Sustainability in EIS of sugarcane ethanol sector

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Introduction

Brazilian sugarcane ethanol is expected to play an important role in achieving sustainability (Filoso et al. 2015) by providing a relevant source of renewable fuel in the global energy scenario. Brazil is the largest grower worldwide and since 2003 sugarcane ethanol has been mostly produced for attending internal market of biofuels for flex fuel vehicles fleet (Goldemberg et al. 2008). However, there is a still current prospect for growth and also for import to supply foreign market (de Mattos Fagundes et al. 2016).

Notwithstanding, some recognized benefits for diversifying energy grid by using renewable sources there is a controversial debate with regarding sustainability of sugarcane ethanol production not only in Brazil but in other parts of the world such Southern Africa, Thailand and Latin America (Janssen; Rutz, 2011). Significant negative impacts are inherent in all stages of the sugarcane ethanol production process from agricultural to industrial phase. Brazilian ethanol has been subject of considerable criticism from the international market that crediting serious problems to environment and social matters to its production (Triana, 2011).

As a response to this growing concern on sustainability of expanding production of biofuels some traditional impact assessment tools have been recommended such as Life Cycle Assessment (LCA), Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). Of these instruments, EIA is broadly applied for assessing the planned expansion and expected impacts in sugarcane ethanol producer countries such Brazil (Gallardo and Bond, 2011a). To achieve sustainability the Brazilian sugarcane ethanol production has been using EIA guided by the Environmental Impact Statements (EIS).

In Brazil, since 1981, EIA is applied to projects that may cause significant effects to the environment (Montaño and Souza, 2015), when the Brazilian National Environmental Policy was introduced. According to Gallardo and Bond (2011a, b) the institutional framework for EIA in Brazil has some examples of good practice, especially in the State of São Paulo. For Sánchez and Silva-Sánchez (2008), in this state the EIA process is quite strong.

This research has as a problem the following question: is there a balance between the distribution pattern of the environmental, social and economic impacts of the EIS of sugarcane ethanol plants in the State of São Paulo?

The objective of this research is to explore how the Environmental Impact Assessment embraces the sustainability pillars in Brazilian sugarcane ethanol sector.

Methodology

This is an applied research based on exploratory-descriptive approach, performed through a multi-case study where data collection was accomplished by documental data. In Brazil there are currently 382 sugarcane plants capable to produce ethanol fuel, 357 in operation and 25 authorized, of these, 164 are located in the São Paulo State (ANP, 2016), the foremost Brazilian producer. Due to this reason we choose those sugarcane plants situated in the State of São Paulo - where there is evidence of good practice in EIA process (Sánchez and Silva-Sánchez, 2008; Montaño and Souza, 2015) Some ethanol plants have the Bonsucro environmental certification, specific to the sugarcane production chain, in search of greater sustainability (Jordão and Moretto, 2015). As a criterion of our research subject, we selected plants that have EIA and Bonsucro environmental certification. In

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order to meet these criteria, 12 plants were selected as subject of this research, with the selection of 12 Environmental Impact Statement (EIS) sector.

The theoretical framework from an extensive review of the literature regarding sugarcane expansion for ethanol production compiled by Gallardo and Bond (2011a and 2011b) was used for featuring sustainability – environmental, social and economic – issues in documental data. The documental analysis embraces the categorization of contents of 12 EIS, named EIS 1 to EIS 12. The categorization of each EIS of sugarcane ethanol enterprise mainly focuses on two of the main chapters of this report: impact analysis and Management plan that includes mitigation, offset measures and also monitoring plan.

Results and Discussion

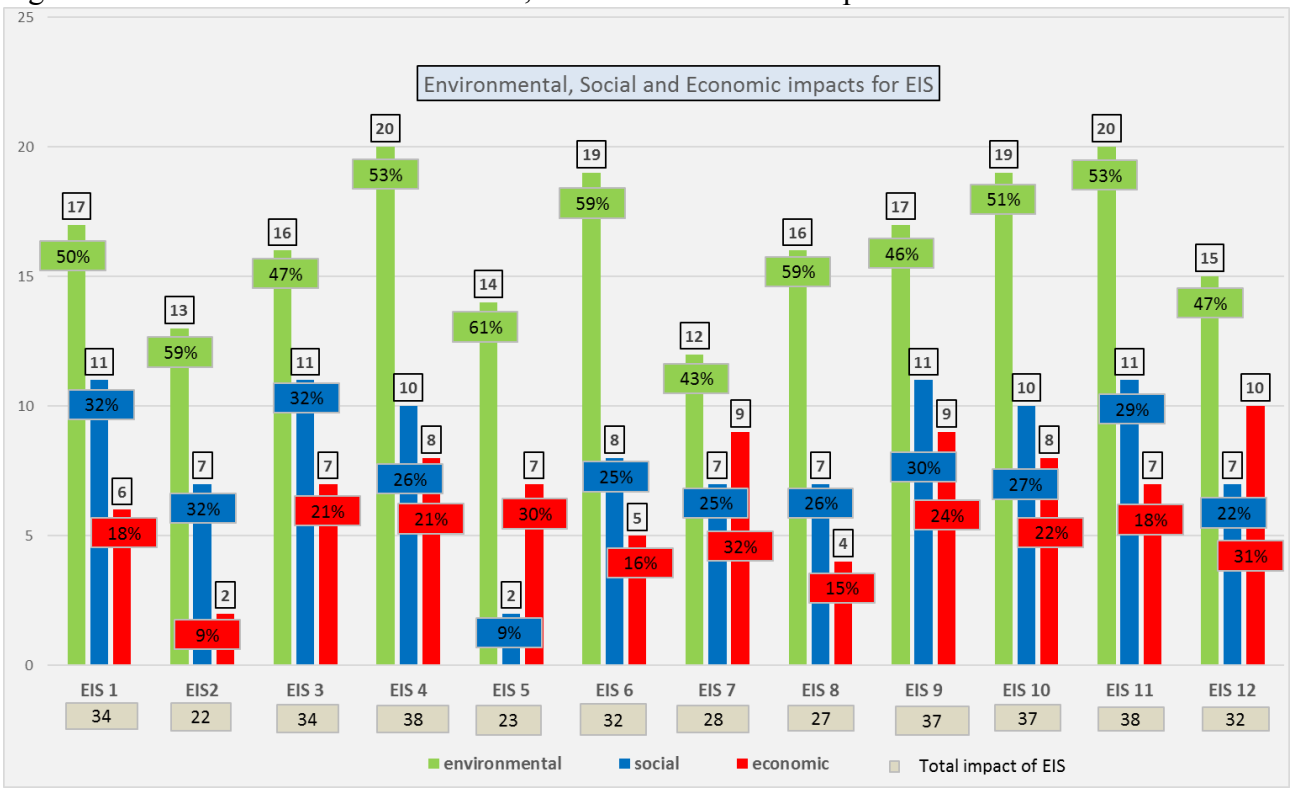
Table 1 presents the categorization of an EIS (EIS 3) that is a representative EIS in terms of impacts of the sugarcane sector, and Figure 1 consolidates the distribution of environmental, social and economic impacts for each EIS analyzed. In the first column are described the categorization of the impacts of the EIS 3. In the second column are described the management plans of such impacts. The third column is the classification of the category in environmental, social and economic.

Table 1 - Categorization of EIS 3.

Impacts	Managment Plan	Category
Affected protected areas	Environmental monitoring program; Communication and social participation plan	
People's expectations	Communication and social participation plan; Mobilization and staff demobilization program	
Pollution by construction site and construction works	Environmental management program; Soil conservation plan	
Urban facilities and services	Environmental monitoring program; Communication and social participation plan	
Vegetation removal	Integrated plan for permanent preservation area recovery; Wildlife conservation plan	
Earthwork	Environmental management program; Soil conservation plan	
Increased local noise level	Medical control of occupational health program; Hearing conservation program; Conservation program of environmental risks	
Tax revenues of municipalities	Communication and social participation plan; Mobilization and staff demobilization program	
Pressure of health infrastructure, housing and education	Inclusive policy of social welfare, health, housing and education;	
Pressure on public safety infrastructure of municipalities facing the arrival of workers from other regions	Communication and social participation plan; Mobilization and staff demobilization program	
Land use change for cropping sugarcane in areas occupied by pastures and other crops	Environmental monitoring program;	
Erosion process intensification	Soil conservation practices plan; Environmental management program	
Pressure on conservation areas	Agroenvironmental Protocol; Integrated plan for permanent preservation area recovery; Wildlife conservation plan; reforestation program	
Disturbance of wildlife	Monitoring wildlife program; Integrated plan for permanent preservation area recovery; Wildlife conservation plan	
Use of degraded areas by previous monocultures and pastures	Integrated plan for permanent preservation area recovery; Wildlife conservation plan; reforestation program	
Increase of jobs	Manpower qualification plan; communication and social participation plan; mobilization and manpower demobilization program	
Impacts on urban infrastructure that should meet the workers	communication and social participation plan; mobilization and manpower demobilization program	
Interference in archaeological sites	archaeological program; Heritage education program	
Pollution of surface water	Selection for use of pesticides; Handling and disposal of packaging control; Biological control; water resources plan conservation	
Groundwater pollution	Selection for use of pesticides; Handling and disposal of packaging control; Biological control; water resources plan conservation	
Changing the chemical soil	Selection for use of pesticides; Handling and disposal of packaging control; Biological control;	

quality	water resources plan conservation	
Risk to workers in the application of pesticides	Training of employees; Use of protective equipment; Safe storage of packaging and products; environmental monitoring program	
Pollution of surface water by fertirrigation	Fertirrigation practices control; water resources plan conservation	
Groundwater pollution by fertirrigation	Fertirrigation practices control; water resources plan conservation	
Job offer reduction in agriculture by mechanization	Manpower qualification plan; communication and social participation plan; mobilization and manpower demobilization program	
Impacts on traffic	monitoring and maintenance of roads program; Avoid transportation of heavy loads; Traffic control Program	
Increase road risks	Adequate cargo; safety conditions of vehicles; secure transport of agricultural machinery and implements.	
high consumption of water resources to meet the demands in the factory	water resources plan conservation; environmental monitoring program	
Pollution of surface water by industry operation	water resources plan conservation; environmental monitoring program	
Air pollution emission	environmental monitoring program	
Reducing pollution by ethanol use	environmental monitoring program	
Pressure on the road system	Traffic control Program	
Increasing of employment and income	communication and social participation plan; mobilization and manpower demobilization program	
Deactivation of industrial and agricultural activity	communication and social participation plan; mobilization and manpower demobilization program	
	Social impact – 11 Environmental impact - 17 Economic impact – 6	

Figure-1 – Distribution of environmental, social and economic impacts for the 12 EIS.



From Figure 1 the total of 382 impacts presented in the 12 EIS: 198 (52%) are environmental; 102 (27%) are social and 82 (21%) are economic. There is a strong predominance of environmental impacts (generally greater than 50% considering each EIS) then the social and economic impacts in all the EISs. Social impacts are the second category after environmental ones.

The number of economic impacts exceeded the social impact only in 3 EIS (EIS 4, EIS 11 e EIS 12).

The pattern of distribution of impacts between EISs is mostly similar showing that regardless of the particularities of each project the approach of EIA process mainly focuses on environmental matters. Morisson-Saunders and Pope (2013) highlighted that EIA represents a traditional way of assessment guided by a biophysical approach once project-based EIA is always not directed to strategic focus thus the scope of sustainability issues in EIA process is quite limited.

According to Bond and Morrison-Saunders (2011), EIA is considered an environmental advocacy tool rather than a more sustainability-related approach. In an EIA survey undertook in the UK, Chadwick (2002) reported that social impacts were rarely included and social and economic impacts were only limited to population data, potential employment opportunities and / or community infrastructure needs. Despite all the advances made in terms of EIA practice, in Brazil EIS has been developed with a purely environmental focus (GALLARDO; BOND, 2011) the data from this research corroborates this statement.

Socioeconomic impacts evaluation is historically relegated in EIS, doing by an imprecise and incomplete way according to Conde (2012). This analysis does not meet social demands and only serves to approve projects. Difficulties of quantifying some social impacts are also highlighted by Burdge (2012) who emphasized the need for considering social impacts within EIS, in order to provide a more sustainable perspective in EIA process. Greater participation of society is desired in all phases of the EIA process. For Thérivel et al. (1992) society's participation in the EIA process is quite limited however it is one of the challenges to be improved in this taking-decision process guided by EIS. For undertaking it is necessary provide a wider range of information.

According to Sheate (2012, p. 92) after review of 25 years EIA process in Europe some authors criticize a rationalist model of EIA supported by a weak view of sustainability. However some authors "argue that EA can support a strong view of sustainability, one that is rooted in its integrative concepts". Gallardo and Bond (2011a) reached the same results with a different sample of environmental studies in sugarcane sector in the São Paulo state. These authors demonstrated that the potential significance of social and economic impacts hasve been poorly considered.

The Social Impact Assessment (SIA) is proposed as an alternative to this constraint in the traditional approach of EIA (ESTEVES; FRANKS, VANCLAY, 2012). SIA can be used as an independent evaluation or within the context of EIA. In this sense a broader range of socioeconomic impacts would be an advance towards greater sustainability.

Conclusions

The research shows that there is a strong predominance of environmental issues on social and economic issues in all EIS analyzed in the ethanol sector of the state of São Paulo. It reinforces the expectation of literature where this imbalance is often encountered. To overcome this more environmental approach, some social and economic actors must become involved in EIA processes from the very beginning to the final decision-making phase, ensuring that more social and economic aspects are better addressed in the EIA of sector.

The involvement of society in the whole EIA process, from the beginning of the process to the final decision-making phase, would be a way of ensuring more social and economic would be better addressed.

In addition EIA process can be benefit of the development of social and economic indicators for assisting he assessment of social and economic impacts. As well as to bring professionals with experience in social matters for integrating the team responsible for EIS can be better enhance the balance of sustainability pillars.

Brazil has crucial social and environmental issues, such as large ecosystems, great biodiversity, great socio-cultural wealth, great social and educational challenges and a necessary economic growth and reduction of social inequalities. In this context sustainability is not mere requirement but an urgent necessity.

References

Art, J., Caldwell, P., Morrison-Saunders, A. (2001) Environmental impact assessment followup: good practice and future directions — findings from a workshop at the IAIA 2000 conference. **Impact Assessment and Project Appraisal**, 2001, v.19, n.3, p. 75-185.

Bond, A., Marrisson-Saunders, J.A. (2011). Re-evaluating sustainability assessment: aligning the vision and the practice. **Environ Impact Assess**, v.31, n.1, p. 1-7. Burdge, R. J. (2012). The practice of social impact assessment background. Impact Assessment and Project **Appraisal, v.21, n.2, p.84–88, Feb. 2012.**

Chadwick, A. (2002). Socio-economic Impacts: Are They Still the Poor Relations in UK Environmental Statements? Journal of Environmental Planning and Management, v.45, n.1, p. 3–24.

Conde, L. C. D. (2012). A análise dos Impactos Socioeconômicos na Estrutura do EIA/RIMA: A importância da abordagem humanista para a sustentabilidade. Rev. Adm., v. 5, Edição Especial, p. 799-804.

Esteves, A. M., Franks, D., Vanclay, F. (2012) Social impact assessment: the state of the art. Impact Assess Proj Apprais, v.30, n.1, p. 34-42.

de Mattos Fagundes, P., Padula, A. D., & Padilha, A. C. M. (2016). Interdependent International Relations and The Expansion of Ethanol Production and Consumption: The Brazilian Perspective. *Journal of Cleaner Production*.

Gallardo, A. L. C. F., & Bond, A. (2011) a. Capturing the implications of land use change in Brazil through environmental assessment: Time for a strategic approach? Environmental Impact Assessment Review, 31(3), 261-270.

Gallardo, A. L. C. F., & Bond, A. (2011) b. Investigating the effectiveness of environmental assessment of land use change: A comparative study of the approaches taken to perennial biomass crop planting in São Paulo and England. Biomass and bioenergy, 35(5), 2285-2297.

Goldemberg, J., Coelho, S. T., & Guardabassi, P. (2008). The sustainability of ethanol production from sugarcane. *Energy policy*, *36*(6), 2086-2097.

Janssen, R., & Rutz, D. D. (2011). Sustainability of biofuels in Latin America: risks and opportunities. Energy Policy, 39(10), 5717-5725.

Jordão, C. D. O., & Moretto, E. M. (2015). The environmental vulnerability and the territorial planning of the sugarcane cultivation. *Ambiente & Sociedade*, *18*(1), 75-92.

Montaño, M., & De Souza, M. P. (2015). Impact assessment research in Brazil: achievements, gaps and future directions. Journal of Environmental Assessment Policy and Management, 17(01), 1550009.

Morgan, R.K. (2012). Environmental impact assessment: the state of the art. Impact Assessment and Project Appraisal, v.30, n.1, p.5-14.

Morrison-Saunders, A., & Pope, J. (2013). Conceptualising and managing trade-offs in sustainability assessment. *Environmental Impact Assessment Review*, *38*, 54-63.

Sánchez, L. E., & Silva-Sánchez, S. S. (2008). Tiering strategic environmental assessment and project environmental impact assessment in highway planning in São Paulo, Brazil. Environmental Impact Assessment Review, 28(7), 515-522.

Sheate, W. R. (2012). Purposes, paradigms and pressure groups: Accountability and sustainability in EU environmental assessment, 1985–2010. *Environmental Impact Assessment Review*, *33*(1), 91-102.

Thérivel, R., Wilson, E., Thomson, S., Heaney, D., Pritchard, D. (1992) Strategic Environmental Assessment. London: Earthscan.

Triana, C. A. R. (2011). Energetics of Brazilian ethanol: Comparison between assessment approaches. *Energy Policy*, *39*(8), 4605-4613.

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