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AN ANALYSIS OF THE LATVIAN BIODIESEL INDUSTRY: FACTORS RESTRICTING DEVELOPMENT AND PROBLEMS TO BE SOLVED

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Abstract

The aim of our thesis was to answer the following research questions: *what are the factors preventing expansion of the production of biodiesel in Latvia?* and *what should be done in order to facilitate the production of biodiesel in Latvia?* This research is interesting since there are many preconditions in Latvia for successful production of biodiesel, but for several years the output has been restricted to one small-scale plant. Interviews with industry stakeholders, review of secondary material and analysis permitted us to identify several restricting factors. From the production side, the main preventing factors are the poor technological state of farmers, who produce the necessary production input, rape-seed, as well as the rather low bargaining power available to farmers. Additionally, the government shows low direct or indirect interest in the industry's development. Marketing problems arise mainly because of an uninformed society and a low production output, thus currently being unattractive to the largest fuel retailers.

To facilitate the development of the industry, several measures must be taken. Interest of consumers must be raised, which in turn will increase the government's and fuel retailers' interest. Additionally, to ensure certainty a clear pricing mechanism should be in place for farmers as well as communication from the government and the producers to the farmers on the need for rape. Time must be devoted to planning of cultivation, increasing efficiency, and decreasing transaction costs.

Key-words: biodiesel, rape-seed

1. Introduction

In August, 2005 the World witnessed one of the worst weather-caused devastations. The northern coast of the Gulf of Mexico was hit by Hurricane “Katrina”, which was one of the strongest hurricanes recorded (Hurricane Katrina, 2005). Because the Gulf of Mexico is a rich source of oil, the hurricane stopped much of the extraction and recycling of oil on the coast of the gulf. World oil prices began rising sharply and the price of oil surpassed the price recorded in the seventies during the oil-shock. This resulted in significant increases of petrol and diesel prices globally.

If weather and other unanticipated factors (such as a shortage of supply of natural gas from the Russian gas monopoly *Gazprom* that some European countries witnessed at the start of 2006) affect energy prices only once in a while, the rapidly developing eastern region of the world affects prices in the long term. With rapid expansion of economies, the region’s energy demands are not lagging far behind, so that the region is constantly increasing its demand for energy, including oil, further driving prices upwards.

As a result, dependence on external energy sources creates risks and will only increase payments for energy in the long term. Thus, the European Union has for some time been thinking about diversifying its energy supplies to reduce dependence on external sources. The decision is moving in favour of renewable energy, which can be produced within the borders of the EU. Wind generators are nothing revolutionary, nor are solar energy generators. Neither is bioenergy; however, its production is very limited across the world, although it possesses many benefits.

To facilitate the development of bioenergy, Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels for transport was issued, defining targets of biofuel as a share of total petrol and diesel sold on the EU markets. By the end of 2005, this share should have been 2% and by the end of the 2010 it should be no less than 5.75% (2003).

Directive 2003/30/EC is in place, thus every EU member state has to comply with it. Even disregarding this directive, the production of biofuels in Latvia is beneficial from various points of view, since it can reduce unemployment in the agricultural sector, reduce dependence on foreign energy supplies, and improve environmental performance (Gudriniece, 2000). Thus, our interest in this paper is to analyze why the biofuels industry has so far not developed.

More specifically, we focused on production of biodiesel, since, according to Boyan Kovalov *et al*., biodiesel production in Latvia seems to have more potential than production of bioethanol (2003). Further, the use of biodiesel is much more straightforward than the use of bioethanol, since bioethanol requires significant modifications to transportation vehicles (Znatnajs, 2006). These factors represent the reasoning for the delimitation of our paper.

The benefits of locally produced biodiesel and biofuel in general are notable, but currently the production of biodiesel is restricted to one plant with a yearly capacity of 3500 tons of biodiesel per year (TV5/Dabas taka, 2005). Two new plants are expected to start operations towards the end of the first quarter of 2006 (Diena, 2006). Another indication of favourable conditions for biodiesel production is the fact that both Lithuanian and Estonian biodiesel producers are exporting their production to Latvia (Stroža, Aug 2005). Thus, in our research we will aim to answer the following research questions:

What are the factors preventing expansion of production of biodiesel in Latvia?

What should be done to facilitate the production of biodiesel in Latvia?

The paper is structured as follows: first we summarize previous research, present a theoretical overview, and outline our methodology. We proceed with an analysis of the external environment, constituted by Pest and Porter's five forces analysis, the internal environment, which will be an analysis of the biodiesel production value system, and conclude our analysis with Stakeholder mapping. We then end with discussion of our results, and propose areas for further research.

2. Literature Review

We have looked at the papers published on this topic previously, and outline the main ones in this section. We have to note that this field is not very extensively studied, so our literature summary is quite short.

A discussion forum on the topic "Measures to implement biofuels in Europe" (Pelkmans *et al*, 2005) sets out a simplified value system of production of biofuels and identifies problems in each part of the system along with possible solutions.

Boyan Kovalov *et al* (2003), in their report "Biofuel production potential of EU candidate countries" assess the potential of the 10 newest EU members to contribute to the enlarged EU's automotive fuel supply in 2005 – 2010 via producing biofuel. The reported conclusions, based on national forecasts and optimal technically feasible estimates, are that the potential contribution of

the 10 countries to biofuel production is 3%. Bioethanol appears to have a larger potential than biodiesel (not to be the case in Latvia), production costs in the 10 countries appear similar to EU-15 production costs, biodiesel production costs are lower than bioethanol production costs, final net production costs are influenced by revenue from by-products, and cultivation costs constitute around 80% of all costs.

Boyan Kovalov (2004) in his report "Biofuel potential in the EU" investigates the internal production potential of the EU (15 old member states at the time of writing) for transport biofuel. He concludes that meeting the 2% target stipulated by Directive 2003/30/EC will not cause distortions to agricultural production. Substantial efforts, however, would be needed to reach that target due to almost non-existent biofuel production. The 5.75% target is reachable only with substantial changes to agricultural production. He also states that bioethanol production requires less land than biodiesel production (on equal terms), and that EU enlargement would reduce relative land requirements due to larger relative biofuel crop potential in new accession countries.

Marina Enguidanos *et al.* (2002), in their paper "Techno-economic analysis of Bio–diesel production in the EU: a short summary for decision-makers" present the crucial facts related to biodiesel production technique.

These researches focus on EU-wide analysis. One publication deals specifically with the situation in Latvia. Arnis Kalniņš (2005) in his book presents an economic evaluation of conditions in which the most profitable recycling of rape-seed is possible in Latvia. The author devotes time in presenting the experiences of countries that are producing biofuel for more than 10 years. He also presents estimates of costs for biofuel producers.

3. Theoretical Overview

This section presents the theoretical construction of the paper, outlining theoretical models used.

3.1 Strategic Analysis

In Mintzberg's and Quinn's view, corporate strategy is the pattern of decisions that shapes an organization, sets out its plans and objectives, defines the way in which to achieve them, and determines the contribution of the organization to society. (1995, p. 47). This process, however, is not solely influenced by a strategic entity's internal environment since other influences are also important. As Johnson and Scholes put it "strategic analysis is concerned with understanding the strategic position of the organization in terms of its external environment,

internal resources and competences, and the expectations and influence of stakeholders." (1999, p. 17). So, we have to look at three areas from the viewpoint of biodiesel producers.

3.2. External Influences

Johnson and Scholes explain that determining external influences is not a straightforward procedure – the environment is affected by countless factors and one must make sense of them in decision-making. Evaluation is constrained further by the uncertainty of the environment, whether it is static or dynamic.

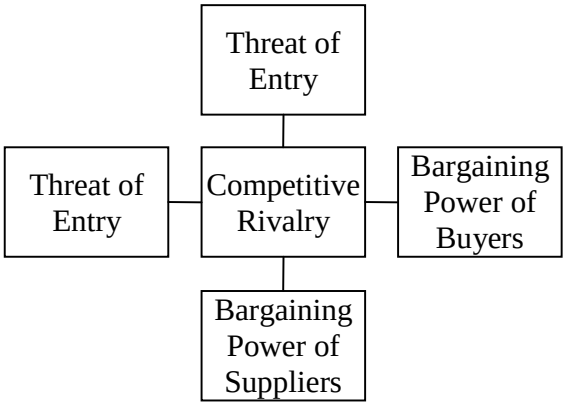
3.2.1. PEST Analysis

To make sense of the external environment, Johnson and Scholes propose the PEST analysis tool to identify past external influences and future uncertainty of the environment. The tool has four broad factors to consider: political, economic, sociocultural, and technological. (1999, p. 104 - 107)

3.2.2. Porter's Five Forces Analysis

Michael Porter states that "the industry structure has a strong influence in determining the competitive rules of the game as well as the strategies potentially available to the firm" (1998, p. 3). Thus, industry-specific factors must also be taken into account. He proposes that the competitive state of a given industry depends on five factors: Threat of entry, intensity of rivalry between existing competitors, pressure from substitute products, bargaining power of buyers, and bargaining power of suppliers.

Porter's Competitive Forces



Porter explains that the threat of entry refers to the barriers to entry into an industry. Competitive rivalry means the level of competition between existing competitors. Pressure from substitute products is the substitutability of a product from other industries. Bargaining power of buyers means the extent to which buyers can exercise power over the producers of a product. Bargaining power of suppliers is the extent to which suppliers of inputs can influence trade conditions with the producer (1998, p. 3-27).

3.3. Internal Environment Analysis

Scholes and Johnson explain that successful strategies depend not only on the external environment but also on an organization's *ability* to succeed in that environment. This is defined as *strategic capability.* Analysis of strategic capability determines whether an organization's resources and competences suit its external environment (1999, p. 151-152).

3.3.1. Value System Analysis

To analyse strategic capability, we chose the value chain model which describes the "activities within and around an organization and relates them to an analysis of the competitive strength of the organization" or in other words, the ability to provide competitive products. The source of competitive advantages lies in the potential to manage links among different activities (Johnson, Scholes, 1999, p. 156-157).

Links, however, exist not only between processes within an organization but also between organizations. This creates a value system – a system of upstream and downstream value chains (Value chain, 2005). Hence, an organization's success depends on its value chain and on how well the linkages between relative value chains are managed.

3.4. Stakeholder Analysis

Analyzing the external and internal influences on an organization is not always sufficient for a complete picture. Every organization is influenced by its stakeholders. Johnson and Scholes explain that stakeholders are groups that depend on an organization to fulfil their goals, and, in turn, an organization depends on them.

"Stakeholder mapping" is a helpful tool in analyzing stakeholders. This tool identifies what are different stakeholders' interests in an organization and what are their powers to influence it. (1999, p. 213-215).

To sum up, our theoretical framework for the paper consists of analysis of the external environment and industry influences, the internal environment factors, and identification of powers and interests of stakeholders that can affect the production of biodiesel.

4. Methodology

To answer our proposed research questions, we have structured our analysis of the Latvian biodiesel industry according to our theoretical framework.

4.1. Methods

To answer the research questions we used semi-structured in-depth interviews with industry stakeholders, and secondary data collection methods.

For the interviews we outlined the general topics and questions (Appendix A), but did not stick strictly to the guide. We performed the interviews at the interviewee's chosen place and recorded the interviews on tape. We created partial transcripts and omitted irrelevant discussions. We used a thematic approach to analyze responses.

In total we identified 6 stakeholders affecting the biodiesel industry.

Industry stakeholders	**Role in industry**
The EU	The European Union
The government	Policy maker, shapes the supply-side of biodiesel production
Fossil fuel retailers	Retailers fossil diesel, potential/existing retailers of biodiesel
Latvian grain producers	Main suppliers of rapeseed
Latvian biofuels association/producers	Association which unites biofuel producers, thus also representing the biodiesel producer.
Consumers	Users of fossil diesel who in part can be users of biodiesel

Originally, we planned to interview four stakeholders, except the EU, since that would incur significant costs to us, and consumers, because the demand for biodiesel exceeds local production capacity (Znatnajs, 2006; Kisiels, 2006), while in 2005a portion of realized biodiesel was imported from Estonia and Lithuania (Stroža, Aug 2005), showing that demand exceeds local supply. Further, the existence of large users indicates attractiveness of biodiesel. Also, since the price of biodiesel is lower than that of fossil diesel, biodiesel can also out-compete fossil diesel in price terms. Thus, in our paper we assumed demand for biodiesel as a given.

Because there were largely no possibilities to interview more than one expert from each stakeholder group, the number of interviews conducted is small. We interviewed three stakeholders: two interviews with the government, one with the rape producers' cooperative, and one with the Latvian Biofuel Association, because the only significant biodiesel producer, Delta Riga Ltd, rejected our request for an interview. The Latvian biofuel Association unites all significant biofuel producers, thus we substituted the interview with the biodiesel producer for an interview with the Biofuel Association. The necessary view of the fuel retailers was obtained at the Latvian Biofuel Association's general meeting on the 15th March 2006 from the comments of Jevgenijs Kisiels, the President of the Association of Latvian Fuel Producers and Retailers. The list of interviewees and commentators can be found in Appendix B.

The second method, secondary information collection, was essential since the number of interviews did not give sufficient grounds to draw conclusions. Thus, the information gathered in secondary sources gave us additional views of stakeholders, especially fossil fuel retailers. With these data we filled the gap left by the small number of interviews.

4.2. Data Sources

We gathered secondary information mainly from five sources: the newspaper 'Dienas Bizness' homepage, Latvian Statistical yearbooks 2004 and 2005, the web-site of the Ministry of Economics, and the Ministry of Agriculture of Latvia. We also gathered some secondary information from other sources, for example the news agency LETA web page.

4.3. Reliability and Validity

The main question regarding reliability in qualitative research, according to Easterby-Smith *et al.* (2002), is whether alternative researchers would reveal similar information (qtd. in Saunders, Lewis, and Thornhill, 2003, 253). By interviewing different industry representatives, research could provide other results, but should not reveal anything radically opposite. Our research might have some reliability problems since the number of interviews conducted is rather small, but we have put extensive effort into searching for relevant information in secondary sources, improving the reliability of our research.

According to Robson (2002) the possible main threats to validity are history, testing, and maturation (qtd. in Saunders, Lewis, and Thornhill, 2003, 102). History is concerned with recent events which might have an influence on current actions and events. To our knowledge, we have not experienced such events during the course of the research.

Testing is concerned with the perception of interviewees that topics of discussion might be of disadvantage to them, thus influencing results. To limit this threat we structured our interviews so that the questions are broadly the same for all interviewees. Hence, cross-checking of answers was possible. The information gathered in secondary sources gave us additional possibilities for cross-checking.

Maturation is concerned with events occurring during data collection which might cause data validity problems (Creswell, 1998). Since the industry is currently dynamic, there were significant events occurring during the research. Towards the end of our research, new biodiesel factories were planned to be opened, but we have largely excluded them from our analysis.

The largest threat to validity is the small number of interviews. That, however, is because of lack of the availability of experts within the stakeholder group. Because stakeholder groups are small in numbers, interviewing additional experts would not lead to improvements in validity, since the experts are acquainted with each other with homogenous views. To reduce the validity threat, we used secondary information, which did not reveal anything contradictory.

5. Background Information

What is Biodiesel?

The European Biodiesel Board (What is biodiesel?, 2006) states that biodiesel is a renewable fuel produced from vegetable oils. In the Latvian climate, the most suitable plant for biodiesel production is rape. In the transportation sector, biodiesel may be used when blended with fossil diesel and in pure form. "Tests undertaken by motor manufacturers in the European Union on blends with diesel oil between 2% and 30%, and 100% pure have resulted in guarantees for each type of use" (What is biodiesel?, 2006). Minor modifications to vehicles for use of 30% and pure biodiesel are needed if a guarantee is not provided by the manufacturer of a vehicle. Rape-seed oil can be used as fuel, but that requires modifications to machinery (Znatnajs, 2006; Kisiels, 2006).

Among other features of biodiesel we must note its environmental performance. "Biodiesel has been demonstrated to have significant environmental benefits in terms of decreased global warming impacts and reduced emissions**."** (Why use biodiesel?, 2005).

Industry's output in Latvia

In Latvia, production of biodiesel production started in November 2001, when the first plant, Delta Riga Ltd, started its operations. The capacity of the plant then was 2500 tons of biodiesel. In November 2005, the total output of biodiesel reached 2000 tons (Stroža, Dec 2005). With an additional 11 thousand tons consumption of bioethanol, most probably Latvia will have reached the 2% level of biofuel proportion in total fuel consumption in the transportation sector in 2005. At the end of the first quarter of 2006, two additional small-scale production plants were expected to start operations – Mammas-D Ltd and Mežrozīte Ltd with a production capacity of 3000 tons of biodiesel each (Diena, 2006). The Ministry of Economics of Latvia (Dūmiņš, 2005) states that by the start of 2007 two large-scale factories will start operations. Each factory will have a capacity of about 100 thousand tons of biodiesel.

Industry Output in Europe

In Europe, biodiesel production started in 1992. Since then, output levels have been increasing rapidly and in 2004 total production output reached approximately 2 million tons. There are around 40 biodiesel plants in Europe (Production of biodiesel in the EU, 2006).

After this brief introduction, we now start our analysis with an examination of the external environment of Latvian biodiesel producers.

6. PEST analysis

As mentioned in the methodology part, we have structured our analysis according to the Pest framework.

6.1. Political Factors

Legislation:

Production of biodiesel is governed by several laws; the most important is the Law on Biofuels adopted in the first third of 2005. It sets out the underlying principles of State policy on biofuels, its circulation, and determines State support for production (Republic of Latvia, Apr 2005). The law was approved in a more primitive version compared to that initially proposed by the Latvian Biofuel Association (Znatnajs, 2006).

The Latvian Cabinet of Ministers regulation No. 498 “The order of administering circulation of fuel which contains bioproducts”, determines the rules on circulation and the administration of excise tax in relation to pure and blended biodiesel (Republic of Latvia, July 2005).

The Latvian Cabinet of Ministers’ regulation No. 712 “The order in which State support is allocated to a yearly minimum required production of biofuels and in which financially encouraging quotas of biofuel are determined” sets the guidelines for supporting production of biodiesel (Republic of Latvia, Aug 2005).

In addition, Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport defines targets for biofuel consumption in relation to all petrol and diesel sold in the transportation sector. This directive is binding on all EU member states.

Although the legislative framework is not perfect (Balode, 2006; Znatnajs, 2006), the positive aspect is that the framework exists and creates a foundation for the industry’s development (Balode, 2006; Melkins, 2006; Znatnajs, 2006).

Government Stability:

Latvia in the last 15 years has witnessed many different governments. This does not create a favourable soil for continuity, thus threatening development of the biodiesel industry. With Directive 2003/03/EC, this risk is diminished, as development of the biofuel industry is a priority of the European Union. (Znatnajs, 2006; Kisiels, 2006)

6.2. Economic Factors

Economic Development

The general economic level of a country has several implications. A richer country will have more expensive goods, such as cars, in the economy. Additionally, the wealthier the country is, the more transportation services are bought by organizations as a result of higher transportation and logistics needs. Although fuel is rather an un-substitutable commodity, a richer economy will have larger fuel expenses. Latvia has in recent years experienced very rapid GDP[1] expansion, which has contributed to individual and organizational wealth. Real GDP growth in 1995 – 2004 was 5.7 % whereas average growth in 2000 – 2004 was 7.4 %. Both figures exceed GDP growth in the majority of the world.

Putting Latvian economic development into perspective, it can be seen that there is significant room for further development. Compared to the EU average GDP level, Latvia is considerably lagging behind.

Transport Vehicle Statistics

The number of registered vehicles in Latvia is growing at a slightly slower pace than GDP. Over the past 5 years, the number of road transport vehicles grew on average by 5.4 % annually, whereas average GDP growth for the same period was around 7.9 % annually. The number of registered passenger vehicles, the majority of road transport vehicles, has grown faster than the total number of road transport vehicles and slightly slower than GDP (Appendix C, table 1). Hence, just as there is a significant potential for economic development, the room for growth of road transportation vehicles is no less significant.

Looking at the types of vehicle according to fuel type, we can draw two notable conclusions (Appendix C, table 2). In 2005, more than the half of all registered buses and lorries and 18% of passenger vehicles were diesel-powered. The share of diesel-powered vehicles has increased over the past 3 years. In 2003, roughly half of all buses and lorries and 14% of all passenger cars were diesel-powered.

[1] Measure of economic development.

To sum up, the number of transport vehicles in Latvia has been growing at a slightly smaller rate than the GDP growth rate, and the share of diesel-powered vehicles is increasing.

6.3. Socio-Cultural Factors

Society's View on Biodiesel

Because no research has been conducted on society's view on biodiesel, we addressed this factor in our interviews. All interviewees thought that society's view on biodiesel is influenced by fossil diesel prices, because when the diesel price is high the demand for biodiesel increases (Znatnajs, 2006; Kisiels, 2006). Edgars Ruža (2006) speculated that biodiesel is perceived as a lower quality product than fossil diesel, even though its quality requirements are more stringent compared to fossil diesel. In case of quality problems, consumers usually relate these to biodiesel instead of other possible causes, e.g. where the biodiesel was bought (Znatnajs, 2006), and the technical specifics of its usage[2].

6.4. Technological Factors

Advances in Car Technological Development

The majority of diesel-powered vehicles currently in circulation in Latvia are compatible with low-blend biodiesel mixes (up to 5 % of biodiesel in total fuel volume). Some cars can use pure biodiesel without modifications. Volkswagen, for example, since 1997 produces cars that can be fuelled with pure biodiesel. Furthermore, all new diesel cars sold in the EU must be operational with pure biodiesel without modifications (Melkins, 2006; Znatnajs 2006).

To sum up, the legislation is primitive but provides a framework for the industry's existence. The economic environment is favourable and improving. The socio-cultural environment seems to be positive, but depends on the price of fossil diesel. The technological environment is decent and improving, as all new cars have a requirement to be powered with biodiesel without modifications. All in all, the external environment is not perfect, but the potential for improvement exists.

After examining external macro influences, we now turn to our analysis of industry-specific external influences on biodiesel producers.

[2] Use of biodiesel results in so-called "engine cleaning", meaning that the particles left by fossil diesel are cleaned out of the car's fueling system and engine. This initially results in quicker clogging of fuel filters. An uninformed user will think that this is because of biodiesel whereas in reality the particles were left by fossil diesel.

7. Porter's Five Forces Analysis

7.1. Entry Barriers

Here we will discuss the most notable barriers of entry into the biodiesel industry that potential new entrants face.

Economies of Scale

To attain economies of scale, a biodiesel factory should have a capacity of 100 thousand tons of biodiesel (Ruža, 2006; Znatnajs, 2006). There is a view that smaller plants can exist as regional biofuel centres. Such plants will have an advantage in supplies, as rape-seed must be processed within 24 hours of its collection, and will have sufficient economies of scale to compete with large scale factories (Melkins, 2006; Znatnajs, 2006). Small-scale factories are inefficient and will need to expand capacities (Ruža, 2006; Znatnajs, 2006).

Capital Requirement

Creating a large factory requires high capital investment. Ministry of Economics data shows (Dūmiņš, 2005) that the setup of a factory with 100 000 tons of capacity requires 20 to 22 million Euros. Regional factories require around 1.5 to 2 million Euros to build (Znatnajs, 2006; Kisiels, 2006). The infrastructure for smaller scale factories is expensive, thus these plants should be built where some basic infrastructure exists (Znatnajs, 2006; Kisiels, 2006).

Government Subsidies

Government subsidies are a limited entry barrier since they are given to plants with a certain minimum production capacity. The minimum, however, is low, thus this barrier is small.

Access to Distribution Channels

Distribution is essential for this industry's successful development. Currently, several fuelling chains offer pure biodiesel to consumers. These fuel stations are located regionally apart from three in Riga, which are located in traffic-busy regions (Ovi Ltd representative, 2006). For current production, existing distribution is sufficient, but the largest fuel retail companies (e.g., Neste and Statoil), should also retail biodiesel in their fuel stations if the realization is to be expanded. As the main factor for not retailing biodiesel, Statoil and Neste are indicating lack of demand and lack of information in society (Diena, 2006; Stroža, 21 Oct 2005). Additionally, as indicated by Delta Riga, current output is too small to supply the largest retailers (Delta Riga Ltd representative, 2006). Statoil, however, indicated that the introduction of biodiesel in their fuel

stations is in the 2006 perspective (Stroža, 21 Oct 2005), and the Neste network could start retailing biodiesel within three years (Diena, 2006).

To sum up, the current barriers to entry are rather small. The only notable barrier is access to distribution channels, but for current output this does not present a significant barrier.

7.2. Bargaining Power of Buyers

The importance of buyers cannot be questioned – they secure consumption of biodiesel. In this section we will analyze the extent of buyer bargaining power.

Dependence on a Single or Few Buyers

In the fossil diesel industry, dependence on few buyers is low. The same is also true for biodiesel – it can potentially be used by any diesel car. Initially, however, a large customer can create a stable demand, e.g. local municipality for public transport (Ruža, 2006). Also, rape-seed suppliers may buy cheap biodiesel from plants, creating stable demand (Znatnajs, 2006; Kisiels, 2006). The industry does not depend on few buyers, since almost all biodiesel is realized in existing retail chains, with a portion being imported (Stroža, Aug 2005).

Ability of a Backward Integration

The largest fuel retailers can integrate backwards into biodiesel production. For example, Neste in cooperation with the company Total is considering building a biodiesel plant (Kamonen, 2005). For the Latvian biodiesel industry, such integration is a threat if retailers build plants outside Latvia. But because the end price of biodiesel depends largely on the price of rape, which is a homogenous world price (Ruža, 2006), this threat is smaller, since importation incurs high transportation costs.

For individuals, the initial costs of small-scale production would exceed the benefits even in the long-term (Ruža, 2006; Znatnajs, 2006).

The bargaining power of buyers is currently rather small. However, the potential ability of backwards integration is a threat, but only with a significant increase of output.

7.3. Bargaining Power of Suppliers

Importance of One Production Input

Biodiesel production depends on the availability of rape. Almost 80% of biodiesel production costs arise from the price of rape-seed (Kovalov *et al*., 2003). Because rape is sold at a world-determined price, the bargaining power of suppliers seems high. Due to the perishable

nature of rape-seed, however, farmers with no swift access to drying kilns have small bargaining power (Ruža, 2006; Melkins, 2006; Znatnajs 2006), being forced to sell rape at lower prices.

Concentration of Supplying Industry

About half of all rape-growers participate in the cooperative "Latvijas Rapsis". Their production is realized mostly outside Latvia. The other half of rape-growers sell their production in Latvia. Based on output, rape-growers have different trade terms. The smaller landowners are paid with large delays (Ruža, 2006). Thus, rape-growers are moderately concentrated.

Substitutes to Supplier Products

Biodiesel can be produced from other oil-seed plants such as sunflower or soybeans, (Melkins, 2006; Kalniņš, 2006); however, only rape can be successfully cultivated in Latvia (Melkins, 2006; Ruža, 2006; Kisiels, 2006). Other possible substitutes, such as used cooking oil, have very limited supply.

Importance to the Supplier's Industry

Current biodiesel production does not process all rape-seed produced, but the demand for rape-seed is expected to increase. Biodiesel producers are important for rapeseed producers, but exportation possibilities make local biodiesel producers less important for rape growers.

Ability of Forward Integration

Several rapeseed producers use rape-seed oil in their own farming vehicles. The output of these producers is small and the oil is not offered on the general market. If rape oil produced is offered to the market, then the producer must build an excise warehouse for accountancy and quality checking purposes. That incurs significant costs (Melkins, 2006; Znatnajs, 2006), eliminating small-scale forward integration possibility.

Alternatives to Rape Realization

Alternatives to rape-seed realization exist, but are not favourable. One such alternative is production of rape oil for cooking purposes, but that requires quick-access drying kilns, and this market is small.

To sum up, the bargaining power of suppliers who can access drying kilns is quite high. Overall, bargaining power is low because of dependence on biodiesel producers as a result of lack of drying kilns and since other opportunities for rape producers largely do not exist.

7.4. Intensity of competition within the industry

Number of Competitors

Currently one company, Delta Riga Ltd, produces biodiesel. Two companies – Mežrozīte Ltd and Mammas-D Ltd - were expected to start operations in March 2005, each with a yearly capacity of 3000 tons of biodiesel (Diena, Mar 2005). The number of competitors is expected to increase, since at least two large-scale companies are expected to start operations in 2007.

Pace of Industry Growth

In 2005, Latvia reached the biofuel consumption target of 2% (Znatnajs, 2006). Growth has been small, as there was only one factory. However, growth is expected to pick up since there will be new entrants. Potentially this industry can be large, as biodiesel can substitute diesel.

Fixed Costs

Fixed costs make up around 20% of total production costs. This permits the industry to have many producers with relatively low output, ensuring a competitive, rather than a monopolistic, end price.

The intensity of competition within the production industry is currently very small, since there is only one significant producer. This industry can be highly competitive, indicated by the cost structure and the potential size of the industry.

7.5. Pressure from substitute products

Present Possible Substitutes

The only substitute for biodiesel is fossil diesel. Biodiesel itself can be interpreted as a substitute product for diesel. The relatively high price of diesel, created by high oil prices, administrative barriers, as well as subsidies to biodiesel producers, ensure biodiesel's competitiveness with fossil diesel (Kalniņš, 2006). In his book, A. Kalnins (2005, p. 164), indicates that the current cost of 1 litre of biodiesel to the producer is around 0.71 LVL. Since there is a subsidy of 0.17 LVL/litre, the retail price is around 0.54 LVL/litre, making biodiesel competitive with fossil diesel.

Emerging Substitutes

Hydrogen energy is an emerging substitute, with the world's richest countries having a small number of hydrogen cars. This technology in the long-term can create serious competition for biodiesel. Additionally, electric-powered cars are a possible future substitute for biodiesel, but currently such technology is not feasible alone, and can be attractive only in combination with a liquid fuel engine (Hybrid vehicle, 2006).

To conclude, pressure from substitute products is moderate since there are no substitutes for biodiesel other than fossil diesel. Since the price of fossil diesel will likely increase, the threat is likely to diminish.

Up to now we have analyzed the external environment of biodiesel producers. We conclude that the industry suffers from lack of information to society and the small bargaining power of suppliers of rape. Additionally, possible entry barriers might arise in the future, but our analysis shows that currently it is impossible because of lack of both output and demand from society.

Now we proceed with analysis of the internal environment faced by the biodiesel producing industry, which we conduct with analysis of the biodiesel production value system.

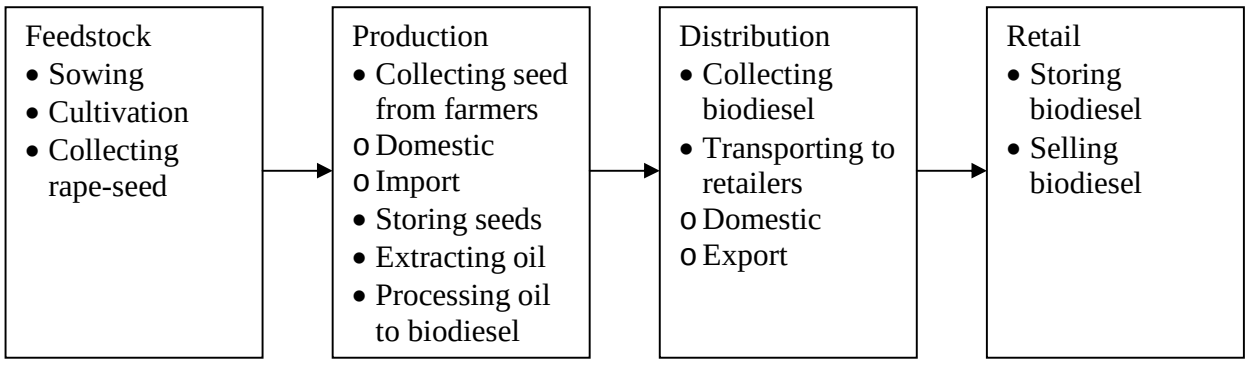
8. Value system analysis

The value system of the biodiesel industry includes the value chain of a biodiesel producer's supplier, the value chain of the biodiesel producer and distribution channels, and the value chain of a biodiesel producer's buyers.

From Pelkmans *et. al.* (2005) we created the following value system:

- Feedstock, which includes growing rape and collecting rapeseed.
- Production, which includes processing rapeseed into oil, transforming oil into biodiesel, and realizing processed rape.
- Distribution, which is the process of transporting biodiesel produced to retailers.
- Retail, which is the collection of biodiesel when delivered and selling it to the final consumer.

Value System of Biodiesel Production



Let us consider now all these processes in more detail, so that we can identify the critical processes in each chain and analyse each critical process.

8.1. Feedstock

The critical factors in the feedstock chain are the availability of cultivation land, rape-yield, availability of cultivation technology, collection technology, and drying technology (Pelkmans *et al.*, 2005).

Availability of Land

Based on data available from the Central Statistical Bureau of Latvia, the total sown area for 2004 was 899.2 thousand hectares, 54.3 thousand hectares of which were used for rape cultivation. There is approximately 1 million hectares of un-sown land (Znatnajs, 2006; Kisiels, 2006). Furthermore, sugar beet cultivators might need to cultivate other plants in the future (Langenfelde, 2006, Jirgena, 2006), meaning that there are no land constraints for cultivating rape.

Rape-Yield

Rape-yield in 2004 was 1.9 thousand tons per hectare. Edgars Ruža explained that in some areas the yield is 5 thousand tons per hectare. On average a typical yield for the Latvian region is 2-3 tons per hectare (Ruža, 2006; Melkins, 2006). This is not as high as in, e.g., Germany, but enough to permit feasible cultivation of rape.

Availability of Cultivation Technology

Most small and middle-sized land owners are still working with technology from Soviet times. Rape cultivation requires specific technology, thus current cultivation is inefficient (Ruža, 2006; Melkins, 2006; Znatnajs, 2006). Still, there were possibilities to acquire technology with the help of the EU support payments (Ruža, 2006; Balode, 2006). Thus, lack of technology is because of lack of information when the support money was available, since if farmers had known that rape would be in demand at the time when the support was available, the cultivation technology could have been more advanced. Furthermore, small landowners cannot operate technology at full capacity (Ruža, 2006; Melkins, 2006), requiring coordination and planning between small landowners. Now it is essential to inform farmers of the need for rape to encourage investments (Znatnajs, 2006; Ruža, 2006). This should come both from government and producers.

Availability of Drying Technology

One of the largest obstacles for rape-seed production is lack of drying technologies (drying-kilns). After the collapse of the Soviet Union, most drying-kilns were vandalized. As explained by Edgars Ruža (2006), ten years ago the government was advised of the need for drying-kilns.

The government did not react, resulting in a lack of drying-kilns now. Gints Melkins (2006) concurs that drying kilns are unavailable and the government is planning measures to tackle this, but a definite action plan is unknown.

Cultivation

Cultivation of rape is not straightforward. To produce the highest possible yields, rape should be cultivated on a given land plot once in a three to four-year period (Ruža, 2006; Melkins, 2006; Znatnajs, 2006). Furthermore, there are two types of rape – summer and winter rape. Winter rape yields earlier than summer rape (Znatnajs, 2006; Melkins, 2006; Jirgena, 2006). Thus, advance planning must be in place for best possible yields and more constant supply of rape-seeds.

Furthermore, weather affects rape yields around once every five years (Melkins, 2006), affecting both farmers and biodiesel producers. For this, government provision is required – financial aid for farmers and fuel reserves to compensate for shortages in biodiesel supplies, when the biodiesel share is more significant.

Finally, there are no subsidies for rape cultivators, whereas in other EU countries they exist. Subsidies are, however, expected to be implemented (45EUR/ha) in the near future.

8.2. Production

The critical factors in the production chain are the logistics of collected seeds, storage of seeds, availability of extraction technology, standards of biodiesel produced, and storage of biodiesel produced (Pelkmans *et al*., 2005).

Collection of Seeds

In case of large factories, collection of seeds will be highly problematic and will involve considerable logistic costs. Such plants would require supplies of dried seeds via water routes since logistics by land routes is expensive. Regional plants would not face such problems, since rape-seeds can be supplied from a radius of 30-40 km and dried at the plant (Znatnajs, 2006; Melkins 2006). Still, collection should be planned to avoid large supplies in very short time frames.

Storing

Storing the dried seeds does not require specific facilities (Melkins, 2006), but that is a factor in production. Large plants will need large storage facilities to accommodate large, infrequent supplies. (Znatnajs, 2006 Melkins, 2006). Regional plants can have smaller facilities having smaller initial and fixed costs. If collection of rape is planned, which can result in a smooth

supply of rape, these costs can be further decreased. Thus, smaller plants represent fewer logistical and storage problems compared to large plants.

Extraction

Extraction has two phases – primary and secondary extraction. Primary extraction yields 30% of oil from the rape mass, and secondary extraction yields 10-12 % more (Ruža, 2006; Znatnajs, 2006). After primary extraction, the processed rape can be used in wide secondary markets whereas after secondary extraction such possibilities are smaller (Znatnajs, 2006; Kisiels, 2006). For large plants, secondary extraction is feasible (Ruža, 2006; Kalniņš, 2006), but not for smaller plants, since secondary markets for processed rape are emerging (Znatnajs, 2006; Kalnins, 2006; Kisiels, 2006).

After extraction, the oil can be used as fuel if the operating temperature of the engine has reached 70 degrees Celsius (Melkins, 2006; Znatnajs, 2006). For transport operated for long periods, such fuel is feasible (Znatnajs, 2006). Several farmers are using such fuel, and modification expenses repay after 7-8 months (Latvijas Avīze, 2006).

Production of Biodiesel

After production, biodiesel cannot be stored for long, (Znatnajs, 2006; Melkins, 2006). On the one side this means that large storage facilities are not required, on the other realization becomes very important. Furthermore, biodiesel must comply with 16 quality requirements. Fossil diesel has only 5 measures. (Stroža, 27 Oct 2005; Znatnajs, 2006; Melkins, 2006). The standards are stringent to ensure that biodiesel is of high quality. Otherwise the industry could have been killed of in its infancy (Melkins, 2006).

8.3. Distribution

The proximity of retailers to producers, as well as logistic routes, are essential factors in this part of the system.

Proximity of Distribution Channels

Proximity is important, as biodiesel cannot be stored for long and distribution incurs costs (Znatnajs, 2006; Melkins, 2006). Currently, this is not problematic since all biodiesel produced is realized and more is imported. The large fuel retail networks should start retailing biodiesel in the near future, expanding distribution channels further. Estimates show that 30 % of extracted rape oil can be sold back to farmers for use in farming machinery (Latvijas Avīze, 2006; Znatnajs, 2006), further improving distribution possibilities.

Large factories will need to export biodiesel (Znatnajs, 2006; Kisiels, 2006) and the proximity of markets is important. If rape oil is exported, proximity is less important, since quick realization is not essential.

8.4. Retail

In the Retail chain of the system, the important considerations are the blending of biodiesel with fossil diesel and final customer demand for biodiesel.

Blending with Diesel

The blending of diesel occurs in excise warehouses under the "supervision" of the State Revenue Service in order to ensure the accountancy and quality of the biodiesel. This is also a requirement for pure biodiesel. As mentioned by Gints Melkins (2006), biodiesel produced for own use need not be stored in these warehouses. This is not encouraged as it creates a risk of poor-quality biodiesel appearing on the market (Znatnajs, 2006; Melkins, 2006). Testing for quality occurs at the warehouses and it is an expensive process, as it cannot be done in Latvia (Znatnajs, 2006).

Realization

Biodiesel can be realized in three mixtures – pure biodiesel, 30% mixture or up to 5% mixture of biodiesel. Mixtures of up to 5% do not require informing the end buyer, whereas the other two mixtures require informing the buyer (Znatnajs, 2006; Melkins, 2006; Balode, 2006). Thus, fuel retailers can benefit from blending diesel with biodiesel up to 5%, since retailers can keep the same price and have a higher margin as a result of the 0% excise tax rate on the biodiesel part. Thus, we expect that retailing of 5% biodiesel will expand. Currently, most biodiesel is realized in pure form. In the future, the larger retail networks are expected to start offering biodiesel, increasing realization possibilities.

So, up to now we have analyzed both the external and internal environments of biodiesel producers and we can briefly summarize the main findings of the internal environment analysis. There are no land constraints on cultivation and rape yield is acceptable. The technological state is poor, largely because of poor communication from the government and producer side. Thus, the average yield can be improved. If cultivation is planned, it can reap benefits along all clusters of the value system. Provisions for bad crop years should be created on a government scale. Furthermore, lack of financial support to farmers is a constraining factor. To reduce the cost of biodiesel, markets for rape by-products should be encouraged. Additionally, the use of rape oil in farming machinery should be encouraged, ensuring some realisation.

Stringent quality requirements must be maintained until biodiesel becomes a widespread product, and distribution networks must expand if the producing industry is to develop, and *vice-versa*.

Now we can proceed with the final part of our analysis, where we discuss interest in the industry's development and power to influence the development of each stakeholder. This will help to identify disparities of power and interest that are hampering the industry's development.

9. Stakeholder Analysis

Within the biodiesel industry there are six main stakeholders: The European Union, the Latvian government (State), the producers of biodiesel, farmers, fuel retailers, and consumers.

9.1. The European Union

Interest

The EU shows high initiative to develop alternative energy sources, since the dependence of the EU on foreign energy supplies is high. Secondly, the EU is interested in decreasing pollution, and non-renewable energy sources have a significant impact.

However, since the EU's aim is to increase consumption and not directly the production of biodiesel, its interest to influence the Latvian biodiesel industry is partial.

Power

The EU directive does not stipulate that every member country must **produce** biofuel, it states that every country should **realize** a certain percentage of biofuel. The importance is that there are measures of punishment set by the European Commission if requirements from directives are not fulfilled. When creation of the biofuels law in Latvia was delayed, the EC threatened monetary sanctions (Znatnajs, 2006; Balode 2006). Despite the power to influence realization, the EU's power to influence production of biodiesel in Latvia is smaller, since the directive emphasizes realization and not production. The realisation target is a significant power nonetheless, as are subsidies to rape growers that are being considered. Hence, the EU's power to influence production in Latvia is medium.

9.2. The State

Interest

The Latvian Government's interest is to increase the State's independence from external energy sources and to foster the economic development of the country. Additionally, the State is interested in rural development, which in general is suffering (Znatnajs, 2006; Kisiels, 2006). There are about 1 million hectares of unsown agricultural land, and rape is viewed as almost the

only way to cultivate that land (Znatnajs, 2006; Kisiels, 2006). These should be pre-requisites for high interest from the State. As we discovered in interviews with Gints Melkins (2006), Andra Balode (2006), and other stakeholders, the State is adopting a sort of "fence-sitting" approach without much influencing the industry's development. Coupled with the fact that the relevant legislation was adopted with delays, the State has small interest in development of the industry.

Power

The State has high power to influence development of sectors of the economy, since it is the legislator. On the other side, legislation should not contradict the common policy of the European Union. Still, the State's ability to create a legislative framework can significantly influence the industry's development, thus its power is high.

9.3. Producers of Biodiesel

Interest

Biodiesel producers are the most interested in the development and prosperity of the industry. Their main driving force is economic profits; hence, their interest is high.

Power

The only real possibility of producers to influence development is to improve society's perception through organizations (e.g. the Latvian Biofuel Association), the media, and marketing. Producers can also influence the industry's development by producing biodiesel of a high quality. Hence, biodiesel producers possess medium power.

9.4. Farmers

Interest

Similar to biodiesel producers, the farmers' main interest is profit. Production of biodiesel can offer this, since there are stable buyers. Thus, the farmers' interest is to have a lasting buyer, who would be ready to purchase rapeseed for fair prices.

Additionally, by producing rape, farmers can create access to cheaper energy for themselves, as farming machinery is suited for using the cheaper rape oil as fuel. Thus, for farmers the interest is high.

However, since farmers can export rape, this diminishes their interest in the industry's development, but that is not an option for all farmers, since many lack access to drying kilns.

Power

Rape cultivators possess two tools to influence the industry - one is the production of rape and the other is exportation of rape-seeds. For farmers who are united in a cooperative, the power to influence is significant, as they can export the seeds. Individual farmers have much smaller power, as without access to drying kilns they are dependent on producers of biodiesel. Still, because farmers can choose to cultivate another crop, their power is medium.

9.5. Consumers

Interest

The interest of end consumers is to pay less for fuel. A secondary interest, which is rare and probably insignificant, is to reduce air pollution. Currently only a small percentage of consumers is using biodiesel, thus interest is quite small.

Power

The consumer has significant power simply because it can choose fossil diesel. Ultimately it is the end buyer who will determine the success of the industry, thus possessing the highest power.

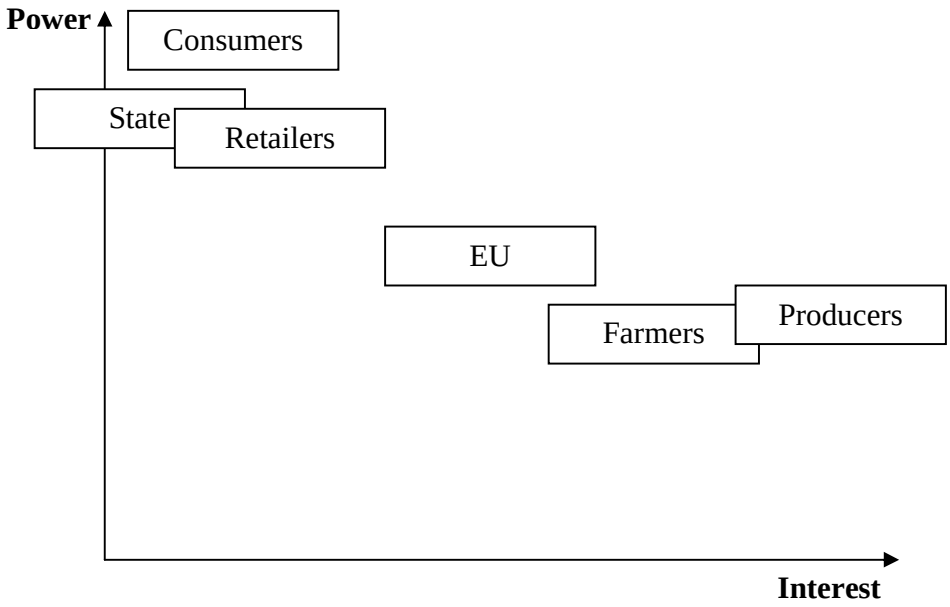
9.6. Fuel Retailers

Interest

Fuel retailers are interested in earning profits. They will realize biodiesel if there is both a sufficient demand for and a sufficient supply of biodiesel. Currently, both are lacking. Thus, the fuel retailers' interest is proportional to consumer interest and producers' output. Currently the interest of the fuel retailers is small.

Power

The fuel retailers' power to influence biodiesel production development is high because they deliver the product to end consumers. Although their power is high, whether retailers will exercise their power or not depends both on consumer interest (demand) and producers' output, and now both are unfortunately lacking.



Above is an illustration of the stakeholder map and several implications can be drawn. There is a group of stakeholders with very high power to influence development of the biodiesel industry but have low interest. Most notably, this is the State and consumers. Retailers are uninterested largely as a result of lack of interest from consumers and lack of output from producers. There are several ways to raise the interest of the consumer. The government can do that by marketing and financial means. That, however, is a slim possibility, given the State's low interest. Another option is for producers and/or the EU to raise consumer interest since they have a high interest and some power to do that. The primary stakeholder for this should be producers, since their interest is the highest.

Once the interest of consumers is raised, retailers will follow and increase realization. The interest of farmers will follow, since the industry will become a stable buyer for them. As a result, the State will have to raise its interest to avoid pressure not only from producers but also from society, farmers, and potentially the retailers.

So, we have analyzed the biodiesel producing industry and now we can present problems, and analyze the measures that need to be taken to facilitate the industry's development.

10. Discussion of Results

We start by summarizing the major problems. Externally, there are two notable problems – legislation is poor and society is uninformed. Another problem is that not all diesel vehicles are suited for using biodiesel. The industry analysis revealed that suppliers of rape are in an

unfavourable position because of lack of bargaining power. Other industry forces present fewer barriers, permitting development of the industry. The value chain analysis revealed that farmers lack farming technology and there is a lack of drying kilns. Supplying plants with seeds is a logistical challenge, especially in the case of large factories. Quick realization is required of biodiesel produced. Furthermore, cooperation with distribution channels is in its infancy. The accountancy of biodiesel flow is problematic, as all biodiesel must be accounted for and tested for quality abroad.

Additionally, essential stakeholders show little interest in development of the biodiesel producing industry.

We think that the problems can be divided into two categories: production problems and marketing problems. Hence, we will propose solutions accordingly.

10.1. Solutions to Production Problems

The main problem on the production side is that farmers have little bargaining power as a result of lack of drying kilns, facing unfavourable prices and payment conditions from biodiesel producers. This creates uncertainty for farmers, which in the long run can slow down the production of biodiesel. This can be solved if all farmers united in an association and build their own drying kilns. That, however, is inefficient and should be avoided. Regional biodiesel plants should be built, but that can create the same problem for farmers, since producers could offer unfair trade terms. The State can participate with own equity in new plants, ensuring stability for the farmers. This process, however, is difficult to control, thus a price regulation mechanism can be created. In Germany, for example, the price mechanism ensures that farmers are paid the previous year's rape price (Znatnajs, 2006), creating certainty and willingness to cultivate rape. Thus, this measure would not contradict the common policy of the EU. Furthermore, production is stagnating because of lack of supply of domestic rape, because of lack of communication from the government and producers of the need for rape. Thus, farmers are reluctant to invest and expand cultivation.

It is essential for farmers to cooperate in cultivation, to avoid simultaneous yields of rape and to increase efficiency of use of technology. For that matter, regional cooperatives and associations can be created where producers can also participate, benefiting themselves.

Since there is no State support for rape growers, farmers are exposed to risks during years of bad crops. Provisions on a government scale, such as compensation and fuel reserves, should be

maintained. Obviously, rape growers must be given subsidies, as are other farmers in other sectors. Additionally, the technology of farming must be improved. The State's arguments that farmers had the chance to acquire the technology with the help of support instruments are odd at best, since there was no vision from the government that such industry has long-term potential, despite suggestions from industry stakeholders. This clearly indicates the State's low interest in development of the industry. The government and producers should clearly communicate to farmers that this industry has high potential, encouraging farmers to invest in farming technology.

Finally, innovation in utilization of processed rape should be encouraged; this can reduce net costs of producers and create new industries in the economy.

10.2. Solutions to Marketing Problems

Marketing problems arise from the fact that the State and consumers, who have the highest power to influence the industry's development, demonstrate small interest. Thus, producers must raise the interest of both. The low interest of the State seems to be a given. That, however, can be changed if producers conduct informative campaigns, raising the interest of consumers, and pointing out the State's low interest. Consumers and producers, coupled with media pressure, can raise the State's interest. The precondition for that is the high quality requirement for biodiesel, minimizing negative experiences. Of course, breaking stereotypes and educating society is required. With time, when the quality of biodiesel is not questioned, the stringent requirements on biodiesel quality might be reduced. In that case, quality tests might be done locally, reducing costs**,** but this is only speculation. Still, stringent quality checks should be maintained for the foreseeable future.

With an increase in interest of consumers, distribution networks would also increase interest in retailing biodiesel. Currently, distribution networks are indicating lack of demand as a restring factor in retailing biodiesel. Since no stakeholder has exact estimates of demand, this argument is valid. Furthermore, large retailers are not interested in retailing biodiesel either because of lack of supply. Hence, the precondition for their interest is sufficient output as well as demand from society.

Moreover, for consumers and retailers a 30% biodiesel blend is pointless. Such a fuel mixture requires modification to those vehicles that require it, as well as separate storage tanks for fuel retailers. A 30% biodiesel blend is also more expensive than a 100% biodiesel blend because of

the excise tax rate on the fossil diesel part. Thus, retailing such a mixture creates transaction costs for retailers and is more expensive to the end consumer than pure biodiesel. This mixture should not, however, be dropped, but its use should not be encouraged – those who do not want to modify their vehicles will either use fossil or a 5% biodiesel blend, and those who modify their vehicles will prefer a 100% biodiesel blend. Under market conditions, this mixture will disappear anyway.

11. Suggestions for Further Research

Now that we have answered our research questions we can suggest the most pressing areas for further research. Since no stakeholder group has a concrete estimate of the demand for biodiesel, such research needs to be carried out, since in our research we assumed demand for biodiesel as a given. The results will show the exact demand for biodiesel, aiding in the planning of construction of factories. Additionally, such an estimate will help fuel retailers in evaluating the possibilities of retailing biodiesel.

Additionally, research on society's views on biodiesel needs to be conducted in order to know society's attitudes, stereotypes, and other matters. With this information, efficient marketing campaigns can be planned and targeted specifically to raise the awareness and interest of society, which we consider as one of the main problems.

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Appendix A
Interview guide

PEST questions

Political factors

What is the current legislation governing biodiesel production and circulation?
What are the implications of being part of EU?
Latvian Government – activities in biodiesel industry?
How can upcoming Government elections influence biodiesel industry?

Economic factors:

What are the economy-wide factors affecting biodiesel industry?

Socio-cultural factors:

What is the Society's concern by ecology issues?

Technological factors:

What are the main technological factors influencing biodiesel industry?

Porter's five forces

Entry barriers

Are there significant economies of scale?
Are the capital requirements big?
What is the importance of distribution channels?
Is government's policy supportive for production of biodiesel?

Intensity of competition within industry

What are the expectations of industry growth?
Are there high fixed costs (in production)?
Are there high storage costs?
Are there high exit barriers?

Substitute products

What are the emerging substitutes? Their significance?

Bargaining power of buyers

Is there huge dependence on single/several buyers?
Are there significant switching costs for the producer to switch to another buyer?
Do buyers have ability to integrate into biodiesel production?
Competition - how informed are buyers of alternative?

Bargaining power of suppliers

How concentrated is the rapeseed producers' industry?
What are the possible substitutes to rapeseed?
Are biodiesel producers important customers to rapeseed producers?
Can suppliers forward-integrate into the biodiesel production industry?

Internal value system questions

Feedstock

How much Land is suitable for growing rape in Latvia?

What is the Rape yield?

To what extent are cultivation, collection and drying technologies available to rapeseed producers?

Is it profitability to cultivate rape?

What is the time-lag between demand for rapeseed and the supply?

Production

To what extent is Logistics significant in the process of collection dried seeds?

From local market?

Imports?

Is the Storage technology of dried rapeseeds specific?

What is its availability?

Are oil extraction technologies/biodiesel production technologies available?

Are there and what are the Difficulties in reaching biodiesel quality standards

How important is Storage of produced biodiesel. Is there anything specific?

Distribution

To what extent is proximity of retailers to biodiesel producers important?

What are the currently available logistic roots? Are they sufficient?

Domestically?

Exports?

Retail

Where is the blending of biodiesel with fossil diesel performed?

What is the Fuel consumption of biodiesel in relation to fossil diesel?

Stakeholder questions

Who are the main stakeholders in the industry?

What are the available tools to different stakeholders to influence industry development?

Appendix B
Interviewees and commenting persons

Edgars Ruža	Director of the Cooperative “Latraps”
Gints Melkins	Head of agricultural infrastructure department
Andra Balode	Deputy head of the department of the Government’s support
Daumants Znatnajs	The president of the Latvian Biofuel Association
Helma Jirgena	The director of agricultural department of the Latvian Ministry of agriculture
Jevgenijs Kisiels	The President of the Latvian Association of fuel producers and retailers
Arnis Kalniņš	Doctor of economic sciences

Appendix C

Figure 1

Transport vehicles total

	1995	2000	2001	2002	2003	2004	2005
Lorries (including road tractors)	68700	97100	99700	102700	104626	107553	113113
Growth of lorries		41.3%	2.7%	3.0%	1.9%	2.8%	5.2%
Busses	16500	11500	11500	11300	10983	10740	10644
Growth of busses		-30.3%	0.0%	-1.7%	-2.8%	-2.2%	-0.9%
Passenger cars	331800	556800	586200	619100	648901	686128	742447
Growth of passenger cars		67.8%	5.3%	5.6%	4.8%	5.7%	8.2%
Total transport vehicles	417000	665400	697400	733100	764510	804421	866204
Growth of total transport vehicles		59.6%	4.8%	5.1%	4.3%	5.2%	7.7%
GDP growth			8.0%	6.5%	7.2%	8.6%	9.1%

Source: Latvian Statistical Yearbook 2004, Latvian Statistical Yearbook 2005

Figure 2

Transport vehicles according to type of fuel in 2003								
	Lorries	%	Busses	%	Passenger cars	%	Total	%
Petrol	49041	46.9%	5137	46.8%	543374	83.7%	597553	78.2%
Diesel	52637	50.3%	5530	50.4%	91089	14.0%	149257	19.5%
Petrol and natural gas	2767	2.6%	305	2.8%	14369	2.2%	17441	2.3%
Natural gas	181	0.2%	11	0.1%	69	0.0%	261	0.0%
Total	104626		10983		648901		764512	
Transport vehicles according to type of fuel in 2004								
	Lorries	%	Busses	%	Passenger cars	%	Total	%
Petrol	46602	43.3%	4590	42.7%	557990	81.3%	609182	75.7%
Diesel	57850	53.8%	5863	54.6%	109432	15.9%	173145	21.5%
Petrol and natural gas	2928	2.7%	278	2.6%	18644	2.7%	21850	2.7%
Natural gas	173	0.2%	9	0.1%	62	0.0%	244	0.0%
Total	107553		10740		686128		804421	
Transport vehicles according to type of fuel in 2005								
	Lorries	%	Busses	%	Passenger cars	%	Total	%
Petrol	45175	39,9%	4315	40,5%	587376	79,1%	636866	73,5%
Diesel	64687	57,2%	6051	56,8%	131569	17,7%	202307	23,4%
Petrol and natural gas	3079	2,7%	269	2,5%	23445	3,2%	26793	3,1%
Natural gas	172	0,2%	9	0,1%	57	0,0%	238	0,0%
Total	113113		10644		742447		866204	

Source: Latvian Statistical Yearbook 2004, Latvian Statistical Yearbook 2005