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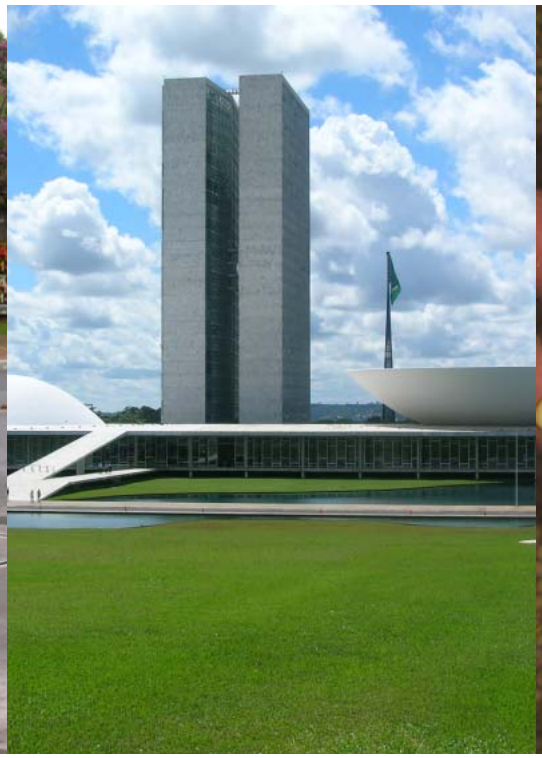
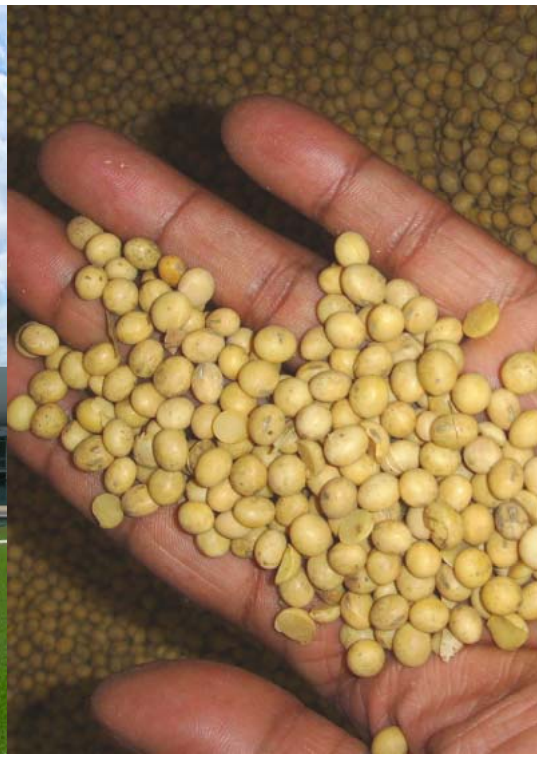
Exploring Biodiesel Production in Brazil

A study on configurational patterns in an evolving policy domain

S.L. Stattman, P.S. Bindraban & O. Hospes





Report 199

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Abbreviations

ABIOVE	Brazilian Association of Vegetable Oil Industries
ADM	Archer Daniel Midlands
AEP	Agro Energy Plan 2006-2011
Amaggi	André Maggi Group
ANEC	National Association of Grain Exporters
ANFAVEA	National Association of Motor Vehicle Manufacturers
ANP	National Petroleum Agency
ANUT	National Association for the Users of Freight Transport
AproSoja	Association of the Producers of Soy of the State of Mato Grosso
B2	Blend of 2% biodiesel with diesel (the figure represents the percentage of biodiesel added to diesel, i.e. B20 consists of 20% biodiesel)
BNDES	National Bank for Economic and Social Development
CDM	Clean Development Mechanism
CNP	National Petrol Agency
CNPE	National Agency of Energy Politics
COFINS	Contribution for the Finance of Social Security
CONAB	National Supply Company
DIEESE	Department for Statistics and Socio-Economic studies
EBDA	Bahian Institute for Agrarian Development
EU	European Union
GM(O)	Genetically Modified (Organism)
GTI	Inter-Ministerial Working Group
ha	Hectare
IAPAR	Agricultural Institute of Paraná
IPAM	Institute for Environmental Research of the Amazon
IPI	Industrial Products Tax
MAPA	Ministry of Agriculture, Livestock and Food Supply
MDA	Ministry for Agrarian Development
MME	Ministry of Mines and Energy
Mt	Mega Tonne (1000 kilogramme)
NEAD	Center for Rural Studies and Rural Development
NGO	Non Governmental Organisation
PCVDG	Principles, Criteria and Verification Development Group of the RTRS
Petrobras	Brazilian Petroleum
PIS	Programme of Social Integration
PNPB	National Plan for the Production and Use of Biodiesel in Brazil
PRONAF	National Programme of Family Farming, for biodiesel
RTRS	Round Table on Responsible Soy
SEBRAE	Brazilian Service of Support for Micro and Small Enterprises
SFS	Social Fuel Stamp
WTO	World Trade Organisation

Preface

The developments in the emerging field of bio-fuels are so fast that actual production of feedstock and biofuels are taking place while discussions on their effectiveness to curtail climate change and to provide environmentally friendly renewable energy are still ongoing. It is also highly questioned whether biofuels can create a promising opportunity for rural development in poorer regions and nations. Brazil is a frontrunner in the production of bio-ethanol and it the first country in the world to implement a national bio-diesel program with specific emphasis on enhancing rural development.

This report presents the results of an explorative study on the dynamics and impacts that could be expected from the National Biodiesel Program of Brazil. It explores the role, position, concerns and strategy of the main actors and their position towards the use of soy oil for biodiesel production and assesses the feasibility of small farmers to engage in the biodiesel chain. The broader aim is to contribute to the (inter)national discussion on the relationship between food, feed and fuel production from a social science perspective. The conclusion should be seen in this perspective of being an 'explorative analysis' carried out in 2007, though the findings might well have been confirmed, as almost 80% of current feedstock for biodiesel in 2008 comes from soybean. These insights already provide valuable information about the governance process from which intervention measures could be derived and provide a solid for outlining a research agenda.

This report is based on the thesis written by Sarah Stattman, student in the field of International Development Studies at Wageningen University and Research Centre. The field work was carried out during a 3 months period from March to May 2007 in Brazil and yielded many friends apart from valuable information for the study. We would therefore like to thank all the people in Brazil who took the time to explain about their country, their dedication and the valuable information provided, as well as exposing us to the flavours of Brazilian culture.

Sarah Stattman
Prem Bindraban
Otto Hospes

Wageningen, July 2008

Summary

At the moment there is a lot of international enthusiasm and criticism on biofuel policies. Some argue that the use of biofuels leads to competition between food, feed and biofuels while others see new opportunities for small farmers and regional development. Brazil is the first country that is implementing biodiesel policies on a national scale. For this purpose it set up an inter-ministerial Biodiesel Programme (PNPB) to promote sustainable development of its society through use of biodiesel and by improving the competitiveness of Brazilian agribusiness. The PNPB has multiple goals: (1) enhancing *social* inclusion of family farmers, (2) improving regional development and generating *economic* incentives through generation of jobs and income in the biodiesel sector, (3) finding sustainable alternatives for fossil fuels and taking care of the *environment* by reducing CO2 emissions, and (4) supporting *technology* to improve local development.

In Brazil a large variety of oleaginous crops is available to produce this biodiesel; the government suggested the use of rapeseed, palm oil, castor bean, jatropha, sunflower, soybean and algae. The choice for a particular crop can depend on the type of farming and geographical region. As the government specifically aims at the inclusion of small farmers it has developed mechanisms to include their produce into the biodiesel production chain. Therefore a Social Fuel Stamp and a tax reduction system have been introduced to promote the use of alternative oil crops that are not already traded on the international commodity market. There seems, however, to be a tension between the quantity of vegetable oils needed for biodiesel production and the social objectives of the PNPB. Almost 90% of the vegetable oil in Brazil is produced from soybean, while the poorest farmers in Brazil are not engaged in this commodity. In this context the question that this thesis aims to answer is 'how can theoretical insights in evolving policy fields about the role of actors help to frame the current governance structures with regard to the use of soybean for biodiesel production in Brazil and to reflect on the feasibility of small farmers to engage in this emerging industry supported by the specific measure of the PNPB?'

To answer these questions a network overview of biodiesel and soy production is used to identify key actors and institutions. This is combined with a chain analysis of both production chains in order to relate them to the perceptions of actors in order to analyse social-cognitive networks.

Cultivation of oleaginous crops by different actors

The net-chain analysis demonstrates the different visions and interests portrayed by the actors involved with the development of the PNPB. It shows that their position depends on their current chain position (Fig. 1). Based on this information it is possible two distinguish two important patterns. In the first place there is the pattern of 'risks'. This one applies mainly to small farmers. They have to produce crops on which very little agronomic knowledge is available, technologies still have to be improved, and they all produce a little which needs an efficient and widespread infrastructural network. On the other hand there is the pattern of 'opportunities' that primarily applies to producers of soy oil. Only soybean, which is not a very efficient oil crop, has sufficient quantity and infrastructure to be used on the short term. However soybean production itself is not without controversies. It is generally produced by large scale farmers and linked to international trading market. This has resulted in several initiatives promoting the use of more sustainable soybean production. With their experience and management of the chain the production of biodiesel is a differentiation of their market opportunities thus giving them a stronger position in international trade.

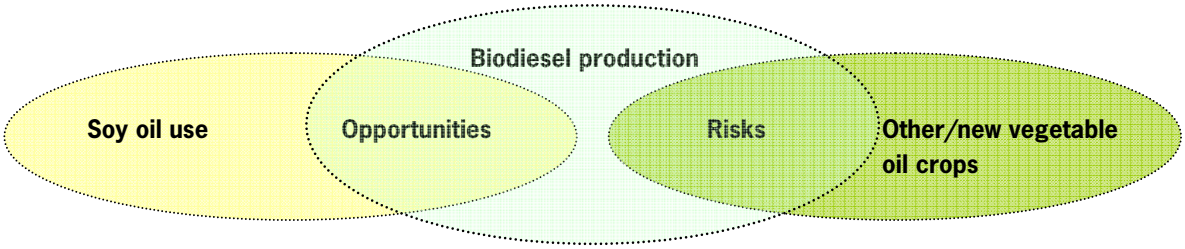

Figure 1. Opportunities and risks with biodiesel production.

These aspects suggest that the PNPB might have difficulties achieving all its objectives. A tension field will arise between the availability of sufficient vegetable oil and the willingness to produce this oil. If the government really wants to support small farmers they need to improve their sense of security for the transition and production of oleaginous crops. However, if the main goal appears to be sufficient supply of biodiesel than soy oil might be an interesting alternative at the medium long term.

The shaping of governance structures

The research also analyses the development of governance structures in the rapidly evolving policy field of biodiesel production. It becomes clear that policies are not independently operating structures, but a flexible system that evolve as a result of interaction between various interest groups. Even though improving the livelihood of small farmers is one of the main objectives, it is questionable whether they are able to participate in the development of the PNPB. Fig. 2 shows that both the soy and the PNPB arena's consist of a large variety of key players that have their own perspective on the development of the biodiesel market in Brazil. These include: producers, small farmers, biodiesel industry, vegetable oil purchases, regulatory agencies, ministries, extension services, non-governmental organisations, and other smaller actors that are not further specified. For all actor groups it seems difficult to make generalisations. The size and diversity of the country bring about a huge variety in context and organisational structures. Some actors argue that introducing such a new system comes with many unpredictable risk and consequence while others might see it as a (technical) challenge. Yet, the current position in either the soy or PNPB arena seems of key importance for their attitude as well as their influence on the future evolvement of the biodiesel infrastructure. `

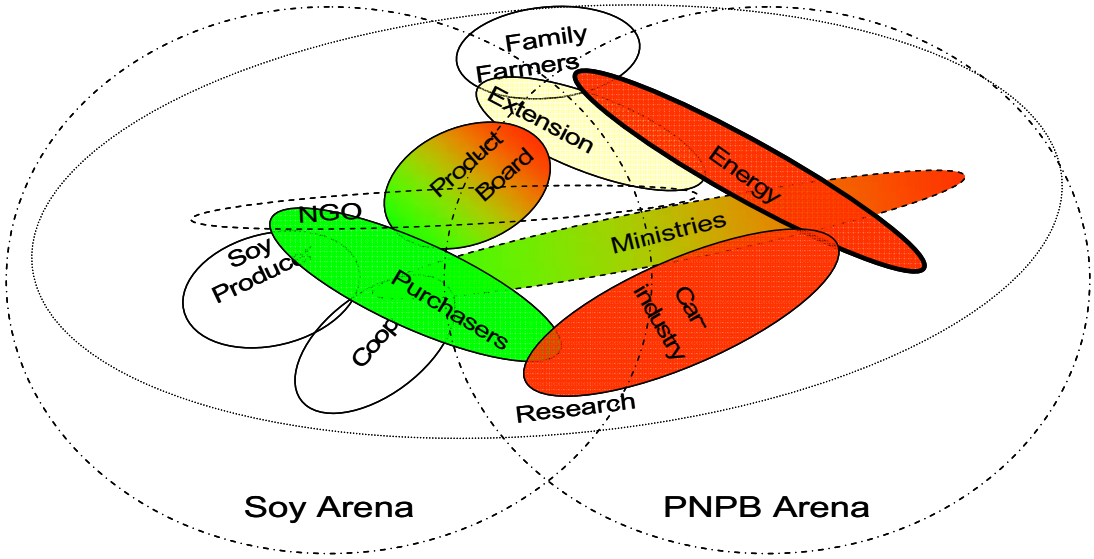

Figure 2. Soy and biodiesel production arenas.

The theoretical assumption of this thesis is that there is a shift in the way governance is shaped in evolving policy fields. Characteristic of evolving policy fields is that net-chains and discussion arenas are still being shaped at the same time that governing mechanisms are set in place. These governing mechanisms are the outcome as well as the initiation of altering relations, resulting in processes of continuous change and dynamics. As a consequence actors are confronted with high amounts of insecurity on the final outcome, because the system itself is flexible. As the governance mechanisms are set in a deliberative process, actors can participate in the process of shaping these governance mechanisms. Based on their views and strategies they might strive for certain scenarios. To influence these processes different elements need to be taken into consideration. Who has more dominant power can have major influence on the way and evolving policy field will be shaped. The configuration approach is used to map the interaction between social and cognitive elements. In this type of analysis the social patterns are defined by interaction between actors based in an assessment of the net-chain. This is an approach that links actor-network-theory to ideas on value chains. The cognitive element is defined by reality definitions of actors. These reality definitions are based on their process of sense making of their experiences with society. This means that changes in patterns of social structures or in reality definitions can alter the configurational patterns, but at the same time configurational patters shape and are in return shaped by interactive processes. At a certain moment they can bring actors together, there can be a moment of development, but it can also lead to disintegration. New information and unexpected occurrences can be the drivers for these types of alterations.

While the configuration approach only focuses on interaction processes, there are also other variables that play a role. These are the different power relations between actors, their intrinsic view on natures and the way in which they interact. Together these show, for instance, the political struggle that is reflected by discursive struggles over the environment. The battlefield for different opinions and powers can be described as an arena, which is the place to depict the transformation processes that can be explained with regard to (in) flexibility and (non-) interaction as a result of fixations or escalated harmony. By studying these concepts it becomes possible to look at certain development paths. Particular views and strategic interests may indicate a wish for different future scenarios. This means that not all development alternatives receive the same treatment. As a consequence the idea for a particular system and/or technology is the outcome of a series of social processes based on local perspective and individual behaviour of actors.

By using the configuration approach it became clear that the PNPB shows a clear relation between the process of sense making by actors and the development of the governance process. The results presented in this thesis are based on an explorative study during 2007 and require further insights for firms statements and to be able to better understand the governance processes. At the same time, however, the findings might well have been confirmed, as almost 80% of the feedstock for biodiesel in 2008 comes from soybean.

1. Introduction

The world population is expanding and the demand for all natural resources is rising. As a result there are many challenges with regard to the governance of these resources. This increasing demand may lead to competing claims on land, water and energy. One area that is heavily debated is the extraction of energy from various sources in order to sustain increasing global needs. The recent debate about biofuels can easily be put into this context. In the policy field of climate change, geo-political power struggles and the declining amount of fossil fuel supplies many nation-states are seeking ways to diversify their energy matrix. Biofuels are suggested as a possible and sustainable solution, because they can be made from many different crops and are considered (by some) to be carbon neutral. Biofuels in itself are not a new concept in these debates, but the scale which is currently proposed is unprecedented. One of the main questions is whether biofuels are a possible solution for some of the challenges we face with regard to fuel demands. This is not a simple question. It is unclear what the impact will be when biofuels become (a significant) part of agricultural production. As a result the overall demand for certain crops will go up whether they are used for food, feed, or fuel. This will have consequences for the production of other crops and the use and distribution of scarce resources all along a diversity of supply chains. Policy and market decisions to stimulate such a large conversion towards biofuels are quite risky, since the understanding of the (in-) direct consequences is still at a very basic level. The interconnectedness of the world market has shown that decisions taken with regard to agricultural production and use in one area might have huge impacts on others when supply and price become affected.

Changes in agricultural production will affect many people. On a local level this might result in land use changes and internationally it can affect supply chains and therefore also the prices for agricultural production. As a result of this situation many different actors with a large variety of interests are affected by shifts in production. Within the current debate on the stimulation of biofuels it remains unclear who will be affected and in what way. This debate needs looking into as not all actors share the same opinion on this issue. Some argue that the increased demand for production can simply be overcome by increasing agricultural yields through increased efficiency and expansion of the agricultural area; others believe that the changes in demand will have severe consequences for the world food chain, especially with regard to the poorer regions in the world. To consider the effects of these global changes and their possible impact on a local situation, it is necessary to get a grasp of the complexity in the interaction process by studying the debates in various development scenarios. In order to do this it is necessary to gain more understanding on the underlying developments and power relations between different sets of actors in these debates, for instance, to see whether or not decisions and arguments are accepted by different actors. This way it will become possible to understand how varying (underlying) principles can affect the final outcome of this policy debate. Since Brazil has a lot of experience with biofuels and is aiming at a frontier position in the international biofuel market, the actors and debates in this country will be used as a case study.

Biofuels in Brazil have a long history[1]. In the 1970s there was a strong governmental intervention to promote the use of ethanol, a biofuel derived from sugarcane to replace gasoline, as fuel for cars at a national scale. Now the government has decided to make more changes in their energy matrix, by stimulating the production of biodiesel. The arguments used by the Brazilian government are of a diverse nature; by stimulating the use of biodiesel they want to decrease their dependency on fossil fuels, to promote sustainable green energy use, and to create a social programme for the poorer areas in the country. Through the years Brazil has gained a lot of experience in this field and other countries are studying this situation in order to set up their own programs. As public and commercial interest in biofuels is growing, opposition increases. Some groups claim that an increased use will actually have a negative environmental and social impact. Much of the debate is concentrated on the stimulation of biofuels in general, but also on the kinds of feedstock that are eligible sources for energy production. In Brazil there is a lot of discussion on the use of soybean for this purpose. Over the past decades the production of this bean has increased enormously in the Brazilian Cerrados. Demand was mainly driven by the food and animal feed market. Activists are very worried that a new demand for fuel, on top of the existing ones, will result in even more monoculture and

[1] Paragraph 5.3 contains a more complete version of this history.

agricultural land expansion. As the collection of scientific and practical information on the possible consequences of this demand is still at the start, the impacts of this increased demand, and whether they are positive or negative, remain unclear.

In this introductory chapter, some information will be given on biofuels - focussed on the Brazilian context - in order to create a better understanding the current developments and to put them in their context of technology development and policies (paragraph`1.1). This part will be followed by a short introduction into the discussion on soybean production in Brazil, because of its possible role and its strong linkages to the production of biodiesel for the next few years (paragraph 1.2). These two elements form the core of the debate about the biodiesel development in Brazil. Next, the complexity of the debate is introduced and explained by a theoretical discussion on contemporary governance challenges (paragraph 1.3). The following paragraphs will explain the research objectives, the leading research questions and hypothesis which form the base of this thesis (paragraph 1.4-1.6). This chapter concludes with a brief overview of the following chapters and a readers guide for those who are interested in specific elements of the study (paragraph 1.7).

1.1 Biofuels policies in Brazil

Brazil has a specific energy profile. Since 2006 it has achieved self-sufficiency in crude oil and it can be considered a hub for energy integration in South America; especially with regard to the production and use of ethanol, where it can be considered one of the world leaders (OECD/IEA 2006). The combination of the size of the country with its richness in natural resources, and the policy decisions made by the Brazilian government in the 1970s to support the use of biofuels, have laid the foundation for this position. In 2006 the Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA) released the *'Brazilian Agroenergy Plan 2006-2011'*. In the first paragraph the Ministry states that the goal is 'to promote the sustainable development and the competitiveness of Brazilian agribusiness to the benefit of Brazilian society'. The plan has to support Brazil's position in the world market as well as stimulate tropical agricultural technology.

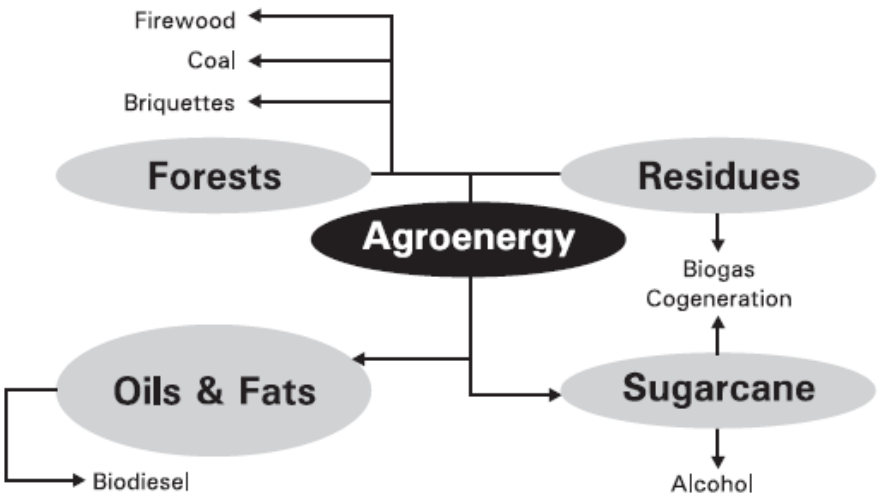

Figure 1.1. Agroenergy matrix.
Source: MAPA (2006).

Figure 1.1 shows that the production of biodiesel is only one element of the agro-energy plan as presented by the Brazilian government. The production of biodiesel is drawn up in 'the National Programme of Production and Use of Biodiesel (PNPB)[2]. This is an inter-ministerial programme of the Federal Government, and its objective is to

[2] http://www.biodiesel.gov.br/index.html.

implement an economically and technically sustainable form of the production and use of Biodiesel. The goal of the programme is to introduce biodiesel in the Brazilian energy matrix. Therefore it has been made obligatory that the diesel oil sold to final consumers throughout the national territory must be at least 2% (B2) biodiesel by 2008 and 5% (B5) by 2013 (MAPA 2006). Since the programme only started in 2005, many parts of the production still take place in pilot plants and rather small volumes. The National Petroleum Agency (ANP) calculated that Brazil produced approximately 736,100 litres of biodiesel from March-December in 2005. However, to meet the requirements of the law, approximately 840 million liters of biodiesel have to be produced in 2008. The production of biodiesel can be based on a number of different vegetable oils from a variety of raw materials. Crops mentioned in the Agro Energy Plan 2006-2011 (AEP) are: soybean, peanut, sunflower, castor bean, and African palm fruit, but also new cultures, such as jatropha curcas, radish, pequi or souari nut, buriti or aguaje palm, macaúba or grugru palm, and other oleaginous plants that still need to be explored (MAPA 2006).

The fact that the PNPB is of a recent date does not mean everyone has similar ideas or perceptions about its future. Some people are very worried about the technical limitations in the first place, it is possible to produce enough, and what are the consequences for diesel quality? Others are worried about the impact it might have on different regions of Brazil. They fear the consequences could be the opposite of the original aims of social inclusion and environmental sustainability. The reason behind this debate is that there has been a gap between the existing, accessible information and knowledge about the impact at micro and macro levels. Different scenarios are made, which all use their own measurement systems. At the moment the EU, the USA and other countries are promoting biofuels and setting up their own goals and standards, but because of political reasoning these might be different from the ones in Brazil. This could have consequences which reach across borders. Currently, Brazilian policy makers present further promotion of biodiesel as a roadmap to social inclusion of poor regions in the country, but global interests might interfere with these local objectives. To understand what is going on, more insight is needed in the drivers and implications of some of these developments.

1.2 Brazilian soy production

One of the consequences of the PNPB is that although the biodiesel market is still very young and technologies have to be improved, regulations are already in place demanding large production quantities. As a result, demand for all vegetable oils has increased rapidly. In order to get production to a certain level, some crops have advantages over others, for instance, because a production system is already in place and functioning on a large scale. Soybean is produced on a large scale in the Centre-West and South of Brazil and delivers approximately 90% of all vegetable oils in Brazil (Abiove 2007). As a result soybean could supply the necessary oil to mix 5% biodiesel with diesel (MAPA 2006). MAPA calculated that biodiesel produced from soybean becomes competitive when the cost of petroleum reaches 60 USD per barrel (given the current technological and production systems), a price that has been reached and exceeded on the international market. This means that soybean has become an interesting source for the production of biodiesel. At the moment the USA are already using soybean oil for this purpose and in Brazil various biodiesel producing factories have started to use it as one of their main resources.

This is an interesting development given that soy is already planted on a large scale in Brazil and the demand for the crop for production of animal feed and the human food industry is still there and rising. This would imply a necessary increase in production. Soy is not the most efficient oil crop, because it has lower oil content than most alternatives, yet, given the high prices currently paid for vegetable oils it is one of the options mentioned. The debate on soybean production has become quite political over the past years. Environmental organisations have many concerns about the increasing expansion of the agricultural area, which goes hand in hand with mono-cropping, the use of agro-chemicals and of GM varieties and loss of biodiversity or something. On the other hand some researchers and soybean producers argue that their production system is environmentally friendly and that Brazil is big enough and has sufficient potential to expand production without damage to the environment. This could be done by intensifying the cultivation in areas which are already in use as extensive pastures (i.e. intensifying cattle farming) or re-establishing use of areas that have been taken out of soybean production before, as demand suddenly declined a few years ago. These were the slightly less productive areas, therefore it is important to realise that the yields/ha will not be as good as in the areas currently used. This group of scientists and producers believe that when soybean

demand rises, it is just a matter of bringing these areas into production again. Increasing productivity is not seen as a problem, because they rely on improved scientific knowledge.

On the other side Greenpeace, for example, launched a large campaign based on their research 'Eating up the Amazon', which persuaded other parties to collaborate in the Soy Moratorium (Greenpeace 2006). This is an agreement that was installed in order to prevent expansion of soybean production into the Amazon region. In the moratorium producers, industry, and NGOs agreed to have a two-year expansion stop in order to think about solutions to the current problems. Though the moratorium seems to have stopped further expansion in the Amazon region of Brazil, it has unintentional side effects. Recently, a lot of complaints by NGOs from surrounding countries such as Argentina and Paraguay have come forward in which they state that the expansion in their countries has increased more rapidly as a result of the Brazilian moratorium. However, the expansion itself has not been stopped, but it has shifted across boarders. Another initiative to promote more sustainable soybean production can be found in the Round Table on Responsible Soy (RTRS). This is a worldwide initiative to set up standards for sustainable production. The initiative is supposed to have an international reach with representatives from Trade, Industry and Finance, Producers and NGOs. The goal of the RTRS is 'to set up a multi-stakeholder and participatory process that promotes economically viable, socially equitable and environmentally sustainable production, processing and trading of soy' (www.responsiblesoy.org). Though both initiatives receive a lot of attention, they just started and there are no fixed agreements about future soybean production. The question is even whether agreements, if they are made, can be kept in a context of increasing market pressure for increased production of soybean. It might depend on this demand whether partners are willing to respect the standards. The increasing demand for biodiesel as a result of the PNPB will likely put extra strains on the issues debated for soybean production, since producers and industry will have different outlets for their product: food, feed, and fuel.

1.3 Problem statement: evolving policy fields

In the current situation vegetable oils are traded around the globe, actions in one place can have far reaching consequences which are demonstrable in other local situations. As distances between producers and consumers have increased in absolute terms, so has their relative interdependence. Groups of actors are linked through institutions or net-chains and meet each other in international arenas. This is especially the case for agro-food commodities, which are traded on a large scale in enormous quantities with various user applications. Recently the vegetable oil commodity trade has become intertwined with biofuel policies, which has resulted in interlinkages with other debates such as food security, biodiversity and climate policy - all within a context of the search for sustainable solutions. The large scale and area involved in biofuel policies implies that many actors with various interests are getting involved. Not only the producers and the companies in the production chain 'own' the right to give their opinion about the policies. For moral and practical reasons, scientists from various epistemic communities, policy makers, legislators, and members of NGOs also want to give their input. Though most steps from the production chain are privately owned its structure has become part of a global discussion on the sustainable management of natural resources.

The concept of 'evolving policy fields' is derived from the notion that there is an increasing amount of issues on the political agenda of many countries, which result in large changes and risks, because of their enormous complexity and possibly far reaching consequences. In these fields the risks are no longer calculable and/or predictable. The biofuel and soybean production debates show very clearly that many social, political and scientific fields have become interrelated, but that at the same time there is a lack of understanding about these interrelations. Some people argue that as a consequence of insufficient scientific knowledge about these issues, further decisions should be deferred, but others say that the momentum should be used to develop technology and improve knowledge. Hajer (2003) argues that under these circumstances *'policy making now often takes place in an 'institutional void' where there are no generally accepted rules and norms according to which politics is to be conducted and policy measures are to be agreed upon.'* As a consequence of this 'institutional void' actors are not only deliberating solutions and measures, but are also continuously negotiating new institutional rules in order to legitimate particular political interventions. According to Hajer (2003) a new kind of deliberative politics has to emerge, since there are no old institutional arrangements present. Yet, it seems more appropriate to speak of an institutional 'arena' rather than

a 'void'. Instead of fixed and accepted rules, there is a huge amount of institutions and ideas present fighting for power and acceptance. This means that governments are confronted with policy problems that are of such a character that there is no simple or unique solution. Chapter 2 will continue to explore the concept of evolving policy fields.

1.4 Research objectives

In this thesis the case of Brazilian biodiesel policies will be explored, but the core objective of this study is of a more abstract nature. The general goal is to improve understanding and analysis of the dynamics of shaping governance in evolving policy fields. This regards the interaction between various actors and their perspectives, leading to a particular outcome.

The second objective is to provide information on the various actors and their position towards the biodiesel production in Brazil, based on the use of soy oil as a main resource for vegetable oil. This objective supports the first, because it will help to gain a better understanding of the evolvement of the policy process by looking at the local context of soybean production with relation to the use of food, feed and fuel in Brazil.

The final goal is to combine information on the Brazilian situation with the theoretical insights gathered on shaping governance in evolving policy fields. The hypothesis is that studying these elements together and linking them to developments and academic ideas on configurations and discourses - by studying how different configurations and actors shape and change the policy process and are shaped by it in return - it will be possible to design an overview of the current policy arena and to understand developments in governance structures in these complex policy fields. As a result this study will contribute to the larger debate on the relationship between food, feed and fuel in a social context with regard to the future development of biodiesel.

1.5 Research question

The problem definition and research objectives led to a central research question which can be divided into a number of theoretical and case related sub-questions:

How can theoretical insights in evolving policy fields about the role of actors help frame the current governance structures surrounding the use of soybean for biodiesel production in Brazil?

Specific theoretical questions

a. What can be distinguished as the governance processes in evolving policy fields?
b. Which methodologies can be used to analyse the dynamics in evolving policy fields?

Specific case questions

c. What is the state of affairs of biodiesel policies in Brazil?
d. What is the current situation of soybean production in Brazil?
e. Who are the different actors and what are their roles, positions and strategies with regard to soybean production and biodiesel in Brazil?
f. Which configurations play a key role in the policy arena of these issues?
g. How are governance structures influenced by the variety of configurations?

1.6 Concept definitions

The biofuel debate is related to a number of different issues. These issues stem from all kind of disciplines which all have their own link to and ideas about the subject, for example, the relation with climate change, energy transition, food-feed-fuel use of resources, sustainable agriculture, long-term policy schemes, implementation scales and technological innovation possibilities. Current issues are whether biofuels in itself should be stimulated at all and if so, how, what kind of resources should be used, and by whom? Characteristic of the discussion is that it does not seem to limit itself to biofuels and their possibilities, but that a lot of attention is drawn to indirect effects and consequences on the long-term. This makes it a very complex debate in which all different scales and levels of society are or want to be involved, because of the possible effects it can have on society in general.

Complex policy areas show a large amount of social, political and scientific interrelatedness, while there is a lack of understanding about the exact implication of these interrelations.

A configuration can be seen as a social-cognitive network identified through analyses performed according to the configuration approach. This approach is a method to analyse the correlation between various interaction patterns of social structures based on various reality definitions, and of cognitive structures that exist between actors in society.

(Global) governance should not only be seen as the formal institutions and organisations that give structure and authority in collaboration and that control the allocation of resources. They are also a mix of all kinds of governing efforts by al manner of social-political actors; public as well as private at different levels in different government modes and social orders (Held et al. 1999; Kooiman 2003). Therefore governing is related to the totality of interactions aimed at solving societal problems or creating societal opportunities in an attempt to establishing a normative foundation for all those activities (Kooiman 2003).

Reality definitions in the configuration approach define how an actor makes sense of his/her surroundings. By doing so an actor constructs his/her own reality. This is not necessarily an individual process, because sense making often occurs in circular processes in which actors interact and influence each other.

The soy debate in this thesis relates to the discussions held in the context of soybean production and its applications. It is a policy debate in which different actors try to convince each other of particular viewpoint as they try to shape the political agenda. The discussions and arguments root in environmental, political and social issues and the impact the soy-chain might have on them. Lately the main concerns (seem to) have been monoculture, genetic modification (GM), expansion, export and demand, sustainability initiatives, and governing models to manage current developments.

Evolving policy fields are present where traditional governing institutions no longer seem able to manage or adjust to the changing role of actors. In this process, actors are not only deliberating on solutions and measures, but are also continuously negotiating new institutional rules in order to legitimate particular political interventions (Hajer 2003). As a result, uncertainty, social-technical interaction, and legitimacy are key matters for discussion, as many actors try to find methods to safeguard their position in the evolving institutional process.

1.7 Methodology

To answer the research questions the thesis work has been divided into three phases. The first phase of *preliminary research* was used to do basic literature study and to get acquainted with views on biofuels and soy production, as well as the broader context of climate change and food security. During this phase the basic knowledge base regarding the evolvement of evolving policy fields and changing governing processes was also laid out.

The *second phase* consisted of field work in Brazil[3]. This three month period was used to collect a lot of local data by talking to people who actually work in the field of soybean production and trade or are involved with biodiesel policies and by visiting several (inter)national conferences and collecting as many documents as possible. This led to identification of the main actors and their views.

The *final phase* consisted of a more critical assessment of the theoretical framework and attempting to fill some of the voids that still existed regarding the practical applications of the presented theories. This was followed by the application of the theoretical framework in order to analyse the generated field data. This led to analysis and grouping of the different reality definitions into configurations and examining their impact on shaping governance structures. A more detailed outline of the operationalisation of the theoretical framework can be found in chapter 4.

1.8 Structure of the report

Chapter 2 addresses theoretical notions on evolving policy fields and their implication for changing modes of governance.

Chapter 3 outlines the theoretical framework used in this study on the emergence of new governance structures as well as a search towards methodologies that can be used in analysing these changes in the complex field of the agro-food industry.

Chapter 4 operationalises the theoretical notions to develop applicable analytical tools. It continues by giving a brief overview of the field methodologies.

Chapter 5 provides the reader with background information on biodiesel policies and soy production in Brazil.

Chapter 6 introduces the viewpoints held by different actors, their roles, positions, and strategies with regard to the use of soybean as a biodiesel crop in Brazil.

Chapter 7 discusses shared values, knowledge and interest patterns that shape configurations regarding biodiesel policies.

Chapter 8 presents the conclusions with regard to the main research questions as well as a critical reflection on theory and recommendations for further research.

Those readers mainly interested in Brazil, soybean production, and biodiesel policies should focus their reading on the introductory chapter and chapters 5-7. Those readers who would like to get a better understanding on the theoretical background and methodologies used for analysing this kind of multifaceted debate can find their information in chapters 2-4.

[3] View Annex I for an overview of the itinerary.

Part I. Theoretical Framework

2. Evolving policy fields in the risk society

Globalisation can be viewed as a broad and disputed concept, which is often surrounded by heated debates about the direction and the consequences it has on international food (and in the future biofuel) commodity markets. This chapter focuses on some of the questions that arise as a result of changes in the international market that lead to new developments and new discussion areas in a range of evolving policy fields. Typical for these fields is that the institutional framework itself seems to become part of the discussion.

2.1 Governing in the risk society

The global food chain has become increasingly complex and large quantities of agro-products are shipped around the world as a consequence the chain has become more vulnerable: if something changes on either the supply or demand side it can affect people everywhere. Therefore decisions made with regard to elements in the vegetable oil chain are connected with a large variability of actors. To understand why governance is challenged and what is happening in these evolving policy fields, Beck (1992) wrote a book on the emergence of the Risk Society. In this book he explains that many aspects of industrialisation have created risks that are incalculable, unpredictable, imperceptible and potentially global in reach. This does not mean that society is more dangerous than before, but rather that as a result of social changes, risk has changed. Giddens (1998) defines this as manufactured risk, which is *'risk created by the very progression of human development, especially by the progression of science and technology. Manufactured risk refers to new risk environments for which history provides us with very little experience. We don't know what the risks are, let alone how to calculate them accurately in terms of probability tables.'* Beck (1997) argues that the more successful sciences have been, the more thoroughly they have revealed their own limitations and deficient foundations. This relates to all sciences; not only the technical disciplines that have developed towards techniques with insecure outcomes; the same applies to for instance the field of economics and management. All these fields have shown that certain explanations and 'certainties' about policies and their implications are full of assumptions than cannot be substantiated as a result of long-term dimensions and complex interactions. As a result these predictions will carry with them a high sense of insecurity and thus risk. Institutions that traditionally had to manage these risks (for example insurance agencies) are no longer able to do so.

For policy makers the challenge will be to find ways to deal with these indefinable risks and to create governance structures that can deal with their complexity. Pritchard (2000) writes that this kind of risk management should become part of business as usual; even if there is unawareness about the consequences of certain developments, governments have an obligation to look after the long-term security of their population. In order to do so, politicians need to rely on information provided by experts, but at the same time realise that the information they receive is not unambiguous. It continuously needs to be taken into account that there are many different regimes and discourses within the scientific community. Biofuels hold a special position with regard to risk, because their impact and consequences are difficult to predict. Not only will their implementation have considerable consequences for the vegetable oil industry; there will also be a large amount of indirect effects. For example when vegetable oil prices rise, this has consequences for the food security of people with lower purchasing power. Arguments used for implementation of biofuels are part of the discussion some would argue that biofuels will solve or diminish problems regarding carbon emissions and thus climate change. Yet, this is a heavily debated issue, because climate change itself is debated and it is uncertain whether biofuels are indeed carbon neutral. It becomes apparent that biofuels are often presented as a solution for debated 'problems'. While at the same time policies (seem to) be based on the precautionary principle thus possibly creating many other unpredictable risks.

2.2 Science in society

The discussion about risk in society is closely linked to the issue of the role of scientific research and technological innovation in society. A large part of this discussion is about the role of science regarding the social aspect of these developments. Beck (1992) argues that there has been a major shift in the way our society has been organised over the last few decades. People's perceptions of risk and uncertainty have unconsciously changed as a result of increasing insecurity on global developments - examples are avian flu or the interrelated trade markets; the local situation is affected by events on the other side of the globe. This propelled a demand for many people to search for new modes of security and as a consequence *'many believe that in the age of risk there is only one authority: science´* (Beck 1992). Some consider that this view is an overestimation of the importance of science, because it is in fact the policy makers that choose from the scientific material that is available to them which studies best fit their objectives. Therefore for an outsider the scientific arguments, used by politicians can give a false sense of scientific authority and objectiveness, which might go far beyond the original ideas presented by the scientist. According to Beck politicians could use science as a form of security against a form of insecurity. In his view this is a dangerous development, because *'one can no longer automatically rely on scientists, because they never have an unambiguous claim or point of view'* (Beck 1992). This leads to the debate whether people look for security, based on scientific knowledge or whether this knowledge is just a servant in the political decision-making process.

In this context people should not forget that science itself has limitations and that its innovations are often stimulated by social interaction, for instance, which kind of scientific research will get funding. Altogether science and technology play fundamental roles in modern society and its development and are in a way linked to every societal problem in this world. Both elements can indeed solve many problems, but it is likely that they will create new ones too. Perceptions of the manufacturing of these consequent risks and how they affect society can vary a lot from actor to actor. In the agricultural sector there are many examples of different perceptions of risk as a result of innovation. For example the introduction of genetically modified (GM) soybean varieties has led to higher yields and to more pest resistance, but on the other hand it has triggered debates about biodiversity, mono-cropping, pollution of the ground water and food safety. Although GMOs were developed to increase productivity and facilitate production they have resulted in new insecurities and fears. These developments and perceptions seem to be present in the biodiesel debate as well. Current arguments used in the biodiesel debate, show this link between science, society and unpredictable outcomes. As a consequence of the debate on the role of knowledge and science with regard to various risks, arguments are becoming increasingly political, because they are negotiated in the interaction of actors instead of simply accepted (Hajer 2003). Some still consider the development of new technologies based on progressive science as an autonomous process, but many others argue that there is an underlying political process in science which stirs developments into certain directions.

In the discussion about technology and the question which developments are the result of applied scientific investigation, there are two main issues. The first one is whether technology should be considered an autonomous development or a humanly controlled concept; and secondly if technology in itself neutral or value-laden (Jasanoff 2002). In the perception of many people technology is a neutral concept shaped by scientific innovation, but this leaves aside that people do not realise the possibility that certain values are 'built' into a product. When this image changes and the construction of technology is not judged at face value, there is much more attention for the continuous interaction between technology and its innovators; that is, the social construction of social and technical networks. Jasanoff (2002) argues that knowing when and how to deploy science and technology has become an important dimension of 'tacit political knowledge'. When this idea is not understood by other parties, not all actors will have an equal voice in the production of scientific knowledge and technology development. For individual consumers it is becoming increasingly complicated to understand what is going on; science cannot provide all the answers and the risks are difficult to oversee as they are part of new technologies. Subsequently different social groups involved with technology can have different understandings of this technology especially when there is a large insecurity about its development and consequences. This can be a reason why certain parties cannot reach consensus.

Yet, the idea that the choice for a particular system and/or technology is the outcome of a series of social processes does not necessarily mean that we can make the socio-technological landscape as we please. According to Layton in Pinch (1987) they are the outcome of negotiation processes between scientists (of all disciplines) and other participants. These could also involve large organisations, governments, industry and civil society. As a result of a range of compromises no one's goal might be reached and the process might result in 'negotiated nonsense'. The changes within the agro food and fuel chain can also be considered as transitions within the existing social constructions, which might come under pressure (Stærdahl et al. 2006). To understand what is going on the underlying thoughts of these constructions have to be uncovered. Stærdahl et al. (2006) argue that *'a shift of attention from environmental planning to the transition of social-technological systems'* is necessary. In their opinion this can only succeed when the normative element of sustainability is again part of the debate in general. This can help to understand whether there are ethical differences which are very difficult to overcome, because they are based on very strong internalised believes, or whether they are based on fears about the possible consequences. In the second case more discussion and debate is possible and the technical system can be adapted to social wishes, while in the first case a decision might be forced by the strongest party. In this view the attention could be put on the emergence of new governance structures and how the actors and networks together form into effective governing networks within these social-technological systems. This might lead to new forms of governance which could find better ways to deal with the increased complexity (Teisman and Klijn 2002).

2.3 From scenario planning to reflexive governance

In the debate on biofuels much attention is given to long-term future scenarios in order to describe changes in this rapidly evolving and very complex field. The size and scope of these changes is significant for the discussion between involved actors. The topics used to analyse and structure their idea result in a variety of future scenarios. A general thought on scenarios is that they should address four basic conditions: relevance, consistence, likelihood and transparency (Godet and Roebelat 1996 In Blom et al. 2006). In this kind of planning it is considered that even though it is often clear that developments can be inconsistent and that future scenarios have to be reconsidered all the time, it is important to look for those elements that are most likely to occur. However what happens if actors do not agree on the basic variables? This 'traditional' way of looking at scenario planning lacks the ability to integrate complexity to a certain level into the model. It tries to explain complexity to a certain extent and to deal with it, but it does not find an appropriate way to work with these complex issues.

In order to start working with complexity issues it is necessary to integrate them together with nonlinearity concepts into the tools of the scenario. All actors (groups) use long-term future scenarios in their sustainability perspectives, because these scenarios underline those elements they consider of vital importance. As a consequence they might overlook other elements which will also interfere with underlying assumptions. Looking for a 'sustainable solution' will demand that the long-term implications and (indirect) effects are carefully considered within each scenario, but is this possible? Voß et al. (in Stærdahl et al. 2006) point at three important aspects, which make traditional rational instrumental planning impossible: a) potential transformation paths and effects of intervention are highly uncertain, because they are a result of complex interactions between social, technical and ecological processes which cannot be fully analysed and predicted; b) sustainability goals remain ambivalent, because they are endogenous to transformation itself, conflicts between objectives cannot be resolved scientifically nor politically, once and for all; c) the power to shape transformation is distributed among many autonomous, yet interdependent actors without anyone having the power to control all others. This is a quite fatalistic perception on the use of scenarios, because discussions resulting from this kind of planning could still result in an active interaction between science and society in which particular technologies are actively developed to reach a goal as described in the scenario. This becomes very apparent in the case of biofuels in which the wish for cleaner energy has triggered a whole range of research and development in a time that biofuels in itself were not considered an economically interesting alternative for fossil fuels. Considering these elements one has to accept that knowledge of the system we deal with is always incomplete and as a result continuous surprise is inevitable (Holling in Scoones 1999). Not only science and knowledge are always incomplete, the system itself is a moving target. The question is how we should deal with this knowledge in the planning process? The complexity of the plea for sustainability and the complexity of the system make it necessary to redefine the planning process.

This leads Voß et al. (in Stærdahl et al. 2006) to come forward with an alternative understanding of sustainable transition and planning within the process of reflexive governance. This would mean that governance structures are shifting in order to deal with these evolving policy problems and their uncertain outcomes. In these processes risks and uncertainty become unpredictable, therefore different ways of policy making are needed, and therefore it is useful to work with flexible scenarios. Scoones (1999) offers three conditions in order to deal with these elements of uncertainty. In the first place there should be understanding of variability in space and time beyond the simple assumptions of equilibrium regulation and into a wider appreciation of complex dynamics, uncertainty and surprise. Secondly, the exploration of scaling in dynamic processes should lead to work on nonlinear interaction across hierarchies in systems analysis, and to a wider understanding of the spatial patterning of ecological processes from small-scale patches to broader landscapes. Thirdly they should recognise the importance of temporal dynamics on current patterns and processes (Scoones 1999). The purpose of this is not to create more institutional overload, but rather to find new mechanisms and tools that deal with this kind of uncertainty in the decision-making process. The kind of changes, their reach, their impact and their interpretation will be very important for the future outcome by pushing particular arguments in the political debate. Until now knowledge gathered in scenario planning has been recognised as introducing these elements and as support mechanisms for the future output of the debate in which they can help to anticipate certain events and occurrences, but scenarios can also be used differently. By gathering views from a wide context and analysing them in certain power relations it is possible to gain a deeper insight into the interaction within the decision-making process between different actors. This would help to describe forecast and developments based on social interaction Figure 2.1 demonstrates the workings of such a process.

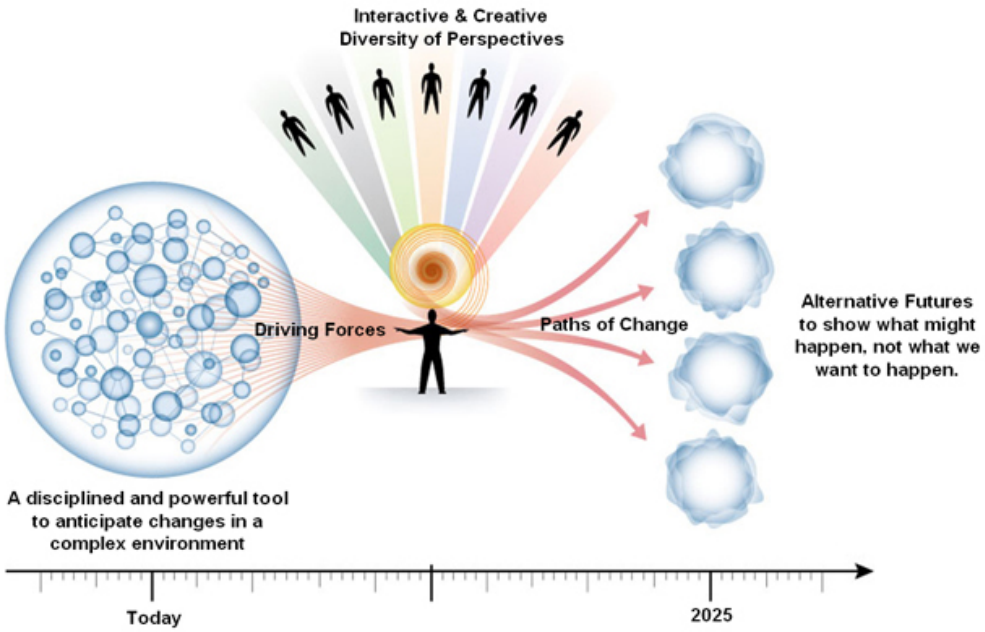

Figure 2.1. Interactive scenario planning.
Source: www.fields-for-food-or-fuel.net.

Making and using scenarios is not an undisputed process as they can be very political in their interpretation, but by explicitly showing the possible elements and issues of uncertainty which are now facing many decision makers they can help to clarify contradictory scientific evidence and show the perspectives as they represent different actor assumptions. The different scenarios of the impact, consequences and side-effects of using soy as a crop for the production of biofuel can be used to analyse the changing social configurations that dominate the debate. The patterning of different actor groups and their position towards certain ideas might help to get preliminary insights on the variable path of change in order to support a reflexive governance process.

2.4 Legitimacy of governance

Discussions about sustainability aspects of the commodity chain often start with the question who has the legitimate right to act and how is the decision-making power is distributed? Just like other networks these governance networks have the possibility to exchange resources and coordinate actors' strategies based on institutional norms and rules (Stærdahl et al. 2006). In order to discuss the 'legitimacy' of established norms in these governance processes it is essential to explain what is actually meant by governance. By examining how governance structures change and acknowledging the challenges that come with them, more insight can be gained in the relationship of actors within governance processes and their connectedness to power in the system. As Voß (2003:4 in Stærdahl et al. 2006) puts it: *'(…) new modes of governance must […] be understood to be embedded in systemic contexts of more encompassing governance patterns which are structured by a specific configuration of social values, knowledge, institutions, technology and natural conditions. Governance innovation therefore needs to relate to this configuration of its context. And it must be acknowledged […], that governance innovation follows specific dynamics, which cannot easily be planned and controlled, but are highly contingent on the interaction of many actors and contextual developments.'* Within the institutional arena actors meet and define the rules and norms that are necessary for a common deliberation process as well as discuss the concrete topics on the issue. As a result the governance structure and the topic itself are commonly developed in this kind of deliberative policy process (Hajer 2003). In this case (global) governance should not only be seen as the formal institutions and organisations that give structure and authority in collaboration and that control the allocation of resources, but as a mix of all kinds of governing efforts by all manner of social-political actors, public as well as private occurring between them at different levels, in different government modes and orders (Held et al. 1999; Kooiman 2003). As a result governing is related to the totality of interactions aimed at solving societal problems or creating societal opportunities in an attempt to establish a normative foundation for all those activities (Kooiman 2003). Based on this definition of governance the challenge remains how to establish a normative foundation for these different principles. A normative foundation implies that there is some kind of legitimacy in order that is accepted by all actors.

The question then arises whether these changing modes of governance are also reflected in different legitimating processes. There are different approaches to analyse the concept of legitimacy. Schouten (2007) distinguishes three main schools of thought: political philosophy, a school of thought that accepts power as legitimate when the governing system is justifiable according to rational norms; political sociology: that seeks to describe legitimacy in a specific (historical) context; and the legal approach that accepts something as legit when it is according to the law. Beetham (1991) makes an effort to combine these different forms of legitimacy and shows that power can be legitimate to the extent that: a) it conforms to established rules, b) the rules can be justified by reference to beliefs shared by both dominant and subordinate parties and c) there is evidence of consent by the subordinate to the particular power relations. This approach is useful for commodity chains, because it does not focus on one specific source for legitimacy, but rather sees it as a division of power relations and their acceptance by the variety of actors. One of the recent developments is that many policy fields started to have self elected actors, which do not necessarily have a group of supporters. These actors negotiate on behave of 'the rainforest', 'the Indians', etcetera, but are not necessarily the legal representative of their constituents. Through some kind of interconnectedness, for example, economic relations or morality they are and want to be involved with these local contexts. According to traditional beliefs this is not necessarily a legitimate situation, but even so the occurrence of these situations is growing as a result of an increasingly active and powerful civil society. Therefore the challenge seems to be to develop a mode of governance that can increase legitimacy within these fields and can help to give them the basic structure. Stærdahl et al. (2006) therefore define legitimacy as *'the social acceptance and compliance with relevant institutions'*, a definition that seems to fit these new governance schemes. To elaborate on this definition it could be said that it requests the general acceptance of people for a certain regime or policy in a certain field, but it does not help to understand when and by whom something has to be 'generally accepted'. This is the challenge of many contemporary policy fields in which governance structures still have to be defined. To gain a better understanding of the dynamics between actors and the development of roundtables as new institutional frameworks, such as the Round Table for Responsible Soy (RTRS), they need to be closely studied.

A tricky element of 'general acceptance' is the role of power. Paulson et al. (2003) explain the relation between power and politics as following: '*We conceptualize power as a social relation built on the asymmetrical distribution of resources and risks and locate power in the interactions among, and the processes that constitute, people, places, and resources. Politics, then, are found in the practices and mechanisms through which such power is circulated.'* To apply these concepts to research Paulson et al. promote *'multi-scale research models that articulate selected ecological phenomena and local social processes, together with regional and global forces and ideas. We also advocate methods for research and practice that are sensitive to relations of difference and power among and within social groups.'* This implies that one should not only recognize the different scales often used in biophysical research, but one should also focus on the different levels of social interaction. Governance itself is shaped by scalar dynamics, but also creates new scalar dynamics. By examining how governance structures change and acknowledging the challenges that come with them, more insight will be gained in the relationship of actors within governance processes and the connectedness to power in the environmental system. Hereby the aim is to distinguish methods and tools which enable research and analysis of the dynamics in these processes of change and innovation within governance networks.

2.5 Concluding remarks

The objective of this chapter is to understand the processes that are linked with the evolvement of policy fields. It shows that policy regimes are changing as a result of changes in the institutional arena. Within the developing institutional arenas actors meet in order to define 'the rules of the game' as well as to discuss the concrete issues related to a certain topic. As a result the governance structure and the topic itself are commonly developed in this kind of deliberative policy process (Hajer 2003). In this way it is possible to understand the path-dependencies of certain socio-technological configurations within these networks. To understand the processes that are going on it is important to keep a close eye on the power relations within the progressing network. While the actors are negotiating the rules of the game, decisions that are taken already reflect interests and possible conflicts around institutional developments. The overview of actors within their context has been studied by many scientists with the help of actor-network theories, but to study evolving policy fields the analysis has to be taken one step further. It requires connecting the different interaction patterns on all scalar configurations. The underlying assumption of this approach is that there is not one actor responsible for all changes and has the sole decision-making power, but that change lies in the interaction and interdependency of actors in a nonlinear interaction process. In this process not only science and knowledge are always incomplete, but the system itself is a set of complex dynamics.

3. Shaping governance structures

The previous chapter demonstrated that there is an evolvement in the way policy fields are shaped and that current developments are amongst others stimulated by increasing demands for flexibility, increased insecurity and a complex interconnectedness with other policy fields. The next step is to analyse how actors interact under these circumstances and in return are shaping and reshaping the institutional system as a result of their actions. To study this arena of various interaction patterns a theoretical framework will be developed that discusses strategies to analyse (strategic) choices as they are made by actors in the decision-making process as well as the role played by for example power relations that are part of the process itself. The purpose of the theories presented in this chapter is to create an integrated scientific perspective on the elements that play a key role in the analysis of the developments regarding governance structures.

In this chapter public-private and private-private interactions are taken as point of departure for new governance structures. These structures are no longer based on strictly hierarchical governmental decision-making, but part of a mix of different horizontal controlling mechanisms where collaboration between public and (semi) private organisations is key (Verbeeck and Loots 2003). This can be based on trends for example regarding shared environmental and social responsibility, which lead to an increased attention for Corporate Social Responsibility thus requiring new and interactive institutions to manage natural resources. Characteristic for these processes is that they are often multi-actor approaches, such as can be seen with the RTRS. Still new difficulties arise regarding the institutional shape in which these processes develop. In this chapter the configuration approach will be explained as a useful methodology to analyse the arena in which these processes take place. Yet, this will be combined with other theories to generate a more complete structure. By applying this combination of theories to the case study they will generate useful insights into the shaping of the policy arena in cases with an international context and multilevel actor-groups.

3.1 The configuration approach

The configuration approach is a method to analyse the correlation between various interaction patterns of social structures and various reality definitions of cognitive structures which exist between actors in society. Point of departure for this approach is that transitions in society are not only a matter of changing hierarchical structures, but also a matter of changes in the minds of people. These ideas are linked to the concept of social order and changing governance, because while these changes are processing in the minds of people there is a high risk that the existing management structures try to keep control by reducing the variety of options. Termeer (2007) argues that the main question is not whether organisations and public leadership interact in processes of change, but more *how* they interact. The assumption by configuration analysts is that the days are gone that a task could be divided in a separate technical-scientific complexity or social complexity. New forms of complexity have come forward which entail that problems can only be understood and tackled when technical, ecological, organisational, administrative, economic, and other complexities are included in a mutual connection and interaction (Termeer 2007). Where a traditional network approach focuses on the impact of fixed structures on the interaction process, the configuration approach focuses on the interactions and processes themselves. The idea behind this approach is that there is no discrepancy between reality and its perceptions. People select subjects in their environment that are important to them at the very moment they give meaning to them (Termeer 2004). In this way people make sense of the reality around them which does not mean that this process happens in isolation. The process of sense making can be reinforced or challenged by other people. When people share the same interpretation they can become part of a social-cognitive network, a configuration. This configuration is not a fixed entity, because it is open to a diversity of dynamics depending on the evolvements in the network. These configurations can also exceed the traditional networks, because they link people and groups who have similar interest without them possibly realising this, this is called a cognitive aggregate. For example a farmer might be connected to innovators from the car industry and bio-technicians, because they share a common interest in resources and products, this might result in similar reality definitions. The configuration approach looks for changes in a dynamic context with a long time horizon that exceed the level of a fixed policy programme.

The configuration approach as it has been developed by Termeer (2007) distinguishes three main dimensions for the analysis of social processes of change: 1) the micro-dimension deals with sense making by actors; 2) the meso-dimension looks at patterns within configurations; and 3) the time-dimension looks at the continuous processes of change. Each dimension can be subdivided in a number of characteristics.

1. Micro-dimension: sense making

In the micro-dimension interpretation can be seen as the construction of reality definitions, rooted in earlier experiences within a certain frame of reference. This means that there can also be discrepancies between theory and practice. During the interpretation process, there is a constant interaction and negotiation on interpretations for the actor. The process of sense making can occur in many different forms:

- Sense making as the construction of definitions of reality: people direct their attention to certain developments and processes. By doing so they construct a definition of reality which is true at that moment, they start to act, and create their experiences based on this action.
- Sense making as sense giving: sense giving relates to the basis of the shaping of identity. It reflects feelings that go deeper than that of perception.
- Sense making as creating stories: stories are created at the moment that people are asked for the reasoning behind their behaviour. By constructing these stories actors make sense of their own behaviour.
- Sense making as a circular process: this explains the double interaction between actors. The input of one actor results in the reaction of the other and vice versa.
- Sense making as a social learning process: people are continuously in contact with one another and by doing so they develop mechanisms about social interaction.

2. Meso-dimension: pattern formation of configurations

During the process of sense making, patterns come about as part of the social process. These patterns in return have their impact on future processes. The variety of patterns can be called configurations. *'They can be characterized as a connection between a social structure consisting of stable patterns of interaction ('who') and agreed-upon rules of interaction ('how') and a cognitive structure that consists of shared meanings ('what')'* (Termeer 2007). In this dimension there is the evolvement of particular patterns in configurations. The truth as definition of a particular reality is established. These patterns can lead to firm social-cognitive structures.

3. Time-dimension: continuous change

Configurations vary through time; they can develop spontaneously, but can also fall apart, therefore their existence is temporary. At a certain moment they bring actors together, there can be a moment of development, but it can also lead to disintegration. New information and unexpected occurrences can be the drivers for this change.

Considering these elements of the configuration approach one has to realise that there is no independent reality, but that reality is shaped by the context of the actor in a social-cognitive structure. The social structure relates to the interaction patterns, whereas the cognitive structure relates to the shaping of reality definitions. Jasanoff (2002) explains that actors do not only seem to carry the views of their institution, but also views from their personal background regarding socio-technical realignments. This means that people can be part of several configurations for example a scientist from a particular epistemic community can have a vision on the technical application possibilities of vegetable oils, but at the same time this scientist can be active in an environmental NGO that wants to stop agricultural expansion. Both functions can have different reality definitions which may come forward in a specific social context (Termeer and Twist 1991). All people are part of several configurations; Termeer and Twist describe this phenomenon as 'multiple inclusion'. Multiple inclusions can be a strong driver for change in configurations since elements of sense making are brought from one reality to another through interaction. To analyse the source of further dynamics and innovation Termeer (2004) proposes to look at the variety of perspectives and their interaction.

Inertia as negative outcome of configurations

Within the configuration approach the variety of dimensions for sense making can be seen as different possibilities for change. Change occurs when interaction and multiple inclusions change or develop alternative configurations. Yet, change might be blocked when fixations emerge. Fixations come into existence when variety is excluded and the

learning process and interaction with other configurations stagnates. This occurs when people do not interact with others who might have alternative ideas. As a result they can get stuck in vicious circles wherein they are no longer able to exchange views or think of other options, in this way restricting development. As a consequence certain elements are not open for discussion and cannot be renegotiated, because they do not fit in the context of views, strategies, cultural matrices, and practices of social actors (Jansen 2004). Those who are part of the dominant configuration process can have considerable impact on fundamental questions about the shaping of society with regard to questions on who we are and how we should live. However those who participate in an alternative configuration can be excluded and suffer the consequences, because they are not given voice nor opportunity. In this case one has to consider that within big organisations like multinationals and governmental bodies not all actors are necessarily part of the same configuration nor can count on an equal voice (Jasanoff 2002). The same applies for the relation between different actor groups, wherein the dominant group can determine whether or not it is open to alternative considerations.

Another process that can negatively influence change due to interaction in configurations is called 'escalated harmony' or 'negotiated nonsense'. This occurs when differences are overlooked with the instruction to create consensus for a specific goal, without common acceptance of all ideas. In the end this can lead to the avoidance of new varieties and/or alternative ideas (Termeer 2006). When a large variety of actors all seem to be part of a particular configuration and have a shared opinion on current developments, they rule out any alternative versions of reality, which results in limitations to the debate. This process occurs when actors are no longer able to operate independently, but are part of a larger context with complex interaction patterns (Termeer 1993).

3.2 Criticism of the configuration approach

Based on the information above it seems that the configuration approach provides a good method to determine policy content, based on the interaction patterns and coalitions between actors in a policy process. It shows the preferences of actors are supported by their cognitive and social framework. The focal point on frames of social-cognitive elements suggests that the major focus for policy analysis should be pointed towards processes of sense making, but there is another side to this approach. Although interaction rules and patterns are part of the institutional framework of the configuration approach, there is only little attention for the institutional context that shapes configurations. This means that there is no specific attention for a discourse analysis of relations that can co-determine processes of sense making (Verbeeck and Loots 2003). In this account the actor is seen as the centre point of analysis while there is no attention for the structures in which the actor needs to operate. A similar critique comes from Pestman (2001) when he quotes Volkart (1951 in Pestman 2001) to describe that although there is truth in the statement: *'if people define a situation as real, it is real in its consequences'*; this does not explicate the role of power within the configuration approach. Indeed, people shape their reality definitions, but it also implies that there is no division between the perceptions of actors and the institutional frameworks in which they need to operate.

Therefore it could be argued that the institutional framework in which actors need to operate is a basic part of the process of sense making. With regard to the management of natural resources some relations and reality definitions therefore might have more power and advantage than others since they have a certain authority in the management chain. Generally the configuration approach has been applied to fixed policy fields with a clear institutional framework thus studying possible evolvements in this field, but always within a defined context. Yet, in evolving policy fields where the deliberative process in order to shape institutional frameworks occurs at the same time as the process of sense-making, the policy fields are not so clearly defined. This means that it is not always clear what actors want, what they can do and how they can organise themselves. In this context the configuration approach does not provide sufficient analytical tools to discuss the output of the decision-making process based on the interaction between various actors.

To adjust the configuration approach it should be complemented with other strings of theory to develop a well balanced structure for analysis and discard any fixations and too narrow analytical focus. The goal of this broadening of theories is to see which theories could complement the configuration theory in order to develop a more holistic analytical scheme for governance in developing policy fields. Schattschneider (1960 in Pestman 2001) argues that

'all forms of political organisation have a bias in favour of the exploitation of some kinds of conflict and the suppression of others because organisation is the mobilisation of bias. Some issues are organised into politics while others are organised out.' In this context Pestman (2001) says that participating in politics also is based on choices that are partly logical, partly moral and partly financial; hence not all claims can receive equal consideration. Long-term consequences are often difficult to estimate since actors form coalitions which might have unforeseeable consequences. In evolving policy fields these processes account for changing hierarchical structures and changes in public-private relations. In order to get a grip on these developments one could study the shaping of new institutions and long-term perspectives by existing actor groups. Additions to the configuration approach in evolving policy fields should therefore focus on the role of discourse in the public debate and the identification of involved actors as well as shifts in their power relations all based on long-term perspectives. Paragraph 3.2.1 and 3.2.2 should be seen as specifications of the configuration approach for application in evolving policy fields. Paragraph 3.3 presents alternative strings of theory that are useful to integrate concepts on scalar dynamics, hierarchical structures and the specific role of natural resources management in this context.

3.2.1 The role of discourse

An aspect that remains out of sight in the configuration approach is the role of discourse. Discourse in the social sciences is generally explained as a set of conceptualized ways of thinking. For example in the debate about biofuels this plays an important role, because 'bio' comes from the Greek word 'bios', which means 'life'. Opponents of the biofuel industry therefore say the word in itself has a positive connotation, while they argue it has a negative impact on the life of the planet, because of agricultural expansion and loss of biodiversity. Therefore these groups stick to the term of 'agro fuels', which singles out the agrarian context of the production. This example shows that it is essential to be aware of these 'implicit' connotations within various networks. They might be discussing the same policy processes, while using different vocabularies thus different reality definitions can be identified. The mainstream opinion has defining power for the vocabulary used in for example policy documents. In a way this seems very similar to the dimension of sense-making within the configuration approach, but discourse theory accentuates the role of vocabulary a lot more. In the debate on biodiesel this can be quite important. An environmental NGO might call cutting trees in the Amazon 'deforestation', while a farmer is talking about 'opening up land'. The different vocabularies used by different actors implies something about their normative structure. Within configurations it might be the case that people would distinguish various configurations about different subjects, while in fact people are discussing the same issue from another perspective. In analysing the configurations this differentiation has to be taken into account.

Other elements of discourse analysis that should receive attention are 'dominant discourse explanations'. In a study by Hecht and Cockburn (1989) on the causal dynamics of rapid deforestation in the eastern Amazonia (Brazil) they pointed out that it is often argued that people clear tropical rainforests to create pasture for cattle ranching, but that these ranching activities are often economically inefficient and environmentally destructive. So the authors explain that macro level political-economic forces, like rents and subsidies generated by successive Brazilian governments created false conditions of high profitability that influenced a variety of social forces acting on the environment. These had a huge impact on the actions of the ranchers, peasants, workers, and trans-national companies in this area. Whether one agrees with this explanation is not important. The fact remains that there is no single truth in these cases, and the different points of view depend on the used reality definition. Yet, some definitions might be more dominant and powerful than others. In discussions on environmental issues there are often different discursive complexities. The impact of certain dominant perceptions and discourses on the specification of environmental problems and interventions can be enormous when other interpretations of the story remain out of site (Bryant 1998). Verbeeck and Loots (2003) argue that the politics on environmental issues can therefore be defined as the struggle for 'discursive hegemony'. This is in line with the notion of fixation used in the configuration approach. Yet, it accentuates the impact of a dominant 'truth' versus alternative logic. It shows how more powerful configurations might be fixated on a certain outcome ignore alternative explanations as a consequence of their fixation. This could lead to situations where change through interaction is no longer possible.

A criticism on discourse analysis is that although it can be a very useful tool when specified as part of the evolvement of configurations, it might not be sufficient to analyse power relations nor to analyse the relations between different networks. Despite the fact that discourse can be steering and influencing in the sense making process, it does not regard the rules and power relations that are already in place. These are tangible elements that play an important role in any debate.

3.2.2 Identifying actors through net-chains

In order to perform a configuration analysis and study discourses it becomes a necessity to distinguish the relevant actors. So far the configuration theory has only been applied to fixed policy-networks where relevant actors could be identified on the basis on their participation in consultation groups or through fixed institutional lines. This kind of methodology does not work for evolving policy fields, since it is especially the institutions themselves which are being shaped through interaction and discussion. This poses a difficult problem for the identification of actors, because not all groups might be present in these deliberative meetings. To resolve this problem it might be useful to rely on actor-network theory, which is often used in the social sciences to identify and map the relations between different actors (which can be people, institutions, etcetera) in a network. By analysing these relationships more insight can be gathered into the internal processes of innovation and knowledge-creation and the shaping of an institutional system even when actors come from different backgrounds. Marsden (2000) argued that actor-network theory in general has been very helpful to overcome the dichotomies between the social and the natural sciences, because it is able to make the social more 'inclusive' of the natural sciences by showing the interaction between both fields. The kind of information generated by actor-network theory could help to find the actors who are involved in process of developing values, building new social constructions and finding a balance between social, political and natural practices. Though the term network functions to explain the various relations between different actor groups or as social systems, a criticism is that it also does not necessarily pay attention to the complex set of power structures regarding the social political interactions. Even though networks can have a very explorative nature, they do not necessarily explain why actors are linked nor do they look into the 'non-existing' relations. The focus lays on interaction more than it looks at 'non-interaction', which might be a very useful indication for fixations and limiting options of change. Since these elements are left out the theory does not explain 'the existence of the network' as such. As a consequence it remains unclear how the governance of the network is organised and which objectives lay behind particular relations. In order to answer these questions clarity needs to be generated on the quantity and quality of interaction and the possible accordance in reality definitions.

Another way to identify actors involved in the process is through chain analysis. The chain relation might provide important tools to understand the interdependency and possible power relations between actors. It identifies those who do not play an active role in the debate, but hold a key position for any institutional change. For example truck drivers might not feel related to the soy production discussion, because they simply transport freight. Yet, the quantity of soybean that is being transported is an important part of employment in their branch of industry. When something would change in the use of soybean and less long distance transport is needed, this group would notice the difference and might for that reason lobby against certain industrial changes. Chain analysis is based on economic and industrial ways of analysis. In general it is considered as the mapping of the process from the first raw material to the end product and the consumer. This implies that all steps in the production process are described. In this way and an overview is generated of all the steps in the production process as well as the various applications and industries that are involved. For economists it is possible to calculate the added value in each step of this process in order to get a good view of the price composition and therefore of the importance of the different steps in the chain. Lazzarini et al. (2001) describe the process of the supply chain analysis as a map of the vertical outline of a certain product for example from farmer to dealer to agri-business to wholesaler and finally to customer. The main criticism of this direction is the lack of knowledge about the non-chain elements such as legislation that might impact the way the chain is organised. Since legislation is not a part of the chain itself it falls outside the unit of analysis for chains. A way to include these non-chain relations is by changing the limitations of chain analysis.

According to Lazzarini et al. (2001) *'a net-chain is a set of networks comprised of horizontal ties between firms within a particular industry or group, which are sequentially arranged based on vertical ties between firms in different layers'.* In this definition Lazzerini et al. (2001) leave out other institutions, such as legislation and NGOs that can also

play an important role. Still, from a network analysis perspective it is no problem to include such actors in the analysis. By combining the net-chain analysis with the configuration approach more insights can be gained as to which groups might be part of the same configuration and which relations might stimulate or slow down innovation. Blom et al. (2006) argue that these net-chains have multiple roles to play in relation to different actors. When this is related to agrarian production it becomes apparent that for example food production plays many different roles in society. The actors in the food net-chain are not only part of the food production chain in itself, but they are at the same time influencing other resource markets of raw materials. This widens ideas on the possible range of players that should be included in analysis in this context to for example: regulatory agencies, private consultants, category managers, retail buyers, wholesalers, marketers, groups of consumers and so on. All these parties are in one way or the other involved with the construction, transfer, quality and value of the product. This corresponds with the description Kinsey (2001) gives of the new food economy in which development of processes and relationships should be put first, and that of products later.

Although net-chain analysis provides a very useful analytical tool for the identification of actors, it also poses problems. The main challenge is to analyse the collected data without ending up in chaos theory with no overview at all. Marsden (2000) and Blom et al. (2006) suggest limiting the scope and focusing on those actors who are actively involved with the process for instance by producing, consulting, making regulations, selling, demanding; thus those actors that are aware of their relation to the net-chain. In this way there can be a focus on information development and exchange in different levels of the chain within certain socio-technological systems while analysing the chain and its participants in their mutual relations and power struggles. Another challenge is the method used to make an in-depth empirical analysis of actors involved and to analytically explore the evolution of the new forms of relationships (Marsden 2000). Understanding these relationships requires extensively studying the space for negotiation and configurational changes. Marsden (2000) proposes to do this by active interaction and continuous reflection on the process. Empirical data based on interviews and observations provide an important point of departure for information collection, but separate information should be collected on the actors in the chain, their relationships and interdependencies. Though this is a solution, it might not be simple, finding collecting the relevant information there can be problems with the transparency of the chain and not all relationships might become clear. Other elements, like trust and interdependency are difficult to measure. Besides actors might not always give the true reason for participating in a network or expressing a particular point of view; there might be hidden agendas and strategic interests which will play an important role. Through triangulation these must be exposed as much as possible.

3.3 Alternative views on governance

In the paragraphs above a model has been developed to analyse possible policy configurations based on comparable reality definitions. This identification of actors involved is based on a close observation of net-chain relations and the reality definitions can be specified with support of discourse analysis. Now it is time to adapt and complement the ideas on steering elements in governance by having a closer look at specific power relations in the form of ordering principles and the role of scalar and human dynamics when natural resources are considered. These elements are left out of the configuration approach, but are key issues within theories on political ecology and social order.

3.3.1 Political ecology: scaling perspectives

Political ecology stems from a broad range of scientific disciplines such as geography, sociology, anthropology, biology and ecology. It combines elements from these fields and examines the relationships among humans and between humans and the physical environment in the context of development. Bryant (1998) defines it as following: *'Political ecology examines the political dynamics surrounding material and discursive struggles over the environment in the third world. The role of unequal power relations in constituting a politicized environment is a central theme.'* Though the focus on the third world seems quite limiting and not relevant for this research the remaining part of the definition does combine elements of political dynamics with discursive struggles, environment and governance structures, hence dealing with the gaps of the configuration approach.

Through political ecology it is also possible to link social and physical sciences through an explicitly theoretical approach and to study local relations between human behaviour and the environment (Paulson et al. 2003). This is an issue that plays a key role in the development of evolving policy fields. In this approach questions about the social relations of production and about access and control over resources are the core focus, but there are challenges as well. According to Paulson et al. (2003) there are three basic issues that confront political ecology today. The first is to define politics and the environment in ways that facilitate a more thorough examination of the relationships between them. This implies that more focus is needed on the scale of analysis and the ways actors can be put together. Secondly, to identify methods for carrying out and analysing research that encompasses relations between politics and environment, and thirdly, to develop ways to apply these methods and findings in addressing social-environmental concerns. When these questions are answered it is possible to operationalise political ecological theory in field research and analytical methods. In order to address these challenges more questions have to be asked about the possible scales, the identification and relation of actors and the way to measure interaction.

The traditional unit of analysis for political ecology has been the local perspective and individual behaviour of actors. At first political ecologists main interest was directed at small scale case studies as the core source for data collection. More recent publications have acknowledged that this has been a limiting analytical factor and researchers have expanded their view to a more international and global context (Brown and Purcell 2005). Nowadays key actors are often identified as the state, local and global organisations, cooperation's, and all other parties that add to the interactions between the various decision-making levels. Power relations between the different actor groups are discovered by studying conflicting perceptions, discourses and knowledge claims about development and ecological processes (Bryant 1998). Still modern scholars continue to use traditional concepts of political ecology by analysing how decisions of communities are made about the natural environment in the context of their political environment, economic pressure and societal regulations, but they use the concept of 'communities' also on the international level (Brown and Purcell 2005, Bryant 1998, Bryant and Goodman 2003, Jackson 1999). Within this international context special attention is often given to the (unequal) power relations within (and between) societies and how these affect environmental and policy decisions. Within this school of thought there is a direction that argues that there is no straightforward relationship between people and the environment in processes of environmental change. *'Social, political, economic and ecological processes interact dynamically requiring analysis to be sensitive to the interaction of structural features and human agency across a range of scales from the local to the global'* (Scoones 1999).

The most important element of this approach is the focus on scales as being socially defined through political struggle. For research in this area it would be relevant to find out the political interests that lie behind particular scalar configurations and why these have been pursued. In using such an approach to scale it becomes possible to link global and national forces with regard to environmental policies towards local ecologies. *'This can result in a more explicit understanding of the way that human-environment dynamics in development take on particular scalar configurations, and how those configurations are produced, undone, and reproduced through political struggle'* (Brown and Purcell 2005). In this case scale itself functions as an objective of analysis. The discussion on scaling within political ecology is very similar to the challenges of the net-chain approach. By linking the ideas of political ecology such as the focus of the impact of certain scalar configurations, to those of net-chains such as the focus on the relations between all actors in and around the production chain a complete overview will be generated for the identification and role of actors. By linking the organizational attributes of various actors to their capacity to act in political-ecological conflicts, the complex development traits and interests of different types of organisations as far as those traits and interests have manifested themselves can be studied (Bryant and Bailey 1997 in Bryant 1998).

Linked to the discussion on scaling is the element of time. Within political ecology there is a special focus on the long-term consequences of colonial legacies. To analyse this there is much attention for the distribution of wealth and landownership and how this continues to have an effect on the current situation. Sensitive feelings in this field could come forward if the distribution of these elements is still linked to the political and economical elites of the past. According to Bryant (1998) there is clear empirical evidence from various parts of Brazil showing how political struggles, economic interests and ecological change come together in patterns of human-environment interaction that characterize Brazil's contemporary (violent) land conflicts. As a consequence, the social and economic inequities of the past are an integral feature in the development of a politicized environment and still have their impact in the

current time frame. This context increases the scale of the debate, because it includes actors that are not directly considered as part of the discussion. Within contemporary agricultural debates in Brazil there is a lot of attention for landownership, because the way in which landowners obtained their land and are profiting from current policies can undermine the arguments that the policies are in the best interest of the nation. If there is a strong relation this could mean that landownership and social position can reinforce each other. This is another use of the concept of time than the one used in the configuration approach, but they complement each other. Here historical events are used to explain current politics and views and in configuration theory time is used to explain the evolvement of such opinions through time.

3.3.2 Power relations relating to social order

The next challenge for political ecology is to identify methodologies which are able to analyse interaction dynamics in various scales. To comprehend the existing differences among scalar configurations it is necessary to find a methodology that is capable of analysing interactions between the actors and link these to power relations. Paulson et al. (2003) suggest that current political ecological research is *'seeking for methods to learn about and from participants in these various arenas and to investigate the workings of knowledge, discourse, and practice in social movements, urban landscapes, institutions like the World Bank, national and global governance, and other spaces.'* According to them this could be done by participative observation, discourse analysis of texts and legislation, examination of archival records and sociological analysis of complex institutions. These techniques are similar to the common ones used in sociological and anthropological research. Besides the configuration approach, discourse analysis and net-chain approaches can answer a number of these questions. The problem is that it still lacks the instruments for the measurement of power within and between relations. In order to understand these power relations it is necessary to develop tools that are able to identify shifts in decision-making power. This was very well shown by Streeck and Schmitter (1985) who declare that too many are focussed on the dichotomy of state and market, in which the state represents elements of hierarchical control and the economy of dispersed competition, as the main decision-making institutions and powers (fig. 3.1). They suggest that these two principles are no longer capable of explaining social order in society as other interactions such as active participation by civil society have come forward.

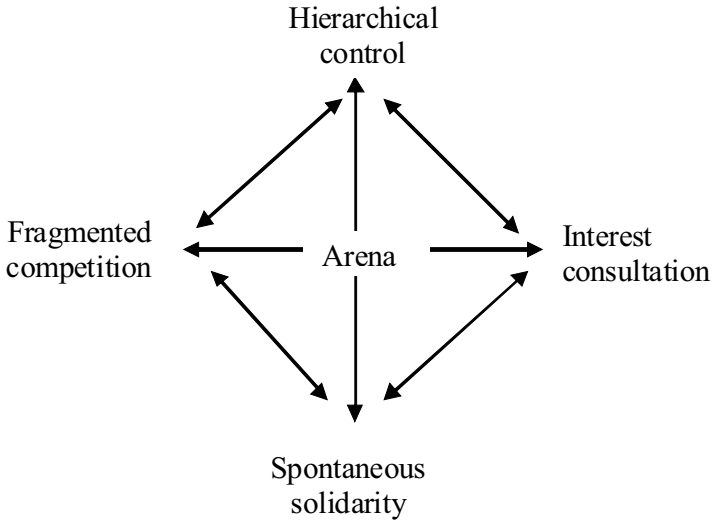

Figure 3.1. Social Ordering.
Adopted from Streeck and Schmitter (1985).

In an attempt to explain this larger variety of social ordering principles Streeck and Schmitter (1985) propose a quite reductionistic model to analyse different ordering principles. They lay-out four key ordering principles:
1) hierarchical control: representing the role of authority; 2) fragmented competition: an optimal allocation of resources; 3) spontaneous solidarity: related to social norms; and 4) interest consultation: organised interests by stakeholders. These elements seem to coincide with: the state, the market, associations and civil society, but this is an incorrect understanding. The ordering principles should be seen as different methodologies of management used by actors, which need to find equilibrium. Within the model every combination of alternatives is possible and it is very likely that the division of ordering principles will change through time as changes in society occur. For example the fourth principle of interest consultation seems to gain more importance as a result of active lobbying and a stronger civil society. When this principle gains power it might be at the expense of hierarchical control. As organised interests meet and form groups they create new networks of cooperation with their own ordering mechanisms. Adjacent to these principles certain views or configurations could be placed that are shaped by a particular organisational structure. The way order is organised within this configuration also determines its openness towards alternative ideas. For example if a farmer's cooperative is organised according to hierarchical principles their configurational point of view will be quite fixed. On the other hand when the cooperation is very open and there is a lot of spontaneous solidarity among members there might be more flexibility and room for change.

Meta-governance

To answer the question of shaping governance structures as a result of shifts in social order in evolving policy field's two realisations have to be made. The first one is that governance itself should no longer be regarded as an independently operating structure, but rather as a flexible system that evolves with its actors. To study this system Stærdahl et al. (2006) argue that a view on 'meta-governance' (governance activities aimed at overlooking and/or changing governance structures) should be established. When meta-governance is conducted, one could look into specific actors, networks and institutional constellations framing the creation and diffusion of knowledge, or framing the guidance of direction. In this way space can be created for analysis of identities and actions within diverse net-chain systems. The study of these governing processes can also include attention for new initiatives or possible blocking mechanisms. In this way a new type of analysis comes into existence that can draw up multi-sectoral, multi-actor and multi-level approaches. One of the basic beliefs about new governance is that power is scattered among a large group of actors, levels and sectors. Therefore it is impossible to distinguish one specific decision-making power, because power is defined in interaction. This will change the way in which decisions are made, because actors have to interact, or as John Dryzek formulates it: *'The only road forward, then, is the road of deliberative, or discursive democracy, based on 'uncoerced and undistorted interaction among competent individuals'* (Dryzek 1990 In Hajer 2003).

The second realisation concerns the formation of special networks and coalitions and how these are ordered according to configurational patterns. In this context Teisman and Klijn (2002) explicate that public-private partnership arrangements can be seen as new forms of governance which fit within the complex relations and interactions of the current network society. Using the efficiency of the private sector and the involvement of civil society can give a new kind of legitimacy to governmental institutions. Within these partnerships the traditional hierarchies between actors are disappearing, because they are increasingly interdependent for the implementation of their policies. Based on concepts of social order it becomes apparent that the dichotomy of public-private partnerships is too narrow and that the focus should be on the struggles of all groups that are involved and that have their own control mechanisms. As these groups seem to organise their knowledge systems about the subjects differently and have different methodologies to propagate their point of view, these systems should be analysed in order to understand decision-making power. Groups that are part of the central configurations are more likely to oversee political developments and know whether political solutions are used than the ones outside. The other configurations might try to understand it, but they will only have or support part of the information, but they will also have their own view. One could say that this illustrates the meta-governance on multi-level scales, mixed with a large number of ordering principles. To understand the broad picture one should not try to separate these different strategies and levels. Kooiman (2003) agrees that many traditional ordering principles of market, state and planning models of the government have lost their applicability as a result of increasingly complex policy issues. For that reason contemporary governance should be considered as *'a mix of all kinds of governing efforts by al manner of*

social-political actors, public as well as private occurring between them at different levels, in different government modes and orders.'

In much literature about transition management the 'arena' has been presented as a management tool for describing the various transformation processes. These processes occur when there is a shift in the ordering principles. These arenas can help to distinguish the types of interaction and transform them to the meta-governance process. Stærdahl et al. (2006) place the arena at the centre of a reflexive governance process, *'where it in a cyclic way moves from stages of organizing multi-actor networks, developing (negotiating) sustainability visions and transition agendas, mobilizing actors, executing projects and experiments and evaluating, monitoring and learning.'* The space between the arrows in the model of Streeck and Schmitter (1985) could symbolise such an arena. The interaction between the lines defines the way the power is organised between the different ordering principles. To recognize how the network functions it is key to identify and install actors in transition arenas and to consider their position within the arena (Kemp and Loorbach 2006). To understand how various views or configurations can impact governance structures one has to analyse if there is a shift in power between the different ordering principles. This is possible as long as the arena itself is centred on a specific context and related to specific issues. This becomes more difficult when policy fields become increasingly complex and interrelated. For the analysis of these shifting governance structures in the biodiesel and soy production debate it is essential to clearly identify arenas which can be explanatory for this process and too understand the various configurations that are present in these arenas. Linking this to the configuration approach, a shift in configurational patterns might result in a shift of social ordering or vice-versa, because it would demand from actors to renegotiate their views and organisation.

3.3.3 Views of nature linked to social order

So far it has still been quite difficult to address the third challenge proposed by political ecologists regarding ways to analyse the relation between social and environmental concerns. The main reason is that it seems that there is no clear one-on-one relation between the two. However by studying views on nature and relating them to ideas about social order it is possible to make groupings as is done by Schwarz and Thompson (1990). They claim that views of nature play an important role in explaining the implicit and explicit assumptions a person or organisation could have and that could influence his, her or its actions based on the normative impact. In this case every view in itself could be treated as a hypothesis on how nature reacts when humans interact with it. When different groups of actors come up with different ideas about a problem and possible solutions they might not understand each other. For example scientific research can offer a number of solutions, but not all of them might be acceptable to different layers of society, because they feel that their point of view is not taken seriously. Van Eeten (2001) argues that it is useful to make different views explicit since: *'explicating implicit views can not only increase the understanding of other parties in the conflict, but also make you see your own position more clearly and maybe uncover new ways of looking at the problem'*, for example by understanding what would be a preferred governing structure. New ways of looking at the problem will generate new ways of solving it by possibilities to break through fixation. This is closely related to the process of 'sense making' as described in the configuration approach which describes how actors can redefine their views based on new information. To comprehend this approach one needs to realise that nature can be looked at in different ways. If people talk about the same thing with a different view of it in mind, this results in misunderstanding. These views are mostly implicit, so it is hard for an actor to understand the others. This makes for a tendency to think of the others' view as irrational and false. In order for the actors to change this and build trust necessary for constructive cooperation, these views must be explicated (so that the differences in standpoints and the underlying reasoning for these differences are made clear) and scrutinized. Schwarz and Thompson (1990) divide these views into nature capricious, nature tolerant, nature benign and nature ephemeral. To explain their theory they envisage the views by seeing nature as a ball that rolls along the line of human action. This line can have different shapes (Figure 3.2).

People also have different ways of looking at society. These can be divided by grid and group, which produces four ideal types of views. Grid can be high or low, which means that the room for manoeuvre is seen as low or high. For instance, one can feel there is little a person can do to change things, that most actions are dictated and firmly set in rules. This person thinks of grid as high. The group-part is divided into high and low as well, which means a person

feels like part of a collective, or like an individual. The arrangement then looks as follows: people who think of grid as high and group as low are called fatalists. They feel there is nothing they can do to change anything and no-one is there to help them, so they just undergo life. High grid and high group translates into hierarchy, where you belong to a group which follows rules determined by people higher up in the hierarchy. The low grid/low group category is called individualistic; everybody makes their own rules and can do what they want. The last view is egalitarian, which means one thinks of grid as low and group as high, in this case there is a strong sense of 'we versus them'. The group can make its own rules, which do not apply to outsiders (Schwarz and Thompson 2001).

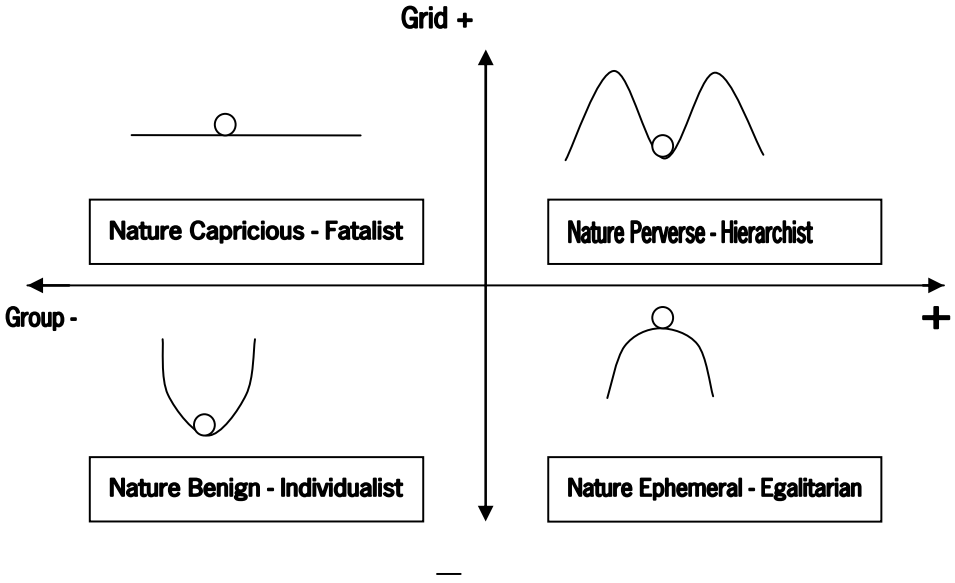

Figure 3.2. Views of nature combined with views of society.
Source: Schwarz and Thompson (2001).

The model of views of nature can then be combined with the model on views of society to show how views can coincide. Fatalists might say there is nothing they can do to help nature, because it will act independently. Individualists feel that rules are not needed, because nature will always recover, no matter what we do. Together this means that in the low group-views there is no sense of shared responsibility. Hierarchists focus on the necessity to keep the ball between the edges, while egalitarians feel they have to do anything in their power to keep nature safe from harm. These contradictory perceptions of the natural environment are based on contradictory certainties (Schwarz and Thompson 1990). If the actors involved in a specific problem fall into different categories, they might find it difficult to identify with other views, because they have fundamental differences in ideas about the problem. As a consequence they define a problem differently and have a different risk analysis. This means that, for instance farmers and environmentalists can think of nature in different ways. Environmentalists fear that the damage done could be irreparable - a nature ephemeral position - while farmers think nature can recover from most problems or has different stable situations - a nature capricious point of view. Linking these elements to the methodologies used in the configuration approach they help to explain the rational link between the processes of sense-making and social-cognitive structures.

3.4 Concluding remarks

This chapter presented an overview of different strategies to analyse changing governance structures in evolving policy fields. The configuration approach is a useful point of departure to map the social-cognitive frameworks that explain change through interaction. Yet, in itself it remains too vague for a comprehensive analysis of change in evolving policy fields. By adding the specific focus of discourse analysis and the identification of actors through net-chains it becomes operational. The analysis of evolving policy fields in the previous chapter showed that these fields

have a large amount of complexity, interrelatedness, strong interactions between science, environment and society, and discussions about the division of power in a legitimate way. These specific issues fall outside the scope of the configuration approach but are the main issues presented by theories on political ecology and social order.

By combining these different strings of theory it becomes clear that configurations are the outcome of a complex set of variables, presenting a flexible system of interacting actors. Variables that play a key role are the social and environmental scale; social scale to determine the different levels of power analysis and environmental scale to distinguish the relevant unit of analysis in the eco-system and the view on nature. The specific human-environment dynamics represent particular scalar configurations that can be produced, undone, and reproduced through political struggle. This political struggle is reflected in discursive struggles over the environment. The way these struggles are fought over depends on the social ordering principles. If these are organised in such a way that interaction is supported, discussions might develop differently than if there are strong hierarchical powers present. The use of time can play different roles, for instance, time can be used to analyse changes in sense-making, but it can also help to identify the historical context which gives the framework for analysis. The battlefield for different opinions and powers can be described as an arena, which is the place to depict the transformation processes that can be explained with regard to (in) flexibility and (non-) interaction as a result of fixations or escalated harmony.

While studying these concepts it will be interesting to look at the path-dependency often found in scientific research, which hides particular views and strategic interests. This means that not all alternatives and views receive the same treatment or an equal amount of options, thereby loosing some of their perceived neutrality (Jasanoff 2002). The variation in different scientific research systems gives a point of departure for the understanding of the shaping of networks. As a lot of knowledge is produced in relations between agents, Schwarz and Thompson (1990) argue that it is important to notice how science and technology shape the world and are in turn shaped by culture, politics and history. Based on the set of variables presented here it is possible to set up a research strategy that will be elaborated in the following chapter.

4. Analytical tools and data collection

As written in the introductory chapter the objectives of this research are three-fold: 1) improving understanding and analysis of the dynamics of complex policy processes in evolving policy fields; 2) providing information on the various actors and their position towards biodiesel production in Brazil; 3) linking these objectives. The previous chapters outlined a set of theories that can be used to analyse the shaping of governance structures of evolving policy fields in a case study. Yet, the theories themselves do not explain how they can be used for practical field work.

This chapter provides the link between the theoretical framework and its practical application in the case study. The main challenge is to operationalise concepts presented in the theoretical framework in such a way that they become workable tools in analysing the soy and biodiesel debate in Brazil. In order to reach this objective the configuration approach and other theories (focusing on discourse, views on nature, and social order) need to be interconnected for practical analytical purposes. To combine these elements with the case study additional information on the actors and their views regarding the use of soy for biodiesel required as well as information on their social structure. The case study itself is based on qualitative data research of different data-sources which work through different mechanisms within their context (Yin 1994).

4.1 Integrated analytical framework

Based on elements that were indicated in paragraph 3.4 a research strategy can be designed. This plan offers an analytical framework for the case study. Here each element is operationalised in such a way that it can be applied to the case study. Sections 4.1.1 - 4.1.5 all start with a brief link to theory, followed by some of the main challenges to their part of the research. Every section ends with a brief summary of key analytical steps per tool.

4.1.1 Mapping net-chains

Mapping the relevant actors and their coalitions in net-chain analysis takes two steps. First, it requires identifying the correct unit of analysis. Though the scope of the debates on biofuel and soybean production is global, the focus of this research will be on the Brazilian context. This means that the focus will lie on those actors that are actively involved with the discussion as well as those who will feel the direct impact of the new Brazilian policies. The position of international agencies will only come forward in the way that they interact in the Brazilian debates, the same applies for multinationals. Within Brazil one could still identify actors on many different levels: national, regional and local. All these categories are taken into account, but the focus remains on the broader context.

Secondly, the set of relevant actors needs to be identified. Actors can be identified as all individuals or organisations that participate in the discussion. To discover relevant actors from various fields during the preparatory research phase, literature and document studies have been used. From then on there has been an open list to which new actors could be added on the basis of interviews, conferences and other meetings. There are a number of challenges and limitations with regard to the identification of actors. The first one is the enormous size of Brazil as well as its huge local variability in landscape, industry, farming systems and culture. Together with the limited time available for fieldwork this meant that four main regions have been selected for field research and interviews. These regions were the Federal District, the Centre-West, the North-East and the South of Brazil. This already resulted in a lot of travelling and a large amount of respondents. The majority of interviews have been held by agents of these regions and it was only possible to meet most actors once or twice for an interview. As a consequence of the tight travel schedule it was not always possible to verify or cross-check information given by one actor about another. Fortunately gaps in information could be reasonably compensated by the attendance of some national conferences where actors from all regions were represented. Another challenge related to the identification of actors was the accessibility of contacts at higher industrial levels. Through snowball sampling and large international events it was

possible to speak to a number of representatives from these organisations. To reduce possible consequences of missing certain actors many additional documents have been collected.

- Mapping the relevant actors and their coalitions in net-chain analysis (chapter 5 and 6) by:
  - Identifying the correct unit of analysis i.e. scalar dimension
  - Identifying the production chain of biodiesel
  - Identifying the production chain of soy
  - Identifying additional networks that impact both chains
  - Identifying which actors are present in what way in both net-chains

4.1.2 Analysing discourse

To identify which key views on nature exist and how they interact with social order it is essential to grasp the discourses that play a role in the policy debates. Discourses can be studied by looking at the used vocabulary and concepts and how they are used by different actors. In this way it is possible to extract sets of conceptualized ways of thinking as the different vocabularies used by actors reveal something about their normative structure. The next step is to identify whether or not certain discourses are more dominant than others, for instance if there is a struggle for discursive hegemony. While analysing different discourses it is important to keep in mind how these concepts shape and interact with the policy process. If several actors are involved in defining key discourses while neglecting all others this might be a first indication for fixation. However if concepts change rapidly it could indicate a very dynamic and encompassing form of governance. To execute discourse analysis with regard to views on nature is the first step towards identifying power relations. These power relations will reveal themselves as they offer more room for certain perspectives than others (this objective is explained in 4.1.3).

The challenge of analysing discourses is mainly generated by the impossibility to read and analyse all available data and how concepts change through time. Therefore the analysis of concepts and their use in this study will be limited to those actors which have been identified in the net-chain. To link certain concepts to a particular view or normative structure of nature runs necessitates interpretation by the researcher. The risk of misinterpretation will be reduced by asking different actors within the net-chain about the views and discourses of others.

- Analysing different values based on views on human-environment interaction and linking these to the used discourses by (chapter 6):
  - Identifying which natural resources are being discussed
  - Distinguishing which concepts play a central role
  - Analysing how concepts are captured in a particular discourse
  - Identifying which views on nature can be distinguished dependent on the actor
  - Looking whether groups can be distinguished around a particular discourse
  - Identifying which concepts are part and which are neglected in the policy debate/arena

4.1.3 Analysing power relations

In order to explore how actors interact in a situation of changing social order, the policy arena has to be studied. Relations might be organised around specific views, production chains or projects. Within these relations social, political, economic and ecological processes interact dynamically requiring examination of the structural features and the range of scales from the local to the global. To be aware of the interaction patterns broader than just public-private relationships might offer new insights. The model by Streeck and Schmitter (1985) offers this opportunity. When actors are open for alternative control mechanisms as a way to break through fixed patterns of responsibility

they might also be open to other processes of change. In order to do so one should combine social elements of relationships with their position in (relation to) the production chain and see how decision-making power is organised. Who is part of the debate and who is not, gives an insight on the accessibility of the debate. These schemes show who talks to whom and how configurations come about. By adding additional information on the process of sense making it is possible to detect elements of how actors influence each other in the decision-making process. Further interactions between social and environmental elements hold a central position in the debate and create a complex discussion in which the outcome of particular acts remains unpredictable. To integrate power relations in such human-environment interactions, attention will be given to possible changes in environmental perspectives or hierarchical shifts.

The challenge of analysing power in this thesis is related to the assumption that power shapes perspectives. It assumes that a specific configuration might use discourse as a way to promote a particular point of view about others. This is a very recognizable strategy in evolving policy fields, because by determining what the 'objective' point of view is can have consequences for power held over the shaping of institutions. The relation between different perspectives portrayed by actors in their social-cognitive framework and the final implementation of these perspectives tells us something about the power of certain networks. In evolving policy fields there is a lot of insecurity about the role of science, risk and long-term scenarios. These elements indicate different ways of handling change and interaction. Whether or not a view becomes the dominant approach to a certain issue is partly determined by the way it is accepted and replicated by others. The model of social order indicates that the way society is organised can determine whether or not there is room for alternative views and ideas. If there is a shift between various ordering principles this means that ideas can change as a result of interaction. On the other hand interaction can also occur within a certain ordering principle when room is allowed for discussion. By analysing key issues in the discussion arena it is possible to find out if possible conflict about them is a result of shifting power relations. In the context of the management of natural resources different views on nature can indicate whether some ordering principles are preferable to others.

- Analysing power relations through different principles of social order by (chapter 6):
  - Looking at the interaction patterns
  - Looking whether actors adopt or share perspectives of others
  - Considering 'powerful players' in net-chain relation
  - Analysing if groups are homogeneous or heterogeneous
  - Considering dependency relations (e.g. in net-chain)
  - Analysing if interaction patterns of decision-making reflect power relations
  - Identifying possible shifts in the groups of actors that coincide with a dependent relationship

4.1.4 Distinguishing configurational patterns

Starting point of the configuration approach is the realisation that reality can be defined by a construction of reality definitions (Termeer 1993). This means that there is no objective reality separate from the processes of perception. A configuration in this context indicates a specific moment in the social process in which a number of reality definitions are connected in stable interaction patterns (Atlantis Alliantie 2006). To identify relevant actors the configuration approach distinguishes between social and cognitive dimensions by asking: 'who', 'what' and 'how' followed by describing interaction patterns that refer to the amount and kind of interactions. This is the micro dimension based on sense making by actors. This information can be gathered on the basis of information collected as suggested in paragraphs 4.1.1 - 4.1.3. The next step is to combine this information into sets of values and sets of actors in order to distinguish configurational patterns. The meso-dimension that focuses on pattern formation of configurations relates to similarities portrayed by actors to distinguish overlapping perspectives and approaches. This relates to the social structure of the net-chain as well as the cognitive structure portrayed by discourse. In this second dimension the social-cognitive configuration is characterised by a (sub)network of actors whose social structure is relatively stable and whose actors have similar reality definitions regarding a particular issue (De Jong 1999).

The third dimension of change through time is the biggest challenge of the configuration approach. In order to study change it is required to follow the shaping of configurations over longer time periods in order to see changes in configurational patterns. As a consequence of the limited time available for this research it is impossible to identify fixations over a long time period. To analyse these elements follow up research will be necessary. However an attempt will be made to identify those reality definitions which can become fixations, such as those that are unlikely to change and that might need special attention in the future, for instance based on the kind of power structure that supports the policy and its openness for change and adaptation. Based on the results of data collection it is possible to identify the main configurations. These configurations can be regarded as a 'photograph' of social relations and views as they reflect a specific moment in time (the first six months of 2007). Within these configurations it is possible to distinguish different dimensions, for instance, two actors are against the use of soy oil for biodiesel, but the arguments might have a different background therefore their process of sense-making could have evolved along different lines.

For a researcher the configuration approach brings with it certain challenges, because analysis of reality definitions will always be coloured by personal interpretation. To reduce the element of personal interpretation and to be as objective as possible triangulation of different data sources has been used. The aim is to provide all actors with an equal voice by allowing all data sources, for example an illiterate farmer cannot express himself in the same way as a multinational, but the lack of official documentation should not inhibit inclusion of his point of view. The strategies and steps explained in the previous paragraph are another way to apply a methodology to the identification of configurations.

- Combining sets of values with sets of actors in order to distinguish configurational patterns (chapter 7) by:
  - Identifying shared value sets i.e. cognitive frameworks
  - Linking these value sets to social relations of the net-chain
  - Identifying whether coalitions are shaped around shared value sets and net-chains
  - Identifying interaction, change or fixation within particular value sets
  - Looking for long-term objectives that carry similar and road maps

4.1.5 Analysing the shaping of governance

The final step of the research is to reflect on theory and to discuss whether the shaping of governance institutions in evolving policy fields can be viewed as the result of configurational patterns. In order to approach this question reflection is needed on the role of debate arenas as well as the way they determine the shaping of institutions. In this way it can be tested if shared value sets shown by several configurations indeed have an impact on the shaping of structure and are shaped by it in return. This will indicate how the role of certain actors might be more dominant in the policy process than the role of others, and whether the policy is open to these views. An analysis of the interests, values and knowledge captured by different interest groups in a specific configuration and thus influencing the shaping of institutions gives a strong indication of the evolving governance processes. The main challenge is to see if certain groups of actors and/or configurations have such a dominant role that they can influence the shaping of institutions in the policy process.

The challenge of this part is to attribute certain policy decisions or discussions to particular configurations. Especially since the object of research is a large, disorderly and dynamic policy field. Yet, another approach is to look at what specific actors have contributed to the debate. This could be indicated by concepts and issues that are added as a result of their notifications to the policy debate. Shaping governance institutions in a deliberate process would also imply that the organisation of these evolving fields is steered by these configurational patterns. Therefore an active search for specific examples should be part of the general analysis.

- Define linkages between the shaping of governance principles in an evolving policy field (chapter 7 and 8) by:
  - Looking at the information gathered in the previous points and analyse which configurational patterns can be distinguished and how they reflect values of their participants
  - Seeing whether these patterns have resulted in new governance issues
  - Understanding if these patterns are part of evolving policy fields

4.2 Data collection

In the text below a detailed outline is given of the various research techniques, including several methodological points. The choice for this variety of methodologies was formed by the idea to reduce chances of certain actors or views being overlooked (Table 4.1). By using multiple sources and approaches and having open conversations a lot of room has been given to collect as much new input as possible. Through triangulation it is possible to generate an integral image of the research object. Moreover it diminished the chance of conclusions based on coincidence as much as possible (Verschuren and Doorewaard 1995).

Literature research has been important to generate basic understanding of the issues at stake and to identify the initial list of actors. Literature research has taken place in three main areas: for the development of the theoretical framework, for the collection of information about biofuels (specifically biodiesel) and for information about soybean production. Together this was the starting point for much of the questioning and reasoning that form the basis for this thesis.

Document research involved all the non-scientific information provided by actors through folders, flyers, power point presentations and magazines. In most cases it clearly showed a particular perspective and reasoning behind arguments. This also helped to distinguish which parties are actively involved with both debates. When documents were signed or designed by different actors they also provided insights in the relationships between different actors.

(In) formal interviews have been held during all stages of the research[4]. Conversations with individuals and spontaneous discussions provided important insights in the (local) situation as well as the larger context. It also helped to distinguish those actors who are actively involved and the reasoning behind their views. Most actors were selected through snowball sampling, but to make sure that there were different entrances, several 'snowballs' were set up with the goal to have representation of different actor groups, such as: government officials, local politicians, representatives of companies, industry leaders, non-governmental organisations, consultants, investors, interest groups, scientists, and farmers. Most regional interviews took place in four regions in Brazil: the Federal District, the South, Centre-West and the East. During conferences in São Paulo and Rio de Janeiro there were possibilities to meet with other national actors. During the interviews the views of actors and their connections had to come forward. Though a 'list' of topics was used, it remained important that the respondent could also pinpoint his or her special focus and contacts. In this way the respondent could show most of his/her personal ideas and give their own weight to certain subjects.

Event analyses have been made on three occasions. These occasions were selected because of their variety in actors and location. They consist of: a farmers meeting in Rondonópolis, a conference of industry and research in Rio de Janeiro, a NGO meeting in São Paulo and the Round Table on Responsible Soy in São Paulo. Within this research an event analysis can be regarded as the study of a specific situation, area or part of the trade chain. It is possible to look at a specific situation as authoritative for the larger context. During events multiple information sources were available: formal presentations, interviews, documents and observations about behaviour and strategy. This information is helpful for analysis of interaction processes, because it can help to show certain relations.

[4] Contact the author for information on the interviewees.

Table 4.1. Data sources.

Data type	Quantity	Examples
Literature research	See reference list	• Scientific literature • Published articles
Document research	± 100	• NGO reports and flyers • Consultant reports • Company information • World wide web
(In)formal interviews	± 100	• See interview list
Event analysis	4	• Farmers meeting in Rondonópolis • Conference of industry and research in Rio de Janeiro • NGO meeting in São Paulo • Round Table on Responsible Soy in São Paulo

The various data types that were used have been employed to distinguish the configurational patterns. Since all data is based on qualitative work it is impossible to make any observations about the exact quantity of actors that share a view. However this is not the objective of this thesis, which has a more explorative nature and aims to identify the main reality definitions and their interaction.

4.3. Concluding remarks

This chapter helped to operationalise the key-concepts derived from the theoretical framework and gave an overview of the used research methodologies. The application of diverse theories and methods will help to improve the reliability of the findings as a result of cross-referencing. As was written in the problem definition the main challenge is to identify the scale and area involved with biofuel policies and all the actors that have an interest in getting involved. The challenge of studying evolving policy fields, such as biofuels, is that there is not much overview about the interrelatedness of various issues. For many participants in the chain this might lead to lack of understanding with regard to developing institutions. The question of who is and who is not part of the debate is an interesting element of net-chain analysis, because the assumption is that only those who participate - in whatever way - can be part of deliberative politics and thus shape new governance institutions in evolving policy fields.

Part II. Case Study - Biodiesel And Soybean Development

5. The role of soybean in the Brazilian biofuel programmes

To comprehend the role of soybean in the biodiesel debate it is crucial to have more background information on the circumstances in which current policies are embedded. This chapter starts with a brief technical introduction on biofuels in general and biodiesel in specific. This background information is needed to understand the production process of biodiesel and its impact and/or demand from the market. This is followed with an (historical) outline of Brazil's first biofuel programme, ProAlcool. By studying its development and evolvement through time more insights can be gained in the strategies that are currently used as this experience laid the knowledge and experience base for the contemporary biodiesel programme.

The remaining part of the chapter focuses on the biodiesel legislation as set up by the Brazilian government and discussions on the various feedstock possibilities. By addressing these feedstock options it is just a small step towards the other key issue of the case study: Brazilian soy production. Production systems are explained in combination with political and technical developments in this area and their possible consequences. Though the international context is not the focus of this thesis some information is needed to understand the implications of current developments. Therefore some issues that are debated with regard to the international market will be briefly introduced in the context of the debate on sustainable production and competing claims. By linking the issues regarding biodiesel demand and production, and soy production and use in the Brazilian - and partly international - context the magnitude of both (policy) debates becomes clear.

5.1 Basics about biofuels

To understand the impact of biofuel policies on the market some understanding is needed about what biofuels actually are. To address these point technical elements of these policies need to be addressed. Biofuels can be defined as solid, liquid, or gas fuels consisting of, or derived from biomass.[5] The definition can be narrowed down by saying that biofuels are defined as liquid or gas transportation fuels derived from biomass. Biomass is often considered as a good source for renewable energy, because of its regenerative nature and short carbon cycle. General assumption about biofuels is that these fuels could improve the sustainability of the world energy consumption and limit the emission of carbon gasses especially in the transport sector. Within biofuels a distinction is made between first and second generation biofuels.

First generation fuels are based on fuels made from: sugar, starch, vegetable oil, or animal fats using conventional technology (UN Energy 2007). The most common first generation biofuels are: pure plant oil, biodiesel, bio-ethanol, biogas and bio-alcohol. Brazil built up a lot of experience with the production of bio-ethanol using sugarcane in the ProAlcool programme (paragraph 5.3). New developments follow each other rapidly in improving the production of these biofuels. For instance the Brazilian oil company Petrobras recently developed and patented the H-Bio process. H-Bio is a kind of diesel oil which is obtained from the mixture of vegetable oil with petroleum during the refining process. In this test soy oil was used to, but other oleaginous plants can be used as well (UNCTAD 2006). Petrobras plans to start producing H-Bio on an industrial scale thus providing Brazil with international leadership in the biodiesel segment of the biofuel industry and at the same time supporting the PNPB. Next to al these developments worldwide research is going on with regard to second generation biofuels. These can be made from lignocellulosic biomass feedstock (for example all types of trees, grasses, agricultural residues such as corn stover, sugarcane bagasse, straw, etc.) using advanced technical processes (UN Energy 2007). These fuels are still being developed and not available on the market. The most common processes mentioned in this context are: bio-hydrogen, bio methanol, mixed alcohols and Fischer-Tropsch diesel.

[5] en.wikipedia.org/wiki/Biofuel#_note-0.

It is important to realise that different fuels have to be replaced by a variety of substitutes (ethanol is a replacement for gasoline and biodiesel as a replacement for diesel). As explained Brazil has experienced with ethanol production, but is now also looking for ways to include biodiesel in their energy matrix. Biodiesel is a first generation biofuel which can be produced from a variety of vegetable oils and animal fat. The most commonly used vegetable oils are derived from; soybean, rapeseed, palm, castor bean, jatropha, sunflower and algae. The production process of biodiesel starts with the crushing of oil seeds in order to separate the oil content from the residue (cake). The vegetable oil or animal fat is than subjected to a chemical reaction called transesterification. In this chemical reaction the oil or fat is mixed with a catalyst and with an alcohol to transform the triglycerides into methyl esters and glycerol (Knothe 2005). For every ton of biodiesel 100kg glycerol is produced which finds it way into the pharmaceutical industry (Aantjes 2007). The remaining esters have long chains of fatty acids which have different characteristics depending on the composition of vegetable oil or animal fat. In any case biodiesel is mixable with petrol-diesel in all ratios. The reason for this transesterification, compared to the usage of pure plant oil, is that the viscosity of transestrificated biodiesel is more similar to that of petrol-diesel than pure plant oil. It is possible to use engines that can run on pure plant oil alone (the engine needs adaptation to this fuel), but biodiesel can be exchanged with all diesel engines (Knothe 2005).

Since biodiesel can be produced of a large variety of feedstock often depending on availability and geographical region, the diesel characteristics might be dissimilar in different regions. In Brazil a large variety of oleaginous crops is available. Each of these crops has its specific features with regard to yield/ha, oil content and harvesting as technical elements (Table 5.1). Besides technical variability different crops also vary with regard to the social and environmental impact of different crops and the amount of farming experience and scale in which they are currently used.

Table 5.1. Characteristics of oleaginous crops in Brazil.

Species	Oil origin	Oil contents (%)	Harvest (months/year)	Yield (tons of oil/hectare)
African palm	Nut	22.0	12	3.0 - 6.0
Coconut	Fruit	55.0-60.0	12	1.3 - 1.9
Babassu	Nut	66.0	12	0.1 - 0.3
Sunflower	Grain	38.0-48.0	3	0.5 - 1.9
Colza/canola	Grain	40.0-48.0	3	0.5 - 0.9
Castor beans	Grain	45.0-50.0	3	0.5 - 0.9
Peanut	Grain	40.0-43.0	3	0.6 - 0.8
Soybean	Grain	18.0	3	0.2 - 0.4
Cotton	Grain	15.0	3	0.1 - 0.2

Source: MAPA (2006).

The mounting requirement for biodiesel as an additive to diesel places a large additional demand on the availability of vegetable oils in the near future. For continuous biodiesel production sufficient feedstock with a stable production pattern is necessary. Though the government stimulates a variety of oleaginous crops some might be more efficient than others (Table 5.1). A number of variables can influence crops suitability for large scale biodiesel production, for example: yield per hectare vs. investment costs, labour requirements, agronomic knowledge, infrastructure, pest control, geographical region, farming system, distance to factory, outlet market possibilities, nearness of crushers and biodiesel factories. In addition every plant-oil has its own characteristics (e.g. viscosity, reaction to temperature, effects on the engine), which make some oils more suitable for use in engines than others. Still large scale biodiesel production is a new development which makes the speed of technological innovation and (in) direct consequences quite unpredictable, for instance for the vegetable oil food market, unpredictable.

5.2 The biodiesel chain

Biodiesel can be produced of a variety of feedstock, but it is also possible to combine various resources. To produce biodiesel vegetable oils and bovine oils from a variety of agrarian sources are collected. These oils are brought to the biodiesel factory where a process of transesterification takes place. By mixing different primary materials the biodiesel will have different characteristics. The choice for the primary material can depend on a number of variables: the location i.e. what is the most common oil crop, general availability and price of different primary materials, long-term contracts with farmers, obtaining oils from the (free) vegetable oil market, availability of bovine fat. Biodiesel producers are also influenced by the legislation of the Brazilian government that stimulates certain crops and producers through tax incentives and auctions (paragraph 5.5).

At present a mixture of soybean oil with bovine fat is quite common. Biodiesel enterprises need to obtain the soy oil only. They have various possibilities: they could buy the beans, crush them, sell the meal and use the oil or they could buy the oil on the market. Yet, the obligation of the Social Stamp to participate in national auctions requires these companies to be in contact with the producers. After the chemical processes, the biodiesel factory will have several outputs. Next to the main objective of producing biodiesel a large amount of glycerine comes out of the process. Although glycerine is not a focus of this study it is important to realise that its production has an economic impact on the biodiesel chain. Since the market is highly competitive producers are currently seeking for ways to economize this part of production as well. The biodiesel that is produced in the factory will be B100 (a 100% pure biodiesel). This kind of diesel can be used for private purposes, but can not be sold as part of the PNPB. Therefore it needs to be diluted till B2 (2% biodiesel mixed with petrol diesel) to apply with current legislation. Dilution is done by the distributors of the biodiesel. After dilution the biodiesel is distributed and can be sold at the gas station.

This is a standardised version of biodiesel production. There might be many local differences depending on local use and market. Also the chemical process is open to innovation, which means that new methods of production biodiesel might alter the production chain.

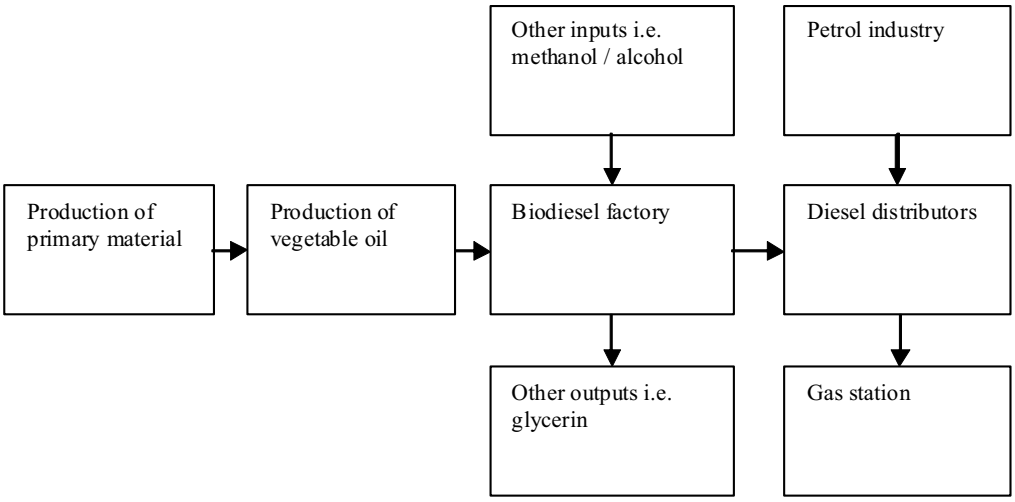

Figure 5.1. Simplified biodiesel chain.

5.3 Historical outline of Brazil's ProAlcool programme

To place current developments in a historical perspective an introduction to Brazil's first large renewable energy is essential. The Brazilian 'ProAlcool' programme started in 1975[6] in response to the oil crisis of the 1970s and the low prices of sugar on the international market. Its goal was to reduce Brazil's dependency on the import of foreign fossil

[6] Based on Decree No. 76.953.

fuels and to address certain environmental and social considerations by stimulating ethanol production to replace gasoline (UNCTAD 2006). At the start the programme was heavily subsidised by the government by a set of governmental interventions to increase alcohol demand and supply (Puppim de Oliveira 2002). Through high taxes on fossil fuels and the creation of competitive assets, such as development of institutions, investments in technological capabilities for renewable fuels and tremendous subsidies the ProAlcool programme was embedded in society (OECD/IEA 2006; Puppim de Oliveira 2002). Based on these prerequisites set by the government the programme resulted in a transformation of the Brazilian fuel structure. By the mid-eighties almost 75% of the 800.000 cars could run on ethanol. As the programme progressed Brazil became the world's second largest producer of fuel ethanol from sugarcane after the USA (OECD/IEA 2006).

Puppim de Oliveira (2002) argues that the programme consisted of two phases. He argues that the first phase, 1975-1979, was based on governmental policies to facilitate expansion and conversion rates for ethanol production. The second phase, 1980 and onwards, was focussed on industrial investments and efficiency combined with the introduction of the alcohol fuel cars. In both periods agricultural and industrial policies were reshaped to comply with the programme, there were high investments made by public research resources, incentives were given to the private sector and car owners were stimulated to drive cars running on pure alcohol. Problems with the ProAlcool started when the sugar prices went up, resulting in a severe shortage of ethanol in 1989. One of the reasons for this could be that the world sugar market has a strong impact on ethanol supply and can lead to ethanol shortages in times of high world sugar prices. This shows that the price of ethanol had little to do with the cost of production, but should be regarded as the opportunity costs of producing ethanol versus sugar. The seasonality of ethanol production was another explanation given for the effects of varying prices. Moreira and Goldemberg (1999) summarised several explanations for this enormous decline: 1) the price of alcohol which started in 1979 as 64.5% of the gasoline price increased to 80%, 2) the tax advantage for alcohol cars was eliminated in 1990 and many 'popular' cars could not be so quickly adapted to pure alcohol, 3) there was a lack of confidence in a steady supply of alcohol and Brazil needed to import ethanol/methanol to compensate for a loss in local production. As a result the sales of ethanol-fuelled cars declined to less than 1% of total annual auto sales in 1990 (ESMAP 2005). To bring the ethanol programme back to its feet the Brazilian government took measures to prevent future shortages and authorized ethanol imports. Though explanations for the crisis vary it became clear that in spite of all efforts many consumers lost their confidence in the security of ethanol supply and discredited the ProAlcool programme.

An important turning point took place in 2003 when Volkswagen, quickly followed by other producers, introduced the 'flex fuel' car. This car gave consumers the opportunity to buy any combination of the cheapest fuel. This protected consumers from any fuel shortages (UNCTAD 2006). Currently, ethanol provides for 40% of Brazil's driving fuel, and 70% of the cars sold in Brazil have flex fuel engines. In total almost 1.8 million vehicles are able to run in the form of flex fuel (OECD/IEA 2006, UNCTAD 2006). It has become impossible to buy pure gasoline as even the gasoline at the pump is blended with ethanol at a 20-25% blending rate. Since the creation of ProAlcool in 1975 all the prices received by ethanol producers were determined by the federal government, just like the prices of all other fuels. In May 1997, the price of unhydrated ethanol was liberalised, hydrated ethanol[7] followed in February 1999 (Goldemberg et al. 2004). In 2006 the price of ethanol again increased to a level where it is almost becoming uncompetitive with the price of gasoline. Since ethanol is a little less efficient in the engine the price of hydrous ethanol cannot exceed 70% of the price of gasoline, at which point it becomes less attractive for consumers (OECD/IEA 2006). Currently there are no direct subsidies for ethanol production in Brazil, though there is an internal tax differential between ethanol and gasoline depending on the state (UNCTAD 2006). In 2005 Brazil's ethanol production was 15.9 billion litres, which is more than a third of the global production. From this production 2.6 billion litres were exported which accounts for a 50% market share of global ethanol exports (OECD/IEA 2006).

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[7] 'In Brazil, ethanol is used in two forms. In 'anhydrous ethanol', water has been almost totally removed to a level that makes it suitable for blending with gasoline. On the other hand, 'hydrous ethanol' is about 95 % pure, the balance being water. Hydrous ethanol is not suitable for blending with gasoline and is used directly as a fuel. Flex-fuel vehicles, widely marketed in Brazil beginning in 2003, are capable of running on any combination of hydrous ethanol and a gasoline-anhydrous ethanol blend. Pure gasoline is no longer sold in Brazil, and until April 2006 the gasoline-anhydrous ethanol blend contained 25 percent anhydrous ethanol. In other countries, a blend of gasoline and 5 to 10 % ethanol is most common. Before the introduction of flex-fuel cars, ethanol vehicles could only use hydrous ethanol, that is, without addition of gasoline. Nowadays, flex-fuel vehicles in Brazil can run on any mixture of a gasoline-ethanol blend and hydrous ethanol' (OECD/IEA 2006).

There are questions about the productive capacity of Brazil for further expansion of ethanol production. As a result of the increased demand for ethanol, sugar cane production expanded rapidly from about 50 Mt[8] in 1970, to over 280 Mt in the 2004-2005 harvest and this is likely to increase even further in the near future (UNCTAD 2006). The production area of sugarcane is centred in the state of São Paulo, but is expanding to other states and areas. Due to improved techniques in agricultural management production costs have gone down as a result of increasing yields (UNCTAD 2006). Though these adjustments have improved the environmental sustainability, there are concerns about the emergence of monoculture in certain production regions and the social impact of for instance the labour conditions in the field. Though policy makers in Brazil frequently stated that they want to make Brazil world leader in the market of renewable energy, others show that the country needs to improve its infrastructure, such as building more ports, storage tanks, loading facilities, and to improve railway and pipeline links between the ports and sugar-producing regions in order to reach this goal (OECD/IEA 2006).

5.3.1 The ProAlcool policy process

In general the success of the ProAlcool is debated by many different actor groups. They agree that it resulted in new economic activities, technology development and environmental impacts, but it is difficult to measure concrete results (Puppim de Oliveira 2002). It is hard to measure the economic result, because of the mainly indirect impact of, for example, jobs that were generated, fossil fuel import that was limited. Still it is clear that the programme has resulted in a large improvement of technical knowledge and experience with regard to ethanol production and its actual use. With regard to the environment this is a very debatable issue. Some argue that it has resulted in less carbon emissions while others argue that it has destroyed ecosystems. Though environmental issues did not play a very strong role in the beginning of the ProAlcool programme in contemporary analyses it is gaining importance. Puppim de Oliveira (2002) argues that however people may feel about the ProAlcool programme, it serves an as good example of organisational capacity with regard to pursuing an alternative energy strategy. By analysing the steps in the policymaking process of the ProAlcool programme it appears clear that several key-actors influenced most policy directions: central and state governments, military groups, the alcohol industry, sugarcane agricultural aristocracy, bureaucrats, researchers and the media. Together these actors created the public policy based on their values, interests and knowledge in a process that interacted with political, social, technological and economic ideas according to their time. Though the group of actors might shift, for instance Brazil no longer has a military government; this understanding is useful to apply to current policies that drive other renewable energy sources, such as biodiesel. It seems that during the set up of the ProAlcool programme these actors worked together to set up the mix of incentives that created the energy shift in Brazil.

5.4 The Agro-Energy plan 2006-2013

Since the start of the ProAlcool programme in the 1970s Brazil has gained al lot of experience with ethanol and the alcohol market. Though there have been some attempts in the same period to produce biodiesel this never got any significant follow up in practice. Diesel keeps coming back in focus, because it is the main fuel used in all public transportation systems and the overland freight transport. The current biodiesel legislation is embedded in the large 'Agro Energy Plan 2006-2013' (AEP) and is linked to a package of governmental legislation, funding and scientific initiatives. The AEP is the result of an inter-departmental group, Group of Trabalho Interministerial (GTI 2003), which was established by the Presidential Decree on the 2nd of July 2003 in order to study the viability of biodiesel as alternative source of energies. The group was coordinated by the Civil House of the Presidency of the Republic and was a collaboration between various ministries:

- Civil House of the President of the Republic
- Ministry for Transport
- Ministry for Agriculture, Cattle and Supply
- Ministry for Development, Industry and Foreign Commerce
- Ministry for Mines and Energy

[8] Mt stands for Mega Tonne. 1 tonne = 1000 kg → Mt = 10^6 tonne.

- Ministry for Farming
- Ministry for Planning, Budget and Management
- Ministry for Science and Technology
- Ministry for Environment
- Ministry for Agrarian Development
- Ministry for National Integration
- Ministry for Cities

The work of the ministries resulted amongst others in a policy paper by the Presidency of the Brazilian republic that there are no technical or legislative barriers to the use of biodiesel as a additional source of energy supply in addition to regular diesel as long a there is a guarantee of input, supply, process capacity and distribution opportunities (Cadernos NAE 2004). The use of this new energy will among others depend on the relative amount of energy consumed in the production process. In ethanol Brazil has proven to be very efficient (sugarcane converts in the ratio 8.3:1), with the biodiesel crops this is somewhat different. The energy efficiency of soy oil is 1.4:1 and of palm oil 5.6:1, this means that crops such as palm have a large opportunity, but only if their production goes up and there is enough oil palm available (Cadernos NAE 2004). Based on the learning experiences from the ProAlcool programme the government claims to be confident that biodiesel will experience a similar learning curve as ethanol, which is assumed to be a good foundation for secure implementation of the PNPB (MME 2004).

5.4.1 The National Biodiesel programme

According to the Brazilian government the biodiesel programme should target all collective and commercial transport as well as the energy supply in remote areas. The government states that:

'the National Programme of Production and Use of Biodiesel (PNPB) is an inter-ministerial programme of the Federal Government and its objective is to implement a sustainable form - in techniques and economics - of the production and use of Biodiesel. In an approach that enforces social inclusion and regional development, through the generation of jobs and income[9].'

13 September 2005 the law nº 11.097 introduces biodiesel in the Brazilian energy matrix. Here biodiesel is defined as[10]:

Biodiesel: biocombustível derivado de biomassa renovável para uso em motores a combustão interna com ignição por compressão ou, conforme regulamento, para geração de outro tipo de energia, que possa substituir parcial ou totalmente combustíveis de origem fóssil.' (NR) (SEBRAE 2007).

Biodiesel: a biofuel derived from renewable biomass in order to use for combustion engines that according to legislation can substitute partial or totally fossil fuels (SEBRAE 2007).

As shown in paragraph 5.4 the creation of the PNPB was done by twelve ministries and coordinated from the Office of the Presidential Chief of Staff in GTI. The Ministry of Mines and Energy is in charge of the operational management the Programme. Law No. 11.097 was passed authorizing a voluntary 2% blend (B2) addition of biodiesel to petrol diesel from 2005-2007 (Table 5.2). In the timeframe 2008-2012 this mix will become mandatory and by 2013 and onwards a 5% blend (B5) mix of biodiesel to diesel is required (UNCTAD 2006; MAPA 2006; OECD/IEA 2006).

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9 http://www.biodiesel.gov.br/index.html.

10 An overview of the PNPB laws can be found in Annex II.

Table 5.2. Mandatory blends and market potential.

Time frame	Blend biodiesel to diesel	Market potential	
2005-2007	2% authorised (B2)	Potential market:	800-840 million litres/year
2008-2012	2% Mandatory (B2)	Sound market:	1 billion litres/year
2013<	5% Mandatory (B5)	Sound market:	2,1-2,4 billion litres/year

Source: MAPA (2006).

The main objective of the PNPB is to implement a sustainable programme that promotes social inclusion, create jobs and increases income for small farmers. It should also substitute a significant part of the imported diesel consumed in Brazil and have a positive environmental impact. The strategies to reach these goals are based on special tax systems that promote the purchase of raw material from small farmers, compulsory blending even though the biodiesel price might be above the diesel price and governmental auctions to guarantee the introduction of biodiesel on the market.

Figure 5.2 designed by the Brazilian government shows the perception of the central government with regard to the biodiesel programme. Based on technological innovations and developing scientific knowledge they want to stimulate the social, environmental and economic pillars of the programme in order to create a strong biodiesel market. Research programmes are stimulated to focus on agronomic technology (for example developing new oleaginous plant species, increasing knowledge about the plant nutrition and germplasm, developing new agricultural techniques) and industrial technology (improving oil extraction methods, developing new transformation processes, evaluating impact on machinery, etcetera) (MAPA 2006). It is argued that past and present experiences with the ProAlcool programme resulted in a lot of experience by producers, traders and policy-makers in introducing biofuel into the national energy matrix. This background gives sufficient strength and security to introduce the PNPB.

The strategies used by the PNPB seem partly derived from the ProAlcool programme. This includes for instance the strategic input of research funding, knowledge building, economic incentives, social objectives stirred by governmental control. Still there are large differences as well. Ethanol from sugarcane is very concentrated in the region of São Paulo state. All ethanol has to be brought there where it is redistributed throughout the country; this is contrary to the biodiesel programme that wants to stimulate regional production and use. Also the biodiesel programme does not focus on one particular crop, but on all oleaginous seeds available, especially those which can be produced by family farmers. In the light of these differences the outcome of current policy measures can be quite unpredictable, because of (un) known variables. For the short term the government set minimum percentages for the replacement of diesel with biodiesel, the question is whether there will be sufficient raw material available to deliver the demanded quantities, and whether the oil quality of all these crops has good characteristics. In sum, the biodiesel programme opened up an evolving policy field wherein institutions and governance structures are still evolving rapidly and where the final outcome is yet to be awaited.

5.5 Organisational aspects of the Biodiesel programme

The aim of social inclusion and regional development of the PNPB become clear in the policy incentives given by the central government through the creation of the 'Selo Combustível Social', that is the Social Fuel Stamp (SFS) and a region, farmer and crop specific taxation model. Both elements take into account the large regional differentiations in Brazil based. Further the use of biodiesel is promoted by a regulatory framework that should make biodiesel competitive with diesel. The framework includes different levels of biodiesel to diesel blends, forms of use and taxation. The tax rules include differential rates depending on the oilseeds used, where they are grown, and whether they are produced by large agribusiness concerns or family farmers (MME 200X). Additional to this biodiesel feedstock and the fuel itself are exempted from Industrial Products Tax (IPI) (MME 200X). This part will start with an overview of these the different regions as they are distinguished by the PNPB, followed by a more detailed explanation of both social policy incentives and economic investment strategies.

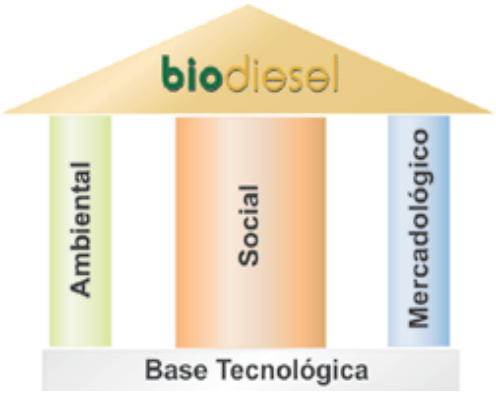

Figure 5.2. Framework of the National Biodiesel Programme.
Source: www.biodiesel.gov.br.

5.5.1 Brazilian regions

The *North Region* of Brazil consists of the states: Tocantins, Rondônia, Pará, and Roraima. This region covers a large part of the Amazone biome[11] and Cerrado areas. Therefore the region has a rich variety of native species which offer many varieties of oleaginous crops, such as different palm species. Within Pará there are already more than 5 million hectares deforested for the planting of palm plantations (MAPA 2006). As these regions have limited infrastructure they depend heavily on diesel oil for power generators and transportation. The region now uses more that 3 million tons of diesel per annum. Current biodiesel production in the region itself would only cover a little more than 10% of the demand; therefore it is very unlikely that the region can be self sufficient in this area on the short term (MAPA 2006). The government assumes that self sufficiency will not be a problem when palm oil production takes of in the next years.

The *North-East Region* accounts for 15% of the diesel oil consumed in Brazil (MAPA 2006). It consists of nine states; Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe. The region has a great variability in climate since it has a very dry and desert like vegetation on the inlands and tropical forest along the coast. Over the last years it has been one of the poorer regions in the country though there has been some economic growth. The region holds a specific position in the PNPB, because biodiesel produced in this area has the highest tax exemption, especially when castor bean is used as the main source. The crop is fully adaptable to semi-arid areas and is an alternative for family farming according to MAPA (2006). Other crops that are suitable for this region are: babaçu, mamona and palm. Within the PNPB the goal is to develop oil crops together with family farming in agronomic adaptability. Recently, as a result of tax exemptions and the social stamp a number of biodiesel plants have been built in a number of North-Eastern states.

In the Agro-energy plan the *Centre-West and South* are described as one region, but in fact most people would separate Centre-West with the states of: Goiás, Mato Grosso, Mato Grosso do Sul; and Distrito Federal; the South-East with the states of Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo; and the Southern states of Paraná, Rio Grande do Sul and Santa Catarina. According to MAPA (2006) soybean can supply the oil necessary to mix 5% biodiesel in fossil diesel for the next years in these regions. There are worries, because of the lack of fiscal benefits with regard to the crop 'soy' and the region 'Centre-South'. The agrarian infrastructure in this region is of such a kind that many other crops: sunflower, castor bean, cotton and peanuts could also be introduced. According to the government there is enough farmable land with extension possibilities available.

[11] One should be aware when referring to the Amazon. The Brazilians distinguish 'the legal Amazon' (the protected and defined Amazon region) and the 'Amazon bioma' (the complete area which shares the amazon ecosystem).

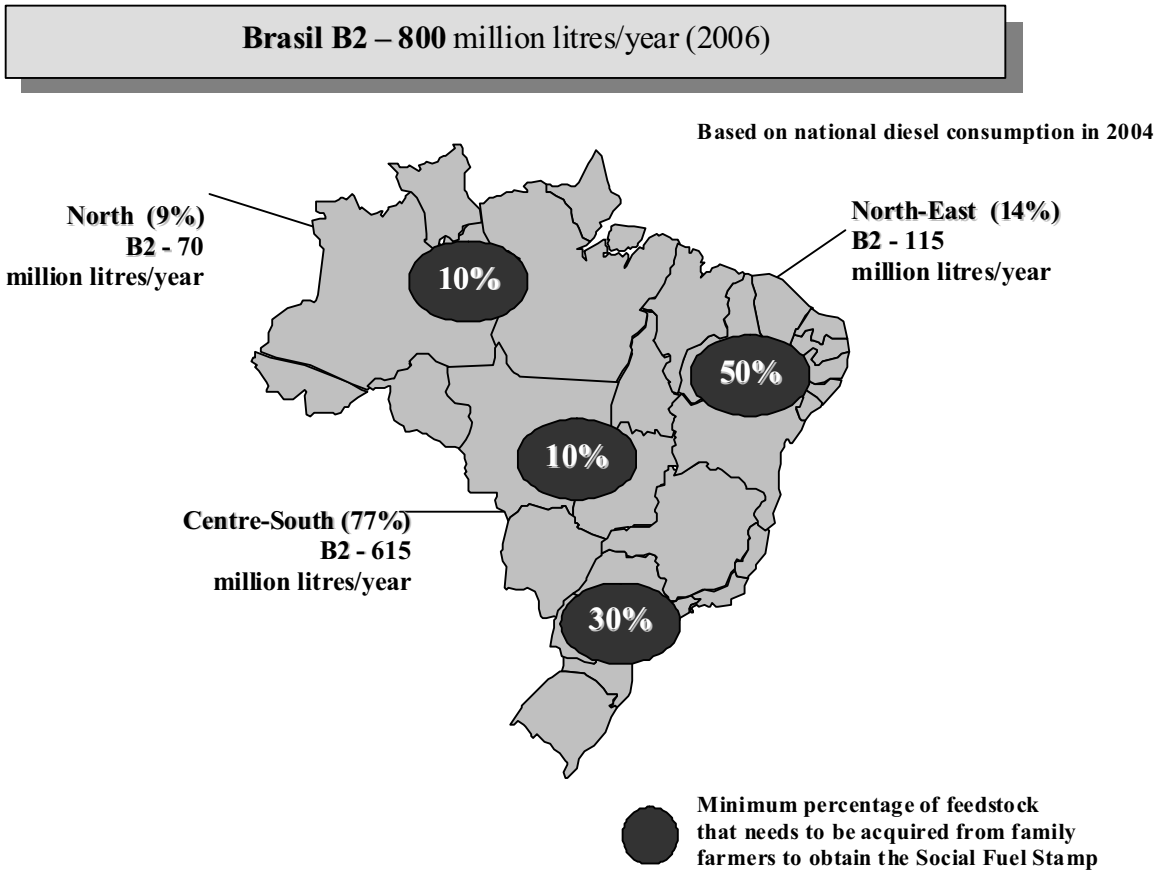

Figure 5.3. Mandatory blends per region to obtain the Social Fuel Stamp.
Source: ABIOVE (2006).

5.5.2 The Social Fuel Stamp

The SFS is developed to promote the social pillar of the PNPB. The SFS is issued by the Ministry of Agrarian Development (MDA) in accordance with the rules set in their National Programme for Family Agriculture (Programa Nacional da Agricultura Familiar - PRONAF). The SFS allows biodiesel producers - that are authorized by Brazilian law - to produce and sell biodiesel provided as long as they meet the following requirements:

1. They have to purchase a minimum percentage of raw materials from family farmers: 10% from regions in the North and Mid-West; 30% from the South and South-East and 50% from the North-East and the Semi-Arid Region.
2. They have to sign contracts with family farmers who sell the biodiesel feedstock under supervision of some kind of representation, such as; an agricultural worker or labour unions that focus on Family Agriculture. These labour unions can be the National Confederation of Agricultural Labourers, the Federation of the Workers of Familiar Agriculture, the National Association of the Small Agriculturists, and other accredited institutions such as the MDA.
3. They need to enter into contracts with family farmers establishing deadlines and conditions of delivery of the raw material and the respective prices, and to provide family farmers with technical assistance. In such a way that it is compatible with the MDA based on the development of family agriculture and agricultural extension services.

This stamp is supposed to stimulate the production of certain oil crops and technological routes and to stimulate participation of family agriculture (Figure 5.3). The stamp also has a practical use during the implementation period of the PNPB. During this period the National Petroleum Agency (Agência Nacional de Petróleo - ANP) will hold auctions to guarantee sufficient biodiesel supply in the initial stages of market development. These auctions are

regulated by instruments issued by: the National Council of Energy Policy (CNPE), the Ministry of Mines and Energy (MME) and ANP, and only companies have the SFS may participate in these auctions. They can also benefit from a partial or total reduction of federal taxes, as defined by the biodiesel tax legislation and use this certificate to market their biodiesel brand and origin. The tax advantages can be quite substantial, for instance the if an industry in the North-East is considered without the Stamp they have to pay a tax of R$ 0.15 per litre biodiesel when it is produced from Mamona or Palm, and R$ 0.218 per litre biodiesel for other crops. With the Social Stamp you do not have to pay to pay tax for Mamona and Palm in the first case and only R$ 0.07 per litre biodiesel in case of other primary materials (SEBRAE 2007). Besides the tax cut there are also other economic incentives to try to receive the SFS. The National Bank for Economic and Social development (Banco Nacional de Desenvolvimento Econômico e Social - BNDES) finances 90% of the costs for projects who carry SFS. Other projects are only eligible for financing between 50%-90% (MME 2004).

5.5.3 Biodiesel tax model

As shown the in the previous paragraph the SFS is tightly linked to the taxation model set up in combination with the PNPB. The tax system has been designed in such a way that it supports biodiesel producers that use family farmers for the production of their feedstock production. By doing so they are expected to contribute to the promotion of social inclusion and reduction of poverty, through income and jobs generation in Brazil's poorest regions. This means that tax exemptions are given based on the kind of crop, the production region and the kind of farmer that has produced the feedstock. For example everywhere in Brazil, biodiesel producers that acquire their raw material from family farmers are eligible for a federal taxes reduction up to 68%. However, if the purchases are made from family-based producers of palm oil in the North Region, or of castor oil in the North-East and in the Semi-Arid Region, the reduction may reach a 100%. If the same raw material would come from other agricultural producers, that are not considered family farmers, the maximum taxes reduction is 31%. In order to qualify for the tax benefits at all, biodiesel producers have to hold the SFS certificate (MME 2004, www.biodiesel.gov.br, www.anp.gov.br, www.mda.gov.br).

The tax cut applies to two kinds of taxes: PIS and COFINS. Programme of Social Integration (Programa de Integração Social - PIS) is a tax based on a social contribution or taxes paid in kind. PIS applies to all legal entities and demands payments for unemployment insurance of workers who earn up to two times the minimum wages. Contribution for the Finance of Social Security (Contribuição para o Financiamento da Seguridade Social - COFINS) is a federal tax over the gross income of companies that operate on a strict commercial basis. They have to pay 7.6% and all other companies 3% over all their sales of goods and services. The objective is to create social security with regard to payment of social welfare, health and social assistance.

Table 5.3. Tax exemption per region, farmer, and crop.

Criteria	Biodiesel				Diesel
	Case 1	Case 2	Case 3	Case 4	PIS/COFINS + CIDE
	Family agriculture North/North-East and semi aid Castor or Palm	General Family Agriculture	Intensive Agriculture North/North-East and semi aid Castor or Palm	General condition	
% of reduction	100%	68%	31%	0%	
Federal tax	€/m³	€/m³	€/m³	€/m³	€/m³
PIS/COFINS	0,00	25,28	54,69	78,70	78,70

Source: ABIOVE (2006).

5.5.4 Financial support programmes

To support investments into the biodiesel industry two financial programmes were set up in the context of PNPB. The first is 'The Programme of Financial Support for Investments in Biodiesel'; this programme offers a special credit system for investments and commercial initiatives. It is financed by BNDES and other financial agents, which are supported by BNDES, such as the Bank of Brazil. The second programme already existed, but added biodiesel to its mandate. This is the 'National programme for the support of Family Agriculture' (PRONAF). PRONAF finances the expenses needed for the production of oil crops. To be eligible to this financial support it is necessary to show a contract made between the family farmer and the biodiesel producer. PRONAF is financed by BNDES, Banco Da Amazõnia, Banco do Nordeste and Banco Da Brasil with the same rules adopted for other financial support of the programme. Moreover, for the attainment of financing to the agricultural production in it is necessary that the production of the oil crop is foreseen in the Agricultural Zoning of Climatic Risk. This prerequisite stems from the Ministry of Agriculture, Cattle and Supplying (SEBRAE 2007).

Both financial programmes are set up in such a way that they should stimulate social inclusion as well as economic viability of the sector. Based on experiences with the ProAlcool programme the government wants to make sure that the newly involving industry will not have to much trouble with initial investment costs. This also creates a stimulus to guarantee sufficient production possibilities within a short time frame.

5.6 Competitiveness of soybean oil for biodiesel production

As explained in there are a large variety of feedstock available in Brazil for the production of biodiesel (paragraph 5.1). Based on current production rates only a few are able to contribute substantially to the production targets set for the next years. Worldwide palm oil and rapeseed are considered as the best suppliers of feedstock for the production of biodiesel, yet, Brazilian production is quite low and it will take at least ten years before there is sufficient production (Bindraban and Zuurbier 2007; MAPA 2006). Allowing for the learning curve and initial sunk costs over the next years, and the improvement refinement technologies - as is expected based on experience with the ProAlcool programme - the Brazilian government assumes that biodiesel production costs will drop significantly over the next years. The mandatory blends set by the federal government lead to a demanded mix of 840 million litres for the B2 rule in 2008, and 2100 million litres for a 5% blending in 2013 (MAPA 2006). These are large volumes are demanded within a short time frame. At the moment almost 90% of the vegetable oil production in Brazil is derived from soybean at a total volume of 5.6 million tons in 2004 (Bindraban and Zuurbier 2007). Taking into account these elements and the prosperity of soybean production it is very likely to assume that soybean might be one of the main oil crops for biodiesel in the near future, in spite of the social programs stimulating other crops. The logistics and agricultural knowledge in this field give way to rather rapid expansion possibilities, as does the flexibility of soybean between different markets.

Table 5.4. Demand for biodiesel production and total.

Geographic region	Regional demand for Biodiesel B2[12] (millions of litres)	Regional production of vegetable oils (millions of litres)						
		Cotton	Palm	Mamona	Peanut	Sunflower	Soy[13]	Total
North	74		179				91	270
North East	114	84		73			368	525
Centre-West	91	196				17	2.153	2.366
South	156					7	2.602	2.609
South East	347				35	1	1.008	1.044
Brazil	782	280	179	73	35	25	6.222	6.817

Source: ABIOVE (2007).

A comparative study by MAPA (2006) illustrates that refined soy oil prices have been US$ 69.00/barrel on average during the last 15 years. MAPA assumes that soy oil for consumption has a higher cost than soy oil for industrial purposes. Therefore they assume that biodiesel, based on soy oil, becomes competitive when the cost of petroleum reaches US$ 60.00 per barrel.

Other sources for biodiesel crops such as sunflower, palm, castor bean, babassu, cotton and jatropha can be considered as contributing to future feedstock options, but currently lack the necessary volume (Bindraban and Zuurbier 2007). Currently the government is actively stimulating the use of alternative crops, but it will take time to develop them and have family farmers in the North-East integrate them in their farming system. Therefore it seems plausible that a major part of demanded quantity will be provided by soybean oil in the near future. Bindraban and Zuurbier (2007) calculated that this increased demand for soybean for bio-diesel would reach up to an expansion of acreage of 1.3 million hectares at a current production level of 2.8 t ha-1 and a total oil content of 18%, to satisfy the B2-goal. Acreage will expand to 2.9 - 3.3 million hectares to apply with B5. The total expansion will also depend on possible increasing yields per hectare in the next years.

Altogether the PNPB is a large scale and ambitious programme set up by the Brazilian government to promote the use of biodiesel and to improve regional development. To guarantee these objectives research programs are funded, investments in industry are supported and certificates are appointed towards industries that incorporate family farming for production of feedstock. Though many aspects of the programme seem well reasoned the large scale ambitions also lead to insecurity. For example the government is stimulating particular oil crops for family farmers while there is little agronomic knowledge available on large scale production of these crops. Another issue that came up is whether the SFS will continue to function effectively after there is sufficient supply and auctions are no longer needed to stimulate the market.

5.7 The role of soybean

Soybean does not seem to be the most efficient crop for biodiesel production, because of its relative small oil content compared to other crops. However its large variability and flexibility in the international trade market and its many uses make it an attractive resource. Its efficiency also depends on technological innovations that would increase (oil content) production and energy conversion. In the past years there have been many public discussions about the use and expansion of soy. The new demand of soy oil for biodiesel needs to be added to the already rising demands on the food market of soy oil, and the animal feed (soy protein) market that rises as a result of increasing meat consumption. The absolute expansion of soybean area is also determined by foreign demand and production.

[12] Based on diesel consumption in 2005.
[13] The national production for soy oil was divided on the installed processing capacity for each geographic region.

When for example the United States lowers their share of soybean area to stimulate corn production for biofuel with corn, this will increase the soy prices on the world market, thus providing the Brazilians with an additional incentive for more expansion. Adding up these demands it is likely that soybean production will be increased significantly in the next years. These shifts and demands on the production and usage of soybeans will have consequences on the soybean commodity market as well as the producing countries. This paragraph below outlines basic information on the (Brazilian) soybean production system as well as new developments in this area. Taking into account these developments and the international context of will make it easier to understand the debate on the impact of using soy for biodiesel.

5.7.1 Soybean production

Soybean is mainly grown in temperate, (sub-) tropical regions and very suitable for capital-intensive, large-scale cultivation. Originally soybean was mainly grown in the Asian countries for human consumption, but as the crop expanded to other parts of the world, this changed. At first soybean was produced in the USA and Brazil for cheap edible oil and high-protein animal feed (Clay 2004). In this period the protein (soybean meal) was first considered a by-product of the oil production process. Increased demand for protein in the animal feed industry turned these economic incentives around and further expansion was driven by the protein content. Currently both the protein and oil content of soy have a number of uses in human food, animal feeds and other industrial applications, one of which may include biofuel in the future. New changes in the demand chain for soybean products and increased interest for the oil content and the implications of this demand on the production chain in context of economic, social and environmental consequences.

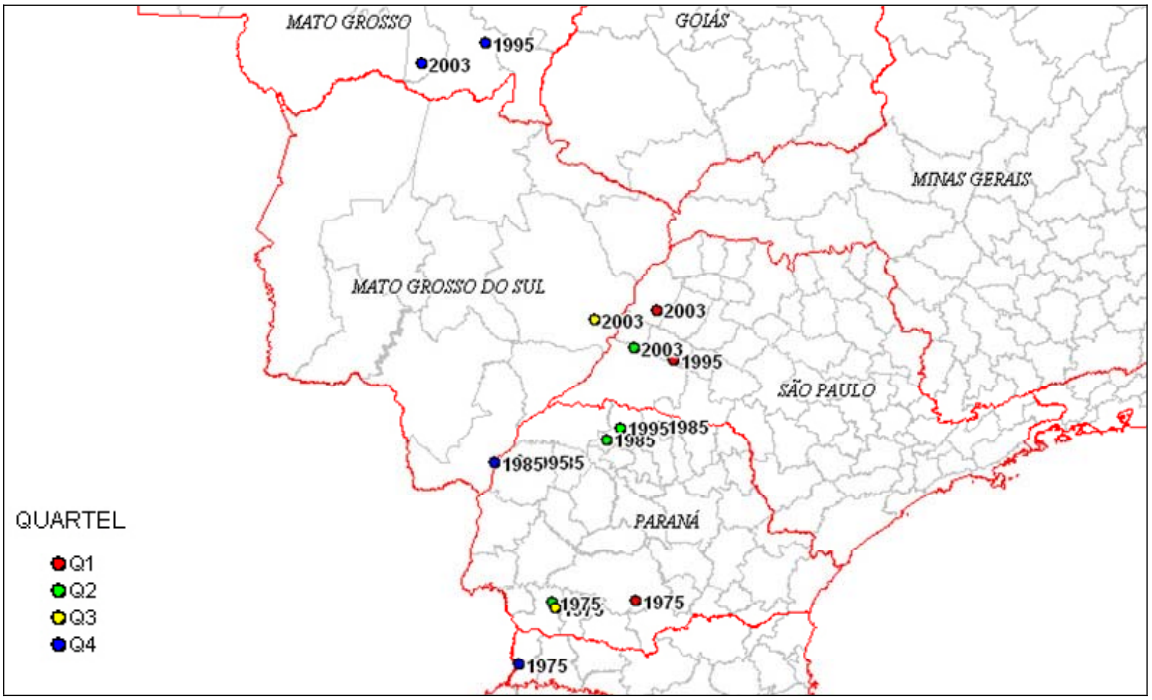

Figure 5.4. Shifting centre of soy production.

Source: EMBRAPA (unknown)

Currently soy is mainly planted in the South and Centre-West of Brazil. New varieties and improved agronomical knowledge resulted in gradual expansion possibilities to the North. The expansion of soybean from the Southern production region to the North was stimulated by a number of factors since the 1960s. Perhaps the strongest drivers were the increased technological and agronomic knowledge which enabled the production of more suitable varieties, fiscal incentives, higher market demands and therefore high prices, improvement of transport and low

value lands in Mato Grosso compared to the prices in the South (Dall'Agnol 2004). Over the past fifteen years the production growth of soybean has mainly taken place in the Centre-West region, principally in the state of Mato Grosso were the area has nearly quadrupled to 11 million hectares (Berkum et al. 2006). As a consequence soybeans are one of the main agricultural crops in Brazil and provide 20% of the agricultural income (Berkum et al. 2006). Farm size and family farming versus industrial farming is quite regional dependent as can be explained as a result of historical development. In the Southern production states (Rio Grande do Sul, Santa Caterina and Paraná production takes place on relatively smaller scale (though there is a broad range from family farms that only own a few hectares to large farmers who own between 300-1800 hectares). This is an older agricultural region in which the first immigrants got small plots which some gradually expanded. The Centre-West on the other hand is characterised by large farms with thousands of hectares of soybean. This area is relatively new agricultural land. There are also different (conflicting) explanations for the expansion to the North, such as: the introduction of sugarcane, population pressure in the South, availability of cheap land and governmental incentives. Fact remains that the farms in the Centre-West often large scale and based on mechanical agriculture. When demand for soybean would increase further most expansion will probably take place to the North or Centre of Brazil (Berkum et al. 2006).

5.7.2 The soy chain

To map the soy chain it is important to acknowledge the different production areas and management systems. As shown in previous information about production areas the plots in the South tend to be smaller than the ones in the Centre-West areas. Due to historical developments farmers in the South are generally also more organised which means that (part of) their produce is sold through cooperatives or associations. In the North-East associations are being set up in a way to organise small farmers and make it easier for industry to buy sufficient feedstock at once. From the soybeans that are produced most areas differentiate between genetically modified (GM) and non-GM beans. This is the result of different international approaches toward the use of GMO. The GM soybean is often called RR soybean after the herbicide RoundUp Ready, created by the American company Monsanto. This variety is resistant for certain compounds of herbicides and insecticides (Wilson 2004). Though GM soy has been widely introduced and is common in Argentina, USA and Canada there are strong concerns about its impact on the environment. Environmental NGOs to fight the use of GM crops in general, and for instance the EU demands explicit labeling of GM soy. In Brazil the use of GM soy is officially permitted since 2005. Before that time the federal government held a strong anti-GM position, but actual farming practices and the availability of GM varieties in Argentina, where it was already legalized, resulted in this legislative change. After official approval the use of GM soy has increased rapidly and the Brazilian Ministry of Agriculture indicates that over 40% of the area has been planted with GM Soy (Berkum et al. 2006). For the export market the GM and non-GM varieties have their own production chains, depots and harbours. There are two main options: one part of the soy is directly transported to the large harbours for international export through overland freight transport. These soybeans are not crushed but transported as a whole grain. In the harbour they are transferred to ships, when they arrive on their destination they are adapted to their various user applications. Another part of the soybeans is crushed in Brazil. After crushing the soy oil and soy cake is separated. The oil is used for all kinds of food and non-food products (such as biodiesel). The cake is used for animal feed and human food production and the production (Embrapa Soja 2006).

In 2007-2008 Abiove (2007) estimated a total production of 55.2 MMT soy. In 2007 approximately 25 MMT of this produce was directly exported. The export of whole beans is partly stimulated as a consequence of a law that stimulates the export of primary material rather than of industrialised products. Brazil has legislation in place were a tax is levied for every 'act' in every state along the production chain, for example if the beans are crushed in another state than were they are produced or shipped extra tax is levied. Still part of the domestic crushed soybeans is still exported. Figure 5.5 shows a graphic representation of the soy-chain. One needs to realise that this is not static entity, but that it changes in volume and flows as a result of supply, demand, and legislation. These elements will be looked into in the next chapter.

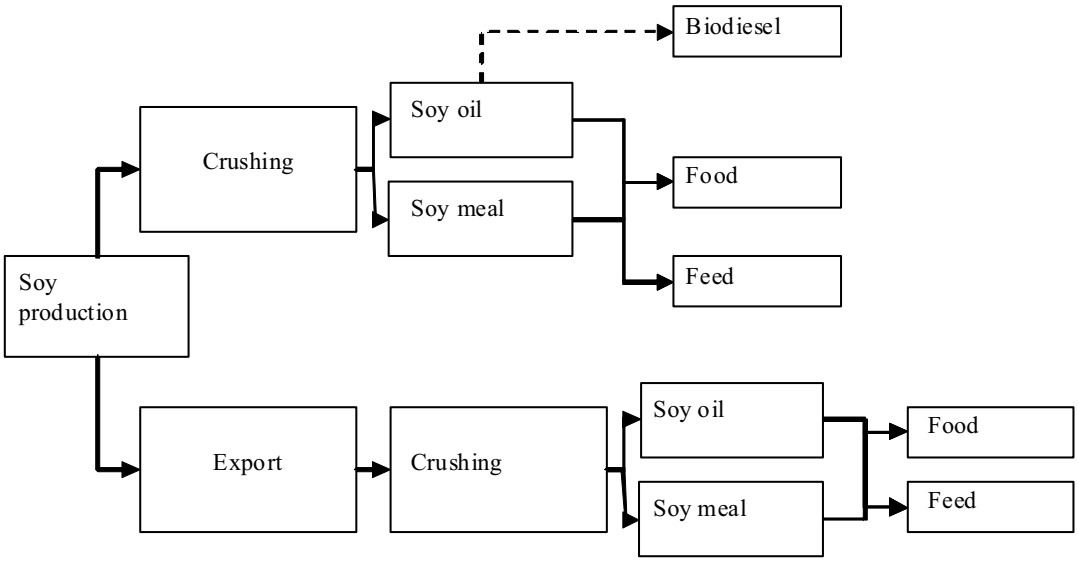

Figure 5.5. Simplified soy chain.
Adapted from Abiove (2007; AIDEnvironment (2006).

5.7.3 International soy trade

The USA, Brazil, Argentina, China, India, Paraguay, Canada, Bolivia and Indonesia are the principal production countries of soybean. China, the European Union (EU), India, Japan, Mexico, South Korea, Thailand and Indonesia are the main importing countries (Clay 2004). Typical for the soy industry is that international trade is dominated by four large trading companies: Archer Daniel Midlands (ADM), Bunge, Cargill (all US, although Bunge has Dutch roots) and Dreyfuss (France). The only Brazilian producer and exporting company that plays a significant role in the trade market is the André Maggi Group (Amaggi) (Berkum et al. 2006). Over the last years the increasing demand in the food and feed sectors have led to increased soybean prices over the last decades. Only recently between 2003-2005 there has been a sudden fall in international prices. This fall was mainly due to a number of events that occurred in the same period. One element was the appreciation of the Brazilian Real of more than 30% in relation to the USD. This had impact on the prices farmers paid in order to purchase their inputs versus the price they could receive for their produce. Secondly prices of petrol oil had a strong impact on the prices of fertilizers and freight costs, these prices rose significantly over the past years. harvests (Abiove 2006).

This sudden price fall resulted in many cash problems for the farmers and a drop in total acreage, because farmers left less productive areas out of production. The problem cash problem for the farmers even expanded because of a soy disease, Asian rust, which resulted in a loss of harvests. In 2007 the soybean planted area was 20.69 million hectares, 9.1% (2.06 million hectares) less than the previous season (CONAB 2007). The reduction in the area is probably due to the lower soybean prices at during the planting season and the increases transportation costs as a consequence of higher fuel prices for soy produced in the states of Mato Grosso and Goiás. Though the total area declined productivity went 16.7% up as a result of good weather conditions and less soy diseases such as Asian rust and the fact that because of a short term decline in demand the better soils were used and worse soils lay fallow. This resulted in an average growth of 6.2%, raising production from 55.03 million tons to 58.42 million tons this year (CONAB 2007). Though the reasons for the sudden fall led to temporary shifts it is unlikely that they changed the trend of increasing demands. Based on calculations by Bindraban and Zuurbier (2007) it is more likely that international demand for soy will continue to grow in the next years. In future calculations for the (international) demand for soybean increasing meat markets in Asia and China should considered, as well as the use of soy oil for biodiesel production.

5.7.4 Controversies and sustainability initiatives

The growth in soy production led to many economic benefits for the producing states. However, there are also potential negative social and environmental consequences. The social consequences are often related to landownership issues, illnesses due to use of pesticides and bad labour conditions. Possible negative environmental consequences are lack of variation between crops, resulting in monoculture, increased deforestation and water pollution. For instance, Greenpeace (2006) argues that expansion and increased deforestation in natural reserve areas go hand in hand. Though it might be hard to prove the dynamics of land conversion it seems clear that soybean is moving further North. Greenpeace points at the indirect connection between the expansion of soy cultivation in recent years and deforestation in the Amazon region. This relation is explained by their calculation that soy cultivation expands predominantly in previous cattle grazing areas where some infrastructure is present. In these areas soil fertility gradually improves until it is suitable for agrarian production. As a consequence livestock farming continues to move further North to newly opened-up areas in the Cerrado and/or the Amazon biome (Berkum et al. 2006). Clay (2004) also points out the effect of soil erosion and degradation, use of agrochemicals and genetically modified seeds when discussing the impact of soybean production. According to Clay there is a lot of room and possibilities for improvement on the production side, like the use of no-tillage systems (which is a practice widely spread in Brazil), further increase of yield per hectare (therefore less agricultural land is needed) and crop rotation (to prevent pests and soil degradation). To address the controversies surrounding soybean production a number of initiatives have been set up to alter current conditions. Some are only relevant for Brazil, but others have a worldwide scope. The initiatives that are most important in the Brazilian context are:

- *Round Table on Responsible Soy*

The RTRS is an international forum to promote the responsible production and trading of soybeans. The goal of the Global Roundtable on Responsible Soy Association (RTRS) is, 'to set up a multi-actor and participatory process that promotes economically viable, socially equitable and environmentally sustainable production, processing and trading of soy' (www.responsiblesoy.org). To be successful it is crucial that all actors have a shared definition on sustainable production criteria. The participatory process of the RTRS is aimed at developing such a definition. To study the legitimacy and governance system set in place by the RTRS is important to look at its representation of actors and their compliance with the set procedures. Its goal is to set sustainable production standards on a worldwide level, although currently the focus lies on South-America as production region, and the EU as main importer. Important element of the RTRS is that governments cannot have membership. The board and the Principles, Criteria and Verification Development Group (PCVDG) are organised according to three different interest groups: Producers, Trade, Industry and Finance, and NGOs. All have an equal voice and number of representatives. The first results are that a set of nine basic principles have been set up that will be further elaborated by a RTRS' PCVDG. The group will develop a set of normative baseline requirement of standards, expressed as verifiable principles, criteria and indicators that define responsible production and early processing (crushing and trade) of soybeans.

Table 5.5. Key dimensions of the RTRS.

Dimension	RTRS principles
Economic	1. Impact of Infrastructure
Social	2. Compliance with Labour laws and requirements 3. Respect for Land Rights 4. Small scale and traditional land use 5. Rural communities and migration
Environmental	6. Water as a key resource 7. Soil as a key resource 8. Protection of Biological diversity 9. Responsible use of agrochemicals

- *The Basel Criteria for Responsible Soy Production*

The purpose of the Basel Criteria for Responsible Soy Production is to provide a working definition of acceptable soy production that can be used by individual retailers or producers. It is expected that companies meeting the requirements of the Basel Criteria will be well positioned to comply with any international criteria that are developed. There are three main objectives behind the development of the Basel Criteria for Responsible Soy Production:

– to provide a working definition for environmentally, socially and economically responsible soy production;
– to enable businesses to source soy for their animal and food products from farms that are managed in a responsible way;
– to provide input into the development of internationally applicable and accepted criteria for sustainable soy production through a multi-stakeholder process provided by an international round table on sustainable soy.

The main aspects covered by the criteria include: compliance with applicable legislation, technical management and production, environmental management, social Management, continuous improvement, and traceability (Proforest and WWF Switzerland 2004).

- *Soy Moratorium*

NGOs complain about soybean expansion in the Amazon. Therefore ABIOVE (Brazilian Vegetable Oil Industry Association) and ANEC (National Grain Exporters Association), together with their respective member companies committed themselves, not to trade soy produced in the Amazon Biome. Of areas that were deforested after July 24 2006. This commitment is valid for two years. During that time a working group will work on developing a governance structure for the responsible production of soy in the Amazon Biome. This should include stimulating an end to deforestation and reconciling economic development with socio-environmental conservation. The Working group consists of ABIOVE, ANEC and various companies from the industrial sector and the Brazil Soy Articulation, International Conservation, Greenpeace, IPAM, TNC and WWF Brazil from civil society.

- *Institute for Responsible Agribusiness*

The mission of Institute for Responsible Agribusiness is to contribute to the development of sustainable agribusiness through building knowledge, dialogue with stakeholders and communication. The final objectives are to create a permanent think tank on sustainable agribusiness, generating technical and pragmatic information, to promote an extensive dialogue with NGOs and research Institutions, to support and influence government actions related to sustainability in agribusiness and to communicate with direct and indirect stakeholders. The members of ARES constitute of 19 major Brazilian agribusiness associations: National Confederations (ABAG, ABAG/RP, CNA, OCB, and SRB), Inputs Associations (ANDA, ANDEF), and Sectorial Associations (ABIA, ABIEC, ABIOVE, APROSOJA, ABEF, UNICA, ABIMILHO, ABIPECS, BSCA, CNPC, ORPLANA and Research Institutes (ICONE).

- *National Pact for the Eradication of Slave Labour*

In May 2005, a National Pact against Forced Labour, coordinated by the International Labour Organisation and the Ethos Institute for Social Responsibility, was signed by a large number of public and private enterprises in which they agreed not to buy products made from slave labour. Although this is not specifically focussed on soy, Abiove argues that the soy production chain has adopted a 'Zero Tolerance' policy (http://www.abiove.com.br/english/ss_trabalho_us.html and http://www.reporterbrasil.com.br).

5.8 Concluding remarks

This chapter allowed for more elaborate background information on the case study. As explained in the introduction chapter the long history of experience with biofuels is very typical for Brazil. Brazilians gained their experience with transitions in the energy matrix with the ProAlcool programme. The PNPB is a new challenge created by the Brazilian federal government. Its social, economic and environmental pillars demonstrate the large ambitions the government has with this programme. It is expected that the PNPB will have a major impact on the vegetable oil market and the energy industry. However, it is still unpredictable how the programme will work out, as the policy field itself is still quickly evolving. Some of the key questions are; which crop(s) are able to provide sufficient vegetable oil for biodiesel production? Who will produce these crops? What are the impacts and consequences of this newly created demand? Based on current calculations it seems that, at least in the near future, soy oil will play an important role.

This comes with new challenges, since soy is already a crop with high demands, and controversies in the social and environmental area.

The challenge is to give some indication on how this policy field might evolve. In the theoretical framework (part I) it was stated that this evolvement is based on the large variety of dynamics (re)shaping the institutional process. In this context the relations between actors and their cognitive framework are crucial to identify possible scenarios. For the ProAlcool programme it became clear that a small group of key-actors determined the policy outcome. The question then arises whether the same observation can be made for the PNPB. To analyse the different chain processes and views, expectations and concerns of actors the net-chain is a helpful first step. It shows which groups have economic, technological or social interests in the shaping of this biodiesel market. The next chapter will highlight the key-players in this field and analyse how they are positioned in the context of using soybean as a biodiesel crop.

6. Reality definitions related to actor groups

This chapter presents an overview of the key issues that came forward when the reality definitions of the actors in the biodiesel debate were studied. The net-chain figure shows which actors play a key role and the following paragraphs highlight the most important issues per group. To structure the different opinions the pillars of the PNPB are taken as point of departure. This implies that social, economic, environmental and technological arguments are identified and analysed. This leads to an overview of different reality definitions by different actor groups. For the purpose of this research the focus lays especially on the different feedstock options that are available, with specific attention for the role of soybean oil.

6.1 Net-chain for the use of soybean as biodiesel crop

The net-chain analysis is an analytical tool to combine actor network theory with chain analysis, resulting in a methodology to distinguish different levels and types of organisations. To make a net-chain, information is needed on the flow of goods in the chain and the flow of ideas and relations in a network. This chapter presents the flow of biodiesel production in general, and soybean in particular. At the same time it also indicates a number of involved actors, who participate in the various discussion and production areas. Based on observations of the previous chapters it is possible to distinguish those actors who play a key role in current events and decisions. In this context actors can be individuals, organisations, industrial branches and other interest groups. Stakeholders are more specific, because they (generally) represent and economic interest in either the soy-chain or biodiesel-chain. They will produce as long as there is a market with good prices. Actors in the biodiesel debate might have broader perspectives in the sense that they also have other objectives and interests which are not only linked directly to biodiesel production. This could be the position of Brazil in the WTO-negotiations or participation with climate control treaties. For some of them this discussion is just a part of their operational area.

As this is an exploratory study to develop a better feeling for the biodiesel production in Brazil, one of the main challenges is to draw borders for the identification of the net-chain. To prevent this situation certain limits on scope and focus need to be drawn. Therefore attention lies with those actors that are actively involved with the process, for instance, by producing, consulting, making regulations, implementing, selling, and demanding. Figure 6.1 demonstrates a schematic overview of the flow of goods throughout the Brazilian (and international) market. At the same time the chain helps to identify which actors are involved in the network and what kind of interests they might have. Besides the flow of goods these networks demonstrate other relationships that are based on, for instance, organised interests, legislation and organisational practices. These can impact decisions made by the actors in the chain as a result of strategic decision-making, normative frameworks or chain dependency. Figure 6.1 does not reflect reality in all its complex facets, but it indicates some of the key-processes in both chains as well as actors that interact at different levels with these processes. As the biodiesel chain is still evolving its ‘final’ shape is unpredictable, therefore the figure should be seen as a momentarily frame of a dynamic process.

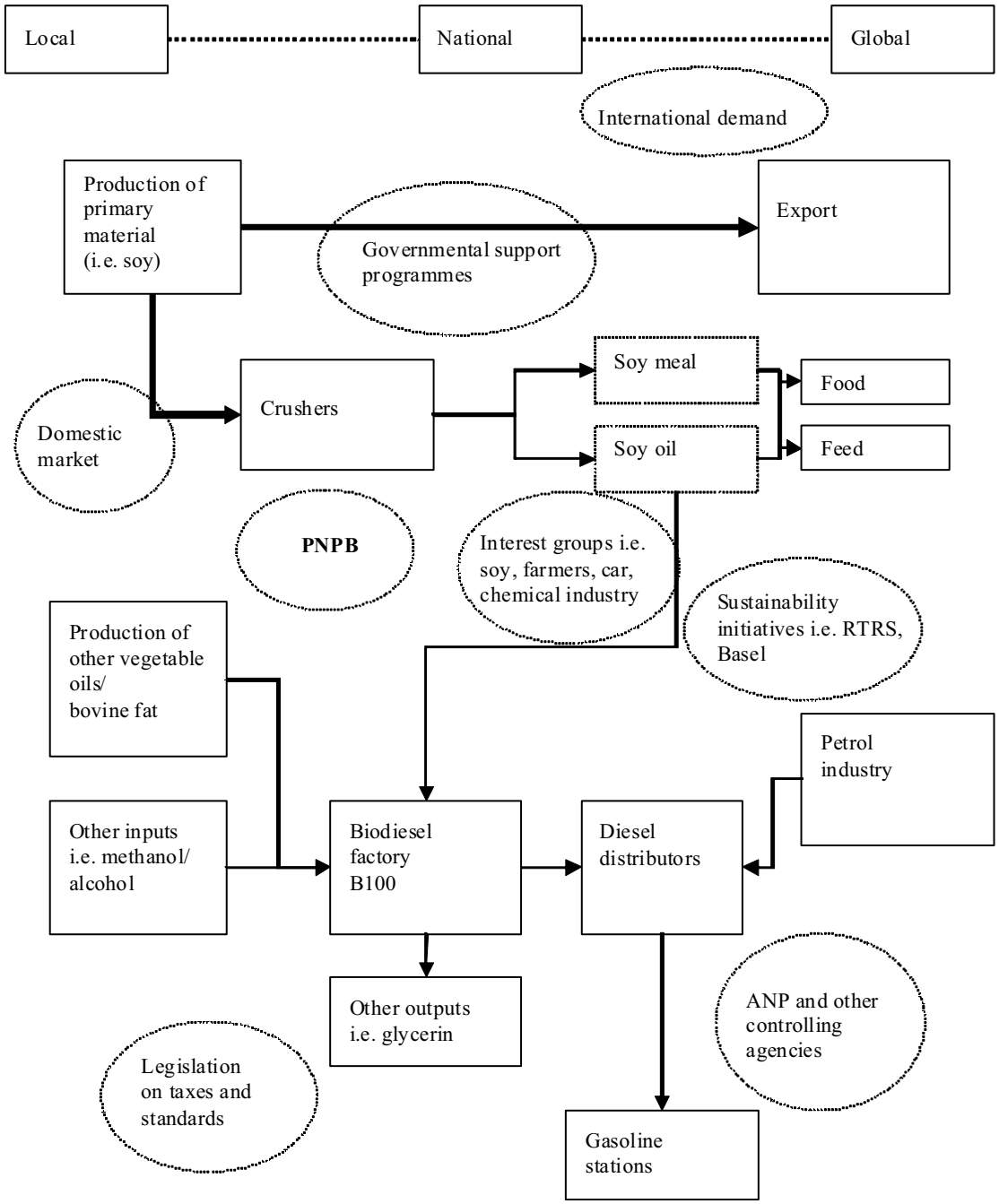

Figure 6.1. Integrated soy - biodiesel chain.

(Box: represents part of the chain, Circle: represents (social) network)

6.2 Actor perspectives

Per actor attention will be pointed at the key-issues of the group and their view on the use of soy as a biodiesel crop[14]. To understand the arguments made, these viewpoints will be put in the context wherein actors need to operate, that means their social as well as chain position. To distinguish the views and perspectives within groups, key-issues will be discussed. These main issues will be summarised on the basis of the pillars of the PNPB: social, economic, environment and technological. By addressing their importance to different actors, it is possible to indicate possible tension fields. Each set of reality definitions is summarised in key issues or that portray the intrinsic value behind the arguments.

Unfortunately the size and variety of Brazil make it impossible to study all actors in all regions. Therefore this chapter will present a selection of various groups that have been identified in the net-chain as key-players. It is important to realise that they show only part of the large variety of reality definitions that exist, but cannot be used to say anything about the size of groups that share a particular view. The focus lies on the range of ideas, rather than the exact size and composition of the group. Secondly, people often speak in general terms about groups of actors, when they discuss the position of 'industry', 'government' or 'NGOs'. When analysing reality definitions it is very difficult to generalise since there is not one industry, nor one governmental level nor one type of NGO involved. For instance, there are large differences between the 'soy-industry' and the 'diesel-industry' and farmers from different geographical regions.

6.2.1 Reality definition of family farmers

Agriculture accounts for a large part of national employment and income in Brazil. The amount of people working in this industry is a large complex group of actors. Farming systems and crops vary per region and farm size. Generally speaking the term 'family farmers' applies to subsistence farmers who live on their farm land and produce a variety of crops needed for their own households. Sometimes extra income is generated by selling surplus to traders or cooperatives. 'Producers' often own much larger areas of land and produce crops on a commercial basis. In general these producers have a more economic approach to farming and will often respond more directly to market demands. It is difficult to present a generalised perspective of farmers towards the use of soy for biodiesel, because of the large variety. Yet, it is possible to differentiate between farmers who are asked to start production of biodiesel crops as a consequence of the PNPB and farmers that are already producing soy and see new market opportunities. Within the PNPB, the SFS and tax reduction are used to promote production of different biodiesel crops. These systems are mainly focussed on new oleaginous crops, such as mamona, which can be produced by family farmers in the North-East. For these small farmers entering production of these alternative crops is quite a challenge as these crops have not been produced at a commercial scale before. Therefore farmers have little agronomic knowledge and experience, thus increasing the risk of entering this new market. A small farmer in the North-East states: *'We have two jatropha plants, but we only use them for medical purposes (when we have cuts). If it would give a good profit we would plant more, but we have no experience with planting these crops at a larger scale'.* This statement indicates that farmers have little knowledge and experience with many of the oil crops that are promoted by the federal government. Below the key considerations with respect to the different elements of the PNPB from a family farmer perspective are summarised.

[14] All information presented in this chapter is based on field research in Brazil. During this research interviews were held, events visited, and additional documents collected. All sources have been made anonymous as the scope of the thesis is not to pinpoint specific people, but rather to identify key-actor groups and insights in their reality definition. A list of visited institutes can be found in Annex III.

Social considerations
The principal social aspect for small farmers is that the PNPB offers opportunities for them to increase their level of organisation. Attention given to them by governmental and extension agencies can improve their options to participate in the biodiesel market. However this social interference can also have a downside. Small farmers are stimulated to produce specific types of crops of which they have little agronomic knowledge and experience. Different extension services can send out mixed messages that confuse the farmers. Besides this the scale level on which they are able to participate is limited, because of their access to land and the fact that they need to keep part of their land for other (food) crops. *Key issue: criteria to participate*
Economic considerations
From an economic perspective the PNPB offers new income opportunities. Together with the stimulation measures aimed at industry, such as the SFS and tax cuts when small farmers are involved, incentives are in place to stimulate the inclusion of small farmers into the market. However it remains insecure whether they can keep involves when the government diminishes these economic incentives in the long run. For industries it can be a trade off whether the economic incentives for the inclusion of small farmers weigh against the need for investments in new technology and machinery and large scale production. This should also be added against the long term insecurity in the biodiesel market as it is just in its initial phase. *Key issue: value upgrade*
Environmental considerations
For small farmers alternative oil crops and their reaction in a local production climate adds to the level of insecurity. It remains difficult to assess at this moment in time which crops are most suitable for the local climate conditions and what kind of problems might arise (plagues and plant diseases). *Key issue: suitability oleaginous crops*
Technological considerations
From a technological point of view biodiesel has some real advantages. For instance, far-off regions can produce their own energy thus decreasing their dependence on expansive diesel supplies. However, there are many technical dimensions that should be considered by small scale farmers. For instance, the competing claims between various production crops for food, feed, fuel and cash crops. They might need different infrastructures and care. Another technical element is the limited agronomic knowledge and equipment available for all these different chains. *Key issue: technological applicability*

6.2.2 Reality definition of producers

The situation is different in the major soybean production states in the Centre-West. These regions form the agricultural frontier. The production of soybean in this area is directed at the international commodity market. At first producers were very optimistic and suggested: '*In this earth, everything you plant will grow.'* Soybean farmers from this region have received (international) attention for the last decade. They were confronted with discussions about GM soy, the total expansion of the soy area, monoculture soy, plant diseases, market fluctuation, and sustainability issues. As a result even larger farmers seem more concerned about the future and they are organising themselves to operate more efficient and to be able to participate in discussions. They are setting up their own cooperatives and associations. They recognize that their market access is partly dependent on their position and action regarding sustainability issues. As a result farmers are getting closer to think about the management of natural resources.

Fluctuations in soy prices, the high diesel price, and soy diseases led to more cautiousness with farmers. Realising the fragility of their business and their dependence on large international traders made producers more calculating with regard of cost-benefit ratios of production.

On this basis biodiesel would be a form of diversification, making them more flexible towards the market. This flexibility is two-fold, because farmers can sell their produce (especially the oil-content) to more industries in the market, but they can also start to produce their own biodiesel thus dealing with the high transport costs for agricultural productions. Still, many producers do not know much about biodiesel production and therefore consider the policies of the PNPB as a contemporary fashion. They prefer to observe a little longer before investing in this market. If they decide to make any investments they have to be well deliberated in order to diminish any financial risk. Most farmers want to wait in order to see how the PMPB laws will work out in practice.

Social considerations
Large scale soy producers are improving their positioning in the market. As their products can be sold to different markets, they might be able on the long term to take a stronger position towards the other industries. In this sense they already have some strong advantages, because they have experience with large scale production and have the knowhow and infrastructure necessary to produce at a large scale. However, after some bad years in the soy industry, many farmers have become careful and they want to see which direction the development of the PNPB will take, before they make large investments. *Key issue: societal positioning*
Economic considerations
From an economic perspective producers are the increasing options for a number of market outlets as well as a solution for the high diesel costs. The production of biodiesel will decrease their dependency while improving their options. However, they are still dependent on the price fluctuations in the world market and the fact that they will have little to no advantages advantage of SFS and/or tax reductions policies. If they want to increase their scale level it will also be difficult, because the expansion of agricultural area is one of the principle discussions. *Key issue: market differentiation*
Environmental considerations
On the one hand market access is dependent on the position and action towards sustainability issues, on the other they do not want to ruin their livelihood. These different goals might also result in a variety of interpretations on sustainability itself. This is reflected in the discussions on GM soy, the total expansion of the soy area, monoculture soy, plant diseases, market fluctuation, and sustainability issues Increased pressure on production. This shows that there are many different ideas and considerations in this field for producers. *Key issue: sustainable production*
Technological considerations
Soy producers are mainly focussed on the improvement of soy cultivation, the introduction of new more efficient technologies and problems with infrastructure in far-off regions. In this context the high diesel costs are incentive for private biodiesel production, but the opportunities depend on the question whether technology can be adapted to such an extend that there is an economic benefit for these production types at the local level. *Key issue: improvement of soybean*

6.2.3 Reality definition of farmer cooperatives

There are many farmers' cooperatives in Brazil, but their organisational style, size and core objectives vary. In general there are more and better organised cooperatives in the South (based on local narratives practically every farmer is a member of one of these cooperatives), while in the North-East and West cooperatives are treated as some kind of novelty. For Brazilian law cooperatives have certain advantages, for example, they pay less tax for their products and they can receive specific subsidies. Next to cooperatives there are associations. These are more loosely organised and operate at a smaller scale. They do not have the same kind of formal registration and are often organised among smaller groups of farmers. In the context of these associations farmers can teach each other about farm management, crops and pest control. However, the association does not have the same legal status as the cooperative. Since the cooperative fulfils a special function within the Brazilian legal system they also have a right to certain tax advantages within the Social Fuel Stamp for biodiesel as well as relatively cheap loans for any investments made in the biodiesel industry. In this way it can be quite profitable to enter the biodiesel market or for external companies to take care that a cooperative is delivering the primary material for their factory. The scale and the organisation of the cooperative can guarantee a steady flow of resources.

One aspect that needs to be pointed out is that farmers can have an ambiguous attitude towards cooperatives. Though membership is voluntarily, farmers feel they sometimes do not have a choice whether or not they want to participate. Cooperatives generally offer full service packages, such as schooling, healthcare and extension services. In return farmers are obligated to buy their seeds, fertilizers and pesticides with the cooperative and sell their harvest through the cooperative. This can result in conflict when the preferred options are not available, or farmers feel that the cooperative hold back too much money for new investments. Yet, cooperatives are seeking for ways to increase the value of the products their farmers produce to increase their income. Depending on their specialisation and region they choose the best options. Based on field observations it is possible to distinguish different development paths, for example, cooperatives that are already involved in the vegetable oil industry, those that are involved in the energy industry, those operating in the soy business, and new ones being set up in order to coordinate biodiesel production.

Social considerations
Cooperatives are able to operate at a very practical level. Their level of social organisation guarantees a certain scale and flow of resources. Their organisational form also makes them interested in the continuity of practices. Consequently cooperatives can have decision-making power over the crops that their members produce. They do this through their own extension services. Since they can control production as well as trade they can have strong influence on the net-chain. However, farmers can have an ambiguous attitude towards cooperatives. They are not always in favour of certain policy decisions. At the same time the cooperatives feel a responsibility towards their members that can make them inflexible. *Key issue: control over net-chain*
Economic considerations
Cooperatives can apply more easily to the relatively cheap loans of the government for any investments made in the biodiesel industry and because of their structure cooperatives are entitled to tax reductions and are an important partner for industry to obtain the SFS. The switch can be easier for cooperatives, because they can receive specific subsidies and loans aimed at cooperatives. To go into a particular field of production will carry little risk, because their members produce the primary feedstock needed for production. However, many cooperatives are already specialised in a particular direction. Thus their level of interest in the biodiesel market depends on current production strategy. When they are in the biofuels industry it is easier than when they are in e.g. food production. In general the decision is calculated decision, because they are unwilling to gamble with financial resources. *Key issue: calculated investments*

Environmental considerations
If a cooperative has positive attitude towards sustainable production, it can achieve a lot. Their farming members already own land and the cooperative can promote sustainable practice and advice to stop for deforestation. On the other side cooperatives might force farmers to use specific pesticides that are not environmental friendly, but can improve the yield. *Key issue: boundary conditions*
Technological considerations
Technological developments are partly supported by government. However, there are costs connected to teach people to operate these technologies. This also means additional education on a cooperative level. *Key issue: long-term perspectives*

6.2.4 Reality definition of extension services

There are many types of extension services available to the farmers. The Ministry for Agrarian Development (MDA) has an extension service at state level as do states, cooperatives, and different industries. The later group is obligated by the SFS to provide support services to the small farmers that produce their oil seeds. This wide range of extension service providers aims at farmers to provide technical support, to help with farm management and to promote specific crops. All in the context of improving the livelihood of farmers and guaranteeing agricultural production. The amount of farmers that receives support is large as can be seen in the graph below. Table 6.1 indicates that a growing amount of farmers receives technical assistance. Though most services operate in similar ways, they can have conflicting objectives. To indicate some of these different views, examples from several services will be discussed. These are located in different geographical regions of the country.

Table 6.1. Number of farmers that receive technical assistance.

Number of families that received technical assistance between 2001-2005	
2001	76.749
2002	85.460
2003	169.821
2004	427.419
2005	450.700

Source: DIEESE and NEAD/MDA (2006).

Social considerations
Extension services often address the poverty issues of small scale farmers. On the one hand the increasingly flexible market for farming products is seen as an advantage. However, many employees of extension services wonder whether the PNPB is the best solution for that goal. The fact that different extension services are rooted in different organisation and/or commercial structures does not help. It makes it difficult for the farmer and the services at time provide contradictory advice. *Key issue: upgrade farmer position*

Economic considerations
Economic considerations are viewed with regard to the impact they will have on farmers. In this respect they see new income sources for farmers. Small farmers can be included in chain and large farmers will have more market opportunities. However, it remains a question how long these advantages will remain. For instance, the comparative advantage of soybean can make it difficult to stimulate farmers to produce other crops in the end there can be competing claims with food and fuel production for land. This means that to produce biodiesel crops is not necessarily in the best interest of the farmer. *Key issue: efficiency of production*
Environmental considerations
A key issue mentioned by extension services is that they are concerned with the long-term impact of these production systems on the eco-system. As a result of the market farmers are not always to take the most sustainable decisions. This became very clear with regard to the GM soybean. *Key issue: ecological awareness*
Technological considerations
Extension services are concerned whether the technology that is being developed fits wit the farmer and if the efficiency of vegetable oil chain can be improved. When there are many options this can result in a broader variety of farmers or in more confusion. *Key issue: appropriate technology*

6.2.5 Reality definition of product boards and vegetable oil traders

Two major product boards are involved with the discussion on the use of soybean for biodiesel. These are the Brazilian Association of the Vegetable Oil Producers (Associação Brasileira das Indústrias de Óleos Vegetais - ABIOVE) and the National Association for Grain Exporters (Associação Nacional dos Exportadores de Cereais - ANEC). ABIOVE seems to be most active in the debates on soybean production and its possibilities. The association was founded in 1981 and its eleven member companies are responsible for 72% of Brazil's soy processing volume. ABIOVE's objective is to represent the vegetable oil industries, to cooperate with the Brazilian government in policies that govern the sector and to promote Brazilian grain products.

In 'Soy vision 2020' ABIOVE estimates that demand for soybean will rise as a result of population growth and economic development. Therefore the outlook for the soybean complex is even more favourable even when it is viewed as an important oilseed. Even if it would loose market share on the biodiesel market new demand will come from India and China. So far, estimates on the necessary increase of soybean production have not included the additional demand for soy oil for biodiesel production. Dealers expected that in this case production can go up and will quickly meet the new demand. Concerns by the industry are not directed at the use of soy oil for biodiesel, but rather at soy production itself. In recent years there have been increasing worries over rapid expansion and monoculture which are the consequences of ever rising demand. To tackle criticism and address these issues in a constructive way ABIOVE participates in initiatives such as the Basel Criteria and the RTRS. This allows them to share their perspective on sustainable production and maintain access to all markets. In implementing these sustainability issues they point directly at the international responsibility. ABIOVE argues that more diversification is the most secure base for sustainability.

Social considerations
Product boards represent the vegetable oil industries and want to cooperate with the Brazilian government in policies that govern the sector and promote Brazilian grain products. In this context soy oil, which represents 90% of Brazil's current vegetable oil production, will be a major source for biodiesel production on the short and medium term. The product boards are positive about this development, because it creates new opportunities for its members. However they are not specifically focussed on small farmers. *Key issue: expand vegetable oil and grain markets*
Economic considerations
A new commodity with new trade options in the vegetable oil market is regarded as a positive development. Especially since the price of these oils, and specifically soy, will be higher validated. As long as the diesel price remains high, it is a strategic option to invest in biodiesel in the western states. Yet, in these states there is no tax advantage for soy oil in the PNPB and no special loans for the industry. In this way it is still economically interesting to work with small farmers to obtain the SFS. *Key issue: improve market diversification*
Environmental considerations
To invest in sustainability is also a way to guarantee future market access. Especially because other crops oilseeds will be effective, but need many years of agricultural improvement. *Key issue: improve market access*
Technological considerations
The demand for biodiesel will also affect the infrastructure for soybeans. It is likely that more beans are crushed in Brazil to keep the soy oil and export the meal. This needs scientific studies on the impact of new measures and the necessities for sustainable production. *Key issue: improve efficiency*

6.2.5 Reality definition of purchasers from food and feed industries

Traditional buyers of soybean and its derivatives are generally found in the food and feed industry. As a consequence of interests from the energy industry for 'their' primary material they express serious concerns with regard to the implementation of biodiesel. They expect higher market prices for all vegetable oils thus compromising their current business. They argue that the biodiesel legislation in combination with the financial incentives results in higher food prices, because this increases the price of vegetable oils. Normally the price of vegetable oils for food is always higher than the price for biodiesel, but current policies create a false demand in favour of the biodiesel industry. For the feed industry the process is a little different. They generally buy the protein part of the bean. When the production of soybean is driven by its oil content, there will be more protein available, which will make it a cheaper feedstock, which will decrease the prices of their cattle feed. Besides, they can sell their animal fat to the biodiesel industry, which can use the fat for production of biodiesel as well.

Social considerations
The discussion is focussed on the competing elements between various sectors of the vegetable oil market. The type and extend of competition depends on the oil prices as well as the prices in the food market. *Key issue: secure net-chain position*
Economic considerations
The use of soybean can also have economic advantages for the food and fuel industries. For instance, the oil prices might increase, but as a result of increased production it is possible that the protein content becomes cheaper. However, in any way the competing claims imply that the food and feed industries will have less control over the chain and become more dependent on market developments. *Key issue: lower raw material costs*
Environmental considerations
Environmental issues play a role towards the consumers at the end of the claim. As these are important customers the companies might be more sensitive to the public opinion. Yet, as long as additional products is needed there will remain a large claim on the agricultural area by these sectors. *Key issue: type of production should fit consumer demand*
Technological considerations
The use of a larger variety of oleaginous crops can also lead to changes in the production infrastructure. Different crops might become used in different parts of the vegetable oil market. Other crops that have a higher oil content than soy might become interesting alternatives as soon as the technological knowledge in this area improves. *Key issue: improve efficiency*

6.2.6 Reality definition of energy producers and distributors

The transport energy industry can be divided in three major groups. The first group consists of dealers in petrol fuel and its derivatives; the second group is involved with ethanol production; and, the third new group are the biodiesel producers. Within the petrol group Brazilian Petroleum (Petróleo Brasileiro S/A - Petrobras) is the most important player. Though other petrol traders are active in Brazil, Petrobras is coordinating the mixing process of biodiesel to diesel. The incentives and financial support set by the government to promote biodiesel production has led to initiatives all over the country. These are not only biodiesel factories, but also investors, developers of technology, and other commercial activities. These different actors show many different visions on biodiesel production, its future, and possible consequences. An element that is considered important by industry is the energy balance of different feedstock options, together with the quantity and quality of eventual co-products and residues. If these have economic values this alters calculations on efficiency of production. Many state that initial challenges for setting up a production factory are the limited amount of producers and the location. Producers of oilseeds should not be at long distances, because that results in high transport costs. As the infrastructure for biodiesel is still evolving industries have to deal with insecurity about the distribution system and the unreal prices with regard to production structure. An employee of a large producer mentioned that biodiesel production is very exiting, because it is possible to explore new potential markets and shape a new commodity. This also concerns questions which type of feedstock is best to use. Promotion of the human and social development in a healthy environment are considered an integral part of their business.

Social considerations
The social context is mainly relevant in order to receive access to the SFS and tax reduction. However these incentives can be contrary to practical considerations with regard to a stabile and secure supply chain. Therefore the long term perspectives for various enterprise strategies will influence the companies' decisions. *Key issue: societal positioning*
Economic considerations
Economic decisions are influenced by the financial support for technology development, a possibility of tax reduction and the development of a new commodity market with high grow potential. Yet, on the downside of these developments is the high level of insecurity about sufficient production of most oil crops. For the moment soy oil is most reliable feedstock, but there is no tax reduction possible. This implies insecure market developments where long-term perspectives are unclear. *Key issue: long-term perspectives*
Environmental considerations
The environmental awareness is based on results regarding the public and political demand for new energy sources. Therefore it depends how profitable the new industry is. However, investors are also careful, because there is still a high level of insecurity considering the availability of sufficient vegetable oil. *Key issue: alternative energy sources*
Technological considerations
The economic efficiency is largely determined by high investment costs in new technologies. Therefore the efficiency of these technologies depend whether the mining of biodiesel to diesel is efficient and what type of feedstock guarantees the best results. *Key issue: efficiency of production*

6.2.8 Reality definition of ministries

Brazil is a federation with three main political levels: federal, state and municipalities. The PNPB is set up at the federal level by twelve different ministries. Each ministry is supposed to attend to its own specific field in those areas that are influenced by the AEP and PNPB. As described in chapter 5, the government is aiming at a variety of oil crops to stimulate biodiesel production, in order to achieve social inclusion, technology development, and alternatives to expensive petrol fuel. As a consequence they do not have a specific vision on soybean as the most import biodiesel crop. Though many people have pointed out Brazil's previous experience with the ProAlcool programme, the head of the biofuels department of the Ministry of Agriculture in Brasilia clearly states *'Ethanol is a product, biodiesel is a project'.* This demonstrates that although the policy process has started, the whole biodiesel scheme is not yet in place. Even between ministries there is a lot of insecurity about future developments. For instance, the coordinator for biodiesel from the Ministry of Agrarian Development expects that there will not be a big role for soy as a feedstock for biodiesel. Its low oil content compared to other crops makes it less efficient. In the next five years soybean might be one of the main crops, but this is just expected for the starting phase. Besides, the soy market is already believed to have 'owners', therefore it will be difficult to start using the soy oil for biodiesel in Brazil. Most of the countries to which Brazil exports prefer whole beans instead of crushed ones. Therefore government officials expect it will be difficult to change the commodity flows in this market. However, the Ministry of Agriculture has a different vision. They are looking towards the possibility of Brazil becoming a frontrunner in the international biodiesel market. At the moment they are following the international discussions on the different biofuel standards. Other crops than soy are still problematic due to little experience, unknown plant diseases, and little

production area. In the past improved technology was a good way to solve many problems, but this will take many years.

Social considerations
In the PNPB there is a strong focus on small farmers and agro-industry in the context of regional development. By promoting the large biodiesel scheme they hope to achieve social inclusion and jobs in rural areas and industries. However each ministry has its own goals that are influenced by the AEP and PNPB, but can also have a broader scope. In this sense different ministries might strive to improve different aspects of the biodiesel programme. *Key issue: national development*
Economic considerations
From an economic point of view, trade is a good way to generate hard currency savings. Therefore it is interesting to present Brazil in a worldwide frontrunner position. Other considerations are the diversification of the energy matrix, which makes Brazil less dependent on fossil fuels. *Key issue: enforce Brazil's position*
Environmental considerations
The PNPB also has an environmental component. By using biodiesel the government hopes to improve air quality by reducing the amount of exhaust. However the environmental impact of biodiesel is still unpredictable. It may also lead to additional deforestation and competition with food and feed production. *Key issue: land use*
Technological considerations
'Ethanol is a product, biodiesel is a project', this applies also to the technologies necessary to develop a biodiesel market. New technologies, changes in the industrial processes, crop variety, biodiesel quality, etc. are all part of current research connected to the PNPB. To stimulate a variety of oil crops the government wants to expand the agricultural knowledge base, research has to be enforced to develop different varieties, but it takes time to develop new projects and get results. *Key issue: create infrastructure*

6.2.9 Reality definition of regulatory councils of energy sector

From the 1990s Brazil's energy sector has been liberalised step by step. To support and monitor these developments several governmental agencies are responsible: the National Council for Energy Policy (Conselho Nacional de Política Energética - CNPE) and the National Agency of Petroleum, Natural Gas and Biofuels (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis - ANP). They have to improve and monitor energy efficiency, competition and new energy programs on behalf of the government.

CNPE supervises the blending of biodiesel into the energy matrix. The council has to stimulate a gradual increase in percentage of biodiesel to diesel over the next years. To achieve this, it has to create a committee for the Management of Biodiesel (Comitê de Gestão do Biodiesel - CGB) which will support this gradual adjustment that has to monitor and to promote the use of biodiesel (Cadernos NAE 2004). CNPE established the production guidelines of biodiesel and percentage blends with petrodiesel and has implemented these through the resolutions for the National Petroleum Agency (ANP) (MME 200X). CNPE sets the amount of biodiesel that can be produced within the boundaries of the SFS. CNPE is mainly concerned with the standardisation of different diesel qualities. They are

instructed by the ministries to set standards that are open for diesel from various primary materials as not to limit market access.

ANP has to regulate all activities for biodiesel producers. They set out specifications for the new fuel, and establish the distribution along the value chain (MME 200X). Based on their estimates in the first four auctions, the government has bought 840 million litres of biodiesel which are thought to have benefited 205.000 small farmers. Based on the preliminary results ANP calculated that the average final prices for biodiesel were decreasing. This is their first indication that biodiesel will become increasingly competitive with traditional diesel. The ANP is most concerned about the standardization of mixtures during the implementation period. This is challenged because of irregularities between production offers and withdrawals, the determination of the quality of biodiesel, the distinction between areas were biodiesel is produced versus were it is demanded (what are the transportation costs to get in on the right places), a suitable infrastructure for distribution, technical differences between different vegetable oils and limited information flows about distribution and the commercialization of biodiesel without a clear legal system.

The ANP says that the PNPB is not set up to exclude large farmers, such as the soy farmers in the West, from biodiesel production, but rather is implementing measures to motivate small farmers in poorer areas. To guarantee that the SFS functions, representatives of the ANP are allowed to perform field visits to check whether the biodiesel really is produced with the oilseeds from these farmers. Though ANP has to monitor the whole chain, this is quite difficult. Originally they only had to monitor petroleum, than they were made responsible for gas and now also biodiesel. Therefore they are concerned about their capacity to monitor all steps correctly.

Social considerations
Regulatory councils are steered by their mandate obtained of the federal government to monitor the biodiesel chain, and specifically the SFS and the taxation system. This is described as a complicated job, because there are many disorderly developments in this new policy field. The different monitoring agencies are all looking for the best ways to carry out this new job. *Key issue: manage new policy field*
Economic considerations
Economic considerations are partly influenced by the insecurity of many social and political decisions. For instance it remains unclear for how long the process with the auctions will continue. Decisions in this area depend on the rate with which production will increase. Many agencies worry that they do not have sufficient staff to check and implement all the new legislation within the demanded timeframe. *Key issue: security of supply*
Environmental considerations
The environmental task consists primarily of setting up a system to diminish negative environmental impact. However, several agencies have claimed that they are not properly equipped to monitor impact on environment. This means that they have a large responsibility, but no system is actually set in place for the monitoring. *Key issue: alternative sources*
Technological considerations
The biodiesel quality is a technical issues, which the agencies need to monitor the market while taking care that sufficient production to reach the set targets. This can only be done with some type of standardised methods. However the standards themselves are still open for discussion. *Key issue: standardisation*

6.2.10 Reality definition of automobile industry

In Brazil there are eighteen companies involved with the production of vehicles and six that focus on agricultural machines. There are twenty-five vehicle factories, five motorcycle factories and eleven factories for agricultural machines, 67.8% of production is aimed at the domestic market (ANFAVEA 2006). After the introduction of ethanol into the Brazilian fuel circuit it took until 2003 until Volkswagen, developed the flex-fuel car. This car, especially designed for the Brazilian market, gave consumers a flexible choice for the kind of fuel they preferred (gasoline or ethanol). Through sensors in the car, the board computer is able to recognise which fuel is being used and adjusts the combustion parameters, without any necessity of interference from the driver. This solved the problem of many Brazilian car buyers as to which kind of engine they wanted in their car. This technological change took place as a result of the availability and price variations in the Brazilian fuel sector. The question that most car manufacturers currently have is how the biodiesel policies impact their industry.

Some of the lessons learned by the car industry are that it takes time to replace an existing car fleet and that it also depends a lot on the general availability of the new fuel, next to the time it takes to develop new technologies. Currently, the main diesel users are: trucks (since Brazil does not have many river or train transport almost all freight transport happens over land), busses (this involves all public transportation systems) and agricultural machines. In 2005, 55.3% of fuel used in Brazil was diesel (ANP in ANFAVEA 2006). The PNPB promotes the use of various oil crops for biodiesel production, in order to diminish regular diesel demand. Special characteristics for biodiesel are that it can be used with the existing fleet, because it is compatible with the quality of diesel and that it can be compatible with the engines within the new emissions rates that are set for diesel. The use of B2-B5 is possible for the conventional car fleet. These are the additives currently obligated by the government. However when the percentage of biodiesel would increase to B20 it could only be used by closed fleets; if it would be increased even further to B100 it would only be suitable for vehicles with a special engine.

Social considerations
In Brazil (bio)diesel is primarily used as a transport fuel for trucks and public transport. This results in necessary adaptations in the truck fleet, but it takes time to replace existing fleets. This is also coupled with a concern expressed by industry about the impact of biodiesel on the engine when higher blending targets are set at the insecurity expressed by consumers about biodiesel use. *Key issue: continuity of standards*
Economic considerations
Broad use of biodiesel can go two ways for the car industry. On the one hand a new market will arise, for cars/trucks with adapted engines. However, to get to this market investments are needed to alter the existing system. *Key issue: costs of adaptation*
Environmental considerations
Currently the automobile industry is blamed for a considerable part of the CO_2 emissions. By switching to biodiesel they show good intentions towards the environment. However, as industry points out some elements of the particulate matter of biodiesel are even more polluting that in regular diesel. *Key issue: long-term use of liquid transport fuels*
Technological considerations
It takes time to adapt engines to higher concentrates of biodiesel. Industry has warned that the transition will be a gradual, because of the time needed to develop and improve technologies. *Key issue: integrate with existing technologies*

6.2.11 Reality definition of research institutes and scientists

Embrapa is the Brazilian Agricultural Research Corporation. Its mission is to provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer. This institute has the main responsibility to develop the oleaginous crops that are recommended under the PNPB. For this purpose a special section 'Embrapa Agro-Energy' has been set up. They develop technologies in order to obtain primary material for the production of biodiesel and to exploit co-products, while analysing the impacts of these activities. Other groups that play an important role in the development of knowledge on biodiesel and soybean are universities, commercial research institutes, and consultants.

The main objective of Embrapa Agro-Energy is to produce and transfer knowledge that contributes to the sustainable production of energy from agriculture and to the rational use of renewable energy for the purpose of ensuring the competitiveness of the Brazilian agribusiness and supporting public policies to benefit society. This objective is supported by Embrapa's biodiesel programme that focuses on: support changes of the energy matrix in a sustainable form, analyse new forms and sources of agro-energy, look for ways to minimize inequality of regional development for the creation of new economic alternatives, look for ways to improve income and social inclusion, to reduce emission of gases and their greenhouse gas effect and petrol import, possibility to increase export of biofuels, and to increase competitiveness, environmental sustainability and energy rationality of biodiesel.

Social considerations
The scientific community is not only steered by social considerations on a small scale, but also about the ability to develop Brazil at large. For this purpose technological innovation does not focus especially on the community, but rather on the crop and connected technological questions. *Key issue: develop Brazil*
Economic considerations
From an economic perspective the biodiesel programme is interesting, because it generates new uses for all kinds of vegetable oils. This results in new commodity trade options and a stronger focus on actors from the net-chain to improve Brazil's position. *Key issue: frontrunner position*
Environmental considerations
Biodiesel is one of the renewable energy sources that is hoped to address the climate problem as well as the limiting resources of fossil fuels. From this perspective it would be interesting if sustainable production of degradable and renewable products could take place. *Key issue: sustainable production*
Technological considerations
Agronomic knowledge in many fields needs to be improved for the different biodiesel options. So far the scientific focus has been on soybean improvements. However, little is known about other oleaginous crops and the possibilities of new technological developments, such as 2nd generation biofuels. *Key issue: alternative energy*

6.2.12 Reality definition of Non Governmental Organisations

There are many types of Non Governmental Organisations (NGOs) active in Brazil. Some focus primarily on social issues while others have their main focus on the environment. Some are strictly local or national organised while others are part of international networks. Besides these Brazilian NGOs there are also international NGOs, for instance, working on the preservation of the rainforest in the Amazon. What these organisations have in common is that they are all organised around particular concerns regarding certain developments. On the issue of the use of soybean for biodiesel production most organisations are still deliberating their point of view. As biodiesel policies are still new, organisations are waiting to see what will happen. Their position largely depends on the type of crops that are going to play a key role in the production. When soy oil is going to be a major feedstock then many organisations have a strong opinion. Not so much about the specific use of soybean for biodiesel, but rather on large scale production in general.

The concern regarding soybean production is not only pointed against the production of soybean itself, but also at the (presumed) indirect effects. Socio-economic effects range from issues, such as: large-scale cultivation of soy driving away small farmers, lack of contribution to food for local markets, insufficient labour rights, illegal land use, and etcetera. Environmental effects, concern: use of GM seeds, monoculture, unlimited expansion, loss of local biodiversity, insufficient protection of natural reserve areas, and water pollution. The analytical scale of these effects depends on the perspective of the NGO. Those working under local circumstances address the effects they observe in their direct environment. Others pinpoint to the responsibility of the international market, because that is considered the real driver, behind current demands on Brazilian soil. Though many of these concerns are shared by a large group of NGOs, there are strong internal differences. By some, improvement of local infrastructure is seen as an opportunity for regional development and social-economic improvements, while others argue that this opens the opportunities for increased deforestation and expansion.

How NGOs deal with the issues they set on the agenda varies per group and issue. International platforms like the RTRS are used by those who are willing to negotiate with industry in order to find solutions. Other initiatives such as the Soy Moratorium (used to create a period for reflection and negotiations) and Basel Criteria (used to create a market for sustainable soy) are initiatives to alter and improve they way in which soybean is produced and to define good practices. In each of these initiatives the main issue is ‘how to define sustainable production?’, Other groups are unwilling to negotiate and choose for more radical options, such as land occupation, and negative campaigning. They do not believe in the negotiation process, because they do not trust the multinationals, which are thought to do everything to stretch the process as long as possible. The used tactics depend on the strategy chosen by an organisation. In some cases it just wants to set standards to prevent any worse conditions, while in other cases they want to show what is possible in a positive way. This leads to a lot of discussion between NGOs on the way the soy market should be organised. Most NGOs expect that the demand for biodiesel will lead to more soy expansion. They argue that laws are ridiculous, because in the end the laws will only support the strongest parties and weaken the position of the small scale farmers.

The field of biodiesel production is viewed quite differently. As the PNPB is set in the market as a social programme to integrate small farmers and give them additional income opportunities, many organisations are in favour of this goal. Still, they are quite sceptical about the execution of the programme and its assumed positive effects. Although the SFS and tax exemptions are clear attempts, it is questionable whether these incentives are indeed enabling the small farmers. Others groups are more sceptical and argue that the real objective is support to the agro-industry. In their opinion the industry benefits most of the new programme as additional market outlets and cheaper fuel alternatives are created. Some organisations say that they lobbied for the introduction of biodiesel to provide energy options to remote areas of the country. However, current policies are out of control. NGOs that are more focussed on an environmental perspective are more concerned with the environmental impact the policies will have. One of the arguments used for biofuels is that they would be CO_2 neutral. However, the positive climatological impact of biofuels is quite debated. Some argue that current ideas are too simplistic, because they looks at the substitution of fossil fuels by biomass, while ignoring social and environmental problems that are generated by implementation.

Social considerations
There is no agreement between NGOs whether biodiesel will have a positive or a negative impact on the social conditions in Brazil. A lot will depend on the way in which the policies are implemented. This needs a dialogue over chain management and fair contracts between financers and producers. When all of this happens the PNPB could lead to good results when the focus remains on small farmers. *Key issue: equal opportunities and social, and ecological awareness*
Economic considerations
Sustainability involves economic, environmental and social issues which all need to be considered to see how the biodiesel chain needs to be organised. For instance, a fund to reduce risks for small producers when the harvest fails and to guarantee their labour rights. The way the PNPB will involve depends on who has decision-making power. Therefore, the added value should befit the producer tin the same way as the industry. *Key issue: power in chain*
Environmental considerations
Environmental reasoning depends on the region, the crop and the type of farmers. The use of soy oil within the PNPB is considered as an additional danger for the Brazilian ecosystem, because of the monoculture and expansion of the agricultural area. However when small farmers and local systems can be included it could also put a stop to the large scale system towards a more environmental friendly system. *Key issue: sustainable production*
Technological considerations
Standards, monitoring and verification are important tools for a good system. The system should not only be influenced by technological, but also by social considerations which are appropriate for small farmers. *Key issue: transparent system*

6.2.13 Reality definitions of other actor groups

Of course, there are many more actors than can be extensively discussed within the boundaries of this thesis. During recent years the interest for biofuels for transportation has grown rapidly. In the first place as a consequence of a convergence of views on climate change and CO_2 emissions; secondly, as worries have increased about the security of energy supply; and thirdly, as a result of geo-political tensions and their impact on the supply of fossil fuels. To what respect these aspects play a role varies per country and region. As biofuels are in the centre of these debates, they attract an enormous group of organisations and people who look for new opportunities. These include banks, investors, consultants, media, international organisations and many countries. Besides, these groups there are others that are worried about the impact biofuels might have on: ecosystems, crop diversity, social conditions, etc. As the objectives of biofuels are so diverse, so are those who are interested in it. This means that biofuels have become a question of: energy, environment, geo-politics, social issues, food production, water use, international trade, land expansion and climate change.

So far, the PNPB is a programme aimed at the internal market of Brazil. This does not mean that it can operate independent of international developments. For instance, if an international technical standard for biodiesel would be created, this might impact the Brazilian production chain. Or when the prices for vegetable oils would rise to such a level that it becomes more interesting to sell them to the international market that to use them for local biodiesel production. These developments might interfere with the implementation of the PNPB. Besides these developments it is also possible that countries or regions that import products from Brazil will set certain (sustainability) standards

and criteria. This can impact the economic incentive against deforestation of new areas or produce crops in certain ways. It might also impact which crops are more efficient for biodiesel production in Brazil.

6.3 Concluding remarks

This chapter elaborated further on the actors that play a key role in the production chains of soy and biodiesel and indicated which other parties play a critical role in the soy-biodiesel net-chain. The key objective was to indicate which parties play a role, but also introduce and analyse their views on the different pillars of the PNPB. It became clear that all actors expect that the biodiesel programme will have significant impact on society. This signifies the start of a succession of effects and modifications in the net-chain. Impact is noticeable in organisations, technology processes, commodity chains, public images. To analyse the debate during this process of change can help to understand how the process of sense making actually comes forward. The changes in Brazilian fuel policy touch upon the interests of a large diversity of parties and actors. This chapter showed the reasoning for different actor groups, explaining their point of view regarding the use of soybean for biodiesel. It is also attempted to indicate what lies behind their reasoning. This chapter discussed their plans, expectations and concerns in the context of this evolving policy field. Based on all documents surrounding implementation it seems that the government is working hard to create a biodiesel market. As no other country has tried this before at such a large scale, Brazil is aiming at a frontrunner position in this sector. This results in a lot of debates in which the positions can be quite opposite as long as the underlying arguments do not become clear. As long as people reason from different dimensions they will have different objectives. This is also an explanation for the different regional incentives of the PNPB. Producers in the Centre-West reason from a different background than small farmers in the North-East. As a result every region has its own implementation strategies of the PNPB. The developments regarding the field of soybean and biofuel signify large scale modification processes that can and probably will have an enormous impact on, for example, organisations, technology processes, commodity chains, public images.

For all actor groups it is difficult to make any generalisations. The size and diversity of the country bring about a huge variety in context and organisational structures. Some actors argue that introducing such a new system comes with many unpredictable risk and consequence while others might see it as a (technical) challenge. These policy changes also alter the social relations and interaction patterns of the involved actors. For some this will result in new opportunities, while others are afraid of the consequences. By studying the varying interpretations and views more clarity on the underlying assumptions of different groups can be generated. It shows how actors take action based on their expected scenario, how coalitions might be shaped on the basis of common goals. The following chapter will take look closer at the interaction between actors in the net-chain and identify if the points of views here result in coalitions with shared value sets. This will be the next step to see how governance is shaped in this policy field.

7. Configurations in the Biodiesel programme

The goal of this chapter is to analyse the information collected on different actors presented in chapter 6 with support of the theoretical framework (part I of the thesis). The configuration approach will be applied to the ideas of actors, which have been identified through net-chains relations. Clustering social and cognitive elements to configurations will help to indicate the various configurational patterns and scenarios that can play a role in the development of governance structures. These patterns indicate different aspects of the policy debate(s) that currently take place in Brazil and show how actors might react in response to them. Analysing these debates with support of the theoretical framework not only increases insight in this specific policy field, but will also help to see whether this approach is a useful way to analyse dynamics in evolving policy fields.

7.1 The Biodiesel Programme as evolving policy field

The theoretical assumption of this thesis is that there is a shift in the way governance is shaped in evolving policy fields. Characteristic of evolving policy fields is that net-chains and discussion arenas are still being shaped at the same time that governing mechanisms are set in place. These governing mechanisms are the outcome as well as the initiation of altering relations, resulting in processes of continuous change and dynamics. As a consequence actors are confronted with high amounts of insecurity on the final outcome, because the system itself is still flexible. As the governance mechanisms are set in a deliberative process actors can participate in the process of shaping these governance mechanisms and affect their outcomes. Based on their views and strategies they might strive for certain scenarios. To influence these processes different elements need to be taken into consideration. For instance, existing net-chain relations attempt to incorporate the new field into their existing system. Who has more dominant power can have major influence in the evolvement of a (re)organising field. The PNPB is a new and ambitious governmental programme that stimulates the evolvement of a biodiesel market and policy framework. It is not developed in isolation, but with the participation of twelve different ministries. This in itself is an indication for its many different objectives and supposed outreach. The programme aims at an adaptation of the energy matrix, as well as at objectives with regard to social inclusion, environmental issues, technological improvement, and economic development. The range of these goals reflects the multi-level strategies used by the Brazilian government to implement this programme in society. It remains to be seen whether these goals, that are the central pillars of the PNPB, work complementary or whether they have internal competition. As the final outcome of this policy programme is quite insecure, actors need to decide on their strategy. The programme is set to stimulate the production of new agricultural crops, but the question is how farmers and other net-chain participants will react. Stakeholders have to decide whether they see new opportunities in the current framework or whether they are reluctant to participate in the new and unpredictable developments of the PNPB.

Contrary to the level of insecurity that still exists in the biodiesel market are the organised interests in the field of soy production and trade. Its international context, has led to a rapid and high level of organisation within the chain. Over the past years strong networks between producers, researchers, traders, and politicians have been shaped. On top of that, as an international commodity, it has attracted the attention of many NGOs from local to international level. The forecast for soy products has been very positive. The increasing demand for the crop as food, feed, and possibly fuel feedstock leads to an almost constant increase in production, despite certain controversies that are linked to this development, such as the use of GM seeds and expansion as the agricultural area. An institution as the RTRS indicates the importance of soy for many vested interests, but also points at difficult decisions that need to be taken to guarantee sustainable production. Therefore, the status of soy production in Brazil is completely different from the status of many other vegetable oil crops that suggested for biodiesel production in the PNPB. To analyse what will happen with the insecurities of the biodiesel programme versus the high level of organisation for soybean is key to understanding the evolvements in both policy fields. This can be studied by looking how actors frame the current processes and how governance in these processes is shaped by actors and shapes their views in return. As explained in chapter 3 traditional technocratic approaches are no longer sufficient to analyse the interactions in this type of dynamic governance shaping processes. To analyse how the policy field for biodiesel will evolve it is

necessary to study the various configurations that exist. Hereby the main assumption is that insights in configurational patterns will indicate possible changes in behaviour. By identifying linkages between different strategies a first step can be taken towards drawing certain scenarios for these policy fields. The configuration approach includes interaction as key element of the analysis. Therefore it is a useful methodology to analyse interaction of various groups, values, convictions, expectations and concerns as they can be distinguished with regard to the PNPB and soy discussion arenas.

To identify developments in the policy process the configuration approach distinguishes between social and cognitive dimensions. The social structures can be captured by studying which actors are involved and how they interact, for instance, by a net-chain. The cognitive dimensions are based on the values, expectations, and assumptions of the actor. Based on these elements it is possible to identify reality definitions for different actor groups, as has been done in chapter 6. These reality definitions show how an actor makes sense of his/her/its surroundings. When actors influence each other through interaction, it is possible that these reality definitions are open for change. However, fixations can occur that close possibilities to further interaction. A configuration in this context indicates a specific moment in the decision-making process in which a number of reality definitions are connected in stable interaction patterns (Atlantis Alliantie 2006). The result of an analysis based on the configuration approach is to analyse transitions in society as a result of changes in the minds of people. This gives insights on the way policy is or can be organised and how it can be executed.

7.2 Social dimension of the configuration approach

Actors can be integrated in the net-chain for many different reasons. Based on information generated by the net-chains for soy and the net-chain for biodiesel production, it was possible to identify key-actors in both discussion arenas. Based on the information provided by these actors and their participation on events it is possible to say something about the intensity of interaction. Table 7.1 indicates how often groups are assumed to have interaction. It indicates that there is at least occasional, interaction between most groups. This interaction can have many different forms, for instance, meetings, mutual events and research projects.

Table 7.1. Interaction patterns between actor groups.

	Interaction											
Theme / Actor group	1. Small farmers	2. Producers	3. Cooperatives	4. Extension services	5. Product boards	6. Purchasers	7. Energy sector	8. Ministries	9. Regulatory councils	10. Automobile industry	11. Researchers	12. NGOs
1. Small farmers	x	1	2	2	0	0	0	0	0	0	1	2
2. Producers		x	1	1	1	0	1	1	0	0	2	2
3. Cooperatives			x	2	1	2	1	1	1	0	1	1
4. Extension services				x	0	0	0	1	1	0	1	1
5. Product boards					x	2	2	2	1	0	1	2
6. Purchasers						x	0	1	0	0	1	2
7. Energy sector							x	2	3	1	2	1
8. Ministries								x	3	2	2	1
9. Regulatory councils									x	1	1	0
10. Automobile industry										x	2	0
11. Researchers											x	1
12. NGOs												x

0 Never 1 Occasionally 2 Frequent 3 Very frequent

Most striking is that small farmers have less interaction with other groups than these groups have among each other. While small farmers are part of the scope of the PNPB, they are not actively represented in policy discussions. Another group that stands out is the automobile industry. For them the discussion on type of primary material and execution of the PNPB is not very important, they are only interested in a good (bio) diesel standards that fit with exiting technologies. Based on additional information from the reality definitions it also appears very typical that although NGOs have a broad network and are able to interact with most other actors, their cognitive focus seems to be more directed towards the use and production of soybean than biodiesel. Although the table is not specified for interaction based on regional level, additional information from chapter 5 and 6 indicates that there is a regional variety in interaction patterns. This is mainly due to the large variety of eco-systems, composition of the kind of farmers and different organisational focuses of regions. Figure 7.1 shows an overview of the different soy and biodiesel production arenas while portraying the position of different actors.

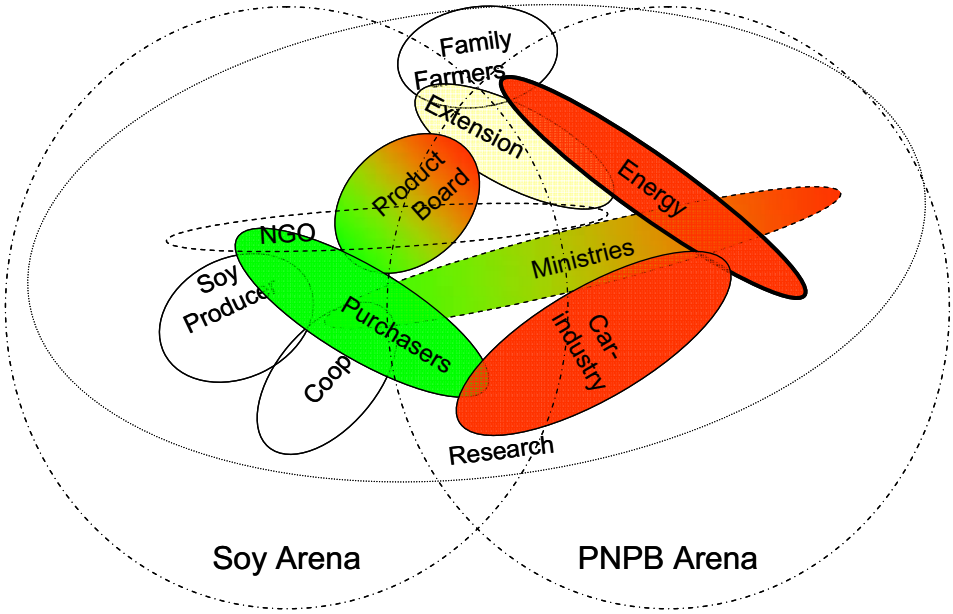

Figure 7.1. Soy and biodiesel production arenas.

7.3 Cognitive dimensions of the configuration approach

The cognitive dimension of the configuration approach focuses on the process of sense-making by actors. This process is based on deliberations, plans, expectations and fears that are described by the reality definitions (chapter 6). The cognitive dimension is based on the themes mentioned by actors in their reality definitions. Then it is rated how actors are expected to view the reality definition of others. When there is a correlation between social interaction and the cognitive dimension, it is possible to speak of a configuration. When there is only a correlation in the cognitive dimension, it is called a cognitive aggregate. The themes mentioned by each actor are organised by pillar of the PNPB. The exclamation mark indicates that the theme was introduced by that specific actor as the most important element relating to that pillar of the PNPB. All the themes of various actors are put together to see whether actors have similar or contrary visions on elements that are considered of key-importance to other groups. All information is based on data collected by research methods, such as, interviews, documents, and events. This inductive method was used, in the first place, to identify the main actor groups; secondly, to identify key-issues of actors, which have been summarised in actor perspectives. The opinion of other actors on other themes has been generated from the context of their information. Reasoned from the actor perspective each theme received a green or red colour code. The light grey code has a positive connotation that means that this element could be seen as an opportunity and or good alternative to that specific actor. The dark grey colour stands for risks as a consequence of that specific theme. This means that execution of that element could pose a threat to the objectives of that actor, or

that acting according to that theme could be a risky business. When the box is kept white, this indicates that either that particular theme is not relevant for that actor, or that information on that issue could not be retrieved from available information.

	Opportunity / Innovation
	Risk / Threat
	No issue
!	Reality definition mentioned by actor group

7.3.1 Social pillar

Table 7.2. Configurations in the social pillar.

Social pillar										
Actor group \ Theme	Criteria to participate	Societal positioning	Control over net-chain	Upgrade farmer position	Expand vegetable oil and grain markets	Secure net-chain	National development	Manage new policy field	Continuity of standards	Equal opportunities
1. Small farmers	!									
2. Soy producers		!								
3. Cooperatives			!							
4. Extension services				!						
5. Product boards					!					
6. Soy purchasers						!				
7. Energy sector			!							
8. Ministries							!			
9. Regulatory councils								!		
10. Automobile industry									!	
11. Researchers							!			
12. NGOs										!

The aim of the Brazilian government with the social pillar of the PNPB is to improve social inclusion of small farmers. To achieve this goal they have introduced the SFS and tax reductions. Both are aimed at integrating small farmers, from poorer regions in the biodiesel production chain. These farmers are stimulated to produce a variety of high-oil-content crops. The final goal is to improve national development by supporting local energy production and having an alternative to fossil fuel. Of course, none of the other actor groups is against these objectives. However, not all groups are happy with the strategies that are chosen by the government (Table 7.2). For instance, current purchasers of vegetable oils (mainly soy oil) are extremely concerned about a price increase as result of this 'artificial' demand. They claim that this forces them to increase food prices to compensate for the higher vegetable oil prices, which will in fact have a negative impact on society. For small farmers it remains questionable whether they will benefit from the PNPB. The energy industry receives these economic incentives to include them in the production process, but they have very little control over their own chain position. This can keep them from making

radical changes in their production system. This leads to problems for energy producers, because they will have insufficient feedstock. Therefore these companies will have to balance whether the economic advantages of including small farmers weigh against the additional costs and efforts to include them in the system.

Although soy producers are not the focus of the PNPB, and are not able to receive tax reductions, they are very positive about their options. It might give them more control over their produce and a stronger position in the chain. For the social pillar to be successful it will be a serious challenge to maintain quality and quantity standards, while maintaining open participation of biodiesel production to all vegetable oil producers. Very much of this success will depend on the capability of the government to manage the evolvement of this policy field, while receiving pressure of the more powerful groups that have their organisation set up. For now the SFS seems a very important driver to include small farmers in the production chain, because it is the only way for the energy companies to create market access. But, for these energy companies the small farmers also pose great risks and logistic challenges which will have their costs. A possible strategy to improve relations between the energy industry and small farmers is a stronger focus on cooperatives for small farmers, because these are able to negotiate between the energy industry and small farmers or to collect sufficient resources to enter the biodiesel market themselves.

7.3.2 Economic pillar

Table 7.3. Configurations in the economic pillar.

	Economic pillar											
Theme / Actor group	Value upgrade	Market differentiation	Calculated investments	Efficiency of production	Market diversification	Raw material costs	Long-term perspective	Enforce Brazil's position	Security of supply	Costs of adaptation	Frontrunner position	Power in chain
1. Small farmers	!											
2. Soy producers		!										
3. Cooperatives			!									
4. Extension services				!								
5. Product boards					!							
6. Soy purchasers						!						
7. Energy sector							!					
8. Ministries								!				
9. Regulatory councils									!			
10. Automobile industry										!		
11. Researchers											!	
12. NGOs												!

The economic pillar of the PNPB is aimed at the development of a new market (Table 7.3). One element that this pillar should provide is new income sources for farmers. This gives them the opportunity to provide the necessary feedstock in order to produce the biodiesel. Another element is that by altering its energy matrix Brazil will make hard currency savings, and will be less dependent on foreign import. The table shows that most farmers have a positive attitude toward the element of market differentiation. However, they are reluctant about the financial risks that are involved with making such a transition. This reluctance could hold them back from investing in new oil crops. They first want to wait for more insights in the development of the PNPB, before taking a financial risk. This attitude

can slow down the participation of small farmers, thus opening the market for soy producers. For them it is mainly an opportunity, because as a consequence of world wide demand soy production will rise anyway. Now they will be able to differentiate in their market outlets, which will give them a stronger position in the net-chain. This is exactly why current buyers of vegetable oils see this as an economic risk.

Under current legislation the economic challenges seem very positive for cooperatives, especially when they are able to get more power over the chain. This would be the case when, for instance, they would not only produce the vegetable oils, but also are able to make their own biodiesel. This would give them the special benefits for cooperations of the PNPB on top of normal economic benefits. This would reduce their economic risks of investing in this industry. Ministries, researchers and NGOs mainly see great opportunities in the introduction of this cooperative based new system. They do not necessarily share the same outcome, but all of them see it as an opportunity to change existing situations, and to open up new fields of income and research.

Based on all the economic themes mentioned it becomes clear that the major challenge for success of the PNPB will be the costs of adaptation and the expectant attitude towards new investments. Whether these are overcome might depend on the position actors have in the production chain, and the consequences of a wrong calculation. The large investments done by the energy industries indicate that there are sufficient incentives and expectations to take these risks.

7.3.3 Environmental pillar

Table 7.4. Configurations in the environmental pillar.

	Environmental pillar								
Actor group \ Theme	Suitability oleaginous crops	Sustainable production	Boundary condition	Ecological awareness	Market access	Alternative energy sourcing	Land use	Alternative sources	Use of liquid transport fuels
1. Small farmers	!								
2. Soy producers		!							
3. Cooperatives			!						
4. Extension services				!					
5. Product boards					!				
6. Soy purchasers									
7. Energy sector						!			
8. Ministries							!		
9. Regulatory councils								!	
10. Automobile industry									!
11. Researchers		!							
12. NGOs		!							

Regarding the environmental pillar of the PNPB the government has stated that biodiesel is better for the environment, for instance, because it has less CO_2 emission than regular diesel. This claim in itself is debated by researchers which point at (possible) higher CO_2 emissions as a consequence of deforestation which is needed to increase the production area. Although it is difficult to indicate the direct relation between deforestation and the

PNPB, it is clear that the current demand for vegetable oils for biodiesel can be put on top of existing demands. In this case it becomes crucial how efficient the oil crops (% of oil content) are that will produce sufficient primary material (Table 7.4). This has impact on the area which is needed for sufficient production. However, for most actors this does not seem the most important deliberation. The question is whether the will make these decisions from an ecological point of view. Though everyone wants to have a sustainable production system, this is needed to continue practice; ideas on 'sustainability' are variable. Reasoned from a producer perspective sustainability can mean something very different than reasoning from an environmental perspective. This becomes clear in initiatives such as the RTRS. Farmers strive for continuity of production, while purchasers strive for continuity of supply, and NGOs focus more on the social and environmental conditions under which the production takes place.

Characteristic is that the focus on the environmental pillar is not as strong as on the other three pillars. There are no special financial incentives to produce in a 'sustainable' way. Also the goals of the environmental pillar are not as clearly defined. In Brazil the most heard point of view by all actors that the PNPB is foremost a social and energy programme for Brazil. They reason that the focus of other countries on the environmental aspect can be used for the benefit of Brazil. Within the ministries the general consensus seems that the PNPB will have a positive environmental impact.

7.3.4 Technological pillar

Table 7.5. Configurations in the social pillar.

	Technological base								
Actor group \ Theme	Technological applicability	Improvement of soybean	Long-term perspective	Improve efficiency	Infrastructure	Standardisation	Integrate with existing technologies	Alternative energy	Transparent system
1. Small farmers	!								
2. Soy producers		!							
3. Cooperatives			!						
4. Extension services	!								
5. Product boards				!					
6. Soy purchasers				!					
7. Energy sector					!				
8. Ministries						!			
9. Regulatory councils							!		
10. Automobile industry								!	
11. Researchers									
12. NGOs									!

Technological improvement is the base, rather than a pillar, of the PNPB (Table 7.5). The government has indicated that improvement of technological knowledge is a basic requirement for success in the other three pillars. To strengthen the development of technological knowledge, financial programmes have been set up to fund research. Based on the themes indicated by the different actor groups, it shows that technological improvements are indeed a key issue for the development of the biodiesel market. For farmers and producers this is mainly based on the need for agronomic knowledge: on different oleaginous crops, disease management and soil improvements.

For the energy industry technological knowledge is needed to improve the efficiency of conversion of vegetable oil to diesel and to be able to develop the infrastructure that is needed. It is apparent that there is some discussion over standardisation of the biodiesel quality. On the one hand standardisation is necessary to guarantee characteristics of the biodiesel, but on the other hand this poses a risk to more variety of oil crops (as each of them has different oil characteristics).

In the context of technological innovation and knowledge improvement there are a few elements that seem to play a key role. In the fist place the question which technologies need to be developed and what should be the primarily used raw material? If the goal is to give small and remote farmers an opportunity to produce their own energy, different technological requirements and infrastructure are needed than if it supposed to supply the whole nation with biodiesel. In fact this is the social-economic dimension of technology development. There is a fear that there will be few dominant trajectories that can push away other initiatives. This could apply to the whole biodiesel debate. As a consequence of the PNPB attention from most actors is drawn towards biofuels. This shifts attention away from possible other alternatives.

7.4 Configurations on the role of soybean for biodiesel production

As explained before a configuration can be seen as a social-cognitive network. It can be used to analyse the correlation between various interaction patterns of social structures and various reality definitions of cognitive structures which exist between actors in society. So far, the main focus has been on the micro-dimension of the configuration approach that is focused on the sense-making by actors. This process of sense-making led to the analysis of reality definitions which have been analysed in the previous paragraphs. The next step of the configuration approach is to understand the meso-dimension that focuses on the pattern formation of configurations. These patterns can be defined as connections between the social and cognitive structures. This will be the next step to analyse the governance structures of the use of soybean for biodiesel production in Brazil.

7.4.1 Configurational patterns

The analysis of the different pillars shows that the current discussions over the PNPB can be divided in configurations of 'risks' and 'opportunities'. To which group actors belong seems to depend on their position and influence in the chain. For example, cooperatives can start investing in crushers and biodiesel factories while receiving different economic incentives. For them there is no real 'downside' of the current legislation. Purchasers of vegetable oils are not so positive, because the additional competition from the fuel market which raises the prices they have to pay for their material. Generally speaking those who control the feedstock have a strong advantage in the production chain. For them the PNPB offers new opportunities and markets. This results in Figure 7.2 that indicates these configurations from a production point of view. Based on this assessment it is very likely that under current conditions soy oil and production will play an important role in the production of biodiesel in the near future.

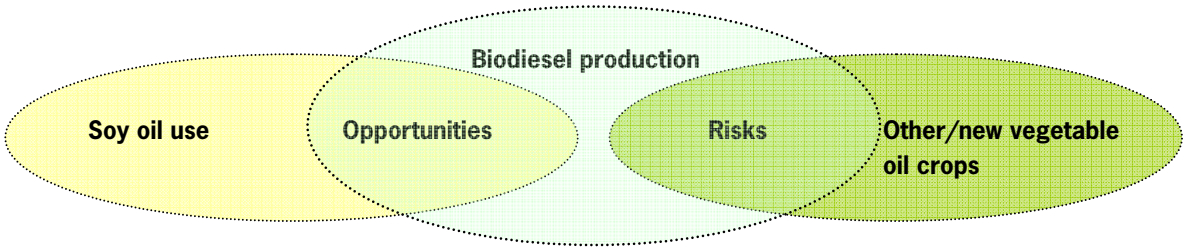

Figure 7.2. Opportunities and risks with biodiesel production.

This development is intertwined with the interests of the agro-industry that has a strong position within current soybean production. In the past years the soybean crisis and the increased demands for more social and environmental friendly production have put pressure on their production scheme. However, the current demands for vegetable oil and the increasing demand for food and feed production in general are likely to give them new opportunities. Abiove (2006) speaks about agro-energy as the new agricultural paradigm. This means that biodiesel can have substantial future. This might lead to changes in the Brazilian infrastructure, because currently most soybeans are exported. Now there is the possibility to add more value to the product.

Small farmers that produce soybean might also benefit from this development, but they remain more dependent on cooperatives to manage their flow of products. However, for the PNPB they are stimulated to produce other oil crops. Most actors have expressed that they estimate that it is very unlikely that they are able to produce sufficient oil to satisfy short term demand for the B2 legislation. The question is whether these small farmers are actually aiming at participation of the PNPB. To them the programme poses many risks: they have little/no experience with the proposed crops, there is generally little agronomic knowledge available on these crops, the future of the PNPB is insecure in their perspective, and they prefer to have several crops instead of one thus only producing little vegetable oil that will not satisfy biodiesel factories. Still, the PNPB can have a positive impact on these small farmers, because the SFS forces companies to include small farmers in their production matrix in order to be able to participate in the national auctions. These auctions will only remain important in the initial phase of the PNPB. The regulatory offices have declared that they are set up to stimulate sufficient production. Whence production has reached a satisfactory level it is very likely that the auctions will be cancelled. At that moment it depends whether the costs and benefits of including small farmers weigh against the possible tax exemption that is offered by the government to those who still carry the SFS. How these developments play out will depend largely on the attitude of the different ministries and their deliberative process. When the levels of production and frontrunner technologies become more important, it less likely that the social pillar will be a success. When the main focus remains on including these small farmers in the process the outcome can be quite different.

Typical for the configurations of the PNPB is that the environmental pillar does not seem to play a key-role. Pressure in this aspect mainly comes from parties outside the chain. How these developments will continue will be determined by long-term processes, for instance, the impact of the international context on the demand for vegetable oils, the impact and perceptions on discourses surrounding environmental issues, and the technological developments will each (re)shape the reality definitions of actors and the strategies they base there actions on. The use and application of these resources is always part of a political discussion on how society should be organised. Then there is the interaction with the technological development. When this first generation of biofuels is no longer perceived the best solution al support for the programme is likely to collapse. A problem with these configurational patterns is that they only focus on developments within these policy arenas. It is impossible to look at other developments which may influence the reality definitions of actors. As shown in previous criticism on the configuration approach, more attention is needed for different arenas, the role of power and human-environment interactions that impact the reality definitions of actors. This attention could point towards other types of interaction, which can impact the existing development paradigm.

7.4.2. The role of other policy arenas

Separate from the discussions on the role of soybean as a biofuel crop there are other issues that can play a crucial role in the development of this policy field. These issues were presented by actors as alternatives to the current development path. They indicate the interaction with other policy fields which leads to the conclusion that it is nearly impossible to study bioenergy as a single topic without considering its broad social, economic, environmental and political context. Characteristic for the field of biofuels are the controversies with other policy fields that become part of the discussion. In this discussion there are clearly different groups that focus on: energy security, agricultural production, environmental sustainability, regional development, climate change, geo-politics, food security, water scarcity, competing claims, etc. These different arena's show that there are multiple and possible conflicting objectives. For instance, the discussion on the competing claims of food, feed, fuel and forest. This leads to growing issues of complexity and interaction that are part of complicated discussions in the scientific, but also social and

economic world. Part of this complexity can be explained by scalar differences. On a local level biofuels can make a good contribution to the environment, but on a larger level this might lead to additional deforestation and food security problems in other regions. The complexity to analyse these (possible) relations makes it a sensitive discussion topic.

For Brazil applies that actors that are part of these additional arena's will put pressure on elements of the PNPB to direct in such a way that it favours their objectives. This can also bring to focus conflicting interests within the pillars of the PNPB. For instance, the debate on the kind of feedstock used to produce biodiesel. Currently soy is already an important crop for the world trade markets. Its many user applications make it a very commercially interesting clop. However this could collide with the objective of the Brazilian ministries to promote alternative vegetable oils produced by small farmers. Many actors have expressed that the first few years of the PNPB are crucial for its future outcome, because it will determine the focus of the programme. When technology develops it might very well be that biodiesel production based on first generation technology (as it is intended in the PNPB) might be an outdated technology. The fixation on the current state of technology might undermine a view towards more efficient and accurate technologies. Especially since the choice for this technology is coupled to a social development programme. In the end the results of the PNPB will not only depend on the programme itself, but also on the interaction with other developments and policy arenas.

7.4.3 Human-environment interaction

In the discussion on the implementation of biofuels, one of the key elements is the production method and the type of crops that will be produced. Biofuels themselves have long been regarded as 'green energy sources' which has a positive connotation. However, questions are being raised by scientists and NGOs whether biofuels are as green as they are assumed to be. For instance, the question whether the green house gas emissions are in fact better than with petrol fuels. In the discussion on the crops, soy itself is heavily debated. Initiatives such as the RTRS, The Basel Criteria, and the Soy Moratorium indicate that expansion will not go without discussion. All these initiatives focus on the 'sustainable' aspects of production. The discussion on what is sustainable production and how it should be weighed against other objectives is still on-going. Although from an international perspective this discussion seems to be directed towards the Amazon and soy, on a local scale, most Brazilians have expressed their concern with the Cerrados, Brazilian savannah.

Looking at the element of environment in the context of the PNPB it shows that each configuration has its own set of goals, values and interpretations of reality. When this is linked to the theory of Schwarz and Thompson (1990), one might say that even though actors move in the same socio-technical regime, they can have a different understanding of this situation and the consequences and directions of innovations. Some actors might want to focus on the precautionary principle rather than taking the risk of uncontrollable damage to the environment. Others want to focus on practical solutions to existing problems. The fact that the Brazilian government puts such a strong focus on the AEP is regarded as a fixation by some of the parties. Although the government claims that they have proof about the positive impact of the PNPB on Brazil opponents claim that the impact of biofuels can not be seen in a laboratory. They argue that most of its effects are not a direct consequence, but rather an indirect consequence of their use. For instance, the competition with food production is only seen on a large scale rather than in a specific local context. This implies that these environmental problems and scarcity of resources can no longer be addressed in isolation from global socio-economic distortions. This becomes very clear in the many debates that are held on these issues. For instance, producers tend to see themselves as good caretakers of the soil and environment. They argue that they do not want to exploit their soil, because that is their source of income. They even consider themselves as 'improvers' of soil quality the Cerrado has bad soils and after many years farmers are able to improve the fertility. This is completely different from the perspective of many NGOs who focus on the use of agro-chemicals and deforestation. This indicates that definitions on 'sustainable management' lay very far apart. This example shows that although there is an environmental pillar in the PNPB, there is no common understanding on what it means. To work with the environmental pillar of the PNPB a concept as 'sustainability' needs to be operationalised.

7.4.4 Power relations as part of configurational patterns

Looking at the different patterns of interaction it remains very difficult to distinguish the role of power relations in the net-chain. In order to do this more information is needed on the contracts, negotiations, and choices made by different players in the net-chain. Yet, it is possible to speak in very general terms on the basis of information collected during interviews. For instance, those who control the supply of feedstock have a very powerful chain position. This aspect shows that the PNPB can alter social relations and interaction patterns. Groups that were not linked before might all of a sudden have a common denominator. Therefore there is a large difference between soybean producers who want to integrate biodiesel production in their part of the chain or other industries that are looking for a general kind of feedstock and want to receive any tax cuts presented by the government. However, existing power relations can also mean that, for instance, producers are less likely to enter the biodiesel market. When they have long-term contracts with their buyers they cannot suddenly switch to the biodiesel market.

Power relations also play a role when the international context is taken into account. For instance, the international discussion on the chemical composition for biodiesel impacts the choice for particular crops. As each oil crops has its own characteristics, a certain standard could include or exclude variety. This element portrays the political aspect of technology and sustainability. In the setting of standards power relations can be reflected. Busch (2000) points out that '*by ignoring standards and the disputes about them, we risk missing one of the most important aspects of the transformation of agriculture and contemporary rural life itself for it is through standards that the moral economy is produced and reproduced.'* The discussion on standards may have very important consequences for Brazil with regard to their export possibilities. As the government is aiming at a frontrunner position in the biofuel market, it needs to be able to access the international trade markets. This can favour certain crops over others as a result of 'trade barriers' based on 'technical' requirements. In the end this might lead to the preference of certain crops of the PNPB over others thus restricting farmers in their options.

7.5 Scenarios as outcome of configurations

The time-dimension is the third element of the configuration approach. In the time dimension the focus lays on the study of continuous change and interaction patterns. For a newly evolving policy field it is a challenge to give indications on its future development. Yet, based on the configurations that were pointed out earlier, it is possible to draw certain scenarios based on current reality definitions. How these developments will turn out is, of course, dependent on the interaction between actors in the future. In a sense the PNPB supposes that it can re-shape society. This confidence is partly based on Brazil's earlier successes with the ProAlcool programme. Yet, there are some key differences with that should not be overlooked. The ProAlcool programme was based on Brazil's necessity to obtain more cheap energy. It was enforced with strict measures of governmental control. Looking back Puppim de Oliveira (2002) states that the programme has been successful as the result of the ambitions of key-actors with governmental power that had a strong interest it its success. Many decisions could be forced by the military government of that time. However, society has changed. Strict economic measures have become more complicated as a result of WTO trade agreements and other strong international actors can have an impact on decisions made by, for instance, producers. The ideas of a manageable and controllable society have been exchanged for a more complex and dynamic vision. It seems to be impossible to govern processes such as the PNPB without collaboration of other parties. To achieve its goals, different organised interests need to discuss possible strategies for a mutually satisfying outcome. However, in this approach there is no question about a regime change, because in fact it would be a continuity of current processes. The configuration approach helps to understand the reasoning used by actors to defend a certain strategy. The strategies indicate various scenarios that are possible within the current reality definitions. Yet, these are not fixed. By progressing insights and interaction ideas can be altered or re-established. This process of change through interaction as it is described in the configuration approach can be analysed by indicating the configurational patterns. The current status of the policy process reflects the high dynamics and changes that are still possible.

- *Scenario I – Biofuels are an important provider of transport energy*

In this scenario there will be a move away from petrol fuels due to limited availability or as part of political strategy. Biofuels are an interesting alternative within reach of existing technology. The availability of sufficient biofuel production is the main driver. In the first years the production will be primarily based on soy oil, because it is the only vegetable oil that is available on the demanded scale. Over time this oil will be substituted by other more efficient crops. As technological knowledge improves the conversion rate will become more efficient. In this scenario neither the social nor the environmental elements are of key importance. Small farmers will only be included as long as there are special programs that focus on their participation.

- *Scenario II – Biofuels are an important driver of social and environmental developments*

In this scenario the focus of the PNPB will be primarily directed towards its support of small farmers. Technological innovations and plant improvement will help these farmers to produce sufficient fuel for themselves and the market. Within this technological innovation there will be a lot of attention for 'sustainable development'. This means that the environmental impact of the programme needs to be taken into consideration. Within this path soy will primarily remain an important crop for the food and feed market.

- *Scenario III – First generation biofuels are an outdated technology*

Within current scientific research there is a lot of attention towards new renewable energy sources. In this context there is attention for 2nd generation fuels and the inclusion of, for instance, algae. These crops are not expected to compete with food production in the same way as the current generation of biofuels. Whence these alternatives are introduced in the market the government has to develop new policies for the different pillars of the PNPB, because current mechanisms are no longer functional. The soy market will continue to grow as a result of additional demands from China and India.

With regard to the production of biofuels and their use and distribution it is clear that they link to existing technological systems. As a consequence scenarios defined by actors are likely to exist within the existing paradigm. However, if actors would view biofuels as a technological regime change, thus altering the energy paradigm, expectations might be quite different. The PNPB and its related objectives are the result of changing ideas on how society should look like. It depends on the position of an actor whether they feel that the programme is a continuity, which means, it is set up to support farmers and energy dependence, or whether it is a step towards a new paradigm. This new paradigm could be the use of alternative energy sources with less impact on the environment and more opportunities to include poor regions, providing Brazil with a new and frontrunner position in the world. The problems that have been indicated are not simple. They are part of complex and ambiguous discussions on the future social, economic, environmental and technological developments. Based on the arguments and insights of different actors it is possible to say that developments in these areas have dynamics that cannot be controlled by the measures taken in the PNPB. Discussions on these themes are not exclusive to the Brazilian context as developments in 'the outside world' can play a key-role in their future development.

7.6 Concluding remarks

In the theoretical part of this thesis it was explained that in evolving policy fields governance itself should no longer be regarded as an independently operating structure, but rather as a flexible system that evolves with its actors. The configuration approach suits this perspective as it focuses on the relations and interactions between actors. This helps to gain more insight in public-private partnerships that can be seen as part of newly governing mechanisms. The set up of the PNPB is a classic example of the government trying to steer all kinds of social, economic, environmental, and technological developments. However, it its consequences on society other actors play a key-role. The configuration approach has proved useful to indicate which different perspectives exist in the evolving field of biodiesel production in Brazil. It is able to illustrate issues that are considered most relevant by key-actors. The approach as it has been used in this thesis is based on inductive methods, putting the actors at the centre of attention. This seems very useful to map people's ideas on the direct impact of policies. Especially when the assumption is that these different configurations influence technological development. In this case scenarios can be studied as an outcome of dominant net-chain relations.

For an in-depth policy analysis the configuration approach seems to have certain shortcomings. As the focus lays primarily on existing reality definitions it does not include other development paths and/or more radical changes. The difficulty while using the configuration approach within an evolving policy fields is that all actors in the policy process will have their own perception of the policy problem, the policy development, the other actors within the network, the interdependencies and the (dis-) advantages of cooperation (De Jong 1999). As a result their reality definitions might be on completely different scales. Yet, this is no problem when governance is viewed as a deliberative process between different actors. In this case governments have to operate in (policy) networks of mutual interdependent actors who each have their own objectives and their own ways for influencing other actors (De Jong 1999). This shows that the configuration approach seems suitable to discuss changes and interaction within an existing paradigm, but is inadequate to describe possible paradigm changes (Ingen-Housz 2007). Scenarios described on the basis of the configuration approach look at current social and cognitive dimensions within a policy field. As actors can be multiple included in other policy fields they can also consider other (intrinsic) values that play a role in their decision-making process.

8. Conclusions and recommendations

The collection and analysis of information from previous chapters contributes to answering the research questions. This chapter will present the main conclusions based on that information. Throughout the execution of the research more questions arose that could not be answered in the course of this project - which is inherent to an explorative research. Therefore, this chapter closes off by presenting a preliminary research agenda to address future research topics in the field of biofuels and soybean in the Brazilian context.

8.1 Main conclusions

This research began with observing that the governance structures are changing in the context of global developments. These changes resulted in theoretical insights on the way that governance is shaped in evolving policy fields. These fields are characterised by a changing, more active, role of actors that participate in a deliberative policy process. The policy field of biodiesel production in Brazil can be viewed as such a policy field. The theoretical framework also indicates that the way actors behave in these fields is largely determined by the notion of increased risks, insecurities, questions about the role of science and the legitimacy of institutions as well as perceived opportunities. To understand the dynamics of the interaction between actors and their impact on the governance structure the configuration approach is a useful method. This approach has proven itself very useful to map the social structures and cognitive patterns that exist with different key-actors in the existing policy debate. It was possible to identify the ideas that lie behind the decision-making process of these actors. Yet, to be able to identify the actors and the way they reason it was essential to complement the configuration approach with notions on the use of discourse, relations in the net-chain, power perspectives and ideas on social order. These additional elements made it possible to operationalise the theory in such a way that different the configurational patterns of actors could be transformed to configurations that indicated possible development scenarios.

Empirical findings resulted in the identification of the configurations of 'risks' and 'opportunities'. These configurations are primarily based on an actors' position in the net-chain and their view on the opportunities and risks for their position in the biodiesel net-chain complying with their current chain position. These configurations pose a challenge to the PNPB as was initially set up by the government. The social, economic and environmental pillar based on technology development of the PNPB can conflict with the positions that actors have about their role in the policy scheme. For instance, the inclusion of small farmers, which is an objective of the PNPB, can become problematic when they do not want to take the risk of investing in oil crops they have no farming experience with. Still, based on past experiences with the ProAlcool programme the government is confident that they are able to do the same with biodiesel. However, the situation in the country has entirely changed over the past decades. There is no authoritarian government that can force a farmer to switch their cropping system and Brazil has become linked to the international commodity market thus making it more difficult to create a radical transition, as they will have to comply, for instance, with consumers from trading countries. Based on these observations the question remains what will happen with the development of biodiesel production.

The configuration of 'opportunities' showed that actors that are already involved in either vegetable oil production or the production of biofuels are positive about participation with the biodiesel programme. This situation is mainly relevant for large producers and cooperatives who have an advantage in the sense that they can produce the feedstock necessary for biodiesel production themselves. To them investing in the biodiesel market is foremost a way to increase market differentiation. In this context the role of soybean producers is crucial. Currently, soy oil is the only crop that is produced at such a scale that it is able to deliver the input (of feedstock) needed to comply with the blending targets set by the Brazilian government. At the moment these farmers are confronted with high diesel costs, which form an important part of their production costs, and international fluctuations for soybean demand thus making their production more risky. On the other hand the variety of end uses of soybean products, make that the market has certain flexibility. In this context investing in producing their own biodiesel creates new opportunities and more independence. The fact that the PNPB does not create similar economic incentives as they do for small farmers does not seem to influence these initiatives.

Empirical findings also give an indication about possible policy developments with regard to the three pillars of the PNPB. The social pillar is supported by the SFS and tax reductions. In the current situation all biodiesel producers are required to integrate small farmers into their supply chain, because without the SFS they cannot buy their biodiesel quota in the auctions set by the government to stimulate the market. However, the auctions are a temporary measure in the initial phase of the PNPB. Hence the question can be asked whether it will remain attractive to include small farmers in the production system when the auctions are put to an end. This can be part of the deliberation process for biodiesel producers, because small farmers also demand higher investment costs and deliver limited amounts of oil. It is even a question whether these small farmers are interested, because they also have other objectives, such as food production. The economic pillar of the PNPB is set at creating a strong economic position for Brazil. This includes saving on costs of having to buy diesel as well as creating a frontrunner position in the developing biofuels market worldwide. How this pillar will evolve depends mainly on developments in the international market with regard to the price of petrol fuel and the interest for biodiesel. Most actors assume that the amount of money going into research and regional development projects will be a good investment for the future of the country. The third, environmental, pillar is most difficult to analyse as there are neither fixed incentives nor goals. The basic assumption is that biofuels are good for the environment. Still, there are organisations that have expressed their concern with regard to this development, because they expect additional deforestation and agricultural expansion. Between different actor groups there is no consensus about the possible impact and sustainable approaches.

The technological base is important to all actors. How technology develops and the focus of these developments are a huge part of the future composition of biodiesel production. For instance, if it is focussed on simple technologies and development of new oleaginous crops it will be an additional incentive for small farmers. On the other hand if technology aims at developing sophisticated systems for a more efficient energy transfer of vegetable oil than the development path will be quite different. In this sense the outcome of technology will also be the result of social choice, and therefore of institutionalised perspectives. A general misconception in the area of technology development is that it will contribute to all the objectives of the PNPB. If current investments are considered, many are aimed at developing new technologies which benefit those actors that already have an advantageous position. This type of science is developed by those who have most power to steer scientific developments towards their interest. Whether or not it is accepted that science might develop in this direction is a political choice, but in this way institutionalised perspectives can cause controversies over technology innovation.

Based on the analysis of the PNPB it is clear that different configurations shape and change the policy process and are shaped by it in turn. Who is part and who is not part of the discussion gives many insights in the existing power relations. Findings of this research make it is clear that biofuels will remain an important issue in Brazil as well as in the international arena for the years to come. The interaction with other policy fields has made it of long-term strategic significance to many different actors. They reason from different objectives, such as geo-political strategies, social programmes and sustainable energy production. In this process a tension field exists between the demands of society to make their own decisions in a deliberative process and the responsibility of a government to tackle issues that rise above ‘the agency’, i.e. power to act, of specific actors. In the theoretical part of this thesis it was explained that in evolving policy field governance itself should no longer be regarded as an independently operating structure, but rather as a flexible system that evolves with its actors. The configuration approach suits this perspective as it focuses on the relations and interactions between actors. This helps to gain more insight in public-private partnerships that can be seen as part of new governing mechanisms. The approach as it has been used in this thesis is based on inductive methods, putting the actors at the centre of attention. This seems very useful to map people’s ideas on the direct impact of policies. For an in-depth policy analysis of power relations and paradigm changes the configuration approach has certain shortcomings. As the focus lays primarily on existing reality definitions it does not include other development paths and/or more radical changes when they are not a part of the cognitive framework of the key actors.

8.2 Recommendations for a research agenda

This research has tried to give an overview of the current situation in biofuel policies in Brazil and the (possible) role of soybean in this context. It has used the configuration approach complemented with ideas on net-chains, governance, and human-environmental interaction processes. In this way the research has been able to explore the developments occurring in Brazil as a consequence of the PNPB. Biofuels are a controversial topic in which policy developments and the behaviour of actors play a key role. The field is intertwined with other policy arenas such as environmental issues, energy security, and social development. The interaction between these arenas and expected technological developments result in many more questions. There is an urgent need to obtain more insight in the consequences of certain choices and to consider possible alternatives. Some of the main issues that need more research attention are summed up below.

- Roundtables, such as the RTRS on soybean (and very recently also one on biofuels), are set up as multi-organisational partnerships between industry, producers and civil-society. Governments are assumed to facilitate the process so it can evolve successfully. These roundtables aim at being private-private partnerships set up to promote sustainable production. Yet, this is in contrast with the competitive market and bureaucratic hierarchies. There is also a question of representation and duplication regarding actors who have no part of the discussion process. It will be very interesting to obtain more insight in the legitimacy of these roundtables as well as their effectiveness to promote sustainable production as they develop in the international market. Another aspect of these roundtables is the role of social end ecological research and the extend to which results can impact, for instance, the criteria development process.

- To study the impact of the PNPB on Brazilian society, studies should be done on the changing international context of vegetable oil production and trade. In this specific context it will be interesting to look at who profits of current policies and whose situation deteriorates. In this sense it will be interesting to see whether the configurations of 'risk' and 'opportunity' indeed give an indication of the evolvement of the policy field of biodiesel production. Especially for the position of small farmers.

- The Brazilian government set up a system of (the) SFS and tax reduction to include small farmers in the PNPB. Based on the empirical findings small farmers still consider it a large risk to participate in the production of feedstock for biodiesel. Therefore it might be interesting to study the consequences of both policies and how they impact the market for biodiesel production and social inclusion. Currently there is already an interesting discussion on small farmers producing more expensive vegetable oils for niche markets and the pharmaceutical industry, while soy and palm oil can attend to the diesel market.

- The environmental impact of biofuels is a debated subject. There are many different visions on the way its impact should be measured. Different measuring methods and results contribute to controversies in biofuels policy. To resolve this situation more understanding is needed of the exact social, technical and environmental impact and how it should be measured. This will also contribute to the discussion whether biodiesel is a good solution from an environmental point of view.

- One of the most challenging elements of the discussion on the implementation of biodiesel is the role of 'indirect impacts'. These play a key role in the world-wide discussion on the competition between food, feed and fuel. Still, it is extremely difficult to measure possible indirect effects, but it is impossible to neglect their existence. Certainly because many people are already worried about the consequences of increasing food prices. For future research it will be interesting to break down the different type of concerns to analyse how these relate to the discussion on competing claims on natural and social resources.

- Within the current implementation of biofuel policies there has been a focus on the tool of certification. The question is to what extend certification addresses problems of sustainable production? Who can design the criteria? What are the right criteria? And if it is a good method, how can it be implemented? For instance, the Dutch Cramer Committee set criteria for sustainable biofuel production. Is this an effective method to promote more sustainable production? Are other countries and industries willing to implement these kinds of criteria? If so, how can these criteria be adapted to locally usable tools?

- One of the goals of Brazil is to develop an international frontrunner position in the international trade of biofuels. For this, biofuels need to be made into a commodity. The question is whether this fits with some of the country's other goals, such as, environmentally friendly energy and geo-political independence. Therefore it should be studied what the consequences of a biodiesel market would be, especially when vegetable oils themselves are already a commodity.

- When biodiesel is 'elevated' to an international commodity this might impact the discussion on technical standards. Different vegetable oils have different oil characteristics. Already there seems to be a tendency among countries to define standards in such a way that they comply with the characteristics of their own oil crops. Currently, Brazil uses a very flexible standard in order to include all oleaginous crops in the PNPB. However, what are the consequences if they want to trade on the international market? Does this close the door for certain 'alternative' oil crops leading to less production possibilities for farmers? Or will standards perhaps be used as non-tariff trade barriers?

- Technological developments play a key role in the evolvement of biodiesel production. For now the focus primarily resides with 1st generation methodologies. Huge investments are going into the promotion of this technology, but how long will it last? What are the types of innovations that can be expected? Are other sources of renewable energy to be developed that can be compared with biodiesel? In this respect it is also relevant to evaluate the link between the type of technology that is developed and they type of farmers for whom it is suitable. This also influences whether the technology aims at the production of feedstock material or about biodiesel as well.

- All the research topics summed up above indicate that there is an urgent need for more understanding of the biodiesel policy field if governments continue the road for promoting biofuels. In this case politicians need to become aware of the consequences of their decisions. Part of this understanding comes from insights in the way decisions are made and how complex systems can be managed. This research used the configuration approach as a starting point for this kind of analysis. However, there are still some gaps in the way information can be collected. Therefore new research methodologies need to be developed to analyse these types of international, complex and quickly evolving policy fields.

In 1912 Rudolf Diesel (1858-1913) applied for a biodiesel patent stating that: *'The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become in course of time as important as petroleum and the coal tar products of the present time.'* Could he have anticipated the discussions that would follow when biodiesel production would be implemented, and the impact they have on society?

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Het ontwerpen van een onderzoek. Utrecht.

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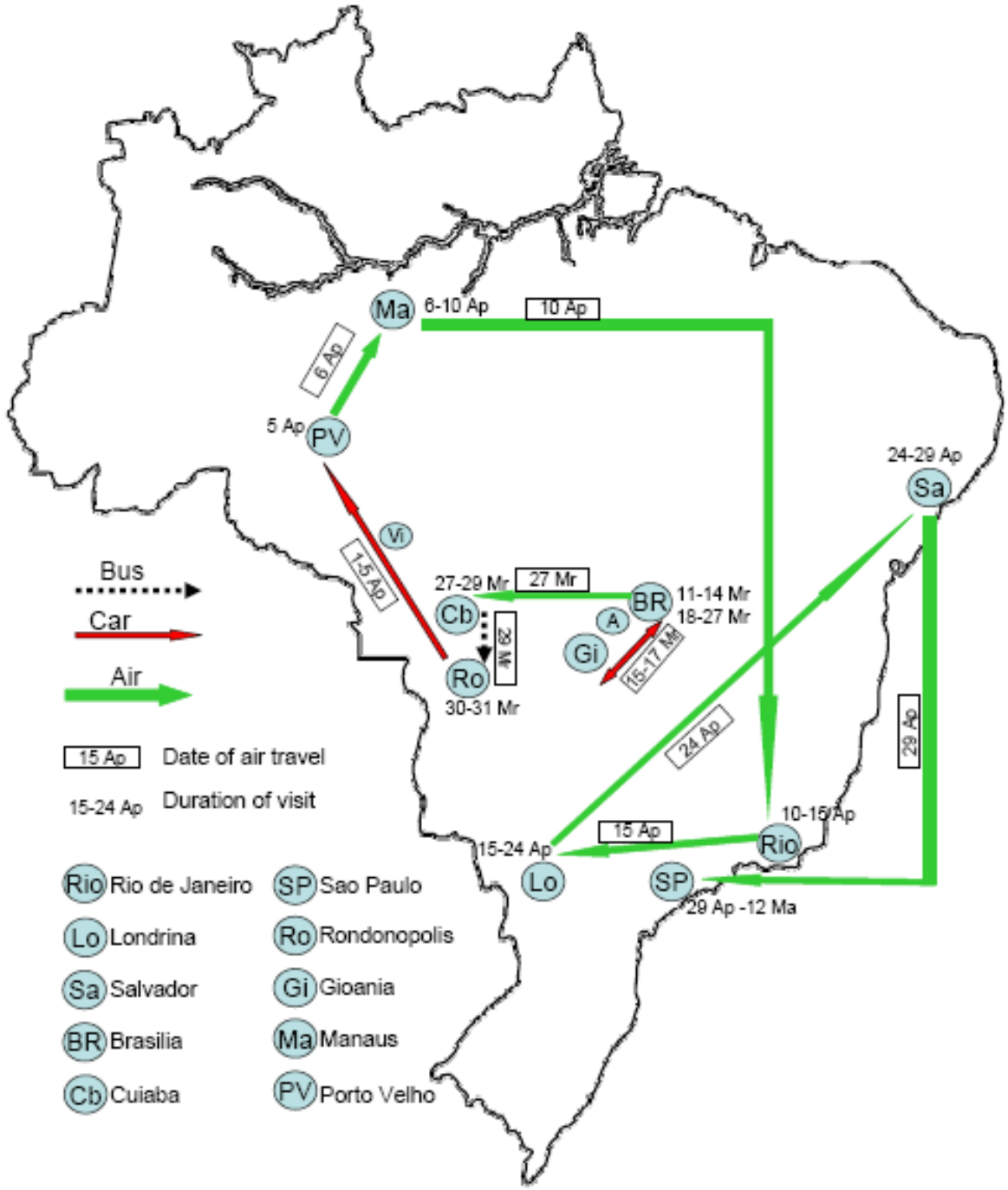
Annex I.

Itinerary



Annex II.
PNPB laws

The PNPB is based upon laws, executive orders and other legal and normative documents. The basic ones are listed below:

- Law # 11.097, 2005: defines biodiesel as a new fuel in the Brazilian energy matrix, establishes a mandatory mix of 2% starting from January, 2005 and of 5% in January, 2013, all over the national territory. Gives ANP the competence to regulate and supervise the production and commercialisation of biofuels.

- Law # 11.116, 2005: defines the federal tax model applicable to biodiesel (exemption or reduction of CIDE, PIS/PASEP and COFINS, per region, type of producer and oleaginous raw material).

- Normative Instructions SRF # 516, 2005, and # 628, 2006, which establish, respectively, conditions for the registration of biodiesel producers and importers and a special regime for the calculation and payment of federal taxes PIS/PASEP and COFINS.

- Executive Order # 5.448, 2005: establishes at 2% the percentage of the mix of biodiesel and authorises higher percentages for use in generators, train engines, boats and captive vehicle fleets.

- Normative Instructions MDA # 01, 2005 (establishes criteria and procedures for granting the use of the Social Fuel Stamp) and MDA # 02, 2005 (establishes criteria and procedures for including projects of biodiesel production in the mechanism of the Social Fuel Stamp).

- ANP Resolutions: Resolution # 41, 2004, which deals with biodiesel producers, and Resolution # 42, 2004, which deals with the commercialisation and inspection of biodiesel.

- Resolution BNDES # 1.135/2004: Creates the Programme of Financial Support for Investments in Biodiesel, which provides financing for all stages of the productive chain (the programme funds up to 90% of projects having the Social Fuel Stamp and up to 80% of projects without this characteristic).

(www.biodiesel.gov.br, www.anp.gov.br, www.mda.gov.br)

Annex III.
List of visited organisations

Brazilian Association of Vegetable Oil Industries
http://www.abiove.com.br/

André Maggi Group
http://www.grupomaggi.com.br/pt-br/index.jsp

National Petroleum Agency
http://www.anp.gov.br/

AustenBio Tecnologia em Biodiesel
www.austenbio.com.br

Barralcool
http://www.barralcool.com.br/

Brazilian Foundation for Sustainable Development
http://www.fbds.org.br/

Caramuru
http://www.caramuru.com/home.htm

Centro Brasileiro de Ação Cultural
http://www.cebrac.org/

Centroalcool
http://www.centralcool.com.br/

Coamo
www.coamo.com.br

Companhia Nacional de Abastecimento
http://www.conab.gov.br/conabweb/

Cooperbio
http://www.cooperbio.com.br/

Comissão Pastoral da Terra
http://www.cpt.org.br/

Dutch Embassy in Brasilia
http://www.mfa.nl/brasil

Empresa Baiana de Desenvolvimento Agrícola S/A
http://www.ebda.ba.gov.br/

Emater Paraná
arapongas@emater.pr.gov.br

Embrapa headquarters
http://www.embrapa.br/english

Embrapa Soybean
www.cnpso.embrapa.br

Escola Superior de Agricultura 'Luiz de Queiroz' - Universidade de São Paulo
http://www.esalq.usp.br/

Ethos Institute
http://www.ethos.org.br

Famato
http://www.famato.org.br/

Galvani
http://www.galvani.ind.br

Greenpeace
www.greenpeace.org.br/

Grupo de Trabalho Amazônico
http://www.gta.org.br/

Instituto Agronomico do Paraná
www.iapar.br

Ministry of Agriculture
http://www.agricultura.gov.br/

Ministério do Desenvolvimento Agrário
www.mda.gov.br/saf

Movimento Sem Terra
http://www.mst.org.br/mst/home.php

OD Consultancy
http://www.odconsulting.com.br/

Petrobras
http://www.petrobras.com

Pólo Nacional de Biocombustíveis
http://www.polobio.esalq.usp.br/

Reporter do Brasil
http://www.reporterbrasil.com.br/

Roundtable for Responsible Soy
http://www.responsiblesoy.org/eng/index.htm

Seminário International Soja
http://www.cnpso.embrapa.br/soja2007/

TecnoCampo
http://www.tecnocampo.com.br

Universidade Federal da Bahia
www.ufba.br

Wageningen UR
Agrotechnology & Food Sciences Group
http://www.afsg.wur.nl/UK/

Wageningen UR
Plant Research International
http://www.pri.wur.nl/uk/

Visited websites

Agência Nacional do Petróleo, Gás Natural e Biocombustíveis
www.anp.gov.br
visited 1-11-2007

Associação Brasileira das Industrias de Biodiesel
www.biodieselbr.com.br
visited 1-11-2007

Associação Brasileira das Indústrias de Óleos Vegetais
www.abiove.com.br
visited 1-11-2007

Associação Nacional dos Exportadores de Cereais
http://www.anec.com.br/principal.html
visited 1-11-2007

Banco Nacional de Desenvolvimento Econômico e Social
www.bndes.gov.br
visited 1-11-2007

Banco do Brasil - agronegócios
www.bb.gov.br
visited 1-11-2007

Brazilian Association of Vegetable Oil Industry
http://www.abiove.com.br
visited 1-11-2007

Biodiesel.Br
www.biodieselbr.com
visited 1-11-2007

Carbonobrasil
www.carbonobrasil.com.br
visited 1-11-2007

Conselho Europeu de Biodiesel
www.ebb-eu.org
visited 1-11-2007

Empresa Brasileira de Pesquisa Agropecuária
www.embrapa.gov.br
visited 1-11-2007

Fields for food or fuel
http://www.fields-for-food-or-fuel.net/index.html
visited 1-11-2007

Instituto Brasileiro de Geografia e Estatística
http://www1.ibge.gov.br/ibgeteen/mapas/imagens/brasil_populacao_gde.gif
visited 22-01-2007

International Energy Agency
www.iea.org
visited 1-11-2007

International Food Policy Research Institute
http://www.ifpri.org/2020/focus/focus14.asp
visited 28-01-2007

Ministério da Agricultura, Pecuária e Abastecimento
www.mapa.gov.br
www.agricultura.gov.br
visited 1-11-2007

Ministério de Desenvolvimento Agrário
www.mda.gov.br
visited 1-11-2007

Ministério de Ciência e Tecnologia
www.mct.gov.br
visited 1-11-2007

Ministério de Minas e Energia
www.mme.gov.br
visited 1-11-2007

National Biodiesel Board
www.biodiesel.org
visited 1-11-2007

Petrobras - Petróleo Brasileiro S.A.
www.petrobras.com.br
visited 11-11-1007

Portal Agronegócio
www.portalagronegocio.com.br
visited 1-11-2007
Portal BIODIESEL
www.biodiesel.gov.br
visited 1-11-2007

Reporter Brasil
http://www.reporterbrasil.com.br
visited 1-11-2007

Roundtable on Responsible Soy Association (RTRS)
www.responsiblesoy.org/eng/index.htm
visited 1-11-2007

United Soybean Board
http://www.ussoyexports.org/resources/aboutsoy.htm
visited 30-01-2007

Vakantielanden
http://www.vakantielanden.net/image/landkaarten/brazilie.jpg
visited 22-01-2007

Wikipedia - Mato Grosso
http://en.wikipedia.org/wiki/Mato_Grosso
visited 22-01-2007

World Economic Forum
http://www.weforum.org/en/knowledge/KN_SESS_SUMM_16822?url=/en/knowledge/KN_SESS_SUMM_16822)
visited 22-01-2007