LOW CARBON ECONOMY AND THE SUGAR AND ALCOHOL INDUSTRY: AN APPROACH TO ESG MANAGEMENT

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Abstract: Ethanol production can generate both positive and negative externalities, all related to ESG (environmental, social and governance) principles. Thus, a study of the positive and negative externalities of ethanol production was conducted through a critical analysis of the literature and construction of a conceptual framework. The results highlighted that ethanol production has positive externalities (renewable source, reduction of emissions and sustainability) and negative externalities (soil degradation, pollution, use of pesticides). However, management that ensures an adequate balance between these externalities can provide social, environmental and governance benefits for the entire organization.

Keywords: Industry; Ethanol; Environmental; Social; Governance.

1. INTRODUCTION

ESG management (environmental*, social and governance*), which comprises the index that evaluates the impact of the company's operations on three sustainability axes - environment, social and governance[1], can provide not only companies, but also governments, an idea of how they are impacting society. In the case of ethanol turbines, ESG management is crucial to ensure that production is sustainable and does not cause negative externalities, so that it can remain perennial in the market and can receive funding from development agencies to continue its development[2].

Just boosting ethanol production is not a simple task. In a context of increased ethanol production, decarbonization of the economy and adaptation of the sustainability process, the forced sugar and alcohol industries, like any industry today, need support in terms of promotion and, for that, it needs to be attentive to the requirements of most investment funds, which are based mainly on ESG management metrics[3].

The environmental indicator assesses how the company acts in environmental management. Companies that have an established sustainability system, as well as programs for prevention and care for the environment leave n / A front nest index . In addition , companies that develop green innovation , for example , in addition to improving their financial performance , attract potentially environmentally proactive stakeholders[4]. Credit risk is positively affected by environmental factors, that is, countries that have better environmental indicators, present better levels of credit risk, especially for the CO 2 emission and exposure factors[5].

The social indicator evaluates whether the organization violates independent human rights, which monitor the relationships between the company and its employees, suppliers and the community where it is located. Corporate social responsibility statements add not only profit maximization like companies that do, but mainly brand recognition. However , these practices must be directly related to the organization's efforts to carry out social practices and, not only, to generate evidence for compliance with specific laws and incur the inclusion of n / A list of greenwashing *companies*[6].

The governance indicator, on the other hand, evaluates corporate management practices that are mobile in the fight against corruption and *compliance.* Corporate governance refers to the way a company is managed and directed, including the relationships between management, shareholders, and other interested parties. Increasingly, investors are looking for companies with good governance, as they believe that companies that use these indicators n / A conducting organizational practices are more efficient in their performance analysis than before, when using only traditional financial and operational indicators [7] .

There are several sources of funding for ethanol engines that are inscribed with competent practices and ESG management, such as BNDES, FUNDEP, among others[8,9]. A source of support for companies is fundraising through environmental certifications, such as decarbonization credits (CBios). These credits are issued based on the reduction of greenhouse gas emissions and can be traded on the market. The purchase of CBios encourages the production of efficient biofuels, encouraging companies to reduce emissions. the Brazilian government's RenovaBio program created the CBios to promote the production and consumption of biofuels with less environmental impact. Companies that meet sustainability criteria can issue and sell CBios in the financial market, generating additional revenue[10, 11].

In addition, ESG management can also be an important factor to attracting private investment for the ethanol industry. Companies that have authoritative and governance practices are seen as more attractive by investors who value socio-environmental responsibility. In this sense, the adoption of practices such as transparency of the disclosure of information and implementation of equality and diversity policies can be important differences for companies seeking investments with ESG management issues[12]. In view of the above, the objective of this study is to understand what are the positive and negative externalities related to ethanol production and relate them to the ESG in order to generate information to support the management of organizations in the ethanol production sectors.

2. METHODOLOGY

The research began with a critical analysis of the literature on the positive and negative externalities related to ethanol production. The methodology used consisted of mapping the externalities generated in the process of manufacturing ethanol as fuel for leaf vehicles, through an online search in different sources of information, such as Science Direct, Web of Science, Scope, Google Scholar and Google. studies were considered that addressed records, dissertations, journal articles, pre-prints, conference/congress abstracts, unpublished manuscripts, governed report or any other document relevant to the study. Quantitative results were considered, searched by title and abstract, using the descriptors "ethanol externalities" and applying secondary filters: order by psychological, any language, review articles and no patents. We chose to exclude the publication period filter since 2021. The selected See More publications were students using a conventional content analysis methodology[13,14]. inspired by the study by Betim et. al[15], it was possible to categorize the effects in relation to ethanol production in terms of centripetal forces (*f*(+)), which provided positive effects, or centrifugal (*f*(-)), which provide negative effects on the fuel ethanol production process. a conceptual framework was built within the Graphic Raws platform [16] .

3 RESULTS AND DISCUSSION

Industrial production can simultaneously generate positive and negative externalities. Documental content analysis provided a view of what they are, from the perspectives of different authors (figure 1). Notably, sugarcane ethanol has many positive externalities, such as being a renewable energy source and having lower greenhouse gas emissions when compared to gasoline. when produced from sugarcane emit less GHG when compared to gasoline and it is biodegradable, which means it can be easily broken down by the environment. This all makes it a more sustainable alternative to fossil fuels such as gasoline, which are formed from non-renewable resources and produced for global warming [17] .

Within the ESG agenda, corn ethanol proves to be more one alternative sustainable complementary to that of sugar cane, for the fuel segment, this time adapted to all situation's climate and soil in Brazil. What causes the decentralization of production, stimulating regional development, a since the corn, in addition to being a production alternative cleaner, can be harvested no states of Rio Grande do Sul, Paraná, Mato Grosso and Goiás. The planting of sugar cane it is climate regions restricted cold [18.] Ethanol from sugarcane manages to reduce GHG emissions by 78%, compared to gasoline, while ethanol from corn reduces, on average, 19%. Second-generation ethanol, on the other hand, allows for even greater reductions, of 86% compared to fossil fuel. although it was one of the sectors most affected by the Covid-19 pandemic, it is likely that emissions will rise again as demand increases and uptake of alternative fuels remains limited [19] .

However, it is important to consider the possible negatives of sugarcane ethanol production and take steps to minimize them. Ethanol production can lead to degradation of soil and gas from air and water. Therefore, it is important to ensure that ethanol production is done in a sustainable manner. Another negative externality is not intensive use of fertilizers and pesticides, which can contaminate soil and water and affect human and animal health[20]. Furthermore, the production of ethanol from sugarcane can consume large amounts of water and energy, which can have negative environmental effects [21,22] .

To minimize the negative effects of sugarcane ethanol production, it is important to implement sustainable production practices and ensure responsible use of fertilizers and pesticides[20]. Furthermore, it is important to invest in more efficient technologies that can reduce water and energy consumption to production of ethanol from sugar cane[21]. According to Bordonal et al.[23] the production of ethanol from sugarcane is more accepted than corn , in terms of energy balance, since sugarcane provides 700% more energy than what it consumes to be produced. Corn offers only 20%. In addition, sugarcane ethanol (1st generation or 1G) is highly efficient in terms of energy balance, reduced water use and reduced GHG emissions when compared to other raw materials.

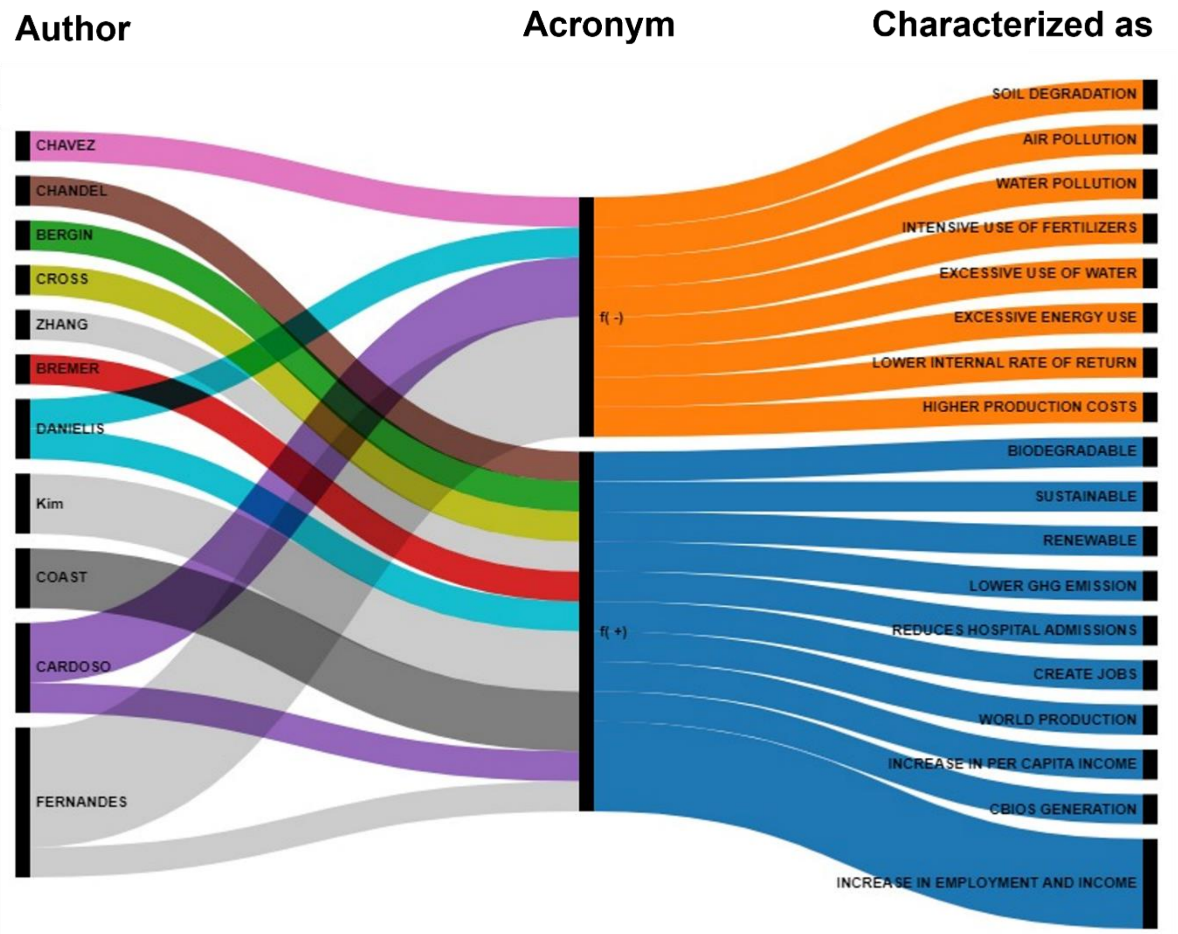
Ethanol industries where technologies were manual, the highest levels of job creation were observed; however, lower internal rates of return and higher ethanol production costs. In general, mechanized scenarios were associated with lower ethanol production costs and higher internal rates of return due to lower biomass production costs, higher ethanol production and higher electricity surplus. Considering the restrictions on burning sugarcane and the practical difficulties of manual harvesting of green cane, the environmental analyzes surprised that mechanized harvesting of green cane with straw recovery presents, in general, the best comparative balance [24] . Costa et. al [25] when analyzing the concentration of particulate matter n / D atmosphere in the state of São Paulo/BR in 2018, they verify a drop of 2.6% of the total PM2.5 fuel in the atmosphere (corresponding to 7.2% of concentration of particles associated with the transport sector). With this, they estimated that ethanol consumption, *ceteris paribus*, prevents 371 deaths per year, and the population 's life expectancy increases by 13 days from birth. If there is a 10% increase in the demand for hydrated compared to that seen in 2018, there would be 43 fewer deaths per year and life expectancy would increase by 1 more day.

Another positive externality of fuel ethanol is that it can be produced in several regions of the world, which means that it can help to diversify the energy production base and make it less dependent on fossil fuels, produced mainly in some countries. Martins et. al [26] studied the evolution of the Sugar and Alcohol Industries in terms of production, employment and wages from 2000 and 2009. They found that the Sugar Industry saw its production, employment and wage multipliers fall from 2000 to 2009. The Alcohol Industry, on the other hand, showed a significant increase in the production multiplier due to the still heated flex-fuel car market, but saw the other multipliers fall. The drop in employment and wage multipliers was mainly caused by the discovery of the pre -salt layer in 2007, which contributed to Brazil ceasing to carry out political projects for the ethanol market and focusing again without fossil fuel.

The results of this economic activity of fuel ethanol production can generate the positive n / A local economy of a region , such as increased gross domestic product - GDP 4.27 , gross domestic product - GDP per capita 28 , income increased employment income [26.29–31] . According to Ribeiro et. al [27] to reach the required level of decarbonization by 2029, ethanol production will grow by 87.7%, driven by the drop in its price compared to gasoline. Total fuel energy consumption would drop by 7.10% and frozen fuel would rise by 0.35 percentage points, while GDP would increase by just 0.08% in last year's scenario, when the price of CBIO would reach R$223.35 (like US$74.45). The authors infer that RenovaBio can be an effective policy to promote the reduction of carbon intensity and works as a protection against unfavorable scenarios to produce biofuels. Therefore, the policy can help Brazil achieve its nationally determined contribution by boosting the use of biofuels in the country's transport sector.

Companies involved in ethanol production can ensure that their activities are socially and environmentally responsible, as well as protecting their long-term self-interest. In addition, a company that uses these indicators to conducting organizational practices is more efficient in its performance analysis than before, when it used only the traditional financial and operational indicators[7,32]. Ethanol has a low production cost per unit of energy it produces compared to other fossil fuels[21]. Furthermore, when combined with multiple products, it has the potential to improve the economy of biorefineries and biofuel production[33].

Figure 1- Conceptual Framework of the Global Strategy for Reducing GHG Emissions (Source: The author).



4. CONCLUSION

The conclusion of this study is that ESG management is essential to assess and mitigate the impact of the ethanol industries in environmental, social and governance terms. While ethanol production has positive externalities such as renewable energy and reduced greenhouse gas emissions, there are also negative externalities such as soil degradation and pollution. Therefore, sustainable measures such as responsible production practices and efficient technologies are needed to minimize these impacts.

Companies involved in ethanol production can benefit from adopting ESG indicators into their organizational practices, as this allows them to assess their performance more comprehensively and identify areas for improvement. In addition, the use of ethanol can contribute to the diversification of the energy matrix, reducing dependence on fossil fuels.

However, it is essential to find an adequate balance between the externalities related to ethanol production, in order to guarantee social, environmental and governance benefits for all involved. Temperature control plays an important role in this process, and both companies and governments must seek an optimal balance between the factors involved.

In short, ESG management and the adoption of sustainable practices are crucial to ensure that ethanol production is environmentally responsible, socially beneficial and in compliance with governance principles. This will allow the ethanol industry to make a positive contribution to global sustainability, minimizing negative impacts and maximizing benefits to society and the environment.

Thanks

Thanks to Senai MT for the financial support and the professionals of Senai CIMATEC for the guidance and support.

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