Bachelor Thesis

Improving the Bioethanol Sector in Germany, France and Spain



University of Twente
School of Management and Governance
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Sebastian Anderke
s1073931

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Supervisor:
Dr. Joy S. Clancy

Second Reader:
Martin Stienstra

Abstract

Modern global threats like the climate change and the rising oil prices increasingly influence the EU and its citizen. Renewable technologies, such as biofuels, are being more and more used to fight these treats or to limit at least their consequences. The Thesis at hand contributes to the increasing use and analysis of biofuels as anticipated by the EU.

It is a study focusing on the bioethanol sectors of Germany, France and Spain. Thereby it analysis their current bioethanol sector to give recommendations for improvement. Porter's Diamond Model, which elaborates the competitiveness of a nation for a specific industry sector, is the tool used for the analysis. The great advantage this tool brings with it, is that it draws a very clear picture of the national competitiveness, allowing for an in-depth estimation of the countries strengths and weaknesses in the given sector.

As the analysis shows Germany has a strong national competitiveness in the bioethanol sector. Nevertheless it is recommended to strengthen the cooperation of different industries to support each other and to fend of foreign imports, thereby increasing the demand for bioethanol.

Like Germany France also has a strong national competitiveness in the bioethanol sector. Part of this strong national competitiveness is derived from tax relief. To decrease fiscal expenditure the French government is advised to switch from the policy tool of tax relief to the policy tool of mandatory blending quotas in order to promote the bioethanol demand.

Spain has in contrast to the previous two countries a medium weak national competitiveness in the bioethanol sector. This can be partly traced back to the current economic recession in Spain and the monopolistic character of its bioethanol sector. The policy recommendations take these special circumstances into account and aim at helping the industry sector to become more competitive. Among other things Spain is advised to help bioethanol companies getting credits for further development and to improve the national human resources.

Overall recommendations to the four countries include a continuing support of bioethanol as this will help the countries in many ways. They are furthermore advised to increase their endeavours in research projects, especially at those that aim at reducing negative externalities of the bioethanol production.

Following the recommendations will help the three countries to tackle the previous mentioned pressing problems of today.

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List of Abbreviations

Diesel with a 100 % share of biodiesel	B100
Dried Distillers Grain	DDG
Ethyl tert-butyl ether	ETBE
European Union	EU
Greenhouse Gas	GHG
Instituto de Crédito Oficial	ICO
Petrol fuel with a 5 % share of bioethanol	E5
Petrol fuel with a 10 % share of bioethanol	E10
Petrol fuel with a 85 % share of bioethanol	E85
Research and Development	R&D
United States of America	USA

1. Introduction

The increasing awareness and combating of the climate change as well as the rising oil prize have made biofuels[1] becoming a major topic on the agenda of policy makers as well as scientists in recent years. Different programmes to improve and promote the generation and usage of biofuels were set up (Balat, 2007). Bioethanol, on which my Bachelor Thesis will turn its attention to, is one among several biofuels which are increasingly operated economically. Connected to the use of biofuel is the proponent's perception to make use of the advantages, mentioned later in this abstract, these fuels poses compared to fossil fuels. Because different proponents have dissimilar assumptions about the biofuels itself and the advantages and disadvantages they bring along them, various policies with different emphasis have been created (Londo & Deurwaarder, 2007). These differences lead to different economic conditions for companies operating in the biofuel sector. The Bachelor Thesis at hand will look at these different economic conditions for the bioethanol sector from a national perspective assuming that national governments are the driving forces behind the different policies. For states belonging to the European Union (hereafter: EU) the initiative might have come from an EU institution; however it is the national law in which the initiatives are transformed into programmes (Londo & Deurwaarder, 2007).

In this context the EU Directive 2009/28/EC and Directive 2009/30/EC are of great importance. Whereas the former requires the Member States to have a 10% share of renewable energy in the transport industry by 2020 (Commission, 2009a) the latter makes, among other things, a 20% reduction of greenhouse gas[2] (hereafter: GHG) emissions in the transport industry by 2020 compared to 2010 mandatory (Commission, 2009b). Within these Directives the EU set up coherent targets for all its belonging Member States. This allows for a detailed analysis of the different methods Member States have on how to reach that goal.

The two EU mentioned directives can be seen as part of a long lasting biofuel debate that started around 25 years ago (Londo & Deurwaarder, 2007). Despite this long period of time, seen from a political perspective, the arguments to promote biofuels almost did not change and can be boiled down to three main points. The first argument says that they will have a positive impact on fighting the climate change, although this impact differs with the type of biofuel. Using biofuels, especially in the transport industry, is said to release less GHG into the atmosphere compared to a higher GHG footprint of fossil fuels (Balat, 2007). The second argument in favour of biofuels is that it will decrease the oil dependency from oil exporting countries. If EU Member States have the possibility to produce their own fuels, this would

1 In the context of this Thesis biofuels are defined as 'liquid or gaseous fuels made from plant matter and residues, such as agricultural crops, municipal wastes and agricultural and forestry by-products` (Balat, 2007: 1)

2 A GHG is any of the gases whose absorption of solar radiation is responsible for the greenhouse effect, including carbon dioxide, methane, ozone, and the fluorocarbons (Dictionary, K 201)

lead to a relative decrease of oil import. The third argument says that they could help to support the rural development, where the crops for the biofuels are planted (Londo & Deurwaarder, 2007). However, there are also two main arguments against an increase in producing and using biofuels. The first argument says that they are not reducing GHG emission in the amount that is anticipated by their proponents. Conflicting publications, either in favour or against biofuels, furthermore fuelled this debate (Londo & Deurwaarder, 2007). The second argument says that biofuels might negatively affect the prices of food. It is argued that biofuels consume agricultural land making it more valuable which will then lead to an increase in food prices but also in price volatility (Balat, 2007). The paragraph above gives a small outline of the current debate concerning biofuels. Although my Bachelor Thesis will deliberately not contribute to the on-going debate, it is useful to keep it in mind, to be better able to evaluate policy and business practises regarding their sustainability and effects on the environment.

My Bachelor Thesis will pay a close attention to economic conditions and policy practises influencing bioethanol producing industries within some European states. It will look at the countries of Germany, France and Spain to give a detailed analysis and comparison between these three states. They are the biggest producer of bioethanol in the EU[3] and have comparable basic conditions for producing bioethanol (Flach, et al., 2012). Within all three states the main energy crops for the production process are either cereal crops (mainly maize, rye, wheat and barley) or sugar crops (mainly sugar beet). The latter are transformed into bioethanol by firstly extracting the sugar from the plant, which is processed further into bioethanol with the help of fermentation and distillation. The cereal crops undergo a similar refining process with the exception that the additional step of breaking down the starch with the help of either acid hydrolysis or enzymes into sugar is needed (RESTMAC, 2008). Another starting product is lignocellulosic biomass which is transformed into alcohol with enzymes breaking down the cellulose into sugar. This way of generating bioethanol is called 2nd generation bioethanol and plays only a marginal role in today's production. Because this process is more expensive than the 'traditional' ways of refining bioethanol it is still in the developing phase trying to reduce costs and to increase the efficiency (Poganietz, et al., 2008). With only small dissimilarities the refining processes are very similar in the three countries under study and all three have a similar level of technological development in the bioethanol sector. The difference between these countries therefore lies in the national policies and thus the economic conditions.

The major intention for me to conduct this research lies in the deep analysis of climate change during my Bachelor studies. In many subjects I came across this very pressing problem affecting many aspects of our every-day life. Therefore I want to contribute to its solving. As bioethanol is a technology that is correlated to fighting climate change and is

[3] Together Germany (759 mil. liters), France(949 mil. liters) and Spain(465 mil. liters) produced 43,5 % of the total EU production (5,000 mil. liters) in 2012 (Flach et al, 2012)

dealt with extensively in the media I choose to focus on this topic. The following Thesis is thereby intended for policy-makers within ministries (environment, agriculture and industry) as well as parliaments. It takes the latest developments, like the anti-dumping tax on American bioethanol, into account to equip these people with good a good analysis and good solutions to foster bioethanol demand and production.

The underlying target of the Thesis is to investigate the national competitiveness, as an indicator of the general economic conditions prevailing in a country, within these three countries in the field of bioethanol; that is to show where the strengths and weaknesses of each country are. From this investigation an advice will be given on how to improve policy programmes, which means to foster the bioethanol production, of the three countries under study.

1.1 Research question

Deriving from the afore-mentioned the research question guiding this study will be:

> *In what way can the governments of Germany, France and Spain improve their domestic bioethanol sectors to make them more competitive?*

To be able to better answer this question it is further subdivided into two sub-questions. The first sub-question thereby concentrates on elaborating the strengths and weaknesses of the three different policy programmes. Answering the first research question will thereby examine the national competitiveness of the countries' bioethanol sector with the help of Porter's Diamond Model. The wording of the first sub research question is the following:

I. How competitive are the bioethanol sectors of Germany, France and Spain?

The second sub-question aims at taking the information derived from the first research question as input. It investigates how the national competitiveness of the bioethanol can be further enhanced. The second research question therefore is:

II. Which policies are to be introduced to enhance the national competitiveness of Germany's, France's and Spain's bioethanol sector?

The main research question as well as the two sub-questions are descriptive types of research question. The answers to the first questions will require an analysis of the national competitiveness, whereas the second answer will be a suggestion for improvement to policy decision makers.

The following chapter will elaborate the concept of national competitiveness and the theory of Porter's Diamond Model which is the basic tool for the intensive study of the bioethanol sector.

2. Theory

2.1 Competitiveness

In order to find out about the strengths and weaknesses of an industry sector in a country, one should look at its competitiveness. One speaks thereby of national or macro competitiveness to contrast it against the competitiveness of a single company. A national business sector that is competitive on the world market is, generally speaking, able to compete successfully against the specific business sector from other countries (Ball, et al., 2004). This is the basic requirement for the sector, in this case the bioethanol sector, to survive and to grow, which is important to fulfil EU and national regulation and to become independent from bioethanol imports.

Competitiveness is not an absolute term measuring a distinct concept. There is also not an overall consent on how to define competitiveness, because it depends on the point of view from which to look at competitiveness (Balkyte & Tvaronavičiene, 2010). It can be broadly defined as '*the ability to produce the right goods and services of the right quality, at the right price, at the right time. It means meeting customers' needs more efficiently and more effectively than other firms do (Edmonds, et al., 2000: 20)'*. This definition of competitiveness is from a company perspective emphasising the ability to do the right thing in an efficient way.

However competitiveness does not necessarily relate to companies only. A region, a country or the EU, consisting of several countries, may be competitive as well, as Balkytė and Tvaronavičienė (2010) point out. This does not mean that the regions or the countries directly compete against each other. It is rather the companies of these areas that do so. However, because the companies competitiveness is affected by economic and social conditions as well as political actions, it is the nation that is important for the overall competitiveness (Ball, et al., 2004). Thereby the emphasis lies on, similar to a company, doing the right thing. However, in this case it is not what the customer wants but rather enabling citizens to produce high incomes. Thus, competitiveness from a national perspective would be defined as '*the set of institutions, policies, and factors that determine the level of productivity of a country. The level of productivity, in turn, sets the sustainable level of prosperity that can be earned by an economy" (Schwab et al., 2009: 4).* The International Institute for Management Development also uses the idea of evaluating competitiveness on a national level by the nation's ability to foster economic growth: *"Competitiveness of Nations is a field of Economic theory, which analyses the fact and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people" (Garelli, 2005: 2).* Porter who studied national competitiveness in the late 1980ies developed a

theory on how to conceptualize and investigate national competitiveness in a theoretical model.

2.2 Porter's Diamond Model

In order to measure national competitiveness in the three countries under study the Diamond Model developed by Michael Porter in his book 'The Competitive Advantage of Nations' will be used. By asking himself *'why do some social groups, economic institutions, and nations advance and prosper?',* (Porter, 1990: xi) Porter maps the competitiveness of business clusters in ten important business nations. He thereby illustrates the dynamics that potentially exist and make out the competitive advantage one nation enjoys over the other in a given business sector. He generalises these dynamics and transforms them into model called the Diamond Model, usually referred to as the *Porter's Diamond Model*. His intention behind his book was '*to help firms and governments to choose better strategies and make more informed allocations of national resources*' (Traill & Pitts, 1998: 17).

This model nowadays is well established and is heavily used by researchers and business consultants alike (Clancy, et al., 2001; Traill & Pitts, 1998). His book had a huge impact on the scientific community in two ways. First it provided a tool that is known for its multifaceted analysis of national competitiveness. The Diamond Model became famous for concentrating on different determinants of competitiveness and the intermediating linkage between them, thereby going beyond existing theories of the time it was formulated (Grant, 1991). Secondly it received a lot of attention and critique by the scientific community, which is dealt with in the next abstract of this chapter (Traill & Pitts, 1998).

Other models to estimate the competitiveness of nations are the 'Double-Diamond Model' which takes the international activities of the companies into account and the 'Nine-Factor Model', which is an extension of Porter's Model. The reason these model were not chosen as the analysis tool is, for the Double-Diamond Model, that a lot of attention is paid to the international environment (Staskeviciute & Tamosiuniene, 2010). However I want to primarily focus on the competitiveness within the three economically big countries Germany, France and Spain dealing with the international aspect only marginally. The focus of the bioethanol producers of the three states lies almost solely upon the domestic national market. Despite the Single European Market, the international aspect, which is exporting of bioethanol, is not of great importance to them up to now. Only Spain exports the surpluses, which make out 1.9 % of the national bioethanol production, to other European countries. The Nine-Factor Model was not chosen, because it is very similar to Porter's Model, however it received very little attention (Staskeviciute & Tamosiuniene, 2010). Due to this little attention I was not fully able to guarantee its validity.

In his model Porter distinguished between four determinants that create national competitiveness as well as two variables that influence these determinants. The degree of the national competitiveness an industry enjoys depends on the state of the determinants. Thereby the determinants are mutually dependent on each other; thus one strong determinant alone will not lead to a strong national competitiveness. Generally speaking all four determinants have to be strong for a solid national competitiveness. However if one determinant is weak within a nation this does not automatically mean that this nation possesses a weak national competitiveness. It can still be competitive, however its competitive potential is constrained be the weak determinant. Porter acknowledges that even nations in which only one or two determinants are strong can be competitive in industries involving little advanced technology; whereas this competitiveness is unsustainable and other nations are likely to achieve competitiveness in these industries as well (Porter, 1990).

The four determinants are 1) Factor Conditions, 2) Demand Conditions, 3) Related and Supporting Industries as well as 4) Firm Strategy, Structure and Rivalry. These four determinants are furthermore influenced by two variables, which are 1) Government and 2) Chance. Unlike with the four above mentioned determinants these variables do not interact with each other but only influence the determinants (Porter, 1990). The following figure gives a detailed overview of the Porters Diamond Modell with its four determinants and two variables which determine national competitiveness:

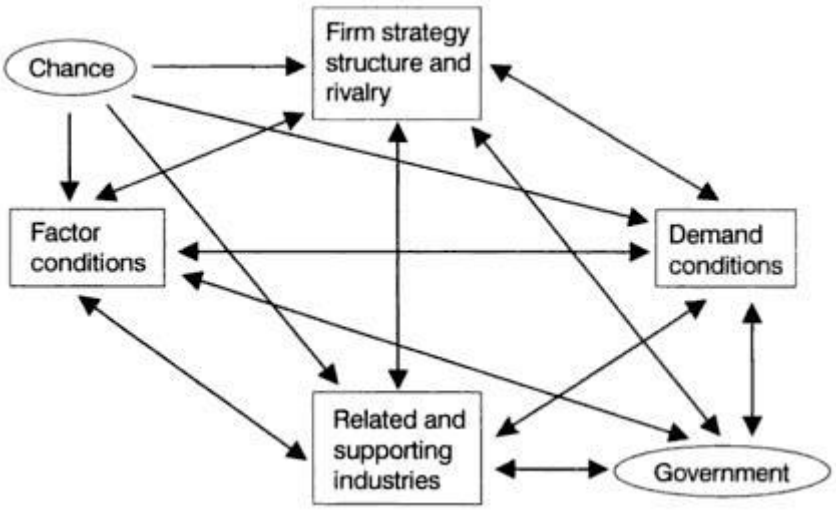

Figure 1: Porter's Diamond Model from 'The Competitive Advantage of Nations' (Traill & Pitts, 1998)

Factor Conditions: Porter (1990) adopted this determinant from the *factors of production* being part of standard theory of trade. Therefore he distinguishes between the Human

Resources, Knowledge Resources, Physical Resources, Capital Resources and Infrastructure.

Demand Conditions: This determinant describes the home market and thus the national demand of a product. A strong home market benefits companies who are then able but also forced to innovate in new products. With the high quality products they have an advantage over competitive foreign companies, even if the domestic demand declines (Porter, 1990).

Related and Supporting industries: These are the supplier and supportive services of the given industry sector. Such companies consume useable by-products, produce cost-effective solutions and often participate in the innovation process. If these companies are present they stimulate the innovation process, which again leads to a competitive advantage (Porter, 1990).

Firm Strategy, Structure and Rivalry: These three aspects of company determine the success of the companies abroad. The way companies set their goals and experience barriers of market entry is important to the company's success. Companies which face a harsh competition in their domestic market are more likely to have made the right decision, which in turn gives them an advantage in national competition (Porter, 1990).

Government The government can influence the afore-mentioned determinants by policies and/or other legal constrains. This may also occur indirectly by influencing the customer or production chain of companies (Porter, 1990).

Chance This variable groups all events that are outside of control of a firm or government. These events are of great importance to a company as they create discontinuities and can rise or lower its competitiveness. Examples for such events are war, weather extremes or technological breakthroughs (Porter, 1990).

2.3 Critiques of Porter's Diamond Model

Although this model of Porter is widely recognised and used, as described above, it also attracted a lot of critique. The main points of critique that arose concerned his idea of 'home base' and the deriving of his theory.

One assumption of the Diamond Model is that companies possess a 'home base' from which they operate in the international markets. However, as Clancy et al (2001) point out, this does not hold true for small open economies as for example Canada, Finland, Austria, New Zealand or Ireland. In these countries the economic prospects are too limited to be most important to some industries. Therefore, industries do not use these countries as their home base from which they compete in the world market but rather see their home base in the international sphere, where they possess greater economic prospects. This argument against the use of the Diamond Model however can be neglected in the context of this Bachelor Thesis. Germany, France and Spain possess a strong economy with many businesses and a sufficient domestic demand. As mentioned in the previous abstract the bioethanol producer of these three countries concentrate almost solely on the domestic market.

The second point of critique concerned the way Porter derived his theoretical model. Researchers such as Ingram (1991) observe that Porter did not build his theory upon existing theory but rather used '*a shower of anecdotes*' (Ingram, 1991: 50). Ingram furthermore criticises that his theory is to be seen as suggestive hypothesis, which are not tested by Porter. Ingram's critique is contradicted by Grant (1991). He mentions that, although Porter uses multiple sources to build his model on, these are theories and concepts mostly originating from the field of strategic management. Although Davies and Ellis (2000) weaken the argument that Porter's theory was not tested by Porter due to the inductive character of his research, they criticise Porter's case selection. For his theory building Porter selected 111 different industry sectors in ten technologically-advanced nations[4]. Because of this the external validity of his Diamond Model is to be judged as low, since it cannot be guaranteed for technological-undeveloped countries (Davies & Ellis, 2000). This point of critique is noteworthy; however it does not have any influence on my Bachelor Thesis. Within my Thesis I concentrate on the countries of Germany, France and Spain which are all technological-advanced countries. That is why the Diamond Model is applicable to them.

From a political perspective I have to criticise Porter's Diamond Model for neglecting a mutual influence between the two variables Government and Chance. This neglecting in my opinion only holds true for the fact that the Government is not able to influence Chance. However the other way around there is an influence. For example extreme weather conditions such as floods will cause the governments to establish funds to absorb the financial damages or to react with other policies.

[4] These nations are Denmark, Germany, Italy, Japan, Korea, Singapore, Sweden, Switzerland, United Kingdom and the USA.

The following chapter will elaborate the methodological framework as well as important scientific aspects which are relevant to this Bachelor Thesis.

3. Methodology

3.1 Research design

The research design I choose for my Bachelor Thesis is a 'framework guided description'. The basic assumption of this research design is to use a theoretical model and to apply it to a specific situation. This is a deductive way of doing research with the exception that the model is not to be confirmed at the end of the research process, but is handled by the researcher as a given element. This does not necessarily mean that the theoretical model is taken as granted. The researcher has to make sure the model is suitable for applying it to the given situation. Furthermore he has to guarantee for the model, which means that the model is truthful and accepted by the scientific community. A critical assessment of the theoretical model by the researcher is therefore of great importance (Gerring, 2011).

Applying this research design to my Bachelor Thesis means that, with the help of a model, in this case the Porter's Diamond Model, I will identify the strengths of the determinants and variables present in Germany, France and Spain. With the help of the analysis I will rank the determinants into the categories Strong, Medium Strong, Medium Weak or Weak. Therefore applying the model to the three countries will show the strengths and weaknesses of the countries in their national competitiveness which I am then able to use for qualified improvement suggestions. The advantage of this research design is that it allows me to draw a very clear picture of the unit of analysis, the bioethanol sectors of Germany, France and Spain.

The following scheme visualizes the structure of my Bachelor Thesis:

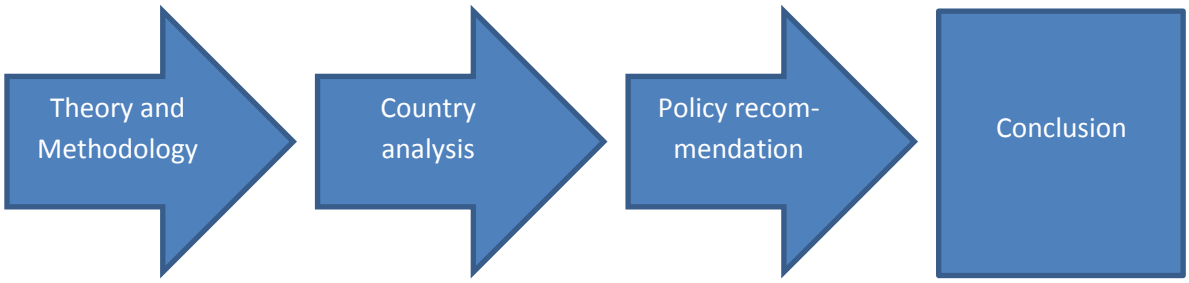

Figure 2: Structure of the Bachelor Thesis

Many threats to internal validity such as Testing, Instrumentation, Statistical Regression or Contamination are not applicable to the chosen research design as they refer to

experimental research design, dealing with a dependent and an independent variable (Gerring, 2011). However one threat to the internal validity, which has to be taken into account, is Maturation. The conducted analysis and correlated to this the given recommendations are only valid for a certain period of time; that are one to two years. This is because events, which happened after the analysis might change the national competitiveness, so that the recommendations become out-dated.

Other threats to validity, being important to take into consideration, are Construct Validity, which is whether the Diamond Model is suitable for measuring the aspect of national competitiveness, and Content Validity, which is whether the Diamond Model covers all aspects of national competitiveness (Babbie, 2012). Turning towards Construct Validity, the Diamond Model is to be considered as an applicable theory to measure national competitiveness. This assessment is supported by multiple researchers, as indicated above. Therefore my Thesis possesses high construct validity. Because the Porter Model draws on multiple facets from existing theory the construct validity is to be judged high as well. The previous mentioned critique that the model is not applicable to small open economies does not decrease this assessment, because it does not reduce the span of the Diamond Model in covering the aspects of national competitiveness.

A disadvantage of this analysis is that it does not allow for generalization; that is its external validity is to be assessed as quite low. Because I will be able to give recommendations on the basis of an analysis, these recommendations are only valid for the countries under study. (Babbie, 2012). I cannot guarantee for a correct application of the recommendations towards countries outside this study. Although this limitation exists it does not influence the core character of my study that is to determine the national competitiveness of the bioethanol sector in the countries under study.

The reliability of the Thesis at hand is very dependent upon the span of time that passed since its publication. I judge the reliability as very high in the near future, as I am confident possible retest will show similar results as this Thesis. However, as mentioned earlier in this abstract, possible events might influence the basic conditions and thereby the national competitiveness of the bioethanol sectors under study. Therefore an analysis conducted in e.g. five years from now might not derive at the same results.

3.2 Case selection

As described already in the introduction the focus of this Thesis lies upon the countries of Germany, France and Spain. There are two main reasons for choosing these three specific countries as the units of observation. The first is that within the EU these countries are the most important ones to my study measured against their amount of bioethanol

consumptio(Flach, et al., 2012)n. Taken together they make up for over 50 % of the total EU bioethanol consumption in 2012[5] (Flach, et al., 2012). This means they have an established bioethanol sector with a dense network of supplying industries and customers. That is important because the Porter's Diamond Model which is the key component to my analysis is most useful for me in a business sector in which all four determinants, as listed below, are at least partially present. If they are at least partly present I can give detailed suggestions on how to improve the determinant. This is not possible if a determinant is too weak in a country.

The second reason is that the bioethanol sectors of the three countries are quite alike. They have a similar way of producing the bioethanol, as listed above, as well as a comparable amount of bioethanol production. (CrossBorder-Bioenergy, 2012)[6]. This similar condition allows for a clearer comparison of the countries as influencing variables, such as means of producing bioethanol, are weakened. The result is that I am able to treat the countries alike, that is to develop improvements which are valid for all three countries.

3.3 Data selection

The data, necessary to determine the strengths of the four determinants and two variables in the three countries under study, is mostly secondary data. It comes from scientific articles, published in peer-review journals, as well as official documents. Official documents are legislative texts, official company and business association texts and reports from governmental as well as non-governmental organization. All these documents are controlled for their independence as well as methodological suitability to guarantee a high level of scientific quality within this Bachelor Thesis. Primary data, which is unfiltered compared to secondary data, was deliberately not chosen due to several reasons. The most important reason is that the Diamond Model is a very broad model which takes a lot of aspects into account. The amount of aspects is furthermore increased due to the study of three different countries. To get a sufficient amount of data would require an extensive collection of primary data, which was judged to be too resource consuming, that is time and money consuming. Another argument for choosing secondary data was that it allowed for a clearer recognition of relationships between the four determinants and thus a better overview of national competitiveness. That is because interviewing e.g. a company will not illustrate how the Demand Condition of a nation is be evaluated.

[5] The German (1,709 mil. liters), French (949 mil. liters) and Spanish (456 mil. liters) consumption of bioethanol makes up 53.2 % of the total EU consumption (5,853mil. liters) in 2012.

[6] CrossBorder-Bioenergy is a project coordinated by business associations, consultants and scientists and co-financed by the EU that helps SME's to evaluate bioenergy markets in Europe and help them with their investment decisions.

In the following chapter I will give an overview of my findings over the three countries under study. I will analyse all important aspects of the four determinants and the two variables for each country.

4. Country Analysis

In order to analyse the national competitiveness I will first elaborate the determinant Factor Condition. This is followed by the determinants of Demand Condition, Related and Supporting Industries as well as Firm Strategy Structure and Rivalry. The analysis of the Government and the Chance variables forms the end each country specific analytical part.

4.1 Germany

Factor Condition

The first German determinant under consideration is the determinant Factor Condition. It is to be subdivided into several smaller aspects. These are, as mentioned above, 'Human resource', 'Knowledge resource', 'Physical resource' which is the feedstock in this case, 'Capital resource' and 'Infrastructure'. Starting with the Human Resource one can say that Germany is well equipped with this resource. Germany has a deregulated job market with good availability of workers. However the German industry is warning about a shortage of high skilled worker, which might also affect the Bioethanol sector (OECD, 2012b).

Knowledge Resources are very present in Germany. The country has a strong tradition in the engineering and chemical business sector. On top of that Germany has a high amount of universities and other research facilities (Commission, 2013b). Many of these universities offer studies in agronomics and bioenergetics/renewable energy, so that a lot of knowledge is created in the universities (FNR, 2013).

Physical Resources needed for the bioethanol production are agricultural crops, mostly cereals and sugar beets. The amount of crops that are available for the bioethanol industry depends on the amount of available arable land and on the yield of this land. Prognoses say that both of these factors will rise in the next years for Germany. This is because advanced growing and processing technologies lead to an increasing supply of energy crops whereas on the other hand a shrinking population in Germany lowers the need for land used for food production. Therefore the supply of physical resources can be considered as very sufficient (CrossBorder-Bioenergy, 2012).

The same holds true for the Capital Resources needed for investments. This assessment is supported by two facts. Germany is marked on the one hand as very safe country for investment. That is, Germany is assessed to be stable with only a marginal risk of loan default due to public failure. On the other hand banks in Germany have experience with giving loans for bioenergy projects and production facilities. Due to the 'Energiewende', the concentration on renewable sources of energy by the German government, a lot of investments are made in bioenergy projects and projects for renewable sources of energy (CrossBorder-Bioenergy, 2012).

The Infrastructural aspects also support the bioethanol industry in Germany to a great extent. Germany has very dense road, waterways and railroad networks which are in very good condition. Except for shipments on the waterways, which might freeze in winter, transportation is therefore feasible throughout the entire year (CrossBorder-Bioenergy, 2012).

All of the five aspects for the Factor Condition are very beneficial the bioethanol producers in Germany. Therefore this determinant is strong in Germany supporting the national competitiveness to a great extent.

Demand Condition

The Demand determinant for Germany is very closely related to the governmental regulations which influence the demand to a great amount. At the moment the German government concentrates at increasing the bioethanol demand, in order to fulfil the EU Renewable Energy Directive, via the blending with traditional petrol fuel. The demand of bioethanol within Germany was around 1709 million litres in the year 2012. Germany bioethanol refineries however produced only 759 million litres in the same year, because lower-priced imports entered the German market. This fact negatively influences the German national competitiveness; although legislative measures were implemented to counteract this development, as mentioned later.

In 2011 around 88 % of the consumed bioethanol in Germany are used for petrol blends with low ethanol concentration (E5 and E10); whereas the remaining percentages of the consumed bioethanol cover Ethyl tert-butyl ether (hereafter: ETBE) (around 10.5 %) and E85 fuel (around 1.5 %) (CrossBorder-Bioenergy, 2012). Because bioethanol is mostly consumed with the consuming of blended petrol fuel its demand is strongly correlated to the demand of petrol fuel. The demand of petrol fuel however is assumed to shrink until 2020 by one quarter, due to fuel saving developments in the automobile industry, hence decreasing the demand for bioethanol (Reimers, 2012). Another constraint currently decreasing the bioethanol demand in German is an on-going debate about the technical compatibility of car engines with bioethanol. Insufficient information by the government and misinformation in

the media during the introduction phase of E10 have caused a restrictive attitude of German citizen towards petrol with a bioethanol blend. This attitude can be observed in the low market share of 14 % the E10 petrol had in the segment of blended petrol (E5 and E10) in 2011 (CrossBorder-Bioenergy, 2012; Reimers, 2012). This negative attitude decreases the strengths of the German Demand Condition determinant.

Looking on these figures the future assessment on biofuel demand seems to be quite negative. Nevertheless the German Bioethanol Industry Association assumes a 100 % increase in the bioethanol demand of currently 1.2 million tons up to 2.4 million tons (Reimers, 2012). This assumption is justified with the expectation that an increased biofuel quota and an increasing oil price will increase the need for alternative fuels (CrossBorder-Bioenergy, 2012). Having this plus the cheap imports in mind the German Demand Condition determinant is judged to be medium strong.

Related and Supporting Industries

The network of supporting industries can be evaluated as very dense in the German biofuel industry. There are a lot of companies connected to the biofuel producers, which show a great variation in their size and the type of business. Therefore this determinant is very strong in Germany as the following analysis shows.

On the one hand these are farmers, producing the agricultural starting product, which are mostly organized in small sized businesses. These farm businesses are usually located in the surrounding (up to 50 km) of the bioethanol refineries to avoid high transportation costs. Farmers also buy some of the leftovers of the bioethanol production, which are called Dried Distillers Grain (hereafter: DDG). This DDG is produced by drying the mash after all bioethanol has been extracted and it has a very high share of protein making it a good animal food (Özdemir, Härdtlein, & Eltrop, 2009).

Other businesses being integrated in the bioethanol network are the mineral oil companies and chemical industries, who are the customers to the bioethanol producer. These are great international conglomerates such as Shell, BP, Exxon Mobile, etc. These companies need the bioethanol to fulfil legal blending requirements for their petrol or to produce other chemical components out of the bioethanol like ETBE's (Schmitz, 2003).

Of great importance for the bioethanol producer are the plant constructing and maintaining firms, which build the refineries. Because refineries for bioethanol are technical very complex there are usually external companies who plan and construct the refineries taking the bioethanol producer's demands and specifications into account. Lurgi, GEA Wiegand, Bayer Technology Service and the M & W Group are four German companies operating successfully in this area (RESTMAC, 2008).

This huge amount of related and supporting companies increases the competitiveness of German bioethanol producers.

Firm Strategy, Structure and Rivalry

In Germany the bioethanol industrial sector is still very young, as economically motivated production of bioethanol started in 2005. After the introduction of the blending quotas the domestic consumption of bioethanol, which was 759 million litres in 2012, has always exceeded the above mentioned domestic production (Flach, et al., 2012). Nevertheless the German bioethanol refineries only operate at an average utilization rate of around 70 %. This is because the domestic produced bioethanol is more expensive than the non-EU produced bioethanol. This leads to a situation where there is not a harsh rivalry between the German national producers, but rather between the domestic producers and the international producer, especially from the USA (CrossBorder-Bioenergy, 2012; Wunderlich, 2012). Taking the Diamond Model into account this circumstance weakens the competitive advantage of bioethanol in Germany in two ways. The first concerns the Demand Condition determinant mentioned above. The second is that a strong domestic rivalry, which leads to a higher national competitiveness, is not present in Germany.

Currently there are 10 different refining plants in Germany, which are operated by 8 different bioethanol producing companies, with Verbio and Südzucker being the biggest two producer (Reimers, 2012).

The German producers therefore follow two main strategies. On the one hand they invest in research and development (hereafter: R&D) projects which optimize the refining process as well as R&D projects to make 2nd generation bioethanol cheaper to produce. To do so the bioethanol producing companies work together with German universities and other research institutes (Schmitz, 2003). The other main strategy is to fend the cheap bioethanol imports. In early 2013 the German bioethanol industrial association provoked together with other European bioethanol industrial associations the introduction of an anti-dumping tariff against blending bioethanol from the USA (Wunderlich, 2012).

Although a strong domestic rivalry is not present in Germany the determinant Firm Strategy, Structure and Rivalry is judged as medium strong. This is because the structure, with multiple companies in this sector, and the strategy of these companies are strengthening this determinant.

Government

The governmental variable plays a very central role for the competitiveness of the German biofuel industry. That is because it has a very positive influence on the demand and

connected to this all other determinants too. In its desire to introduce and to increase the usage of bioethanol in the transport sector the German government has used different policy tools. Since the year 2007 the German government fosters demand by granting a tax exemption on fuels with a high biofuel share; that are E85 and Biodiesel B100. This exemption from the energy tax (formally mineral oil tax) is granted until the year 2015. However this favoured B100 much more than E85 because, unlike with E85, there is no expensive automobile modification needed for B100. Since 2007 the government introduced a mandatory blending quota for E5 of 1.2 % which rose up to 2.8 % in the year 2009. It also allowed for an E10 blending, which was not possible to sell until then. From the year 2015 on another support scheme will come into force which takes the GHG saving of the used biofuels into account. The scheme makes a staggered GHG emission saving of the biofuel compared to a benchmark fuel mandatory (Bundesrepublik-Deutschland, 2010). An overview of the quota system and the GHG saving system is given below:
The final GHG saving quota of 7 % is equal to a 13.2 % share of biofuels in the total fuel mix.

Year	Quota: diesel	Quota: petrol	Total quota
2007	4.40%	1.20%	-
2008		2.00%	-
2009		2.80%	5.25%
2010			6.25%
2011			
2012			
2013			
2014	4.40%	2.80%	6.25%
2015		decarbonisation 3.0%	
2017		decarbonisation 4.5%	
2020		decarbonisation 7.0%	

Figure 3: German blending quotas

Other ways of supporting the bioethanol sector are funds for R&D projects. These are financed by the Federal Ministry for Food, Agriculture and Consumer Protection and cover 25 % to 100 % of the research costs. This gives bioethanol producers a strong incentive to further develop the technologies in use. Some German Bundesländer have additional sources of funding R&D projects although they mostly concentrate on small and medium sized companies (CrossBorder-Bioenergy, 2012).

Chance

Of the many possible events that could influence the bioethanol sector two are important to take into consideration. The first are extreme weather conditions. The bioethanol sector is dependent on the agricultural starting products so that unfavourable weather conditions may have a number of effects on the bioethanol producing industry. Unfavourable weather conditions lead to higher prices for the crops. Because of the higher prices farmers might

decide to sell their goods to the food industry depending on the revenue they earn there. This however creates chances for other farmers, also from other regions, who may now have the chance to sell their goods for a higher income. This example shows that bad weather conditions, and therefore higher food prices, might influence the bioethanol producing industries a lot (Poudel, et al., 2012). As history shows Germany is like other states as well affected by heat and drought on the one hand but also by coldness and floods. Another very influential factor is the oil price. As a substitute to bioethanol sudden variations in the oil price can lead to a high demand, if the oil price is high, or to the reverse effect, if the price is low (CrossBorder-Bioenergy, 2012). The overall influence of the variable Chance is given however it is impossible to determine its exact influence on national competitiveness in the future.

4.2 France

The second bioethanol sector under consideration is the French bioethanol sector.

Factor Condition

France is to be judged as very rich in Human Resources. Generally speaking there is an abundance of well-qualified workers available to the industry. Traditionally trade unions have a lot of influence in France and are involved to great extents in the decision making processes of companies (OECD, 2012a).

France has a long tradition in the growing of wheat and sugar beets the two main agricultural starting products for the French bioethanol production (Schmitz, 2003). Having this in mind, plus the fact that there many universities and research facilities in France, which carry out research in the field of biofuels (CampusFrance, 2013), the Knowledge Resource can be considered as very present (Commission, 2013a).

The physical resources of the bioethanol industry being mostly the agricultural starting products are very present. France is the main producer of wheat in the EU and together with Germany the biggest producer of sugar beets. It is therefore not surprising that all the energy crops used for French bioethanol production are grown domestically. The total amount of arable land used for bioethanol energy crops is 0.6 % measured against the total amount of arable land. However because the production rate in the agricultural sector is assumed to raise due to technological development the amount of crops from the available farmland is assumed to raise as well (Gagnepain, 2012).

France is ranked as a stable country for foreign investments. Furthermore banks are experienced and willing to give loans to renewable energy projects and biofuels. Capital

resources may also come from the government, as described below. Therefore the Capital Resource aspect is to be considered as very present in France (U. S. A. DoS, 2012).

The same holds true for the infrastructural aspect. France has a very dense network of rail and motorways, enabling a quick access even to remote areas. Transportation is therefore feasible throughout the year. France furthermore has the additional infrastructural advantage of having much access to open water. Big harbours such as Le Havre, Bordeaux and Marseille enable a cheap marine transportation. Despite these overall good conditions there are additional future investments from the government necessary to counteract to the aging process of French infrastructure (OECD, 2010).

Because all five aspects are supporting businesses in France the Factor Condition determinant is to be ranked as strong in France, thereby strengthening the national competitiveness of the French bioethanol industry greatly.

Demand Condition

The demand for bioethanol in France was 949 million litres in 2012. Coming from the refineries the bioethanol is split up into the main products of bioethanol for low blends, bioethanol for high blends (E85) and ETBE's. The ETBE play a very important role in the French consumption as they are used for petrol blends since the early 1990's. They can be added to the traditional petrol up to 15 % of volume without further declaration. This leads to an ETBE consumption counting for around 30 % of the total bioethanol consumption in 2011. The remaining 70 % of the bioethanol are used for blending petrol. Bioethanol for E10 blends makes up the biggest part of the consumed bioethanol (Gagnepain, 2012). E85 has only a marginal share, which is likely to change, because it is in the starting phase following a national action plan set up by the French government. This plan aims at making fuel pumps for E85 available throughout the country and giving incentives to people to switch from traditional fuel to E85 fuel. This shows that the demand of bioethanol is very dependent on the inputs, such as quotas and tax incentives, from the government (Cour.des.Comptes, 2012). The E85 fuel programme will increase the national demand of bioethanol and therefore also the national competitiveness of bioethanol producers.

In France there is no negative attitude towards the introduction of higher blends in petrol. However, a discussion has arisen concerning the overall status of biofuels. It primarily focuses on the cost-benefits of biofuels and reflects for and against arguments as described in the introduction of this Thesis (Henard, 2013). Increasing quotas are contributing to an increasing demand for bioethanol in the upcoming decade (Henard, 2011). Because of this increase in demand and despite the negative attitude towards bioethanol the Demand Condition determinant was judged as strong.

Related and Supporting Industries

In France there is a similar Related and Supporting Industry structure observable as in Germany. The refineries obtain their agricultural crops from the local farmer. These are usually small and medium sized companies and located on average around 30 km away from the refineries. The trade between the producer and the farming enterprise is often regulated in multiannual growing contracts, granting the bioethanol producers a stable supply and the farmer a secure income (Schmitz, 2003). The refineries then sell their produced bioethanol to the chemical and mineral oil industry. The by-products of the refining process, which is mostly DDG, are sold to cattle owner. Connected to the French bioethanol industry are numerous companies for plant manufacturing, planning and maintenance (Henard, 2012).

The two big French car manufacturers Peugeot-Citroën and Renault can also be considered as related industry as they offer cars with flexi fuels engines, which are able to drive with the E85. As the government, which is also strongly intervening in the French car industry, gives incentives to use this fuel the amount of cars in France with a flexi fuel engine raised sharply in the past decade. The selling of flexi fuel cars decreased in 2010 when a change in EU regulation made the cars less attractive to car manufacturers. GHG emission flexi-fuel cars could save via the use of high blend bioethanol was not taken into account when calculating the overall GHG emissions of a car (Cour.des.Comptes, 2012).

The Related and Supporting Industry can be considered as big and supports the French bioethanol industry and the French national competitiveness. This determinant is therefore judged as strong.

Firm Strategy, Structure and Rivalry

The French bioethanol industry faces two main challenges, which it takes into account for further planning. The first is challenge is the push towards 2nd generation bioethanol driven by the French government and the public opinion, who hold the biofuel industry partially at fault for increasing food prices. French bioethanol producer therefore invest heavily into R&D to establish a procedure for lignocellulosic bioethanol production which is economically useful (Henard, 2012). The second challenge is, although the French bioethanol sector is self-sufficient, the French bioethanol producer fear for cheaper imports. The French bioethanol industrial association therefore supported the introduction of a European anti-dumping tariff (Henard, 2013).

The French production of bioethanol, which was 949 million litres in 2012 (Flach, et al., 2012), equals the consumption of bioethanol resulting in some rivalry between the companies. There are two important producers of bioethanol in France, naming Cristanol, a public owned company, and Tereros a farmer-cooperative owned company. Both of these companies run multiple refineries (Cour.des.Comptes, 2012).

Since all of the three aspects are positively influence the national competitiveness of the bioethanol industry this variable is considered as strong.

Government

With the overall goal of having a 7 % blending quota in 2010 the French government has, behind Portugal (10 %), the second highest biofuel incorporation rate of all EU countries. This shows its very supportive influence on the other four French determinants of national competitiveness. The French government planned to achieve its ambitious goal via several measures. It installed mandatory blending quotas for traditional petrol and E10 (Jung, et al., 2010). Furthermore biofuels are eligible for tax privileges. Bioethanol used for blending was taxed with 37 € per hectolitre less than petrol. This amount of tax privilege was however constantly reduced and accounts 14 € per hectolitre in mid-2013 (Cour.des.Comptes, 2012).

The fuel E85 was seen as a central aspect to meet the incorporation target whereas it was only taxed with a rate of 28.33 € per hectolitre instead of 33.43 € per hectolitre (2007). This tax reduction resulted in an E85 price of slightly below 1€ per litre. Cars with a flexi fuel engine gained additional tax privileges, such as a lower car registration fees or a tax reduction for company cars (Jung, et al., 2010). However technical difficulties in the car manufacturing and a changing regulative framework hindered the development of the E85 fuel market (Cour.des.Comptes, 2012).

The French government grants additional tax privileges loans for R&D projects to develop bioethanol technology further. Hereby the concentration lies upon research projects for 2nd generation bioethanol. Regional authorities have additional support schemes that companies can apply for (Henard, 2013).

Chance

French bioethanol production is likely to be affected by weather extremes as well as high ups and high downs of the oil price. The impacts by the two phenomena are basically the same as in Germany. Oil price volatility will increase or decrease the bioethanol demand. As with each agricultural product, the influence of extreme weather conditions, such as heat or cold is given. These will reduce the amount of crops harvested increase thereby their price and the price of their final products (Charles, 2013). Because one cannot estimate which events will occur this variable has an indefinable influence on the government and the other four determinants.

4.3 Spain

The final bioethanol sector under consideration is the Spanish sector.

Factor Condition

A dual picture can be drawn for the Human Resource capital in Spain. The unemployment rate is very high which gives the companies the opportunity to choose for the best fitting person for a job. However, the job market in Spain is very rigid. That is because Spanish employment law is very employee friendly. Furthermore the Spanish job market is unattractive to skilled foreign workers. These negative effects on Human Resources are continuing to restrict businesses besides the fact that they are being dealt with by the government in recent structural reforms (OECD, 2011).

Knowledge Resources are present in Spain due to a number of research institutes and universities, with a lot of research projects on renewable sources of energy and also biofuels (Commission, 2013c). Spain has a long tradition in the biodiesel and in the wine growing and distillation industry; however it does not have a long lasting tradition in bioethanol as well as the manufacturing industry or the farming of the agricultural products needed for bioethanol production. Shortages in public funding for research projects furthermore reduce the attaining of knowledge additionally (OECD, 2011).

The acquisition of Physical Resources for the bioethanol is challenging for the Spanish bioethanol producer. 95 % of the feedstock used for the Spanish bioethanol refineries consists of cereals, mostly corn and wheat, whereas the remaining 5 % consist of wine alcohol. The production deficit of Spanish cereals, resulting in an annual import demand of around 9 to 12 million tons, makes it mandatory for the bioethanol producer to import all the necessary energy crops. Therefore they have to import annually around 1 million tons of cereals (Guerrero, 2012).

Spain is ranked as a political stable country with small non-payment risks of government loans. The Spanish economy is very open to foreign investments as it is seen as help to fight the temporary economic crises. The current crisis also leads to a shortage in loans given by private banks. Public financial institutes such as the ICO try to overcome this situation by lending money, especially to technological innovative and renewable energy projects. Due to these reasons the Capital Resources are difficult to obtain (U.S.A. DoS, 2012).

The Infrastructure of Spain is ranked as very good. Spain has very dense motorway and railroad networks which are in a good condition. Being surrounded by the Mediterranean Sea and the Atlantic Ocean Spain has a very good maritime connection enabling transport throughout the year (Schwaab, 2012).

Only the infrastructural aspect is positively influencing national competitiveness. The other aspects are either missing, as in the case with Physical Resources, or only partial present. They are therefore not supporting businesses in Spain, which is why the Factor Condition is judged as medium weak for Spain.

Demand Condition

Spain is self-sufficient in terms of bioethanol demand. That is all of its national demand for bioethanol is covered by the domestic production. It consumed 456 million litres of bioethanol in 2012, compared to a domestic production of 465 million litres (Flach, et al., 2012).

Nearly all produced bioethanol in Spain is transformed into ETBE. This Bio-ETBE is mixed with the traditional petrol to achieve the biofuel incorporation rate. Because Spain focussed mostly on the blending of petrol with ETBE, the E10 blend and E85 blend played only a marginal role in the past. This marginal role is said to change from the end of 2013 on, when the availability of the traditional petrol is no longer guaranteed via law. With the beginning of 2014 E10 blends are to be introduced at the filling stations, raising the demand of bioethanol (Guerrero, 2012).

At the moment the overall share of petrol measured against the total amount of transportation fuel is only 20 %. This share is assumed to decrease further due to a decreasing demand on petrol in Spain. This means for the bioethanol industry that in the long term their potential market is shrinking due to a foreseeable decrease in demand. For the near future, which is the 15 years, an increase in demand is expected due to the distribution of E10 blends and the rising of the incorporation quota to 10 % in the year 2020 (Guerrero, 2012).

In Spain there has not been a broad public discussion concerning the introduction of bioethanol blending. This is because blending happened mostly ‘invisible’ with the help of ETBE blending (Guerrero, 2012).

Because of these arguments the Spanish Demand Condition determinant can be considered as strong and is increasing the national competitiveness.

Related and Supporting Industry

In Spain the amount of Related and Supporting Industries can be considered as relatively low, compared to the amount of such industries in Germany and France. Due to the necessary importing of the energy crops the Spanish bioethanol producers have only little contact to the Spanish farmers. The only connection between those two parties lays in the

DDG which the bioethanol producers sell to farmers as animal food. This means by implication that the bioethanol producer are forced to cooperate as part of the business process with the importing companies of cereals (Guerrero, 2012).

Since most bioethanol is transformed into ETBE for blending, the Spanish bioethanol producer sell their bioethanol to chemical and mineral oil companies for further processing. Important companies in this sector in Spain are Repsol and Cepsa (Repsol, 2013).

Another aspect, decreasing the amount of Related and Supporting Industries additionally, is the fact that three out of four Spanish refineries, with a capacity of 95 % are designed and constructed by Abener, a company belonging to Abengoa, the dominant bioethanol producer of Spain (Abengoa, 2013). This does not increase the share of related and supporting industries. This determinant is judged to be medium weak in Spain, whereby it does not increase the national competitiveness of the bioethanol industry much.

Firm Strategy, Structure and Rivalry

In its structure the Spanish bioethanol sector is very special compared to the other bioethanol sectors elaborated in this Thesis. That is because there are only two different companies which operate the currently four refining plants, naming Abengoa and Acciona & Uriel Investment. Whereas the former company operates three refineries and produces 95 % of the Spanish bioethanol, the latter Acciona & Uriel Investment has a single refinery with share of 5 % of the total production. This makes Abengoa virtually a monopolist among the Spanish bioethanol producer, resulting in almost no rivalry between the two Spanish bioethanol producers (Guerrero, 2012). This lack of rivalry is decreasing the national competitiveness of the Spanish bioethanol sector.

The strategies of the two companies are quite different, resulting from their different nature. Abengoa's main strategy is to guarantee growth by investing in R&D projects. Special attention lies thereby upon the further development of 2nd generation biofuels. The motive behind this is the desire to become more independent from imports (Abengoa, 2010). Acciona & Uriel's main strategy is to collect profit out of leftovers and overcapacities from the wine industry, whereas R&D plays only a marginal role (Guerrero, 2012).

The lack of rivalry and the quasi-monopolistic structure do not strengthen the Spanish national competitiveness. The strategy of Abengoa to concentrate innovation and new ways of refining however supports the national competitiveness, so that the determinant is ranked as medium weak.

Government

The governmental incentives for promoting the demand of biofuel consist of two different measures. The first measure is a tax privilege. The share of biofuels in blended fuels is exempted from the hydrocarbon tax, which is currently 0.401 € per litre. Therefore a litre of petrol blended with bioethanol saves the mineral oil company 0.17 € per litre compared to a petrol without any biofuel blends. However, this tax privilege is limited and will expire by the end of 2013. The second measure is a mandatory incorporation quota. This quota was introduced in 2008 and made it obligatory to offer petrol with a minimum of 1.9 % bioethanol. The quota was raised in the year 2009 to 2.5 %, in the year 2010 to 3.9 % and lays currently at 4.1 %. The quota does not follow a given roadmap, but it fixed by law every two to three years in advance (Guerrero, 2012).

A further support for bioethanol producers is granted by the Spanish government in forms of tax exemptions for R&D projects. Project plants, which are mostly owned by different parties, as e.g. the producing companies and research institutes, apply to be recognised as a project plant and if granted receive a tax relief on hydrocarbon tax. The conditions to get a tax relief are an experimental character of the project and an annual production below 5000 litres (Guerrero, 2012).

Both measures have a positive influence on the four determinant of the national competiveness of the Spanish bioethanol industry

Chance

The Spanish bioethanol industry is affected by a volatility of the oil price as the German or French bioethanol producer. A high price is likely to increase the demand, whereas a low price will decrease the demand.

Because energy crops for the production are imported from abroad, Spanish bioethanol producer are independent from domestic weather. The companies have multiple foreign sources of cereals supply to choose from. However unfavourable weather conditions abroad will also affect the cereals price, as this creates pressures on farmers to sell their products to potential buyers who are willing to pay most. The Abengoa bioethanol refineries are furthermore capable of using different cereals as starting products. Therefore if the price of one cereal crop is high they are able to switch to a different less-expensive cereals, provided they are not bound to long term contracts (Guerrero, 2012). This gives them some economic advantages.

The influence this variable has on the other determinants and the government is indefinable because of the unpredictability of the future. However Spanish refineries might have more scope for action due to a possible switch of the resources and their origin.

The next chapter will contrast the national competitiveness of the three countries under study against each other. By doing this comparison an answer to the first sub research question will be provided.

5. Comparison

In this chapter I will compare the three countries to one another to be able to give an overall assessment of the competitiveness of their bioethanol sector. This assessment is therefore the answer to my first sub research question.

The Factor Condition determinant is quite similar between the two countries of France and Germany. Both are to be judged as having a strong Factor Condition determinant. Spain is falling behind except for the Infrastructure with which all three countries are very well equipped (Schwaab, 2012). Whereas France and Germany have a sufficient amount in Human Resources as well as in physical resources Spain has a high amount of unemployed workforce which however might be difficult to hire because of rigid regulations and no domestic physical resources for the bioethanol production (OECD, 2011). Knowledge Resources are attainable in all three countries due to research facilities and universities, but France and Germany already have a long dating tradition in some fields of the bioethanol sector from which companies can benefit (CrossBorder-Bioenergy, 2012; Schmitz, 2003). Capital Resources are basically available in all three countries but might be more difficult to obtain in Spain because of a current economic recession (U.S.A. DoS, 2012). Due to these aspects the determinant Factor Condition is to be judged as medium weak for Spain.

The basic prospect for the bioethanol demand is the same in the three countries. The bioethanol demand increased significantly in the past five years and is said to continue to increase for the upcoming decade. The consumption of bioethanol however varies in the three countries. Whereas Germany consumes the bioethanol mostly in form of E10 blending (CrossBorder-Bioenergy, 2012), Spain consumes it via transforming it into ETBE's (Guerrero, 2012). The French consumption can be considered as lying in the middle since it is consumed via ETBE's and via blends simultaneously (Gagnepain, 2012). In Germany and France there is a broad public debate concerning the environmental impact of biofuels (mostly France) and the compatibility of bioethanol and car engines (Germany) (CrossBorder-Bioenergy, 2012; Henard, 2013). Whereas Spain has not experienced such a broad public debate, these debates tend to limit the demand of bioethanol in France and Germany. Nevertheless the Demand Condition determinant is strong in all three countries.

The Related and Supporting Industries are very present in Germany and France and include close cooperation with the supplying agricultural industries, technical assisting and

constructing companies and the consuming companies. In France the Related and Supporting Industries also include the French car manufacturers (Cour.des.Comptes, 2012), whereas in Germany a close cooperation between bioethanol producer and car manufacturers is not given. Due to the nature of business Spain also cooperates with supplying and technical assisting and constructing companies. However the supplying industry mainly includes importing companies. Except for the Acciona & Uriel bioethanol refinery, Spanish bioethanol refineries therefore have no close direct contact to the growing farmer of the energy crops (Guerrero, 2012). The technical assisting and constructing industries of the Spanish bioethanol plants belong to the company operating the refineries and therefore do not increase the Spanish Related and Supporting Industry determinant, which is Medium Weak (Abengoa, 2013). The Related and Supporting Industries determinant for Germany and France is strongly supporting the national competitiveness, whereas for Spain it only has a medium weak strength.

The Structure, Strategy and Rivalry determinant is, except for the producer's strategy, quite different in all three countries. In Spain there is only a single dominant producer, resulting in a quasi-monopoly with only a very limited rivalry (Guerrero, 2012). In France one can observe multiple producers, creating competition between these producers (Cour.des.Comptes, 2012). Germany has multiple bioethanol producers as well, whereas the rivalry is not addressed to each other but instead to foreign producers, which beat the German bioethanol in price (Reimers, 2012). The strategy is similar in all three countries. That is to invest in R&D projects to develop further in order to get a competitive advantage and to be able to fight off foreign producers. This determinant is to be considered as Medium Weak in Spain due to a single producer and Medium Strong in Germany due to the limited rivalry. For France the determinant is judged as Strong.

The governments of all three countries heavily influence the bioethanol market of their country by artificially increasing the demand. This is done with quotas of different height in all three countries. Furthermore are all three countries grant tax relief for the usage of bioethanol. Additionally to the measures increasing the demand there are funds granted for R&D projects. This measure aims at fostering the technical development of bioethanol products (Flach, et al., 2012).

The variable Chance is boiled down in this Thesis to the aspects of unfavourable weather condition as well as extreme ups and downs in the oil price. Bad weather influences the harvest of energy crops and therefore the amount and price of the crops. A good harvest therefore benefits the bioethanol industry whereas a bad harvest will increase prices and therefore harm the bioethanol industry. The Spanish bioethanol industry is to a small extend independent from the weather because it is flexible in its choice of cereals as well as the place of origin. This independence is, however, bounded by long term contracts with suppliers as well as the world cereal price which will rise and affect Spain in years with overall bad weather conditions. The price of oil, which is a substitute of bioethanol, may

have a positive effect on bioethanol as well, if it is high. It also might limit the demand of bioethanol if the price for oils is low (Guerrero, 2012).

Deriving from the above mentioned aspects the national competitiveness of the German bioethanol industry can be considered as high. The Factor Condition as well as the Related and Supporting Industries determinants are strong in Germany. There is a high demand of bioethanol within Germany, which however is partly satisfied by imports. Therefore the Demand Condition determinant is medium strong in Germany. The Strategy, Structure and Rivalry of the German bioethanol producers is supporting the competitiveness, although a strong rivalry among the domestic producers instead of fighting foreign producers would increase the competitiveness additionally. The German government is supporting the bioethanol industry, whereas the Chance variable has indefinable effects on the bioethanol industry.

The French national competitiveness of the bioethanol sector is to be judged as high, even higher than in Germany. France has a strong Factor Conditions determinant. The demand of bioethanol in France is very high and is furthermore expected to rise, so the Demand Conditions determinant is very strong in France (Flach, et al., 2012). There is again a great amount of Related and Supporting Industries within France which help the bioethanol industry. The rivalry among the French bioethanol producers as well as the R&D towards next generation bioethanol equips the sector with a good competitiveness. The French government has set high target for the bioethanol sector and contributes to achieve this aim. The variable of chance is to be evaluated indefinable as in Germany.

The national competitiveness of the Spanish bioethanol sector is, unlike the two others, to be evaluated as medium low. Spain is struggling with an economic regression which reflects in the Factor Condition. There is a very good infrastructure and a sufficient supply of knowledge but only a limited supply of capital resources as well as an ambiguous situation in the labour market. A sufficient supply of the Physical Resources does domestically not exist and has to be imported. The Demand Conditions determinant for Spain is strong as the demand is expected to grow. In Spain there is no strong support of the Related and Supporting Industry for the bioethanol industry. The strategy of the sole important bioethanol producer is promising; however there is no rivalry in Spain which would increase national competitiveness. The government is supporting the bioethanol producers and therefore the national competitiveness. As Spanish bioethanol producer are less dependent on local weather the variable of chance is less indefinable for the Spanish bioethanol sector.

The following chapter of the Thesis aims at giving policy recommendation based upon the above conducted analysis of the three different bioethanol sectors

6 Policy recommendation

First there will be an abstract concerning general recommendations which are addressed to all three countries alike. The second abstract will give specific recommendations addressed to a single country.

6.1 General

My overall recommendation is to continue the support of the bioethanol industry. From an economic point of view the three countries can benefit very much from this industry sector. That is bioethanol industries create jobs, not only in the industry itself but also in supplying and consuming industries (Flach, et al., 2012). As the bioethanol is mostly refined via automated processes the number of people employed directly in one refinery is relatively small. For example, Germany's biggest refinery[7], located in Zeitz, employed around 115 people in 2012 (Economic importance studie). Additional to these direct employed people there is a huge number of jobs indirectly created by bioethanol refineries. Following a study conducted by the WifOR institute[8], the previous mentioned bioethanol refinery in Zeitz creates, for example around 2.300 indirect jobs in 2012. Many of these jobs lie in rural areas, and give people additional income and job prospects there. To import the bioethanol from foreign producer would result in a loss of these jobs. A strong national bioethanol production also implies to be independent from other countries. Thereby the danger of price increases and supply shortages would be greatly limited (Jung, et al., 2010). On top of that it would be easier for the three countries to supervise the impact of the bioethanol production on the environment and the food prices and to respond to negative externalities if necessary.

Following from the previous mentioned recommendation my advice to Germany, France and Spain is to elaborate a detail roadmap about the measures of support and, being of equal importance, the time of their implementation and possible abolishment. In order to do business and to invest resources, bioethanol producer need a clear picture of the framework conditions. That is they need to know how the demand of the bioethanol and how the business is likely to develop. On the one hand the roadmap should thereby be flexible enough to be able to react on unforeseeable events. On the other hand it should submit enough information to the bioethanol producer. An additional point is that the roadmap should be consistent. A change in government should not result in a change of the bioethanol framework, which would be poisonous to the business climate (Cour.des.Comptes, 2012).

[7] The bioethanol refinery in Zeitz, operated by CropEnergies Bioethanol GmbH, has a capacity of producing 360 mil. Liters of bioethanol per year.

[8] The WifOR institute is an independent economic research institute which was outsourced by the Technical University of Darmstadt.

All three of the analysed countries possessed funds or tax relief that support R&D projects of bioethanol producers or research institutes. These funds and tax reliefs should be maintained, even in times of economic and fiscal difficulties, as currently in Spain and partly in France. That is because they accelerate the development process which tries to overcome negative externalities the use of biofuels brings with them. An example is to make lignocellulosic biofuels economical profitable so that food would no longer be needed for the production of fuel. The development of biofuel production technologies would foster the position of the EU as the third biggest bioethanol producer worldwide[9] and make it more independent from external influences (Jung, et al., 2010).

A core point of the bioethanol policy of the three countries under study should be to achieve a broad public understanding about the bioethanol production. Thereby the attention should not necessarily be paid to the understanding of the technical processes but rather about the motivations behind the production of bioethanol. Transparency should be a main tool to achieve this goal. People should know why their government is supporting an industry sector whose starting product is food and how big this support is. People should be made familiar with the advantages but also the disadvantages biofuels bring with them and how the government plans to minimalize and remove the disadvantages (Cour.des.Comptes, 2012).

6.2 Country specific

As the analysis shows the bioethanol industry is already very competitive in Germany and therefore there is no need for radical changes in bioethanol policies. My advice to the German government is to promote the cooperation between bioethanol producing companies, mineral oil companies and German car manufacturers in terms of E85 usage. Except for Opel, there is no German car manufacturer offering a flexi fuel car, which is able to run with E85 blends. However, an increase in the use of E85 engine cars would higher the demand of bioethanol and also increase the German incorporation quota, which has to be, as mentioned in the introduction, 10 % in the year 2020. The higher demand would also secure jobs connected to the bioethanol industry, provided the bioethanol is refined within Germany and not imported from abroad. Another advantage is that, unlike with mineral fuels, the usage of bioethanol does not contribute to the dependence on oil and the oil exporting countries. The German car producers could improve their corporate image, given the condition that biofuels are accepted and judged as environmentally friendly by the public. Furthermore an incentive has to be given to the mineral oil companies to offer E85 fuel pumps so that it is broadly available in Germany.

[9] The EU (4.539 mil. liters) had the biggest bioethanol production behind the USA (52.617 mil. liters) and Brazil (21.097 mil. liters) in the year 2011.

As the analysis showed Germany is struggling with bioethanol imports which are cheaper than the domestic produced bioethanol. These imports mainly come from the USA where bioethanol benefits from national subsidies. The German government is therefore advised to limit the subsidised imports from the USA to help the German bioethanol sector. That is that German bioethanol refineries are able to operate at a higher utilization rate than only 70 %. This would also increase the rivalry among the bioethanol operators and therefore the national competitiveness. The scope of action for the German government is however limited in this aspect by international law. Germany has to apply to rules of the World Trade Organization as well as the EU, which has the sovereignty in the policy field of tariffs. Germany should therefore influence the EU to watch closely foreign subsidies of bioethanol and support the introduction of anti-dumping or punitive tariffs as happened already in the past. Such measures help to strengthen the German determinants of Demand Condition as well as Strategy, Structure and Rivalry.

The French competitiveness of the bioethanol industry is judged as quite high in the analysis, which makes only small adaptations in the bioethanol policies necessary. France is currently experiencing an economic regression and it is furthermore forced to reduce the national debt. Therefore I recommend the French government to use exclusively the policy tool of mandatory blending quotas in petrol in order to promote the demand of bioethanol, as Spain will do from the beginning of 2014 on. Currently the French government also uses tax exemptions for the promotion which proved expensive to the French state. With mandatory blending quotas the government would have higher tax revenues. A negative aspect to this suggestion is that the price for petrol within France is therefore likely to increase, because the mineral oil companies will add the higher costs for the bioethanol to the price for petrol (Cour.des.Comptes, 2012).

The situation for Spain appears to be very difficult at the moment. On the one hand the Spanish bioethanol industry needs to be supported to gain more competitiveness. On the other hand the Spanish economy is in a recession and the Spanish government has to decrease the national debt (OECD, 2011). This leaves the government with only a very limited scope of action concerning national expenditures. The national government can furthermore not solve the problem of missing national starting products for the bioethanol industry, since policies cannot generate farming soil.

The first recommendation to Spain is to establish a detailed roadmap until the year of 2020, as it is already mentioned and evaluated in the general recommendation. However, in the case of Spain an additional emphasis is needed to this point because the Spanish government only sets its biofuel incorporation targets in three years period. This is very unfavourable to the Spanish bioethanol producer since they depend on continuant prognoses (Guerrero, 2012).

My second recommendation to the Spanish government is to grant targeted incentives for new start-up bioethanol producers. This is important to decrease the quasi monopolistic

power of Abengoa and to establish some competition. This will benefit the Spanish bioethanol sector as a whole because more competition will lead, following Porter's Diamond Model, to more competitiveness by strengthening the Firm Strategy, Structure and Rivalry determinant. These incentives for start-up companies could include a small tax relief or purchase warranty on their produced goods.

The third recommendation to Spain aims at improving the current shortage of credits and thereby the Factor Condition determinant. It is urgent for the bioethanol sector and for the whole Spanish economy to have access to credits needed for R&D but also for development. In order to overcome this shortage of credits Spanish public banks (U.S.A. DoS, 2012), such as the 'Instituto de Crédito Oficial' could function as public creditors, lending money to companies who face problems of getting loans from private banks. Hereby a qualitative validation of the debtor is to be implemented to minimize the credit default risk.

One of the most pressing problems of the Spanish economy remains the high unemployment rate. This also affects the Human Resource of the bioethanol industry as dealt with in the determinant of Factor Condition. My recommendation to overcome the high unemployment is that the government should invest in unemployed people. Although additional public expenditure is to be avoided this investment would pay out in the end. Unemployed should be given extra training and education to fit the market need and to update their skills. This would make unemployed people more interesting to companies and would as well act contrary to the deficit of knowledge resource for the bioethanol producers. Furthermore, the current policy of deregulating the labour market, as it is done by the Spanish government, should be fostered to make it easier for companies to create new jobs (OECD, 2011).

7. Conclusion

In the light of climate change and an increasing oil price biofuels are seen as one of multiple promising technologies to solve these problems. In the year 2009 the EU took up this issue and passed the two directives 2009/28/EC and 2009/30/EC. These directives aim at increasing the use of renewable resources and at decreasing the amount of GHG emission within the Member States' transport sector. Both of these targets are to be achieved via the increased use of biofuels. Bioethanol is one type of biofuels that is mostly consumed by blending it with petrol.

The main idea behind this Bachelor Thesis is to investigate in what way the bioethanol sectors of Germany, France and Spain can be strengthened by their governments, assuming that governments are the driving policy makers. In order to give a qualified policy

recommendation, first an in-depth analysis of the current situation of the bioethanol sector is provided, by evaluating the national competitiveness of the three countries in terms of their bioethanol industry.

This type of competitiveness, also called national competitiveness, measures the set of institutions and policies that are present and support the creation of value for the countries companies. The model used in this Bachelor Thesis to measure the national competitiveness is called Porter's Diamond Model. It consists of four determinants influencing each other and two variables influencing these determinants as well. The determinants are called Factor Conditions, Demand Conditions, Related and Supporting Industries and Firm Strategy, Structure and Rivalry. Chance and Government are the two factors which influence these determinants. The stronger the determinants the better is the national competitiveness (Porter, 1990).

The analysis, which forms the answer to my first sub-research question, is summarized in the following scheme:

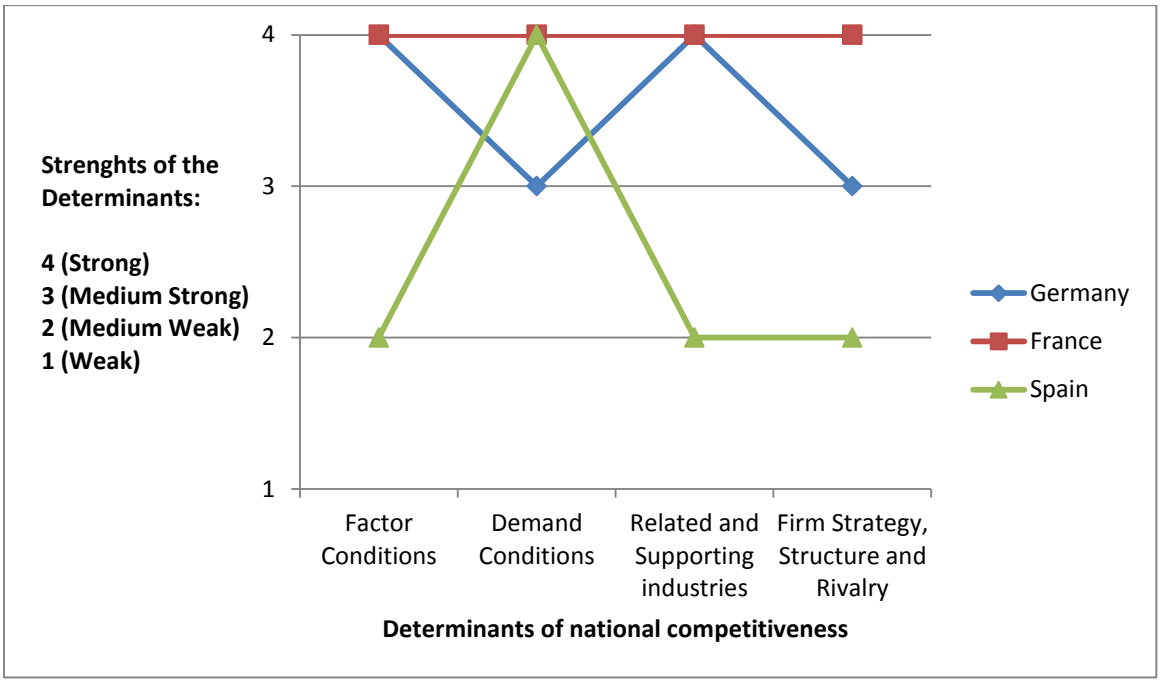

Figure 4: Overview of the national competitiveness of the German, French and Spanish bioethanol sector

One can easily observe from the scheme that France has a very strong national competitiveness in the bioethanol industry. It also has the strongest national competitiveness of the three countries and is followed by Germany. The bioethanol sector of Germany is also quite competitive but is negatively influenced by subsidised imports which affect the determinants of Demand Conditions and Firm Strategy, Structure and Rivalry. Spain has a rather weak national competitiveness. Except for the determinant Demand Conditions, which is strong, all determinants are to be ranked as medium low. This is

because Spain suffers from two negative effects, being an economic regression and a quasi-monopolistic structure in its bioethanol sector. The two influencing variables of the Porter Model are quite alike in all three countries. The governments influence the bioethanol sector by increase the demand and connected to this the production of ethanol. This greatly increases national competitiveness as it influences not only the Demand condition determinant but also the other determinants. The influence of the variable Chance can have a positive effect on the national competitiveness of the bioethanol sector (favourable weather conditions, high oil price) but also negative consequences (unfavourable weather condition, low oil price)

This analysis shows that there is the possibility to improve the national competitiveness of bioethanol in Germany, France and Spain. The overall recommendation is to continue with the support of the bioethanol sector as this will directly increase the national competitiveness. The support should be consistent and long term oriented on the one hand, but on the other hand leave scope for action, to address future challenges. This is of great importance to give businesses a clear idea of the upcoming legislative framework, which they need to successfully conduct future planning. The countries are furthermore advised to enter into a dialogue with the people. Biofuels are a very controversial topic. The dialogue should therefor contribute to a public understanding of the biofuel policies the governments are conducting. The policy makers should thereby be transparent as possible to show why the government is passing regulations and spending its money in the context of biofuels. This advice will strengthen the Demand Condition determinant, as people will be less restrictive towards biofuels, and therefore the national competitiveness.

The German government is advised to support the use of E85 blends to increase their bioethanol incorporation rate and to reduce subsidised imports. Both measures increase the Demand Condition and the Firm Strategy, Structure and Rivalry determinants. The French government is advised to switch from the policy tool of tax relief to the policy tool of mandatory blending quotas. This will help the French governments in its efforts to reduce the public expenditures. The Spanish government is advised to act more future oriented, thereby elaborating a bioethanol roadmap until 2020. Furthermore I recommend helping start-up companies in the bioethanol sector. This would strengthen the Firm Strategy, Structure and Rivalry determinant of Spanish bioethanol companies thereby equipping them with more competitiveness on the world market. Despite the requirement of the Spanish government to cut its public expenditures, I recommend to increase the investments in training and education of unemployed people to improve the Human Resource Capital for Spanish bioethanol producers. This would on the one hand lower the high unemployment and on the other hand help the bioethanol companies by providing them with a qualified workforce. This measure aims at strengthening the Factor Condition determinant.

Despite these several findings there is further research necessary in this field. I concentrate my work on the countries of Germany, France and Spain, because they are the biggest and

therefore the most important bioethanol producer within the EU. However, as other countries have other framework factors they might use different strategic approaches, from which governments could learn. As biofuels are regarded as a future-oriented technology, research should join this technology to pave its way. The Bachelor Thesis at hand aims at doing this in the best intentions.

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