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THE POLITICAL NETWORK FROM ETHANOL: INFLUENCE AND POWER IN THE DECISION MAKING PROCESS

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Biofuels have been considered fundamental to partially replace fossil fuels and thus slow the global climate changes. In Brazil, bioethanol from sugar cane is predominant however its production and use have been queried by national and international community about their sustainability. In addition, it becomes important to consider that there is a political network embedded into the sector, which influences directly and indirectly in the bioethanol and sugar cane future. Thus, this article brought and discussed about sustainability, bioethanol and political network issues based on a literature review of the major authors and journals on these topics. Additionally this research presented a preliminary model for identifying the main actors and their relationships into the ethanol decision making network. We concluded that this model may help to identify essential attributes to be considered into the ethanol sustainability assessing.

KEYWORDS: Bioethanol, Sugarcane, sustainability, political network.

INTRODUCTION

Biofuels have attracted interest for policy makers and scientists by presenting themselves as potential replacements for fossil fuels. This is because the biofuels are considered a renewable and infinity resource, given that they can be produced from biomass. Furthermore, the greenhouse gases emissions, which cause disruptions in the global climate system, could be reduced by replacing the petroleum products and reducing their dependence.

However, there is no consensus about this issue in view of the fact the biomass production and its industrial processing require the use of fossil fuel energy in the fertilizers, pesticides, machinery and to transport raw materials and inputs. Nevertheless, monoculture can result in soil degradation, natural ecosystems destruction, and in some cases in competition for land use between food and energy productions (Pereira & Ortega, 2010).

The main forms of biofuels are bioethanol and biodiesel. Bioethanol or ethanol is the most important in the world market. The sugar cane ethanol is produced mainly in tropical areas like Brazil and Columbia, while in other areas, such as the United States, European Union and China is predominantly maize ethanol (Cheng & Timilsina, 2011).

In Brazil, the sugar cane ethanol has been used as fuel since many years. Anhydrous ethanol has been added to gasoline (up 25%) while the hydrate ethanol has been used as fuel since the 1970s with the introduction of cars powered by ethanol. Today, Brazil is the second largest ethanol producer in the world, and the first producer of sugar cane ethanol.

This scenario was made possible mainly because to government interventionist policies that subsidized the production and even the consumption of fuel this fuel, mostly from the 1970s as a the solution to the crisis and dependence on oil.

Understanding this scenario this article conducted a literature review on the topics sustainability of sugarcane ethanol and public policy. Therefore an analysis was performed to identify the most relevant papers, journals and authors related to the current discussion on the topics. In addition, a preliminary mapping and analysis was formulated about the political network from ethanol toward to understand its characteristics and how this affects the political process.

Sustainability or "Unsustainability" of sugar cane ethanol.

The media have focused on economic advantages and it has alleged environmental benefits about production and consumption of sugar cane ethanol. But in fact, scientific studies have shown that the reality surrounding the issue is further related to questions about the unsustainability of the activity.

Regarding the environmental dimension Pereira & Ortega (2010) claim that ethanol production is associated with significant consumption and damage of natural resources, which causes environmental impacts at local and regional levels. When considering the air component, the authors explain that the sugarcane ethanol production releases CO^2 due to the use of fuels and other industrial inputs during the industry and agriculture processing, as well as the transportation.

Considering the large scale ethanol production, this not only enhances the climate problem but also causes, for instance, the reduction of arable land to produce food crops, livestock competition with an excess of ownership ecosystems, among others which threats the preservation of biodiversity and the soil fertility (Gomiero , Paoletti & Pimentel, 2010) .

In addition to those ecological effects Gomiero, Paoletti & Pimentel (2010) warn about the social consequences, which may relate to: (1) food security, leading to an increase in the food price, (2) transnational corporations and large landowners instituting conflicts with small farmers because indigenous and subsistence areas. Nevertheless Hoefnagels, Smeets & Faaij

(2010) explain that before these points being questioned and debated many others should be investigated given that a large variation in performance can be found for the same type of biofuel, depending on the soil, the cultivation site, and on the allocation procedures used for sub products.

All this coupled to the expected increase in world population would result in the same way an increase in competition for natural resources among economic, urban, industrial, environmental sectors. This implies an impact, for example on the availability of water for producing foods and bioenergy (Stone et al. 2010; Huffaker, 2010).

The concern becomes larger when relating the water availability with climate change because higher temperatures and less precipitation increase the irrigation need. However, any increase in irrigation activity to adapt to the climate change would be restricted by water availability.

Despite the irrigation use for the production of sugarcane in Brazil is generally low the growing demand for ethanol can therefore expand the monoculture production for regions where irrigation would be complementary to the precipitation.

For better exemplification of the complexity and integration between different negative impacts, Pereira & Ortega (2010) evaluated the sustainability of sugar cane ethanol by Emergy Evaluation[1] and Life Cycle Analysis and thus examined the environmental feasibility of a large production scale. When considering the fossil fuels involved in the agricultural and industrial production phases the study indicated that 1.82 kg of soil are eroded and 18.4 l of water and 1.52 m^2 of arable land are needed to produce 1 liter of sugar ane ethanol. In addition, 0.28 kg of CO2 are released per liter of ethanol produced. The energy content of

[1] Emergy Analysis (EA "has been frequently used to evaluate production systems, mainly because it takes into account all the inputs needed to conduct a process: nature contributions (rain water, groundwater, soil, sediment, and biodiversity) and inputs provided by the human economy (chemicals, raw materials, machinery, fuel, services , payments , etc.). Besides results, AE provides quantitative information about the impact of the studied system associated with the environment and can be used to calculate the carrying capacity" (Pereira and Ortega, 2010).

ethanol is 8.2 times higher than the fossil energy required to produce it. Emergy indices indicate significant negative environmental impacts. The results of this study indicate that sugarcane and ethanol production present unsustainable when a large-scale production system is adopted.

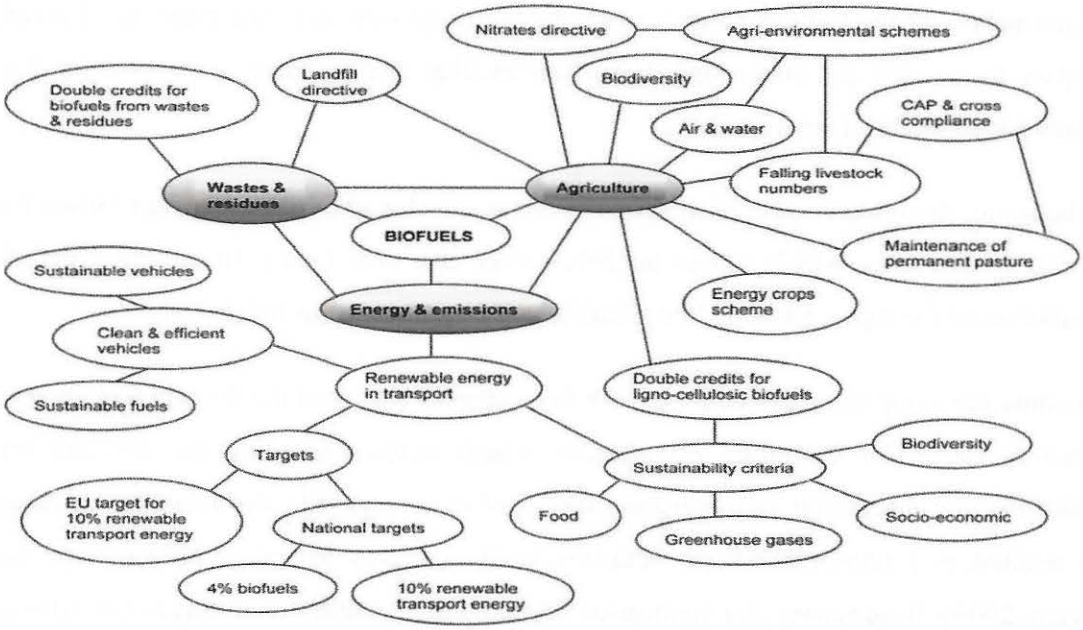
Nevertheless, the traditional productive means might not prevail in the future for the reason that bioethanol can also be produced from lignocellulosic materials such as agricultural residues, grasses, forestry and wood residues. In this case bioethanol is commonly named as 2nd generation bioethanol. Though, for its production s are needed efforts to develop advanced profitable technologies, seeing as the conversion of lignocellulosic material to ethanol is more difficult than of sugar cane and until now there are some challenges for the commercial applications of these technologies (Cheng & Timilsina, 2011) .

Public Policy and sugarcane context

Since 2003, governments around the world have implemented policies and programs to increase the production and use of biofuels (Whitaker, 2010), and the energy and agricultural policies are the policies that have addressed the most frequently deployment of biofuels. In the energy sector have been major concerns about the sustainability of biofuels systems, i.e. on how biofuels can achieve the production targets. On the other hand, the agricultural policy interests have been on the impact on food prices and on the proportion of agricultural land (Smyth et al., 2010).

However, not only specific policies affect biofuels. This subject permeates different policy areas and is also influenced by many other contexts, such as GHG emissions, waste management, among others. Smyth et al. (2010) support this view and present a framework (Figure 1) illustrating the complexity involved in biofuels production, with reference to the American scene.

Figure 1. Political network influence of biofuel production on the American scene. Source: Smyth et al. (2010).



By understanding the figure it becomes clear that the production and use of biofuels are heavily influenced by several policies resulting in a complex net of incentives and constraints.

METHODOLOGY

For the literature review initially were listed by the Web of Science - Database of Thomson Reuters - 150 articles considering the years 2000 to 2012. The keywords used for the search were sustainability, sugar cane ethanol and public policy. However we searched on the abstracts the presence of topics and discussions focused on the following topics : (i) economic sustainability, (ii) environmental sustainability, (iii) environmental sustainability, (iv) social impacts, (v) environmental impacts, (vi) ecological impacts, (vii) local impacts, (viii) regional impacts , (ix) sustainability assessment models, (x) energy policy (xi) social policy (xii) and agricultural policy.

The selected articles were analyzed by indexes from the analytical software HistCite. This software allowed us to identify the key literature about the topics and the most cited authors and journals with the highest number of publications, as well as it presented the descriptive statistics for groups and subgroups (mean and median citation rates of papers, number of authors per paper, etc.) among others.

Furthermore, the research also used dynamic tables developed by the Microsoft Office Excel software to determine which journal publishes more about the topics. Hence this article held discussions on the topics based on the HistCite and Excel softwares indications.

Regarding the mapping of political network from ethanol was used the Snowball method, also known as Geometric Sampling Propagation, which enables mapping the different actors involved in the discussion and decision-making process related to sustainability of ethanol. The method is a non-probabilistic sampling technique used to access hidden populations (Fávero, 2009). In summary, the application of the method enables recording actors who have relationships with those who originated the data collection. The procedure is repeated successively until the possibilities of new actors inclusion are exhausted and thereby the contours of the network set up.

The empirical object of this method is to build the network structure by the relationships among the websites. The method used the Internet feature to map the institutions by the hyperlinks and thus highlighted the actors who take party on policies and actions related to ethanol. This approach assumes that Websphere is a symbolic universe[2] and, consequently, it is possible to analyze the actors characteristics that compose it, its distribution, and the relations among them.

[2] According to Berger & Luckmann (1985, pg . 132), " the symbolic universe is conceived as the matrix of all the meanings socially objectifiedd and subjectively real [...]. At this legitimation level the reflexive integration of distinct institutional processes reaches its full realization. A world is created. [...] The institutional roles become participation modes in a universe that transcends and includes the institutional order."

The mapping started by UNICA website (Union of Sugarcane Industry) and followed up through hyperlinks found on this website. All institutions that have influence in São Paulo state were investigated. We considered relevant stakeholders those presented involvement in sustainability projects and partnerships. We measured up to three orders of distancing in relationships forming an integrated network among UNICA, ARES Institute (Institute for Responsible Agribusiness) and ABAG (Brazilian Association of Agribussiness). Unica is the initial actor linked to ARES which consecutively led to ABAG.

In operational terms the websites were mapped by applying the Snowball Method, identified and organized digitally through tables originated by Microsoft Excel 2010 software.

RESULTS AND DISCUSSION

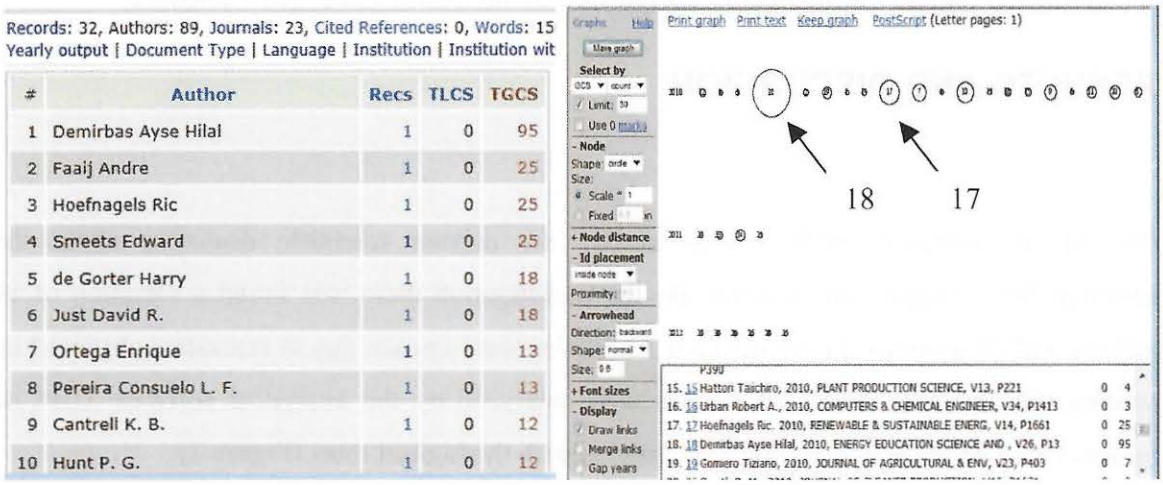
One of the research goals was to survey the current scientific discourse about the sustainability of sugar cane ethanol. By the investigation there was found a variation of 89 authors and 23 journals. From this total 32 articles were chosen due to relevance observed by reading the abstracts. Thus, 32 articles were analyzed by the analytical software HistCite indices being used for this research the articles with the highest rates (Figure 2).

Figure 2. Sample Articles with higher -analysis generated by HistCite .

#	Date / Author / Journal	LCS	LCS/t	LCSx	GCS
1	18 Demirbas Ayse Hilal **Biofuels for future transportation necessity** ENERGY EDUCATION SCIENCE AND TECHNOLOGY PART A-ENERGY SCIENCE AND RESEARCH. 2010 OCT 2010; 26 (1): 13-23	0	0.00	0	95
2	17 Hoefnagels Ric, Smeets Edward, Faaij Andre **Greenhouse gas footprints of different biofuel production systems** RENEWABLE & SUSTAINABLE ENERGY REVIEWS. 2010 SEP 2010; 14 (7): 1661-1694	0	0.00	0	25
3	10 de Gorter Harry, Just David R. **The Social Costs and Benefits of Biofuels: The Intersection of Environmental, Energy and Agricultural Policy** APPLIED ECONOMIC PERSPECTIVES AND POLICY. 2010 SPR 2010; 32 (1): 4-32	0	0.00	0	18
4	7 Pereira Consuelo L. F., Ortega Enrique **Sustainability assessment of large-scale ethanol production from sugarcane** JOURNAL OF CLEANER PRODUCTION. 2010 JAN 2010; 18 (1): 77-82	0	0.00	0	13

For the analysis of the most cited articles the research was based on the GCS index - Global Citation Score which shows the number of citations to the article. Another analysis was based on authors (Figure 3) considering the Recs index that shows the number of documents written by the author into the 32 records collection.

Figure 3. Most cited authors - Histcite.



Records: 32, Authors: 89, Journals: 23, Cited References: 0, Words: 15
Yearly output | Document Type | Language | Institution | Institution wit

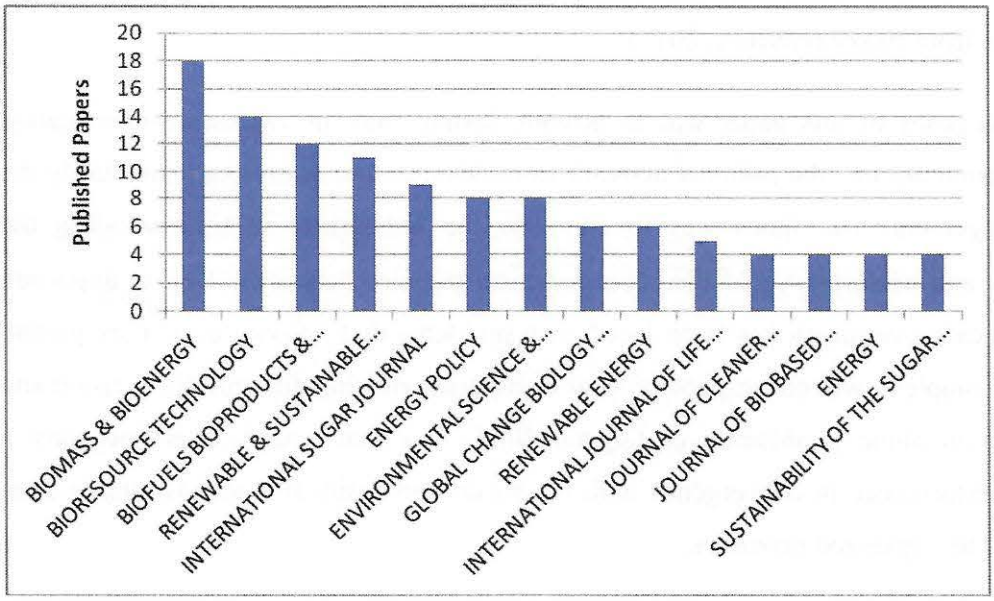
#	Author	Recs	TLCS	TGCS
1	Demirbas Ayse Hilal	1	0	95
2	Faaij Andre	1	0	25
3	Hoefnagels Ric	1	0	25
4	Smeets Edward	1	0	25
5	de Gorter Harry	1	0	18
6	Just David R.	1	0	18
7	Ortega Enrique	1	0	13
8	Pereira Consuelo L. F.	1	0	13
9	Cantrell K. B.	1	0	12
10	Hunt P. G.	1	0	12

In the graph generated by Histcite (Figure 3) GSC can be visualized due to the radius of each circle and the number of times that each article is cited in the databases. As a result, the articles number 18 and 17 are the most cited. Generally the graph is represented in network format with links between the circles representing the citation between authors. In this case the figure shows that the authors did not cite each other within the analysis. This is perhaps because the years related to selected articles are in a very small interval time which shows a close date of publication and therefore less integration. For the journals analysis was elaborated a dynamic table by Microsoft Office Excel software. Among a universe of 149 journals published about the themes 10 were highlighted with the greatest number of publications from 2000 to 2012 years (Table 1 and Figure 4).

Table 1. Journals with more publications about ethanol sustainability.

Spotlight Journals	Year											
	2000	03	04	05	06	07	08	09	10	11	12	Total
Biomass & Bioenergy	1					1	1	5	2	7	1	18
Bioresource Technology								3	6	5		14
Biofuels Bioproducts & Biorefining-Biofpr						3		2	1	6		12
Renewable & Sustainable Energy Reviews				1				4	3	2	1	11
International Sugar Journal					1	1	1	1	2	3		9
Environmental Science & Technology		1		2				2	1	1	1	8
Energy Policy						1	2	4		1		8
Renewable Energy								1	1	2	2	6
Global Change Biology Bioenergy									2		4	6
International Journal Of Life Cycle Assessment							1	2	1	1		5

Figure 4. Journals with more publications about ethanol sustainability.



The application of such procedures enabled to develop a theoretical quality for this article, and highlighted the key points that represent the current discussion surrounding the sugarcane issue.

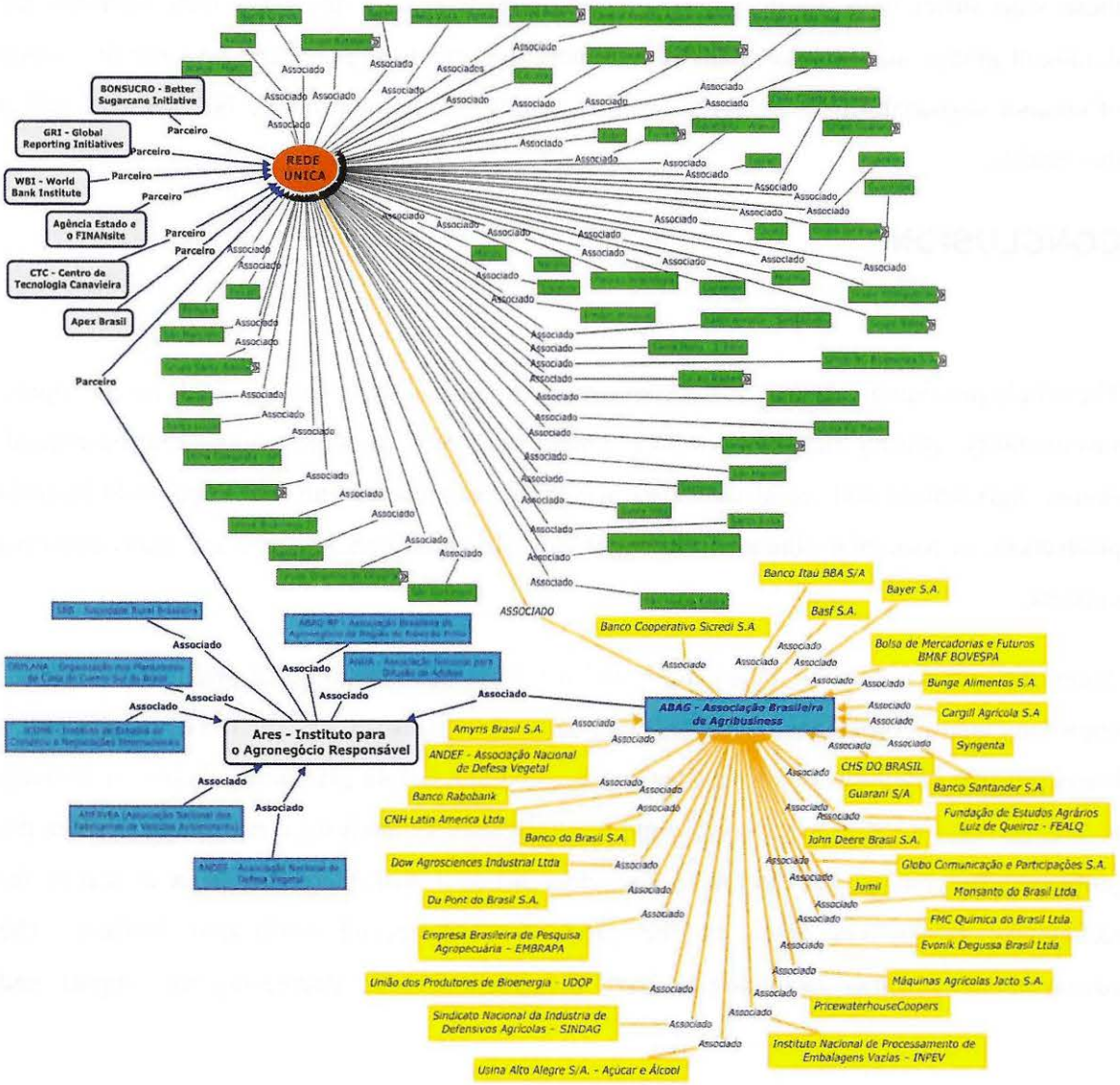
Additionally this paper attempts to outline a model for identifying the main actors and their relationships into the ethanol network decision making. In an attempt to map the political network from ethanol was used Snowball method. For this we performed a preliminary network (Figure 5) in view of the fact that the research is in early stages and represents the first step in a larger study. In this article the political network from ethanol should be understood as the group of actors involved in the political process while participating in the discussion on the sustainability of sugar cane ethanol.

The network designed by the Snowball method tends to be influenced by the relational characteristics of the original actor, knowing that this determines the inclusion of other actors in the network. Despite this Hanneman & Riddle (2005) warn that there should be a careful selection of the starting point for the data quality, i.e., for the data may represent the characteristics of the relations between the actors within the studied population. Soon, the actor chosen to initiate the mapping is UNICA the largest representative organization of sugar and bioethanol from Brazil (UNICA, 2012).

One of the purposes of this paper was to provide insight into the *ethanol decision making network* configuration, i.e., the political network from ethanol, demonstrating prematurely the network arrangement. The focus was to elucidate the importance in understanding the characteristics and performance of the socio-technical policies networks. This is important because the local government has been faced with problems that become ever more global, i.e. systemic, complex , without respecting local boundaries, making difficult the decision and response reaction alone (Goldsmith & Eggers, 2004). For that reason, it is necessary a government performance in convergence with the social and political demands arising from society shaped by organized networks.

The policy networks are a type of structure which integrates different interests and forms of governance, representing relations between state and society in the formulation and implementation of public policies. The policy networks are the idea that public policies are generated by the interaction of multiple interrelated agents who adjust their behavior to achieve converged strategic objectives (Kenis & Schneider, 1991).

Figure 5. Preliminary mapping of Political Network from sugar cane ethanol - State of Sao Paulo.



Thus, understanding these circumstances it is clear that agents alone neither solve problems nor seek effective solutions what demonstrates that the network approach has intrinsic relationship with decision making and public policy, and the characteristics and relationships of the ethanol network make all difference in the situational analysis in which it is the sustainability discussion.

The complexity does not reduce the need to understand what actors who handle greater power and influence in political decision because in this situation there are those who dominate and those who suffer with the decision. Understanding who they are, what their interests, the dominant groups and their attitudes is extremely important to understand how the discussion of ethanol sustainability is evolving. This is mainly because the public policies will reflect this reality.

CONCLUSION

The article presented a review of the latest and key authors, papers and journals on the topics: sustainability, ethanol and public policy. Therefore, it was possible to infer that ecological, energy, agricultural and social issues are widely interconnected and that large-scale biofuels production, in particular ethanol from sugar cane, triggers high pressure and many negative impacts.

About the current biofuels sustainability debate it has been heading for production systems, improving energy efficiency, and also specifically the performance of the life cycle product. It is evident that ethanol is not a panacea energy, and that before planning policies for biofuels on a large scale it requires a systemic and multidisciplinary analysis to contribute to solve the problems. In contrast the literature also demonstrated that there has been a search for technology alternatives, such as the production of second generation biofuels. The advancement in these technologies have the positive side: decreasing the impact and

protecting the environment, especially climate change. However, these technologies still have serious barriers to their commercial applications.

This paper has described some of the ways in which a political network can be modeled.We concluded that the complexity understanding about the social and political relations, even so relations that permeate new public spaces as the case in cyberspace, allows the conception of policy planning and management systems. Finally, policies to be appropriate in the planning and decisions about ethanol should consider all of these concerns related to many variables and interdependent subsystems.

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