Assessing Forced Labor in the Sugarcane Supply Chain of Brazil

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This report presents research on forced labor in the sugarcane industry in Brazil. ICF Macro, Inc., prepared this report according to the terms specified in its contract with the U.S. Department of Labor. The research team would like to express sincere thanks to all the parties involved for their support and valuable contributions.

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This study was prepared by ICF and its in-country consultants.

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ABBREVIATIONS

ANEEL	National Electric Energy Agency
CONAB	National Supply Company
CONSECANA	Sugarcane, Sugar, and Ethanol Producers Council of São Paulo
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
FDI	foreign direct investment
f.o.b.	free on board
GDP	gross domestic product
ILO	International Labor Organization
ISCC	International Sustainability & Carbon Certification
KII	key informant interview
MAPA	Ministry of Agriculture, Livestock, and Supply
MT	metric tons
ORPLANA	Organization of Cane Producers Associations in Brazil
PPE	personal protective equipment
SAF	sustainable aviation fuel
TRS	Total Recoverable Sugar
UNICA	Union of Sugarcane Industry and Bioenergy

GLOSSARY

Bagasse: The fibrous residue left after the extraction of juice from sugarcane, often used as fuel.

Bioelectricity: Electricity generated from biological sources, such as sugarcane bagasse (biomass).

Biogas: A gas produced for fuel by the anaerobic decomposition of organic matter, such as sugarcane.

Cachaça: A traditional Brazilian distilled spirit made from fermented sugarcane juice, consumed as an alcoholic beverage.

***Estabelecimentos* (or *Estabelecimentos Rurais*):** A broad term that, in the context of Brazilian agriculture, is used to refer to agricultural holdings, operations, or units of production. Best translated as "farms" or "rural establishments," rather than general "businesses" or "companies," because it encompasses a wide range of production scales and legal structures.

Ethanol: A type of alcohol used as a biofuel, produced from the fermentation of sugarcane juice or molasses.

Flex-Fuel: A term used to describe vehicles that can operate on either pure ethanol or gasoline, or any blend of the two.

Flex Plants: Facilities that can process both sugarcane and corn as feedstocks for ethanol production.

Labor Recruiter (*Gato*): An informal labor recruiter or broker who serves as an intermediary in the hiring of workers, often outside formal channels and sometimes associated with exploitative or illegal labor practices.

Large Property: A large rural property is defined as one exceeding 15 fiscal modules, [1] which can represent more than 500 hectares and reach several thousand hectares in highly productive agricultural regions. Large properties are typically operated as agribusiness enterprises, with high mechanization levels and significant capital investment.

Medium Property: A medium-sized rural property covers an area between 4 and 15 fiscal modules, usually ranging from 100 to 500 hectares in most regions of Brazil. These properties often combine family and hired labor and may produce sugarcane for both local markets and agro-industrial supply chains.

Mills: General reference to all sugarcane processing facilities, including sugarcane mills, sugarcane and ethanol processing facilities, flex mills, and alcohol distilleries.

Mixed Plants: Facilities that process sugarcane to produce both sugar and ethanol.

Small Property: According to Brazilian land classification, a small rural property is defined as an agricultural establishment of up to four fiscal modules in size. In practice, this generally corresponds to up to 100 hectares, depending on regional parameters. Small properties are typically family-run and used for subsistence or small-scale commercial agriculture.

[1] A fiscal module is a unit of land measurement established by the Brazilian government to assess the economic size and productive potential of rural properties. Its value varies by municipality, ranging from 5 to 110 hectares, depending on factors such as soil fertility, land use, and regional agricultural conditions (Law No. 8.629/1993). More information can be found at: https://www.jusbrasil.com.br/legislacao/104141/lei-8629-93.

Spot Producer: An independent supplier who sells sugarcane to different buyers annually, rather than committing to a longer fixed-year contract (typically five years) with the same seller.

Sugarcane: A tropical grass whose stalks are a major source of sugar.

Turmeiro: An intermediary supervisor who oversees, manages, and sometimes recruits groups of workers in sugarcane production, often acting as the direct boss rather than the landowner or company representative.

Vinasse: A liquid byproduct from the production of ethanol. Common end uses include fertilizer and biogas.

EXECUTIVE SUMMARY

PURPOSE OF STUDY

This study examined forced labor in Brazil's sugarcane industry, with particular focus on highly mechanized areas in the border region between São Paulo and Minas Gerais states. The research aimed to identify the presence and characteristics of forced labor in non-harvesting activities such as planting, field maintenance, and manual cutting, and to map the domestic supply chain of sugarcane to trace how products produced under exploitative conditions enter downstream markets both domestically and internationally.

CONTEXT

Brazil is the world's largest sugarcane producer and leading global exporter of sugar, processing approximately 677 million metric tons of sugarcane in the 2024/25 harvest into 44 million metric tons of sugar and 29 billion liters of ethanol. Sugarcane production is highly concentrated geographically, with more than 90% of national output originating in the Center-South region,[2] and São Paulo alone producing approximately 50% of Brazil's total output.

Brazil's sugarcane sector underwent a fundamental transformation toward mechanization in the 2000s, and mechanization rates in São Paulo now reach 99–100% for harvesting activities. Despite these advances, forced labor practices persist in the non-mechanized phases of production. Brazilian authorities rescued 361 sugarcane workers from conditions deemed analogous to slavery under Brazilian law in 2022, and 258 from similar conditions in 2023.

METHODOLOGY AND DATA COLLECTION

This study employed a mixed-methods approach, integrating secondary data analysis, worker interviews, and key informant interviews. Primary data collection was conducted from June to September 2025 in the Ribeirão Preto region of São Paulo and through remote interviews. Researchers conducted interviews with 77 adult sugarcane workers, focusing on those involved in planting and other non-harvesting activities. Respondents were identified through local organizations and snowball sampling. The study used purposive and convenience sampling, resulting in a diverse but non-representative sample; findings offer valuable insights into forced labor but cannot be generalized to the entire sector. The interviews consisted of a mix of closed-ended and open-ended questions. Key informant interviews were conducted with 25 stakeholders, including government officials, academics, journalists, union representatives, private sector actors, non-governmental organizations, and community-based organizations.

The study also mapped the domestic supply chain by triangulating information from multiple sources, including worker and key informant interviews, corporate financial reports, industry publications, government statistics, and trade data. This analysis examined the extent to which sugarcane can be traced from production through domestic consumption and export markets, and it identified major barriers to traceability, particularly the mixing of sugarcane from multiple farms at mills and the confidentiality surrounding supplier information. Researchers developed three case studies that attempted to directly trace sugarcane products from establishments with indicators of forced labor through downstream supply chains.

[2] For the purposes of this report, the Center-South region of Brazil refers to the states of São Paulo, Minas Gerais, Goiás, Mato Grosso do Sul, Paraná, and Rio de Janeiro.

The study operationalized the measurement of forced labor according to the guidelines provided in the 20th International Conference of Labor Statisticians' *Guidelines Concerning the Measurement of Forced Labour* (2018) and the International Labor Organization's *Hard to See, Harder to Count* (2024). According to these guidelines, a case of forced labor requires performing work that is both involuntary and under the threat or menace of a penalty.

KEY FINDINGS

The study found evidence of forced labor in the non-mechanized phases Brazil's sugarcane industry; 30% of respondents (23 of 77) experienced forced labor based on the presence of both coercion and involuntary work indicators. Key findings include the following:

- **Risk of forced labor remains common in non-harvesting activities.** Among the 77 workers interviewed, 23 (30%) experienced forced labor in their most recent job. The most common indicators of forced labor were hazardous or degrading working conditions (experienced by 48% of workers; n=37) and restrictions on workers' movement (experienced by 32% of workers; n=25).
- **Employment is characterized by extensive informality and intermediation.** Only 51% (n=39) of workers had written employment contracts, 30% (n=23) operated under verbal agreements, and 19% (n=15) had no contract at all. The vast majority (91%; n=70) identified their direct supervisor as a *turmeiro* or *fiscais* (recruiter/subcontractor), rather than a direct representative of the company or landowner, indicating highly intermediated work structures in which ultimate employer responsibility is diluted.
- **Workers face hazardous conditions with inadequate safety protections.** Nearly all respondents indicated that their work involves health or safety risks, including use of sharp and dangerous tools or machinery (96%; n=73), exposure to extreme heat (95%; n=72), carrying heavy loads (45%; n=34), and exposure to hazardous chemicals (26%; n=20). Despite these risks, 30% (n=23) of workers were not provided with the personal protective equipment needed to stay safe, and 47% (n=36) did not receive the training needed to perform their job safely. One-third (32%; n=24) of workers reported that their employer endangers their life by failing to take proper safety precautions. Thirty-nine percent (n=30) reported injuries or illnesses due to their jobs.
- **Working hours regularly exceed legal limits.** Thirteen percent (n=10) of respondents reported working more than 10 hours per day, which exceeds Brazil's legal limit. Four respondents reported working seven days per week without rest days, a practice that does not comply with Brazilian legal requirements. Fourteen percent (n=11) reported being required to work non-stop without breaks.
- **Deceptive recruitment practices and economic coercion are common.** One-fifth (21%; n=16) of respondents indicated that job conditions did not match what they were promised, with workers reporting deception about payment rates, work hours, and job nature. Thirty percent (n=23) reported feeling compelled to take the job due to economic pressures.
- **Child labor concerns require further investigation.** Twenty-one percent (n=16) of respondents reported that people under age 18 work at their worksites. Qualitative interviews revealed that young people aged 15–17 accompany parents and perform the same activities as adults, including planting and manual cutting. Given the hazardous nature of sugarcane work, any work by children under age 18 constitutes hazardous child labor under Brazilian and international standards.

- **Internal migration patterns create worker vulnerability.** More than half of respondents (55%; n=42) were born in Maranhão in Brazil's Northeast,[3] and 31% (n=24) were born in São Paulo itself. Workers were typically recruited in their home regions by intermediaries. This migration pattern creates vulnerabilities, as workers far from home face limited support networks and increased dependence on employers and intermediaries.
- **Most sugarcane products are consumed domestically, with significant export markets for sugar.** The São Martinho Group case study illustrates typical market patterns. Of sugar sold during the first quarter of the 2025/26 harvest year (April–June 2025), 55.5% was exported to foreign markets and 44.5% served the domestic market. In contrast, ethanol sales were predominantly domestic (92.9%), with only 7.1% exported. Domestically, ethanol is deeply integrated into Brazil's transportation fuel infrastructure through mandatory blending requirements[4] and consumption in flex-fuel vehicles. High domestic ethanol consumption is further reinforced by market access barriers to imported ethanol.
- **Sugarcane enters diverse downstream markets, including emerging sustainable aviation fuel (SAF) production.** Sugarcane products are used in sugar for industrial users and consumers, ethanol for transportation fuel and emerging SAF markets, bioelectricity generated from bagasse that contributes to the national electric grid, and various chemical and pharmaceutical applications.
- **Limited traceability mechanisms allow products produced with forced labor to enter all downstream markets.** The mixing of sugarcane from multiple sources at processing facilities creates significant traceability challenges. Mills do not segregate sugarcane by supplier during processing, making it impossible to trace specific batches of sugar or ethanol back to individual farms. Individual mills may work with 50–100 contractors, each managing teams of workers. This aggregation obscures the origin of products produced with forced labor inputs, allowing them to enter both domestic and international markets without detection.
- **Current certification systems are insufficient to prevent forced labor.** Sustainability certifications such as Bonsucro and International Sustainability & Carbon Certification Carbon Offsetting and Reduction Scheme for International Aviation Plus cover only approximately 15% of Brazil's sugarcane production. The research documented cases in which certified facilities had connections to forced labor violations, indicating significant gaps between certification requirements and actual labor practices on the ground. According to data collection findings, there is no industry monitoring system that could ensure that forced labor was not used in sugarcane production. Recent investigations documented that at least two certified plants implicated in slave labor scandals were supplying ethanol to major global airlines, highlighting critical gaps in sustainability certification systems.

CONCLUSION AND RECOMMENDATIONS

This study found that forced labor remains a significant concern in Brazil's sugarcane sector, driven by a complex interplay of economic, social, and structural factors. The study documented that 30% of respondents experienced forced labor, with cases identified across multiple establishments in the Ribeirão Preto region. Findings suggest that despite substantial technological advances through mechanization, which has improved many working conditions in harvesting, forced labor persists in the non-mechanized phases of production, particularly in planting, field maintenance, and manual cutting in areas inaccessible to machinery. Once sugarcane enters processing facilities, the limited traceability mechanisms, extensive use of contractors and subcontractors, and co-mingling of sugarcane from

[3] For purposes of this report, the Northeast region includes the states of Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe.
[4] Set according to Federal Law N° 14.993 of 2024.

multiple suppliers make it nearly impossible to distinguish between products produced with forced labor and those produced without it.

This study offers the following recommendations:

To the Government of Brazil:

- Strengthen labor inspection capacity by increasing the number of Ministry of Labor and Employment labor inspectors in regions with high sugarcane concentration, ensuring periodic visits to medium and small suppliers and contractor operations, particularly during planting periods.
- Improve transparency and inter-institutional coordination in supply chain monitoring, with integrated public systems among the Ministry of Labor and Employment, the Ministry of Agriculture, the National Agency of Petroleum, Natural Gas and Biofuels, and the National Supply Company for production traceability and identification of risk practices.
- Strengthen the joint liability system for purchasing plants, ensuring that outsourcing and subcontracting arrangements do not serve as loopholes for abusive practices and that mills maintain accountability for labor conditions throughout their supply chains.
- Expand social protection programs and economic alternatives in migrant-sending regions, especially in the Northeast, to reduce the vulnerability of workers who migrate to São Paulo for sugarcane employment.
- Promote regulatory reforms that strengthen supply chain transparency in the biofuels sector by revising mandatory ethanol blending policies and establishing legal requirements for traceability.

To Private Sector Actors:

Downstream consumers and processors in Brazil's sugarcane sector—including mills, sugar exporters, ethanol distributors, SAF producers, and cement/bioelectricity companies—should implement robust supply chain due diligence and monitoring mechanisms to identify and address forced labor risks, such as the following:

- Move beyond contractual clauses to establish proactive auditing and monitoring programs with unannounced field visits to sugarcane suppliers and outsourced labor contractors, focusing particularly on planting periods and crop management activities.
- Make contract renewals and commercial partnerships conditional on proven compliance with labor and human rights laws, with corrective action plans for non-compliance and de-accreditation from supply chains for serious and recurring violations.
- Invest in technologies and systems that allow, at a minimum, the segregation of suppliers by level of socio-environmental risk, even if complete traceability to individual farms remains challenging due to raw material mixing at processing facilities.
- Create and promote safe, confidential, and accessible reporting channels for workers, including those of outsourced contractors, managed by independent third parties to prevent retaliation against whistleblowers.
- Ensure through active verification that all workers in the supply chain receive adequate personal protective equipment and ongoing safety training, addressing the identified gap in which nearly half of workers receive no training.
- Review payment practices based purely on production quotas, which encourage exhausting work hours and can result in pay below minimum wage, moving toward hiring models that prioritize formalization and stability.

To Civil Society and Other Stakeholders:

- Expand the participation of rural workers' unions in collective agreements and private socio-environmental certifications, ensuring that workers have effective representation in negotiations with mills and contractors.
- Promote independent, multilateral audits that include civil society organizations, workers' associations, and universities in monitoring labor practices in the sector, particularly for suppliers to certified operations and emerging sectors like SAF.
- Support community empowerment initiatives and accessible reporting channels, including mobile apps and partnerships with local associations, so workers can safely report abuse.
- Conduct further research on forced labor prevalence across different regions, production scales, and contractor arrangements in Brazil's sugarcane sector to inform targeted interventions.

Implementation of these recommendations requires coordinated efforts from all stakeholders. Progress toward eliminating forced labor from Brazil's sugarcane sector will require addressing both immediate labor violations and underlying socioeconomic factors—including informal employment, economic desperation driving internal migration, complex intermediary arrangements, and productivity-based payment systems—while simultaneously strengthening oversight, traceability, and accountability throughout the supply chain. The persistence of forced labor in a highly mechanized, globally integrated sector demonstrates that technological advancement alone is insufficient to eliminate exploitation.

1 INTRODUCTION

Brazil is the world's largest sugarcane producer and leading global exporter of sugar, accounting for nearly half of all global sugar exports. Sugarcane cultivation in Brazil traces its origins to the Portuguese colonial period in the 16th century. Mechanization of sugarcane harvesting began gradually in the 1950s, with the emergence of the first loading machines. However, the pace of mechanization accelerated dramatically following the launch of the National Alcohol Program (Proálcool),[5] an ethanol promotion program, and continued through the 2000s. This transformation was intrinsically linked to broader regulatory, economic, and social changes: land concentration, rural-to-urban migration, and intensified migratory flows of workers from the Northeast to the Center-South seeking employment in the expanding sugarcane sector.

Until the mid-2000s, much of the harvesting remained manual and involved burning the sugarcane straw before cutting to facilitate the work. Beginning in the mid-2000s, the sector underwent a rapid and comprehensive shift toward mechanized harvesting, largely driven by new environmental regulations that phased out pre-harvest burning and by investments in advanced harvesting equipment. By 2022/23, mechanized harvesting accounted for approximately 91% of all sugarcane harvested nationally, with São Paulo state reaching rates of 99–100%.

Despite the sector's high rates of mechanization, concerns about labor exploitation persist. Reports of forced labor in non-harvesting phases such as planting, fertilizer application, and maintenance continue to emerge. In 2022, Brazilian authorities rescued 361 sugarcane workers from conditions analogous to slavery, and 258 were rescued in 2023 (Casara et al., in press; Repórter Brasil, 2024; Stropasolas, 2023).

This study was designed to examine labor conditions in Brazil's sugarcane sector on the border region between Minas Gerais and São Paulo states among laborers involved in planting in highly mechanized production areas. The study had two primary objectives:

- To identify the presence and characteristics of forced labor in sugarcane production, especially in areas with high mechanization
- To map the domestic supply chain of sugarcane in the target region where research found indicators of forced labor, identifying key actors and tracing how sugarcane produced under exploitative conditions may enter downstream markets

1.1 ECONOMIC OVERVIEW

Brazil is an upper-middle-income country with a gross domestic product (GDP) of $2.18 trillion and a per capita GDP of around $10,280 in 2024 (World Bank, 2025). The national economy is structured around three primary sectors: services (59% of GDP), industry (20%), and agriculture (7%) (IBGE, 2025a). Although agriculture represents a relatively small share of Brazil's GDP, within the agricultural sector, sugarcane stands as one of the country's most economically significant crops. The Union of Sugarcane Industry and Bioenergy (UNICA) estimates that the sugarcane value chain generates more than $100 billion annually, equivalent to approximately 2% of Brazil's GDP (UNICA, 2025c). Together,

[5] Created in 1975 during the global oil crisis, Proálcool was Brazil's first major ethanol program, designed both to reduce dependence on imported gasoline and to stabilize the sugarcane industry after a drop in sugar prices. The program unfolded in several phases: first promoting ethanol blending in gasoline, then supporting large-scale production of hydrated ethanol for dedicated alcohol vehicles. After deregulation in the 1990s and rising sugar prices, ethanol production declined, but the sector was revitalized in the 2000s with the introduction of flex-fuel vehicles. Despite debt and productivity challenges in the 2010s, Proálcool laid the foundation for Brazil's modern sugar-energy industry and its global leadership in ethanol production (Melo, 2020).

sugar and ethanol rank as the fourth largest segment of Brazilian agribusiness exports, behind soybeans, meat, and forestry products (MDIC/ComexStat, 2024).

The Brazilian sugarcane industry generates significant direct and indirect employment across the supply chain, from farming through processing and distribution. An estimated 730,000–780,000 workers are employed in the sugarcane sector in Brazil, down from well over 1 million in the late 2010s (Sugarcane.org, 2025b; Voora et al., 2023).[6] This decline has in large part been driven by increasing mechanization in the sector (Gomes & Walter, 2023).

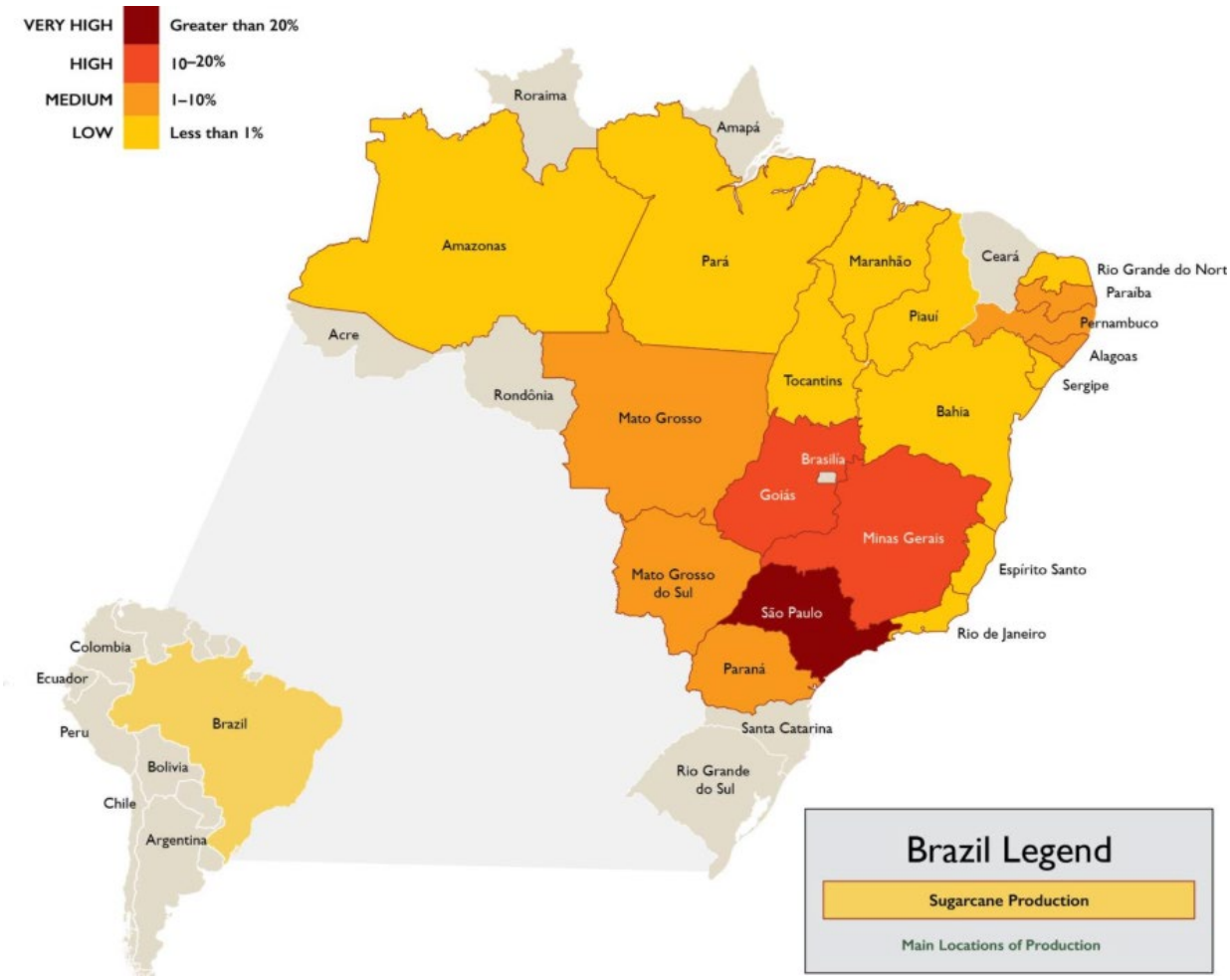
1.2 SUGARCANE PRODUCTION AND CULTIVATION IN BRAZIL

According to the National Supply Company (CONAB), in the 2024/25 harvest, Brazil processed approximately 677 million metric tons (MT) of sugarcane, which were processed into 44 million MT of sugar and 29 billion liters of sugarcane ethanol (CONAB, 2025).[7]

Sugarcane production in Brazil is highly geographically concentrated. In the Center-South region of the country, the four states of São Paulo, Minas Gerais, Goiás, and Mato Grosso do Sul collectively accounted for 80–90% of the national total in 2024 (CONAB, 2025a; Hayashi & Podesta, 2025). São Paulo alone produced 332 million MT of sugarcane, roughly 50% of Brazil's total sugarcane output. By contrast, the traditional sugarcane areas in the Northeast region now account for only about 8% of Brazil's production (CONAB, 2025). This shift was the result of a variety of factors, including topography, logistics, and the concentration of universities and other research institutions developing and promoting agricultural innovation.

[6] According to Brazilian labor statistics, approximately 102 million persons were employed in 2025 (IBGE 2025; Trading Economics, 2025). As of 2024, 7.9 million Brazilians were employed in the country's agriculture sector (IBGE, 2025b).
[7] Brazil's 2024/25 harvest spanned approximately 8.7 million hectares of sugarcane cultivation, with an average yield around 77 MT per hectare (CONAB, 2025a).

Figure 1. Sugarcane production in Brazil, 2024



Note: For purposes of this report, the following states are included in the Center-South region: São Paulo, Minas Gerais, Goiás, Mato Grosso do Sul, Paraná, and Rio de Janeiro. The Northeast region includes the states of Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe.
Source: ICF

1.3 LABOR IN SUGARCANE CULTIVATION AND HARVESTING

The widespread mechanization of Brazil's sugarcane sector during the 2000s fundamentally transformed labor dynamics in the industry. Between 2013 and 2018, documented cases of severe labor exploitation in the sector declined dramatically, a development that suggested that technological advancement might eliminate exploitative practices. However, starting in 2018, documented cases of workers rescued from exploitative conditions have increased (Casara et al., in press; Repórter Brasil, 2024). This resurgence reflects the convergence of multiple factors—some predating mechanization and others emerging in the last decade—that have created renewed vulnerabilities in the sector.

Even with high harvesting mechanization rates, the need for labor persists in specific activities, particularly planting, replanting, and crop maintenance such as weeding and gap-filling.[8] The most

[8] The economic rationale for maintaining manual labor in certain cultivation activities centers on agronomic outcomes that mechanization cannot yet match. While mechanized planting typically yields four to five harvests, manual planting can produce up to seven harvests with greater precision and higher productivity. Industry stakeholders have also raised concerns about

precarious and exploitative conditions are concentrated among workers performing these tasks. Media reports have described "a new boom in forced labor cases […] in recent years, no longer during harvest season but rather during sugarcane planting" (Repórter Brasil, 2024). The sporadic, seasonal nature of these tasks makes it economically unattractive for companies to maintain formal, permanent teams, and the demand is instead met through outsourced and often informal labor.

This structural incentive was reinforced by the 2017 outsourcing law (Law No. 13.429/2017) that permits companies to hire third parties for core business activities. This shift enabled recruitment of rural laborers by independent contractors instead of direct hiring by mills. The resulting structure dilutes accountability: mills purchase sugarcane from supplier farmers, who contract with labor intermediaries, who may subcontract additional layers, creating what inspectors describe as "fourth-party, sometimes fifth-party, production processes" (Repórter Brasil, 2024). This fragmentation reduces protections and obscures responsibility for living conditions, food provision, and payment guarantees.

This report consists of five sections. Section 1 introduced the context and objectives of the study, and Section 2 provides a detailed account of the study's methodology and its limitations. Section 3 provides findings on the supply chain, including a discussion of sugarcane cultivation, processing, domestic mapping, downstream end uses, and traceability. Section 4 provides findings related to the labor conditions in the sector. Section 5 presents three case studies that directly trace the movement of sugarcane products produced with indicators of forced labor through the downstream supply chain. Section 6 provides a conclusion and policy recommendations.

2 METHODOLOGY

This study employed a mixed-methods approach, integrating secondary data analysis, worker interviews, and key informant interviews (KIIs) to examine forced labor in the Brazilian sugarcane sector and to map the sugarcane supply chain in the border region between Minas Gerais and São Paulo.

Secondary Data Review: The research began with a review of existing literature, reports, and trade data related to forced labor and the sugarcane supply chain in Brazil. This review informed both the study design and the final analysis.

Worker Interviews: Researchers conducted interviews with 77 adult sugarcane workers, focusing on those involved in planting and other non-harvesting activities in the Ribeirão Preto region of São Paulo state. Respondents were identified through local organizations and snowball sampling. The interviews consisted of a mix of closed-ended and open-ended questions and were administered on hand-held tablets with the SurveyCTO platform. Automating skips and filters through electronic administration ensured that interviewers only saw relevant follow-up questions, which helped reduce fatigue for both respondents and interviewers. Interviewers recorded responses to close-ended questions using the tablet, and open-ended responses were captured through audio recordings.[9] The interview captured information about socio-demographic characteristics, recruitment, work activities, and indicators of forced labor. Work-related questions were asked in reference to the respondent's most recent sugarcane employment.

Key Informant Interviews: KIIs were conducted with 25 stakeholders selected for their expertise in legislation, labor rights, sugarcane production, and supply chain dynamics. Of these, 20 focused on the supply chain (private sector actors, non-governmental organizations, and community-based

mechanical harvester efficiency, with estimates that production losses from mechanized harvesting could reach 10%. These quality differentials make manual or semi-mechanized approaches attractive for certain operations, despite the complexities of managing temporary labor forces (Casara et al., in press; Madala & Sandhu, 2025).

[9] Two respondents declined audio recording, and handwritten notes were taken in these cases.

organizations), and 5 focused on labor conditions (government officials, academics, journalists, and union representatives).

All instruments were translated into Portuguese, tested, and revised based on field feedback. Quantitative data were analyzed using Stata and Microsoft Excel, and qualitative data (interview transcripts) were coded and analyzed using Dedoose. The research team triangulated findings across data sources to ensure that all conclusions were supported by multiple lines of evidence.

2.1 MEASURING FORCED LABOR

This study uses the definition of forced labor contained in International Labor Organization (ILO) Convention 29: "The term forced or compulsory labor shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily." The study operationalizes this definition of forced labor according to the guidelines provided in the 20th International Conference of Labor Statisticians' *Guidelines Concerning the Measurement of Forced Labour* (2018) and the ILO's *Hard to See, Harder to Count* (2024).

According to the guidelines, a case of forced labor requires performing work that is both involuntary and under the threat or menace of a penalty. *Hard to See, Harder to Count* (2024) describes three employment stages: recruitment stage, employment stage, employment separation stage. For this study, a worker must have experienced both involuntariness and coercion during the same employment stage to be classified as a case of forced labor.

See Appendix 10 for the full text of the worker instrument used in this study and Appendix 11 for a mapping of questions to indicators.

2.1.1 Legal Standards for Forced Labor in Brazil

The ILO's definition of forced labor differs importantly from the Brazilian legal framework governing labor exploitation, which adopts the framing of labor conditions "analogous to slavery" (Codigo Penal, 2003). Article 149 of the Penal Code defines these conditions as follows: "Reducing someone to a condition analogous to that of a slave, either by submitting them to forced labor or to an exhausting workday, or by subjecting them to degrading working conditions, or by restricting, by any means, their freedom of movement due to a debt contracted with the employer or representative" (Codigo Penal, 2003). A definition of "degrading working conditions" is provided in MTB Ordinance 1.293/2017: "Any form of denial of human dignity by violating the fundamental rights of the worker, notably those provided for in the norms of labor protection and safety, hygiene and health at work" (MTB Ordinance, 2018).

The category of conditions "analogous to slavery" as defined in Brazilian law is rather broader than the ILO's definition of forced labor, notably in that it does not require the presence of *both* involuntariness and coercion. As such, while the Brazilian standard of labor "analogous to slavery" encompasses all forms of labor exploitation that would satisfy the ILO's definition of forced labor, it also includes many forms of labor exploitation beyond those defined by the ILO. For example, a worker exposed to violations of safety and health standards could be considered to be in degrading working conditions and thus in a situation analogous to slavery. However, exposure to safety and health violations alone, without an accompanying indicator of coercion, would not result in a worker's being considered in forced labor under the ILO definition. The terms, therefore, may not be used interchangeably.

2.2 TRAINING AND PREPARATION

Training for the research team was conducted in June 2025 in Ribeirão Preto, São Paulo state. The training comprehensively covered the study's objectives, the definition and indicators of forced labor,

research design, fieldwork procedures, research ethics, informed consent protocols, and data quality assurance. The team also received a detailed review of the research tools and participated in mock interviews, with feedback sessions aimed at refining interview techniques.

The research team included two former sugarcane workers, and their participation broadened the team's technical knowledge and facilitated a deeper understanding of local culture in production areas. This approach ensured that the questions were culturally appropriate and worded in a way to be easily understood by interviewees, helping bridge potential gaps between researchers and the worker community and increasing the validity and accessibility of the research instruments.

The training concluded with a pilot in Guariba, São Paulo. Following the pilot, the research team held a debriefing session to discuss challenges encountered and lessons learned, leading to minor revisions to the questionnaire to improve respondent comprehension.

Prior to data collection, the research design and instruments were approved by ICF's independent Institutional Review Board. All research activities were conducted in accordance with strict ethical guidelines, including informed consent, confidentiality, and data security. Verbal informed consent was obtained from all respondents prior to interviews, and all personal identifying information was redacted before data analysis.

2.3 DATA COLLECTION

Data collection took place between June and September 2025. Fieldwork with workers took place in the Ribeirão Preto region, São Paulo state, with 77 interviews completed. KIIs were conducted virtually. More than 70 potential KII respondents were contacted over 2 months, resulting in 25 completed interviews.

To protect workers from potential retaliation, interviews were conducted in neutral locations away from the worksite to allow participants to speak candidly without being observed by employers or supervisors.

Interview with sugarcane worker. Source: ICF

2.4 CHALLENGES, LIMITATIONS, AND LESSONS LEARNED

Worker Recruitment: Respondents were identified through local organizations and snowball sampling. The team also implemented an incentive system, providing food baskets to participants upon completion of the interview, which proved effective in building trust and encouraging participation. Despite these efforts, some workers remained hesitant to participate due to concerns about confidentiality and potential repercussions from employers.

Sampling Method: The study employed purposive and convenience sampling rather than probability sampling, which allowed for a diverse pool of respondents but introduced limitations regarding representativeness. As a result, findings are not statistically representative of Brazil's sugarcane sector. However, the data provide valuable insights into the existence and characteristics of forced labor in the study area and, when combined with qualitative findings, offer a broader understanding of the issue.

Supply Chain Tracing: Supply chain tracing in the Brazilian sugarcane sector is challenging due to a combination of structural, operational, and commercial factors. Most workers are unaware of the ultimate destination of the sugarcane they help produce, making it difficult to source firsthand knowledge to support tracing efforts. At the processing stage, sugarcane from hundreds of different farms—whether owned, leased, or independent—is routinely mixed together in mills. This co-mingling further obscures traceability. Compounding this, mills treat supplier lists and contract details as proprietary business information, and public agencies that collect production data are bound by confidentiality agreements, releasing only aggregated data that omit individual supplier identities.

3 SUPPLY CHAIN FINDINGS

3.1 SUGARCANE CULTIVATION IN BRAZIL

Almost all commercial sugarcane cultivation in Brazil currently relies on replanting cuttings taken from existing sugarcane plants (called *toletes* in Portuguese, or "setts" in English) (M. H. R. de Oliveira et al., 2025). Planting these *toletes* is a highly labor-intensive task, requiring workers to dig a 10–15 cm deep furrow, wet the soil in the furrow, place 1 sugarcane *tolete* horizontally at the bottom of the furrow, and fill in the furrow with loose soil (Madala & Sandhu, 2025). Planting is typically conducted through either fully manual methods or semi-mechanized approaches that combine automated equipment with manual soil coverage and seedling placement.[10] An industry representative describes a typical semi-mechanized process as follows:

> *"You plant two paths, leave four empty. Then, when the cane grows, you cut [manually] and split it into the empty paths. In this case, you do more manually, but it is not 100% of the planting. Most of the planting is mechanized using planters. You harvest the cane with a harvester, put it in a transshipment that transports it to the harvester, the harvester spreads it on the path, and the tractor comes, covers it, and does all the mechanized processing."*
>
> *—Industry representative*

This hybrid approach creates pockets of intensive manual work within otherwise mechanized operations.

Sugarcane stalks are then allowed to grow to maturity before harvesting. In Brazil, sugarcane planted during the summer season (February–April) reaches maturity in approximately 12 months, and sugarcane planted during the winter season (August–September) requires 12–18 months to reach maturity (Zheng et al., 2022). During the growth and maturation process, sugarcane cultivation requires ongoing management activities, including fertilizer application, herbicide and pesticide spraying for weed and pest control, and mechanical cultivation between rows to control weeds and improve soil aeration. Some of these tasks are starting to be mechanized, with the most advanced operations employing tools like GPS-guided tractors equipped with precision spreaders and spray systems, but many farms still employ field workers to perform most of these crop management tasks.

[10] Producers maintain manual or semi-mechanized planting approaches for multiple reasons. Agronomically, some sources suggest that seedlings planted through manual planting can yield two to three additional harvests, compared to those planted with mechanized methods, likely due to greater precision in seedling placement resulting in higher germination rates and productivity (Casara et al., in press; Madala & Sandhu, 2025). Terrain and investment constraints also play roles: not all producers have flat terrain optimal for large machinery, and smaller farms may lack the scale to justify significant capital investment in specialized equipment. As one labor inspector noted, "Considering that some areas do not allow for more advanced mechanization—or that not all farmers will have the resources for it—this movement of workers will not stop" (Casara et al., in press).

Upon reaching maturity, sugarcane stalks can be harvested. Sugarcane is harvested by cutting the stalks a few inches off the ground, leaving a small section of stalk and the root mass undisturbed.[11] The stalks are then cut into smaller pieces to facilitate weighing and transport by truck to a processing facility (Tolan & Cordero, 2021). Experts and workers interviewed for this study indicated that nearly all sugarcane harvesting in Brazil's Center-South region now uses mechanized harvesting equipment.

*Sugarcane truck (*transbordo*). Source: Antoniosi*

Any biomass generated by the sugarcane plants other than the stalk (including stalk tops, sharp sugarcane leaves removed prior to harvest, and dead leaves on the ground after harvest) is collected and treated as a separate byproduct that can be processed into a biofuel source to produce energy.

3.2 SUGARCANE PROCESSING IN BRAZIL

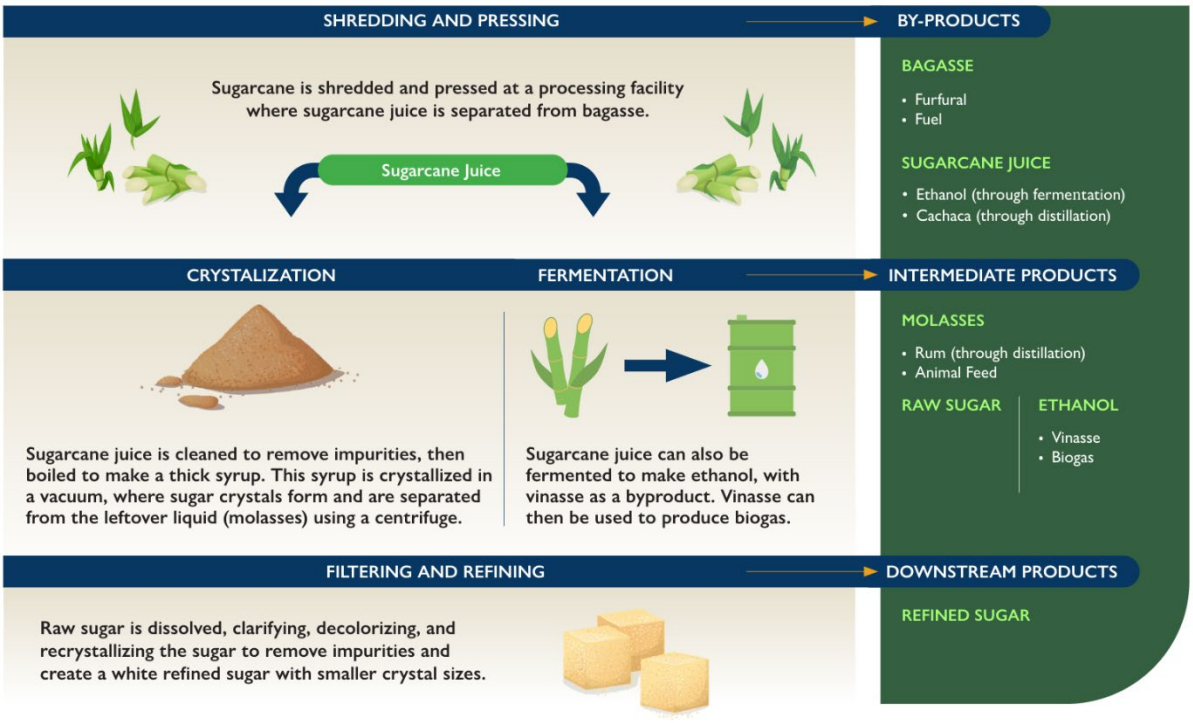
Sugarcane is highly perishable and must be transported to a processing facility within 24 hours to preserve sucrose yield. Experts and workers interviewed for this study emphasized that, due to these strict timing requirements and the high cost of transport, harvest sites are generally limited to a maximum distance of about 30 km from processing facilities. According to a sugarcane supply manager:

> *"Sugarcane suppliers have to be as close as possible. Because we work with an average radius of 25 km. So, if you have a property 100 km from the mill, it becomes almost unfeasible. Due to logistics costs and everything else. We have areas around 60 to 70 km away, but in smaller quantities. The main focus is to have it as close to the mill as possible. Because logistics are very expensive."*
>
> *—Industry representative*

In addition to the primary downstream products of sugar, ethanol, and *cachaça,* primary byproducts of Brazilian sugarcane include vinasse, molasses, bagasse, and filter cake, each of which are further processed into a variety of downstream goods use in multiple end-use industries. (See Appendix 6, Sugarcane Products and Byproducts, for further detail.)

[11] After harvesting, the sugarcane plant will begin to send up new stalks, called *ratoons*, which will grow into the following year's sugarcane crop. Sugarcane plants can live for more than 10 years, generating a harvestable stalk roughly every 12–18 months, but the volume of sugar that each plant produces tends to decrease with each successive harvest. Under the rainfed conditions typical of Brazil's major sugarcane-producing regions, sugarcane must be replanted approximately every three to six harvests. This more frequent replanting is required because of declining yields due to crop and soil damage caused by heavy traffic of machines and trucks over the stumps during harvesting, progressive accumulation of pathogens, and genetic factors affecting productivity in successive cultivation cycles (Matsuoka et al., 2009).

Figure 2. Sugarcane processing flow chart



Source: ICF

3.3 PROCESSING FACILITIES

Brazil is the world's leading producer and processor of sugarcane, with a highly diversified processing sector. Facilities vary in technological sophistication and product focus, which is key to understanding the structure and flexibility of the country's sugarcane supply chain.

3.3.1 Processing Facility Types

Although some older plants still operate as a single-product unit, such as sugar mills or independent distilleries, the current prevailing model is the integrated complex. These modern facilities generate multiple revenue streams by producing sugar, ethanol, bioelectricity, and various byproducts. This integration and operational flexibility distinguish Brazil from other major sugarcane-producing countries.

Processing facilities can be roughly separated into the following types:

Sugar Mills (*Usinas de Açúcar*): These facilities exclusively produce raw sugar from sugarcane, converting juice into raw sugar, and typically include equipment to further process raw sugar into refined sugar. Sugar mills that exclusively produce sugar are increasingly rare in the Center-South region, though some persist in the Northeast, where historical operations have not made the capital investments required to add ethanol production capacity.

Ethanol Plants (*Destilarias*): These units exclusively produce ethanol from sugarcane juice or molasses. Distilleries exclusively focused on ethanol production were established during the Proálcool program era, when government incentives strongly favored ethanol production, both hydrous ethanol (containing approximately 5% water, used directly as fuel in flex-fuel vehicles) and anhydrous ethanol (less than 1% water, blended with gasoline) (Hayashi, 2024; Primrose, 2024).

Mixed Plants (*Usinas Mistas*): These facilities represent the most common configuration in the Center-South region, capable of producing both sugar and ethanol with production ratios adjusted based on market conditions. Mixed plants provide operational flexibility that enables processors to optimize revenue by shifting production toward the more profitable product at any given time (CONAB, 2025).

Flex Plants: A recent innovation in Brazilian sugarcane processing, flex plants can process both sugarcane and corn as feedstocks for ethanol production. This dual-feedstock capability addresses the seasonal nature of sugarcane availability; as traditional sugarcane mills operate only during the harvest season, typically April through November in the Center-South region, leaving processing capacity idle during the off-season. Flex plants use corn ethanol production during the sugarcane off-season, enabling year-round operations and improving capital use. The integrated model offers additional advantages beyond extended operating seasons.[12]

> *"When it comes to integrating the two [supply chains for corn and sugarcane], you have what they call 'flex' mills, this is an initial model, a little older. You also have the full mills, which are 100% corn, and you have a model they call 'flex fuel,' but we tend to call them 'integrated' so as not to confuse it. They can produce with corn all year round and can produce with sugarcane during the sugarcane off-season."*
>
> *—Journalist specialized in the sugar-energy sector*

By processing corn year round, flex plant facilities can more effectively use sugarcane byproducts, particularly bagasse for continuous bioelectricity generation throughout the year rather than only during the sugarcane harvest period.

> *"This model is generally recommended so that you can use the sugarcane bagasse to generate energy, so that you have energy all year round, but you're also producing corn ethanol all year round and you don't have to keep changing the settings of the equipment and the factory in the off-season and then come back and jeopardize maintenance. This is a more recent model."*
>
> *—Journalist*

This approach represents an evolving process toward more continuous, efficient production systems that maximize the use of both feedstock and byproducts.

Distilleries: These facilities produce *cachaça* from sugarcane juice and operate at a significantly smaller scale and volume than sugar and ethanol processors. The *cachaça* sector encompasses both small family-operated producers and large-scale industrial operations. Some large producers and blenders, such as the brand Cachaça 51 (produced in Pirassununga, São Paulo), aggregate production from numerous small producers to create blended products for mass-market consumption. As one government research representative explained:

> *"It's difficult, you won't be able to sell a very small amount of sugarcane to someone else to make* cachaça*. But what can happen is that it doesn't even happen here with Cachaça 51 in São Paulo. They receive a lot of* cachaça *from small producers, and they also have their own areas, but they kind of mix it all together, and then you have a blended* cachaça*, which is of poorer quality. […] But there's a big market for it."*
>
> *—Government research center representative*

[12] Brazil's ethanol sector represents a complex dual-feedstock system in rapid evolution, with sugarcane-based production historically dominating but corn ethanol emerging as a transformative force. As of 2024–2025, Brazil produces approximately 36.83 billion liters of ethanol annually, with corn ethanol reaching approximately 7.7–8.2 billion liters (representing roughly 21–22% of total production), and sugarcane ethanol comprising the remainder at approximately 28–29 billion liters (Krueger, 2025; Sugarcane.org, 2025c; UNICA, 2025b). This dramatic compositional shift occurred remarkably quickly; until 2015, Brazil's ethanol production derived almost exclusively from sugarcane, but substantial investments in corn ethanol facilities—particularly in Mato Grosso, Goiás, and Mato Grosso do Sul—have fundamentally altered the sector's composition, with corn ethanol production growing by 32.8% between 2023 and 2024 (Hayashi, 2024; Sugarcane.org, 2025c).

3.3.2 Processing Facility Operations

Brazil's sugar and ethanol industry includes approximately 400 sugarcane processing facilities, most of which are concentrated in the country's main sugar-producing regions, such as São Paulo, Minas Gerais, and Paraná.[13] *Cachaça* production occurs on a significantly smaller scale compared to sugar and ethanol. According to the 2024 Cachaça Yearbook compiled by the Ministry of Agriculture, Livestock, and Supply (MAPA), Brazil registered 1,266 *cachaça*-producing establishments in 2024 (de Almeida, 2025).[14]

Sugarcane processing facility in Ribeirão Preto. Source: ICF

São Paulo alone hosts more than half of Brazil's processing capacity, benefiting from favorable agricultural conditions, proximity to export infrastructure, concentration of research institutions, and access to capital and technology (CONAB, 2025). This geographic concentration creates regional economies heavily dependent on sugarcane processing, with municipalities like Sertãozinho, Pradópolis, and Guariba serving as industrial hubs.

The shift toward integrated sugar-ethanol-bioelectricity processing facilities favored large-scale operations that could optimize output allocation based on commodity prices and achieve economies of scale in processing. Smaller mills, on the other hand, that are focused exclusively on sugar production lack the flexibility, capital, and scale efficiency to compete effectively.

3.3.3 Byproduct Processing Operations

In practice, Brazilian sugarcane processing facilities typically integrate multiple production lines and ancillary operations within a single industrial site. Large modern processors tend to be vertically integrated facilities that maximize value extraction from sugarcane and the ensuing byproducts.

Sugar Refineries: These specialized industrial facilities further process raw sugar into refined white sugar, crystal sugar, or confectioner's sugar. Refineries are typically located within sugarcane processing

[13] This study was unable to determine the precise number of active sugarcane mills in Brazil at the time of writing. NovaCana, the largest private database in Brazil's sugar-energy sector, lists 432 sugarcane processing units in Brazil, but these data do not differentiate between active and inactive units (NovaCana, 2025b). The most recent government data on this point indicate that there were 324 active sugarcane mills in Brazil as of 2021, 40% of which were located in São Paulo and 69% of which were listed as "mixed mills" (mills capable of producing both sugar and ethanol from sugarcane) (CONAB, 2025b).
Up-to-date mapping of sugarcane mills is hampered by the lack of official public information in Brazil. Institutions such as CONAB and *Agência Nacional do Petróleo, Gás Natural e Biocombustíveis* (National Agency of Petroleum, Natural Gas and Biofuels) were cited in interviews with ICF as sources of information, but neither agency provides publicly accessible aggregated data on sugar or ethanol production facilities.

[14] Minas Gerais state leads *cachaça* production, with 501 establishments (39.6% of the national total) and 2,492 registered products (34.5% of national total), followed by São Paulo and other southeastern states (de Almeida, 2025). The declared production volume for 2024 reached 292.46 million liters, with the Southeast region producing 59.04% of the national total (de Almeida, 2025; Ferreira, 2025).

mills. Raw sugar exported may be consumed as raw sugar or may be processed in a raw sugar refinery abroad that co-mingles raw sugar from multiple sources.

Energy Cogeneration Units: Globally, bagasse and sugarcane waste are used to generate energy for the processing facility. In Brazil, virtually all facilities operate thermoelectric equipment to generate electricity (Coelho Junior et al., 2024; Kabeyi & Olanrewaju, 2023). Processors in Brazil also sell surplus electricity to the national grid. As of 2025, sugarcane-derived bioelectricity contributes approximately 4% of Brazil's electricity consumption, totaling 21 gigawatt-hours (UNICA, 2025a).

Yeast Production Facilities: Specialized units, typically attached to facilities that produce ethanol, extract and process yeast biomass from ethanol fermentation to produce nutritional supplements and other yeast-derived products. These facilities represent another avenue for capturing value from sugarcane processing byproducts.

The integrated configurations showcase the industry's progression toward the comprehensive use of sugarcane components and the industry's technological ability to quickly adapt to market prices and demand.

3.4 DOMESTIC SUGARCANE INDUSTRY: BRAZIL

The Brazilian sugarcane processing sector exhibits substantial foreign direct investment (FDI) concentration among a limited number of large multinational corporations and joint ventures. The Center-South region's processing industry is dominated by large multinationals and domestic conglomerates that have achieved significant market consolidation through FDI and mergers and acquisitions.[15] Technologically advanced processing facilities require large capital investments and efficient upstream supply chains, with many operations vertically integrated from production through downstream product distribution. Increased industry concentration and scale create competitive pressure on smaller firms.

Processing mills operate sophisticated harvest scheduling systems that coordinate multiple contractors, transportation providers, and field operations to ensure a continuous supply of fresh sugarcane at optimal maturity from multiple farms. During peak harvest periods, mills operate 24 hours per day, 7 days per week, processing sugarcane as rapidly as it arrives. Given sugarcane's perishability, it is typically sold to the nearest processing facility.

3.4.1 Major Foreign-Invested Processing Groups

The sector has undergone significant ownership changes during 2023 to 2025, with significant oil and energy companies consolidating positions, while agricultural commodity traders largely exited processing operations:

- **Raízen (Shell-Cosan Joint Venture):** A 50-50 partnership between Shell plc (UK/Netherlands) and Cosan (Brazil) formed in 2011 and made permanent in 2016. The company operates approximately 27–35 production units (exact count uncertain due to ongoing divestitures) with installed crushing capacity of 105 million tons per year, though actual crushing is 72–78 million tons due to capacity rationalization, drought impacts, and 2024 wildfires (Raízen, 2021). Raízen is executing a major restructuring program, with R$15 billion (USD $2.76 billion) (in targeted asset sales to reduce debt, having already sold mills to Cocal, Grupo Colorado, and Ferrari (Ficher, 2025).

[15] One 2023 source estimated that Brazilian companies control just over two-thirds of all sugar mills in the country, and foreign multinationals control the remaining third (Medina & Costa, 2023).

- **SJC Bioenergia:** Now 100% owned by Cargill (USA) following acquisition of the remaining 50% stake from USJ bondholders in 2024 for approximately R$2.8 billion (USD $518 million) (BRICS Competition Law and Policy Centre, 2025). SJC operates 2 flex mills (processing both sugarcane and corn) in Goiás with combined capacity of 9 million tons annually. Contrary to the broader trend among agricultural commodity traders, Cargill is expanding its Brazilian bioenergy presence.
- **BP Bioenergia (formerly BP Bunge Bioenergia):** Now 100% owned by BP plc (UK) following completion of Bunge's exit in October 2024. BP acquired Bunge's 50% stake for approximately R$7.6 billion (USD $1.4 billion) enterprise value (BP Global, 2024; Bunge, 2024b). The company operates 11 agro-industrial units across São Paulo, Minas Gerais, Goiás, Tocantins, and Mato Grosso do Sul, with 32.4 million tons annual crushing capacity. BP is investing R$530 million (USD $97.5 million) to expand the Pedro Afonso (Tocantins) facility from 2.6 to 3.4 million tons capacity by July 2026 (Vital, 2024).
- **Tereos Açúcar & Energia:** 100% owned by French agricultural cooperative Tereos SCA. Tereos operates 7 mills exclusively in São Paulo state with crushing capacity of 21–23 million tons annually (Tereos, 2025a, 2025b). In 2016, Tereos acquired Petrobras' entire 45.97% stake in the Brazilian sugar and ethanol producer Guarani S.A. for R$1.1 billion (USD $202 million), leaving Tereos the sole owner of Guarani (Shumkov, 2016).
- **COFCO International:** 100% owned by COFCO Corporation, China's largest state-owned food processing company. COFCO operates 4 mills in São Paulo's interior region with 17 million tons annual crushing capacity (COFCO, 2025; Ficher, 2024). According to an expert interviewed for this study, approximately 40% of COFCO International's global investments and two-thirds of its 11,000–12,000 employees are Brazil-based.
- **Atvos:** Controlled by United Arab Emirates sovereign wealth fund Mubadala Capital, which acquired a 31.5% controlling stake in 2023 with R$500 million (USD $92 million) investment (Atvos, 2023). Atvos operates 8–9 mills across Goiás, Mato Grosso, Mato Grosso do Sul, and São Paulo with 30 million tons installed capacity (22–23 million tons used). The company is reportedly bidding for additional Raízen mills (Sousa et al., 2025).
- **Shree Renuka Sugars (India):** The Brazilian operations of this Indian conglomerate underwent complex restructuring following a 2019 divestiture from the parent company. Current beneficial ownership remains unclear, though operations continue at the company's Madhu facility (São Paulo), processing approximately 6 million tons annually (Renuka do Brasil, 2025; RPAnews, 2018).

Table 1. Comprehensive FDI table: Processing operations by company

Company	Parent/Country	Ownership structure	Mills	States	Crushing capacity (MT/year)	Recent changes (2023–2025)
Raízen	Shell (UK-Netherlands)/Cosan (Brazil)	Shell ~44%, Cosan ~44%, Public ~12%	~27 (down from 35)	SP, GO, MS, MG	**105M installed**; 72–78M actual	Divesting ~R$15B in assets; sold mills to Cocal, Grupo Colorado, Ferrari
bp bioenergy	BP plc (UK)	100% BP (acquired Bunge's 50% Oct 2024)	11	SP, MG, GO, MS, TO	**32M**	Bunge exit completed; R$530M Pedro Afonso expansion
Tereos Açúcar & Energia	Tereos SCA (France)	100% French cooperative	7 (incl. 1 JV)	SP only	**21–23M**	Stable operations; group-level financial pressure

Company	Parent/Country	Ownership structure	Mills	States	Crushing capacity (MT/year)	Recent changes (2023–2025)
COFCO International	COFCO Corporation (China, state-owned)	100% Chinese state	4	SP (interior)	**17M**	New Santos terminal (2025); ongoing water efficiency investments
SJC Bioenergia	Cargill (USA)	100% Cargill (full control 2024)	2	GO	**9M** (sugarcane + corn flex)	Acquired remaining 50% from USJ bondholders (USD ~$518M)
Atvos	Mubadala Capital (United Arab Emirates) + others	Mubadala 31.5% controlling stake	8–9	GO, MT, MS, SP	**30M installed**; 22–23M used	Mubadala invested R$500M (2023); bidding for Raízen mills
Renuka do Brasil	Shree Renuka/Wilmar (India-Singapore)	Divested from parent 2019; complex	1 active	SP	**~6M** (Usina Madhu)	Judicial recovery continues; record 6.18M MT crushed 2023/24
Renuka Vale do Ivaí	Shree Renuka/Wilmar (India-Singapore)	Status unclear post-2019	2	PR	**~3.1M** (uncertain)	Operational status unclear after 2019 divestiture

GO=Goiás, MG=Minas Gerais, MS=Mato Grosso do Sul, MT=Mato Grosso, PR=Paraná, SP=São Paulo, TO=Tocantins
Source: ICF

3.4.1.1 Recent Exits from Processing Operations

Several major multinational commodity traders have exited Brazilian sugarcane processing entirely while maintaining trading operations:

- **Louis Dreyfus Company:** Sold its processing subsidiary Biosev to Raízen in February 2021, exiting all mill ownership while remaining among Brazil's top sugar exporters through trading operations. Louis Dreyfus Company inaugurated a new 90,000-ton intermodal terminal in Pederneiras, São Paulo in August 2025 (Louis Dreyfus Company, 2025).
- **Archer Daniels Midland:** Fully exited Brazilian sugarcane processing around 2016, selling its sole mill in Limeira do Oeste, Minas Gerais (ADM, 2016).
- **Bunge:** Completed exit from Brazilian sugarcane processing in October 2024 after selling its 50% stake in the BP Bunge joint venture, citing that "this business is not core to Bunge's long-term strategy" (Bunge, 2024a).

3.4.2 Major Domestic Groups

- **São Martinho:** A 100% Brazilian-owned publicly traded company operating multiple facilities, including the world's largest single-site sugarcane mill in Pradópolis, São Paulo, with crushing capacity of approximately 10 million tons per harvest (NovaCana, 2020; Souza, 2025).
- **Copersucar:** A producer cooperative founded in 1959 representing approximately 39 associated member mills that maintain independent operations. Copersucar functions primarily as a marketing and export cooperative rather than a processing operator, ranking as one of the world's largest sugar and ethanol traders (Neves et al., 2016; NovaCana, 2025b; UDOP, 2023).

3.4.3 Industry Structure and Vertical Integration

Major actors in Brazil's sugar sector demonstrate strong tendencies toward vertical integration, with control over production, processing, and often marketing, which shapes integrated supply chains. Mills capable of flexibly adjusting output between sugar and ethanol dominate the sector, allowing operators to respond to relative commodity price fluctuations. The sector's consolidated structure creates

challenges for supply chain traceability, as large multinational operations often source from dozens of third-party contractors alongside company-owned production.

3.4.4 Corn Ethanol Facilities

A recent innovation in Brazilian sugarcane processing is the emergence of flex plants that can process both sugarcane and corn as feedstocks for ethanol production. Until 2015, Brazil's ethanol production derived almost exclusively from sugarcane. In 2025, ethanol in Brazil is produced from corn and sugarcane. Corn ethanol production has expanded rapidly in Mato Grosso, Goiás, and Mato Grosso do Sul, with some facilities operating as flex mills, processing both sugarcane (seasonally) and corn (year round). As of 2024–2025, corn ethanol represents approximately 21–22% of Brazil's total ethanol production (7.7–8.2 billion liters annually from approximately 36.8 billion liters total) (Colussi et al., 2025; Farmdoc, 2025; UNICA, 2025b), with sugarcane ethanol comprising the remainder. This dramatic compositional shift occurred quickly and continues to grow; corn ethanol production increased 32.8% between 2023 and 2024 (Hayashi, 2024; Sugarcane.org, 2025c).

The supply chains for sugarcane and corn ethanol overlap in two ways. First, flex plants use sugarcane bagasse to power corn ethanol production facilities. Second, although corn and sugarcane ethanol necessitate different processing lines, the downstream fuel ethanol is chemically identical. Once produced, sugarcane and corn ethanol can be co-mingled intentionally or unintentionally in storage, pipelines, or fuel depots. Retail fuel in Brazil does not distinguish between sugarcane-based and corn-based ethanol, although some international buyers may have environmental regulatory or marketing concerns that require sugarcane-based ethanol. Because of these operational overlaps, the rapid rise of corn ethanol directly affects the structure and traceability of sugarcane-based ethanol supply chains.

3.4.5 *Cachaça* Production

Cachaça operates in a significantly smaller segment of the downstream sugarcane market. Traditionally an artisanal family enterprise, the sector supports thousands of small and medium-sized producers, particularly in traditional producing regions of Minas Gerais and northeastern states, where *cachaça* production represents an important economic activity for rural communities and family-operated distilleries. International beverage companies engaged in Brazil's spirits sector include Bacardi, Diageo (which acquired Ypióca in 2019), and Pernod Ricard, though CONAB does not systematically track small-scale *cachaça* production in national harvest statistics.

3.4.6 Domestic Supply Chain: Landownership, Leasing, Contracting, Sales

Large groups dominate the sugarcane processing industry, and they continue to rely heavily on land leasing arrangements to grow sugarcane and outsource production from independent farmers. This study was unable to quantify the amount of land owned by processing mills from publicly available data, but KII findings indicated that approximately 75% of sugarcane production in the Center-South region takes place on land managed by mills themselves, whether the mills own the land directly or operate it under long-term lease agreements. Mills source the remaining 25% of sugarcane from small and medium-sized independent farmers.

Leasing Agreements: Mills that lease the land from landowners will manage planting, harvesting, and transportation, either with their own staff or a subcontractor. Due to the perishability of cut sugarcane, these farms tend to be located close to the mill.

> *"In the past, there were more suppliers [sugarcane farmers] than owned areas. Today, I would say that there are more areas owned by the mills themselves. You may ask if the area owned by the mill is actually owned by the mill, and that is not necessarily the case. What often happens is that they enter into*

partnership agreements whereby the mill takes care of [leases] the property that is in the name of a particular producer. And they consider this theoretically as the mill's own area because it is the mill that manages it. […] But that doesn't mean that the area is necessarily owned by the mill."

—Government research center representative

Independent Farmer Contracts: While large integrated operations dominate Brazilian sugarcane production in Sao Paulo, an estimated 8,500 small and medium-sized farms produce 25% of sugarcane production in Sao Paulo and Minas Gerias (IBGE, 2017).[16]

These landowners who grow sugarcane to sell have multiple sales options, even though the sugarcane ultimately is processed by a nearby mill. Landowners may manage their own production, typically outsourcing, through an intermediary (*gato*) for recruiting workers to plant, harvest, and transport the sugarcane. The intermediary may arrange for sale to a local mill, or the grower may arrange for the sale himself, either to the mill directly or through a cooperative association, such as those affiliated with the Organization of Cane Producers Associations in Brazil (ORPLANA). ORPLANA represents 35 sugarcane producer associations, encompassing thousands of members (Orplana, 2025). Respondents in the sugarcane industry indicated that older, small farmers tend to lease their land to large groups or form partnerships with other nearby groups to aggregate and sell sugarcane, as one government research center representative explained:

"The farms are medium-sized, but they are grouped together in large areas nearby […]."

—Government research center representative

According to industry experts interviewed, these contracts are usually between a larger grower and the mill. The larger grower will then separately contract with multiple smaller growers until the desired quantity is achieved. In this way, co-mingling of sugarcane from multiple farms occurs before the sugarcane arrives at the mill. Given the absence of a single regulatory body to track these entities, research was unable to quantify the size and stakeholders involved in this aspect of the supply chain.

In all sales agreements, the duration of the contract varies. Contracts between the producing landowner and the facility can be one-time "spot-contracts" or contracts with a multi-year commitment.

"[Contracts are] usually per harvest. […] The average duration for planting sugarcane is five harvests, every five years, so the contracts are on average five years long. There are some that we call 'spoteiro' when it is not per harvest. It is 'spot' cane, where the supplier has an annual contract and chooses who he wants to deliver to each year. But most are for five years or three years, at least."

—Industry association representative

The price paid in contract agreements to processing units is guided by a private self-regulatory system: the Sugarcane, Sugar, and Ethanol Producers Council of São Paulo (CONSECANA) (Hayashi & Podesta, 2025). Created in São Paulo and adopted in other states, it establishes a pricing and payment methodology for raw materials based on their quality, not just their volume. This system is based on the concept of Total Recoverable Sugar (TRS). TRS measures the amount of sugars (sucrose, glucose, and fructose) in sugarcane that can be effectively converted into sugar or ethanol in the industrial process.

"Depending on the amount of [TRS] your cane produced, you receive an additional differential for your cane. There are any number of contracts. There are contracts with a fixed [TRS], which are not included in this calculation of raw material quality. Depending on supply and demand, contracts vary greatly. […]

[16] The 2017 Census of Agriculture (*Censo Agropecuário*), conducted by the Brazilian Institute of Geography and Statistics (IBGE) with results released in 2019, represents the most recent comprehensive data available on agricultural establishment numbers, land use, and production characteristics in Brazil. The next IBGE agricultural census is scheduled to take place in 2027 (Carneiro, 2025).

CONSECANA determines the value of this [TRS] on a monthly basis. It determines the value according to the market."

—Sugarcane producers association

3.5 DOMESTIC INDUSTRY: SÃO PAULO STATE

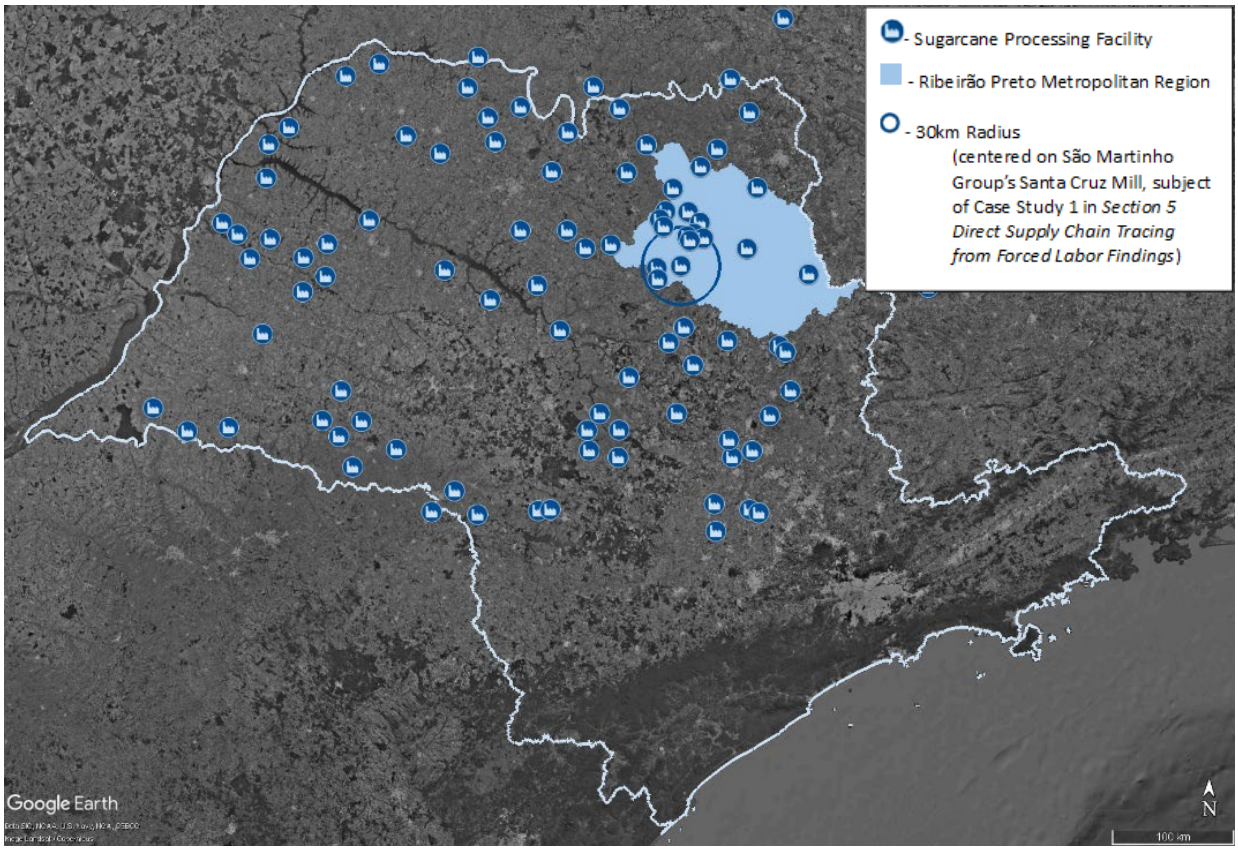
According to the 2017 Agricultural Census by the Brazilian Institute of Geography and Statistics, São Paulo stands out as Brazil's leading sugarcane-producing state, with 65 of the country's 100 largest sugarcane-producing localities located within its borders (IBGE, 2018).

The sugarcane sector in São Paulo is dominated by large, sophisticated economic and political actors. The state has achieved a globally recognized level of agricultural modernization, with mechanized harvesting now exceeding 98% of all crops (CONAB, 2025b; Hayashi & Podesta, 2025). The exact rate of mechanization for planting is not publicly available, but expert interviews conducted for this study suggest that it is likely to be above 90%, closely mirroring the harvest mechanization rate.

Ribeirão Preto,[17] located in the interior of São Paulo, serves as a major hub for Brazilian sugarcane production. Nearly 2,400 of the 15,000 *estabelecimentos* (a broad term used to refer in this context to agricultural holdings, operations, or units of production) dedicated to sugarcane cultivation identified in the 2017 Brazilian Institute of Geography and Statistics census are in the Ribeirão Preto region of São Paulo state (IBGE, 2018). The region benefits from a favorable climate, fertile soils, high productivity, widespread mechanization, and advanced technology and research. Despite these advancements, reports of human rights violations persist in the local production chain.

[17] The Metropolitan Region of Ribeirão Preto, the data collection location, has 34 municipalities.

Figure 3. Processing facilities in the state of São Paulo



Source: Papel Social, based on UNICA data

Major business groups such as Raízen and São Martinho have their principal operations in São Paulo. Notably, the São Martinho Sugar Mill in Pradópolis is the world's largest single-site sugarcane processing facility, with a crushing capacity of 10 million tons per harvest (NovaCana, 2020). Interviews indicate that these companies are highly vertically integrated, managing everything from agricultural production to energy generation and export logistics.

In addition to large multinational corporations, cooperative associations play a significant role in organizing the supply chain. Copersucar, founded in 1959 as a cooperative of São Paulo mills, has grown to become the world's largest sugar and ethanol trader, representing 39 member mills (NovaCana, 2025a; UDOP, 2023). As mentioned previously, sugarcane producers in São Paulo also benefit from ORPLANA, a cooperative made up of 35 associations (Orplana, 2025).

> *"To give you an idea, until 2013, 2014, we had manual harvesting. Until 10 years ago, we harvested by burning. Today, the exact figure is that 98% of sugarcane crops in São Paulo are mechanized. So, practically speaking, less than 2% is still harvested manually. […] If you have 98% of the mills mechanized, I have the impression that planting also follows the same line."*
>
> *—Government agency representative*

3.6 DOWNSTREAM END USE: DOMESTIC CONSUMPTION AND EXPORT

3.6.1 Food and Beverage

This study identified instances of forced labor in sugarcane cultivation and harvesting. Once sugarcane reaches the mill, sugar produced from multiple suppliers is co-mingled, complicating the process of tracing the downstream raw and refined products back to specific farms. Consequently, in the absence of more exhaustive traceability systems, all downstream raw and refined sugar products are at risk of being produced with forced labor. This risk extends throughout global supply chains: because Brazil exports most of its sugar, food and beverage manufacturers worldwide may unknowingly rely on sugar linked to exploitative labor practices.

3.6.1.1 Sugar

Brazil exports most of its sugar, so downstream food and beverage industries around the world are at risk. Approximately 38 million of the 44 million MT of sugar Brazil produced in the 2024/25 harvest was exported. The residual sugar was consumed domestically. Many mills that produce sugar have their own sugar brands[18] and process and package products for direct sale to consumers through domestic retailers, as well as industrial buyers. Sugarcane is typically transported to the mill by truck. Mills may transport downstream sugar products to buyers by truck or rail. A key informant indicated that it is typically most efficient to send sugar destined for export markets to the port by truck.

In the food and beverage industry, Brazilian sugar is essential for large multinational corporations. Large-scale industrial consumers value Brazil's capacity to supply consistent quality and the large volumes required for industrial-scale production. Industrial sugar buyers encompass multinational food and beverage corporations, including soft drink manufacturers (the Coca-Cola Company, PepsiCo, Nestlé S.A.); dairy companies (Danone); and confectionery manufacturers (Nestlé, Ferrero, Hershey's).

Mills also sell raw sugar to domestic sugar refineries or trading companies, which then direct it to the export market.[19] Sugar may be transported to ports by truck or train. NovaCana reported that in 2024, 59% of Brazilian sugar exports (by value) were purchased by four traders: Wilmar, Sucden, Alvean, and Raízen [20] (NovaCana, 2025c).

In 2024, Brazil sugar exports totaled $18.6 billion (38.2 million MT). The majority of sugar exports, 86% by value, were exported in the form of raw sugar, rather than refined sugar (TDM, 2025) (see Appendix 8). Brazil's sugar exports have a significantly large and diverse international market base, to the extent that the largest destination market, Indonesia, accounted for only 8.9% by value, followed closely by India (8.7%) and China (7.6%). Buyers in these destination markets may further process the raw sugar into refined sugar for consumer or industrial use or consume the raw sugar, depending on market preferences.[21]

[18] Some specialty sugar products, including demerara sugar and organic sugar, command premium prices in niche market segments.
[19] Sugar destined for export is often transported by rail to terminals at the Port of Santos, a logistics model that reduces costs and dependence on road transport.
[20] More complete quantitative data are not publicly available. Subscription service NovaCana publishes more exhaustive information on traders and shipping companies.
[21] Although the destination markets for raw sugar trend the same as destination markets for total sugar exports, refined sugar exports were concentrated in different markets, led by Mauritania (7.9%), Cameroon (7.2%), and Senegal (7.1%) (TDM, 2025) (see Appendix 8). This likely reflects a lack of a sugar refinery industry in these foreign markets.

Table 2. Top 10 destination markets for Brazilian sugar exports (raw and refined), by value and quantity, 2024

Destination market	Value (USD)	Market share	Destination market	Quantity (MT)	Market share
Global	$18,601,675,229	100%	Global	38,218,784	100%
Indonesia	$1,652,876,344	8.9%	Indonesia	3,464,794	9.1%
India	$1,615,441,242	8.7%	India	3,353,045	8.8%
China	$1,405,429,320	7.6%	China	3,020,862	7.9%
United Arab Emirates	$1,145,391,247	6.2%	United Arab Emirates	2,490,479	6.5%
Algeria	$1,053,729,244	5.7%	Algeria	2,226,778	5.8%
Morocco	$924,150,303	5.0%	Egypt	1,980,944	5.2%
Egypt	$922,974,806	5.0%	Morocco	1,933,078	5.1%
Saudi Arabia	$892,168,219	4.8%	Saudi Arabia	1,897,215	5.0%
Bangladesh	$767,366,991	4.1%	Bangladesh	1,640,547	4.3%
Malaysia	$761,034,092	4.1%	Malaysia	1,605,072	4.2%

Source: TDM, 2025. Value free on board (f.o.b.) as reported by Brazil.

3.6.1.2 Cachaça

Within the beverage sector, the industry uses sugarcane juice and food-grade ethanol for the production of *cachaça,* vodka, and neutral spirits for blending, and as an ingredient in flavored alcoholic drinks and liqueurs beyond traditional sugarcane spirits. According to the 2024 Cachaça Yearbook, compiled by MAPA,[22] Brazil has 10,526 *cachaça* brands. International beverage companies with operations in Brazil's spirits sector include Bacardi, Diageo (which acquired a Brazilian *cachaça* producer in 2019), and Pernod Ricard. The sector also supports thousands of small and medium-sized producers, particularly in traditional producing regions of Minas Gerais and northeastern states, where *cachaça* production represents an important economic activity for rural communities and family-operated distilleries (de Almeida, 2025; Ferreira, 2025).

In 2024, Brazil exported $14 million worth of *cachaça* (TDM, 2025; Ministério da Agricultura e Pecuária, 2024). The United States remains the largest destination market for Brazilian *cachaça,* at 24% ($4 million), followed by Paraguay (11%) and Portugal (10%). Although the United States leads the market share in value terms, Paraguay is the top importer by quantity (19.7%), reflecting price premiums for premium *cachaça* varieties sold in the American market.

Table 31. Destination markets for Brazilian *cachaça,* by value and quantity, 2024

Destination market	Value (USD)	Market share	Destination market	Quantity (L)	Market share
Global	$14,544,293	100.0%	Global	6,661,887	100.0%
United States	$3,537,884	24.3%	Paraguay	1,313,405	19.7%
Paraguay	$1,603,571	11.0%	Germany	1,223,310	18.4%
Portugal	$1,486,728	10.2%	United States	824,091	12.4%
Germany	$1,371,171	9.4%	Portugal	660,708	9.9%
France	$839,242	5.8%	France	508,580	7.6%
Italy	$769,539	5.3%	Netherlands	263,473	4.0%
Uruguay	$767,782	5.3%	Spain	236,988	3.6%
Netherlands	$727,647	5.0%	Italy	232,210	3.5%
Spain	$590,799	4.1%	Cuba	183,878	2.8%
United Kingdom	$401,504	2.8%	Bolivia	133,992	2.0%

Source: TDM, 2025. Value f.o.b. as reported by Brazil.

[22] Data collected by MAPA in 2023.

3.6.2 Energy

3.6.2.1 Ethanol

One of the primary economic drivers of sugarcane production is the economic value of ethanol. The vast majority of ethanol is produced from sugarcane feedstock, although corn-based ethanol has been increasing in the last decade. In the 2024/25 harvest, Brazil produced 37 billion liters of ethanol, 79% (29 billion liters) of which was produced from sugarcane, with the remaining 21% from corn.[23] Of the ethanol produced from sugarcane feedstock, the majority (65%) was hydrated ethanol (19 billion liters), and the residual 10 billion liters were anhydrous ethanol[24] (Krueger, 2025; Sugarcane.org, 2025c; UNICA, 2025b).[25] A vast majority of this, nearly 95% of the ethanol produced in Brazil, is consumed domestically.

> *"Brazilian ethanol, I would say that 95% of it today is a product sent to the fuel sector in Brazil. In other words, it is directed to automobiles. Then you have a small share of ethanol. […] I would say that of the 35 billion liters of ethanol we are producing this year, we export […] a very small number."*
>
> *—Industry representative*

Ethanol derived from corn and ethanol derived from sugarcane can be produced as unique products or co-mingled in processing facilities or downstream sales points. The majority of ethanol is consumed as fuel in Brazil and likely comes from co-mingled sugar and corn feedstock sources. For domestic consumption needs, ethanol from sugarcane and ethanol from corn functionally interchangeable and are frequently co-mingled during transportation and storage operations, as both meet the same technical specifications for automotive fuel. Consequently, all ethanol fuel in Brazil is at risk of containing inputs produced with forced labor. International destination markets with human health requirements (pharmaceutical or cosmetic end use) or environmental regulations (specific carbon intensity requirements) may require feedstock identification throughout the supply chain (Desplechin, 2010; Ethanol Producer Magazine, 2024).[26]

In the Brazilian energy sector, the domestic regulatory framework[27] governing ethanol as an automotive fuel centers on mandatory blending requirements that create guaranteed demand. Ethanol dominates Brazilian domestic fuel consumption, particularly in the fueling of flex-fuel vehicles that can run on any mixture of gasoline and ethanol. Consumers with flex-fuel vehicles, which have dominated new car sales in Brazil since their introduction in 2003, can choose to fill their tanks with pure hydrated ethanol or a gasoline-ethanol blend.

> *"Energy is a major [downstream sugarcane] product: sugar, alcohol, and energy. Next, there is biogas, methane gas, produced through the chemical process of fermenting vinasse. […] There are already mills with 100 km pipelines to reach a point in the city and distribute [biogas]. As I told you, we have*

[23] Corn ethanol, although growing rapidly, is regionally concentrated in the midwest (Mato Grosso, Mato Grosso do Sul, Goiás). The region produced more than 7.8 billion liters of corn ethanol in the 2024/25 harvest (CONAB, 2025).
[24] Both types of ethanol follow the same production steps until fermentation, which produces hydrated ethanol. To obtain anhydrous ethanol, hydrated ethanol undergoes an additional dehydration processing step, in which nearly all the remaining water is removed.
[25] The ratio of hydrated to anhydrous ethanol for sugarcane ethanol is consistent with the ratio of production for total ethanol production: the majority was hydrated ethanol (24 billion liters) and the rest anhydrous ethanol (13 billion liters) (CONAB).
[26] The California Air Resources Board, for instance, requires specific Low Carbon Fuel Standard certification for ethanol imports, necessitating documented traceability of feedstock origin and production practices (California Air Resources Board, 2024).
[27] For more detailed information on Brazil's regulatory framework, see Appendix 9: Ethanol Regulation in Brazil.

organomineral fertilizers,[28] which are made from filter cake, leftover bagasse, and boiler ash, which are all mixed and transformed."

—Industry cooperative representative

Hydrous ethanol is sold at gas stations for direct use in flex-fuel vehicles, and anhydrous ethanol is blended with gasoline. In August 2024, the mandatory blend of ethanol into gasoline was increased to 30%, following a measure approved by the National Energy Policy Council[29] aimed at increasing Brazilian energy self-sufficiency and reducing fuel prices while expanding ethanol demand (Planalto, 2025). This mandatory blending applies uniformly nationwide and creates substantial captive demand for ethanol production.

Ethanol sales are regulated by the National Petroleum Agency. Mills supply ethanol (anhydrous or hydrous) to fuel distributors, which transport it by pipeline or truck to distribution centers before sending it across the country. Distribution companies are responsible for transporting the fuel to gas stations. Key fuel distributors purchasing ethanol include Petrobras Distribuidora (Brazil's state-controlled oil company), Ipiranga, and Shell, operating through its partnership with Raízen. These major distributors maintain supply partnerships with numerous mills throughout the Center-South production region and present multiple points of co-mingling products from multiple sources.[30] Direct sales from mills to gas stations are possible, but this type of sale is exclusive to a few large conglomerates with vertically integrated distribution centers, such as Raízen and Shell, and it is not the standard method of delivery in the state of Sao Paulo.

In addition to automotive fuel, ethanol is also a key component in the relatively smaller sustainable aviation fuel (SAF) sector.[31] Following international standards, SAF can be voluntarily blended with fossil jet fuel as long as they meet technical specifications established by the National Petroleum Agency. Brazil invests heavily in research, development, and regulation to expand the sustainable use of biofuels, including ethanol, biodiesel, and emerging aviation fuels, as part of a broader climate and energy transition agenda (Melo, 2020).

Table 42. Top destination markets for Brazilian ethanol exports, by value and quantity, 2024

Destination market	Value (USD)	Market share	Quantity (L)	Market share
Global	$1,051,421,903	100.0%	1,884,195,506	100.0%
South Korea	$416,751,361	39.6%	774,816,690	41.1%
United States	$181,828,211	17.3%	313,340,613	16.6%
Netherlands	$91,866,348	8.7%	152,677,597	8.1%
Nigeria	$54,688,691	5.2%	110,760,864	5.9%
Philippines	$54,030,131	5.1%	95,929,481	5.1%
Singapore	$38,086,225	3.6%	80,172,672	4.3%
Japan	$35,414,328	3.4%	64,114,481	3.4%
India	$29,047,414	2.8%	62,568,077	3.3%
Ghana	$27,155,765	2.6%	43,216,575	2.3%
Cameroon	$16,019,500	1.5%	21,309,250	1.1%

Source: TBD, 2025 as reported by Brazil. Value f.o.b.

[28] An organomineral fertilizer is a type of fertilizer that combines organic matter (such as compost or manure) with mineral nutrients to enhance soil fertility and crop growth.

[29] Brazilian gasoline historically contained approximately 20–25% anhydrous ethanol by volume.

[30] Since the enactment of the RenovaBio program in 2017, distributor engagement with mills regarding sustainability certification and decarbonization credits has increased (Hayashi, 2024).

[31] In Brazil, biofuels play a central role in the transport sector as a strategy to reduce greenhouse gas emissions, especially in aviation, which is one of the largest sources of CO_2.

While ethanol is primarily used for fuel in Brazil, it is also primarily used for non-fuel uses in most importing markets. According to an industry expert interviewed for this study:

> *"For the international market, there is a demand […] in fact, it is also worth mentioning that most of the 1.5 billion liters of ethanol that I mentioned is exported abroad, and most of this ethanol, almost all of it, is not for fuel purposes. It is for other purposes, such as making beverages, pharmaceuticals, and food, rather than for vehicles. This is because there is very little use of ethanol for fuel purposes, except in the United States. It is predominant in Brazil and the United States. Now India is also using it on a larger scale, but it has practically its own production. And it is derived from sugarcane, for the most part. Because there are requirements for you to use ethanol with a lower carbon footprint, there is a whole assessment for this purpose. So, today, we have seen almost no participation of corn ethanol in the international market. On the other hand, the American market, which is predominantly a corn market, already has a share in the international market with its ethanol for fuel purposes. The U.S. exports to India and Europe, for example, with a focus on automotive fuel."*
>
> —*Industry market consultant*

3.6.2.2 Sustainable Aviation Fuel

The sugarcane-based SAF sector has gained prominence in Brazil, positioning the country as a critical feedstock supplier for the emerging global SAF industry, though actual commercial SAF production from Brazilian ethanol remains extremely limited as of 2024–2025. SAF produced from sugarcane ethanol offers the potential for 60–80% lifecycle greenhouse gas reductions, compared to petroleum-based jet fuel, making it strategically important for aviation sector decarbonization efforts (Araujo, 2023; Raízen, 2023). However, investigative journalism has revealed that several Brazilian ethanol producers certified for SAF feedstock supply have documented connections to forced labor violations in their sugarcane supply chains, raising critical questions about the social sustainability of "green" aviation fuels (Repórter Brasil, 2024).

Brazil's role in the SAF value chain positions the country as a feedstock supplier rather than a processing hub. The SAF production pathway begins with Brazilian sugarcane ethanol exports to overseas processing plants, where ethanol undergoes catalytic conversion through the alcohol-to-jet pathway and is blended with conventional jet fuel to create drop-in aviation biofuel. Raízen achieved a watershed moment in August 2023 by becoming the first global ethanol producer to receive International Sustainability & Carbon Certification (ISCC) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) Plus certification, the mandatory international standard for SAF feedstock suppliers under the CORSIA framework maintained by the International Civil Aviation Organization (Araujo, 2023; Raízen, 2023). This certification enables Raízen to export certified sustainable ethanol to SAF production facilities worldwide. Only two Raízen facilities obtained the ISCC CORSIA Plus certification: the Costa Pinto and Gasa bioenenergy parks, the latter of which was subsequently cited by labor inspectors for four violations of outsourcing labor laws affecting third-party contractors (Repórter Brasil, 2024).

Following Raízen's certification breakthrough, several additional Brazilian producers obtained ISCC CORSIA certification in late 2023 and early 2024, including BP Bunge Bioenergia, Usina Coruripe, São Martinho, Adecoagro, Copersucar, and Zilor (Guedes, 2024; Souto, 2023). However, despite this certification progress, actual commercial SAF production from Brazilian ethanol remains minimal as of 2024–2025, with the fundamental bottleneck found not in ethanol feedstock availability but rather in the limited number of operational alcohol-to-jet processing facilities globally (CleanBridge, 2024). The Repórter Brasil investigation documented that three of these ISCC CORSIA Plus certified producers—Raízen, BP Bunge Bioenergia, and Usina Coruripe—had supply chains connected to recent forced labor cases in sugarcane production, despite their sustainability certifications (Repórter Brasil, 2024).

LanzaJet's Freedom Pines plant in Georgia, USA, which opened in January 2024 and reached full commercial operation in November 2025, represents the world's first commercial-scale facility producing SAF from ethanol feedstock through the alcohol-to-jet pathway, with 10 million gallons per year capacity (Fisher, 2025; LanzaTech, 2025). The facility receives Brazilian sugarcane ethanol as feedstock, and Raízen sent its first shipment to LanzaJet in April 2024 (Repórter Brasil, 2024). Financial backing comes from major aviation and energy stakeholders including British Airways, Shell, Microsoft's Climate Innovation Fund, Southwest Airlines, All Nippon Airways, and the U.S. Department of Energy (Whyte, 2022). When contacted by Repórter Brasil, LanzaJet emphasized its "robust code of business conduct throughout its supply chain" and reliance on ISCC Plus, ISCC CORSIA, and Bonsucro certifications that "include rigorous human and labor rights elements audited annually by third parties" (Repórter Brasil, 2024).

The ISCC CORSIA Plus certification includes six sustainability principles for sugarcane-cultivated properties, including requirements for "compliance with human, labor, and land rights" that explicitly prohibit forced labor and illegal salary deductions for personal protective equipment (PPE) and accommodation—requirements that extend to subcontracted companies (Repórter Brasil, 2024). Despite these standards, the Repórter Brasil investigation found that certified mills BP Bunge Bioenergia and Usina Coruripe already held certifications at the time of forced labor incidents involving their operations, and these certifications remained valid following the incidents. The Bonsucro certification organization, when contacted, stated that it takes "immediate action" upon learning of human rights violations allegations and requires licensed certification bodies to "investigate problems and monitor corrective actions," but it did not comment on specific cases (Repórter Brasil, 2024). The investigation highlighted significant gaps in certification oversight, with monitoring relying primarily on documentary audits often conducted remotely, and unions reporting difficulty participating in or observing certification audits (Repórter Brasil, 2024).

The specific forced labor cases connected to ISCC CORSIA Plus certified producers involved severe labor violations. In March 2023, 212 workers were rescued from conditions analogous to slavery at sugarcane plantations supplying BP Bunge Bioenergia's Tropical Bioenergia and Itumbiara Bioenergia mills in Goiás and Minas Gerais states (Repórter Brasil, 2024). Workers, primarily migrants from Piauí and Maranhão states, were forced to pay for their own housing, food, and transportation—illegal deductions that created debt bondage—while enduring degrading conditions that included sleeping on floors without mattresses, moldy accommodations with leaking roofs, and exposure to aerial pesticide applications (Repórter Brasil, 2024). In April–May 2022, 18 workers were rescued from 3 farms supplying exclusively to Usina Coruripe's Campo Florido mill in Minas Gerais, where workers faced 6-hour daily commutes covering 150 km each way, resulting in only 4 hours of sleep (Repórter Brasil, 2024). One worker, Alisson Moreira dos Santos, died from septic shock after developing an infection from wearing discarded boots found in the garbage because no protective equipment was provided (Repórter Brasil, 2024). The administrative infraction against Usina Coruripe for submitting workers to conditions analogous to slavery was confirmed in June 2024 after the company exhausted all appeals (Repórter Brasil, 2024).

Raízen's supply chain connections to forced labor cases involved indirect relationships through its ethanol suppliers. The Colombo Agroindústria, a Raízen supplier according to agribusiness credit documentation, had 32 workers rescued from forced labor in March 2023 and 11 additional workers rescued in May 2023 at separate sugarcane planting operations (Repórter Brasil, 2024). Workers at these sites endured debt bondage from mandatory food purchases at employer-designated stores, slept on old mattresses found in garbage, and lacked access to bathrooms and potable water in the fields (Repórter Brasil, 2024). The Cerradinho BioEnergia, another Raízen supplier that also provides ethanol to Ipiranga and Vibra, had 23 workers rescued in May 2022 from a leased farm where workers slept in a former church building without proper bedding and performed bodily functions in the bush due to a lack of bathroom facilities (Repórter Brasil, 2024). In each case, the forced labor infractions were attributed

to third-party contractors or sub-lessees rather than the mills themselves, illustrating the supply chain fragmentation enabled by outsourcing practices (Repórter Brasil, 2024).

Despite the nascent state of commercial production, SAF represents a significant future market opportunity for Brazilian ethanol producers. Industry analysis suggests that Brazil could provide feedstock for substantial SAF production, given its established ethanol infrastructure, though economic viability currently requires premiums of $0.40–$2.00 per liter to incentivize biojet fuel production from sugarcane using available alcohol-to-jet technologies (Watson et al., 2025). The Brazilian government enacted the Fuel of the Future Law in October 2024, establishing a SAF mandate that will come into force in 2027, targeting a 1% reduction in the aviation sector's 2026 emissions from domestic flights, increasing by 1% per year to 10% by 2037 (Hayashi, 2024; Primrose, 2024). The documented labor rights violations raise important questions about whether SAF procurement will incorporate adequate social due diligence alongside environmental carbon accounting, particularly as European Union Corporate Sustainability Due Diligence Directive requirements come into force requiring companies to verify human rights compliance throughout their supply chains (Repórter Brasil, 2024).

3.6.2.3 Bagasse

Brazil stands out internationally for its efficient use of sugarcane byproducts to generate bioelectricity. A byproduct of both sugar and ethanol processing, bagasse is widely used to generate power, supplying both the energy needs of processing facilities and contributions to the national electric grid.[32] Surplus electricity is sold to the National Interconnected System. This activity is regulated by the National Electric Energy Agency (ANEEL), which authorizes plants to operate as independent power producers and establishes the tariffs and conditions for access to the grid.

According to data from ANEEL, 84.3% of Brazil's centralized power generation comes from renewable sources. As of 2024, the 3 largest renewable sources in the electricity matrix are hydroelectricity (55%), wind power (14.8%), and biomass (8.4%). Within the biomass category, sugarcane bagasse and sugarcane leaf waste represent the dominant fuel sources (ANEEL, 2024). In 2024, sugarcane accounted for 75% of all biomass-derived bioelectricity delivered to the national grid (21,218 gigawatt-hours out of 28,260 gigawatt-hours total biomass generation), for a total contribution of 5.2% to the national grid (Sugarcane.org, 2025a; UNICA, 2025a, 2025d).[33] An industry representative emphasized the importance of the electricity contribution as follows:

> *"The mills produce energy. In fact, there are mills that end up producing energy for the grid, for a city of 200,000 inhabitants, even large cities."*
>
> *—Industry representative*

This study was unable to identify a full, consolidated list of all companies contributing electricity from bagasse to Brazil's national grid, but KIIs indicated that most large sugarcane mills do supply power.[34] As of 2023, Brazil had 637 biomass-based generation units nationwide, most of which (422 plants) run on

[32] In the case of co-generation, sugarcane bagasse can be reused as electricity. Bagasse is burned in boilers, generating heat that transforms water into steam. The steam, in turn, moves a turbine, whose rotation converts thermal energy into mechanical energy. This energy is then transferred to an electric generator, which transforms it into electricity (Nepomuceno & Vasconcelos, 2025).

[33] Note, the 5.2% is calculated from data from two different sources: using ANEEL data, 84.3% of centralized power comes from renewal energy, of which 8.4% is biomass; and using UNCA data, 75% of biomass contributed to the national grid.

[34] Databases from ANEEL and the National Interconnected System require cross-referencing and additional analysis time to verify each facility's participation. This type of analysis is not feasible within the research constraints of this report. The data are also limited, as these databases do not specify how many units are currently active, but instead indicate the amount of energy generated per facility.

sugarcane bagasse, totaling 12,410 megawatts of installed capacity (Ministério de Minas e Energia, 2024).[35]

3.6.3 Pharmaceuticals

Beyond transportation fuel applications, ethanol serves multiple industrial sectors and typically commands higher profit margins than fuel ethanol sales. Industrial applications extend to cosmetics and personal care products, in which ethanol functions as a solvent in perfumes, colognes, and personal care items. Brazilian sugarcane ethanol's cost competitiveness relative to ethanol from other feedstocks (such as sugar beets produced in Europe) makes it attractive for these applications.

During the COVID-19 pandemic, demand accelerated for hand sanitizer production. As one industry representative explained:

> *"The pharmaceutical industry uses a small proportion of ethanol as alcohol. In perfumery, ethanol is used to make perfume. And sugarcane ethanol is cheaper than ethanol from beets or other crops. Sugarcane costs less to produce. That's why it's widely used for other purposes."*
>
> *—Industry representative*

However, for export markets, particularly those with health and safety or carbon intensity, sustainability certification on ethanol feedstock can be critically important (Desplechin, 2010; Ethanol Producer Magazine, 2024). Sugarcane-based ethanol is often preferred because it has a lower footprint than corn-based ethanol. As environmental regulatory guidelines are more explicit than labor requirements, global importers do not have an equivalent business concern over the purchase of products at risk of being produced with forced labor. Ethanol exported to Asian markets for food and pharmaceutical applications commands premium pricing but requires rigorous quality specifications and feedstock verification that preclude co-mingling with other ethanol streams (S&P Global Commodity Insights, 2025).

The critical regulatory distinction lies in feedstock sourcing and potential co-mingling points. Brazil's National Agency of Petroleum, Natural Gas and Biofuels maintains comprehensive databases tracking production volumes, mill-level output, and feedstock types (sugarcane versus corn) to support this regulatory oversight, though the agency's mandate focuses primarily on fuel quality and market regulation rather than labor conditions in feedstock production (Hayashi, 2024).

Exports of ethanol for pharmaceutical or cosmetic end uses are tracked through the ethanol export statistics provided previously.

3.6.4 Chemicals and Plastics

Ethanol can also serve as a solvent in various industrial processes, including coatings, inks, and chemical synthesis, while also functioning as a chemical intermediate in the production of ethylene and downstream petrochemical products (Elchemy, 2025; Ethimex, 2019; Krueger, 2012).

Braskem, South America's largest petrochemical company, is the primary purchaser of sugarcane ethanol in Brazil for bioplastic production. Braskem's operations are based in the state of Rio Grande do Sol, to produce "green bioplastics" that carry lower lifecycle carbon emissions due to renewable feedstock. The company has achieved Bonsucro certification for its sugarcane-ethanol-to-bioplastic supply chain. However, absent more robust traceability systems, sugarcane-based ethanol is at risk of being made with sugarcane produced with forced labor.

[35] In 2023, biomass power generation in Brazil reached a record 3,218 average megawatts, supplying 4.6% of national electricity demand, according to the Electric Energy Trading Chamber. Brazil maintained its global leadership in clean energy, with 93.6% of electricity coming from renewable sources.

These bio-based resins are used to manufacture packaging, bags, toys, housewares, industrial cables and wires, packaging films, hockey fields, reusable water bottles, and numerous other products, with applications across packaging, footwear, cosmetics, paints, and adhesives sectors (Braskem, 2023; Rosengren, 2025).

According to Braskem earnings reports, the overall sales volume of the company's bio-based polyethylene was 191,000 tons in 2024, representing a 23% increase from the prior year (Rosengren, 2025). To produce 260,000 MT of bio-based polyethylene at current capacity requires approximately 84,500 hectares of sugarcane cultivation, representing approximately 0.025% of Brazil's total arable land and consuming roughly 1.7% of total Brazilian ethanol production (Braskem, 2025). Braskem reports that its bioplastics are exported to more than 30 countries and used by more than 250 major brands, with downstream customers including Tetra Pak, Johnson & Johnson, Natura & Co, Grupo Boticário, Nissin, and Allbirds (Braskem, 2023; Rosengren, 2025).

Exports of ethanol for chemical and plastics end uses are tracked through the ethanol export statistics provided previously.

3.7 TRACEABILITY

3.7.1 Traceability Overview

Processing mills source from multiple smaller farms, and sugarcane is co-mingled at the point of processing. A government informant explained that, in general, mills in São Paulo operate with more of their own sugarcane planted areas, with 30–40% of the sugarcane coming from third-party suppliers.

This point of co-mingling in the supply chain increases the processing facilities' risk of producing downstream sugarcane products produced with forced labor.

In the Brazilian sugarcane industry, traceability faces significant structural barriers, both physical and commercial, which are partially mitigated by private certification systems. The main obstacle to end-to-end traceability lies in the mill's industrial process itself. During crushing, sugarcane from hundreds of different farms—owned, leased, partnered, or independent suppliers—is mixed. This process makes it difficult for anyone outside the industry to isolate the origin of a specific batch of sugar or ethanol. A key informant describes this barrier clearly:

> *"Traceability, as long as it's sugarcane, even from the supplier. The mill has to know what type of raw material it is buying, where it is coming from, where it is being planted, for contractual reasons […] but it depends a lot on the final process, because in the final process, the milling process, it is very comprehensive, so several trucks arrive, several types of cane, and in the end, everything comes out together. I believe it is much more complex to know the type of bagasse that is being sent to that pharmaceutical industry. The mill will have initial traceability, but for the final product, it will no longer be possible to define which bagasse is which."*
>
> *—Industry representative*

This physical mixing is reinforced by a commercial information barrier. Qualitative interviews indicate that mills consider their supplier lists and contract details to be strategic and proprietary information. Public agencies that collect production data directly from mills operate under confidentiality agreements. They release only aggregated data, without detailing the origin of the sugarcane by supplier. Detailing origin is seen as essential to maintaining trust and access to information with the private sector, according to one interviewee.

"That's where I'm coming from, that's the thing, you'd have to go out into the field yourself. I get this information from the mill and we don't break it down. That's why we have credibility with the mills, we pass on generic information. We don't specify."

—Government agency representative

If a case of forced labor is identified on a supplier farm, all of that mill's customers may unknowingly be purchasing products contaminated by this human rights violation. The complexity of the supply chain and the dilution of origin serve as mechanisms that can hinder accountability.

3.7.2 Private Certification Systems

To fill this gap in traceability and transparency, private certification systems have emerged, serving as a form of voluntary governance. The most prominent is Bonsucro, a global standard developed specifically for the sugarcane supply chain.

These private systems coexist with government regulatory programs, such as RenovaBio (National Biofuels Policy). Although RenovaBio also assesses production sustainability to assign an energy efficiency rating to each plant, its primary focus is the biofuel's carbon intensity, not the raw material's social traceability. A market expert differentiates between the two approaches:

"The requirement is much more about standards and less about traceability. Now, I think we can talk much more about this subject when we have, for example, the RenovaBio program. There, you have a much more comprehensive questionnaire to assess your suppliers, your planting, your management, your industrial process, your storage, your transportation, the entire chain. To be able to actually assess whether you comply with all environmental rules, from the point of view of sustainability, from the point of view of governance […] I think that's more or less what we can see in the Brazilian market. But for traceability, I haven't seen it."

—Industry market consultant

There is only one initiative on full traceability on the sugarcane sector: the Brazilian Agro-traceability System (Sibraar), developed by the Brazilian Agricultural Research Corporation (Embrapa), a government entity. Sibraar uses blockchain technology as a transparent authentication tool for its production and tracing data.

"[T]he Granelli mill, which is located here in the municipality of Charqueada, near Piracicaba. It's a family business. And it was very successful. They make brown sugar, and today 100% of the sugar they produce goes to the blockchain, which shows where it comes from, which producer, which field plot produced that sugar. So there's complete traceability, which today we say most markets are demanding, whether for soybeans, corn, or meat as well."

—Sugarcane producers cooperative

While public policy focuses on macro-environmental goals, private certifications meet a market demand for assurance and granular transparency in the supply chain. They function as a risk management mechanism for global brands that are under increasing pressure from consumers, investors, and international legislation to demonstrate that their products are free from human rights and environmental violations.

Certification, however, is not universal, creating a segmented market in which sustainability and traceability are, in many cases, attributes of a premium product, rather than a basic condition guaranteed by the entire industry. One interviewee stated that only 15% of sugarcane production in Brazil is certified by Bonsucro, for example, and that this results in less attention being paid to supply chain tracking:

"There is still a very low level of consumer awareness regarding these sustainable attributes. Consumers, especially consumers of commodity products such as sugar, for example, are much more concerned with the

price of a bag of sugar than where that sugar comes from. […] So little attention is paid to how this ethanol is being produced, the environmental and social conditions of this production chain."

—Certifying company representative

3.7.3 Gaps in Monitoring and Due Diligence

Product tracking in the sugarcane supply chain is also hampered by a lack of monitoring at the highest levels of the industry regarding what is happening at its base. Producer associations interviewed stated that, in general, contracts between suppliers and mills cover any type of regulation in the sector.

"There is a wide variation in contracts, all based on CONSECANA. […] The contract covers everything. It covers the harvest season, when they have to deliver, every month while the mill is running. I talk about the legislation, that there can be no slave labor and all the labor laws that the supplier has to comply with, all those rules, laws, NRs [National Regulations], and labor laws."

—Sugarcane producers association

Several interviewees reported that many plants fail to conduct regular on-site visits and inspections, instead relying on the contract. Working conditions experts believe that, in practice, this is not enough to ensure due diligence.

"Of course, the contract says that the partner undertakes not to exploit child labor, not to exploit slave labor, but everything is just 'window dressing,' because they don't have any effective control system for what's happening with their partners. They don't worry about it, imagining that if they don't worry about it, they won't have any responsibilities, and then the working conditions at these suppliers tend to be worse."

—Government labor inspector

4 LABOR FINDINGS

This section begins by detailing the demographic characteristics of the respondents, including age, sex, education, and region of origin, and outlines the main types of work performed in the sugarcane sector. It then examines workers' reports of their working conditions, recruitment pathways, contract types, exposure to occupational hazards, provision of safety equipment and training, earnings and payment systems, and work schedules. Next, the analysis presents findings regarding workers' being subjected to conditions of forced labor, presenting quantitative indicators of involuntary work and coercion, and discusses how these manifest in the sector.

The study found that 60% of respondents reported at least one indicator of involuntary work, most commonly hazardous or degrading working conditions (48%), followed by onerous hours (25%) and deceptive recruitment (18%). Thirty-five percent experienced at least one indicator of coercion, with restrictions on movement being most frequent (32%), along with abuse of vulnerability (8%), withholding wages (5%), retention of identity documents (4%), and threats of violence (1%). Combining both dimensions, 30% of respondents met the criteria for forced labor.

Finally, the section addresses child labor, noting that 21% of respondents reported minors working at their sites and providing qualitative accounts that underscore the socioeconomic vulnerabilities driving exploitative practices in Brazil's sugarcane industry.

4.1 CHARACTERISTICS OF RESPONDENTS

Respondent demographic characteristics are provided in Table 5.[36] Respondents ranged in age from 19 to 64 years old, with an average age of 36 years old. Nearly two-thirds (65%) of respondents were male, and just over one-third (35%) of respondents were female.

Table 53. Respondent background characteristics

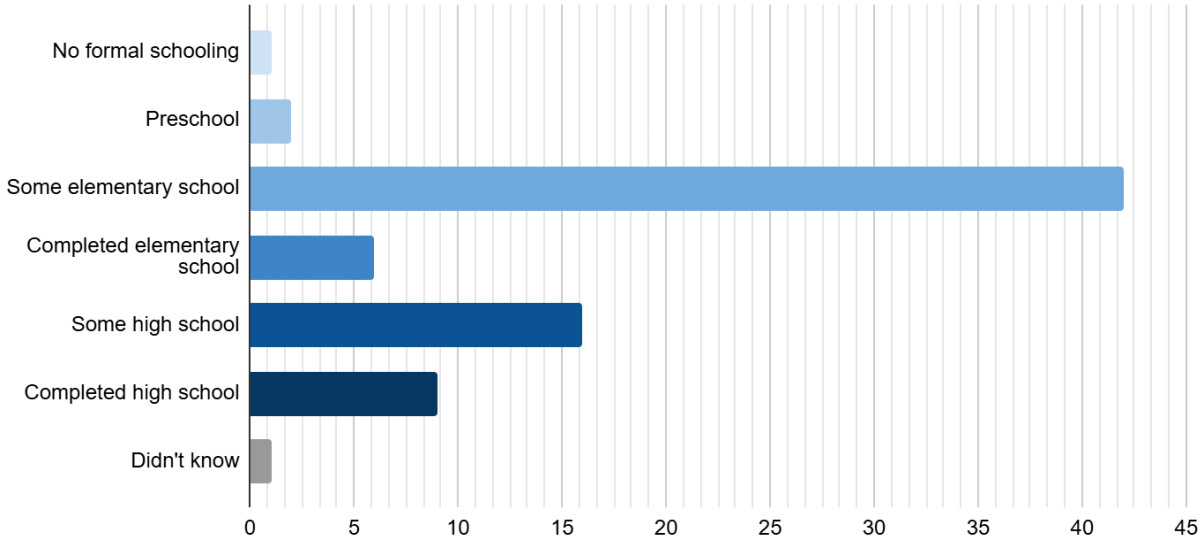
	%	N
Age (years)		
18–24	10%	8
25–39	55%	42
40–54	29%	22
55+	6%	5
Sex		
Male	65%	50
Female	35%	27
Education[1]		
No formal education	1%	1
Preschool/Kindergarten	3%	2
Some primary education	55%	42
Complete primary education	8%	6
Incomplete secondary education	21%	16
Complete secondary education or higher	12%	9
Number of respondents (N)		**77**

[1] One respondent did not know their highest level of education.

Most respondents (55%) had some primary education, 8% finished primary school, and 33% completed some schooling beyond primary school. Only one person never attended school.

[36] For all tables: Missing responses ("don't know" and "refused") are excluded from the denominator for all estimates. Some estimates are presented for all respondents and some by subgroup. Tables presenting estimates by subgroup use column percentages, meaning that they show the percentage of workers in each row among those in the subgroup indicated in that column. Each row presents both an estimate and the numerator, denoted by "n," associated with the estimate. The denominator, denoted by "N," is included at the bottom of tables in which all rows have the same denominator, and it is presented in the final column of the row in tables in which rows have varying denominators (due to question filters).

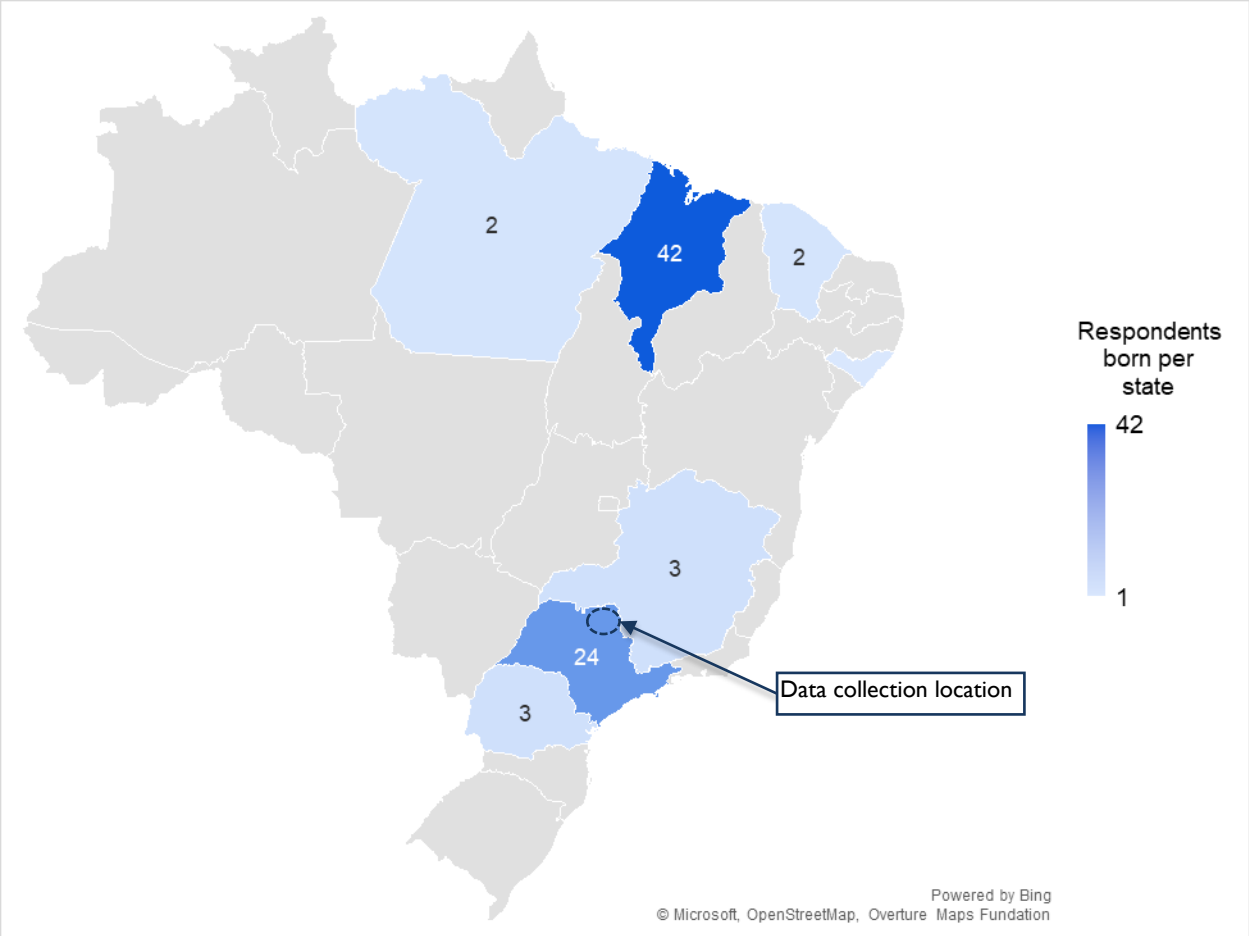
Figure 4. Distribution of respondents' educational attainment



Source: ICF

All respondents worked in São Paulo, but most were born elsewhere; 31% were born in São Paulo, and more than half came from Maranhão (55%). Despite the diversity of origins, only 10% of workers reported that they relocated for their most recent job in sugarcane. The remaining workers who were not born in São Paulo likely moved earlier in life or for a previous job.

Figure 5. Mapping the state of birth of respondents



Note: Numbers correspond to the number of respondents born in each state.
Source: ICF

Primary sugarcane activities of respondents are shown in Table 6. Three-fourths (74%) reported spending the most time on planting or preparing sugarcane fields, and 19% reported dedicating most of their time to cutting or harvesting; 6% identified other work-related tasks as their main activity. Responses indicate some differences in primary activities among men and women. Similar percentages of men (72%) and women (78%) reported planting as their primary activity. However, the percentage of men (24%) reporting cutting or harvesting as their primary activity is twice that of women (11%). This disparity likely relates to the highly physically demanding nature of cutting and harvesting.

Table 64. Primary sugarcane activity

	%	n
Planting or preparing sugarcane fields	74%	57
Cutting or harvesting sugarcane	19%	15
Other sugarcane activity	6%	5
Number of respondents (N)		**77**

The nature of manual work in sugarcane production varies significantly, depending on the degree of mechanization. A union leader from Minas Gerais described the most common activities in mechanized planting operations:

"There is a machine that throws the cane on the ground, and the workers distribute it within the furrow. Then some people come with cane knives, hitting about 3 canes and cutting the cane into pieces, with a gap of about 30 to 40 centimeters between each cut. Then a machine passes over the top, applying a product to prevent termites from eating the cane. As this machine passes, it covers the cane. Then the workers come in to touch up, covering the furrow with a hoe. They cover the cane that was left exposed."

—Union representative

Even in highly mechanized areas, manual support work remains necessary. Workers interviewed in Ribeirão Preto confirmed performing tasks alongside machines, with some riding on trucks during planting operations despite safety concerns. One worker explained the continued need for manual intervention:

"The machine puts it in (the cane) and you spread it, but it's manually. Sometimes, when planting, it has to be manual. Because if you cut each bud with the machine, it hardly grows. If you cut it with a cane knife, it grows better."

—Sugarcane worker

In areas in which mechanization is impossible, such as steep terrain, rocky ground, or other hard-to-reach locations, workers perform cutting tasks manually. During periods of lower demand for planting or harvesting, the workforce shifts to complementary tasks such as field maintenance, fertilization, irrigation, and weeding. As one worker described:

"The machine picks up the cane; we cut the cane where the machine can't get in to cut it. Because there are lots of places where the machine can't get in to cut. […] Sometimes on hills, rocks, things like that. […] These last few days we've been doing more of the daily work, which is weeding under trees and cutting cane. There's been very little planting."

—Sugarcane worker

Roles within sugarcane crews are typically divided based on age, gender, and physical capability. Men generally perform the most physically demanding tasks, such as cutting and loading cane. Women participate extensively in planting activities, particularly covering distributed cane with soil, and in post-harvest cleaning, collecting the remaining cane pieces (butts or stubs) left in the field. Younger individuals or those under age 18, when present, are usually assigned to cleaning and maintenance tasks.

All respondents were employed by an employer for their most recent sugarcane job; none reported being self-employed. The majority (91%) indicated that they report to field supervisors or team leaders, typically known as *turmeiros* or *fiscais* in the sugarcane sector. A few respondents mentioned reporting to other actors, including owners, company representatives, subcontractors, cane suppliers, and recruiters. The high proportion of respondents who reported *turmeiro*s as their supervisors, rather than being supervised by representatives of the company or the landowner, reflects the intermediary work structure of the sugarcane sector. The *turmeiro* coordinates and sometimes recruits sugarcane field teams, oversees task distribution and production, and reports to superiors. In many cases, the *turmeiro* also functions as an enforcer, which can include applying pressure for productivity and, at times, complicity in abusive practices.

*"What we have observed is that when sugarcane is purchased by the mill from suppliers, many of the working conditions are not respected, because the mill's own sugarcane suppliers, even though they respect or say they respect labor legislation in the sugarcane contract, they will hire or subcontract contractors or third-party companies, which is the outsourcing of outsourcing, which we call '*quarteirização*,' to harvest the cane, which has led to a series of human rights and labor rights violations."*

—Academic researcher

4.2 NATURE OF WORKING CONDITIONS

4.2.1 Recruitment and Contracting Practices

The study explored pathways into respondents' jobs to understand whether deceptive recruitment took place (Table 7). Most (82%) respondents reported that someone helped them get their job, and respondents could report more than one source of help. Among those who received help, friends or neighbors were the most common source of assistance (68%), followed by family members (32%); a smaller proportion received help from labor intermediaries, including *turmeiros* (10%) and brokers (*gatos*) (3%). Almost one-third (30%) of workers felt compelled to take the job. For all of these respondents, their sense of being unable to refuse this job was rooted in poverty or lack of alternative jobs.

Many sugarcane workers came from the northeastern region of Brazil, where economic conditions are particularly challenging, making them feel obliged to take any available work. A forced labor expert explained:

> *"And then, along with that, we have an economic crisis, a scenario of unemployment, of misery, which makes [the availability of] labor abundant. And it means that these workers—since you're talking about the Southeast specifically—come, mainly from the Northeast. We know that to be able to work in any conditions because the conditions in their place of origin are conditions of total despair, I think we can say that. So, people will accept anything."*
>
> *—Forced labor researcher specialist*

One-fifth (21%) of respondents indicated that the conditions of their job did not match what they were promised before taking the job, mostly regarding the earnings (69%), work tasks (50%), or hours (31%). A number of workers reported, for example, being deceived about the price they would be paid per meter of sugarcane cut or planted. Of the 16 respondents with unmet promises, 9 said that they would be dismissed if they asked for promised conditions, 1 expected verbal abuse, and the rest believed nothing would happen or were unsure.

Although no coercion beyond dismissal was reported in response to the close-ended question, a respondent relayed a more concerning anecdote in response to an open-ended prompt:

> *"I was deceived several times about the price of sugarcane. They really deceive us about the price. They lie to everyone about the price. They say they will pay one price and then pay another."*
>
> *—Sugarcane worker*

This worker went on to describe being promised a payment of R$4.50 (USD $0.83) per meter of sugarcane. Upon arriving at the farm, the supervisor reduced the amount by more than half. When the worker refused to work for the new rate and tried to return to the bus, the vehicle was locked and removed. Left in the sun, without shelter or alternatives, he felt forced to work under the imposed conditions to "earn a little more than R$2 [USD $0.37, per meter] rather than nothing."

Table 7. Recruitment practices

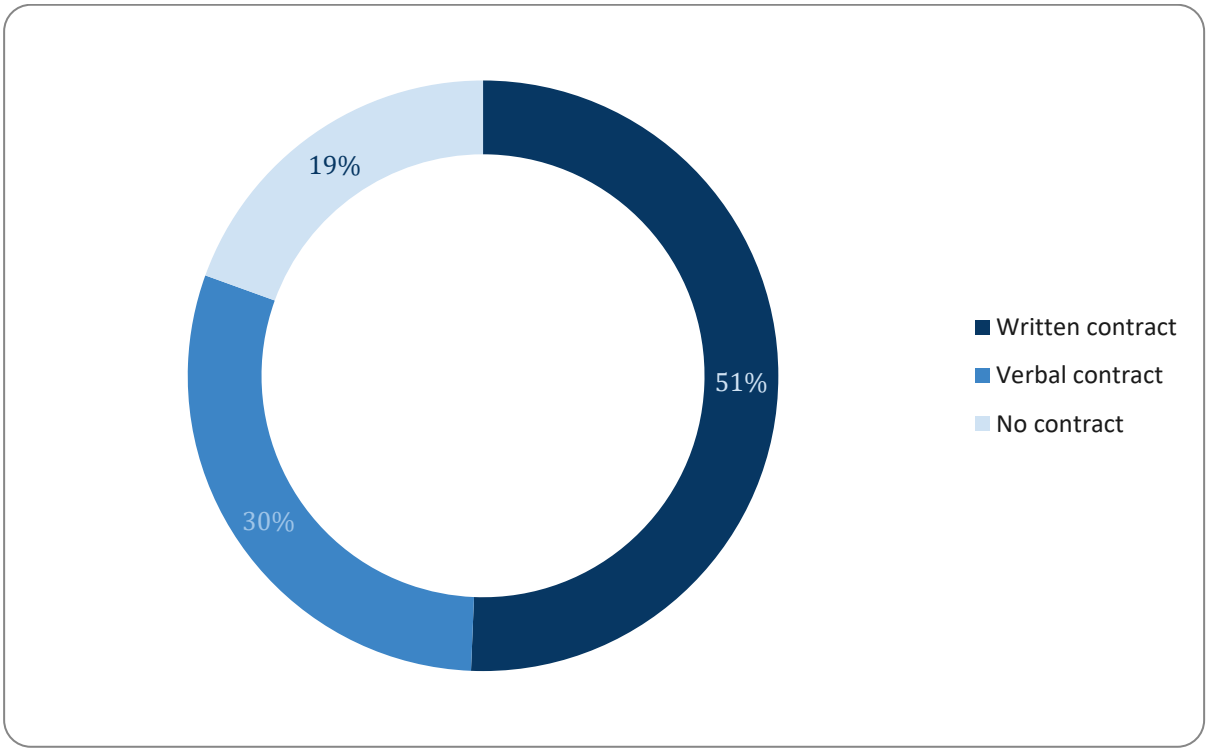
	%	n	N
Someone helped get job	82%	63	77
Source of help[1]			
Friend/neighbor	68%	43	63
Family member	32%	20	63
Field supervisor (*turmeiro*)	10%	6	63
Broker (*gato*)	3%	2	63
Other	11%	7	63

	%	n	N
Conditions of job do not match promises	21%	16	77
Conditions not matching promises[1]			
Earnings	69%	11	16
Work tasks	50%	8	16
Hours	31%	5	16
Nature of the job	19%	3	16
Hazards	6%	1	16
Other	31%	5	16
Contract/agreement			
Written contract	51%	39	77
Verbal agreement	30%	23	77
None	19%	15	77

[1] Multiple responses possible

The workforce in Brazil's sugarcane sector is largely informal, with workers often lacking formal contracts or stable employment relationships. Half of respondents (51%) had written contracts, and a greater proportion of men (58%) than women (37%) had written contracts. A greater proportion of women (37%) than men (26%) had verbal agreements, and a great proportion of women (26%) than men (16%) lacked an agreement of any kind. This lack of formalization exposes a significant portion of workers to instability and limited legal protection.

Figure 6. Contract type reported



Source: ICF

Brazilian labor law explicitly permits verbal employment contracts for most work relationships, including standard agricultural employment. Article 443 of the *Consolidação das Leis do Trabalho (*Consolidation of Labor Laws) provides that employment contracts may be "agreed tacitly or expressly, verbally or in writing."

Seasonal harvest contracts (*contratos de safra*) are included in the class of contracts that may be in writing or expressed verbally (Article 14 of Law 5.889/1973; Decreto 73.626/1974) (Cavalcante, 2022). However, two exceptions exist in which written contracts are required for agricultural workers:

- If an employer provides housing and subsistence goods to workers and wishes to exclude these from salary calculations, they must execute written contracts with witnesses and notify the relevant rural workers' union (Article 9, §5 of Law 5.889/1973).
- If a worker is employed under the short-term rural worker regime (*trabalhador rural por pequeno prazo*), Law 11.718/2008 requires either *Carteira de Trabalho e Previdência Social* (Work and Social Security Card) registration or, alternatively, a written contract containing specific elements authorized through collective bargaining agreements.

Standard seasonal sugarcane workers employed under *contratos de safra* arrangements, as opposed to the very short-term contracts under Law 11.718/2008, may therefore be legally hired based on verbal agreements, though employers remain obligated to register all workers in the Work and Social Security Card system regardless of whether a separate written contract exists.

Neither exception appears to apply to the majority of interviewed workers in this study. Regarding the housing exception, although some interviewed workers do receive employer-provided housing (*alojamento*), interview evidence indicates that workers typically pay for this housing through wage deductions or direct monthly payments rather than receiving housing as an in-kind salary benefit that employers exclude from wage calculations. Regarding the short-term worker exception, the *trabalhador rural por pequeno prazo* regime under Law 11.718/2008 applies only to engagements of two months or less within a one-year period with individual rural producers (*produtor rural pessoa física*); interview evidence indicates that most workers have seasonal contracts of three to four months or longer (such as four-month planting contracts or harvest season employment spanning April through December), and are employed by mills or labor intermediaries (*turmeiros*) rather than individual producers, placing them under the standard *contrato de safra* framework in which verbal contracts remain permissible.

Despite the legal permissibility of verbal contracts, their prevalence in agricultural employment creates significant practical obstacles for workers seeking to enforce their labor rights. Workers employed under verbal agreements face substantial evidentiary challenges when attempting to prove employment terms in disputes over wages, working hours, or workplace injuries, a burden that falls disproportionately on populations with limited formal education and literacy. Study interviews illustrated these difficulties. One worker who suffered a workplace injury while employed informally reported spending nearly three years unable to access treatment or compensation: "I had an accident at work, but since we were casual workers, without registration, there was nothing I could do. I had to support myself however I could." The same worker described how the absence of written documentation facilitates deception regarding employment terms: "We live by deception, to be more exact. They deceive a lot of people, saying they'll pay one way […] but then when it comes time to get paid, it's not what we agreed to." The lack of written documentation also facilitates the broader patterns of exploitation documented in this study, including wage theft, unauthorized deductions, and failure to provide promised benefits—violations that are difficult to contest without proof of the original agreement.

4.2.1.1 Labor Subcontracting and Outsourcing

The widespread use of labor contracting—often referred to as "outsourcing"—in Brazil's sugarcane sector is a direct result of recent changes to Brazilian labor law made in 2017 (R. V. de Oliveira, 2018).[37]

[37] Two laws enacted in 2017 collectively transformed Brazil's outsourcing regime. Law 13.429/2017, enacted in March 2017, first amended Law 6.019/1974 to permit outsourcing of any company activity, including core business functions (*atividades-fim*), reversing decades of restrictive judicial interpretation. Law 13.467/2017—the broader Labor Reform enacted in July 2017—subsequently reinforced and expanded these provisions while introducing additional changes to employment contracts,

These changes fundamentally altered the legal framework governing outsourcing in Brazil, facilitating the shift toward contractor-based recruitment that has reduced worker protections in the sugarcane sector. Prior to the reform, Brazilian labor courts had established through *Súmula* 331 of the Superior Labor Court that outsourcing of *atividades-fim* (core business functions) was prohibited, and that contracting companies bore subsidiary liability for labor obligations when outsourced workers' rights went unpaid (Boccuzzi & Vizotto, 2018). The 2017 reform eliminated this distinction between core and non-core activities by amending Article 4-A of Law 6.019/1974, which now permits "the transfer by the contracting party of the execution of any of its activities, including its main activity, to a legal entity under private law providing services that has the economic capacity to carry them out" (Rezende, 2018). In the sugarcane context, this means that activities such as planting and harvesting, previously considered core activities that mills could not lawfully outsource, can now be legally transferred to third-party service providers.

In late 2018, the Supreme Federal Court upheld this change, ruling that a company can legally outsource any part of its business. Crucially, the court established that the contracting party (the primary company paying for the service, such as a sugarcane mill) only holds "subsidiary liability." This means that the mill is only responsible for labor violations as a last resort; a worker must first attempt to sue and collect from the smaller contracting company (the secondary firm providing the laborers). This creates a legal shield for the mills, as they are no longer immediately or equally responsible for abuses occurring on their property (Ruiz, 2018).

> *"These mills, these companies, because of the fines they have already suffered in the past, have taken responsibility and complied with labor legislation. However […] with outsourcing, they are no longer held accountable, even if human and labor rights violations occur at the supplier that is delivering the sugarcane to them. They don't want to know how that sugarcane was harvested, they want to know if the sugarcane is arriving at the mill to be crushed or not."*
>
> *—Academic researcher*

The practical effect of these changes has been to create additional layers of legal separation between mills and the workers who cultivate and harvest their sugarcane. Under the reformed framework, mills that purchase sugarcane from independent suppliers bear no automatic legal responsibility for labor conditions on supplier farms, even when those suppliers further subcontract labor recruitment to intermediaries, a practice known as *quarteirização* (fourth-party contracting).

In a recent interview with Repórter Brasil, law professor Lívia Miraglia of the Federal University of Minas Gerais echoed this point, saying that "the broad and unrestricted permission for outsourcing" granted under the established by the revision of the outsourcing law in 2017, guaranteed legal security for companies at the top of the chain to transfer various production stages, such as sugarcane planting, to service providers (Repórter Brasil, 2024). The result is a supply chain structure in which labor intermediaries and subcontractors—entities that typically lack the financial capacity, institutional oversight, and reputational incentives of large mills—become the direct employers of vulnerable migrant workers, and the companies that ultimately profit from sugarcane processing maintain legal distance from the conditions under which that cane was produced.

4.2.2 Hazardous Work

Most respondents indicated that their work involves health or safety risks. As shown in Table 8, the most common risks, reported by nearly all respondents, were exposure to sharp and dangerous tools or machinery (96%) and exposure to extreme heat (95%). Other common risks included carrying

collective bargaining, and labor court procedures. Together, these laws eliminated the legal distinction between core and ancillary activities for outsourcing purposes and established that contracting companies bear only subsidiary (secondary) liability for the labor obligations of their service providers, meaning that workers must first exhaust claims against their direct employer before seeking recourse from the contracting company.

unreasonably heavy loads (45%) and exposure to hazardous chemicals such as pesticides and herbicides (26%). Less commonly reported hazards included dangerous animals, accidents involving transportation, and risk of falling.

Thirty-nine percent of respondents reported injuries or illnesses due to their jobs. Among those who reported injuries, the most common were hand injuries, back pain, and knee or leg injuries. The main causes of injury were repetitive strain, tool accidents, and heat exposure.

> *"The planting of cane, the cutting of cane, it breaks a guy's back. Because you're bending down all the time, working all day, squatting and lifting, squatting and lifting. And it's hard work. […] I [have] a back problem, a herniated disk due to working in sugarcane for a long time."*
>
> —*Sugarcane worker*

Qualitative questions elicited numerous descriptions of chronic health impacts associated with sugarcane work. Long hours under intense heat and repetitive stress often result in extreme exhaustion and cardiovascular, musculoskeletal, and gastric diseases. One worker described serious complications resulting from the exhaustion and irregular eating habits involved in sugarcane work:

> *"I burst my ulcer, it went to my stomach, my intestines. I had emergency surgery. […] I'm at risk of losing my intestine, but I'm surviving, I'm alive, that's good."*
>
> —*Sugarcane worker*

For this worker and others like him, occupational diseases can result in long-term or permanent disability that preclude continued work.

In addition, 32% reported experiencing mental health problems due to work. One worker described the mental toll of the work:

> *"I can't stand planting sugarcane anymore, because it's these little mounds. […] The work they put us to do there is slave labor. It's slave labor, do you understand? There are poor people there who I think are working because they need to. Because I saw them there I myself can't stand planting in the ground anymore. Because that's work for slaves."*
>
> —*Sugarcane worker*

Another said:

> *"Tiredness and stress, that's what we go through most there. Tiredness, stress, anger. […] I felt like giving up everything and leaving."*
>
> —*Sugarcane worker*

In some cases, psychological effects appear after an injury or physical impact on the worker's health, primarily due to feelings of helplessness in the face of work demands. A worker experienced severe anxiety and stress at work following an arm injury:

> *"It's crazy, I cried, there were times when I left, I'd go to the middle of the cane and cry by myself. 'I'm getting out of here, I'm getting out.' I was dying to leave. I'd stay in the bus, I didn't work, I didn't hit the target. […] Too much [pain]. My arm won't open."*
>
> —*Sugarcane worker*

Table 8. Exposure to hazards

	Total %	Total n	Total N
Risk to health or safety[l]			
Sharp or dangerous tools or machinery	96%	73	76
Extreme heat	95%	72	76
Carrying unreasonably heavy loads	45%	34	76

	Total %	Total n	Total N
Dangerous chemicals	26%	20	76
Other	36%	27	76
Ever hurt or sick because of job	39%	30	76
Main types of injuries and illnesses[I]			
Injury to or swelling in hands	20%	6	30
Back strain or back pain	17%	5	30
Injury to knees or legs	17%	5	30
Injury to feet or ankle	10%	3	30
Heat stroke or dehydration	13%	4	30
Other	40%	12	30
Required to work while seriously sick or injured	12%	9	76
Experienced mental health problems due to work	32%	24	76

[I] Multiple responses possible

4.2.2.1 Inadequate Provision of Safety Equipment and Training

Work in sugarcane fields is inherently hazardous, but employers have an obligation to mitigate the risk in accordance with Brazil's occupational safety and health laws and regulations. The failure to mitigate risk is an indicator of involuntary work with regard to hazardous or degrading working conditions (see Section 4.3, Indicators of Forced Labor). Respondents were asked about employer efforts to mitigate risks.

As shown in Table 9, 30% of respondents reported that their employers did not provide the PPE needed to perform the job safely. All respondents were asked what types of protective gear they generally wear while working, whether provided by the employer or procured themselves.

Most reported wearing boots (96%), hats (96%), gloves (94%), goggles (88%), gaiters or shin guards (83%), and protective clothing such as coveralls (78%). Some workers reported using a respirator or dust mask (16%) or ear plugs (14%). Some workers reported that the PPE provided to them was low quality or infrequently replaced. One said:

> *"They said they would give us new PPE. Two sets of clothes, goggles, gloves, a water bottle, and a lunch box to carry food. But they don't give you anything. They keep imposing rules. If you take one set of clothes, you can't take another, it's one set only. If the boots are among the returned items, they make you wear the old boots that others have already worn. Used shoes."*
>
> *—Sugarcane worker*

One-third (32%) of respondents indicated that their employer endangered their life by failing to take proper safety precautions. When asked whether he believes that his employer is endangering his life by not taking proper safety precautions, one qualitative interviewee responded:

> *"Because we always leave in the morning to work, and it's that thing, we leave in the morning to work and we're not sure how we're going to get back. We put our lives at risk, always our lives are at risk. We already know the job, but we don't know how we're going to get home. […] Because it's risky. Sometimes we work in field plots that are full of snakes, or even a young man died a while ago from a spider bite. He died because of that brown spider. Then what are we supposed to say? They say, 'But you worked without the necessary protective equipment.' They don't provide it. Sometimes people work without it, and accidents happen."*
>
> *—Sugarcane worker*

Respondents were also asked about training provided by their employers, and nearly half (47%) reported that their employers did not provide the training needed to perform their jobs safely. The lack

of adequate training compromises workers' ability to handle tools and chemicals safely, increasing the risk of accidents.

Table 9. Mitigation of risk

	Total %	Total n
Employer does not provide PPE needed to perform job safely[1]	30%	23
Employer endangers respondent's life by failing to take proper safety precautions[2]	32%	24
Employer does not provide the training need to perform job safely[3]	47%	36
Number of respondents (N)		76

[1] Question text: Does your employer provide you with the PPE needed to perform your job safely?
[2] Question text: Does your employer endanger your life by failing to take proper safety precautions?
[3] Question text: Does your employer provide you with the training needed to perform your job safely?

4.2.3 Earnings

More than half of workers (57%) reported that their earnings were not enough to meet their basic needs. On average, respondents earned R$143.29 (USD $27.05) per day and R$3,679.00 (USD $699.01) per month.[38] The analysis revealed a wide disparity in earnings, from R$1,043.00 (USD $198.17) to R$13,035.00 (USD $2,476.65) per month. Most (93%) full-time workers, defined for the purposes of this study as those working 44 hours per week or more,[39] reported earnings above the legal minimum wage (R$1,640 per month (USD $301.76).[40] Seven percent of full-time workers reported earnings below minimum wage.

Many interviewees described working under a production-based pay system, in which they are paid per square meter of sugarcane harvested or planted. The system encourages longer working hours and working to the point of exhaustion to increase earnings, particularly among workers who are struggling to meet their basic needs. Workers reported multiple problems with payments, including recurring delays, withholding of wages, and unexplained deductions.

4.2.4 Work Schedules

Brazilian labor law regulates working hours and rest periods, particularly in the agricultural sector. According to the Consolidation of Labor Laws and relevant rural labor regulations, the standard workweek is limited to 44 hours, with a maximum of 8 regular hours per day and up to 2 hours of overtime. The law mandates one rest day per week.

Respondents reported an average workday of 8.6 hours (median 8 hours), though daily hours varied widely, ranging from 6 to 14. Thirteen percent of respondents reported working more than 10 hours per day, which exceeds Brazil's legal limit. Most workers (84%) worked 6 days per week. Four

[38] Monthly wages were estimated based on workers' reported daily earnings, calculated by multiplying daily earnings by the number of days worked per week, and the result was multiplied by 4.345, representing the average number of weeks in a month.
[39] Brazil's 1988 Federal Constitution, Article 7, Item XIII, establishes that normal working hours shall "not exceed eight hours per day and forty-four hours per week," representing a constitutional maximum rather than a minimum threshold for full-time status (Constituição da República Federativa do Brasil, 1988). In practice, the full 44-hour week with 6-day schedules (also referred to as "6x1," referring to 6 days of work and 1 day off) predominates in retail, services, and manual labor sectors, including agriculture, and office-based and professional employment more commonly follow a 40-hour, Monday–Friday schedule; both arrangements constitute full-time work with all associated protections and benefits under Brazilian labor laws (IBGE 2025).
[40] This figure refers to the state minimum wage in São Paulo at the time of data collection. The national Brazilian minimum wage at that time was R$1,518 (USD $279.31).

respondents reported working seven days per week without rest days, a practice that does not comply with Brazilian legal requirements. On average, respondents worked 50.8 hours per week.

Table 11. Average working hours

	Total %	Total n
Average hours worked per day		
Fewer than 8	18%	14
8	41%	31
9–10	28%	21
11+	13%	10
Average hours worked per week		
Fewer than 48	24%	18
48	37%	28
More than 48	39%	30
Rest days per week		
0 days	5%	4
1 day	84%	64
2+ days	11%	8
Number of respondents (N)		**76**

Fourteen percent reported being required to work non-stop during the workday without any breaks. This lack of rest can lead to burnout and increase the risk of workplace accidents. One worker, when asked if he was forced to work non-stop, replied, "Often, yes. Because sometimes we were forced to deliver the service faster."

Thirty percent of respondents reported working under a production quota. Workers who do not reach production targets can face suspension, leaving them without work or pay for up to three days, pay deductions, and dismissal. When asked if his quota was reasonable, one worker responded:

> *"Oh, the tiredness. Often we try to do it there and we can't. Because it's not every day that you plant 300 meters, 200 meters, 400 meters, 500 meters. One day it's one thing, the next day it's another. Because it's hard work."*
>
> *—Sugarcane worker*

Workers reported dissatisfaction with their schedules, which are often determined by productivity and daily harvesting quotas. Many described the work as physically exhausting, with inadequate rest between shifts. Workers explained that working hours can be extended based on individual and group performance, and no one can leave the field before the collective end of work. The long hours are exacerbated by the time spent traveling, as many workers must travel for more than two hours to reach the sugarcane field.

One worker described the demanding schedule and collective nature of the work:

> *"You have to work until your body can['t] take it. Sometimes there's one who, I think he needs [money] more than the other, works till late. The guys have to wait for him, because we're not going to leave him in the fields. Yesterday I got home at 8 p.m."*
>
> *—Sugarcane worker*

Another said:

> *"Sometimes the guys would stay there until 6 p.m., 6:30 p.m., working. The boss had no time to leave. The more you worked, the better it was for him. Then I said: 'you know what, I'm going to quit.' He doesn't care. All he cares about is what's in his pocket. That's not good enough for me."*
>
> *—Sugarcane worker*

4.3 INDICATORS OF FORCED LABOR

The study explored the two components of forced labor described in Section 2.1, Measuring Forced Labor: involuntary work and coercion.

4.3.1 Involuntary Work

Nearly two-thirds of workers (60%) reported having experienced at least one indicator of involuntary work (Table 12), which "refers to any work undertaken without the free and informed consent of the worker" (International Labor Organization, 2024).

The most common indicator of involuntariness was hazardous or degrading working conditions, experienced by 48% of workers. A circumstance giving rise to this form of involuntary work is "hazardous work conditions posing serious risks to health and safety" (International Labor Organization, 2024), defined for this study as the failure of the employer to mitigate the risks involved in their work (respondent reports that the employer does not provide PPE needed to perform the job safely or that the employer endangers the respondent's life by failing to take proper safety precautions). The other circumstance giving rise to this form of involuntary work is "work while seriously debilitated by sickness or injury" (International Labor Organization, 2024).[41]

One-quarter of workers (25%) experienced onerous working hours or work schedule. Circumstances giving rise to this form of involuntary work include "onerous working hours leaving little or no rest or recovery time" (International Labor Organization, 2024), defined for this study as usually working beyond the legal overtime limit (more 10 total hours per day), and "non-stop work without breaks during the workday" (International Labor Organization, 2024).

Eighteen percent of workers experienced deceptive or fraudulent recruitment, which "relates to the failure to deliver what has been promised to the worker, either verbally or in writing, at the time of recruitment" (International Labor Organization, 2024). Among respondents, deceptive recruitment most frequently occurred in relation to hours, remuneration levels, or the nature of the work.

Table 12. Respondents experiencing indicators of involuntary work

	%	N
Experienced at least one indicator of involuntary work	60%	46
Hazardous or degrading working conditions	48%	37
Onerous working hours or work schedule	25%	19
Deceptive or fraudulent recruitment	18%	14
Abuse or manipulation of debt	1%	1
Inability to terminate employment	0%	0
Degrading work-related living conditions	0%	0
Forced recruitment	0%	0
Number of respondents (N)		**77**

[41] Respondents were asked, "Does your employer require you to work when you are seriously sick or injured?" and a "yes" response indicates that this indicator is present.

4.3.2 Coercion

The International Labor Organization (2024) specifies that involuntary work "is a necessary but insufficient condition for forced labor" (p. 9). The critical distinguishing factor is coercion. To measure this, study researchers systematically paired questions about involuntary practices with follow-ups to determine whether coercion was present. For example, after asking, "Does your employer require you to work when you are seriously sick or injured?" an affirmative response triggered the question, "What would happen if you refused to work while sick or injured?"

More than one-third (35%) of respondents experienced at least one indicator of coercion (Table 13), which "refers to the means used to compel someone to work without their free and informed consent" (International Labor Organization, 2024).

Nearly one-third (32%) of workers experienced restrictions on their movement, defined as circumstances in which an employer or recruiter "imposes some form of constraint—physical or legal—on workers' freedom of movement, thereby coercing them to remain in or at work" (International Labor Organization, 2024, p. 16). Sugarcane workers described being transported to remote worksites with no means of transportation from the site.

Eight percent of respondents experienced abuse of vulnerability, specifically in the form of exclusion from future work. Abuse of vulnerability refers to "situations in which a worker's situation of vulnerability leaves them reliant on their job and with little perceived choice but to remain in it" (International Labor Organization, 2024, p. 18). In the sugarcane sector, many employers know one another, and these respondents believe that being dismissed from one job could lead to being blacklisted and excluded from other jobs in the sector.

Five percent of workers experienced withholding of wages, 4% experienced retention of identity documents, and 1% experienced the threat of physical violence.

Table 13. Respondents experiencing indicators of coercion

	%	N
Experienced at least one indicator of coercion	35%	27
Restrictions on workers' movement	32%	25
Abuse of vulnerability	8%	6
Withholding of wages	5%	4
Retention of identity documents	4%	3
Threat of physical violence	1%	1
Abuse or manipulation of debt	0%	0
Number of respondents (N)		**77**

4.3.3 Forced Labor Findings

As mentioned previously, a worker is considered to have experienced forced labor if they reported at least one indicator of coercion and one indicator of involuntary work during a stage of employment (recruitment, employment, or separation). Twenty-three respondents experienced both coercion and involuntary work during the same employment stage; therefore, 23 respondents (30%) experienced forced labor. All 23 experienced forced labor during the employment stage; none experienced forced labor during the recruitment or employment separation stages.

Table 14 presents the rate of forced labor by various characteristics. Forced labor rates were similar for workers aged 25–39 (36%) and those 40 and over (30%); however, there were no cases of forced labor among the 8 respondents aged 18–24. Male and female workers experienced forced labor at the same rate (30%). A higher percentage of workers with less than a primary education (36%) experienced forced labor, compared to workers who completed primary school or higher (23%). The rate of forced

labor was higher among respondents with only a verbal contract (48%), compared to those with a written contract (28%). Only 1 of the 15 respondents without an agreement experienced forced labor (7%). A higher percentage of workers involved in cutting or harvesting sugarcane (40%) experienced forced labor, compared to workers primarily involved in planting or preparing the fields (28%). All of these comparisons should be interpreted with caution due to the small sample size, and further research is needed to explore the relationships between demographic and work characteristics and forced labor in Brazil's sugarcane sector.

Table 14. Percentage experiencing forced labor by worker characteristics

	%	n	N
Total	30%	23	77
Age (years)			
18–24	0%	0	8
25–39	36%	15	42
40+	30%	8	27
Sex			
Male	30%	15	50
Female	30%	8	27
Education			
Less than primary	36%	16	45
Completed primary or higher	23%	7	31
Type of contract			
Written	28%	11	39
Verbal	48%	11	23
None	7%	1	15
Primary job activity			
Planting or preparing sugarcane fields	28%	16	57
Cutting or harvesting sugarcane	40%	6	15
Other	20%	1	5

KIIs provide additional confirmation that forced labor is present in the sugarcane sector. One key informant explained:

> *"I think the main problem is the issue of supply chains. When we allow outsourcing, subcontracting, and sub-subcontracting in the sector, […] we end up with many small and medium-sized suppliers who, under pressure from an increasingly demanding market, both in terms of productivity and quality, end up subjecting these workers to degrading conditions, exhausting working hours, minimal pay per production, charging ridiculous prices, violating labor rights. Everything, all that: that classic scene that we saw 15 years ago and that we, even though things have improved a lot, we continue to see repeated."*
>
> *—Forced labor researcher specialist*

Workers themselves described their experiences in ways consistent with forced labor. One worker described the difficulty of the exhausting work:

> *"It's slave-like over there. It's very forced, very forced. That's why I say to my boys: 'Study, boy, study.' It's too much. It's too much."*
>
> *—Sugarcane worker*

4.4 CHILD LABOR

Worker interviews explored the presence of child labor in sugarcane worksites. Respondents were asked whether people under age 18 work at the place where they work. One-fifth (21%) of respondents reported that people under age 18 work at their worksites.

The actual percentage of worksites with working minors may be higher due to underreporting. In agricultural settings, family members, including children and youth, often assist with work activities, and adult workers may not always recognize this assistance as child labor, particularly when youth work alongside parents or help with tasks perceived as less intensive (USDOL, 2025).

The presence of minors at sugarcane worksites is concerning, given the hazardous nature of the work. As described in Section 4.2.2, sugarcane production involves exposure to extreme heat, sharp tools and machinery, heavy loads, dangerous chemicals, and other significant occupational hazards. Any work by children under age 18 in these conditions would constitute hazardous child labor under Brazilian law and international standards.

An analysis of the qualitative worker data revealed that most of the youth under age 18 were aged 15 to 17 and accompanied their parents to work. The data indicate that many of these youth perform the same activities as adults, such as planting and manually cutting sugarcane. One worker reported that in his previous job, there were many 17-year-olds who dropped out of school to work with sugarcane:

> *"They worked for the subcontractor [who is the* turmeiro *of the group]. [The* turmeiro*] took a lot of them. [The youth] did the same thing we did: planting sugarcane, cutting sugarcane, doing everything."*
>
> *—Sugarcane worker*

The presence of minors on farms also reflects the socioeconomic vulnerability of working families, who bring their children along because they have no other options for earning a living. When asked about the presence of minors in his work, one interviewee explained:

> *"I've seen some as young as 15 and 16. Boys, girls, all of them. It's like this, you see, the children sometimes go to school until Friday. Then sometimes on Saturday they go to help their parents. They don't stay at home doing nothing, so they go to help their father and mother. Some also study at night and go to the fields during the day to work. Always to help the family."*
>
> *—Sugarcane worker*

The narratives reveal that, although many young people are formally enrolled in school, there is a pattern of early entry into work as a way to supplement family income. There were no reports of minors under age 18 working formally in sugar mills, only in informal planting or harvesting areas.

5 DIRECT SUPPLY CHAIN TRACING FROM FORCED LABOR FINDINGS

Qualitative research findings with sugarcane workers identified eight establishments with cases of forced labor. These entities consisted of three farms, three sugarcane mills or larger corporate groups, and two third-party service providers. From these eight establishments, three were selected for direct tracing case studies (Table 15). Selection was based on the following: (1) the availability and quality of information accessible through desk research, including public disclosures and open-source data; (2) the degree of company transparency and the presence of traceability-relevant documentation, such as operational, production, or location data; and (3) repeated mention by multiple interviewed workers, accompanied by sufficient detail to support supply chain tracing.

Each of the three case studies attempts to trace the movement of sugarcane products from the point of production through downstream supply chains, to the extent permitted by publicly available data and the structural limitations of traceability in the sector. Through detailed worker accounts, these case studies illustrate how exploitative labor conditions in primary production can permeate multiple tiers of Brazil's sugarcane supply chain.

Table 15. Overview, direct supply chain tracing case studies

#	Processing mill	Method of sugarcane transport	End uses
1	Santa Cruz Mill (São Martinho Group)	Truck	Ethanol, sugar, yeast, and energy
2	Moreno Mill (Moreno Group)	Truck	Ethanol, sugar, yeast, and energy
3	Santa Adélia Mill	Truck	Ethanol, sugar, and energy

5.1 CASE 1: SÃO MARTINHO GROUP (SANTA CRUZ MILL)

The Santa Cruz Mill, part of the São Martinho Group, is located in Américo Brasiliense, approximately 10 miles (16 km) from Araraquara in São Paulo state. One worker participant who reported experiencing forced labor conditions worked in sugarcane fields supplying the São Martinho Group in 2025.

5.1.1 Work Activities and Operations

This worker reported performing multiple tasks, including the following:

- Manual planting of sugarcane from trailer-mounted platforms
- Application of agrochemicals, including fertilizers and herbicides using 40 kg backpack sprayers (with a daily quota of 12 applications)
- Field maintenance and weed removal
- Occasional cutting activities

According to this worker's account, planting operations were semi-mechanized, with sugarcane transported by truck or tractor-trailer from mechanized harvest sites to planting areas. The worker reported that the sugarcane produced by the farm where he worked was transported directly to the São Martinho mill.

5.1.2 Corporate Structure and Production Capacity

The São Martinho Group is one of Brazil's largest sugarcane processors, with multiple production units across São Paulo and Goiás states. While it is not possible to identify the specific quantities of sugarcane purchased from the particular farm where the worker was employed,[42] the facility's scale can be understood through corporate reporting. According to the group's official website, the Santa Cruz Mill has a processing capacity of approximately 5.6 million MT per harvest (São Martinho, 2025).

During the first quarter of the 2025/26 harvest (April–June 2025), the São Martinho Group processed approximately 8.2 million MT of sugarcane across all its operations. The group's net revenue reached R$1,858 million [USD $341.9 million], with 86% (R$1,591 million [USD $292.7 million]) derived from sugarcane operations and the remainder from corn processing (São Martinho, 2025).

[42] While not publicly available, with a paid subscription, NovaCana's data platform identifies the destination countries for each mill's production, as well as production data (sugar and ethanol quantities per period), and other details that could aid in accurate product tracking. NovaCana's summary of the Sant Cruz Mill is available at: https://www.novacana.com/usinas/santa-cruz-2.

São Martinho Group's net revenue for the first quarter of the 2025/26 harvest totaled R$1,857.5 million [USD $341.8 million]. By product, ethanol was the largest contributor to consolidated net revenue, totaling R$856.5 million [USD $157.6 million], slightly ahead of sugar (R$803.9 million [USD $157.6 million]). Additional contributions came from cane (R$646.5 million [USD $119.0 million]), corn (R$210.0 million [USD $38.6 million]), electrical energy (R$84.3 million [USD $15.5 million]), dried distillers grains with solubles (R$44.6 million [USD $ 8.2 million]), yeast (R$20.6 million [USD $8.2 million]), decarbonization credits (R$6.9 million [USD $1.3 million]), and other revenues (R$40.6 million [USD $7.5 million]).

The Brazilian domestic market accounted for 62.2% of revenue, at R$1,115.7 million [USD $205.3 million]. Domestic sales were led by ethanol (R$842.1 million [USD $154.9 million]), followed by sugar (R$78.3 million [USD $14.4 million]). Other relevant domestic revenue streams included cane sales (R$632.1 million [USD $116.3 million]), corn-related revenue (R$210.0 million [USD $38.6 million]), electrical energy (R$84.3 million [USD $ million]), dried distillers grains with solubles (R$44.6 million [USD $8.2 million]), yeast (R$20.6 million [USD $3.8 million]), decarbonization credits (R$6.9 million [USD $1.3 million]), and other products (R$38.9 million [USD $7.2 million]).

Exports to foreign markets accounted for 37.8% of net revenue (R$341.8 million [USD $62.9 million]). Export sales were heavily concentrated in sugar (R$725.6 million [USD $133.5 million]), and ethanol exports totaled R$14.4 million [USD $2.6 million]. Other foreign market revenues were marginal, totaling R$1.7 million [USD $0.3 million], with no yeast exports recorded in the period.

Of the total sugarcane processed during this period, approximately one-third (2.8 million MT) came from third-party suppliers. The remaining sugarcane originated either from the company's own farms or from partnership arrangements in which the mill leases land and manages the entire agricultural operation. This processing yielded 475,000 MT of sugar and 297.8 million liters of sugarcane-derived ethanol (São Martinho Group, 2025).

Analysis of sales destinations reveals distinct market patterns. Of the approximately 60,400 MT of sugar sold during the quarter, 55.5% (33,500 MT) was exported to foreign markets, and 44.5% (26,900 MT) served the domestic Brazilian market. In contrast, ethanol sales were predominantly domestic: of the 203.3 million liters of ethanol sold (including both sugarcane and corn ethanol), only 7.1% (14.4 million liters) was exported, with the remaining 92.9% (188.9 million liters) sold domestically (São Martinho Group, 2025).

The Cost of Goods Sold breakdown indicates that third-party suppliers accounted for R$353.3 million [USD $65.0 million], representing approximately 55.7% of total agricultural costs (R$634.5 million [USD $116.8 million]) during the period. Given that third-party sugarcane represented one-third of total volume processed but over half of agricultural costs, it can be inferred that products derived from third-party supplied sugarcane constitute a significant portion of the group's production and sales (São Martinho Group, 2025).

5.1.3 Employment Relationships and Contracting Arrangements

The worker's employment exemplifies the complex and often informal contracting arrangements prevalent in the sector. He obtained employment by directly approaching a *turmeiro* at the contractor's home in the Guariba region. The arrangement was entirely verbal, with no written contract.

The worker explained the informal nature of recruitment in the region:

> *"It's always like this here. When we arrive here in the state, the first job we look for is always cutting sugarcane. We always look for someone who is taking people. If they are taking people, we already know we can go, so they call us and we go."*
>
> *—Sugarcane worker*

His employment relationship was characterized by:

- **No formal contract:** The worker was employed as a casual day laborer (*avulso*) without registration.[43]
- **Verbal agreements only:** Payment rates of R$80–100 (USD $14.72–$18.40) per day were discussed verbally, with actual amounts often varying.
- **Document retention:** The contractor retained the worker's *Cadastro de Pessoas Físicas* (a Brazilian tax identification number), claiming it was necessary to provide "some kind of right," though no benefits materialized.
- **Fluctuating work duration:** Despite being told employment would last 3–4 months, actual work periods were typically only 15–20 days before stopping without notice.
- **Multiple farm locations:** The work crew operated on various properties within approximately 20 miles (30 km) of the mill, changing locations daily based on operational needs.

The worker described feeling obligated to accept work due to limited alternative opportunities: "It's because we have families, right, so we have to work to take care of them. There's no way to change the job […] when there's no work, we take whatever comes along so we don't have to sit around."

5.1.4 Working Conditions

The worker reported exploitative working conditions, including multiple indicators of forced labor.

5.1.4.1 Deception and Contract Substitution

The worker was systematically misled about working conditions: "Sometimes they say it's one thing and then when you get there, it's something else. Then they say, 'Oh, but I only have the cutting or the planting. Either you go, or you don't go.' Then we're left in doubt, because we already left in the morning, there's no way to go back, we have to do the work."

Payment rates were also subject to deception: "They say, for example, that they will pay between R$100 [USD $18.40] and R$150 [USD $27.60], but when the time comes, we have to work for R$80 [USD $14.72], there's no way around it. Then we feel cheated."

When asked what would happen if he demanded the promised conditions, the worker explained: "It causes a lot of trouble, so we avoid it. […] Fighting. They start wanting to fight. […] They say we asked for the job, that we're there to work." He witnessed both verbal and physical altercations, including one incident in which a contractor cut a worker's arm with a cane knife.

5.1.4.2 Restriction of Movement

During working hours, the worker could not leave the workplace: "We had a quota. The only time we could leave was around lunchtime. Before lunch, I couldn't." Even after completing daily quotas, workers were required to wait for the contractor's permission to depart: "We had to wait until 5 or 5:30 p.m. to be released and leave."

The worker lacked transportation to leave remote work sites: "I didn't have transportation or any means of getting anywhere. […] I didn't have anything to get around, to leave the place and go somewhere else."

[43] In this context, "without registration" means that the worker was not formally recorded in the official employment system—meaning that there was no legal employment contract and no entry in government labor records, and the worker did not receive the legal protections, benefits, or rights (such as social security, health insurance, or formal wage guarantees) that come with registered employment in Brazil.

5.1.4.3 Debt Bondage

The contractor charged inflated prices for required work equipment through a recommended cooperative store (Coplan): "A pair of boots today costs on average R$50 [USD $9.20] or R$60 [USD $11.04], they charge R$150 [USD $27.60] or R$180 [$33.12]. It was always abusive. […] We paid twice the price of what we needed."

These purchases were deducted from wages, but workers could not retain the equipment: "They always charged us, deducted it from our pay, but we couldn't take it away. It stayed with them."

The worker accumulated debt that increased arbitrarily: "It was a debt of R$150 [USD $27.60], and I ended up paying R$460 [USD $84.64]. From R$150 to R$460 is a big difference. It's more than double."

The contractor used debt as a control mechanism: "If you don't pay by such and such a day […] it'll go up another R$20 [$3.68] from today to tomorrow. […] They keep saying that, always cheap blackmail." Leaving employment with unpaid debt would result in being "in debt and without a job" and facing ongoing harassment: "It's like owing money to a loan shark, who stays on top of you your whole life, always demanding payment."

5.1.4.4 Excessive Working Hours and Unattainable Quotas

The worker regularly worked 12–13-hour days, departing home at 5:30 a.m. and returning as late as 8 p.m.: "I worked from 3 a.m. to 8 p.m. I worked an average of 12 to 13 hours per day, Monday through Saturday."

Daily production quotas were set at 15–20 tons of planting per day, which the worker considered unreasonable for one person. When quotas were not met, workers faced: "We would be demoted […] they move us to another sector" with reduced daily wages (R$60 [USD$11.04] instead of R$80 [USD $14.72]), or "fired."

The worker described the psychological impact: "We feel a little down, because when we can't meet the target, sometimes we get really anxious. […] Then we have to do it or make it up the next day […] we're in debt."

5.1.4.5 Health and Safety Violations

The worker reported that, at the site where they worked, no PPE was provided: "They don't provide anything. We buy everything." This included boots, gloves, safety glasses, respirators, leg guards, and protective clothing. When applying pesticides with 40 kg backpack sprayers, workers lacked adequate protection: "There was no equipment to use or anything. There were no shin guards, no boots. We had to go as we were."

The worker suffered direct health consequences from pesticide exposure: "Skin disease. Direct contact with poison […] this was raw flesh. It was raw flesh, oozing water." He also experienced vision loss for two days due to thyroid complications he attributed to chemical exposure.

Despite being injured or ill, workers were required to continue working: "If you miss a day, you are fired." Refusing dangerous work resulted in immediate dismissal.

The worker witnessed fatal workplace accidents, including one where a woman was run over by a truck during planting operations: "He ran over the woman and didn't see her […] a family lost their mother in that case."

He described the daily uncertainty: "We leave in the morning to work, and we're not sure how we're going to get back."

5.1.4.6 Abusive Payment Practices

Payment was made by check that could only be cashed at designated stores requiring a minimum purchase of R$150–$160 (USD $28.5–$30.40): "We had to go there and give the check to the person so they could make a purchase and cash the check." The checks were described as "rubber checks" that could not be cashed at banks.

Payments were frequently delayed by six to seven days or more: "It took one to two weeks. Always." When workers requested payment, the contractor would respond: "If I can, I'll give it to you, if not, we'll see later."

Workers who missed days due to illness faced deductions: "If you miss a day […] they deduct it, for example, you have to get R$80 [USD $15.10], then the R$80 was deducted."

The worker assessed his compensation as fundamentally unfair: "We worked very hard. It was a lot of work for very little pay […] we earned very little and worked very hard."

5.1.4.7 Inadequate Basic Conditions

Workers brought their own food in lunch boxes without refrigeration: "It was always in a lunch box in my bag." Food spoilage was common: "Several times" the worker's food went bad, forcing him to work all day without eating. When informed, the contractor refused to provide alternatives.

No functional bathroom facilities existed at work sites: "It was the real bush." A toilet existed on the transportation bus, but it was unusable due to a lack of ventilation: "If you use it, who can stand being on the bus after that?"

Workers often had no lunch breaks: "It was non-stop. There were days when we didn't even have a lunch break. We only stopped to leave."

5.1.4.8 Child Labor

The worker reported that minors as young as age 15 worked alongside adults in all capacities, including pesticide application: "In the position where I worked, there were also five minors working with us. […] The youngest was 15 years old." These children included both boys and girls.

The worker expressed concern: "Children, right, having to work to support themselves. That's difficult. […] We know that it's bad for us who are already old enough to work. Imagine for a child."

5.1.5 Supply Chain Traceability

The production pathway for sugarcane in this case can be traced as follows:

Sugarcane production: Farms were operated by contractors supplying the São Martinho Group in the greater Araraquara/Guariba region. The specific farm mentioned was São João da Bela Vista near Araraquara. Given that mills typically process sugarcane from sources within a 20-mile (30 km) radius, and that the worker explicitly stated that the cane was supplied to São Martinho, this case likely involved the Santa Cruz Mill in Américo Brasiliense, though the worker's limited knowledge of corporate structures prevented definitive confirmation.

Transportation: Harvested sugarcane is transported by truck from fields to the company's industrial units. Mechanized harvesters load the cane onto trucks or tractor-trailers, which transport it to processing facilities.

Industrial processing: The São Martinho mills process sugarcane into multiple products, including sugar, ethanol, and bagasse-derived electricity. During the first quarter of 2025/26, the group's sugarcane operations produced 475,000 MT of sugar and 297,800 m^3 of ethanol from cane. The mills also process corn into ethanol and co-products.

End markets: According to corporate financial reporting, sugar and ethanol produced by São Martinho serve both domestic and international markets. Of sugar sold during April–June 2025, approximately 55.5% was exported and 44.5% served domestic markets. Ethanol sales were predominantly domestic (92.9%), with only 7.1% exported. Energy generated from bagasse combustion supplies the mills' operations and the broader electrical grid.

5.1.6 Certifications and Risk Assessment

The São Martinho Group maintains various sustainability certifications, including Bonsucro certification for sustainable sugarcane production. However, the documented labor violations in this case indicate that certification systems did not prevent or detect exploitative conditions in third-party supply chains.

Sugarcane produced on farms linked to this case, in which serious labor violations meeting multiple ILO forced labor indicators were documented, integrates into the São Martinho Group's industrial chain through third-party supply arrangements. Given that third-party suppliers represented approximately 33% of total sugarcane processed but 55.7% of agricultural costs during the reporting period, and that a majority of sugar production entered export markets while ethanol primarily served domestic demand, products derived from this supply chain carry origin risks associated with the identified exploitative working conditions.

The case illustrates systemic challenges in supply chain traceability and accountability. Despite being one of Brazil's largest and most sophisticated sugarcane processors with established certification programs, the São Martinho Group's reliance on third-party contractors created conditions in which workers experienced severe labor rights violations, including deception, debt bondage, restriction of movement, excessive working hours, health and safety violations, and abusive payment practices. Therefore, both domestic and exported products derived from this sugarcane carry origin risks associated with forced labor conditions.

5.2 CASE 2: MORENO GROUP

The Moreno Group operates a sugarcane mill in Luiz Antônio, a municipality located 35 miles (55 km) south of Ribeirão Preto in São Paulo state.

Seven worker participants who identified as experiencing forced labor conditions reported working in sugarcane fields linked to the Moreno Group during various periods between September 2023 and June 2025. Four of these workers originated from Maranhão in Northeast Brazil, and three came from Brazil's Southeast and South regions (São Paulo, Minas Gerais, and Paraná).

5.2.1 Work Activities and Operations

These workers reported performing multiple tasks, including cutting sugarcane for planting purposes, general cleaning of seedlings, and occasional manual harvesting. One worker specifically described performing manual cutting in areas inaccessible to machinery, such as locations with numerous stones and uneven terrain. According to worker accounts, planting operations were semi-mechanized, and harvesting was mechanized at these sites.

5.2.2 Corporate Structure and Production Capacity

The Moreno Group comprises five companies, all located in São Paulo state. Two units operate at the same address in Luiz Antônio where workers reported employment. Agrícola Moreno de Luiz Antônio LTDA is registered primarily for sugarcane cultivation (CNAE code A-0113-0/00), with secondary

activities in soybean and other crop cultivation.[44] The second entity, Moreno Mill (Central Energética Moreno Açúcar e Álcool LTDA), focuses on raw sugar manufacturing (CNAE code C-1071-6/00), with alcohol manufacturing as a secondary activity (CNAE 1931400).[45]

According to the company's website, the Moreno Mill processes 6 million tons of sugarcane annually, producing 50,000 50 kg bags of sugar daily and 1,200 m³ of ethanol per day (Grupo Moreno, 2025). The facility also produces 2,230 tons of yeast per harvest. Reports from Journal Cana indicate that the 2023/24 harvest was historic for the Moreno Group, which processed a record 11.7 million tons of sugarcane (Gonçalves, 2025).

5.2.3 Employment Relationships and Contracting Arrangements

These workers' accounts reveal diverse employment structures. Some workers performed activities at Agrícola Moreno's sugarcane fields, with harvested material subsequently transported by truck to the Moreno Mill at the same address. Other workers reported employment on third-party supplier properties located farther from the main facilities.

Several of these workers obtained employment through the same recruiter operating in the Guariba region. One worker explained the informal nature of his engagement:

> *"The agreement was this: you go with the boss to work with him. Then, if it's not good, if you think it's not for you, you stop working and don't go anymore."*
>
> *—Sugarcane worker*

Another worker described his employer as a supplier who received orders directly from the sugarcane mill. In this arrangement, no written contract existed, and the work crew operated in various cities within a 20-mile (30 km) radius of the mill, changing locations daily depending on harvest needs.

One female worker reported having formal employment by the sugarcane mill with a written contract. However, her compensation structure varied according to assigned tasks. When cutting or planting sugarcane, she received production-based payment; when performing field cleaning activities, she earned a daily wage of R$77 (USD $14.18). On low-production days, her earnings fell below R$30 (USD $5.52). The mill deducted costs for tools and protective equipment from her final salary, in addition to variations in per-meter payment rates for cut sugarcane. Her gross monthly salary should have reached R$1,900 (USD $349.79), but deductions reduced her actual payment to R$700 (USD $237.25).

5.2.4 Working Conditions

These workers reported consistent problematic conditions, including overcrowded transportation buses to work sites, inability to leave remote work locations, deductions from wages for tools and PPE, deception or omission of important details during recruitment about job requirements and activities, physically exhausting work under harsh weather conditions, and undue pressure to produce.

5.2.5 Supply Chain Traceability

The production pathway for sugarcane in this case can be traced as follows:

- **Sugarcane production:** Farms leased by the Moreno Group or its outsourced service providers in the Luiz Antônio region. These workers reported working on both mill-owned land and third-party properties.
- **Transportation:** Harvested sugarcane is transported by truck from fields to the company's industrial unit in Luiz Antônio. Given that mills typically process sugarcane from sources within a

[44] https://www.econodata.com.br/consulta-empresa/15417965000151-agricola-moreno-de-luiz-antonio-ltda
[45] https://www.econodata.com.br/consulta-empresa/45765914000181-central-energetica-moreno-acucar-e-alcool-ltda

20-mile (30 km) radius, all identified cases likely involved the Luiz Antônio unit, although workers' limited knowledge and a lack of public information prevented definitive confirmation of whether sugarcane could be transported to other group units.

- **Industrial processing:** The Moreno Mill processes sugarcane into multiple products, including raw and refined sugar, ethanol, bagasse, and yeast, with sugar production as the primary focus.
- **End markets:** According to the company's website and worker accounts, sugar and ethanol produced by the Moreno Group serve both domestic and international markets. Energy generated from bagasse combustion supplies the plant's operations and the local power grid. Yeast production targets exclusively domestic markets.

5.2.6 Certifications and Risk Assessment

The Moreno Group holds RenovaBio and Green Ethanol certifications (Gonçalves, 2025). However, no information was found regarding accountability or due diligence certifications.

Sugarcane produced on farms linked to these seven workers' cases, on which serious labor violations were documented, integrates into the Moreno Group mill's industrial chain and subsequently enters domestic or export markets for sugar and ethanol, as well as domestic yeast consumption. Therefore, products derived from this sugarcane carry origin risks associated with the identified exploitative working conditions reported by these workers.

5.3 CASE 3: SANTA ADÉLIA SUGARCANE MILL

The Santa Adélia Sugarcane Mill operates two processing units in São Paulo state, located in Jaboticabal and Pereira Barreto.[46] Two worker participants who identified as experiencing forced labor conditions reported working in sugarcane fields linked to Santa Adélia during the 2024–2025 harvest period and in previous harvests.

5.3.1 Work Activities and Operations

Workers reported performing multiple tasks in the sugarcane production cycle. According to worker accounts, harvesting operations are mechanized, and planting is semi-mechanized at these sites. One of the two workers was employed in a subcontracted area from January to May 2025 under the supervision of a *turmeiro* who received orders from the landowner. The other worker was supervised by a *turmeiro* hired directly by the Santa Adélia Sugarcane Mill and held this position for one year until April 2025.

Both workers described work involving planting operations, sugarcane cutting, and crop management activities. The semi-mechanized nature of planting meant that although some operations used machinery, significant manual labor was still required for tasks such as distributing seed pieces and ensuring proper planting density.

5.3.2 Corporate Structure and Production Capacity

Santa Adélia Sugarcane Mill is a member of the Copersucar cooperative and operates two processing units in São Paulo state. According to the company's 2024/25 harvest report, the mill processed

[46] Two other workers also described being subjected to similar conditions while working on farms in Jaboticabal but were not able to recall the names of any processing facilities to which the sugarcane produced on those farms was sent. The geography of that region makes it likely that the cane they worked to produce was also sent to the Santa Adélia Sugarcane Mill for processing, but because this could not be confirmed, those two workers' experiences were excluded from this case study analysis.

5.5 million tons of sugarcane during the harvest period (March 2024–March 2025). The Jaboticabal unit alone processed 2.7 million tons of this total (Usina Santa Adélia, 2025).

The exact amount of sugarcane produced by third-party suppliers could not be definitively determined, but the breakdown of expenses by nature indicates that "sugarcane acquired from suppliers" represents 20% of expenses, with R$280 million (USD $51,548,000) invested in supplier purchases during the 2024/25 harvest (Usina Santa Adélia, 2025).

During the 2024/25 harvest, total sugar production reached 213,000 tons of raw sugar, produced exclusively at the Jaboticabal plant. According to the harvest report, "Due to the greater price attractiveness of sugar compared to ethanol, the Company maintained its strategy of directing as much of its capacity as possible towards the production of the sweetener" (Usina Santa Adélia, 2025). The company's total production also included 321,000 cubic meters of ethanol and 330,000 megawatts of electricity generated from bagasse cogeneration (Usina Santa Adélia, 2025).

The company's website indicates that, as part of the Copersucar system, it serves clients throughout Brazil and major international markets. Companies purchasing its products include Coca-Cola, Nestlé, Kellogg's, PepsiCo, Kraft Foods, Harald, Predilecta, Arcor, General Mills (Yoki), Masterfoods, and Refrigerante Jaboti. The company also supplies ethanol and electricity to Shell, Ipiranga, Petrobras Distribuidora S/A, Ruff, CPFL, and Elektro (Usina Santa Adélia, 2025).

5.3.3 Employment Relationships and Contracting Arrangements

Both workers' accounts revealed employment arrangements involving both direct mill hiring and subcontracting relationships. One worker was employed through a subcontracted arrangement in which a *turmeiro* received orders from a landowner, creating a multi-layered employment structure. The other worker reported direct supervision by a *turmeiro* hired by the Santa Adélia Sugarcane Mill itself.

Both employment arrangements involved piece-rate payment systems with constant pressure to meet production targets. Neither worker provided specific details about written contracts or formal employment documentation, but the direct hiring by the mill suggests that at least some workers employed at the facility had formal employment relationships.

The work arrangements required extremely long periods of availability. One of the two workers stated that due to commuting time, he remained available for work approximately 13 hours daily, leaving home at 5 a.m. and returning around 6 p.m. This extended availability, combined with physically demanding fieldwork and piece-rate payment pressure, contributed to severe working conditions.

5.3.4 Working Conditions

Both workers reported consistent problematic conditions, including, but not limited to, difficulties related to long distances traveled in remote rural areas, unstable employment arrangements, piece-rate payment systems, and constant pressure to meet production targets.

Infrastructure deficiencies were significant. One worker reported that at times they ran out of drinking water during the workday; when the supply they brought from home was exhausted, there was no place to refill bottles in the remote fields. Both workers reported inadequate facilities, including lack of refrigerators to preserve food and lack of proper restroom facilities.

The physical demands of the work led to serious health consequences. One worker stated that he suffered a heart attack caused by the excessive physical effort required by the work, directly linking the cardiac event to the intensity of manual labor in sugarcane operations.

In addition, one worker reported observing many young workers between ages 15 and 18 engaged in casual labor, hired informally for one day or a few days at a time. According to this account, these youth

workers' tasks ranged from assisting planting crews to cutting sugarcane in the case of older teenagers, raising concerns about potential child labor in addition to forced labor conditions.

5.3.5 Supply Chain Traceability

The production pathway for sugarcane in this case can be traced as follows:

- **Sugarcane production:** Farms with both subcontracted arrangements and direct mill operations in the Jaboticabal region. Worker accounts indicate both mill-owned operations and third-party supplier arrangements, though the precise ownership structure of specific farms could not be determined from available information.
- **Transportation:** Harvested sugarcane is transported to the company's industrial units. The company processed 5.5 million tons total during the 2024/25 harvest, with 2.7 million tons at the Jaboticabal unit, where the reported working conditions occurred (Usina Santa Adélia, 2025).
- **Industrial processing:** The Jaboticabal mill processes sugarcane into multiple products, including raw sugar (213,000 tons during 2024/25 harvest), ethanol (321,000 m^3), and electricity from bagasse (330,000 megawatts). The company's stated strategy prioritizes sugar production due to favorable pricing (Usina Santa Adélia, 2025).
- **End markets:** As a member of the Copersucar cooperative system, Santa Adélia's products reach both domestic and international markets. Major clients include multinational food and beverage companies (Coca-Cola, Nestlé, Kellogg's, PepsiCo, Kraft Foods) and fuel distributors (Shell, Ipiranga, Petrobras Distribuidora S/A). While specific export volume data were not available, revenue data indicated that ethanol represented 58% of sales value (R$864 million [USD $159 million] for 321,000 m^3), compared to R$526 million (USD $97 million) for sugar sales.

5.3.6 Certifications and Risk Assessment

The company holds certifications through the Copersucar cooperative system, though specific sustainability or labor accountability certifications were not detailed in available documentation. As a Copersucar member since the cooperative's founding in 1959, Santa Adélia participates in the cooperative's commercial and operational systems (Usina Santa Adélia, 2025).

Sugarcane produced on farms linked to these two workers' cases—in which serious labor violations, including forced labor conditions, health and safety risks, infrastructure deficiencies, and potential child labor, were documented based on their accounts—is integrated into the Santa Adélia mill's industrial chain and subsequently enters both domestic and international markets for sugar, ethanol, and electricity. Therefore, products derived from this sugarcane carry origin risks associated with the identified exploitative working conditions reported by these workers.

6 CONCLUSION AND RECOMMENDATIONS

This study's findings suggest that forced labor remains a significant issue in Brazil's sugarcane sector, with substantial implications for both the affected workers and the broader global sugar and ethanol industries.

This study identified 23 cases of forced labor among 77 workers (30%) in sugarcane production across the border region between São Paulo and Minas Gerais states. Although Brazil's sugarcane sector has undergone substantial mechanization, with harvesting now 99–100% mechanized in São Paulo, forced labor persists in the non-mechanized areas of production, particularly in planting, field maintenance, and manual cutting in areas inaccessible to machinery. All workers experiencing forced labor were exposed

to conditions constituting violations under both international standards and Brazilian law, facing risks ranging from hazardous working conditions and excessive hours to restrictions on movement and deceptive recruitment practices. The prevalence of piece-rate payment systems, extensive use of labor contractors, and economic pressures on migrant workers from Brazil's Northeast region have created conditions in which exploitative labor practices have become entrenched in the contractor-based portions of the supply chain.

An investigation into the supply chain of sugarcane produced in Brazil revealed that all sugarcane-containing downstream products—both those consumed domestically and those exported internationally—are at risk of being produced with forced labor. Although sugarcane cultivation occurs primarily on small and medium-sized farms and leased land across São Paulo and neighboring states, the harvested sugarcane flows through a complex network of contractors, transporters, and processing mills before reaching end users in sugar markets, ethanol fuel distribution, bioelectricity generation, and emerging SAF production. In the course of this supply chain, sugarcane from various sources is mixed together at processing facilities, making it impossible to trace specific batches back to individual farms.

The persistence of forced labor in sugarcane production reflects broader socioeconomic challenges in Brazil. Economic desperation in the Northeast, limited access to formal employment opportunities, and the lack of alternative livelihoods drive many workers to migrate to São Paulo and accept exploitative conditions through informal contractor arrangements. The seasonal nature of planting and maintenance work, combined with the informal payment systems and limited oversight of subcontractors, creates conditions in which workers can easily become trapped in situations of forced labor. The 2017 outsourcing law (Law No. 13.429/2017) further facilitated this shift toward contractor-based recruitment, reducing worker protections and diluting accountability. As one forced labor researcher interviewed for this study explained, workers from the Northeast region "will accept anything" due to "conditions of total despair" in their regions of origin, perpetuating cycles of exploitation and economic vulnerability.

Addressing forced labor in Brazil's sugarcane sector requires a coordinated response from government agencies, private sector actors, and civil society organizations. Key priorities include strengthening enforcement of existing labor laws (particularly in regard to monitoring contractor operations), implementing robust supply chain monitoring systems that go beyond contractual clauses to include unannounced field visits, expanding social protection programs for migrant workers and their families, and improving traceability mechanisms that can identify high-risk suppliers even when raw materials are co-mingled. The current sustainability certification systems, which cover only approximately 15% of production and have documented gaps in preventing forced labor, must be significantly strengthened. Although the challenges are significant, the findings from this study provide a foundation for developing targeted interventions that can help protect workers' rights while ensuring that the sugar and ethanol industries operate responsibly. Success will require sustained commitment from all stakeholders and a comprehensive approach that addresses both immediate labor violations and underlying socioeconomic factors, including informal employment, economic pressures driving internal migration, complex intermediary arrangements, and productivity-based payment systems that incentivize exploitation.

The persistence of forced labor in a highly mechanized, globally integrated sector demonstrates that technological advancement alone is insufficient to eliminate exploitation. Protecting worker rights in Brazil's sugarcane sector will require not only strengthening oversight and accountability mechanisms throughout the supply chain, but also addressing the structural vulnerabilities that make workers from economically disadvantaged regions susceptible to exploitation by labor intermediaries operating in the informal corners of an otherwise modern industrial sector.

6.1 RECOMMENDATIONS

This study offers the following recommendations:

To the Government of Brazil:

- Strengthen labor inspection capacity by increasing the number of Ministry of Labor and Employment labor inspectors in regions with high sugarcane concentration, ensuring periodic visits to medium and small suppliers and contractor operations, particularly during planting periods.
- Improve transparency and inter-institutional coordination in supply chain monitoring, with integrated public systems among the Ministry of Labor and Employment, the Ministry of Agriculture, the National Agency of Petroleum, Natural Gas and Biofuels, and the National Supply Company for production traceability and identification of risk practices.
- Strengthen the joint liability system for purchasing plants, ensuring that outsourcing and subcontracting arrangements do not serve as loopholes for abusive practices and that mills maintain accountability for labor conditions throughout their supply chains.
- Expand social protection programs and economic alternatives in migrant-sending regions, especially in the Northeast, to reduce the vulnerability of workers who migrate to São Paulo for sugarcane employment.
- Promote regulatory reforms that strengthen supply chain transparency in the biofuels sector by revising mandatory ethanol blending policies and establishing legal requirements for traceability.

To Private Sector Actors:

Downstream consumers and processors in Brazil's sugarcane sector—including mills, sugar exporters, ethanol distributors, SAF producers, and cement/bioelectricity companies—should implement robust supply chain due diligence and monitoring mechanisms to identify and address forced labor risks, such as the following:

- Move beyond contractual clauses to establish proactive auditing and monitoring programs with unannounced field visits to sugarcane suppliers and outsourced labor contractors, focusing particularly on planting periods and crop management activities.
- Make contract renewals and commercial partnerships conditional on proven compliance with labor and human rights laws, with corrective action plans for non-compliance and de-accreditation from supply chains for serious and recurring violations.
- Invest in technologies and systems that allow, at a minimum, the segregation of suppliers by level of socio-environmental risk, even if complete traceability to individual farms remains challenging due to raw material mixing at processing facilities.
- Create and promote safe, confidential, and accessible reporting channels for workers, including those of outsourced contractors, managed by independent third parties to prevent retaliation against whistleblowers.
- Ensure through active verification that all workers in the supply chain receive adequate personal protective equipment and ongoing safety training, addressing the identified gap in which nearly half of workers receive no training.
- Review payment practices based purely on production quotas, which encourage exhausting work hours and can result in pay below minimum wage, moving toward hiring models that prioritize formalization and stability.

To Civil Society and Other Stakeholders:

- Expand the participation of rural workers' unions in collective agreements and private socio-environmental certifications, ensuring that workers have effective representation in negotiations with mills and contractors.
- Promote independent, multilateral audits that include civil society organizations, workers' associations, and universities in monitoring labor practices in the sector, particularly for suppliers to certified operations and emerging sectors like SAF.
- Support community empowerment initiatives and accessible reporting channels, including mobile apps and partnerships with local associations, so workers can safely report abuse.
- Conduct further research on forced labor prevalence across different regions, production scales, and contractor arrangements in Brazil's sugarcane sector to inform targeted interventions.

Implementation of these recommendations requires coordinated efforts from all stakeholders. Progress toward eliminating forced labor from Brazil's sugarcane sector will require addressing both immediate labor violations and underlying socioeconomic factors—including informal employment, economic desperation driving internal migration, complex intermediary arrangements, and productivity-based payment systems—while simultaneously strengthening oversight, traceability, and accountability throughout the supply chain. The persistence of forced labor in a highly mechanized, globally integrated sector demonstrates that technological advancement alone is insufficient to eliminate exploitation.

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APPENDIX 2: QUANTITATIVE ANALYSIS METHODOLOGY—FORCED LABOR INDICATORS

Construction of Involuntariness Indicators

Involuntariness measures whether the work was performed without the individual's free and informed consent. The following indicators were created:

Recruitment Phase (RS):

- **Forced Recruitment (*in_slavery*):** Identifies whether the worker was forced to accept the job through force or direct threats during recruitment.
- **Misleading or Fraudulent Recruitment (*in_decrec*):** Classifies situations in which recruitment was based on false information about the nature of the work, conditions, or pay.
- **Debt-Linked Recruitment (*in_recdebt*):** Highlights cases in which acceptance of the job was conditional on the employee assuming a debt.

Employment Phase (ES):

- **Hazardous or Degrading Working Conditions (*in_hazardous*):** Groups responses that indicate exposure to safety hazards, lack of adequate training, or degrading working conditions during employment.
- **Excessive Working Hours (*in_schedule*):** Identifies workers subjected to excessive working hours or a strenuous work schedule.
- **Debt Abuse or Manipulation (*in_debt*):** Measures whether, during employment, the worker was a victim of debt manipulation that tied him or her to the job.
- **Degrading Housing Conditions *(in_living*):** Composite indicator activated if the employer requires residence in provided accommodation and this presents two or more degrading conditions (e.g., lack of security, unhealthiness, overcrowding).

Shutdown Phase (ESS):

- **Inability to Quit (*in_noquit*):** Records whether the worker tried to leave the job but was prevented by threats or punishment.

Construction of Coercion Indicators

Coercion measures the use of force, threats, or punishment to compel an individual to work. The indicators were distributed according to the phase of occurrence:

Recruitment Phase (RS):

- **Threats of Physical Violence (*co_violence_RS*):** Records whether the worker suffered threats of physical violence during the recruitment process.
- **Movement Restriction (*co_movement_RS*):** Identifies whether the worker's freedom of movement was restricted during recruitment.
- **Debt Bondage or Manipulation (*co_debt_RS*):** Measures the use of debt as a control and punishment mechanism in recruitment.
- **Document Retention *(co_documents_RS*):** Records the retention of identity or work documents at this stage.
- **Vulnerability Abuse (*co_vulnerability_RS*):** For this phase, specifically consider the threat of loss of housing or land *(co_vuln_housing_RS)* to coerce the worker into accepting employment.

Employment Phase (ES):

- **Threats of Physical Violence (*co_violence_ES*):** Records threats of violence during the term of the employment contract.
- **Movement Restriction (*co_movement_ES*):** Identifies restrictions on freedom of movement during employment.
- **Debt Bondage or Manipulation (*co_debt_ES*):** Measures the use of debt as a mechanism of control and punishment during labor.
- **Wage Withholding (*co_withwages_ES*):** Indicates the withholding of payments as a form of punishment.
- **Document Retention (*co_documents_ES*):** Records the retention of documents during employment.
- **Vulnerability Abuse (*co_vulnerability_ES*):** Groups together threats that exploit the worker's vulnerable condition during employment, such as the threat of loss of housing (*co_vuln_housing_ES*), reporting to authorities/arrest (*co_vuln_arrest_ES*), or exclusion from future work (*co_vuln_excl_ES*).

Shutdown Phase (ESS):

- **Threats of Physical Violence (*co_violence_ESS*):** Records threats of violence when the worker tries to leave.
- **Movement Restriction (*co_movement_ESS*):** Identifies restrictions on freedom when trying to leave a job.
- **Debt Bondage or Manipulation (*co_debt_ESS*):** Measures the use of debt as an impediment to separation.
- **Wage Withholding (*co_withwages_ESS*):** Indicates the withholding of the final payment as a form of punishment or impediment.
- **Document Retention (*co_documents_ESS*):** Records the retention of documents to prevent the worker from leaving.
- **Vulnerability Abuse (*co_vulnerability_ESS*):** Groups together threats, such as loss of housing (*co_vuln_housing_ESS*) or exclusion from future work (co_vuln_excl_ESS), used to prevent worker termination.

Final Forced Labor Classification

The final stage of the methodology consists of combining the components. A worker is considered to be in a situation of forced labor if, **for the same phase of the work cycle, he or she simultaneously presents at least one indicator of involuntary labor *and* one indicator of coercion.**

1. *forcedlabor_RS* = 1 **IF** *involuntary_RS* = 1 **AND** *coercion_RS* = 1
2. *forcedlabor_ES* = 1 **SE** *involuntary_ES* = 1 **AND** *coercion_ES* = 1
3. *forcedlabor_ESS* = 1 **SE** *involuntary_ESS* = 1 **AND** *coercion_ESS* = 1

The general indicator (*forced labor*) is activated if the worker was classified as having forced labor in any of the three phases.

- forced labor = 1 **SE** forcedlabor_RS = 1 **OR** forcedlabor_ES = 1 **OR** forcedlabor_ESS = 1

APPENDIX 3: INDIVIDUAL WORKER PROFILES

Worker Profile

A woman in her early 30s, born in Maranhão state, has been working in sugarcane since the mid-2000s and now lives in the Guariba region, in the interior of São Paulo, with her children and husband. During the last harvest, she worked as a *picadeira*: planting, covering, and applying chemical inputs, without a formal contract or protective equipment. She earns an average of R$110 (USD $20.25) per day, often less than agreed, with late payments and arbitrary deductions.

The worker reports exhausting workdays that extend into the night, unattainable goals, and constant pressure from supervisors. She describes episodes of extreme physical discomfort, with vomiting from exertion and chest pains caused by the weight of the buckets of pesticides, and a lack of medical support. She states that, "it's like slavery there, very forced." In addition, the bosses walk around armed, especially on paydays, creating fear and a feeling of constant threat.

The work also compromises her family life: a mother of three, she reports difficulty in paying for rent, food, and basic care due to insufficient and late wages. Furthermore, sex exacerbates vulnerability: women are restricted to heavy labor on the ground, with lower pay than men, and exposed to harassment that, as she reveals, leaves them "embarrassed." According to the worker, it is common for supervisors to "take [sexually] women from the fields" in exchange for favors. She said that a supervisor once made a direct offer of R$100 (USD $18.41) in exchange for sex.

Worker Profile

A man in his early 30s, born in Maranhão state, migrated to São Paulo about five years ago and has since survived on farm work, mainly in sugarcane. His last job was at the Moreno mill, where he spent nine months registered, performing heavy tasks such as weeding, cutting residual cane, and removing stones from the soil. He earned an average of R$71 (USD $13.07) per day, paid in advances and supplements totaling about R$1,900 (USD $349.79) per month, an amount insufficient to cover rent, bills, and family expenses.

The workdays are Monday through Saturday, from 7 a.m. to 3:20 p.m., and include tasks requiring intense physical effort in direct sunlight and few breaks for rest or hydration. The worker reports that, although in theory there are breaks, in practice, supervisors often pressure the team not to stop, even punishing those who rest. "Not even iron can withstand this," says the interviewee.

His body could not withstand the intensity of the work. A few months after starting, he suffered symptoms similar to a stroke, with numbness, dizziness, and a sudden drop in heart rate, reaching 36 beats per minute. He was admitted and intubated at a hospital in Ribeirão Preto and diagnosed with a chronic heart condition. Even after this diagnosis, he reports that mill supervisors refuse to accept his medical certificates and accuse him of "slacking off." One supervisor reportedly even said that he expected workers to work until collapse, and that he wanted to "see workers dead in the fields."

Between heat, physical exertion, illness, and lack of adequate assistance, his story exposes how sugarcane imposes a cycle of work with life-threatening risks that still mark the daily lives of some sugarcane workers in the interior of São Paulo.

Worker Profile

A man in his late 20s, born in Maranhão, migrated to Guariba (São Paulo) in 2019. Since then, he has made a living through alternating temporary jobs, some in sugarcane, some elsewhere. In the last five harvests, he has worked mainly in planting, as a subcontractor for a mill in the Catanduva region.

His payment in the position with the mill varies, as he is paid according to a piece rate system. On some days, he receives around R$80 (USD $14.73); on others, up to R$300 (USD $55.23), depending on the area planted. But there are recurring delays and withholding of payments: he reports an episode in which he signed papers in the morning and only received payment in the evening, after waiting almost 12 hours. Furthermore, he and his colleagues suspect hidden deductions—"they take a little from each of us"—with no official record or documentation on the area a worker planted. For those who do not reach the target of 500 meters per day, the punishment is suspension, leaving them without work or pay for up to 3 days.

This worker, like many others at his worksite who came from Maranhão, was hired as a subcontractor by a *turmeiro* who supplies labor to the mill where he works. Many of his fellow workers are housed in company-provided housing but are required to pay around R$600 (USD $110.40) per month out of their own pockets for water, electricity, and even food—costs that the *turmeiro* had told them would be covered by the company when they were originally hired. Many end up buying food from "authorized grocery store," where prices are inflated, and where they can only buy on credit and even then only with their boss's approval.

The workday, from 7 a.m. to 5 p.m. under the sun, contributes to fatigue. Workers have only 2 short 15-minute breaks to rest and hydrate. But, according to the interviewee, the greatest burden was on the production chain: intermediaries that broker the hiring, mills that benefit from the system, and migrants who are trapped in debt for lodging and food, without ever seeing the promised profits.

Worker Profile

A woman in her 60s, born in Guariba (São Paulo), started working on the farm at age 13, when she had to leave school to help her mother. Since then, she has worked as a casual laborer in the fields for several sugarcane harvests without formal registration. In these positions, she worked in the fields from 7 a.m. to 5 p.m., earning just R$30 (USD $5.52) to R$80 (USD $14.73) per day, and even that pay was subject to delays and deductions for advances. During that work, she reports, she and her fellow workers labor in direct sun without access to shade or a bathroom. And while they were provided with food, it was of such poor quality that it often spoiled before lunchtime and they were left with nothing to eat. On those days, she reports that she pretended to eat because she was embarrassed to admit to her coworkers that she had no food to bring from home.

During one planting season, she worked planting and cutting sugarcane for a mill in Jaboticabal. After weeks of working in the fields, she collapsed one day, suffering a "stroke-like episode" that impacted her breathing so severely that she had to receive a tracheotomy.

Today, unable to keep up with the pace of farm work, she survives by cleaning houses and waits for retirement. She lives in the back of her daughter's house and depends on her family's support to avoid paying rent.

Worker Profile

A 29-year-old woman, born in Maranhão state, migrated to São Paulo in search of work. Since 2018, she has resorted to cutting sugarcane whenever her financial situation becomes difficult. She works on a casual basis, without a formal contract, under the command of an outsourced supervisor linked to mills in the Pradópolis region.

When cutting cane, she faces work under the sun, dust, itching, and long hours without breaks She reports that working in the fields has left her with chronic headaches, depression, and a wrist injury that was caused by the repetitive effort of using a machete. She also described feeling at risk of severe injury during transportation to and from the worksite, which involves riding on old, poorly maintained, and unsafe buses that have frequently broken down and left her and her fellow workers stranded on the road at night without food.

She earns between R$70 and R$80 (USD $12.89–$14.73) per day, but payments are irregular, often delayed by up to 2 weeks. She works without protective equipment and has to buy her own insufficient protection of leggings, boots, and simple clothes.

Today, she alternates between temporary jobs harvesting tomatoes, onions, and lemons. Her story exemplifies working conditions that directly impact workers' physical and mental health.

APPENDIX 4: BRAZILIAN AGRIBUSINESS NEW TECHNOLOGIES

Drone-Based Crop Monitoring: Companies like CromAI use artificial intelligence (AI) to analyze drone imagery, helping farmers make strategic decisions (CromAI, 2025). This technology identifies pests, weeds, and nutritional deficiencies in large sugarcane fields, allowing for targeted chemical application and reduced environmental impact.

Harvest and Yield Forecasting: AI algorithms combined with satellite and radar data predict sugarcane harvest dates and estimate yields months in advance. One project developed by Radaz in collaboration with UNICAMP and Usina São Martinho is described as being capable of predicting the harvest date and productivity levels 3 months in advance with an accuracy of 88% (Radaz, 2025).

Autonomous Field Robots: Brazilian agritech company Solinftec developed the Solix Ag Robotics platform, an autonomous, solar-powered robot using AI for weed control and pest prevention. Company communications report that by performing localized spraying, it can potentially save up to 95% of herbicides and significantly reduce the carbon footprint of agricultural production (Solix Ag Robotics, 2025).

Autonomous Machinery: Brazilian sugar and ethanol producer Jalles Machado implemented an advanced Agriculture 4.0 system using a robust 4G network and AI to enable autonomous operations with millimeter precision for planting and harvesting (Jalles, 2025).

GPS-Guided Operations: As one industry representative explained, virtually every aspect of production is now monitored and controlled through GPS technology:

> *"Everything is monitored by GPS. From the layout you make for soil preparation, to furrowing, planting, cultivation, and harvesting, everything is mapped out with GPS, where the machine can operate without trampling. […] After you go through this whole process of planting, tending, and the cane grows, when you go to harvest, everything is also mechanized. The harvesters harvest, put it on the tractor that throws it onto the truck, and the truck brings it to the mill. That's how it works. And we use drones to apply pesticides, to apply fertilizers, for various things, but mainly for these two purposes."*
>
> *—Industry representative*

Supply Chain Integration: AI platforms developed by companies like Solinftec integrate real-time logistics for harvesting and transport. The AI engine, known as ALICE, organizes real-time logistics for harvesting and transport to ensure efficient delivery to mills, optimizing routes and coordinating the complex interplay of harvesters, transport vehicles, and processing schedules (Solinftec, 2025).

Optimized Transport Routes: Programming models optimize the strategic planning of harvest and transport operations, factoring in crop yield forecasts and mill sugarcane demand to minimize costs and ensure continuous supply (Filho, 2020).

Site-Specific Management: Precision agriculture technology enables field-level variability management, which is key for increasing production. AI and data processing create highly accurate management maps for soil sampling and application of fertilizers and amendments tailored to specific field conditions (FAPESP, 2023).

Enhanced Monitoring of Plant Health: Wearable sensors adapted by researchers in São Paulo monitor sugarcane crops in real time, using AI to measure plant hydration and help farmers predict and prevent pest infestations before they cause significant damage (Barbosa et al., 2022).

APPENDIX 5: MECHANIZATION AT VARIOUS STAGES OF SUGARCANE CULTIVATION

Harrow and crawler tractor preparing soil. Source: Embrapa

Historically, in some areas of the world, workers performed all sugarcane cultivation tasks manually, cutting and loading operations by hand, sometimes using animal-drawn carts for intermediate transport. In recent decades, mechanized harvesting cane cutting equipment, and even mechanized loading equipment, is increasingly common. This hybrid approach reduces but does not eliminate the need for manual labor in the harvesting phase. Although many countries have begun to employ sugarcane harvesting equipment, the use and availability of mechanized equipment in Brazil is more comprehensive across all phases. For example, many producers use specialized sugarcane harvester machines that perform all cutting and loading operations, requiring only skilled machine operators and tractor drivers. Others use even more advanced harvesters that are capable of being operated remotely or operating semi-autonomously, thus eliminating the need for drivers. Likewise, while a mechanical harvester and a mechanical loader are more common, Brazil employs more sophisticated mechanized harvesters that simultaneously cut the cane stalks, remove leaves and tops, chop the stalks into billets, and load the harvested cane into accompanying transport vehicles (Rossetto, 2022). One government research center representative emphasized the extent of this mechanization:

Automated sugarcane planter. Source: CanaOnline

> *"Sugarcane cultivation, in the agricultural sector, has undergone a major shift. You have everything, from planting to harvesting, you have an incredible system within the mill. You have machinery for planting, you have machinery for no-till farming. You have machinery for fertilizing, machinery for applying inputs, whether bio-inputs or chemical inputs."*
>
> *— Government research center representative*

Multi-cultivator machine. Source: Embrapa

There are five main stages involving different equipment in the mechanized production of Brazilian sugarcane:

Soil Preparation: Machines for subsoiling, plowing, and liming ensure adequate soil structure for planting. Crawler tractors and harrows prepare the land with precision.

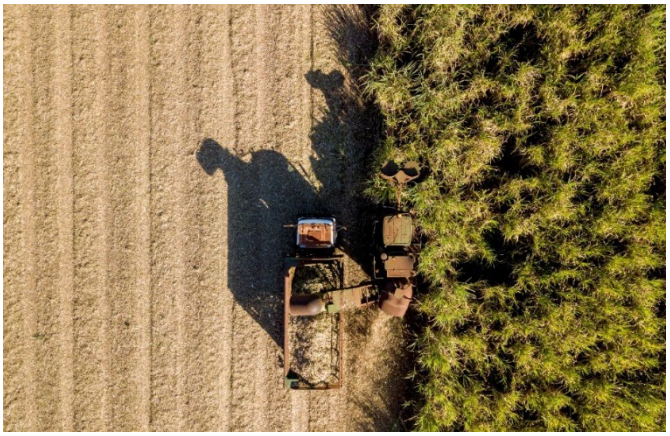
Mechanized Planting: Specialized planting machines perform furrowing, fertilization, and mechanical mulching.[47] While the machines handle these tasks, seedling distribution can still be done manually in some cases, though this varies by operation.

Mechanized Harvesting: Sugarcane harvesting machines cut and chop the plant, depositing it in windrows for collection.

Mechanized Crop Management: Tractors equipped with specialized implements perform fertilization, spraying, and other agricultural tasks aimed at weed control and soil conservation throughout the growing cycle.

Transportation: Specialized sugarcane trucks (*transbordo*) transport harvested cane from fields to mills for processing. Unlike standard highway trucks, *transbordos* feature tipping systems, reinforced structures, and low-pressure tires to reduce soil compaction while ensuring faster, more continuous harvesting logistics.

Sugarcane fertilizer spreader. Source: Embrapa



Mechanized sugarcane harvesters. Source: Embrapa

In addition to mechanized planting and harvesting equipment, sugarcane operations deploy a variety of support vehicles and management systems. The harvesting operation functions as a coordinated fleet rather than isolated machines. As one government research center representative described:

> *"There has to be a feed truck, a bathroom truck, and a fire truck. There is a front line […] around 30 people work on a harvest front. The industrial units organize this. A harvester, two transshipment vehicles, a truck, there is a lot of equipment […] it's practically a fleet. It's not just the tractor or the harvester that does the harvesting."*
>
> *—Government research center representative*

This integrated approach to field operations reflects the sector's evolution toward comprehensive mechanization and operational efficiency.

[47] A multi-cultivator is a machine designed specifically for the cultivation of sugarcane from the regrowth of a previous cut.

APPENDIX 6: SUGARCANE PRODUCTS AND BYPRODUCTS

Raw Sugar: Also referred to as turbinado, crystal sugar, or single-crystallized sugar, it is light golden brown in color. It is produced at sugar mills by cutting and then crushing raw sugarcane with large rollers to separate sugarcane juice from the fibrous stalks. Raw sugar is fit for human consumption and consumed at the retail level, but it is more often further processed at a sugar refinery into refined sugar.

Refined Sugar: Also referred to as granulated or table sugar, it is refined raw sugar. At a sugar refinery, raw sugar is further filtered, decolorized, and recrystallized before being ground into finer crystals. The resulting refined sugar is characterized by its white color, small grain size, and ability to easily dissolve into liquids.

Cachaça: A traditional Brazilian distilled spirit made from fermented sugarcane juice.

Ethanol: Derived from the fermentation of sugarcane juice or molasses and primarily used as a biofuel. Brazil produces two main technological categories of fuel ethanol: **first-generation (1G)** and **second-generation (E2G)**; and two commercial types: **hydrated** and **anhydrous** ethanol.

Hydrated vs. anhydrous ethanol: In the Brazilian fuel market, there are two categories of ethanol. **Hydrated/hydrous ethanol** is the regular ethanol sold at gas stations in Brazil, and **anhydrous ethanol** is the type blended into gasoline. The difference lies in water content: hydrous ethanol contains about 95.1–96% ethanol, whereas anhydrous ethanol contains at least 99.6% alcohol, making it essentially pure ethanol ("anhydrous" means "without water") (NovaCana, 2025b). Both types follow the same production steps until fermentation, which produces hydrated ethanol. To obtain anhydrous ethanol, the product undergoes dehydration through fractional distillation, removing almost all remaining water.

Hydrated ethanol (E100): Contains water and is used in its pure form in dedicated ethanol engines or flex-fuel vehicles. E100 is sold directly as a fuel for flex-fuel vehicles, which make up the majority of the national fleet. Hydrous ethanol is used as a standalone fuel mainly in Brazil, where sugarcane-based ethanol is economically viable thanks to the Proálcool program launched in 1975. It also appears in **cosmetics, cleaning products, antiseptics, and beverages, with varying alcohol concentrations,** depending on the product (NovaCana, 2025).

Anhydrous ethanol is produced by dehydrating hydrous ethanol to remove almost all water. It is blended with gasoline in legally defined proportions, without harming engines. It is blended into gasoline to lower fuel costs, increase octane, and reduce emissions. More than 40 countries, such as the United States, Canada, Paraguay, and China, also use ethanol-gasoline blends, typically at 5–10%. Anhydrous ethanol is also used in **paints, varnishes, solvents, and spirits** (NovaCana, 2025).

First-generation (1G) ethanol: Fuel ethanol (ethyl alcohol, CH_3CH_2OH) can be produced from several crops, such as sugarcane, corn, sugar beets, and potatoes. In Brazil's sugar-energy industry, sugarcane is the dominant feedstock. First-generation ethanol is produced by fermenting sugars (mainly sucrose from sugarcane juice) using yeasts, through a well-established industrial process that is already deployed at large scale. It can also be produced from starchy crops (e.g., corn, wheat), in which the starch must first be converted into fermentable sugars (Melo, 2020). In 2017, 97.1% of the 384 authorized ethanol production plants in Brazil used sugarcane as their primary feedstock, with a total installed capacity of about 217,000 m^3/day, of which 117,000 m^3/day was anhydrous ethanol capacity (ANP, 2017).

Second-generation (2G) ethanol: Also called cellulosic ethanol, it is produced from lignocellulosic residues, such as sugarcane bagasse and straw, rather than from the cane juice itself. It relies on

pre-treatment and enzymatic hydrolysis to break down cellulose and hemicellulose into fermentable sugars before fermentation. The main goal of 2G ethanol in Brazil is to increase total ethanol output without expanding cultivated area, by using residues that are currently mostly burned for process energy (Melo, 2020). This technology has the potential to increase ethanol production by up to 50%, without increasing the planted area, through the conversion of straw and bagasse. Furthermore, cellulosic (or 2G) ethanol is a clean fuel, as it reduces greenhouse gas emissions produced by fossil fuels by up to 90%.

Bagasse: The fibrous sugarcane stalk material that remains after sugarcane is crushed to extract cane juice. Historically, bagasse was considered to be a waste product, but it is now commonly used as a direct energy source in sugar mills. Additional uses for bagasse are as base fodder in animal feed; as an alternative for wood in the manufacture of paper, pulp, and particle board; and as a source of organic chemicals used in the production of furfural.

Filter Cake: Fine organic particulates removed during sugarcane juice clarification; filter cake contains residual sugars, fibers, and nutrients. Filter cake is used as an organic fertilizer to fields as organic fertilizer.

Molasses: The thick, dark syrup remaining after sugar crystallization serves multiple downstream uses, including fermentation feedstock for ethanol production, animal feed supplement providing energy and minerals, and feedstock for industrial fermentation producing yeast, citric acid, and other biochemicals (U.S. Department of Agriculture Agricultural Marketing Service, 2025).

Vinasse: The liquid residue from ethanol distillation, approximately 10–15 liters per liter of ethanol produced. Brazilian mills now use vinasse through fertigation systems that apply it to sugarcane fields as liquid fertilizer, providing nutrients while disposing of the residue in an environmentally acceptable manner (Carpanez et al., 2022; J. T. Oliveira et al., 2025). More recently, the Brazilian domestic industry is capturing biogas from vinasse, generating methane for additional energy. This biogas can be upgraded to biomethane quality and distributed through pipelines to urban consumption centers (De Carvalho et al., 2023).

Furfural: A versatile organic chemical derived from sugarcane bagasse with applications in pharmaceuticals, agrochemicals, resins, lubricants, and specialty solvents. While furfural production from sugarcane bagasse remains limited in Brazil, the potential exists for this value-added processing pathway as mills seek to diversify revenue streams and maximize biomass utilization.

APPENDIX 7: HS CODES

Product	HS code	HS description
Raw sugar	1701.13	Raw sugar not containing added flavoring or coloring matter cane sugar specified in subheading note 2 to this chapter: "Subheading 1701.13 covers only cane sugar obtained without centrifugation, whose content of sucrose by weight, in the dry state, corresponds to a polarimeter reading of 69° or more but less than 93°. The product contains only natural anhedral microcrystals, of irregular shape, not visible to the naked eye, which are surrounded by residues of molasses and other constituents of sugarcane."
	1701.14	Other cane sugar
Refined sugar	1701.91	Cane or beet sugar and chemically pure sucrose, in solid form. Other. Containing added flavoring or coloring matter
	1701.99	Cane or beet sugar and chemically pure sucrose, in solid form. Other. Other
Ethanol	2207.10	Ethyl alcohol, undenatured, of an alcoholic strength by volume of 80% vol. or higher; ethyl alcohol and other spirits, denatured, of any strength
	2207.20	Ethyl alcohol and other spirits, denatured, of any strength
Bagasse	2303.20	Residues of starch manufacture and similar residues, beet-pulp, bagasse, and other waste of sugar manufacture, brewing or distilling dregs and waste, whether or not in the form of pellets. Beet-pulp, bagasse, and other waste of sugar manufacture
Molasses	1703.10	Molasses resulting from the extraction or refining of sugar: Cane molasses
***Cachaça*/rum**	2208.40	Rum and other spirits obtained by distilling fermented sugar-cane products

Note: Ethanol may include ethanol produced from sugarcane or other products, such as corn. Ethanol includes both fuel and non-fuel ethanol, such as beverages.

APPENDIX 8: EXPORT STATISTICS

Exports by HS code, 2022–2024 (value and quantity)

HS Code	Description	Annual Export Value (USD)			Quantity (MT, L)		
		2022	2023	2024	2022	2023	2024
1701.13	Raw sugar, coloring	$ 917,384	$ 2,253,455	$ 546,743	661	2,743	272
1701.14	Raw sugar, no coloring	$ 9,528,719,019	$13,346,415,787	$ 15,925,320,657	24,126,115	27,032,236	33,456,958
1701.91	Refinded sugar, coloring	$ 633,881	$ 795,020	$ 484,058	925	1246	241
1701.99	Refined sugar, no coloring	$ 1,480,323,810	2,401,581,882	2,675,323,771	3,131,702	4,248,702	4,761,313
1703.10	Molasses from sugarcane	$ 51,897	$ 108,214	$ 83,660	57	65	90
2207.10	undenatured, of an alcoholic strength by volume of 80%	$ 1,728,322,513	$ 1,604,515,105	$ 1,038,135,406	2,426,261,223	2,505,786,170	1,857,817,237
2207.20	ethyl alcohol and other spirits, denatured, of any strength	$ 10,782,344	$ 3,452,506	$ 13,286,497	13,624,278	4,582,911	26,378,269
2208.40	Cacha/rum	$ 20,095,765	$ 20,242,453	$ 14,544,293	9,317,696	8,618,832	6,661,887
2303.20	Bagasse	$ 96,110	$ 120,383	$ 41,045	77	144	45

Source: TDM, 2025, as reported by Brazil, value f.o.b.

Top 10 destination markets for Brazilian sugar exports (raw and refined), by value and quantity, 2024

Destination market	Value (USD)	Market share	Destination market	Quantity (MT)	Market share
Global	$18,601,675,229	100%	Global	38,218,784	100%
Indonesia	$1,652,876,344	8.9%	Indonesia	3,464,794	9.1%
India	$1,615,441,242	8.7%	India	3,353,045	8.8%
China	$1,405,429,320	7.6%	China	3,020,862	7.9%
United Arab Emirates	$1,145,391,247	6.2%	United Arab Emirates	2,490,479	6.5%
Algeria	$1,053,729,244	5.7%	Algeria	2,226,778	5.8%
Morocco	$924,150,303	5.0%	Egypt	1,980,944	5.2%
Egypt	$922,974,806	5.0%	Morocco	1,933,078	5.1%
Saudi Arabia	$892,168,219	4.8%	Saudi Arabia	1,897,215	5.0%
Bangladesh	$767,366,991	4.1%	Bangladesh	1,640,547	4.3%
Malaysia	$761,034,092	4.1%	Malaysia	1,605,072	4.2%

Source: TBD, 2025 as reported by Brazil. Value f.o.b.

Top destination markets for Brazilian ethanol exports, by value and quantity, 2024

Destination market	Value (USD)	Market share	Quantity (L)	Market share
Global	$1,051,421,903	100.0%	1,884,195,506	100.0%
South Korea	$416,751,361	39.6%	774,816,690	41.1%
United States	$181,828,211	17.3%	313,340,613	16.6%
Netherlands	$91,866,348	8.7%	152,677,597	8.1%
Nigeria	$54,688,691	5.2%	110,760,864	5.9%
Philippines	$54,030,131	5.1%	95,929,481	5.1%
Singapore	$38,086,225	3.6%	80,172,672	4.3%
Japan	$35,414,328	3.4%	64,114,481	3.4%
India	$29,047,414	2.8%	62,568,077	3.3%
Ghana	$27,155,765	2.6%	43,216,575	2.3%
Cameroon	$16,019,500	1.5%	21,309,250	1.1%

Source: TBD, 2025 as reported by Brazil. Value f.o.b.

Top 10 destination markets for refined sugar from Brazil, 2024

Destination market	Value (USD)	Market share
Global	$2,675,807,829	100.0%
Mauritania	$211,556,406	7.9%
Cameroon	$193,479,155	7.2%
Senegal	$191,097,235	7.1%
United States	$164,288,841	6.1%
Togo	$163,097,315	6.1%
Guinea	$147,165,911	5.5%
Colombia	$130,007,859	4.9%
Côte d'Ivoire	$125,474,010	4.7%
Ghana	$113,974,976	4.3%
Yemen	$112,512,921	4.2%

Source: TDM, 2025 by value (f.o.b.) as reported by exporter

APPENDIX 9: ETHANOL REGULATION IN BRAZIL

Brazil uses a mandatory blending policy—all gasoline must contain a percentage of anhydrous ethanol, determined by Federal Law N° 14.993.[48] **The National Petroleum Agency** regulates production, distribution, and mandatory quality standards for both anhydrous and hydrous ethanol. Federal policy through RenovaBio creates decarbonization credits, rewarding mills that have lower carbon-intensity scores.

Brazilian gasoline used to contain approximately 20% anhydrous ethanol, but in August 2025, the mandatory blend was increased to 30%, a measure approved by the National Energy Policy Council and aimed at increasing Brazilian self-sufficiency and reducing fuel prices.

RenovaBio is Brazil's National Biofuels Policy, established in 2017 to expand the role of biofuels in the national energy matrix and support Brazil's commitments under the Paris Agreement. The program sets annual **decarbonization targets** for the fuel sector and creates financial incentives through decarbonization credits, which are issued by certified biofuel producers based on their environmental performance. Fuel distributors are legally required to purchase decarbonization credits based on their fossil fuel sales, creating a market mechanism that promotes efficient, lower-carbon biofuel production. The policy also relies on extensive support from public research and financing institutions, including BNDES and Finep (Melo, 2020).

Proálcool: Created in 1975 during the global oil crisis, Proálcool was Brazil's first major ethanol program, designed both to reduce dependence on imported gasoline and to stabilize the sugarcane industry after a drop in sugar prices. The program unfolded in several phases: first promoting ethanol blending in gasoline, then supporting large-scale production of hydrated ethanol for dedicated alcohol vehicles. After deregulation in the 1990s and rising sugar prices, ethanol production declined, but the sector was revitalized in the 2000s with the introduction of flex-fuel vehicles. Despite debt and productivity challenges in the 2010s, Proálcool laid the foundation for Brazil's modern sugar-energy industry and its global leadership in ethanol production (Melo, 2020).

[48] Available at: https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/l14993.htm.

APPENDIX 10: FINAL RESEARCH INSTRUMENTS

BRAZIL SUGARCANE STUDY: WORKER QUESTIONNAIRE

Field	Question	Answer
FIELDCONTROL		
type *(required)*	SELECT INTERVIEW TYPE	1 TEST 2 PILOT 3 REAL
Interviewer *(required)*	INTERVIEWER'S NAME:	1 2 3 4 5
State *(required)*	SELECT STATE WHERE QUESTIONNAIRE IS BEING ADMINISTERED	1 1. ACRE 2 2. ALAGOAS 3 3. AMAPÁ 4 4. AMAZONAS 5 5. BAHIA 6 6. CEARÁ 7 7. ESPÍRITO SANTO 8 8. GOIÁS 9 9. MARANHÃO 10 10. MATO GROSSO 11 11. MATO GROSSO DO SUL 12 12. MINAS GERAIS 13 13. PARÁ 14 14. PARAÍBA 15 15. PARANÁ 16 16. PERNAMBUCO 17 17. PIAUÍ 18 18. RIO DE JANEIRO 19 19. RIO GRANDE DO NORTE 20 20. RIO GRANDE DO SUL 21 21. RONDÔNIA 22 22. RORAIMA 23 23. SANTA CATARINA 24 24. SÃO PAULO 25 25. SERGIPE

Field	Question	Answer
		26 26. TOCANTINS
MUNICIPALITY *(required)*	MUNICIPALITY WHERE QUESTIONNAIRE IS BEING ADMINISTERED	
CONSENT		
S1Q01 *(required)*	S1Q01. Have you worked in the sugarcane industry in Brazil in the past year and a half? *Question relevant when: CONSENT = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q02 *(required)*	S1Q02. How old are you? [IF NEEDED, SAY: Your best guess is fine] *Question relevant when: CONSENT = 1 and S1Q01 = 1*	
SECTION 1: GENERAL INFORMATION *Group relevant when: CONSENT = 1 and (S1Q02 > 17 or S1Q02 = -76) and (S1Q01 = 1)*		
S1Q03 *(required)*	S1Q03. INTERVIEWER: MARK RESPONDENT'S SEX. ASK IF UNSURE.	1 1. MALE 2 2. FEMALE 3 3. PREFER NOT TO SAY
S1Q04 *(required)*	S1Q04. Where were you born?	1 1. BRAZIL 2 2. ARGENTINA 3 3. BOLIVIA 4 4. COLOMBIA 5 5. FRENCH GUIANA 6 6. GUYANA 7 7. PARAGUAY 8 8. PERU 9 9. SURINAME 10 10. URUGUAY 11 11. VENEZUELA 55 55. OTHER COUNTRY

Field	Question	Answer
		77 77. DON'T KNOW 99 99. REFUSED
S1Q04A *(required)*	S1Q04A. In which state of Brazil were you born? *Question relevant when: S1Q04 = 1*	1 1. ACRE 2 2. ALAGOAS 3 3. AMAPÁ 4 4. AMAZONAS 5 5. BAHIA 6 6. CEARÁ 7 7. ESPÍRITO SANTO 8 8. GOIÁS 9 9. MARANHÃO 10 10. MATO GROSSO 11 11. MATO GROSSO DO SUL 12 12. MINAS GERAIS 13 13. PARÁ 14 14. PARAÍBA 15 15. PARANÁ 16 16. PERNAMBUCO 17 17. PIAUÍ 18 18. RIO DE JANEIRO 19 19. RIO GRANDE DO NORTE 20 20. RIO GRANDE DO SUL 21 21. RONDÔNIA 22 22. RORAIMA 23 23. SANTA CATARINA 24 24. SÃO PAULO 25 25. SERGIPE 26 26. TOCANTINS 77 77. DON'T KNOW 99 99. REFUSED
S1Q05 *(required)*	S1Q05. Have you ever attended school?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q05A *(required)*	S1Q05A. What is the highest class you have completed?	1 1. PRESCHOOL/KINDERGARTEN 2 2. INCOMPLETE PRIMARY EDUCATION

Field	Question	Answer
	Question relevant when: S1Q05 = 1	3 3. COMPLETE PRIMARY EDUCATION 4 4. INCOMPLETE HIGH SCHOOL EDUCATION 5 5. COMPLETE HIGH SCHOOL EDUCATION OR HIGHER 77 77. DON'T KNOW 99 99. REFUSED
S1Q05AA *(required)*	What is your race?	1 1. WHITE (BRANCA) 2 2. AFRICAN DESCENT (PRETA) 3 3. MIXED ANCESTRY (PARDA) 4 4. INDIGENOUS 5 5. ASIAN DESCENT (AMARELA) 77 77. DON'T KNOW 99 99. REFUSED
S1Q05A_QUAL	• How long have you been working in sugarcane?	
GI_READ	READ: For the following questions, please think about your most recent job working in the sugarcane industry. If you had more than one job, think about your main job.	
S1Q05B *(required)*	S1Q05B. In which state was the job located?	1 1. MINAS GERAIS 2 2. SAO PAULO 55 55. OTHER _____ 77 77. DON'T KNOW 99 99. REFUSED
SECTION 1: GENERAL INFORMATION > Sub1 *Group relevant when: S1Q05B = 1 or S1Q05B = 2*		
SECTION 1: GENERAL INFORMATION > Sub1 > S1Q06_group		
S1Q06 *(required)*	S1Q06. Approximately when did you **start** this job? [SELECT MONTH (IF KNOWN)]	1 1. JANUARY 2 2. FEBRUARY 3 3. MARCH 4 4. APRIL 5 5. MAY 6 6. JUNE

Field	Question	Answer
		7 7. JULY 8 8. AUGUST 9 9. SEPTEMBER 10 10. OCTOBER 11 11. NOVEMBER 12 12. DECEMBER 77 77. DON'T KNOW 99 99. REFUSED
S1Q06_YEAR *(required)*	[RECORD YEAR STARTED JOB]	
INVALID_START_DATE_CHECK *(required)*	The start of this job date that has been selected ([S1Q06] / [S1Q06_YEAR]) is greater than the current date (09 / 2025). Please return and fix the entry. *Question relevant when: INVALID_START_MONTH_FLAG = 1*	
S1Q07 *(required)*	S1Q07. Do you still have this job?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
SECTION 1: GENERAL INFORMATION > Sub1 > S1Q07_group		
S1Q07A *(required)*	S1Q07A. Approximately when did you **stop** working this job? [SELECT MONTH] *Question relevant when: S1Q07 DOES NOT EQUAL 1*	1 1. JANUARY 2 2. FEBRUARY 3 3. MARCH 4 4. APRIL 5 5. MAY 6 6. JUNE 7 7. JULY 8 8. AUGUST 9 9. SEPTEMBER 10 10. OCTOBER 11 11. NOVEMBER 12 12. DECEMBER 77 77. DON'T KNOW 99 99. REFUSED

Field	Question	Answer
S1Q07A_YEAR *(required)*	[RECORD YEAR JOB ENDED] *Question relevant when: S1Q07 DOES NOT EQUAL 1*	2022 2022 OR EARLIER 2023 2023 2024 2024 2025 2025 77 DON'T KNOW 99 REFUSED
SECTION 1: GENERAL INFORMATION > Sub1 > Sub2 *Group relevant when: OVER_18MONTHS_AGO = 0*		
S1Q08 *(required)*	S1Q08. Did you relocate to take this job, including temporarily?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q08A *(required)*	S1Q08A. Did you relocate from another part of Brazil or a different country? *Question relevant when: S1Q08 = 1*	1 1. BRAZIL 2 2. DIFFERENT COUNTRY 77 77. DON'T KNOW 99 99. REFUSED
S1Q08B *(required)*	S1Q08B. From which state in Brazil did you relocate? *Question relevant when: S1Q08A = 1*	1 1. ACRE 2 2. ALAGOAS 3 3. AMAPÁ 4 4. AMAZONAS 5 5. BAHIA 6 6. CEARÁ 7 7. ESPÍRITO SANTO 8 8. GOIÁS 9 9. MARANHÃO 10 10. MATO GROSSO 11 11. MATO GROSSO DO SUL 12 12. MINAS GERAIS 13 13. PARÁ 14 14. PARAÍBA 15 15. PARANÁ 16 16. PERNAMBUCO 17 17. PIAUÍ 18 18. RIO DE JANEIRO 19 19. RIO GRANDE DO NORTE 20 20. RIO GRANDE DO SUL

Field	Question	Answer
		21 21. RONDÔNIA 22 22. RORAIMA 23 23. SANTA CATARINA 24 24. SÃO PAULO 25 25. SERGIPE 26 26. TOCANTINS 77 77. DON'T KNOW 99 99. REFUSED
S1Q08C *(required)*	S1Q08C. From which country did you relocate? *Question relevant when: S1Q08A = 2*	1 1. ARGENTINA 2 2. BOLIVIA 3 3. COLOMBIA 4 4. FRENCH GUIANA 5 5. GUYANA 6 6. PARAGUAY 7 7. PERU 8 8. SURINAME 9 9. URUGUAY 10 10. VENEZUELA 55 55. OTHER COUNTRY 77 77. DON'T KNOW 99 99. REFUSED
S1Q08D *(required)*	S1Q08D. Do you have a boss?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q08DD *(required)*	S1Q08DD. What is the role of your boss? *Question relevant when: S1Q08D = 1*	1 1. LAND OWNER 2 2. COMPANY/PLANT OWNER 3 3. LANDOWNER OR COMPANY REPRESENTATIVE 4 4. SUBCONTRACTOR 5 5. CANE SUPPLIER 6 6. RECRUITER (GATO) 7 7. RECRUITER (TURMEIRO)/INSPECTOR 8 8. MEMBER OF YOUR FAMILY 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED

Field	Question	Answer
S1Q08F *(required)*	S1Q08F. Does anyone tell you when to work? *Question relevant when: S1Q08D DOES NOT EQUAL 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q08G *(required)*	S1Q08G. Does anyone tell you where to work? *Question relevant when: S1Q08D DOES NOT EQUAL 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q08H *(required)*	S1Q08H. Does anyone tell you which tasks to do at work? *Question relevant when: S1Q08D DOES NOT EQUAL 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S1Q08I *(required)*	S1Q08I. Who tells you to do this? [SELECT ALL THAT APPLY] *Question relevant when: S1Q08F = 1 or S1Q08G = 1 or S1Q08H = 1*	1 1. LAND OWNER 2 2. COMPANY/PLANT OWNER 3 3. LANDOWNER OR COMPANY REPRESENTATIVE 4 4. SUBCONTRACTOR 5 5. CANE SUPPLIER 6 6. RECRUITER/CAT 7 7. TOUR OPERATOR/INSPECTOR 8 8. MEMBER OF YOUR FAMILY 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
BOSS *(required)*	INTERVIEWER: WHAT DOES THE RESPONDENT CALL THIER BOSS OR THE PERSON WHO TELLS THEM WHAT TO DO? USE A GENERAL TERM OR NICKNAME, NOT A REAL NAME. *Question relevant when: S1Q09 = 1*	1 BOSS 2 TOUR OPERATOR 3 INSPECTOR 4 LEADER 55 OTHER

Field	Question	Answer
S1Q09_QUAL	• Does anyone give your [BOSS_TITLE] instructions? • (PROBE: Hours of work, location of work, tasks to do, method of doing work) *Question relevant when: S1Q09 = 1*	
S1Q11 *(required)*	S1Q11. Which activities related to sugarcane did you do during the most recent month you worked? SELECT ALL THAT APPLY	1 1. CUTTING OR HARVESTING SUGARCANE 2 2. PLANTING OR PREPARING SUGARCANE FIELDS 3 3. APPLYING FERTILIZERS TO SUGARCANE CROPS 4 4. APPLYING PESTICIDES OR HERBICIDES IN SUGARCANE FIELDS 5 5. TRANSPORTING SUGARCANE OR SUGARCANE BY-PRODUCTS 6 6. OPERATING OR MAINTAINING AGRICULTURAL MACHINERY 7 7. ADMINISTRATIVE OR SUPERVISORY WORK 8 8. WORKING AT A SUGAR MILL (E.G., PROCESSING CANE INTO SUGAR OR ETHANOL) 9 9. WORKING AT A SUGAR REFINERY 10 10. COLLECTION OF SUGARCANE LEFTOVERS (BITUCAS) 11 11. REPLANTING 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S1Q11A *(required)*	S1Q11A.	1 1. CUTTING OR HARVESTING SUGARCANE

Field	Question	Answer
	On which of these activities did you spend the most time? *Question relevant when: numselected_S1Q11_tot > 0*	2 2. PLANTING OR PREPARING SUGARCANE FIELDS 3 3. APPLYING FERTILIZERS TO SUGARCANE CROPS 4 4. APPLYING PESTICIDES OR HERBICIDES IN SUGARCANE FIELDS 5 5. TRANSPORTING SUGARCANE OR SUGARCANE BY-PRODUCTS 6 6. OPERATING OR MAINTAINING AGRICULTURAL MACHINERY 7 7. ADMINISTRATIVE OR SUPERVISORY WORK 8 8. WORKING AT A SUGAR MILL (E.G., PROCESSING CANE INTO SUGAR OR ETHANOL) 9 9. WORKING AT A SUGAR REFINERY 10 10. COLLECTION OF SUGARCANE LEFTOVERS (BITUCAS) 11 11. REPLANTING 55 55. OTHER WORK RELATED ACTIVITY: ... 77 77. DON'T KNOW 99 99. REFUSED
SECTION 2: RECRUITMENT *Group relevant when: CONSENT = 1 and (S1Q02 > 17 or S1Q02 = -76) and (S1Q01 = 1) and (OVER_18MONTHS_AGO =0) and (S1Q05B = 1 or S1Q05B = 2)*		
S2Q01 *(required)*	S2Q01. Next we would like to ask you a few questions about how you started in your job. Did anyone help you get this job? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S2Q01A *(required)*	S2Q01A.	1 1. FAMILY MEMBER 2 2. FRIEND/NEIGHBOR

Field	Question	Answer
	Who helped you get this job? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Anyone else?" BEFORE MOVING ON. *Question relevant when: selected(S2Q01 , '1') or selected(S2Q01 , '3')*	3 3. BROKER/GATO 4 4. TOUR OPERATOR/INSPECTOR 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S2Q01A_QUAL	• Tell me more about how you got this job. *Question relevant when: S1Q09 = 1*	
S2Q01B *(required)*	S2Q01B. Did you have any debt to the broker [gato] or employer for costs related to getting the job, such as recruitment fees or travel? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S2Q01C *(required)*	S2Q01C. Did you have to work to pay off the debt? *Question relevant when: S2Q01B =1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S2Q01B_QUAL	• How much was the debt? • Whom was it to? • What was it for? • [IF RELEVANT] Did you feel your work was fairly applied to reduce the debt? *Question relevant when: S2Q01B =1*	
S2Q02 *(required)*	S2Q02.	1 1. YES 2 2. NO 77 77. DON'T KNOW

Field	Question	Answer
	Did you feel compelled to take this job? *Question relevant when: S1Q09 = 1*	99 99. REFUSED
S2Q02A *(required)*	S2Q02A. Why did you feel compelled to take this job? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Any other reason?" AT LEAST TWICE BEFORE MOVING ON. **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S2Q02 = 1*	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT BY EMPLOYER/RECRUITER 3 3. DEBT BONDAGE OR MANIPULATION OF DEBT (DEBT TO EMPLOYER/RECRUITER) 5 5. WITHHOLDING OF VALUABLE DOCUMENTS BY EMPLOYER/RECRUITER 7 7. THREAT OF LOSS OF HOUSING/LAND 55 55. OTHER _____ 66 66. WORK OPPORTUNITIES ARE SCARCE/WOULD HAVE NO MONEY/ETC 77 77. DON'T KNOW 99 99. REFUSED
S2Q03 *(required)*	S2Q03. Do (did) you have a written contract for this work? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S2Q03_QUAL	• Were you given a chance to read it? • Did you understand it? • Do you have a copy of it?	

Field	Question	Answer
	Question relevant when: S2Q03 =1	
S2Q03A *(required)*	S2Q03A. Did you have a verbal agreement for this work? *Question relevant when: S2Q03 DOES NOT EQUAL1 and S1Q09 =1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S2Q03A_QUAL	• What were you told about this job before you took it? ○ (PROBE: NATURE OF WORK, HOURS, EARNINGS, LIVING CONDITIONS) • Who told you this? *Question relevant when: S1Q09 = 1*	
S2Q04 *(required)*	S2Q04. Thinking about what your [BOSS_TITLE] told you before you started the job compared to the job you're actually doing, Were you misled about the job? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S2Q04A *(required)*	S2Q04A. What were you misled about? [INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY. ASK "Anything else?" TWICE BEFORE	1 1. NATURE OF THE JOB (FUNDAMENTAL DUTIES OF THE JOB, TYPE OF JOB) 2 2. WORK TASKS 3 3. HOURS 4 4. EARNINGS/REMUNERATION 5 5. LIVING CONDITIONS

Field	Question	Answer
	MOVING ON.] **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S2Q04 = 1*	6 6. HAZARDS/SAFETY 7 7. JOB LOCATION 8 8. LEGALITY OF WORK 9 9. IDENTITY OF EMPLOYER 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S2Q04B *(required)*	S2Q04B. What would have happened if you had asked for the work or conditions you were promised? [INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY. ASK "Any thing else?" TWICE BEFORE MOVING ON.] **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S2Q04 = 1*	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT 3 3. DEBT BONDAGE OR MANIPULATION OF DEBT (DEBT TO EMPLOYER/RECRUITER) 5 5. WITHHOLDING OF VALUABLE DOCUMENTS/GUARANTEE BY EMPLOYER/RECRUITER 7 7. THREAT OF LOSS OF HOUSING/LAND 9 9. DISMISSAL OR THREATS OF DISMISSAL 14 14. SUSPENSION/LOSS OF DAYS 55 55. OTHER 66 66. NOTHING 77 77. DON'T KNOW 99 99. REFUSED
S2Q04B_QUAL	• Would you have taken this job if you had known the real conditions? • Why? *Question relevant when: S2Q04 = 1*	

Field	Question	Answer
S2Q04B_QUAL2	• How would you describe your working conditions?	
SECTION 3: LIVING CONDITIONS *Group relevant when: CONSENT = 1 and (S1Q02 > 17 or S1Q02 = -76) and (S1Q01 = 1) and (OVER_18MONTHS_AGO =0) and (S1Q05B = 1 or S1Q05B = 2)*		
S3Q01 *(required)*	S3Q01. Does (Did) your [BOSS_TITLE] provide your housing? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q01A *(required)*	S3Q01A. Does your [BOSS_TITLE] subtract the cost of housing from your earnings? *Question relevant when: S3Q01 =1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q01A_QUAL	• How much do they subtract? • How often? *Question relevant when: S3Q01A =1*	
S3Q01B *(required)*	S3Q01B. Could you have lived somewhere else and still work at your job? *Question relevant when: S3Q01 =1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q01C *(required)*	S3Q01C. Why not? [INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY] *Question relevant when: S3Q01B = 2*	1 1. EMPLOYER, MANAGER, OR RECRUITER WOULD NOT LET ME/ THEY REQUIRE THAT I LIVE HERE 2 2. I CAN'T AFFORD TO LIVE SOMEWHERE ELSE 3 3. NO ALTERNATIVE DUE TO REMOTENESS OF WORKSITE 55 55. OTHER

Field	Question	Answer
		77 77. DON'T KNOW 99 99. REFUSED
SECTION 3: LIVING CONDITIONS > SECTION 3: LIVING CONDITIONS Sub1 *Group relevant when: selected(S3Q01C , '1') or (S3Q01A =1 and selected(S3Q01C , '3'))*		
S3Q01C_QUAL	• Please tell me about your housing.	
S3Q02 *(required)*	S3Q02. How would you describe the quality of your accommodations--Would you say good, ok, or bad?	1 1. GOOD 2 2. OK/FINE 3 3. BAD 77 77. DON'T KNOW 99 99. REFUSED
S3Q02_QUAL	• Tell me more about the bad conditions. *Question relevant when: S3Q02 = 3*	
S3Q02A *(required)*	S3Q02A. Do (Did) you have access to clean water in or near your housing?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q02B *(required)*	S3Q02B. Do you feel that your housing is harmful to your health?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q02B_QUAL	• How do you feel it's harming your health? *Question relevant when: S3Q02B = 1*	
S3Q02C *(required)*	S3Q02C. Do (Did) you feel safe in your housing?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q02C_QUAL	• What makes you feel unsafe? *Question relevant when: S3Q02C = 2*	

Field	Question	Answer
S3Q02D *(required)*	S3Q02D. How many people sleep (slept) in the room you sleep (slept) in, including yourself?	1 1. 1-4 PEOPLE 2 2. 5-8 PEOPLE 3 3. 9 OR MORE PEOPLE 77 77. DON'T KNOW 99 99. REFUSED
S3Q02D_QUAL	• Please tell me about the bathroom in your accommodation. • Does it have a toilet, sink and shower?	
FOM_READ	READ: Now I will ask you about your freedom of movement at work and outside of work. *Question relevant when: S1Q09 = 1*	
S3Q03 *(required)*	S3Q03. During working hours, can you leave your work place if needed? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q03A *(required)*	S3Q03A. Why can't you leave your work place during working hours? [INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY] *Question relevant when: S3Q03 = 2*	1 1. SUBJECT TO FINES/DEDUCTIONS/DISMISSAL 2 2. SUBJECT TO VERBAL ABUSE 3 3. PHYSICALLY UNABLE TO LEAVE 4 4. REPUTATION/WORK PRODUCT WOULD SUFFER 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S3Q03B *(required)*	S3Q03B. How are you physically prevented from leaving? [INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY]	1 1. WOULD BE STOPPED BY SUPERVISOR 2 2. GUARDS 3 3. LOCKED DOORS/GATES 4 4. ISOLATED WITHOUT TRANSPORT

Field	Question	Answer
	PROBE FOR DETAILS. *Question relevant when: selected(S3Q03A , '3')*	5 5. SUBJECTED TO PHYSICAL VIOLENCE 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S3Q04 *(required)*	S3Q04. Can (could) you leave the area of your lodgings outside of work hours? *Question relevant when: S3Q01 =1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q04A *(required)*	S3Q04A. Who prevents you from coming and going outside of work hours? [INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY] *Question relevant when: S3Q04 = 2*	1 1. EMPLOYER/MANAGER/WORKPLACE SECURITY 2 2. RECRUITER 3 3. OUTSOURCING AGENCY 4 4. FAMILY/SPOUSE 5 5. LEGAL RESTRICTION 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S3Q05 *(required)*	S3Q05. Does your [BOSS_TITLE] hold any of your important documents, such as your CPF, work permit, or ID? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S3Q05_QUAL	• Where are they kept? • Why? *Question relevant when: S3Q05 = 1*	
S3Q05A *(required)*	S3Q05A. Can you access your documents if needed?	1 1. YES 2 2. NO 77 77. DON'T KNOW

Field	Question	Answer
	Question relevant when: S3Q05 = 1	99 99. REFUSED
SECTION 4: DEBT AND PAYMENT *Group relevant when: CONSENT = 1 and (S1Q02 > 17 or S1Q02 = -76) and (S1Q01 = 1) and (OVER_18MONTHS_AGO =0) and (S1Q05B = 1 or S1Q05B = 2)*		
S4Q01 *(required)*	S4Q01. Sometimes workers are in debt to their employers, for example after buying or using tools or receiving a pay advance. The next questions are about debt to your [BOSS_TITLE]. Has your [BOSS_TITLE] charged you excessive or unagreed amounts for food, lodging, or supplies? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q01_QUAL	• Tell me more about that. • What were you charged for? • Do you buy from a store owned by your boss? Do you buy from a store recommended by your boss? • Are the prices the same as other stores? • Could you buy elsewhere if you wanted to? *Question relevant when: S4Q01 = 1*	
S4Q01A *(required)*	S4Q01A.	1 1. YES 2 2. NO 77 77. DON'T KNOW

Field	Question	Answer
	Have these amounts put you in debt with your [BOSS_TITLE]? *Question relevant when: S4Q01 = 1*	99 99. REFUSED
S4Q01AA *(required)*	S4Q01AA. Have you ever been fined at work? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q01AA_QUAL	• How much was the fine? • What was it for? • How many times did it happen? • Have you ever had your pay deducted for any reason related to work performance or violation of rules? • Have you been charged for taking a day off work due to illness or similar? *Question relevant when: S4Q01AA = 1*	
S4Q01B *(required)*	S4Q01B. Have you gone into debt with your [BOSS_TITLE] due to fines? *Question relevant when: S4Q01AA = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q01BB *(required)*	S4Q01BB. Do you have any debt with your [BOSS_TITLE]? *Question relevant when: S4Q01A DOES NOT EQUAL 1 and S4Q01B DOES NOT EQUAL1 and S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q01BB_QUAL	• To whom?	

Field	Question	Answer
	• In exchange for what? • What is the amount of the debt • How long have you had this debt? • How are you repaying it? *Question relevant when: S4Q01BB = 1*	
S4Q01BB_alt *(required)*	S4Q01BB_alt. Do you have any other debt with your [BOSS_TITLE]? *Question relevant when: S4Q01A = 1 or S4Q01B = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q01BB_alt_QUAL	• To whom? • In exchange for what? • What is the amount of the debt • How long have you had this debt? • How are you repaying it? *Question relevant when: S4Q01BB_alt = 1*	
S4Q01C *(required)*	S4Q01C. Does your [BOSS_TITLE] unfairly increase the amount of your debt over time? *Question relevant when: S4Q01A = 1 or S4Q01B = 1 or S4Q01BB = 1 or S4Q01BB_alt = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q01C_QUAL	• Tell me more about that. What are (were) the terms of repayment?	

Field	Question	Answer
	Question relevant when: S4Q01C = 1	
S4Q01D *(required)*	S4Q01D. If you were to leave your job before paying off your debt to your [BOSS_TITLE] or recruiter [gato], what would happen? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Anything else?" AT LEAST TWICE BEFORE MOVING ON. **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S4Q01A = 1 or S4Q01B = 1 or S4Q01BB = 1 or S4Q01BB_alt = 1 or S2Q01B=1*	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT 4 4. LOSS OF WITHHELD WAGES BEYOND THE VALUE OF THE DEBT 5 5. LOSS OF WITHHELD DOCUMENTS 7 7. LOSS OF HOUSING/LAND 8 8. ARREST OR PROSECUTION 10 10. DEDUCTION OF AMOUNT OWED FROM FINAL PAYMENT 11 11. WITHHOLDING OF MATERIAL GOODS AS COLLATERAL 12 12. EXCLUSION FROM FUTURE EMPLOYMENT 55 55. OTHER_____ 66 66. NOTHING 77 77. DON'T KNOW 99 99. REFUSED
S4Q02 *(required)*	S4Q02. Now I would like to ask you about your earnings, not including any overtime pay or bonuses you may receive. Include only the amount you take home, after any deductions. About how much do you earn in reais for a typical day's work? INTERVIEWER: IF RESPONDENT IS PAID IN KIND, ASK RESPONDENT TO ESTIMATE VALUE IN R$	

Field	Question	Answer
S4Q02_QUAL	• Can you tell me how you are paid? (PROBE: cash, mobile transfer, bank transfer) • Is the amount always the same or does it change? • Are your payments ever late? Tell me more about that. • If your payments are late or less than agreed have you talked to your employer about it? Please explain what happened if you did. • (IF PAID IN PIECE-RATE) Do you think you are paid fairly for the work you do? Please explain. *Question relevant when: S1Q09 = 1*	
S4Q03 *(required)*	S4Q03 Who pays you? *Question relevant when: S1Q09 = 1*	1 1. LAND OWNER 2 2. COMPANY/PLANT OWNER 3 3. LANDOWNER OR COMPANY REPRESENTATIVE 4 4. SUBCONTRACTOR 5 5. CANE SUPPLIER 6 6. RECRUITER/CAT 7 7. TOUR OPERATOR/INSPECTOR 8 8. MEMBER OF YOUR FAMILY 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S4Q04 *(required)*	S4Q04.	1 1. YES 2 2. NO

Field	Question	Answer
	Are your typical earnings enough to meet your basic needs for food and shelter?	77 77. DON'T KNOW 99 99. REFUSED
S4Q05 *(required)*	S4Q05. Does your [BOSS_TITLE] impose a production quota/target? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
SECTION 4: DEBT AND PAYMENT > S4Q05A_group		
S4Q05A *(required)*	S4Q05A. What is the quota/target? INDICATE THE AMOUNT *Question relevant when: S4Q05 = 1*	
S4Q05A_UNIT *(required)*	INDICATE THE UNIT OF MEASUREMENT *Question relevant when: S4Q05 = 1*	1 SUGARCANE PLANTS PER DAY 2 LINES PER DAY 3 KG PER DAY 4 METERS OF CANE PER DAY 55 OTHER 77 DON'T KNOW 99 REFUSED
S4Q05B *(required)*	S4Q05B. Do you consider the quota/target to be a reasonable amount for an individual worker working alone? *Question relevant when: S4Q05 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S4Q05B_QUAL	• What is the average amount you produce per day? • How do you feel when you don't hit your target? • Do you have enough time during your	

Field	Question	Answer
	normal hours to do your work? • Does anyone help you achieve this target? (PROBE FOR CHILD/FAMILY LABOR) *Question relevant when: S4Q05 = 1*	
S4Q05C *(required)*	S4Q05C. What would happen if you failed to meet the quota/target? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Anything else?" AT LEAST TWICE BEFORE MOVING ON. *Question relevant when: S4Q05 = 1*	1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE 1 AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT 4 4. LOSS OF WITHHELD WAGES 5 5. LOSS OF WITHHELD DOCUMENTS 7 7. LOSS OF HOUSING/LAND 9 9. DISMISSAL OR THREATS OF DISMISSAL 10 10. FINE OR DEDUCTION FROM WAGES 12 12. EXCLUSION FROM FUTURE EMPLOYMENT 14 14. SUSPENSION/LOSS OF DAYS 55 55. OTHER 66. NOTHING/EARN LESS 66 MONEY/REPUTATION WOULD SUFFER 77 77. DON'T KNOW 99 99. REFUSED
S4Q05C_QUAL	• Did your employer do anything to make you work harder or faster? Tell me more about that.	

Field	Question	Answer
	Question relevant when: S1Q09 = 1	
SECTION 5: WORKING CONDITIONS *Group relevant when: CONSENT = 1 and (S1Q02 > 17 or S1Q02 = -76) and (S1Q01 = 1) and (OVER_18MONTHS_AGO =0) and (S1Q05B = 1 or S1Q05B = 2)*		
S5Q01 *(required)*	S5Q01. Do people under age 18 work at the place where you work?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q01_QUAL	• What type of work do they do? • How old are they? • Boys or girls? • Do they go to school? *Question relevant when: S5Q01 =1*	
S5Q02 *(required)*	S5Q02. Does your work involve exposure to… Sharp or dangerous tools or machinery?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q02A *(required)*	S5Q02A. Carrying unreasonably heavy loads?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q02B *(required)*	S5Q02B. Extreme heat?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q02C *(required)*	S5Q02C. Dangerous chemicals?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q02D *(required)*	S5Q02D.	1 1. YES 2 2. NO 77 77. DON'T KNOW

Field	Question	Answer
	Anything else that risked your health or safety?	99 99. REFUSED
S5Q02DD	S5Q02DD. What else risked your health or safety? *Question relevant when: S5Q02D = 1*	1 1. DANGEROUS ANIMALS 2 2. WEATHER CONDITIONS (HEAT, RAIN) 3 3. RISK OF FALLING 4 4. LACK OF MEDICAL CARE 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S5Q03 *(required)*	S5Q03. Does your [BOSS_TITLE] provide you with the personal protective equipment (PPE) needed to perform your job safely? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q03_QUAL	• Is your pay subtracted to cover the cost of the PPE? • How much are the deductions? *Question relevant when: S5Q03 = 1*	
S5Q04 *(required)*	S5Q04. I will read a list of protective gear. Please tell me which items you usually wear when working: INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY. INCLUDE ALL PPE USED WHETHER PROVIDED BY EMPLOYER OR WORKER.	1 1. Protective goggles 2 2. Hat 3 3. Ear-plugs 4 4. Respirator or dust-mask 5 5. Protective clothing such as coveralls 6 6. Gloves 7 7. Boots 8 8. Gaiters or shin guards 55 55. Anything else? 77 77. DON'T KNOW 99 99. REFUSED

Field	Question	Answer
S5Q05 *(required)*	S5Q05. Does your [BOSS_TITLE] provide you with the training needed to perform your job safely? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q06 *(required)*	S5Q06. Does your [BOSS_TITLE] endanger your life by failing to take proper safety precautions? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q06_QUAL	• How was your life endangered? • What safety precautions did your boss fail to take? *Question relevant when: S5Q06 = 1*	
S5Q07 *(required)*	S5Q07. What would happen if you refused to do these hazardous activities? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Any other reason?" AT LEAST TWICE BEFORE MOVING ON. **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S5Q06 = 1*	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT 3 3. DEBT BONDAGE OR MANIPULATION OF DEBT (DEBT TO EMPLOYER/RECRUITER) 4 4. LOSS OF WITHHELD WAGES 5 5. LOSS OF WITHHELD DOCUMENTS 7 7. LOSS OF HOUSING/LAND 9 9. DISMISSAL OR THREATS OF DISMISSAL 10 10. FINE OR DEDUCTION FROM WAGES

Field	Question	Answer
		12 12. EXCLUSION FROM FUTURE EMPLOYMENT 14 14. SUSPENSION/LOSS OF DAYS 55 55. OTHER 66 66. NEEDED THE WORK/MONEY 67 67. DOESN'T CONSIDER WORK HAZARDOUS 77 77. DON'T KNOW 99 99. REFUSED
S5Q08 *(required)*	S5Q08. Still thinking about your most recent job in sugarcane… Have you ever gotten hurt or sick because of your work in this job?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q08A *(required)*	S5Q08A. What types of injury or sickness have you had? INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY *Question relevant when: S5Q08 = 1*	1 1. HEAD INJURY 2 2. INJURY TO OR DEAFNESS IN EARS 3 3. EYE INJURY 4 4. INJURY TO SHOULDER 5 5. INJURY TO OR SWELLING IN HANDS 6 6. SMOKE, DUST, OR CHEMICAL DAMAGE TO LUNGS 7 7. INJURY TO ABDOMEN 8 8. BACK STRAIN/ PAIN IN BACK 9 9. INJURY TO KNEES OR LEGS 10 10. INJURY TO FEET/ANKLE 11 11. HEAT STROKE/ DEHYDRATION 12 12. KIDNEY PROBLEMS 13 13. BURN FROM FIRE 14 14. CHEMICAL BURN 15 15. CUTS/WOUNDS 16 16. GASTROINTESTINAL ILLNESS 17 17. SKIN CONDITIONS 55 55. OTHER 77 77. DON'T KNOW

Field	Question	Answer
		99 99. REFUSED
S5Q08B *(required)*	S5Q08B. How did you get hurt or sick? INTERVIEWER: LISTEN AND SELECT ALL THAT APPLY *Question relevant when: S5Q08 = 1*	1 1. HEAT EXAUSTION/SUNSTROKE 2 2. TOOL ACCIDENT 3 3. MACHINERY ACCIDENT 4 4. INHALATION OF DUST/SMOKE 5 5. VIOLENCE BY COWORKER/EMPLOYER 6 6. CARRYING HEAVY LOADS 7 7. REPETITIVE STRAIN 8 8. FALLING 55 55. OTHER 77 77. DON'T KNOW 99 99. REFUSED
S5Q09 *(required)*	S5Q09. Does your [BOSS_TITLE] require you to work when you are seriously sick or injured? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q09A *(required)*	S5Q09A. What would happen if you refused to work while sick or injured? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Any other reason?" AT LEAST TWICE BEFORE MOVING ON. **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S5Q09 = 1*	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT 3 3. DEBT BONDAGE OR MANIPULATION OF DEBT (DEBT TO EMPLOYER/RECRUITER) 4 4. LOSS OF WITHHELD WAGES 5 5. LOSS OF WITHHELD DOCUMENTS 7 7. LOSS OF HOUSING/LAND 9 9. DISMISSAL OR THREATS OF DISMISSAL 10 10. DISPROPORTIONATE FINE OR DEDUCTION FROM WAGES

Field	Question	Answer
		12 12. EXCLUSION FROM FUTURE EMPLOYMENT 14 14. SUSPENSION/LOSS OF DAYS 55 55. OTHER 66 66. NOTHING 77 77. DON'T KNOW 99 99. REFUSED
S5Q09B *(required)*	S5Q09B. Have you experienced any mental health problems as a result of your job in sugarcane?	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q09B_QUAL	• What have you experienced? *Question relevant when: S5Q09B = 1*	
S5Q09C *(required)*	INTERVIEWER: ASK ONLY IF THE INTERVIEW IS CONDUCTED IN PRIVATE. Now I have a more personal question. Sometimes, bosses ask for sexual favors in exchange for keeping a job or getting better work conditions. Has your boss ever said something like this to you at your most recent sugarcane job?	1 1. YES 2 2. NO 66 66. NO PRIVACY 77 77. DON'T KNOW 99 99. REFUSED
S5Q10 *(required)*	S5Q10. On average, how many hours do you work per day?	
S5Q10A *(required)*	S5Q10A. What would happen if you refused to work over 10 hours per day? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Anything else?"	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT

Field	Question	Answer
	AT LEAST TWICE BEFORE MOVING ON. **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S5Q10 > 10*	3 3. DEBT BONDAGE OR MANIPULATION OF DEBT (DEBT TO EMPLOYER/RECRUITER) 4 4. LOSS OF WITHHELD WAGES 5 5. LOSS OF WITHHELD DOCUMENTS 7 7. LOSS OF HOUSING/LAND 9 9. DISMISSAL OR THREATS OF DISMISSAL 10 10. FINE OR DEDUCTION FROM WAGES 12 12. EXCLUSION FROM FUTURE EMPLOYMENT 14 14. SUSPENSION/LOSS OF DAYS 55 55. OTHER 66 66. NOTHING/EARN LESS MONEY/REPUTATION WOULD SUFFER 77 77. DON'T KNOW 99 99. REFUSED
S5Q10A_QUAL	• Are you paid for your time over 8 hours per day? • Are you paid at a higher rate for this time? *Question relevant when: S5Q10 > 8*	
S5Q11 *(required)*	S5Q11. How many days do (did) you usually work each week?	1 1 DAY 2 2 DAYS 3 3 DAYS 4 4 DAYS 5 5 DAYS 6 6 DAYS 7 7 DAYS 77 77. DON'T KNOW 99 99. REFUSED

Field	Question	Answer
S5Q12 *(required)*	S5Q12. Are you required to work non-stop without breaks during the working day? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q12_QUAL	• Tell me more about your typical workdays. • How do you get to and from work? [PROBE WHETHER TRANSPORT IS PROVIDED BY EMPLOYER AND FREQUENCY] • Can you leave work as soon as you've finished? • What kind of bathroom facilities do you use during the work day? • How is the quality of the food? Is it stored in the fridge?	
S5Q13 *(required)*	S5Q13. Can you raise concerns about your working conditions without fear of retaliation? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q13_QUAL	• Tell me more about that. (PROBE FOR DETAILS OF CONCERNS) *Question relevant when: S5Q13 = 2*	

Field	Question	Answer
S5Q15 *(required)*	S5Q15. Does your [BOSS_TITLE] do anything to keep you from quitting your job? *Question relevant when: S1Q09 = 1*	1 1. YES 2 2. NO 77 77. DON'T KNOW 99 99. REFUSED
S5Q15A *(required)*	S5Q15A. How does (did) your [BOSS_TITLE] keep you from quitting your job? INTERVIEWER: SELECT ALL THAT APPLY. ASK "Anything else?" AT LEAST TWICE BEFORE MOVING ON. **PROBE FOR DETAILS AND SPECIFIC EXAMPLES.** *Question relevant when: S5Q15 = 1*	1 1. THREATS OF OR SUBJECTION TO PHYSICAL VIOLENCE AGAINST RESPONDENT OR RESPONDENT'S FAMILY BY EMPLOYER/RECRUITER 2 2. RESTRICTION ON RESPONDENT'S MOVEMENT 3 3. DEBT BONDAGE OR MANIPULATION OF DEBT (DEBT TO EMPLOYER/RECRUITER) 4 4. WITHHOLDING OF WAGES 5 5. WITHHOLDING OF VALUABLE DOCUMENTS 7 7. THREAT OF LOSS OF HOUSING/LAND 12 12. EXCLUSION FROM FUTURE EMPLOYMENT 55 55. OTHER 66 66. NO COERCION ("NEEDED JOB, COULDN'T QUIT") 77 77. DON'T KNOW 99 99. REFUSED
S5Q15A_QUAL	• Please describe your relationship with your employer. • Have you ever experienced any harassment or abuse by your employer (other than what you've already shared)? Tell me more about that.	

Field	Question	Answer
	• Have you seen any other workers experience any harassment or abuse? Can you tell me about one example? *Question relevant when: S1Q09 = 1*	
S5Q15A_QUAL2	• Is there anything else about your working conditions that you would like to share?	
SECTION 6: WORKPLACE CHARACTERISTICS *Group relevant when: CONSENT = 1 and (S1Q02 > 17 or S1Q02 = -76) and (S1Q01 = 1) and (OVER_18MONTHS_AGO =0) and (S1Q05B = 1 or S1Q05B = 2)*		
S6Q01_QUAL	• Now I would like to ask more about your workplace in general, not just about your own tasks there. Is planting done by hand or using a machine?	•
S6Q02_QUAL	• Is the cane harvested by hand or using a machine?	
S6Q03_QUAL	• About how large is the farm?	
S6Q04_QUAL	• What is the name of the place where you work (worked) for the job we've been talking about? [INTERVIEWER: RECONFIRM	

Field	Question	Answer
	CONFIDENTIALITY IF NEEDED.]	
S6Q05_QUAL	• Where is your workplace located? INTERVIEWER: GATHER AS MUCH DETAIL AS POSSIBLE.	
S6Q06_QUAL	• Do you know where the sugarcane goes after it leaves your workplace? • How is it sold? • How is it transported before/after sale? • Who buys it?	
S6Q07_QUAL	• What are your hopes for the future?	
INTERVIEWER_NOTES	INTERVIEWER NOTES:	
SURVEY_END	END INTERVIEW Thank you very much for sharing your experience. UNIQUE ID: G00B7ES	

BRAZIL SUGARCANE STUDY: LABOR RIGHTS AND LABOR CONDITIONS KEY INFORMANT INTERVIEW PROTOCOL

Interviewer:	Date (DD/MM/YY)
Location of interview:	
KII Code:	Sex:
Profession (if applicable):	
Position (if applicable):	
Employer/Affiliated Institution/Organization (if applicable):	
Contact information (office address, phone number, email):	
Time interview started:	
Time interview ended:	

Interviewer Instructions:

Foster a dynamic conducive to gathering good data. The interview should have the relaxed feel of a conversation. Set the tone by using a slow pace in your speech.

Ask one question at a time. Give the respondent ample time to reflect and fully respond before moving to the next. Try not to interrupt, and don't answer on their behalf.

If the respondent agrees to be recorded, give them your full attention. Make note of any follow-up questions you want to remember to ask, but otherwise focus on the respondent rather than your paper.

Probe for more depth, particularly when responses are brief. Use phrases such as, "Tell me more about that" and "Can you give me an example?" Aim to get specific instances, in considerable detail, whenever possible.

You do not have to ask each question verbatim, but at least broach all the topics covered that are relevant to the key informant. If a respondent makes clear they have no knowledge of that topic, move on to the next. Adapt the flow and questions to make them relevant to the respondent.

For each item, ask the general question first, and then probe the sub-items that have not been addressed spontaneously.

Introduction Questions (KIIs):

1. Could you please tell me your role and what you focus on?
    a. Is there another experience you have in relation to the sugarcane industry?
    b. Can you describe your organization's work directly related to workers' rights in the sugarcane industry in Brazil?
2. What is your overall impression of working conditions in the sugarcane industry?
    a. What are the main issue areas you are aware of?
    b. What do you think of worker-employer relations in the industry?

Recruitment:

3. How do individuals become employed in the sugarcane sector and what recruitment methods are used by employers?
    a. (PROBE AS RELEVANT): How common is employment through a third-party recruiter such as a subcontractor or through an employment agency? If there is no recruitment, how do plantations secure sugarcane workers? Please explain.
    b. Are you aware of any fees / the typical amount associated with the use of recruiters in the sugarcane industry?
4. Are promises made to workers a part of the recruitment methods used? If so what kinds of promises?
    a. In your opinion/experience are those promises being met?
5. Do workers in the sugarcane sector typically have a written contract, a verbal contract or no contract?
    a. If written, do workers usually understand the contents of the contract? (Probes: WRITTEN IN A LANGUAGE THE WORKER CAN UNDERSTAND; WORKER IS LITERATE OR ALLOWED TO HAVE SOMEONE READ IT; WORKER IS GIVEN SUFFICIENT TIME TO EXAMINE THE CONTRACT)
    b. If a non-written contract, who receives payment for sugarcane? How is payment distributed among workers? What ages are the workers who receive payment?
6. Are you aware of any reports of anyone being sold or taken by force to work in the sugarcane sector?

Earnings, Hours, Benefits, and Debt:

7. In your experience, what are the key issues that workers face in terms of their wages and benefits in the sugarcane sector? (EXAMPLES INCLUDE: LOW WAGES, WITHELD WAGES, WAGE DEDUCTIONS, ETC.)
    a. How and how often are workers paid?
8. Are workers paid according to a piece rate or quota system?
    a. If so: what are the typical targets and are those targets reasonable/achievable?
9. How many hours does an average worker typically work? Do they receive pay for all these hours?
    a. How common is it for workers to work overtime or past their agreed hours?
    b. What happens to workers if they refuse to work overtime?
10. How common is it for workers in the sugarcane sector to be in debt to employers or recruiters?
    a. What kinds of borrowing and pay-back arrangements have you seen? Who records these debts, how are the debts recorded, and who keeps this information?

b. How often are workers unable to leave their jobs because of debt to an employer or recruiter?

11. If workers work on a sugarcane farm, how many workers are required to harvest 5 hectares of sugarcane?

Working Conditions, Hazardous Work, and Coercion:

12. What are the main risk factors for labor exploitation in the sugarcane sector?
    a. What factors make a worker in this sector more vulnerable to exploitation?
        i. (PROBE FOR SPECIFICS ON DEMOGRAPHICS – AGE RANGE, GENDER, MIGRATORY STATUS)
    b. In what parts of the industry and its supply chain is labor exploitation most present / visible?
        i. What are the risk factors at each stage (particularly harvest and processing)
        ii. Are you aware of any specific companies that are particularly exploitative? Please explain.
        iii. Are there any plantations or companies that are known to you personally, or by reputation, that do not exploit labor as others in the industry?
13. What are the most common hazards workers face in the sugarcane sector?
    a. In your understanding, are there sufficient health and safety standards in place in the sugarcane sector? Please explain.
14. How common is it to hear of or witness coercion or threats from employers towards workers?
    a. Please explain the specific situations when this occurs and any types of workers more likely to experience it.
15. How common is it that workers are unable to leave their jobs if they wanted? Please explain.
    a. Do workers who leave or attempt to leave their job face any negative consequences from their employers?

Surveillance and Living Conditions:

16. What kind of involvement do employers have in workers' lives outside of work?
17. How do workers access goods and services to meet their basic needs?
    a. Are workers reliant on employers for these items? Please explain.
        i. Are workers provided with these items on credit? Under what conditions?
18. By your estimation what proportion of workers live in employer-provided housing?
    a. Is this housing free or is there a fee? If a fee, how much?
    b. Can those workers come and go freely outside of working areas – including into the nearest town or village?

c. Are workers able to live somewhere outside of employer-provided housing if they wanted? Please explain why or why not.

19. (SKIP IF NOT IN EMPLOYER PROVIDED HOUSING) Can you describe the living conditions of those in employer provided housing? (PROBE FOR: ACCESS TO WATER, ELECTRICITY, HEATING, SIZE, CONSTRUCTION MATERIALS, NUMBER OF FAMILIES/PERSONS TO A HOME, ETC)
20. Have you heard of situations where employers monitor or limit the communications of their workers? Please explain.
21. How common is it for an employer or recruiter to hold onto a workers' identity documents?
    a. How are workers able to regain or access their documents?

Grievance Procedures and Industry/Government Initiatives:

22. What level of understanding do workers have of their rights? Please explain and identify any areas where awareness is low.
23. What mechanisms are available to workers for submitting grievances?
    a. Are workers likely or able to access those mechanisms? Why or why not?
    b. How common is it for workers to experience retaliation for doing so? Please explain.
24. Besides your own organization, what other entities are actively working to improve labor conditions?
    a. PROBE FOR GOVERNMENT EFFORTS, INDUSTRY EFFORTS, AND UNION EFFORTS
    b. How effective have these efforts been and what key gaps (e.g. policy) remain for protecting workers' rights and improving their working conditions?
25. Worker organizations? Unions? Ban against sectors in Brazil- has adversely affected grassroots organization?

Child Labor:

26. Do you know if there are minors under 18 working in the sugarcane industry?
27. If so, how common is it? In which stages and activities does it occur? What factors drive child labor in the industry?

Conclusion:

28. Who are the main stakeholders in the sugarcane industry of Brazil involved in the sale and processing of sugarcane using forced labor?
29. What types of (downstream) goods are being produced from sugarcane obtained through forced labor?
30. Could you suggest any organizations or individuals that are well-informed about the sugarcane sector supply chain or forced labor in the industry that we could interview?
31. Is there anything else you'd like to add?

BRAZIL SUGARCANE STUDY: SUPPLY CHAIN KEY INFORMANT INTERVIEW PROTOCOL

Interviewer name:	Date (DD/MM/YY)
Location and province of interview:	
Type of the respondent:	
Interviewee Code:	
Profession	
Position and responsibility:	
Employer/Affiliated Institution/Organization	
Contact information (office address, phone number, email):	
Time interview started:	
Time interview ended:	

Interviewer Instructions:

Foster a dynamic conversation conducive to gathering good data. The interview should have the relaxed feeling of a conversation. Set the tone by using a slow pace in your speech.

Please ask one question at a time. Give the respondent ample time to reflect and fully respond before moving to the next. Try not to interrupt, and do not answer on their behalf with suggestions.

If the respondent agrees to be recorded, proceed with the interview questions. Give the respondent your full attention. Make note of any follow-up questions you want to remember to ask, but otherwise focus on the respondent rather than your paper.

Probe for more specific answers to questions, particularly when responses are brief. Use phrases such as, "Tell me more about that" and "Can you give me an example?" Aim to get specific instances, in considerable detail, whenever possible.

You do not have to ask each question verbatim, Select the question that addresses pressing research gaps that reflect the KII candidate's area of expertise. Adapt the flow and questions to make them relevant to the respondent.

For each item, ask the general question first, and then probe the sub-items that have not been addressed spontaneously.

It is important to focus on supply chain data collection. One or two labor questions may be asked based on respondents' areas of expertise and one or two supply chain questions asked during labor interviews.

Project Introduction:

READ: ICF International is conducting a study to understand labor conditions and the supply chain of sugarcane produced in Brazil, as well as the labor conditions throughout this supply chain. We hope to learn from you during our discussion. Please note that your identity will be kept confidential, and we will only use the name of your organization/ [ENTITY TYPE] upon your approval.

(IF STAKEHOLDER ASKS) This study is funded by the U.S. government.

Introduction Questions (KIIs):

1. Could you please tell me your role and what you focus on?
    a. Is there another experience you have in the sugarcane industry?
2. Can you describe your organization's work as it relates to the sugarcane industry?
    a. PROBE: What kind of activities in this area do you and your organization undertake?

Supply Chain Theme General:

3. Could you please tell me how the production of sugarcane works in Brazil?
    a. What laws and regulations are central to operations in the sugarcane industry?
4. How important is the sugarcane industry to Brazil? How important is it to the regions within Brazil, such as Minas Gerais, Sao Paulo, etc.?
    a. What has/have been the most significant change(s) to the industry in the last few years? Please explain.
5. Have there been any recent socio-political events that have impacted the supply chain of sugarcane or downstream goods such as raw sugar or ethanol?
    a. How have they impacted your organization?
6. Who are the major stakeholders and influencers in the sugarcane industry?
    a. PROBE TO INCLUDE GOVERNMENTAL AND NON-GOVERNMENTAL ACTORS.
7. Can you describe the various types of mechanization? Are there any official statistics on the degree of mechanization? If not, would equipment sales be a good approximation? Why or why not?
8. [In research area] what would you estimate is the percentage of mechanization at harvesting? At planting?
9. There are a variety of government and industry associations that publish data on sugarcane. Which source do you find to be the most accurate and reliable for sugarcane production? Intermediate goods? What are the limitations of this source?
10. Are companies involved in sugarcane production [in the area of research study] domestic corporations, foreign direct investment, joint ventures, subsidiaries of conglomerates, or some combination? Are these companies focused on vertical integration in the sugarcane sector, or do they tend to be involved in multiple industries outside of sugarcane? [PROBE FOR SPECIFIC COMPANY NAMES, SOURCE OF OFFICIAL RECORDS, AND LIMITATIONS]

Production:

11. Could you please briefly describe the production process of sugarcane from the beginning to the end? Where do you or your organization become involved in that process?
12. How are sugarcane or downstream intermediate processed goods transported from one location to the next?
    a. (PROBE FOR DETAILS ON OWNERSHIP, THIRD PARTY TRANSPOTERS AND CONTRACTUAL RELATIONS).
13. How do mixed sugar-ethanol processing facilities determine the volume of each good to be produced? How quickly can downstream use be changed (one day, one hour, etc)?Can you tell me about the role of sugarcane ethanol in Brazil in the last decade? Are biofuels derived from other materials in Brazil, such as corn? If so, are these products co-mingled? How important is sugarcane to the energy market in Brazil?
14. Are their traditional family cachaca farms in [area of data collection]? If so, what are the names of the branded alcohol? How are their farms harvested (mechanized or manual)? Do they sell the sugarcane byproducts from cachaca processing? If so, who would they sell it to?
15. After harvesting sugarcane needs to be processed within a short period of time, can you describe processing in Brazil?
    a. What about specifically in [data collection area]? How would you describe this processing area compared to other main processing areas in Brazil
    b. What goods (including byproducts and downstream goods) are produced in-country? [If applicable, which of these products is produced by your company?]
    c. Are downstream sugarcane products consumed domestically or for export? Where is it exported to? Please explain.
16. Is there a list of sugarcane plantations, sugar/ethanol processing facilities in Brazil? Which agencies publish this information?
    a. (IF PROCESSOR ASK) Do you have a list of sugarcane plantations that are a part of your supply chain? Tell me more about how that list is updated/maintained.
    b. (IF TRADER ASK) Do you have a list of production sites or processing facilities that you sell to? Tell me more about how that list is updated/maintained.

Tracing and Due Diligence:

17. In addition to raw sugarcane and ethanol, what other downstream goods are produced with sugarcane? Does domestic manufacturing in Brazil use these goods as inputs into other products? If so, which ones? (PROBE FOR BOTH INTERMEDIARY GOODS, DOWNSTREAM GOODS, AND GENERAL END USES. FOR EXAMPLE, IN THE ENERGY, COSMETIC, PHARMACEUTICAL, CONSTRUCTION AND FOOD INDUSTRY)? (IF APPICABLE: WHICH OF THOSE GOODS DOES YOUR COMPANY MAKE?)
18. How might one track sugarcane made at a particular farm through the domestic supply chain?

a. Is there a point in the supply chain where you anticipate traceability of sugarcane from a specific farm would no longer be possible? (PROBE FOR SPECIFICS ON WHAT STAKEHOLDER THE TRACEABILITY ENDS WITH, EX: INTERMEDIARY BUYER, EXPORTER, ETC.)

    i. (SPECIFIC PROBE) When does the mixing of sugarcane from different sites occur, how does mixing occur?

19. What oversight is being conducted by the government or other private stakeholders when it comes to labor standards within the sugarcane industry and its supply chain? How does this impact your company?

    a. PROBE FOR SPECIFICS ON WHAT THE INITIATIVES ARE AND WHO IS PROMOTING THEM (E.G. GOVERNMENT, INTERNATIONAL CORPORATIONS, DOMESTIC COMPANIES, CSOs)

    b. What about any supply chain traceability initiatives specifically? Please explain the stakeholders involved, including your own company.

    c. What are the different certifications available for companies in the supply chain and how common are they?

        i. How are these certifications monitored/approved and is your company a part of any of them? If so, please explain how you got approved and how you are monitored for compliance.

        ii. (PROBE FOR INFORMATION ON BONSUCRO IF NOT OFFERED)

20. [If relevant] What due diligence initiatives does your company participate in to monitor labor conditions on the (site type) you source from?

    a. (IF NOT ANSWERED IN PREVIOUS QUESTION) What supply chain or industry certifications does your company currently have? Can you please explain the process involved in obtaining the certification(s) and how you are monitored for compliance?

        i. (IF NOT ANSWERED IN PREVIOUS QUESTION) Are you actively working to obtain any additional certifications in the near future? Please tell me more about that.

Sourcing Questions for Buyers (Middlemen, Traders, and Processors):

21. Where do you source your sugarcane from?

    a. PROBE (geographical region, names of sites, etc.). PROBE SPECIFICALLY FOR SAMPLE AREA.

    b. Please explain your sourcing process (selection of plantation, types of contracts, duration of contracts, transportation agreements, etc. Is sugarcane from multiple plantations kept separate at processing facilities or is it co-mingled? At what point does your organization combine sugarcane (or its byproducts and downstream goods) from multiple sources? Are there multiple points of co-mingling in the supply chain? Please explain.

22. How often do you source sugarcane from these places within (SAMPLE AREA)?
    a. Are there times of the year when this changes? Please explain.
    b. How do you determine how much you buy from a source? How is the price determined?

Post Export Questions:

23. How would you describe the role of sugarcane exports from Brazil in the global trade of sugarcane?
    a. What are some international markets?
        i. Are there any recent changes (emerging/declining) in these markets? (PROBE BASED ON KNOWN EXPORT DESTINATION MARKETS)
24. Who are the major players/stakeholders in (import country of focus) that import sugarcane from Brazil? Please explain.
    a. Who are the major exporters and importers involved in this? Can you describe in what product form the good is exported from Brazil?
    b. Are you aware of situations where the importing company in the foreign market (import country of focus) is formally connected to the exporter in Brazil**?** (PROBE FOR SUBSIDIARY,OTHER CORPORATE RELATIONSHIPS, OR OTHER BUSINESS OR POLITICAL CONNECTIONS)

Labor Questions:

25. What is your overall impression of working conditions in the sugarcane industry?
    a. What are the main issues you are aware of? (PROBE FOR CHILD/FORCED LABOR IF NOT STATED)
26. What can you tell us about labor standards in the sugarcane industry, especially when it comes to manual planting in sugarcane fields**?**
    a. What are the primary concerns across the industry when it comes to labor standards?
    b. How are labor standards enforced at your workplace and who enforces them?
27. During which stages of the sugarcane supply chain are risks for forced labor most prevalent?
28. Do you think mechanization has improved labor conditions in the Brazil sugarcane sectors? In what states of production or geographical regions are these benefits most commonly realized? In what areas has there been less progress?
    a. Do you anticipate this will change in the next 2 years? 5 years?
    b. Are there geographic, economic, or political limitations to improve worker conditions in some or all regions of Brazil?

Conclusion:

29. Could you suggest any organizations or individuals that are well-informed about the sugarcane supply chain that we could interview?

a. (IF APPLICABLE BASED ON RESPONDENT TYPE: PROBE IF THE INDIVIDUAL HAS ANY ADDITIONAL REPORTS OR DATA THEY ARE ABLE TO SHARE SUCH AS ANY LISTS MENTIONED IN QUESTION 9)

30. Is there anything else you'd like to add?

APPENDIX 11: INDICATOR AND QUESTION MAPPING

Forced labor occurs if there is both involuntary work and coercion at any of the 3 stages:		
Recruitment stage		
Category of indicator	Indicator	Indicator present if…
Involuntary work	Forced recruitment	S2Q02=1 & S2Q02A = 1, 2, 3, 5, or 7
	Deceptive or fraudulent recruitment	S2Q04A=1, 3, 4, 5, 6, 7, 8, or 9
	Recruitment linked to debt	S2Q01C=1
Coercion	Physical or sexual violence	S2Q02A=1 or S2Q04B=1
	Restrictions on workers' movement	S2Q02A=2 or S2Q04B=2
	Abuse or manipulation of debt	S2Q02A=3 or S2Q04B=3
	Retention of cash, assets, or identity documents	S2Q02A=5 or S2Q04B=5
	Loss of housing/land provided by employer	S2Q02A=7 or S2Q04B=7
	Dismissal	S2Q04B=9
Employment stage		
Category of indicator	Indicator	Indicator present if…
	Hazardous or degrading working conditions	S5Q03=2 or S5Q06=1 or S5Q09=1
	Onerous working hours or work schedule	S5Q10 > 10 or S5Q12=1
	Abuse or manipulation of debt	S4Q01A=1 or S4Q01B=1 or S4Q01C=1
	Degrading work-related living conditions	((S3Q01C_1=1) or (S3Q01A=1 & S3Q01C_3=1)) and [(S3Q02=3) + (S3Q02A=2) + (S3Q02B=1) + (S3Q02C=2) + (S3Q02D=3) >=2]
Coercion	Physical or sexual violence	S4Q01D=1 or S4Q05C=1 or S5Q07=1 or S5Q09A=1 or S5Q10A=1 or S3Q03B=5
	Restrictions on workers' movement	S4Q01D=2 or S4Q05C=2 or S5Q07=2 or S5Q09A=2 or S5Q10A=2 or (S3Q03B= 1, 2, 3, or 4) or (S3Q04A=1,2, or 3)
	Abuse or manipulation of debt	S5Q07=3 or S5Q09A=3 or S5Q10A=3
	Withholding of wages	S4Q01D=4 or S4Q05C=4 or S5Q07=4 or S5Q09A=4 or S5Q10A=4
	Retention of cash, assets, or identity documents	S4Q01D=5 or S4Q05C=5 or S5Q07=5 or S5Q09A=5 or S5Q10A=5 or S3Q05A=2
	Loss of housing/land provided by employer	S4Q01D=7 or S4Q05C=7 or S5Q07=7 or S5Q09A=7 or S5Q10A=7
	Arrest	S4Q01D=8
	Dismissal	S4Q05C=9 or S5Q07=9 or S5Q09A=9 or S5Q10A=9

	Threat of exclusion from future work	S4Q01D=12 or S4Q05C=12 or S5Q07=12 or S5Q09A=12 or S5Q10A=12
Employment separation stage		
Category of indicator	Indicator	Indicator present if…
Involuntary work	Inability to terminate employment	S5Q15=1 & S5Q15A=1, 2, 3, 4, 5, 7, or 12
Coercion	Physical or sexual violence	S5Q15A=1
	Restrictions on workers' movement	S5Q15A=2
	Abuse or manipulation of debt	S5Q15A=3
	Withholding of wages	S5Q15A=4
	Retention of cash, assets, or identity documents	S5Q15A=5
	Threat of loss of housing/land provided by employer	S5Q15A=7
	Threat of exclusion from future work	S5Q15A=12