Drivers and Barriers in Sustainable Supply Chains: The Case of the Brazilian Coffee Industry

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Abstract

Despite the growing interest in sustainable practices, many organisations in the agro-food industry are currently struggling to implement sustainable supply chain (SSC) innovations. This research addresses this gap by studying the Brazilian coffee industry, which is considered not only an important commodity for the Brazilian economy, but also the global market. To achieve the goals of this study, a bibliometric assessment of the literature was carried out to understand the drivers and barriers of SSCs, and based on the findings, a survey was conducted with a set of Brazilian coffee stakeholders, obtaining a total of 147 complete answers. The results suggest that the main drivers involved in sustainable supply chain management (SSCM) of the Brazilian coffee industry are social responsibility, economic performance/improvement, regulations (environmental, regional, international), and the adoption of an innovative business model. On the other hand, the barriers identified are the lack of government support, the high complexity of the processes and communication gaps. It is expected that the results of this study can contribute to the SSC literature and reduce the blind spots of decision-makers to prioritise actions and understand better how to overcome the barriers and take advantage of the drivers toward more SSCs in the industry. Limitations and future research opportunities are also addressed.

Keywords: sustainable supply chain; coffee supply chain; drivers and barriers; sustainable practices; coffee industry

1. Introduction

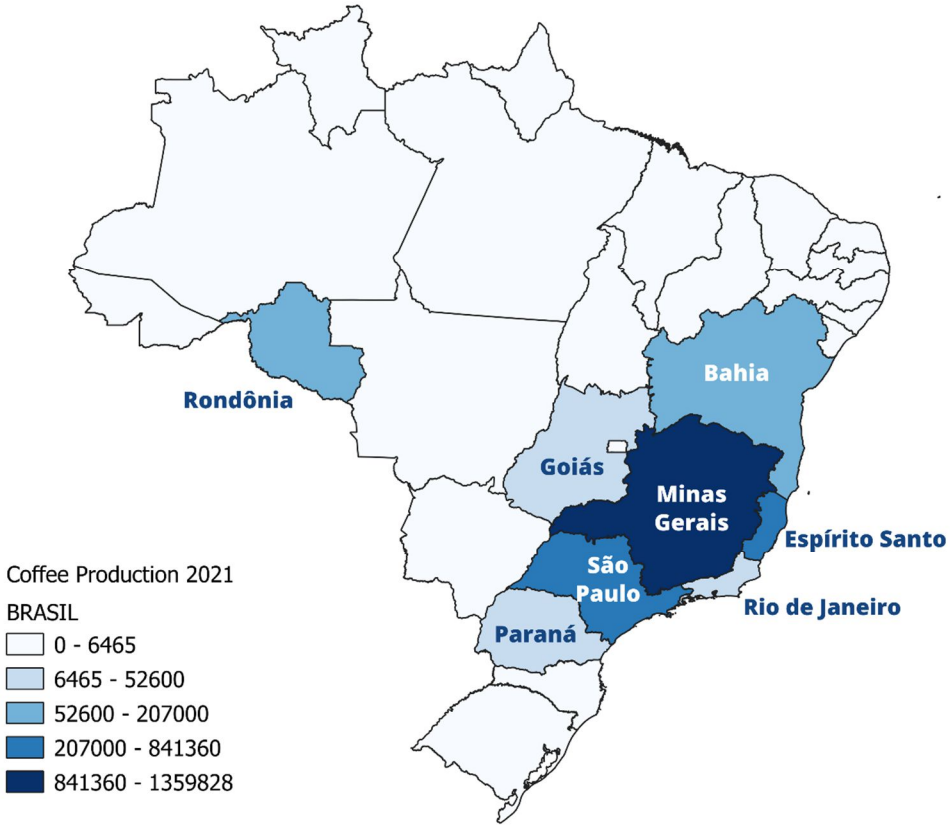
In the last few years, many organisations started to see sustainability as an essential aspect not only connected to financial growth but also to the preservation of social and environmental issues (Corbett & Klassen, 2006; Kolk & Pinkse, 2008). This is particularly relevant once corporate sustainability began referring to the role of companies in "meeting the needs of a firm's direct and indirect stakeholders without compromising its ability to meet the needs of future stakeholders as well" (Dyllick & Hockerts, 2002, p.131).

In this context, the literature states that companies are considering critical environmental awareness in the design and operation of globally integrated supply chain networks (Sundarakani et al. 2010; Seuring and Müller 2008), where there is a growing importance of environmental costs in the supply chain strategy (Ghosh, Jha, and Sharma 2020; Chaabane, Ramudhin, and Paquet 2011). Therefore, understanding the main drivers, ch,allenges and barriers when innovating for sustainability (Gupta, Kusi-Sarpong, and Rezaei 2020; Saeed and Kersten 2019) could help managers drive companies and supply chains towards a more sustainability-oriented state.

Studies on sustainable supply chains (SSCs) have also become relevant for the food industry, especially in developing countries, since these countries play an important role in exporting food worldwide but at the same time, they also face several negative externalities related to the social and environmental dimensions during production, processing and transportation strategies (Jia et al. 2018; Galal and Moneim 2016).

Among the developing countries, Brazil is considered a world potency in the agri-food industry with many sustainability challenges in several supply chains (Pohlmann et

al. 2020), such as coffee (Nab and Maslin 2020). The country is the largest coffee exporter globally and occupies the second position among countries that consumes it. Brazil also accounts for a third of the world's coffee production, making it the world's largest producer, as it has been for over 150 years ("Brazilian Coffee Industry Association" 2021). According to data from the Brazilian Ministry of Agriculture, L,ivestock and Supply, the crop occupies an area of 2 million hectares with about 300 thousand producers in approximately 1,900 cities, mainly distributed in the states of Minas Gerais, São Paulo, Espírito Santo, Rondônia, Paraná, Rio de Janei,ro, Bahia and Goiás. As shown in Figure 1, these top 8 states combined represent 99.47% of the total Brazilian coffee production in 2021 - 2.9 million tons. On top of that, coffee is a relevant source of income for hundreds f cities, and is not only an important sector in the creation of jobs in national agriculture (generating more than 8 million jobs in the country, providing income, access to health and education) but also in providing economic sustainability for the producer and his activity through the expressive performance of exports and domestic consumption. (Ministry of Agriculture, Livestock and Supply 2018).



Note: Developed by the author, based on Brazilian Statistics Institute (2021)

Figure 1. Brazilian coffee production in 2021 in tons.

Moreover, Brazilian coffee is one of the most demanding global productions in terms of social and environmental issues, with increasing concern over sustainable coffee production and strict labour and environmental legislation, which is considered the most rigorous among coffee-producing countries (Brazilian Coffee Industry Association, 2021). In addition, according to van Rikxoort and colleagues (2014), there is a growing interest in climate-friendly coffee production in the coffee sector, but there is no consensus on what exactly this implies (van Rikxoort et al. 2014). Therefore, the demand for sustainability in the coffee supply chain exists; however, there is a lack of understanding of how sustainability in the coffee supply chain (see Figure 2) can be implemented in Brazil and which aspects the stakeholders involved should prioritise. Consequently, it is believed that understanding the main drivers and barriers could

contribute to creating awareness for coffee industry managers interested in implementing sustainability practices. Furthermore, studying sustainability in the coffee supply chains can bring a significant theoretical contribution since there is an ongoing discussion on mitigating the sector's environmental impact (Nab and Maslin 2020) in a scenario in which food systems are responsible for 19-29% of anthropogenic greenhouse gas emissions, and the role of climate certification in the agro-food industry may increase (Birkenberg and Birner 2018).

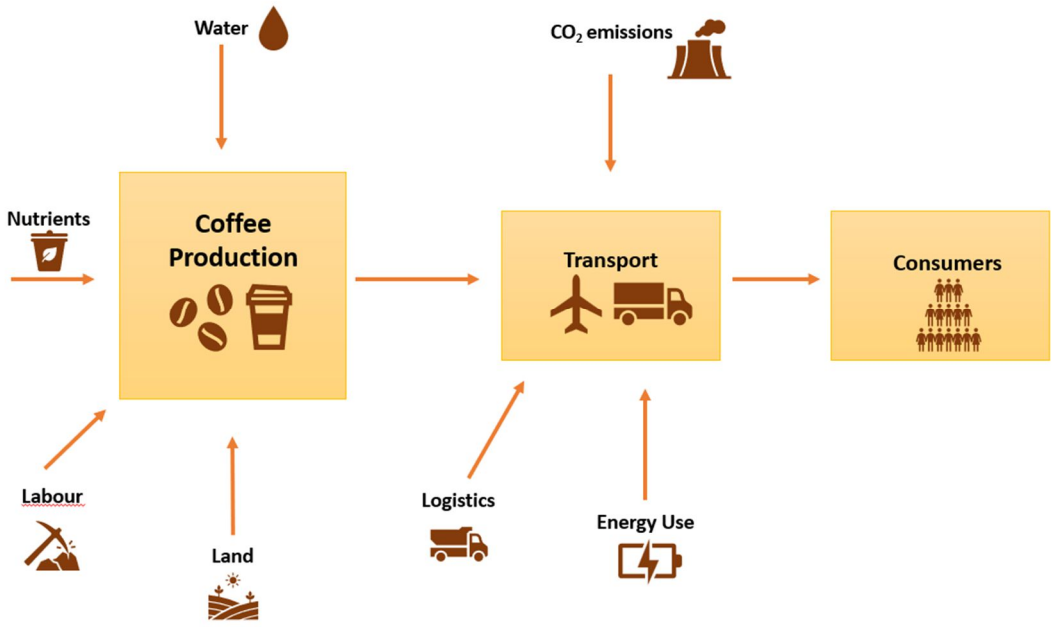


Figure 2. Sustainability Aspects Related to Coffee Production and Trade

In this context, it is essential to consider that current literature in the field urges us to understand the drivers and challenges in implementing sustainability in food supply chains (FSCs). For example, León-Bravo and colleagues (2021) argue the importance of assessing sustainability practices in the FSC by understanding the driving aspects of why companies align their strategies to sustainability and become motivated to implement SSCs. Complementary, other authors also believe the challenges regarding the

implementation of sustainability in FSCs deserve attention since it is essential to unveil the hindering factors in this process (Ghadge et al. 2021). Therefore, despite previous studies that have already addressed issues related to the drivers and barriers in supply chains of other sectors, (Dai, Xie, and Chu 2021) recommend that future work should conduct an in-depth industry study, which is this article's main contribution and uniqueness to the literature and practice.

In this sense, this study builds upon previous work in the field (Basta et al. 2018; Ghadge et al. 2021; León-Bravo, Caniato, and Caridi 2021; Dai, Xie, and Chu 2021) to unveil and discuss the main aspects that could contribute to the implementation of sustainability in supply chains in the coffee industry. Briefly, the goals of this study are to identify and understand 1) the main drivers and barriers to implementing SSCM in the coffee industry and 2) the extent to which these drivers and barriers found in the literature are perceived by professionals working in the Brazilian coffee supply chain. To achieve the goals, a bibliometric analysis was carried out to identify the main categories of drivers and barriers of SSCs, and a survey based on these categories was developed and conducted with Brazilian upstream coffee stakeholders to understand the real-world scenario of the coffee supply chain and explore the theoretical and managerial implications.

To the best of the authors' knowledge, no previous study has focused on exploring the drivers and barriers of the coffee supply chain in Brazil through a survey with the upstream stakeholders of the industry. Therefore, this study contributes to the literature on sustainable food supply chains and coffee SSCs in multiple ways. Firstly, it can foster what (Proença et al. 2022) explicitly urge that further research should be developed in the field by exploring sustainable business practices and the impacts on the environment and society, as well as how stakeholders can work in a committed way toward promoting

changes the supply chain. Secondly, this study can guide managers in the sector on what factors related to the drivers and barriers should be prioritized in implementing SSCM (Dhull and Narwal 2018; Taghavi et al. 2021). Third, the results could generate a good understanding of the industry and establish a common ground for stakeholders in finding feasible solutions through a co-creation approach to designing sustainable coffee supply chains through a more participative model, increasing collaboration, as argued by Umaran et al. (2022). Fourth, the results indicate that access to technology is an essential driver, supporting studies that suggest that big data, blockchain, the internet o,f things and modern agricultural activities are already among the industry's top priorities in the process of implementing sustainability (Kittichotsatsawat, Jangkrajarng, and Tippayawong 2021; Rana, Tricase, and De Cesare 2021). Fifth, this study also addresses the issue connected to the high complexity of change, which is also connected to the inherent tensions in the sector related to the economic,, social and environmental dimensions of corporate sustainability (Shareef et al. 2020; Van der Byl and Slawinski 2015; Hahn et al. 2015). Finally, as final consumers (especially those with a higher level of education and from rich countries) are becoming more aware of sustainability information about the products they purchase (Rana, Tricase, and De Cesare 2021; Sánchez-Bravo et al. 2021), prioritizing the drivers and barriers as well as communicating sustainability practices can increase the sustainability value of the Brazilian coffee.

2. Theoretical Background

Food operations involve production, packaging, storage, and logistics, like any other product, and the physical distance between the growing areas and the final consumer is proportional to the number of steps and actors involved along the supply chain (Accorsi, Ferrari, and Manzini 2019). In the food industry, in order for a food supply chain (FSC)

to become sustainable, the distribution networks need to guarantee the integrity of the food ecosystem, such as the fair use of natural resources, reduction of environmental impacts, and consideration of macro-environmental variables (economic, environmental, and social) (Accorsi, Ferrari, and Manzini 2019).

The explanation for the growing demand for food production in the context of socio-environmental responsibility can be summarised in a few main points, such as the considerable increase in food standards requirements, the industrialisation of agricultural products, the government's concerns about food safety, as well as the rise of globalisation and the growth of the world population (Mangla et al. 2018). The SFSC is already considered a research field of global importance, as it is closely linked to the Sustainable Development Goals, especially to the SDG 12 - Responsible Production and Consumption. In this context, the so-called SSCM is indispensable because it encompasses the correct management of resources,, capital and information throughout the supply chain, with the collaboration of stakeholders under the concept of Triple-Bottom-Line (TBL) (A. Kumar, Mangla, and Kumar 2022).

Coffee is one of the most popular beverages in the world, accounting for more than 55 million 60-kg bags consumed annually. It uses many resources, considered highly relevant for a transition toward a more sustainable production and circular economy (Avraamidou et al. 2020). The supply chain of this particular crop creates approximately 23 million tons of organic coffee waste annually, indicating the growing concern over sustainable practices in the coffee supply chain. The literature follows this assumption, shedding light on packaging innovations to meet consumers' perspectives on ethical enterprise and environmental stewardship (Abuabara, Paucar-Caceres, and Burrowes-Cromwell 2019). On top of that, studies evaluate whether voluntary certification of tropical agricultural commodities (such as coffee) has achieved environmental benefits

and improved economic and social outcomes for small-scale producers (DeFries et al. 2017).

Moreover, the distribution and quality of environmental resources, markets, knowledge, actors, and networks can play an essential role in the ability of a governance mechanism to effectively take root in the coffee supply chain (Hajjar et al. 2019; Grabs and Carodenuto 2021). Another sustainable perspective on the coffee supply chain can be found in (Chen 2020), which elucidates the antecedents that may influence people's purchase behaviour of coffee in the light of sustainable development.

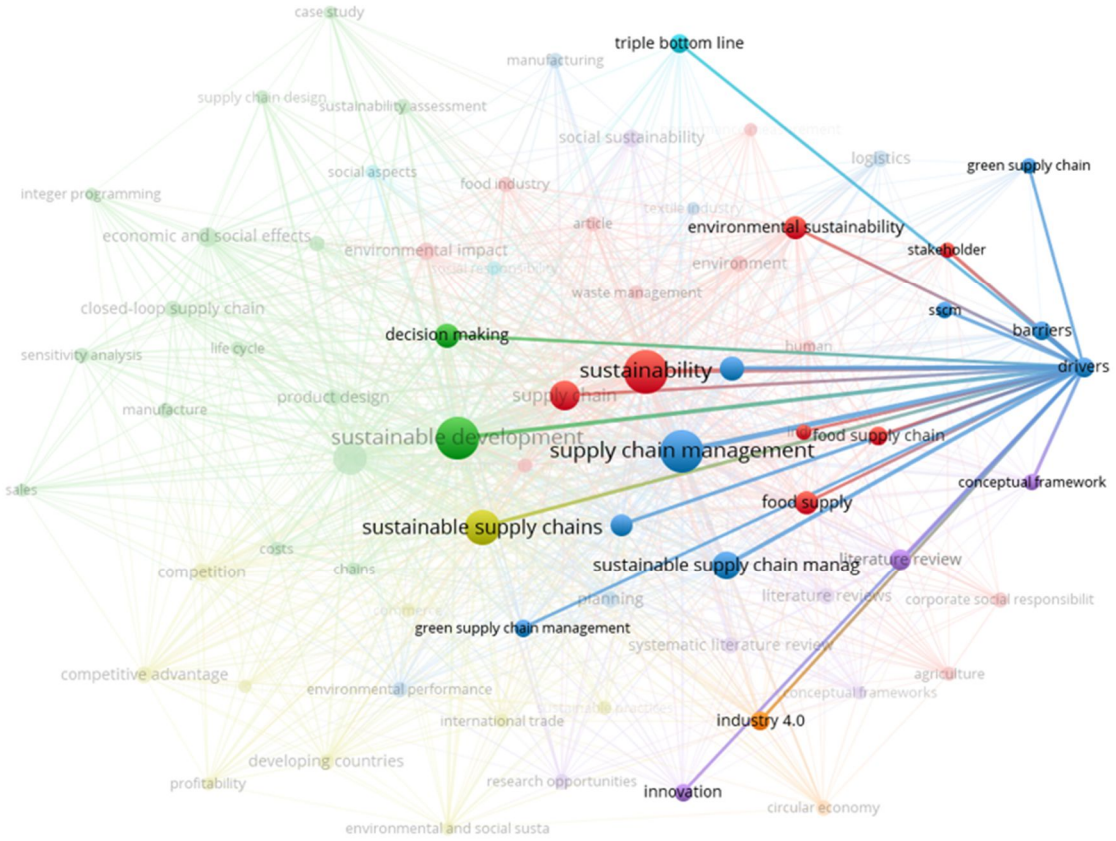
As the concern over social impacts and environmental protection grows, SSCM has become a focus of interest for business practitioners and academics, and the food industry has been widely studied because of its impact on the environment, evidencing that a transition towards sustainable food systems as a crucial factor to effectively manage a global agri-food market (Borsellino, Schimmenti, and El Bilali 2020). In this aspect, scholars argue about the importance of understanding drivers and barriers as a way to explore how sustainability could be implemented in supply chains.

2.1. *Drivers and Opportunities for Sustainable Supply Chains*

Figure 3 evidences the main drivers and opportunities for SSCs identified in the bibliometric assessment using the co-occurrence of terms technique. The most co-occurred terms are connected to sustainable development, supply chain management, SSCs and sustainability, triple bottom line, industry 4.0, FSC, drivers, ,barriers and innovation.

In addition, the figure suggests clusters separated by their colours. For example, the blue cluster shows the connections of terms such as sustainable/green supply chains,, drivers and barriers, where these last two suggest that they are terms explored together in

the literature. The red cluster, in turn, evidences the connection between sustainability and the FSC, which is proven to be important for the SSC topic since food systems are responsible for a substantial percentage of anthropogenic greenhouse gas emissions (Birkenberg and Birner 2018). This bibliometric background corroborated the topics addressed in this study and allowed a more assertive bibliometric search for the following review.



Source: Developed by the author (VOS Viewer output)

Figure 3. Drivers/Opportunities and Sustainable Supply Chain analysis

Applying sustainable practices to a supply chain operation is becoming increasingly important for organisations nowadays; therefore, understanding the factors that encourage and enable such practices is the primary goal of this literature review. For example, (Saeed and Kersten 2019) identified and classified SSCM drivers by understanding the reasons and the encouragement organisations have to undertake

sustainability initiatives and implement sustainable solutions throughout their supply chains, where the main reasons were split into external factors (outside the organisation) and internal (inside the organisation).

The external factors group was classified into three clusters: regulatory pressures (certifications, government legislation, regional or international regulators and trade associations), societal pressures (social well-being, consumer organization,s, media and public p,ressure) and market pressures (globalisation, customers pressure, reputation image, suppliers' pressure, competitive advantage, competitors' pressure, shareholders pressure, and institutional pressure) (Saeed and Kersten 2019).

The second group (internal factors) was classified into four clusters: corporate strategy (operational/economic performance, organisation strategy, cost-related p,ressures and top management commitment), organisational culture (socio-cultural responsibility; innovativeness; code of business conduct; information dissemination and health and safety), organisational resources (resource depletion; human capital, employees pressure/involvement, technology and equipment, and training and development) and organisational characteristics (position in the supply chain, industrial sector, size, geographical location, degree of internationalisation, and current level of sustainability actions) (Saeed and Kersten 2019). Corroborating the previous idea, other authors also separated the drivers into internal and external factors (Sajjad, Eweje, and Tappin 2015), whereby the internal ones involve economic optimisation and the management of business risk (studies proving that SSCM initiatives can improve a company's performance and competitive advantage), reputation and brand image, and support of top management to achieve commitment for implementation. On the other hand, the external factors listed were customer loyalty, public sentiments, NGOs' pressure, and environmental regulations (Sajjad, Eweje, and Tappin 2015).

According to (Zimon, Tyan, and Sroufe 2020), the drivers of SSCM implementation are divided into the internal company (management commitment; organisational involvement; supportive culture; productivity improvement; waste elimination and competitive opportunity), customers/suppliers (business social compliance; environmental regulation compliance; green product requirement; reverse logistics requirement; customer and supplier involvement) and SSCM third parties (regulatory pressure; institutional pressures; international environmental regulation; competition; reputation and social responsibility) (Zimon, Tyan, and Sroufe 2020).

Another driver's perspective was presented by Olatunji and colleagues (2019) through a review aimed to highlight the drivers and barriers of carbon-efficient practices. The main drivers found were new opportunities/markets, cost reduction, intensification of regulation, consumer awareness, supply chain collaboration (help to manage risks and integrate sustainable practices in manufacturing processes), corporate image damages, competitive risk, social respon,sibility and cost of late adoption (Olatunji et al. 2019).

In addition, a perspective evidenced by the bibliometric analysis when studying SSCM was Industry 4.0, which according to Luthra and colleagues (2020), is an enabler of sustainability diffusion in the supply chain. According to the authors, the key drivers of Industry 4.0 to diffuse supply chain sustainability are the collaboration and transparency among supply chain members (coordination and collaboration to integrate Industry 4.0 with the supply chain to increase sustainability in operations), management, support and effective governance (importance of governance structure to define the plan of action in integrating Industry 4.0 and sustainable initiatives in an organisation), development of infrastructure and information technology (important tools to diffuse sustainability in the supply chain), competitiveness, workforce knowledge and expertise in managing resources (needed to ensure required skills in order to improve sustainability

in the supply chain through Industry 4.0), supportive government policies, and adoption of innovative business models (products and processes developed to drive the sustainability of material and goods throughout their life cycle) (Luthra et al. 2020).

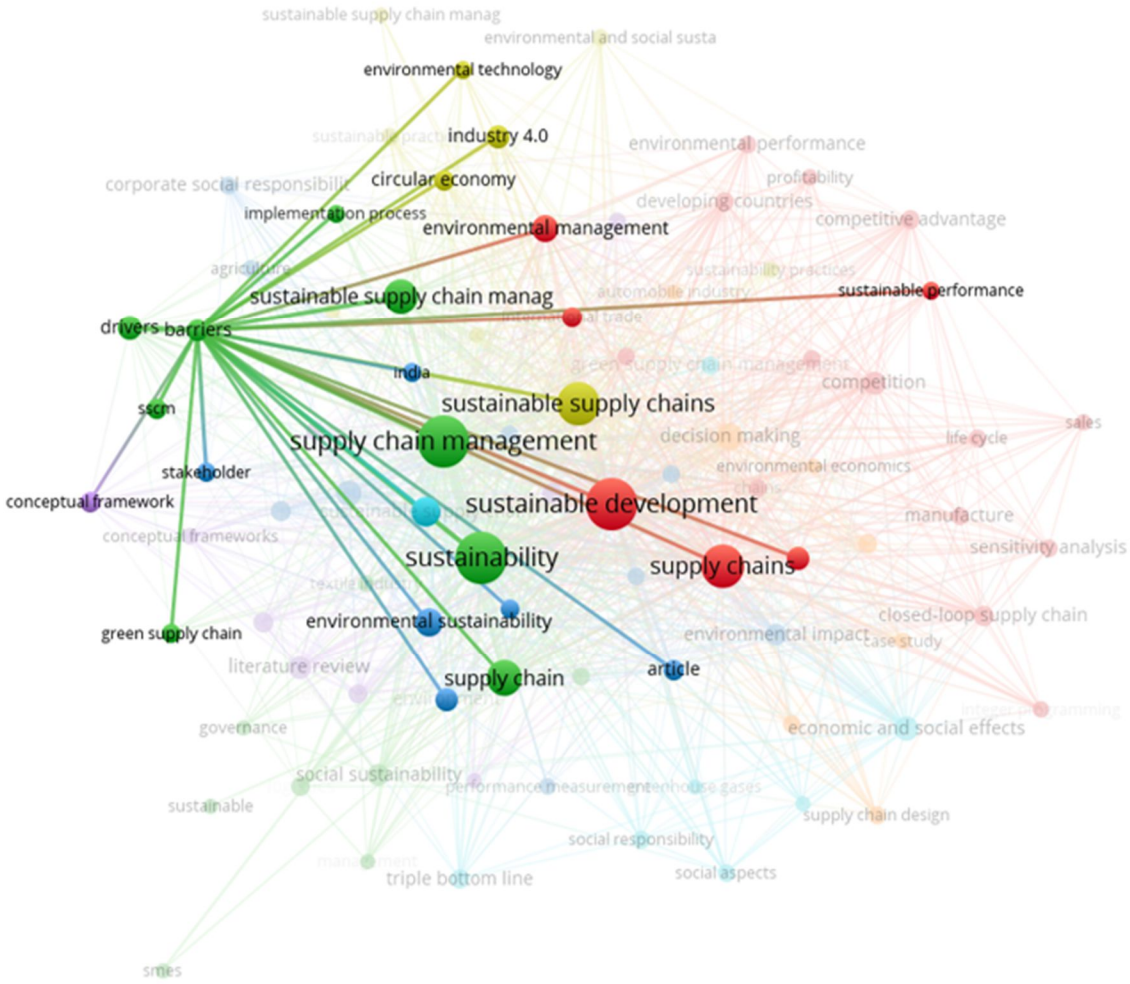
Corroborating the previous authors, Reyes et al. (2021) develop a conceptual reference model that merges Industry 4.0 with lean manufacturing tools to reduce waste and costs in the lean supply chain planning context, which brings to light a conceptual proposal that establishes a relation among the lean and sustainable paradigms to improve supply chain performance by implementing industry 4.0 enabling technologies. Moreover, the model evidences how industry 4.0 can encourage sustainability in supply chain management (Reyes, Mula, and Díaz-Madroñero 2021).

Finally, another perspective related to the drivers was explored by Shibin et al. (2016), presenting important enablers of flexible green supply chain management: financial stability (financial budget is essential to solve the environmental issues related to firm operations), flexible and green product design, organisation culture (environmental concern as part of corporate culture), strategic supplier collaboration (easier access to green and flexible technologies), enabling technologies and information (technologies to improve economic and environmental performance), logistics optimisation (green gas emissions minimisation) and corporate commitment on the topic (Shibin et al., 2016).

2.2. *Barriers and Challenges for Sustainable Supply Chains*

Figure 4 shows the co-occurrence analysis related to the barriers and challenges for SSCs. The co-occurred terms are supply chain management, SSCM, sustainable development, suppl,y chains and SSC. These are connected to stakeholders, sustainable performance, implementation process, environmental management, and environmental technology.

The yellow cluster, for example, shows how the topics Industry 4.0, circular, economy and environmental technology are potential barriers when considering SSCs and might be connected. The red cluster, on the other hand, combines the barriers to topics related to sustainable performance and environmental management, bringing to the discussion a managerial perspective of sustainable practices in the supply chain as well as the company's performance, which is proven to be a concern when considering the application of sustainable initiatives in the supply chain (Friede, Busch, and Bassen 2015). This bibliometric background corroborated the topics addressed in this study and allowed a more assertive bibliometric search for the following review.



Source: Developed by the author (VOS Viewer output)

Figure 4. Barriers and Sustainable Supply Chain analysis

Implementing sustainability into supply chains is not an easy task. Organisations usually face many barriers when innovating for sustainability (Gupta, Kusi-Sarpong, and Rezaei 2020). For example, Boström et al. (2015) explored the main challenges that globalised supply chains face in becoming sustainable and responsible; the main gaps found by the authors were: information and knowledge gaps (importance of reliable data information about sustainability impacts of products and production processes in different parts of the chain), communication gaps (little collaboration and communication around the chain), compliance or implementation gaps (need of clear and solid principles, criteria and guidelines) and power gaps (different power relations among the actors of the chain - more equal power distribution is better for developing more responsible and sustainable governance) (Boström et al. 2015).

In addition, there is Shibin et al.'s (2016) vision on the topic, bringing to the discussion the challenges for the green SCM. The main findings regarding what hinders supply chains in achieving levels of sustainability show that they rely on several factors, such as improper communication among suppliers (information distortion causing inappropriate resource utilisation), poor environmental awareness (small and medium scale enterprises are more likely to suffer from unawareness), poor technology management (unavailability of latest technologies that prevent interference in the institutionalisation of green supply chain strategies), financial barriers (a considerable amount of investment is required) and lack of expert supply chain professionals to ensure strategic collaboration and a good domain of SSC programmes (Shibin et al., 2016).

Furthermore, Sajjad and colleagues (2015) divided the barriers into internal and external groups, as they did with the drivers. The internal barriers are the lack of interest by the top and middle-level management, which can reduce the organisation's capacity to implement sustainability initiatives effectively, as well as monetary constraints or high

costs, making companies struggle to engage in green practices, especially the small and medium enterprises. According to the authors, other internal issues that can inhibit a company's sustainable efforts are legal and administrative complexities, risk-aversion behaviour, lack of awareness, negative perceptions about environmental procurement, and a lack of management skills, experience, and essential tools. For the external barriers, in turn, the main factors are insufficient or inappropriate regulations, lack of SSC performance measurement, and non-standardised performance measures (Sajjad, Eweje, and Tappin 2015).

In Olatunji and colleagues' view (2019), the barriers to carbon-efficient practices that should be highlighted are lack of adequate resources, inadequate supply chain partner collaboration, lack of a standardised approach to carbon auditing, and lack of installation of relevant systems (Olatunji et al. 2019). Gupta et al. (2020) highlighted the following barriers instead: the lack of awareness and understanding among organisations about the benefits of implementing sustainable innovations (sustainable innovation seen as a cost and not as an investment for the future), lack of a skilled workforce in green practices, inappropriate technology for sustainable innovation practices, financial costs associated with sustainability innovation, lack of government support, uncertainties about processes, and the market's acceptance of sustainable innovations (Gupta, Kusi-Sarpong, and Rezaei 2020).

Moreover, Nazam et al. (2020) study list the top seven barriers to the implementation of SSC initiatives: lack of sustainable outsourcing, lack of sustainable production and distribution, fear and resistance towards sustainable competitiveness and innovation, trust deficit in the sustainable buyer-supplier relationship, lack of sustainable marketing and organisational culture, difficulty in sustainable knowledge-sharing, and complexity in adopting sustainable technology practices (Nazam et al. 2020).

Most recently, Kumar et al. (2021) analysed the barriers to managing supply chains for sustainable operations in topics that both appeared in the bibliometric analysis: Industry 4.0 and circular economy. The authors highlighted the following barriers: risk of misinvestment (Industry 4.0 technologies and sustainable practices require a good amount of financial investments), insufficient legislation & control (especially over the small and medium enterprises), lack of a skilled workforce to handle Industry 4.0 and sustainable issues requirements, lack of government support, and lack of management support that can be reluctant to support sustainable operations practices (P. Kumar, Singh, and Kumar 2021).

In addition, Al Zaabi et al. (2013) analysed the barriers to the implementation of SSCM: lack of knowledge and information on sustainability, whereby firms tend to retain the status quo of disbelieving sustainability practices, lack of information sharing, lack of motivation towards employees, lack of qualified staff and training programmes, financial costs (ecological costs are not usually incorporated in the price), lack of tools and resources, and communication gaps and ambiguous information between the parts (Al Zaabi, Al Dhaheri, and Diabat 2013).

Abbasi (2017) presents the main themes and challenges of the topic regarding social SSCs. The challenges were classified into seven categories: inadequate and asymmetric knowledge (about social sustainability criteria), difficulties of operationalisation (lack of clarity regarding definitions of sustainable development), shifting of values (difficulty in changing the company's values over sustainable issues), subjectivity in evaluation (lack of a more tangible and unified tool of measmodelingodelling/assessment of sustainability), difficulties of small and medium-sized enterprises and sustainability stakeholders to transfer their responsibilities to

places/stakeholders with looser regulations and standards, externalising the social and environmental degradation costs (Abbasi 2017).

Moreover, Ghadge et al. (2021) proposed a study to understand sustainability implementation challenges in FSCs, identifying several barriers, including initial investment cost, firm size, the lack of government reg,ulations and the lack of consensus regarding the concept of sustainability by different stakeholders. The internal barriers showed to be significantly more hindering than external barriers (Ghadge et al. 2021). Another perspective on barriers comes from a case study in Bangladesh, in Shareef and colleagues (2020) work that aims to identify the inherent tensions within SSCs. The authors claim that the transition toward greater levels of sustainability and corporate responsibility is problematic, affecting many levels within a supply chain. They conclude that these main tensions involve government intervention and the reassessment of financial incentives to drive a more efficient transition (Shareef et al. 2020).

Finally, regarding Abbasi & Nilsson´s (2012) perspective, there are five main challenge areas in making supply chains environmentally sustainable: costs (one must pay to be green), complexity (a supply chain affects the environment in multiple ways, creating more challenging measurements and assessments of the effects caused), operationalisation (interpretation - complex to translate economic, social and environmental dimensions into activities for every process in a supply chain, and inertia - fear of change, maintenance of the status quo), mindset and cultural changes (lack of engagement by top management in environmentally-related issues) and uncertainties in terms of government actions and decisions, consumer behaviour and demands and competitive advantages (Abbasi and Nilsson 2012).

3. Methods

To achieve the goals of this study, two methods have been selected. The bibliometric analysis based on the co-occurrence of terms was adopted to identify the main drivers and barriers the literature considers relevant to the SSCM. In a second stage, the drivers and barriers identified (see Table 2) were used to develop a questionnaire to understand the stakeholders' opinions of the Brazilian coffee sector. In this sense, the following two subsections illustrate the details related to data collection and data analysis strategies.

3.1. *Data Collection Strategy*

The data collection regarding the bibliometric analysis was performed on the Scopus Database (Scopus 2021). In order to identify the main, two search strings were created using the most important terms used in the literature.

> ***Search String 1 - Drivers:*** (TITLE (sustainab* AND supply AND chain) AND (TITLE-ABS-KEY (driver*) OR TITLE-ABS-KEY (opportunit*)))
>
> ***Search String 2 - Barriers:*** (TITLE (sustainab* AND supply AND chain) AND TITLE-ABS-KEY (barrier*) OR (TITLE-ABS-KEY (challenge*) OR TITLE-ABS-KEY (obstacle*)))

The first search string is related to the drivers and opportunities of SSC, and it was built in two blocks. The first aims to search terms connected to SSC in the title since the authors wish only to explore documents directly related to the topic. In the second block of the string, the command aimed to find the terms "barrier" and "opportunities" in the title, ,abstract and keywords. After applying this search strategy, the Scopus Database returned 437 documents.

The second search string, in turn, was developed to find the documents related to the barriers in the SSC. In this sense, two blocks of terms were created to build the search string. The first one aimed to bring terms connected to SSC, while the second block was developed to return documents that have the terms "barrier" or "challenge" or "obstacle" in the title, ,abstract or keywords. This search string returned 641 documents.

In a second stage, according to the main constructs found in the bibliometric analysis, a questionnaire was created and conducted online through the researchers´ networks and with employees involved in the Brazilian coffee industry supply chain as found on LinkedIn and Instagram. The questionnaire comprising 34 questions was developed to understand the profile of the respondents, their company, and answers to questions based on the literature findings of the drivers and barriers of SSC.

Since the study aims to understand the drivers and barriers of implementing SSCM in the Brazilian coffee supply chain, all categories of stakeholders that were connected with the implementation process of sustainable practices in supply chains of the Brazilian coffee industry were surveyed: inputs (machinery, production of seedlings, pe,sticides and fertilisers), production (producer), industry/transformation (cooperatives) and commercialisation.

A total of 147 respondents completed the online survey. Since non-probability sampling methods through Internet recruitment of hidden populations traditionally reach small samples (Barratt et al., 2015), the number of respondents was considered acceptable for the purpose of this paper.

3.2. *Data Analysis Strategy*

For the first goal of this article, a bibliometric analysis was adopted since it is a commonly used method to understand the main streams of a research field. The VOSViewer, a bibliometric software that applies text mining techniques to understand the possible connections of a specific research field, was adopted to perform the analyses (VOSviewer 2021).

The technique adopted was the co-occurrence of terms, where the output can be seen through a network graph in which the radio of the circles represents the frequency

of co-occurred terms, the width of the connrepresentpresents how strong the terms are connected, and the clusters reflect the frequency in which two or more terms are explored together (Perianes-Rodriguez et al., 2016; van Eck & Waltman, 2014).

It is worth considering that the bibliometric analysis was performed to contribute to the literature review since it could reduce the complexity of the literature and identify the main categories related to the drivers and barriers related to sustainability in supply chains (figures 3 and 4). Therefore, drivers and barriers were selected through the analysis of the co-occurrence graphs in combination with a careful reading of the literature obtained through the searches performed on Scopus. In this sense, the survey can be considered as a sequence of the first stage, where the main drivers and barriers obtained guided the development of the questionnaire so the case of the Brazilian coffee supply chain could be explored under the lens of sustainability.

The survey results, in turn, were analysed through simple descriptive statistics and frequency analysis, using graphs and tables. Table 1 describes the sample where 72.1% of the participants in this survey have a position/function related to sustainability, 80.3% are men, and in terms of age, 4.1% of the respondents are between 18 and 24 years of age, 26.5% are 25-34 years, 36.1% are 34-44, 17.7% are 45-54, and 15.6% are 55 years of age or older.

Table 1. Sample Description

Sample Characteristics	Alternatives	Number	Percentage
Position/function related to sustainability	Yes	106	72.1%
	No	41	27.9%
Gender	Male	118	80.3%
	Female	28	19.0%
	Other	1	0.7%
Age	Under 18 years old	0	0.0%
	18 - 24 years	6	4.1%

	25 - 34 years	39	26.5%
	35 - 44 years	53	36.1%
	45 - 54 years	26	17.7%
	More than 55 Years	23	15.6%
Educational Level	Elementary School	1	0.7%
	High School (enrolled or completed)	6	4.1%
	Bachelor's degree – enrolled	17	11.6%
	Bachelor's degree – completed	49	33.3%
	Specialization or MBA (enrolled or completed)	60	40.8%
	Master Degree – completed	10	6.8%
	Master Degree – enrolled	2	1.4%
	PhD Degree	2	1.4%
Company Size	Up to 19 employees	39	26.5%
	20 - 99 employees	17	11.6%
	100 - 499 employees	11	7.5%
	More than 500 employees	80	54.4%
Coffee supply chain stages	Inputs (machinery, seedling producer, fertilisers, pe,sticides etc.)	14	9.5%
	Industry/Transformation (cooperatives)	72	49.0%
	Production (farmer producer)	39	26.5%
	Inputs and Industry/Transformation	4	2.7%
	Inputs, Pr,oduction and Industry	4	2.7%
	Commercialization	11	7.5%
	Other	3	2.0%
Hierarchy Level	Analyst	7	4.8%
	Assistant	14	9.5%
	Consultant	1	0.7%
	Specialist	22	15.0%
	Engineer	4	2.7%
	Intern	2	1.4%
	Supervisor or Coordinator	18	12.2%
	Manager or Director	24	16.3%
	Owner or Founder	46	31.3%
	President or Vice-president	2	1.4%
	Other	7	4.8%

The table also evidences that the majority (44.9%) of the respondents have a bachelor's degree (enrolled or completed), and 40.8% have completed specialisation courses or an MBA (enrolled or completed). Regarding the respondents' companies, 49%

are involved in the Industry/Transformation (cooperatives) sector and 26.5% in production (farmer producer). In terms of size, the majority of the respondents' companies have more than 500 employees (54.4%), followed by the category of up to 19 employees (26.5%), 20-99 employees, (11.6%) and 100-499 employees (7.5%). Finally, in terms of hierarchy level, the respondents are mainly owners or founders (31.3%), managers or directors (16.3%), specialis,ts (15%) and supervisors or coordinators (12.2%).

4. Results and Discussion

Table 2 synthesises the main drivers and barriers found in the SSCM literature and discussed previously through the perspectives of several authors in the field. These items were also used to develop the questionnaire for the participants (Appendix 1) in order to understand the extent to which these drivers and barriers found in the literature are perceived by professionals working in the Brazilian coffee supply chain. In this way, the respondents were asked to define their level of agreement with each statement regarding the 12 drivers and 13 barriers found in the literature.

Table 2. Main Drivers and Barriers of Sustainable Supply Chains

Category	Items	References
Drivers	● Social well-being/ Social responsibility	Saeed & Kersten (2019) Zimon et al. (2020) Olatunji et al. (2019) Sajjad et al. (2015) Luthra et al. (2020) Shibin et al. (2016) Reyes et al. (2021)
	● Media, reputation/brand image	
	● Customer pressure/loyalty/ Involvement	
	● Competitive opportunity/advantage	
	● Innovativeness/innovation business model	
	● TecInfrastructuretructure	
	● Economic/productivity performance/improvement	
	● Organisational culture/supportive culture	
	● Regulations (environmental, regional, international)	
	● Green products	
	● Government policies/legislation	
	● Supply chain collaboration	
Barriers	● Information and knowledge gaps/distortion	Boström et al. (2015) Shibin et al. (2016)
	● Communication gaps/inadequate collaboration	

	between parts	Sajjad et al. (2015)
	● Unclear principles and measures	Olatunji et al. (2019)
	● Poor environmental awareness	Nazam et al. (2020)
	● Lack of technology/tools	Al Zaabi et al. (2013)
	● Financial costs and lack of resources	Abbasi (2017)
	● Lack of skilled professionals/workforce	Gupta et al. (2020)
	● Lack of top/middle management support	P. Kumar et al. (2021)
	● Lack of government support	Abbasi & Nilsson (2012)
	● Risks/uncertainties	Ghadge et al. (2021)
	● Mindset/cultural changes	Shareef et al. 2020)
	● High complexity	
	● Legal complexity/insufficiency	

Source: developed by the author, based on the literature.

In terms of the 12 drivers (Figure 5), the top five levels of agreement combined were the drivers that most encourage sustainable practices: social well-being/social responsibility with 96.6% (59.2% Strongly Agree and 37.4% Agree), economic/productivity performance/improvement with 91.2% (44.2% Strongly Agree and 46.9% Agree), regulations (environmental, regional, international) with 90.5% (46.3% Strongly Agree and 44.2% Agree), adoption of an innovative business model with 87.1% (34.7% Strongly Agree and 52.4% Agree) and access to technology/infrastructure with 87.1% (39.5% Strongly Agree and 47.6% Agree).

This result is supported by the literature, where authors Zimon et al. (2020) and Luthra et al. (2020) also considered these same five drivers as important factors that encourage and enable sustainable practices in supply chain management. For example, Luthra and colleagues (2020) highlighted that these drivers are very important in the Industry 4.0 perspective, which is an important enabler of sustainability diffusion in the supply chain. On the other hand, the authors Saeed & Kersten (2019) and Sajjad et al. (2015) considered government policies/legislation and customer pressure/loyalty/involvement to be essential drivers for SSCM. However, these were the top two drivers with higher levels of disagreement (Figure 5) in the survey results - the drivers that less encourage sustainable practices: government policies/legislation with

13.6% (10.9% Disagree and 2.7% Strongly Disagree) and customer pressure/loyalty/involvement with 7.5% (4.8% Disagree and 2.7% Strongly Disagree).

Source: Developed by the author (Survey Output)

Figure 5. Level of agreement regarding the 12 drivers of Sustainable Supply Chains

Regarding the 13 barriers, the top four levels of agreement combined were: lack of government policies and legislation with 35.4% (17% Strongly Agree and 18.4% Agree), high complexity of the processes with 35.4% (6.1% Strongly Agree and 29.3% Agree), unclear sustainability principles and measures with 34.7% (10.2% Strongly Agree and

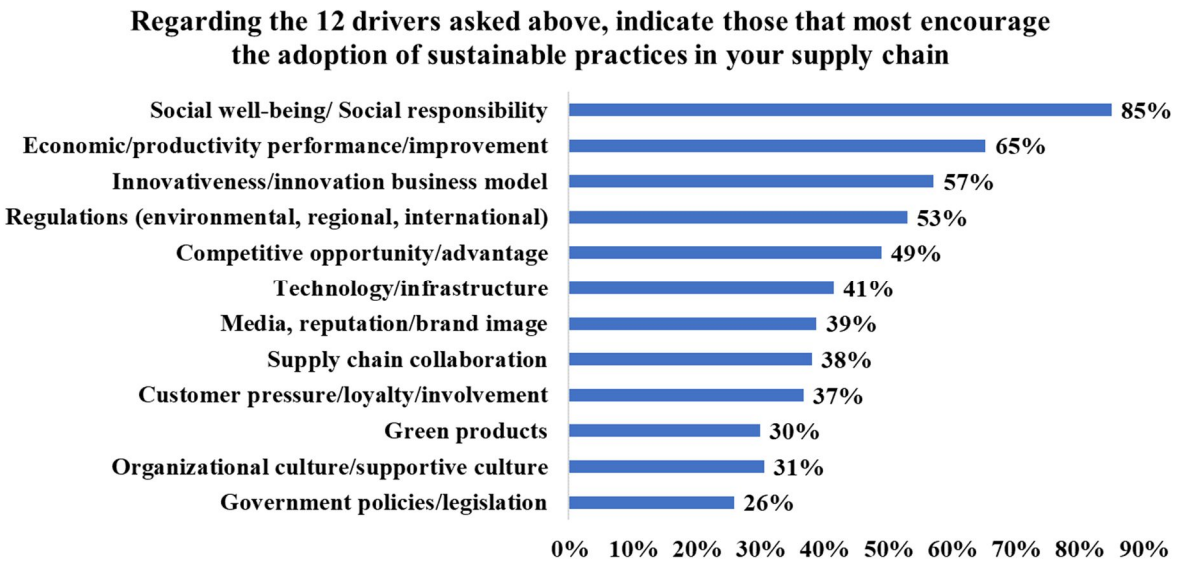
24.5% Agree) and communication gaps/inadequate collaboration between parts with 34% (6.8% Strongly Agree and 27.2% Agree). These results indicate similar findings of previous studies, which also considered these hindering factors of sustainable practices in the supply chain, as in the studies of (Gupta, Kusi-Sarpong, and Rezaei 2020; P. Kumar, Singh, and Kumar 2021). Figure 6 shows the results.

Source: Developed by the author (Survey Output)

Figure 6. Level of agreement regarding the 12 barriers to Sustainable Supply Chains

The findings also indicate interesting results regarding the top four barriers with disagreement levels (less hindering sustainable practices). For instance, poor environmental awareness was reported by 68.1% (38.8% Disagree and 29.3% Strongly Disagree); lack of proper technology/tools by 66.7% (46.3% Disagree and 20.4% Strongly Disagree); lack of top/middle management support by 64.6% (36.1% Disagree and 28.6% Strongly Disagree) and sustainability risks/uncertainties by 63.9% (40.8% Disagree and 23.1% Strongly Disagree). This finding contradicts previous literature (Nazam et al. 2020; Olatunji et al. 2019), indicating that these barriers do not seem to be relevant to the Brazilian coffee supply chain.

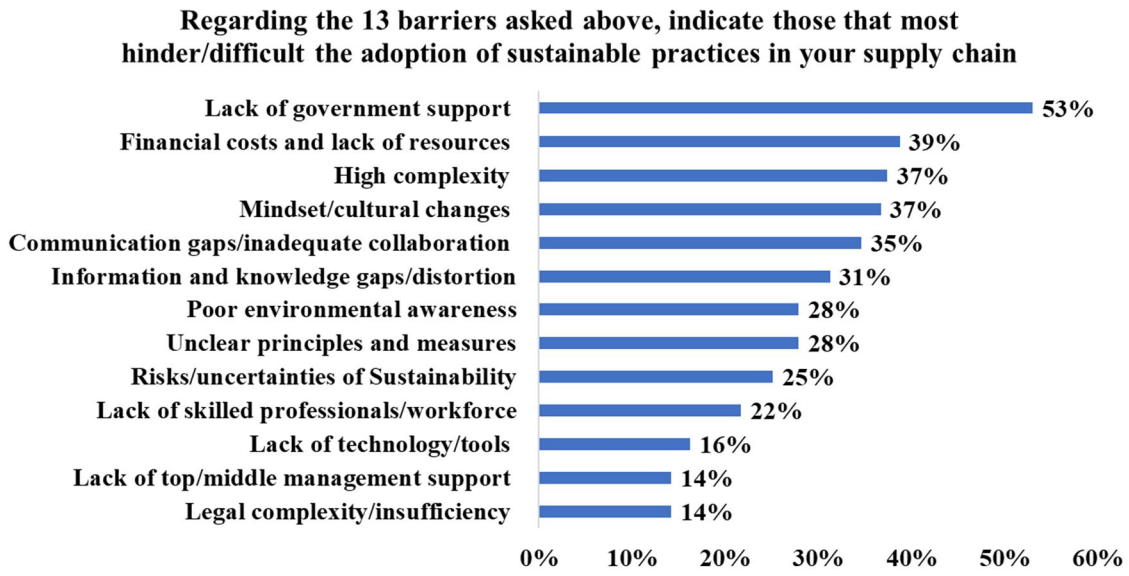
In addition, the respondents also had to indicate, comparatively, which of the 12 drivers and 13 barriers they believed most foster and hinder the adoption of sustainable practices in their supply chain. As seen in Figure 7, of the 147 respondents, 85% consider social well-being/social responsibility to be an encouraging driver, followed by the economic performance (65.3%), innovative business model (57.1%), regulations (environmental, regional, international) (53.1%) and competitive advantage (49%). According to the respondents, government policies/legislation (25.9%) and organisational culture/supportive culture (30.6%) received the lowest responses among the drivers assessed. Such results corroborate the previous analysis in Figure 5.



Source: Developed by the author (Survey Output)

Figure 7. Ranking of drivers of sustainable practices in the Brazilian Coffee Supply Chain.

Figure 8 shows the ranking of the barriers to the Brazilian Coffee Supply Chain. According to the respondents, the lack of government support (53.1%), financial costs and lack of resources (38.8%), high complexity of the processes (37.4%), mindset/cultural changes, (36.7%) and communication gaps/inadequate collaboration (34.7%) appear in the top of the list. On the other hand, legal complexity/insufficiency (14%), lack of top/middle management support , (14.3%) and lack of technology tools (16%) are not seen as relevant barriers that could inhibit sustainability practices in the Brazilian supply chain management.



Source: Developed by the author (Survey Output)

Figure 8. Ranking of barriers to sustainable practices in the Brazilian Coffee Supply Chain.

Finally, it is also worth considering that this study extends prior research since understanding the SSC drivers and barriers (Gupta, Kusi-Sarpong, and Rezaei 2020; Saeed and Kersten 2019; Sajjad, Eweje, and Tappin 2015) is essential to contributing to corporate sustainability (van Marrewijk and Werre 2003). In this sense, addressing this complex and growing demand for sustainability requires identifying the drivers and barriers involved to enable the adoption, implem,entation and upscaling of supply chain sustainability (Saeed and Kersten 2019; Sajjad, Eweje, and Tappin 2015).

5. Conclusions

The bibliometric analysis and literature review unveiled the 12 drivers and the 13 barriers most common in SSCs. The survey results indicate that the main drivers influencing the adoption of sustainable practices in the Brazilian coffee supply chain are social well-being and social responsibility, economic performance/improvement, regulations (environmental, regional, intern,ational) and adoption of an innovative

business model. On the other hand, the respondents indicate that the main barriers that could hinder the adoption of sustainable practices in the Brazilian coffee supply chain are the lack of government support, the high complexity of the processes, and communication gaps/inadequate collaboration between parts.

5.1. Theoretical implications

This study brings a contribution to research on sustainability practices across the value chain since implementing sustainability in SFSC is challenging, as it needs to circumvent the mentioned drivers and barriers that include inspection and regulation issues (Yadav et al. 2022) in addition to aspects such as food traceability, transparency, and environmental concerns while serving the various stakeholders involved in the sector (Friedman and Ormiston 2022). Innovations can be the key to dealing with such a context (Abuabara, Paucar-Caceres, and Burrowes-Cromwell 2019) or also distributed ledger technologies (DLT), such as the blockchain, which could increase food safety, reduce fraud, ensure fair work practices, and reduce carbon emissions (Friedman and Ormiston 2022). In the case of coffee, it is no different; as mentioned by (Bager, Singh, and Persson 2022), the still scarce number of institutions working to protect the environment and society in this sector has increased pressure from consumers and society for transparency. In this sense, the results can contribute to understanding and advancing the various private governance mechanisms, which include certifications, code of conduct, partnerships, and corporate social responsibility (Bager, Singh, and Persson 2022).

This study also complements Saeed & Kersten (2019) work that highlights the importance of research for aiming for clear identification and classification of drivers and barriers of SSCM (sustainable supply chain management) at industry and geographical levels, the coffee industry in Brazil. The results can assist the understanding

of important sustainability issues, identifying diff,iculties, and the required improvements (Saeed and Kersten 2019). On top of that, by evidencing the patterns of the coffee industry in terms of drivers and barriers, it is possible to demonstrate the sector's complexity while pursuing sustainability since they necessarily engage a myriad of internal and external stakeholders. Finally, this work also shows tangible factors the companies in the coffee sector should be cowitherned on addressing, in this sense, the results indicate that stakeholder management towards sustainability might involve prioritisation processes based on these factors.

5.2. Managerial implications

The outcomes of this study also have managerial implications, since SSCM is needed to develop effective business models aligned with long-term goals, managers and stakeholders involved in conducting companies belonging to the coffee industry must consider the context of each pressure within their specific industrial environment. Such initiative is important to not only foster their positive externalities and reduce the negative ones, but to also to understand the details concerning different sustainability drivers and barriers and the extent to which they are considered in developing sustainability strategies. It is expected that the drivers and negative barriers brought forward in this study should be used as key information not only for managers, but also for other stakeholders such as governments and policymakers since the respondents pointed to the lack of government support as one of the main barriers for the sector, showing an important path for public policy in Brazil, that should improve its initiatives concerning sustainable issues for the Brazilian coffee companies.

On top of that, one of the main barriers identified by this study, for example, is the communication gaps and inadequate collaboration between organisations, which shows the need for better communication/collaboration policies among companies in the Brazilian coffee industry, allowing managers to review and possibly improve the way they communicate and cooperate. Therefore, the clear picture of the main drivers and barriers and their relevance assessment brought in this study could help managers to become more aware of the blind spots, creating a roadmap to implement sustainability into supply chains in the Brazilian coffee industry, and cater for more a assertive implementation of sustainable policies. In other words, these results are an opportunity for the companies to implement strategies or even develop action plans to focus on the drivers and barriers that represent a greater opportunity for their business - an enormous potential for companies to optimise their policies and strategies.

5.3. Limitations and future research

This study also has limitations that can be considered opportunities for future studies. The authors believe that understanding how the identified drivers and barriers change over time, could lead to implementing specific policies and their prioritization, when designing supply chains. Secondly, the study was limited to Brazil, and the perspective of other coffee-producing countries could bring significant contributions to both theory and practice. Third, the authors used non-probabilistic sampling, which provided good insights for the prioritisation of sustainable practices toward implementing sustainability in the supply chain and cross-checking with the literature. The authors believe that other studies aiming for a higher number of participants and possibly understanding the perspective of a specific stakeholder could contribute to the research field. Finally, this research could be complemented with in-depth interviews, bringing to

light a qualitative exploration of the drivers and barriers and exploring more assertive strategies to implement sustainability into the Brazilian coffee supply chain.

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