COLLECTIVE ACTIONS IN THE PRODUCTION OF BIODIESEL: RESIDUAL FRYING OIL AS RAW MATERIAL

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Abstract

This paper aims at identifying the collective actions in the process that involves the collecting of residual frying oil directed to biodiesel production, in Brazil. We opted for a survey, with the purpose of seeking the several actions accomplished by associations together with the community and industries, configured as a qualitative analysis. It was verified that besides the associations, there are also schools, universities, city halls, companies, factories, supermarkets, among other organizations, acting in this process. The actions suffer strong influence from the institutional environment, and are put into practice by actors of distinct characteristics, which organize themselves through a sequence of stages. The members receive economical incentive apart, so that they act in favor of the collective objective. The action generates collective benefits for the individuals involved, besides upstream and downstream positive externalities, especially for the environment. Summing up, the collective action brings about collective gains, which individually, would not be reached.

Key words: *Collective actions. Biodiesel. Residual frying oil.*

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1. Introduction

A strongly debated issue nowadays is the sustainability of the planet. In this aspect, generating alternative energy, through renewable sources, is one of the most important measures the countries can adopt to have the contemporaneous way of life maintained, without unbalancing the system.

Among the renewable energy forms, biomass energy stands out in Brazil, through biodiesel production. It is a biodegradable fuel derived from renewable sources, which can be produced from animal fats, vegetable oil deriving from castor bean, oil palm fruit, sunflower, canola, sesame, soy and other vegetables, besides residual oil and fats discarded by households, commercial and industrial kitchens. Biodiesel can totally or partially substitute petroleum diesel oil on automotive and stationary engines, whereas it can be used pure or blended with diesel oil in several proportions.

In the diversity of raw material sources for biodiesel production, the residual frying oil is notorious, for its specific characteristics in terms of results obtained. Biodiesel itself already represents environmental and economical gains, no matter the source, for example, a reduction in gas emissions. According to Aranda (2007), biodiesel emits 1000 times less sulfur oxide and 78% less green house gases, compared to diesel.

Besides the general benefits, as well as other raw materials for the production of biodiesel, additional gains with the use of residual frying oil are brought about from factors such as: adequate destination to a residue that could generate severe environmental problems if inappropriately discarded in sinks, backyards and drains, i.e., it avoids pipe cloggings, raising of cost on sewage treatment processes, contamination of rivers and groundwater. Moreover, by selling the residue, it is possible to generate income and improvements for the communities, such as addressing budget to social inclusion projects and job generation; and it also takes charge of recycling the residue.

The environmental, social and economical gains that can be obtained demand the accomplishment of actions aiming at collecting the residual frying oil and directing it to biodiesel production. This process involves different stages with a great number of people involved, and it is not possible to accomplish it on an individual basis. For the viability of the transformation of this residue into renewable fuel, it is necessary the development of collective actions, i.e., that people with common objectives get together in favor of the group interests.

Given the above, this paper aims at identifying the collective actions existent in the process that involves the collecting of vegetable oil from residual frying directed to the production of biodiesel, in Brazil. Thus, this paper looks for answering some questions: What kind of organizations and actors have acted in this process? What are the incentive forms of these actors? In which way does the institutional environment interfere in these actions? What are the impacts of these actions?

It is assumed that the collective actions existent in the activity of collecting residual frying oil, aiming at using it as raw material for biodiesel production, afford a collective

benefit to the individuals involved, besides promoting positive externalities, upstream and downstream.

Concerning the structure, this paper was divided into six chapters, besides the introduction. In the first moment, the theoretical referential with regard to the Collective Actions Theory is presented, as well as a referential of the systemic approaching of productive chains and the governance structure of the associations analyzed in the biodiesel productive chain. Afterwards, the study presents a bibliographical revision concerning biodiesel and the environmental issue, conceptually characterizing the fuel and its specificities as for the use of residual frying oil as raw material, besides mentioning the legislation about vegetable oil recycling. Chapter four presents the methodological procedures of the study. In chapter five an analysis of the collective actions involved in the process at issue is developed, from a survey of some actions practiced in the country. At last, the final considerations of the study and the references are presented.

2. Theoretical Fundamentation

2.1 The Collective Actions Theory

The Collective Actions Theory aims at identifying the reason that leads the individuals to cooperate instead of developing their activities individually, free from the relationship to the other's contributions. To Laski (1939 apud Olson, 1999, p.18), "the associations exist to accomplish objectives that a group of people have in common". According to Saes (2000), the uprising of the organization is explained by the possibility of the individual reach something that by himself would be practically impossible, or that would be possible, however at higher costs. I. e., the sum of the collective actions isolated, in general, results in inferior net values than the collective action of people with the same interests. To Brito (2001), the reasons that lead to the formation of collective actions are several, and they may be of financial, social, cultural, political and technological character, among others.

In accordance to Hardin (1994), the collective actions are originated from the necessity of coordination, once the last one generates power and, thus, create sanctions that give motive to collective actions, i.e., it promotes instruments which maintain the collectivity. With the collective actions at level of cooperation without the power created by the coordination, the society emerges in conflicts and, therefore, one of the parts only gains something if the other one loses it. Sachs (2003) describes that the collective actions are configured in different formats of associations, going both through representations of political or trade union interests, and activities of purchasing, selling, services, prospection, and quality control. Sandler (1995, apud Nassar, 2001, p.27) defines the collective actions as "activities that require the coordination of efforts of two or more individuals".

One of the great contributions to this theory is found in the work of Mancur Olson, of 1965, entitled "The logic of Collective Action". According to Olson (1999, p.19), the explanation of the reason of the existence of organizations or associations was already comprised in the writings of Aristotle, in the same sense it is defined today, and: "(…) though organizations often also serve purely personal, individual interests, their characteristic and primary function is to advance the common interests of groups of individuals". The origin of this discussion is based on the Social Groups Theory which believes, according to Olson (1999), in its informal chain, that the human species is inclined to creating associations or

joining them, by instinct; in the formal chain, it is believed that the associations and affiliations to groups nowadays are reflexes of the evolution of the societies whose trajectory have gone from primitive to modern industrial societies.

When criticizing this traditional theory, through the argument that the informal variant does not show an explanation in fact and the formal one does not make distinction among groups, Olson (1999) distinguished small from large groups and analyzed their influences on the collective behavior, concluding that the smaller groups are more efficient. To the author, these groups move in favor of a collective benefit purely on account of the individual attraction the benefit has on each member. Whereas the large groups are inefficient and keep away from the optimal result of collective benefit, once smaller will be the action towards obtaining their common interests.

Regarding the taxonomy of the groups, Olson (1999) distinguishes them as nonmarket groups and, in this case, there are two kinds of small groups and one very large: in the so-called "privileged" group, the collective benefit is obtained without the need of coordination, since at least one member has incentive to make an attempt even if he is in charge of all the onus generated; in the "intermediate" group, one member by himself cannot afford the cost of providing the common interest, and his share in the benefit does not incentive himself to act, however, as they are not many members, it is easily identifed when a member is not helping to promote the collective benefit. Thus, the group benefit can, or not, happen, but it depends on certain coordination; in the "latent" group, the fact that this one is composed by a very large number of members, when one of them does not help, refusing his function, the others will not be significantly affected and, consequently, will not have reasons to inform against him. Such individual is known in the literature as the free-rider. His actions, properly accomplished or not, are imperceptible in face of the whole group, therefore, if not easily identified, he does not have incentive to act in favor of the collective benefit.

For this reason, Olson (1999) points out that even if all the members of a group are rational and focused on own interests, they will only act in a volunteer way aiming at the common or group objectives in case there is some incentive apart. These "selective" incentives can be negative, a form of coercion for the ones who do not fulfill their obligations, or positive, through incentives to the ones who act for the common interests of the group. The incentives for the large groups are, in general, of economical character, yet for the small groups where a lot of people value friends and social status, the incentives can be of social and psychological character, since people feel motivated to contribute on account of friendship, prestige, respect and social acceptance. The author does not discard the possibility of social incentives in the latent group since the same shows the characteristic of "federative" group, i. e., it is subdivided in smaller groups.

Nassar (2001) outlines that in the discussion of groups' taxonomy, Olson (1999) does not make reference to their heterogeneity, however, this is a characteristic of great importance as it generates conflicts among the members, interfering in the collective action. This same characteristic has already been mentioned by Zylbesztajn and Machado Filho (1998) as a limiting factor for the collective action, although the authors reason that an organization that involves conflicts of interests (heterogeneous groups) is able to generate higher competition of a whole productive system and, thus, more innovation. Nassar and Zylbersztajn (2004) also aggregate the heterogeneity of the groups to the concepts of large and small groups, discussed by Olson (1999). To them, the heterogeneity is related to generalist and disseminated objectives, what leads to conflicts among the members of the group. Thus, this group has

higher costs of transaction, promoting less satisfactory results of collective goods when compared to an homogeneous group, in spite of generating higher levels of innovation.

The work of Elinor Ostrom configures another important contribution to the Collective Action Theory. Ostrom (2007) focus its analysis on the comprehension of collective actions in an environment of social dilemma, since while some individuals cooperate, others opt by a ride in the contribution of the cooperators. Social dilemmas set individual rationality against optimal results to the group, i.e., if each member of the group develops actions that result in optimal benefits of his own interest, these same actions, in general, lead to suboptimal results, inferior to the ones that could be reached by collective strategies. Ostrom (2007) lists a series of structural variables that affect the probability of collective action with ideal results: a) the number of individuals involved; b) whether the gains are subtracted or shared in the whole; c) the heterogeneity of the members; d) communication *vis-à-vis*; e) production function form; f) information about the actions already occurred; g) the way the members are connected; h) if people can get in and out voluntarily. To these variables are added the reputation, the confidence and the reciprocity, which also affect the cooperation in an environment of social dilemma. To the author, the links among all the factors that influence the optimal result of the collective action are complex and, even though the actors involved have common interests, the relation cost vs. benefit is evaluated as negative or unfavorable, inhibiting efforts of collective actuation.

When Sandler (1995 apud Nassar, 2001) compared collective actions to the market, he developed a criticism denying the impersonal mechanism that is believed to exist in exchange relations. According to him, the existence of market economy is essentially dependent on the collective actuations. Furthermore, to Granovetter (1985), the economical behavior is deeply immersed into interpersonal relationship and the structure of these relations has much more influence than the organizational form, concerning cooperation and order.

2.2 Biodiesel productive chain and governance structures

As the theory suggests, biodiesel productive chain is composed by several segments interconnected. According to Cánepa (2004), in a generic form, the first link of the chain is represented by the inputs for agricultural production, followed by agricultural production and then by the industrialization of raw materials (vegetable oils, animal oils and residual oils and fats). After that, there is the biodiesel production, the next segment is the commercialization and, at last, the final consumer. All the interconnected links are influenced by the environment the chain is inserted, both institutional and organizational.

In this study, the collective actions are analyzed in the first link of the chain, upstream the biodiesel producer link, once the focus of the analysis are the associations and other organizations that collect the residual frying oil and supply the industry which will transform it into biodiesel. Thus, considering the biodiesel produced from the residual frying oil, the associations here represented configure the first link of the chain, whose sequence happens by the segment of biodiesel production, until reaching the final consumer.

These organizations, in general, are not shown in the economical system in the form of market or hierarchical firm. Their governance structure, i.e., their coordination has an hybrid form. The so-called hybrid forms of organization, as studied by Ménard (2011) can be exemplified by strategic alliances, networks, partnerships, franchising, associations, consortium, among other many organizations. They are characterized by a strategic core that coordinates the secondary actives, common among the companies, for collective activities

between two or more partners, i.e., they need specific mechanisms for the coordination of their collective actions, at the same time each partner has the ownership, the right of deciding and the profit of the main active that is exclusively his. The author inquired why a company decides to be hybrid, once that demands the loss of control upon essential rights, and argues that the fact the company does not choose to maintain itself in the pure market or to set off for full integration has an answer in the efficient form of allocation of resources: under determined conditions, hybrid organizations generate results closer to the ideal, resolving themselves better in the transactions.

Having said that, the object of the analysis is presented, already identified as biodiesel, as well as its specificities regarding the use of residual frying oil as raw material for its production. Moreover, the collective actions that have been accomplished by the associations configured in the first link of the productive chain of biodiesel produced from the residual frying oil are identified in practice.

3. Biodiesel and the Environmental Issue

Biodiesel is a biodegradable fuel derived from renewable sources, that can be produced from animal fats or vegetable oils (castor bean, oil palm fruit, sunflower, canola, sesame, soy), and the energy generated by biodiesel is called "renewable energy". Biodiesel substitutes, totally or partially, petroleum diesel oil in automotive (trucks, tractors, cars) or stationary engines (heat and electricity generators), since it can be used pure or blended with diesel in several proportions (MDA, 2012). In conformity to Parente (2003), besides vegetable oils and animal fats, residual oils and fats resultant from domestic, commercial and industrial processing, also constitute raw material for biodiesel production.

With the approval of Law 11.097/2005 by the federal government, regarding the National Program of Production and Use of Biodiesel, which provides the blending of biodiesel with diesel, aiming at obtaining economical, social and environmental benefits, the debate about the use of biodiesel began to effectively make part of the public and private actions. This law established that the diesel oil commercialized in Brazil, from 2008 on, should contain, at least, 2% of biodiesel, mixture that started to be known as B2 and, from 2013 on, this percentage would compulsorily be elevated to 5% (B5). However, since January 1st, 2010, the diesel oil commercialized in Brazil began to contain 5% of biodiesel, which demonstrates the production of biodiesel on a large scale (ANP, 2011).

Among the economical, social and environmental advantages of the production and use of biodiesel, it is highlighted that the economical ones are originated by the crescent increase of petroleum prices and the finite offer of fossil fuels, whereas the production and use of biodiesel bring the perspective of a decrease in importation of diesel oil, besides other indirect effects such as the increment to local and regional economies, both in agricultural sector and services/goods industry. With the expansion of biodiesel market, some Brazilian families are benefited, creating job opportunities and generating income, proceeding from the cultivation and commercialization of the oleaginous plants used in biodiesel production (ANP, 2011).

Concerning the positive effects on environment, since biodiesel is produced from materials originated in the photosynthesis, it provokes the decrease of main vehicular emissions in comparison to diesel derived from petroleum, whereas its combustion does not

increase the concentration of atmospheric carbonic gas (CO2), which does not occur with the diesel derived from petroleum (MDA, 2012).

Considering the importance of sustainable development, the use of alternative raw materials for biodiesel production is notorious, as in the case of residual frying oil. Castellanelli (2008) corroborates this, stating that the use of biodiesel has showed a promissory potential: initially, by its contribution to environment, with the qualitative and quantitative reduction on environmental pollution levels, and, also, as strategic source of renewable energy in substitution to diesel oil and others derived from petroleum. In this context, the emergence of the use of residual frying oil is a raw material that can be transformed into biodiesel, and that formerly would be wasted and dumped in the environment in a wrong way.

3.1 Residual frying oil as raw material for biodiesel

Vegetable cooking oil is a major item on human food. According data from Brazilian Association of Vegetable Oil Industries (ABIOVE), each person in Brazil consumes on average 20 liters of vegetable oil a year, and due to lack of awareness by the population and public policies for collecting frying oil used in households, bars, restaurants and snack bars, almost all the residual oil generated is estimated to be discarded inadequately – thrown in the sink strainer, going down the sewer system, causing impermeability of river beds and contaminating groundwater and water fountains (FLORES, 2009).

The residual frying oil is not as thick as water, and because of this it forms a pellicle on it, causing the retention of solids, clogging and draining problems when poured in sinks or toilets. In rivers, seas and lakes, the pellicle formed by the cooking oil difficults the gases exchange between water and atmosphere, causing the death of fish and other living organisms that need oxygen (PORTO ALEGRE CITY HALL, 2012).

The recycling of used frying oil provides the reduction of costs with water treatment, eliminating an environmental passive resulting from the emission of chemical products necessary to the treatment, besides a significant gain for the society.

According to Pitta Jr. et al. (2009), residual frying oil as raw material for biodiesel productive process may aggregate economical value, reducing the cost of the final derived product in relation to the case in which this one was produced as virgin raw material, and also preserving the environment. The collecting of residual frying oil can also be used to manufacture paints, soap, detergent, ration, glycerin, among others, since discarded adequately.

To Pitta Jr. et al. (2009), a series of stages is necessary so that the return of cooking vegetable oil is transformed into a new raw material, and they are: packing, collecting, storage and transportation to the production location. The packing, in the case of residences, can be done through containers with capacities varying from 500 ml and 2 liters; and at commercial establishments, the containers can have capacities varying from 20 to 50 liters.

For households, these containers are taken to a volunteer delivery point and can have its content poured into a tank with larger capacity, depending on the strategy adopted by the collecting company. The collecting is usually done by a vehicle adapted to receive containers from 20 to 50 liters or with a tank and a suction hose. For storage, also depending on the strategy of the company, the content of the operation can be sent directly to the costumer, or the product is stored until certain quantity is reached before going to production, and it is

possible, or not, to filter the product, removing all impurities of the food that was in contact with the oil (PITTA JR. et al., 2009).

According to these stages (packing, collecting, storage and transportation), nowadays there are already several projects involving collective actions which are developed with the purpose of bringing immediate benefits to communities, industries and, mainly, to environment. These projects will be explained later on.

3.2 Legislation about recycling actions of residual frying oil

Up to now, there is no knowledge about specific federal laws on the discarding of cooking oil. It can fit in the category of urban solid residues generated by households and commercial establishments, or by any other activity that generates solid residues with domestic characteristics. Nevertheless, the absence of an explicit mentioning of cooking oil can hamper the correct discard or the recycling by establishments and citizens, so it would be necessary to create concrete conditions that hinder the release of oil in nature, to incentive the recycling and to supervise the establishments (FLORES, 2009).

Since September 19th 2007, the Draft Bill nº 2074/2007 has been following the legal channels in the Federal Congress, which determines that service stations, hypermarkets, companies which sell or distribute cooking oil and similar organizations are obliged to maintain structures intended to collect residual frying oil, as well as other measures. This project has also other attachments, such as Nº 2075/2007, determining that companies which produce vegetable oil must inform on the labels about the possibility of recycling the product and maintain adequate structures to collect the oil discarded, and, Nº 2076/2007, that resolves about the duty of organizations generators of discarded cooking oil to direct the residues to recycling processes (CÂMARA DOS DEPUTADOS, 2012).

According to Flores (2009), there are some state initiatives, such as the legislation of São Paulo, with the law nº 12.047/2005, determining the creation of a State Program of Treating and Recycling of Oils and Fats of Vegetal or Animal origin and Cooking Use. The state of Mato Grosso do Sul also has specific legislation (Law nº 3.419/2007), which dedicates one chapter to oil recycling, prohibiting the throwing of grease and frying residues in the sewer system. So, these residues must be directed to collecting and posterior transformation into biodiesel, through cooperatives formed by families with low purchasing power, and which familiar income does not exceed the minimum wage.

In accordance to Castellanelli (2008), beef tallow and residual oils are raw materials that are not contemplated in PNPB (National Program of Production and Use of Biodiesel), i.e., they do not permit the acquisition of Social Label and, therefore, they do not guarantee tax exemptions to the manufacturer. Thus, there is no advantage in acquiring these raw materials, due to lack of incentive. To the author, residual oils should be inserted in the PNPB, since this important input for the production of biodiesel has been largely destined to pollute groundwater, damaging the environment. Thus, the author considers necessary the creation of campaigns and incentive to the implantation of cooperatives that aim at its collecting, so that it facilitates the guarantee of competitive prices, biodiesel quality and supplies, besides expanding the social inclusion to urban zones.

4. Methodologies

This research, which aimed at identifying the collective actions existent in the process of collecting residual frying oil, developed by associations together with the community and industries, was configured in a study of qualitative approach, of descriptive character.

The information and data used were secondary, having as main sources web sites of associations and other organizations.

The cutout in time was not delimited, although the action analyzed is a recent practice. The study indicates actions developed on a national basis, and represents just a sample, once the characteristics of the research and the object of the analysis hamper the exact knowledge of the population.

5. Results and discussion

This chapter is intended to identify examples of collective actions developed to collect residual frying oil to be used as raw material in biodiesel production. In Chart 1, some programs accomplished in Brazil are listed, and afterwards, an analysis of the theory of collective actions observed in these programs is presented.

Chart 1- Examples of residual frying oil recycling programs

Program	Description
"Bióleo"	This program was implanted in August 2009 and has the partnership of Petrobrás with *Essencis* Environmental Solutions and PNBE Institute (National Thought of Corporate Bases). The program consists in the mobilization of NGOs, communitarian or neighborhood associations, or any other kind of entity that has an effective socio-environmental program so that they can start to act in a network receiving and collecting this residue. In the households, the population is instructed to store all the leftover frying oil in a pet bottle or in a similar recipient and when the bottle is full they take it to the nearest collecting point. It is also possible to accomplish the condominium collection, at apartment buildings or residential complexes that provide a container where each dweller can deposit the used oil. Restaurants, bars, pastry shops and snack bars that use large quantities of oil can become receiving points of their own residual oil, besides schools, clubs, religious institutions, business establishments, which can also become receiving points. "Bióleo" Program provides the containers (drums). After stored in proper way, and with a volume that justifies the collecting, the material is transported to be blended with mineral diesel oil of Petrobrás, and all the income proceeding from the sales of cooking oil is reverted to social programs in the communities, such as: alphabetization courses, education for senior citizens, communitarian vegetable gardens, purchase of school supplies and reform of gardens and flower-beds around the cities (MELLO, 2010). "Bióleo" program has more than 100 partner associations, located in 5 cities of São Paulo state and 15 districts of the Greater São Paulo that act to receive, gather and collect residual frying oil (PNBE, 2012).
"Papa Óleo" Project	ABRASEL (Brazilian Association of Bars and Restaurants) in partnership with the Tourism Ministry and SEBRAE (Brazilian Service of Support to Micro and Small Enterprises), created the project "Papa Óleo" as a pilot project, accomplished by ABRASEL Bahia. This program regards to a Social Responsibility Fund, which is a bank account opened specially to receive resources to benefit charity actions and institutions. In the project, the partner collecting company must deposit in this fund, the value of R$ 0,30 for each liter of oil collected, confirming thus the characteristic of socio-environmental responsibility project. ABRASEL acts as a kind of catalyzer aiming at extending the process of adequate and safe collecting of oil and accomplishing actions to promote and give visibility to the organizations that joined the project. It is pointed out that the little knowledge about residual oil recycling makes it difficult for the collecting companies to enlarge the collecting process in the establishments, due to lack of care

	in the maintenance of the oil in good conditions. Thus, ABRASEL played this role, of mobilizing and sensibilizing the entrepreneurs and professionals from bars and restaurants, eliminating barriers and communicating the positive results deriving from the activity of recycling, from the massive utilization of all the advertising material of the project such as flyers, posters, certificates, menu stickers, drum stickers, booklets, video, considering the advertisement rules of compulsory inclusion of the brands ABRASEL, "Papa Óleo", SEBRAE and Tourism Ministry in all the promotional pieces locally created (ABRASEL, 2012b).
Bunge's Soya Recycles Program	The multinational Bunge, through the product Soya, released the program Soya Recycles together with Triângulo Institute (Organization of Civil Society of Public Interest) (OSCIP), certificated by the Justice Ministry, that has as objective to mobilize the population to the urban ecological practice. The program has more than 150 points to receive oil residues installed in supermarket chains in the city of São Paulo, littoral and ABC Paulista. The material collected is taken by cooperatives that recycle it, transforming the oil into biodegradable soap, paints, and biodiesel, since these products resulting from the recycling are commercialized by the cooperatives, turning into income and contributing to the sustainability of these associations. During the initial stage of the project with the purpose of increasing the recycling and the sales of the product, Soya distributed to the costumers who bought three oil cans of the brand in the supermarkets taking part in the action, a special funnel to collect the oil, to incentive them to collect and store the used cooking oil in pet bottles (FLORES, 2009; BUNGE, 2012).
AFUBRA's Saturated Oil Collecting Program	AFUBRA (Brazil's Tobacco Growers Association) started in 2009 the Saturated Oil Collecting Program, comprising 69 cities of the three States in the South of the country, 401 schools, more than 121 thousand students and more than 14 thousand teachers and servants. From 2009 to 2011, the Program collected near 121 thousand liters of oil, and almost 60 thousand liters were collected in the last year. The oil is collected by the schools, which make the first filtration and deliver it at the AFUBRA branch where they are registered. The branch directs the saturated oil to the Bioenergy Plant installed at Expoagro AFUBRA Park, in Rio Pardo – RS, and the plant transforms it into biodiesel, used in the vehicles of the Association. As there is a large number of individuals involved, i.e., it is a "latent" group, there is the necessity of incentives apart, and, in this case, the Association provides an economical bonus of R$ 0,50 per liter of oil received to the school that can be exchanged for goods at AFUBRA Agro-Commercial stores (BIODIESELBR, 2011).
Acácia Coopera-tive and UNIARA in Araraquara Project	Acácia Cooperative of Collectors, Collecting, Sorting and Processing of Recyclable Materials of Araraquara together with UNIARA (Araraquara Universitarian Center) developed a project to collect used cooking oil and direct it to biodiesel production, to supply, in 2012, the trucks of selective collecting of recyclable garbage in the city of Araraquara – SP. The cooperative is in charge of collecting the oil and send it to Triangulo Foods industry, another partner of the project, so that the oil can be filtered. Afterwards, the oil is sent to UNIARA and transformed into biodiesel in the university laboratory. Both trucks consume one thousand liters of fuel per month and the use of renewable fuel will result in a monthly economy of around R$ 2,000.00. Moreover, in this same period, the vehicles collect 400 tons of recyclable material, therefore, the environmental benefits are significant, double obtained. (BIODIESELBR, 2012a).
Chain of Recyclable Solid Residues Collectors of Ceará State and Cuidar Program	The Chain of Recyclable Solid Residues Collectors of Ceará State joined Petrobrás Biofuel and installed in Fortaleza the Primary Treatment Station of Residual Oil and Fats. The station has capacity to filter 30 thousand liters of cooking oil per month and collaborates with another project, Cuidar Program, which has as purpose to collect the cooking oil discarded by hotels, restaurants, bakeries, snack bars and households in Fortaleza and direct it to the production of biodiesel in Quixadá Plant. Besides this partnership in the state of Ceará, Petrobrás Biofuel has biodiesel plants in the State of Bahia and Minas Gerais, where it also maintains partnerships with cooperatives, associations and collectors' entities. The collective action provokes, besides social and environmental gains, economical gains to the industry, once it obtains the raw material at competitive prices (BIODIESELBR, 2012b).
Birigui City Project	In the city of Birigui, west of São Paulo, the brothers Marcos Menami and Robson, decided to collect residual cooking oil with the objective of giving an adequate destination to the residue, producing biodiesel from it. In 2007, they mapped the city into five regions and started the collecting. In partnership with a radio station they announced a phone number, so that they would be informed of determined points where they could drop by to collect the material.

	Besides, they formed a partnership with a cooperative that already accomplished the selective collecting of solid residues at condominiums, in order to increase the collecting of discarded vegetable oil. As a form of incentive, at each 5 liters of oil the individual brings, he receives cleaning supplies, result of another partnership with a manufacturer in the city, or a discount of 20% to buy a new can of oil. In the schools, the city hall accomplishes lectures of environmental awareness stimulating the students to bring the used oil from their houses to be recycled. As compensation, the project distributes sweets and popcorn at each 100 liters of oil collected to motivate the children (BIODIESELBR, 2012e).
PROL – Frying Oil Recycling Program	PROL is a program to foment frying oil recycling, especially in the cities operated by the Basic Sanitation Company of São Paulo State (Sabesp). Due to the success obtained, the increasing interest, relevance of the issue for the environment and income generation to needy community involved in the residues collecting and aiming at the preservation of the sewer system unclogged, Sabesp decided to support more proposals. Among them, the ones organized together with the City Halls of Osasco, Itapetininga, Lins, Jales, Presidente Prudente and Pindamonhangaba, in partnership with local entities. As for example, in Registro, the project involves the Commercial Association (ACIAR) and the NGOs IDESC and Cidadão Catador and in President Prudente, Cooperlix (SABESP, 2012).
"Gari do Óleo" Project	Created by Biosantos Institute in 2009, the project is also supported by Sabesp and the initiative collects around 12 thousand liters a day, in Santos. Each district has an agent who is responsible and works properly uniformed, and receives training on the collecting and daily discard of households and small business, making easier the acculturation of such procedure with the creation of 26 new local jobs, contemplated with low income people. It is possible to increase this number, with the expansion of the project "Gari do Óleo" to other cities in the region. In Santos, there are 1.376 ecopoints among households and business (SABESP, 2012).
RENOVE Project – Environmental Recuperation of Tietê River Basin Project	Released by Bio-Bras Organization in 2008, "RENOVE" Project – cleaning-up of rivers through collecting used vegetable oil – started in Mogi das Cruzes. The results of the project surpassed the initial expectations and gained space in supermarkets, churches, schools and business in the region, which joined the project of helping the cleaning-up of rivers and streams of Alto Tietê, installing Eco-Points so that the population has a place to take the vegetable oil used in the kitchen. With the sponsorship of Petrobrás, through Petrobrás Environmental Program, the goal is to expand even more the coverage of the project, since the purpose is to reduce at least 20% of the pollution of Tietê River by vegetable oil, using as tools Environmental Education, Popular Participation and Social Campaigns (BIOBRÁS, 2012).
PROVE - Reuse of Vegetable Oils and Dial-Used-Vegetable-Oil Cooperative of Rio de Janeiro State Program	This program was created in 2008 by the Environment Secretary in partnership with Manguinhos Plant, Technological Incubator of Popular Cooperatives (ITCP/COPPE/UFRJ), Recyclable Material Collectors Cooperatives Federation (FEBRACOM), National Movement of Recyclable Material Collectors (MNCR) and Independent Chain of Recyclable Material Collectors of Rio de Janeiro State (RICAMARE), since ITCP/COPPE/UFRJ renders advisement to the cooperatives that take part in PROVE, helping out the administrative organization, the political management and the oil collecting logistic, implemented in the Metropolitan Region of Rio de Janeiro (ITCP/COPPE/UFRJ, 2012). In 2012, Prove surpassed the frontiers of the Metropolitan Region, reaching the Central and the South Regions, and in the first semester of 2011, Prove reached the North and Northwest Regions (GOVERNO DO RIO DE JANEIRO, 2012). Through Dial-Used-Oil Cooperative in Duque de Caxias, 200 thousand liters of used oil have been collected per month and the incentive to the collaboration of the agents occurs by the payment of R$ 1,00 per liter. In the State of Rio de Janeiro, the collective action accomplished by collectors, 30 cooperatives, condominiums and more than 80 bars, hotels, restaurants and other organizations tripled the collecting of used vegetable oil, from 2009 to 2011. The institutional environment influenced the action, and a plant of transformation of oil into fuel was built to use the fuel in the fishing boats of Arraial do Cabo, through the support of the government of Rio de Janeiro. As for 2012, it is expected the installation of another plant in Petropólis and also another one somewhere in Copacabana, on account of the discard of oil by 70 hotels and 120 restaurants in the neighborhood. Another institutional influence was a Municipal Decree, of 2010, prohibiting the inadequate discard of vegetable oil by legal entities. Moreover, residential buildings with piping for discard and storage of the oil are being built

	(BIODIESELBR, 2012c).
"Cata Óleo" Project	The project is developed in partnership with USP and LADETEL (Clean Technologies Development Laboratory) in Ribeirão Preto. All the oil collected is used in biodiesel production. The laboratory has mapped around 500 bars and restaurants of the city and concluded that it can collect up to 20 thousand liters of the product a month. (PAUDA, 2012).
Biodiesel in homes and schools Project	This project was also started by LADETEL (Clean Technologies Development Laboratory) and BIODIESELBRASIL. The project regards to a wide environmental program in partnership with governmental and non-governmental education institutions, with housewives and other institutions of environmental responsibility. The project acts in the region of Ribeirão Preto, Franca, São Carlos, Passos/Itáu de Minas, Jaboticabal, Araraquara, Matão. A character called BIO (a chemist caricatured in form of doll) will be displayed in the places where there is environmental responsibility, so that these places will be identified as "*environment's friends*". (BIODIESELBRASIL, 2012).
"ReÓleo" – ACIF Program of Cooking Oil Recycling	"Reóleo" began in 1998, in Lagoa da Conceição – Florianópolis. ACIF (Florianópolis Commercial Association) manages a program which gives personal, institutional and material support. Restaurants, bars or other business establishments, generators of residue, contact ACIF to take part in the program, which receive the drums for storage. A collecting company takes the entire residue collected, periodically, to COMCAP (Capital Improvements Company) Storage Central, in the district Itacoruby (GUIA DE FLORIANÓPOLIS, 2012).
Trevo NGO	Working for 18 years, Trevo NGO began its activities in February, 1992, and is one of the pioneers in collecting and recycling oil residues and frying fats. Located in the district of Mooca, East of São Paulo city, in an area of 1.500 m^2, with an infrastructure of tanks with storing capacity of 150 thousand liters of recycled frying oil and collecting around 250 tons/month of residues at more than 2 thousand establishments registered, among restaurants, companies, hospitals, clubs and condominiums. The collected material generates raw material for soaps, paints and varnishes, animal ration, biodiesel, etc. The monthly production of Trevo NGO is around 300 tons of oil, besides receiving donations, Trevo NGO purchases oil for R$ 0,30. The origin of the material purchased by the company is, in its majority, from the collectors and establishments. The collecting process occurs this way: the drums (plastic containers identified with labels informing telephone numbers and web sites for contact) are left, with capacity to store up to 50 liters of frying oil, in major centers generators of residues, such as bars, restaurants, bakeries, hotels, motels, hospitals, companies, etc. The frequency of withdrawals of the drums (weekly, fortnightly or monthly) depends on the quantities of oil generated in each withdrawal point. The oil is sold, in its majority to a company in Rio de Janeiro/RJ, they are about 50 to 100 tons/month, and the transportation to Rio de Janeiro is done through own fleet and, in its minority, by an outsourced fleet where the costs of transportation are from responsibility of Trevo NGO (MATTOSINHO e SILVA, 2010).
ECÓLEO	ECÓLEO (Brazilian Association for Awareness, Collecting, Reuse and Recycling of Edible Oil Residues), non-profitable entity, counts on 12 companies associated collecting and processing oil in more than 60 cities in São Paulo, generating 1200 direct and around 800 indirect jobs, collaborating to the preservation of waters. In the Great São Paulo, the entities collect more than 1.700.000 (one million and seven hundred thousand) liters of used vegetable oil per month, around 5% of the volume consumed in the region (ECOLÉO, 2012). An example of action of collecting and recycling cooking oil, promoted by ECÓLEO was in the district of Cerqueira César, central area of the capital, which reduced in 26% the number of cases of clogging in the sewer system in the region between 2008 and 2009. According to SABESP, the calls to unblock ducts decreased from 727 to 539. Besides, the program, which had adhesion of more than 1.500 of the buildings in the region, saved public money that would be spent with operations of unclogging ducts, and also avoided that thousands of liters of used oil pollute the rivers, lakes, dams and seas of the city. A liter of this residue in São Paulo is sold at around R$ 0,90 and generates jobs and income to more than 1200 Brazilians, among company workers and members associated to cooperatives which collect and recycle the material (FERRO, 2010).

Source: research.

Besides the actions presented, several others of similar character, that already collect residual vegetable oil directing it to biodiesel production and other finalities, were identified in the country such as in the cities of Urussanga-SC, Campina Grande-PR, Bauru-SP, Belo Horizonte-MG, Curitiba-PR, Teresina-PI, Recife-PE, Joinvile-SC, Piracicaba-SP, Fortaleza-CE, Jaú-SP, Varginha-MG, Pontal-SP, Chapecó-SC, Indaiatuba-SP, Montenegro-RS, among others (ECÓLEO, 2012). Since the interests, practices and results are analogous to the mentioned, the study restricted just some examples, which make reference to the object of analysis and answer the questions of the research.

The organizations that have acted in the process oriented to residual frying oil collecting with the purpose of transforming it into biodiesel are, in its majority, associations, besides schools, universities, city halls, companies, plants and supermarkets. As the theory suggests, the associations that developed these projects show structures of hybrid governance, i.e., they are not characterized as market structures or vertically integrated companies. The mechanism of allocation of resources happens, therefore, through partnerships and contracts, formal or informal.

The institutional environment also interferes in these collective actions and can be responsible for developing more projects on this account, through creation of laws like in Rio de Janeiro, which imposes to legal entities and/or city halls the collecting of residual frying oil and the implantation of cooperatives for storage, and plants for the transformation of the residue into biodiesel.

Concerning the different actors involved in the collective actions of collecting residual frying oil for biodiesel production, men and women can be included, from children to elder people, of different classes, professions, religion, with distinct characteristics. I.e., the population, the collectors of recyclable materials or companies which collect these materials, the associations which incentive these programs and the industries which transform this raw material into biodiesel take part in these actions. The action itself demands a large number of actors involved, since the same would not be successful in the attempt of being accomplished individually.

The actors organized themselves by a sequence of stages. One group is responsible for storing the oil residue after its use (households, bars, restaurants, hotels), other members collect the residual frying oil and direct it to the organization responsible for storing this residue at large quantities. Another group, then, transports the oil residue to the plant that will transform it into biodiesel.

According to the research, the large groups prevail. The group as a whole is “latent”. The ones identified are “federative” groups, i.e., groups subdivided into smaller groups. Since the groups are latent, according to the Theory of Collective Action, by Mancur Olson, there is the necessity of incentives apart so that the members decide to act in favor of the group benefit. The incentives verified are, in their majority, economical, once that in large groups the friendship bonds are not perceptible and the members hardly feel motivated by friendship or by social or psychological character incentives. However, as already mentioned, the author does not discard the possibility of social incentives in the latent group, since this one shows the characteristic of “federative” group, and in this case it is emphasized the social and environmental benefits that can stimulate the groups to cooperate to obtain more benefits in common.

In the examples listed above, it is possible to say that the smaller groups are more efficient, once one group by itself, with the same individuals, would not obtain optimal results if it had to accomplish the activities of all stages; the relation cost-benefit would be

unfavorable. It is necessary that smaller subgroups organize themselves to fulfill determined detached tasks (packing, collecting, storage, transportation, chemical transformation) so that the whole task generates collective benefits.

The cooperation results in collective benefits for all the actors involved, besides generating positive externalities downstream and upstream the process in question. I.e., several economical, social and environmental gains can be mentioned, such as: income generation and improvements on the communities, turning waste into value, reducing expenses with treatment of water and sewer system, besides reducing the impact on environment; substitution of fossil diesel by biodiesel, yet partially, generating smaller emission of green house gases and sulphur; avoiding contamination of rivers and groundwater, and also risks to aquatic fauna.

People cooperate in view of their common interests. Interests that can only be accomplished, or are fulfilled in a more efficient and effective way, when one group of people with the same objectives get together to put them into practice. The collective action will result into collective benefits that individually, would not be reached.

6. Final considerations

The purpose of the study was to identify the collective actions in the process that involves the collecting of residual frying oil directed to biodiesel production, in Brazil. The research verified that besides the associations with hybrid governance structures, schools, universities, city halls, companies, plants, supermarkets, among other organizations, also act in this process.

The collective actions in the productive chain of biodiesel from the use of residual frying oil can evidence several economical, social and environmental benefits. Among the social and economical benefits, some are: reduced production cost; increment of regional and local economies; income and job generation; non-interference on food production; funds addressing social inclusion projects; economical gains for the factory that works with raw material at competitive prices. Concerning environmental benefits it is possible to mention the reduction of green gases emission, such as carbon dioxide (CO2) and sulphur; adequate directing of the residue, avoiding the discard in sinks, backyards and in the sewer system which causes pipe cloggings, contamination of rivers and groundwater, raising in cost of sewer system treatment processes and risks to aquatic fauna.

Some institutional initiatives could expand even more these actions to other localities where this kind of residual frying oil collecting has not been accomplished yet, such as the creation of larger campaigns of awareness and incentive to population; the creation of municipal/state laws that demand from legal entities and/or city halls the collecting of the residue; and the implantation of cooperatives for collecting, and plants for the transformation of the residue into biodiesel.

As result of the actions that are already being accomplished, it is notorious that the budget originated from the sales of the oil to the factory is reverted to social programs in the communities, such as alphabetization resources, education for senior citizens, communitarian vegetable-gardens, purchase of school supplies and remodeling of gardens, schools and flower-beds around the cities. They have also been additional income source to recyclable collectors, generated jobs, reduced expenses with sewer system treatment, contributed to the

sustainability of associations and used as deposit of determined value in the Environmental Responsibility Fund.

Concerning the application of the theory of collective actions, it was noticed that the actions are moved by common interests (environmental, social and economical). The actions accomplished suffer strong influence from the institutional environment, and are put into practice by actors of several distinct characteristics that organize themselves by a sequence of stages and configure a latent group, yet, federative, so that they act efficiently. As they are large groups, incentives apart are demanded, so that the members act in favor of the collective benefit. The verified benefits are, in their majority, economical, once in latent groups the friendship bonds are not perceptible and the members will hardly feel motivated by friendship or by incentives of psychological or social character. The collective action provides ideal results for all the involved, directly and indirectly in the process, generating positive externalities upstream and downstream. Such benefits could not be obtained through individual action.

Moreover, this study did not have the character of wearing out the subject, but of providing a brief conjunctural panorama. As suggestion for future papers, it could be assessed whether these actions have been useful also in the daily reality of the involved with these projects, through an *in loco* survey.

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