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Become Aware and Take Care - Social Acceptance of Bioenergy in the Netherlands and Germany:

A comparison between two countries on the basis of differing energy policies

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Abstract

Introduction: Since the usage of fossil fuels leads to negative consequences in the future, an alternative is urgent. One possible solution is bioenergy, a renewable energy produced by organic waste. However, bioenergy is not totally accepted in the Netherlands and Germany yet even though the public's opinion is crucial for its implementation.

Objective: The Netherlands and Germany differ in their approaches towards the energy transition. In particular, Germany, as an international forerunner of climate policy, is already further developed and experienced in its energy transition than the Netherlands. Due to such differences, this study does not only focus on the level of social acceptance regarding bioenergy of the general public in the Netherlands and in Germany, but also how both levels of social acceptance differ in these two countries.

Methods: For the purpose of this study, an online questionnaire was conducted. In order to measure the opinion towards bioenergy, the questionnaire asked for the predictors of social acceptance as well as the respondents' attitude towards bioenergy itself. The answers of 234 participiants were analysed using the statistical software SPSS.

Results: The insights gathered from the survey suggest that, in Germany and the Netherlands, the knowledge level of bioenergy is relatively low. Nevertheless, the attitude towards bioenergy is relatively positive as the benefits of bioenergy were perceived strong. Regarding the differences between the two countries, German citizens turned out to have a higher environmental concern and to have a more positive attitude towards bioenergy.

Conclusion: Based on the given results, it can be said that the knowledge level in both countries should be improved. In addition to that, due to the further developed energy transition approach of Germany, German citizens are more aware of the current environmental situation and have a more positive opinion towards bioenergy. In contrast, Dutch citizens might not feel affected by the energy transition individually yet.

Keywords: Bioenergy, Social Acceptance, Energy Transition

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1. Introduction

Nowadays, the energy use worldwide is dominated by fossil fuels, which has several consequences (Demirbas, 2011). Firstly, burning fossil fuels produces greenhouse gas emissions and carbon dioxide which causes climate change and, therefore, is harmful for the environment (Xu, Zhong, Hochman, & Dong, 2019). Secondly, fossil fuels are finite resources, meaning that in 60 years, the world is running out of them. As a consequence, in a few years, there are no resources to produce energy in the way it is produced now. Lastly, using fossil fuels also poses a political threat to the countries making use of those. This means that such countries are politically dependent on the countries they get oil and gas from (Hassler, Krusell, & Olovsson, 2019). Therefore, a change in energy use and supply is needed in order to overcome the danger of an ecological crisis (Loorbach, 2010). One way to overcome this issue is through the development and use of bioenergy (Jennings, 2007).

Bioenergy refers to biofuels that are obtained through biological processes, such as agriculture and anaerobic digestion (Vassilev, Vassileva, Vassilev, 2015). Since it is made from resources that can be reproduced, bioenergy is considered as a renewable resource. Bioenergy can be used for heating, transportation or, by industries, it can be used in order to power machineries (Jennings, 2007). The usage of bioenergy comes with several advantages, for instance, it addresses several of the mentioned environmental issues (Stoof et al., 2014). Other than that, its implementation supports regional economies by opening a new market and creating new jobs. Lastly, using bioenergy can lead to energy- as well as national security by scaling down the need to import oil from foreign countries (Jennings, 2007).

Today, bioenergy accounts for 70% of the renewable energy consumption (Global bioenergy statistics, 2020). In the Netherlands, the consumption of renewable energy has also grown (Boon & Dieperink, 2014). In 2016, in the Netherlands, 5.7% of the whole energy consumption came from renewable sources. Out of that, 84% was from biomass. This illustrates that bioenergy plays an important role in the Netherlands (Kaa, Kamp, & Rezaei, 2017). In comparison, in Germany, in 2017, 13.1% of the energy consumption came from renewable energies from which bioenergy was the largest part too, since in total, 7.1% of the whole energy consumption was contributed by bioenergy (Bioenergy in Germany Facts and Figures, 2019).

An expert in energy innovation thinks that Germany is further developed than the Netherlands when it comes to renewable energy. He states: “The share in Germany is much bigger than the share in the Netherlands and I assume that the thinking of Germany is also already further developed than that of Dutch people. This would mean that Germans are more

open to bioenergy, which also has something to do with a better financial support from the German government" (M. Arentsen, March 12, 2020). This indicates that the Netherlands and Germany do not only differ in the usage of bioenergy but also in its approach towards the energy transition.

1.1 Energy Transition of Germany and the Netherlands

Over the past years, governments and society increasingly set sustainable development as an important objective. The idea was brought up that, in order to meet the long-term challenge of sustainable development, a green industrial policy is required (Laes, Gorissen, & Nevens, 2014. Green industrial policy can be defined as the government's decision to restructure the economy in order to reach environmental sustainability (Pegels & Lütkenhorst, 2014). However, there is no a specific approach towards energy transition, since transition approaches have to be adjusted to the local circumstances. Therefore, Germany and the Netherlands also differ in their approaches towards the so-called energy transition (Laes et al., 2014).

To begin with, Germany is regarded as the most ambitious country worldwide in the promotion of a transition to sustainable energy (Pegels et al., 2014). Already in the mid-1990s, Germany took the role of the forerunner in regard to climate policy. Due to the Chernobyl nuclear accidents, the German government aimed to reduce 25% of GHG emissions by 2005. However, after the nuclear accident in Fukushima in 2011, and following the advice of the German National Ethics Commission, the decisions were reconsidered and it was decided to implement a complete phase out by 2022 and, additionally, to remove the seven oldest nuclear power plants from operation. Moreover, 80% of the energy supply should come from renewable energies by 2050 (Renn & Marshall, 2016). The objectives of the EEG, the most important green energy policy law, are the sustainable development of energy supply, the protection of the environment, the reduction of the costs of energy supply to the national economy and, lastly, further development of technologies for the generation of electricity from renewable energy sources (Pegels et al., 2014). The goal is to place Germany among the most energy-efficient as well as green economies in the world. Every year, the parliamentary checks on the progress of the goals that are written down in the "Energiekonzept". Additionally, the Ethics Commission describes the German energy transition as a collective process which means that not only the government but also businesses, civil society and individual citizens are involved and responsible for the process (Laes et al, 2014).

In comparison, the Dutch energy policy can be defined as a less "aggressive" approach towards energy transition (Laes et al., 2014). In the Netherlands, policy regulations derived in the form of 'TM', called 'Transition Management'. TM was created to change socio-technical systems and to fix structural problems of unsustainability that still had been unsolved by traditional policies. The model states to run 'transition experiments' in order to test alternative energy practices and technologies. In the 1990s, in the Netherlands, it was found out that non-technological factors, such as institutions and cultural factors are also important in order to reach sustainability. Thus, the TM model does not entirely focus on technologies, but rather on learning processes. In 2001, the fourth Dutch National Environmental Policy Plan (NMP4) took on a transitions approach and the so-called "Energy Transition Program" (ETP) was created. The plan states that current policies need to be changed in order to solve the current environmental problems and that this requires system innovation. For the energy system, the policy plan aims to reduce 40-60% carbon dioxide emissions by 2030 (Kern & Smith). The ETP addresses six themes, namely new gas, chain efficiency, sustainability mobility, green resources, sustainability electricity and built environment. The Dutch energy policy has three main goals: security of supply, environmental quality and economic efficiency. The goal of the Dutch government is to achieve a sustainable energy system with a focus on cost-effective measures to CO2 reductions (Laes et al., 2014).

1.2 Social Acceptance in the Netherlands and Germany

Even though bioenergy has raised several expectations, it has not been fully successfully implemented in the Netherlands and Germany so far. Despite several attempts, the replacement of fossil fuels with renewable alternatives was found to be difficult. This issue is also called 'Carbon lock-in', meaning a country's dependency on fossil fuels and the problem for renewables to break through (Negro, Suurs, & Hekkert, 2008). This problem is related to the term of social acceptance, since, despite its advantages, the role of bioenergy in the future is still disputed. This relates to both environmental and socio-economic aspects (Berndes, 2010). For example, it is said that not all emissions from bioenergy are environmentally friendly, as there are damaging emissions in using ethanol and biodiesel (Jennings, 2007). These doubts could also be found in a study that has been conducted with people living in the Netherlands and Germany. During a focus group, participants mentioned to be concerned that not only waste but also food is burned. Apart from such concerns, people stated to not feel involved in the topic of bioenergy as it does not affect them individually.

However, according to Rittmann (2008), environmental issues can be addressed through bioenergy but only when fossil fuels are replaced on a large scale. He states: "To

make a dent, in global warming, bioenergy must be generated at a very high rate, since the world todays uses 10Tw of fossil-fuel energy" (p.203). However, citizens are required in order make this happen, since many of the obstacles for successfully implementing bioenergy are caused by the lack of social acceptance (Wüstenhagen, Wolsink, & Bürer, 2007). From facts mentioned above, it can be seen that social acceptance is an important factor that needs to be considered when it comes to the implementation of bioenergy. Existing studies cover issues such as the opinion of bioenergy in the Netherlands or in Germany. However, there could be found differences in the approach towards energy transition between the Netherlands and Germany. Therefore, it is of interest to investigate whether such approaches have an impact on social acceptance of citizens in the Netherlands and Germany towards bioenergy. Therefore, this study does not only focus on the level of social acceptance regarding bioenergy of the general public in the Netherlands and in Germany, but also how both levels of social acceptance differ in these two countries. In this research paper, the following research questions will be investigated:

What factors influence the social acceptance of the general public towards bioenergy in the Netherlands and in Germany? How do the levels of social acceptance towards bioenergy differ in both countries?

Findings from this research could make the phenomenon of social acceptance towards bioenergy more tangible. This, in turn, could be used by the Dutch and German government to understand the concerns of the general public and implement them into their political decision making. Additionally, communication professionals could use this research as a base for communication campaigns that target the general public.

2. Framework

The process, implementation and development of bioenergy depends on several different stakeholders and their perception. Therefore, in order to implement bioenergy successfully, the issue of social acceptance needs to be addressed. In the following, social acceptance as a construct will be defined. In addition to that, not only the relevance of social acceptance, but also possible antecedents, that could influence social acceptance will be discussed and identified. The framework is established in the context of social acceptance towards bioenergy.

2.1 Social Acceptance

In the recent years, renewable energy technologies were increasingly regarded from a 'social perspective' (Batel, Devine-Wright, & Tangeland, 2013). Importantly to note is that social acceptance does not only relate to renewable energies, but that it also involves environmental, economic and social aspects (Energy Research Centre of the Netherlands, 2008). The most cited definition of social acceptance is made by Wüstenhagen et al. (2007). They divide social acceptance into three dimensions, namely socio-political acceptance, community acceptance and market acceptance. Firstly, socio-political acceptance is defined as the willingness of stakeholders and policy makers to create institutional changes and policies. Secondly, community acceptance means that local stakeholders accept important decisions and projects regarding renewable energies. Lastly, market acceptance refers to the adoption of innovative products by consumers that can be reached through communication processes. This definition involves several stakeholders.

Since this research focuses on social acceptance of the general public, the focus lies on community acceptance, meaning that the people that are affected by a renewable energy project due to the national context, accept decisions concerning bioenergy. Therefore, in the present research, social acceptance is regarded as the public response to policies, institutions and other stakeholders that relate to bioenergy. This means that in order to reach social acceptance, a particular policy needs to be supported by people who can be influenced by it. In particular, it is a positive attitude towards bioenergy including encouragement, confirmation and approbation (Cohen, Reich, & Schmidthaler, 2014). When relating to encouragement, confirmation and approbation, the concepts of acceptance and support need to be examined. While acceptance means that people only tolerate bioenergy and take it because it is offered, support means that the public actively approves bioenergy and encourages as well as advocates its implementation which is also crucial for social acceptance of bioenergy (POLIMP, 2014).

There are several reasons why social acceptance is important in the context of bioenergy. Firstly, Wüstenhagen et al. (2007) explain that policies cannot be implemented successfully without the approval by several stakeholders. Moula et al. (2013) agree on that and explain that social acceptance is important to consider, since it has an impact on the achievement of energy policy objectives and the implementation of renewable energies. Fast (2013) goes one step further and states that social acceptance does not only affect an innovation's implementation, but once it got implemented, the level of social acceptance also

affects and reshapes its development afterwards. Lastly, social acceptance towards bioenergy is needed for the political legitimacy of the bioenergy industry, since it also influences the willingness of policy-makers to work on supportive policies for bioenergy. Therefore, in order to successfully implement and expand bioenergy, communication strategies are crucial (McCormick, 2010).

2.2 Antecedents

There are many antecedents that influence social acceptance. The drivers that could be found are procedural justice, trust, perceived benefits and risks, political affiliation, environmental concern, proximity, knowledge and, the demographics, such as age, gender and income.

2.2.1 Procedural Justice

One factor that has an impact on social acceptance is called procedural justice. Procedural justice can be defined as the subjective perception of an individual on whether the decision processes regarding bioenergy are fair and in the interest of the community. Thus, the public regards the decision process as fair when it can find the opportunity to participate in the planning process (Wüstenhagen et al., 2007). More precisely, this means that the public has the feeling that its opinions, concerns and interests are taken into consideration in the decision-making process (Terwel, Harinck, Ellemers, & Daamen, 2011). Procedural justice is an important factor to take into account, which is illustrated by Aitken (2010), who states that public participation represents a factor for reaching higher acceptance. Additionally, results indicate that procedural justice significantly explains people's negative attitudes towards renewable energies (Moula et al., 2013). Wüstenhagen et al. (2007) agree on that and explain that outcomes that are regarded as unfair can cause protests of a community. This, in particular, can happen when decisions are made which harm some parts of the community in order to benefit others.

H1: Procedural justice positively predicts social acceptance on bioenergy in the Netherlands and in Germany.

2.2.2 Trust

In several contexts, it has been found out that trust is a predictor of social acceptance (Mercer-Mapstone, Rifkin, Louis, & Moffat, 2018). Social trust means that people rely on others and, as a result, expect beneficial outcomes from them. Additionally, it is explained as a feeling of that a person or institution will act in the best interest of oneself (Wüstenhagen et al., 2007). Thus, people base their trust on social relations. According to Terwel et al. (2011), trust involves competence and integrity. While competence relates to the people's perception on how successfully and well an organization does its job, integrity refers to the honesty and morality of a certain stakeholder. In the current context, a stakeholder is defined as a group, or individual who can affect or is affected by the achievement of the organization's objectives (Mitchell, Agle, & Wood, 1997). In the present research, the stakeholders of bioenergy in the Netherlands and Germany are the government, private companies, non-governmental organizations and researchers (Stigka, Paravantis, & Mihalakakou, 2014).

Apart from that, it was found that procedural justice is closely linked to trust. More precisely, a study shows that the impact of procedural justice on acceptance is mediated by trust, which means that perceptions on fairness positively predicts social acceptance directly as well as through trust (Mercer-Mapstone et al., 2018). This is also supported by Aitken (2010), stating that participants need to trust that the participation in processes is meaningful and that the actors involved in the process will act in their best interests.

H2a: Trust positively predicts social acceptance on bioenergy in the Netherlands and in Germany.

H2b: The prediction of procedural justice on social acceptance is mediated by trust.

2.2.3 Perceived Benefits & Perceived Risks

Moreover, it has been stated that outcome evaluation affects social acceptance (Liu, Wang, & Mol, 2013). Outcomes are defined as the benefits and risks a system produces to its users. In the current context, it means the public's perception on what kind of advantages or disadvantages they gain from the implementation of bioenergy. Those benefits and risks are related to economic, social and environmental aspects, such as the reduction of global warming through the implementation of bioenergy, but also the depletion of natural resources (Acheson, 2012). Additionally, it can be distinguished between benefits and risks for the individual, for the society and for the environment (Bronfman, Jiménez, Arévalo, & Cifuentes, 2012). Apart from that, it is stated that not only people's values play an important

role in developing their perception towards the consequences of bioenergy (Perlaviciute & Steg, 2015), but also people's knowledge. In particular, according to Bang, Ellinger, Hadjimarcou, and Traichal (2000), people who are more informed about renewable energies tend to perceive the benefits of using renewable energies stronger than people who are less informed about renewable energies.

H3a: Perceived benefits positively predicts social acceptance on bioenergy in the Netherlands and in Germany.
H3b: Perceived risks negatively predicts social acceptance on bioenergy in the Netherlands and in Germany.

2.2.4 Political Affiliation

Furthermore, it could be found that the political affiliation of an individual has an impact on the olerance towards renewable energy (Eagle, Osmond, McCarthy, Low, & Lesbirel, 2017). Political affiliation can be defined as an individual's support of a political party and, therefore, it is regarded as a political attitude (Jost, Federico, & Napier, 2009). Firstly, Populus (2005) demonstrates that 37% of people supporting the conservative party also support new nuclear power stations (compared to only 12% of labour supporters and 14% liberal democrat) whilst on the other hand, such supporters are significantly less supportive renewable energy. In the same vain, in Finland, it was found out that voters of the green party and the left league have a significantly lower acceptance towards nuclear energy than those who vote for other parties (Moula et al., 2013). In addition to that, articles published in the US show that, generally, Democrats have a more positive attitude towards bioenergy. This was found to be due to the fact that Democrats have a higher environmental concern than Republicans (Radics, Dasmohapatra, & Kelley, 2015). This is also supported by Karlstrøm and Ryghaug (2014), who state that environmental concerns were, in general, stronger among Labour and Green supporters.

H4a: People that are left oriented have a higher level of social acceptance on bioenergy compared people that are right oriented in the Netherlands and in Germany.
H4b: People that support a liberal party have a higher level of social acceptance on bioenergy compared people that support a conservative party in the Netherlands and in Germany.

2.2.5 Environmental Concern

Additionally, studies show that people with a higher environmental concern have a more favourable attitude towards bioenergy (Thogersen & Noblet, 2012). Environmental concern can be defined as the subjective evaluation of an individual regarding the protection of the environment (Bamberg, 2003). According to Bamberg (2003), environmental concern only focuses on the perception of environmental pollution, where behaviour is excluded. Important to state is that people are interested in the environment mostly due to egoistic motives, such as their own health or their children's future (Bang et al., 2000). Therefore, when individuals feel affected by an issue, they feel involved and, thus, start searching for information. Information search, in turn, results in heightened knowledge about alternatives to environmental problems. Therefore, it can be said that knowledge and concern about the current environmental situation will lead to an interest in renewable energies (Bang et al., 2000). This is why consumers who are more concerned about the environment also tend to have more knowledge about bioenergy than consumers who are less concerned about the environment.

H5: Environmental concern positively predicts social acceptance on bioenergy in the Netherlands and in Germany.

2.2.6 Proximity

Moreover, Cheikh, Abdellatif, and Bakini (2014) state that in general, proximity has a strong impact on an individual's attitude toward renewable energy projects. For instance, in a study, it was found that people that live close to biomass power plants had more negative opinions towards using biomass electricity (Moula et al., 2013). Wüstenhagen et al. (2007) support that by stating that most of the people that are against renewable energy facilities are the ones that live in the near of it. Melia (2013) explains that people who see renewable energy projects in their everyday life might have a different opinion compared to those who live further away. This relates to the NIMBY phenomenon, meaning that locals are against bioenergy projects due to personal reasons (Wolsink, 2000). Importantly to note is that people do not entirely fear bioenergy itself but rather regard it as a threat to their life quality (Devine-Wright, 2011).

H6: Proximity negatively predicts social acceptance on bioenergy in the Netherlands and in Germany.

2.2.7 Knowledge

In addition to that, some studies assume that negative attitudes towards renewable energy are caused by lack of knowledge and understanding (Moula et al., 2013). Knowledge can be defined as the search of objectively factual information (Bang et al., 2000) and as an understanding that is gained by experience. In the current case, knowledge is regarded as being informed about bioenergy but it also might involve the contact with bioenergy, as for instance, having it in the own household. Cheikh et al. (2014) state that knowledge about renewable energy projects increases the likelihood to achieve social acceptance. This means that the most informed people have the most favourable attitude towards bioenergy. Yuan, Zuo, and Huisingh (2015) explain that this is related with the understanding of the social, economic and environmental benefits that lead to a higher level of social acceptance. More precisely, it means that heightened knowledge about renewable energy leads to a stronger perception on the benefits of renewable energy, which, in turn, results in a more favourable attitude (Bang et al., 2000).

H7: Knowledge positively predicts social acceptance on bioenergy in the Netherlands and in Germany.

2.2.8 Demographics

Several studies discuss the impact of demographics, such as age, gender and income on social acceptance on renewable energy. Regarding age, there could be found many studies with opposing results. In one study, it was found out that young people tend to have a more positive attitude towards renewable energy projects while another study reported the opposite (Cheikh et al., 2014). Moula et al. (2013) support that, as it was found out that older participants are against renewable energy, but in contrast, another study also found younger and older people opposing renewables (age 16-24 and 65+) while middle-aged respondents (35-44, 55-64) had a more favourable attitude towards renewables. Dael, Lizin, Swinnen, and Passel (2017) agree on the result that the younger generation opposes bioenergy and state that students under 18 years old were found to have a rather negative attitude towards bioenergy.

H8a: Age predicts social acceptance on bioenergy in the Netherlands and in Germany.

In terms of gender, it was found out that women have a lower level of knowledge concerning bioenergy, but they also have been found to have a more favourable attitude than men (Dael et al., 2017). This is also supported by Radics et al. (2015), stating that men are more informed about bioenergy issues than women across all regions. According to them, women are more likely to support bioenergy due to the fact that they perceive the benefits of bioenergy stronger than the risks.

H8b: Women have a higher level of social acceptance on bioenergy compared to men in the Netherlands and in Germany.

Thirdly, it is stated that the level of income predicts the social acceptance of bioenergy. According to Moula et al. (2013), most of the people that support renewable energies belong to an employed group. This is also supported by another study that states that, in general, respondents with higher incomes are more familiar with renewables and more willing to support renewable energies than those with lower incomes (Yuan et al., 2015). Lastly, Paravantis et al. (2018) supports this finding by stating that people with a higher income are willing to pay for bioenergy and, therefore, are more likely to accept it.

H8c: Income positively predicts social acceptance on bioenergy in the Netherlands and in Germany.

2.3 Research Model

Based on the above-discussed and hypothesized relationships, the visual representation of the conceptual research model can be found in figure 1.

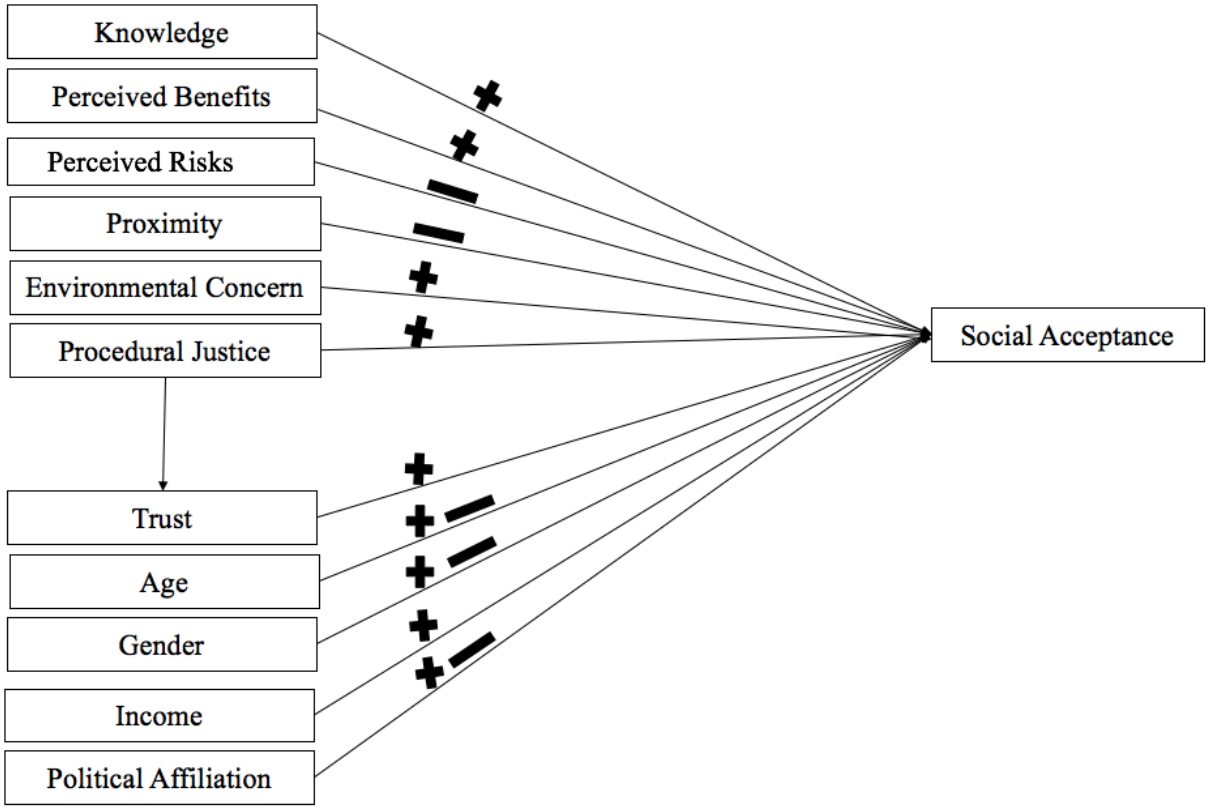

Figure 1. Research Model

3. Method

3.1 Design & Instruments

The purpose of this study was to investigate the level of social acceptance in the Netherlands and Germany towards bioenergy. In order to do so, an online survey was conducted. In order to answer the given research question, a questionnaire was selected, since a questionnaire can measure different variables and by doing so, it can be found out how those variables correlate and influence each other (Gelo, Braakmann, & Benetka, 2009). In the current context, the online questionnaire enabled to measure the predictors of social acceptance towards bioenergy. A questionnaire comes with several advantages, as for instance, it enables to collect a great amount of data in a short amount of time (Babbie, 1998). Secondly, this large data can describe as well as generalize the opinions of the whole population, which was needed in order to answer the research question and hypotheses of the present study (Gelo et al., 2009). Moreover, in contrast to offline surveys, online surveys enable to reach participants

that are dispersed throughout a whole country easier and faster. This also leads to having automated data collection, meaning that the participants can complete the questionnaire from anywhere at any time which, in turn, also reduces the researchers' time, effort and money (Van Selm & Jankowski, 2006).

For this study, the convenience sampling strategy was used. Convenience sampling belongs to nonprobability or non-random sampling. For this sampling strategy, people of the target population that were easily accessible were included in the study. The advantage of convenience sampling was that the participants were readily available, which made the data collection easy and affordable (Etikan, 2016).

3.2 Procedure

Prior to conducting the research, the study was ethically reviewed from the ethical committee of the University of Twente. The survey for the main study was designed in Dutch, German and English in order to not exclude anyone who lives in the Netherlands or in Germany. The survey of this research was distributed through online channels, such as email, social media (Facebook, WhatsApp, Instagram) and the website Survey Swap. Additionally, participants were approached via the scientific research platform SONA of the University of Twente in which suitable students could sign up for participation.

Before filling out the survey, the respondents had to read an introduction about the purpose of the study, their data protection, the right to stop the study at any point and, lastly, had to give their consent to participate voluntarily. If a respondent did not agree, the respondent could not continue with the questionnaire. After obtaining the consent of the participants, the participants were asked for their demographics. Thereafter, the participants were asked about their general knowledge about bioenergy. Followed by that, the participants had to read a short text about bioenergy and its application in case they did not have any knowledge about it. After reading that explanation, respondents were asked to fill out the rest of the questionnaire. The survey had questions sets regarding knowledge level, perceived benefits, perceived risks, proximity, environmental concern, procedural justice, trust and social acceptance. After completing the questionnaire, the participants were thanked. On average, the complete research procedure took approximately ten minutes per participant.

3.3 Measurements

The beginning of the survey consisted of demographic variables, being age, gender, nationality, place of residence, income and educational level. Additionally, the political leanings of the participants were measured by using two scales where participants had to indicate from 0-100 whether their political affiliation is rather left or right and progressive or conservative.

Thereafter, the knowledge level was measured using the items 'I understand how bioenergy is produced', 'I understand how bioenergy works', 'I understand the impact of bioenergy', 'I have heard about bioenergy in the Netherland/Germany' and 'I am experienced with bioenergy'. The items measuring 'Knowledge' were retrieved from a study by Melia (2013). Due to a technical issue, not every participant rated the item 'I understand how bioenergy is produced'. Therefore, this item was eliminated for further analysis. This scale was found to be reliable with a Cronbach's alpha of .81. Additionally, the survey consisted of the association question 'When I think about bioenergy, I think of…' in order to analyse the participants' associations that come into their minds when they think about bioenergy. This variable, as well as all other following variables, were measured using a 7-point Likert scale ranging from 'Strongly disagree' to 'Strongly agree'.

Subsequently, the following variable of 'Perceived Benefits' was measured on a 7-point Likert scale using the items 'Bioenergy is beneficial for me', 'bioenergy is beneficial for society as a whole in the Netherlands/Germany', 'Bioenergy helps to reduce reliance on foreign oil import', 'Bioenergy results in more industries and job opportunities' and 'Bioenergy improves the quality of the environment'. The items measuring 'Perceived Benefits' were retrieved from a study by Acheson (2012) and a study by Bronfman et al. (2012). Since the item 'Bioenergy results in more industries and job opportunities' did not load on any factor in the factor analysis, the item was taken out for further analysis. The 'Perceived Benefits' items combined reached a Cronbach's alpha of .86.

In addition to that, the variable 'Perceived Risks' was measured using the items 'Bioenergy causes the depletion of natural resources', 'Bioenergy leads to a lower food security', 'Bioenergy is more expensive', 'Bioenergy results in a competition for land-use' and 'Not all emissions from biofuels are environmentally friendly'. The items measuring 'Perceived Risks' were retrieved from a study by Acheson (2012) This variable as well was found to be reliable with a Cronbach's alpha of .80.

The variable 'Proximity' was measured using the items 'I would be willing to accept (more) bioenergy facilities nearby my home', 'Bioenergy is fine as long as it is not nearby my

house', 'If bioenergy facilities would be nearby my home, it would threaten my personal life', 'I feel at home where I live'. The items measuring proximity were retrieved from a study by Melia (2013) and a study by Devine-Wright (2011). Due to the fact that the items of this variable did not load on the same factor in the executed factor analysis, this variable was eliminated for further analysis.

The variable 'Environmental Concern' was measured using the items 'If things continue on their present course, we will soon experience an ecological catastrophe', 'The so-called ecological crisis facing humankind has been exaggerated', 'I am concerned about the effect of global warming in the Netherlands/Germany', 'Thinking about the environmental conditions our children and grandchildren have to live under, worries me' and 'We should become more environmentally friendly in order to preserve the earth'. The items measuring 'Environmental Concern' were retrieved from a study by Bamberg (2003) and a study by Thogersen and Noblet (2012). This variable's items combined reached a Cronbach's alpha of .89.

Furthermore, the variable 'Procedural Justice' was measured using the items 'Local authorities conduct the planning of bioenergy facilities in a fair manner', 'When making decisions concerning bioenergy, the needs of all citizens are considered', 'When making decisions concerning bioenergy, the concerns of all citizens are considered', 'When making decisions concerning bioenergy, there is the opportunity for public participation'. The items measuring 'Procedural Justice' were retrieved from a study by Linzenich and Ziefle (2018) and a study by Zoellner, Ittner, and Schweizer-Ries (2005). This variable was as well found to be reliable with a Cronbach's alpha of .81.

The variable 'Trust' was measured by dividing it into several stakeholders. Therefore, all items were used separately for the stakeholders, being the government, private companies, NGOs and researchers. Using 'government' as an example, the variable was measured using the items 'I think that the government carries out its work regarding bioenergy successfully and well', 'I think that the government is honest when carrying out its work regarding bioenergy' and 'I think that the government acts in the best interest of society'. The items measuring 'Trust' were retrieved from a study by Terwel et al. (2011) and a study by Mercer-Mapstone et al. (2018). The items of the variable did not load on the same factor, meaning that the items were separated into three different variables, being 'Trust in Government', Trust in Private Companies' and 'Trust in NGOs and Researchers'. The items of the variable 'Trust in Government' were successfully tested towards their reliability with a Cronbach's alpha of .85. The same goes for 'Trust in Private Companies' with a Cronbach's alpha of .81.

‘Trust in NGOs and Researchers’ was also found to be reliable with a Cronbach’s alpha of .88.

Lastly, the dependent variable ‘Social Acceptance’ was measured using the items ‘All things considered, I approve bioenergy in general’, ‘I would support the building of a new bioenergy facility’, ‘In general, I have a positive attitude towards bioenergy’ and ‘I would be willing to use bioenergy’. The ‘Social Acceptance’ items combined reached a Cronbach’s alpha of .95. The items measuring the dependent variable were retrieved from a study by Batel et al. (2013). The variables ‘Perceived Benefits’ and ‘Social Acceptance’ loaded on the same factor in the factor analysis. However, since these two constructs are impossible to combine in this study, this result got ignored and the variables were still analysed separately.

3.4 Respondents/Sample

In the given study, a total of 263 have filled in the questionnaire. However, due to incomplete answers, 29 questionnaires were deleted. Therefore, the used data set from this study was from 234 respondents (see Table 1), with 43.6% being male and 56.4% being female. The age ranged from 18 to 76 with the average of 34 years (SD=16.66) and 106 of the participants living in Germany and 128 living in the Netherlands. Additionally, 105 participants had a Dutch nationality and 121 participants had a German nationality. Besides a Dutch and German nationality, also people with a British, Greek, Lithuanian, Spanish, Vietnamese, Romanian and American nationality participated. Concerning the level of education, not only students but also employees with different levels of education participated in the study. Most of the participants’ highest completed level of education was high school or equivalent (N=106). Followed by that, the highest degree of 76 participants was a Bachelor degree, of 31 participants a Master’s degree and of 21 participants other than that, such as a diploma or state examination. With 63.7%, most of the participants’ annual income was below 30.000€, which might be due to the fact that mostly students participated in this research. All of the participants knew about the purpose of the study and every respondent participated voluntarily.

Table 1.

Demographics

Items	**Category**	**Frequency**	**Percentage**
Gender	Male	102	43.6
	Female	132	56.4
Nationality	Dutch	105	44.9
	German	121	51.7
	Oher	8	3.4
Place of residence	The Netherlands	128	54.7
	Germany	106	45.3
Annual income	Below 30.000€	149	63.7
	30.000€-60.000€	28	12.0
	60.000€-90.000€	26	11.1
	90.000€-120.000€	20	8.5
	120.000€ or more	11	4.7
Level of education	High school or equivalent	106	45.3
	Bachelor's degree	76	32.5
	Master's degree	31	13.2
	Other	21	9.0

3.5 Analysis

To test the hypotheses presented in the theoretical framework, the results of the survey were analysed using the program SPSS. After using the program to ensure reliability regarding the survey items and ensuring the validity of the study, a correlation analysis was conducted in order to see how the variables of this study correlated with each other. Additionally, a multiple regression analysis was conducted in order to determine the significance of the effects on the dependent variable. Moreover, an independent samples t-test was conducted in

order to find out whether there were significant differences between people who live in the Netherlands and people who live in Germany in all of the results.

3.6 Construct Validity and Reliability

In order to investigate how the items of this research performed in relation to other variables, a validity factor analysis was conducted. Additionally, in order to ensure the reliability of the items of this research, the Cronbach's alpha was calculated. Thereafter, the fitting items could be computed into variables and their effects could be measured.

3.6.1 Validity

To prove the validity of the study, a factor analysis was performed. In total, 43 items, separated by eight factors, which were seven independent variables and one dependent variable, were analysed. The aim was to find out whether or not the variables measure what they are supposed to measure. In the table of 'KMO and Bartlett's Test', the score was over .50, meaning that the data was suitable for the factor analysis. In addition to that, each eigenvalue for every factor of this study was over and above 1, which showed that the items of this research were valid. In the factor analysis, it was important to see whether the items load on the same factors as determined in the questionnaire before. If some items did not load on the factor they were supposed to load on, the variables needed to be adjusted. In this study, some changes were made due to the results of the factor analysis that are mentioned above. The table of the factor analysis can be found in Appendix B.

3.6.2 Reliability

Furthermore, the reliability of this research was tested. The Cronbach's alpha from the variables were calculated to find out more about the internal consistency, meaning how closely related a set of items were as a group. Each Cronbach Alpha from the variables scored over and above .80 (see Table 2). This suggests that the items had a relatively high internal consistency and, therefore, could be computed into variables.

Table 2.

Cronbach's Alpha

Constructs	**Items**	**Cronbach's Alpha**
Knowledge	I understand how bioenergy works. I understand the impacts of bioenergy. I have heard about bioenergy in the Netherlands/Germany. I am experienced with bioenergy.	.81
Perceived Benefits	Bioenergy is beneficial for me. Bioenergy is beneficial for society as a whole in the Netherlands/Germany. Bioenergy helps to reduce reliance on foreign oil import. Bioenergy improves the quality of the environment.	.86
Perceived Risks	Bioenergy causes the depletion of natural resources. Bioenergy leads to a lower food security. Bioenergy is more expensive. Bioenergy results in a competition for land-use. Not all emissions from biofuels are environmentally friendly.	.80
Environmental Concern	If things continue on their present course, we will soon experience an ecological catastrophe. The so-called 'ecological crisis' facing humankind has been exaggerated. I am concerned about the effect of global warming in the Netherlands/Germany. Thinking about the environmental conditions our children and grandchildren have to live under, worries me.	.89

	We should become more environmentally friendly in order to preserve the earth.	
Procedural Justice	Local authorities conduct the planning of bioenergy facilities in a fair manner.	.81
	When making decisions concerning bioenergy, the needs of all citizens are considered.	
	When making decisions concerning bioenergy, the concerns of all citizens are considered.	
	When making decisions concerning bioenergy, there is the opportunity for public participation.	
Trust in Government	I think that the government carries out its work regarding bioenergy successfully and well.	.85
	I think that the government is honest when carrying out its work regarding bioenergy.	
	I think that the government acts in the best interest of society.	
Trust in Private Companies	I think that private companies carry out its work regarding bioenergy successfully and well.	.81
	I think that private companies are honest when carrying out its work regarding bioenergy.	
	I think that private companies act in the best interest of society.	
Trust in NGOs and Researchers	I think that NGOs carry out its work regarding bioenergy successfully and well.	.88
	I think that NGOs are honest when carrying out its work regarding bioenergy.	
	I think that NGOs act in the best interest of society.	

	I think that researchers carry out its work regarding bioenergy successfully and well.	
	I think that researchers are honest when carrying out its work regarding bioenergy.	
	I think that researchers act in the best interest of society.	
Social Acceptance	All things considered, I approve bioenergy in general.	.95
	I would support the building of a new bioenergy facility.	
	In general, I have a positive attitude towards bioenergy.	
	I would be willing to use bioenergy.	

4. Results

4.1 Descriptive Statistics

The following scores were generated from the computed variables on SPSS. Firstly, 'Social Acceptance' (M=5.35, SD=1.2) reached one of the highest scores among all variables tested (see Table 3). This means that in the Netherlands and in Germany, bioenergy was accepted quite well. Additionally, 'Knowledge' (M=3.89, SD=1.33) scored relatively low, suggesting that, in general, the participants did not know much about bioenergy. Furthermore, on average, the participants slightly agreed on the benefits (M=5.19, SD=1.22) and risks (M=4.81, SD=1.06) of bioenergy, meaning that it was associated with several benefits, but also with risks. Moreover, it could be seen that 'Environmental Concern' (M=5.53, 1.17) scored highest among all scores, which suggests that the participants were highly concerned about the environment and its changes. In contrast, 'Procedural Justice' (M=3.98, SD=1.01) scored relatively low, which states that the participants did not feel involved in the decision-making processes regarding bioenergy. Regarding the variable 'Trust', 'Trust in NGOs and Researchers' (M=4.73, SD=.95) scored highest, meaning that there was a relatively high trust in the work and honesty of NGOs and researchers towards society. This is followed by 'Trust in Private Companies' (M=3.86, SD=1.05) and 'Trust in Government' (M=3.78, SD=1.16).

Table 3.

Descriptive Statistics

Variable	N	Mean	Standard Deviation
Knowledge	234	3.89	1.33
Perceived Benefits	234	5.19	1.22
Perceived Risks	234	4.81	1.06
Environmental Concern	234	5.53	1.17
Procedural Justice	234	3.98	1.01
Trust in Government	234	3.78	1.16
Trust in Private Companies	234	3.86	1.05
Trust in NGOs and Researchers	234	4.73	.95
Social Acceptance	234	5.35	1.20

4.2 Association Analysis

In order to analyse the association question "What do you think of when thinking about bioenergy?", two word clouds were created, divided by answers from people living in Germany and from people living in the Netherlands. The word clouds can be found in Appendix D. By creating a word cloud, the words that were mentioned most often appear in the foreground of the word cloud, which indicates what kind of associations the participants had when thinking about bioenergy. Looking at the word clouds, different categories for the most mentioned terms could be created.

Firstly, in Germany, bioenergy was often associated with the result of the process of bioenergy, with energy. Related to that, participants also thought of biomass or biogas. Just as in Germany, in the Netherlands, bioenergy was often simply associated with energy. Additionally, bioenergy was also often associated with biomass.

Apart from that, several participants living in Germany associated bioenergy with material that is needed in order to produce bioenergy, such as corn, palm oil, waste or bioenergy facilities. Also in the Netherlands, regarding the production of bioenergy, waste and compost were often mentioned.

Furthermore, in Germany, the participants associated bioenergy with some advantages of bioenergy and its positive impact. For example, they indicated to think that bioenergy is ecological and green which leads to more sustainability and to the protection of the

environment. Additionally, especially people in the Netherlands also associated bioenergy with some benefits, such as sustainability, a green environment and, lastly, they regarded bioenergy as environmentally friendly.

Finally, especially in Germany, bioenergy was often associated with other renewable energies, such as solar energy, wind energy- or turbines and green cars. Compared to the Netherlands, even though it was not as often mentioned as by German citizens, Dutch citizens also associated bioenergy with other renewables, such as solar energy or wind energy.

4.3 Comparison between the Netherlands and Germany

In order to compare both the Netherlands and Germany on the given results, an independent samples t-test on the dependent as well as the independent variables was conducted (see Table 4). Firstly, the participants living in the Netherlands (M=43.95, SD=22.51) and participants living in Germany (M=37.71, SD=19.72) differed significantly in their political affiliation with people from Germany being more left oriented than people living in the Netherlands, t (232) = -2.23, p = .03. Secondly, there was a significant difference in 'Social Acceptance' with people living in Germany (M=5.64, SD=.91) scoring higher than people in the Netherlands (M=5.11, SD=1.35); t (232) = -3.41, p < .01. The same goes for 'Perceived Benefits', since the participants living in Germany (M=5.40, SD=1.07) scored significantly higher than the participants living in the Netherlands (M=5.01, SD=1.30), t (232) = -2.50, p = .01. This is in line with 'Perceived Risk', as people living in the Netherlands scored lower on 'Perceived Benefits', but perceived the risks of bioenergy stronger (M=5.08, SD=1.06) than people living in Germany (M=4.48, SD=.98), t (232) = .09, p < .01. In the same vain, people that live in Germany (M=5.86, SD=1.10) compared to people that live in the Netherlands (M=5.25, SD=1.16) indicated to have a higher environmental concern, t (232) = -4.12, p < .01. Lastly, there was also a significant difference in 'Trust in NGOs and Researcher', t (232) = -2.91, p < .01, meaning that people living in Germany (M=4.93, SD=.89) had a higher trust in NGOs and researchers than the people living in the Netherlands (M=4.57, SD=.97).

Table 4.
Comparison between the Netherlands and Germany

	The Netherlands		**Germany**			
	Mean	Standard Deviation	Mean	Standard Deviation	t-value	Sig.
Age	33.87	16.46	35.55	16.93	-.76	.45
Income	1.80	1.17	1.77	1.27	.15	.88
Level of Education	1.84	.87	1.88	1.07	-.27	.79
Political Affiliation	43.95	22.51	37.70	19.72	2.23	**.03**
Political Affiliation	44.13	24.08	39.59	21.86	1.50	.14
Knowledge	3.90	1.28	3.88	1.38	.17	.87
Perceived Benefits	5.01	1.30	5.40	1.07	-2.51	**.01**
Perceived Risk	5.08	1.06	4.48	.98	4.43	**.000**
Environmental Concern	5.25	1.16	5.86	1.10	-4.13	**.000**
Procedural Justice	3.99	1.11	3.97	.89	.17	.87
Trust in Government	3.82	1.19	3.74	1.12	.51	.61
Trust in Private Companies	3.91	.98	3.81	1.12	.67	.51
Trust in NGOs and Researchers	4.57	.97	4.93	.89	-2.91	**.004**
Social Acceptance	5.11	1.35	5.64	.91	3.41	**.000**

4.4 Model Testing: Regression Analysis

In order to test the formulated hypotheses in this research, a multiple regression analysis was executed. The model shown included the demographic characteristics as predicting variables (see Table 5 and Table 6). The model was significant with the independent variables explaining 62.3% of the variance in the social acceptance of bioenergy in the Netherlands and

Germany ($R^2 = .62$, F (16, 230) = 22.08, $p < .01$). Therefore, it can be said that this model had a strong explanatory value on the dependent variable, but it still could be improved by adding other predictors. None of the demographic characteristics had a significant effect on 'Social Acceptance', meaning that the age, gender, educational level and income of the participants did not significantly predict social acceptance towards bioenergy in the Netherlands and in Germany. The same accounts for 'Political affiliation', which as well did not have a significant effect on 'Social acceptance'. This means that a left or right orientation as well as a liberal or conservative orientation of the participants did not significantly influence the social acceptance towards bioenergy. However, half of the variables did have a significant t-value on 'Social Acceptance', being 'Perceived Benefits', 'Procedural Justice', 'Trust in Government' and 'Trust in NGOs and Researchers'. The effect of 'Perceived Benefits' on 'Social Acceptance' was the strongest out of all significant effects, which was also in line with the correlation analysis and indicates that people who perceived the benefits of bioenergy stronger were also more likely to accept bioenergy. Additionally, due to the significant effect of 'Procedural Justice' on 'Social Acceptance', participants indicated that if they feel highly involved in the decision-making process, they are also more likely to accept bioenergy. Surprisingly, out of all significant effects, the only negative effect was 'Trust in Government' on 'Social Acceptance', meaning that as soon as the trust in the government increased, the social acceptance towards bioenergy decreased. In contrast, the other half, being 'Knowledge', 'Perceived Risk', 'Environmental Concern' and 'Trust in Private Companies' did not have a significant t-value on 'Social Acceptance'. Importantly to note is that the non-significant effect of 'Knowledge' is the weakest, which indicates that the knowledge level of the participants did not influence how well they accepted bioenergy. Lastly, the non-significant effects indicate that the perception of risks, the concern about the current environmental situation and the trust in private companies did not significantly influence the social acceptance towards bioenergy.

Table 5.

Regression Model Summary

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.79	.62	.60	.75

Table 6.

Regression Coefficients

Model	**ß**	**t-value**	**Sig.**
Age	.01	1.59	.11
Gender	-.08	-.59	.56
Nationality	.19	1.38	.169
Place of residence	.08	.55	.58
Income	-.11	-1.69	.09
Educational level	-.03	-.49	.62
Political Affiliation (Left/Right)	-.003	-1.24	.22
Political Affiliation (Progressive/Conservative)	.000	-.19	.85
Knowledge	.02	.41	.68
Perceived Benefit	.48	8.0	**.000**
Perceived Risk	.02	.30	.77
Environmental Concern	.03	.39	.70

Procedural Justice	.34	5.13	**.000**
Trust in Government	-.13	-2.20	**.03**
Trust in Private Companies	.07	1.12	.26
Trust in NGOs and Researchers	.20	2.58	**.01**

4.5 Mediation Analysis

Additionally, it was tested whether the significant effect of 'Procedural Justice' on 'Social Acceptance' was mediated by 'Trust'. It turned out that the effect of 'Procedural Justice' on 'Social Acceptance' still was significant (t (233) = 7.78, p < .01) even though the variable 'Trust in Government' was added. When adding 'Trust in Private Companies', the effect of 'Procedural Justice' on 'Social Acceptance was still significant as well (t (233) = 8.33, p < .01). For 'Trust in NOGs and Researcher', the effect of 'Procedural Justice' on 'Social Acceptance' was still significant (t (233) = 6.01, p < .01), but the effect of 'Trust in NGOS and Researcher' on 'Social Acceptance' was also still significant (t (233) = 7.2, p < .01). It can be said that the hypothesis that states that the effect of procedural justice on social acceptance is mediated by trust could not be supported.

4.6 Correlation Analysis

In order to see whether the variables correlated with one another or not, a Pearson's correlation analysis was performed. This means that if one of the constructs changed, the other one would change in the same way. There could be found 19 significant correlations. It could be seen that the strongest correlation between the dependent variable and the independent variables was between 'Social Acceptance' and the 'Perceived Benefits' (r = .70, p < .01), followed by the correlations between 'Social Acceptance' and 'Trust in NGOs & Researchers' (r = .56, p < .01) and 'Social Acceptance' and 'Procedural Justice' (r = .52, p < .01). The results suggest that all the independent variables except for 'Knowledge' (r = .09, p = .16) and 'Perceived Risks' (r = .01, p = .92) significantly correlated with the dependent variable.

The greatest significant correlation among the independent variables was the correlation between 'Perceived Benefits' and 'Environmental Concern' (r = .60, p < .01), followed by the correlation between 'Procedural Justice' and 'Trust in Government' (r = .56,

$p < .01$). 'Trust in NGOs and Researchers' correlated with almost every other independent variable, but not with 'Knowledge' ($r = .07$, $p = .29$) and 'Perceived Risks' ($r = -.03$, $p = .70$). It turned out that 'Knowledge' did not have any significant correlations with any independent variables and 'Perceived Risk' only significantly correlated with 'Procedural Justice' ($r = .18$, $p = .01$).

4.7 Hypotheses Overview

From the given results, Table 7 gives an overview of all hypotheses and whether they could be supported or not. In total, three hypotheses could be supported.

Table 7.

Hypotheses with Support

Hypotheses	**Support**
H1: Procedural Justice positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	Yes
H2a: Trust in the government positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H2b: Trust in private companies positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H2c: Trust in NGOs and researchers positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	Yes
H2d: The prediction of procedural justice on social acceptance is mediated by trust.	No
H3a: Perceived benefits positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	Yes
H3b: Perceived risks negatively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H4a: People that are left oriented have a higher level of social acceptance on bioenergy compared people that are right oriented in the Netherlands and in Germany.	No
H4b: People that support a liberal party have a higher level of social acceptance on bioenergy compared people that support a conservative party in the Netherlands and in Germany.	No

H5: Environmental concern positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H6: Proximity negatively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H7: Knowledge positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H8a: Age predicts social acceptance on bioenergy in the Netherlands and in Germany.	No
H8b: Women have a higher level of social acceptance on bioenergy compared to men in the Netherlands and in Germany.	No
H8c: Income positively predicts social acceptance on bioenergy in the Netherlands and in Germany.	No

4.8 Final Research Model

Based on the given results, a final adjusted research model could be created, which can be seen in figure 2.

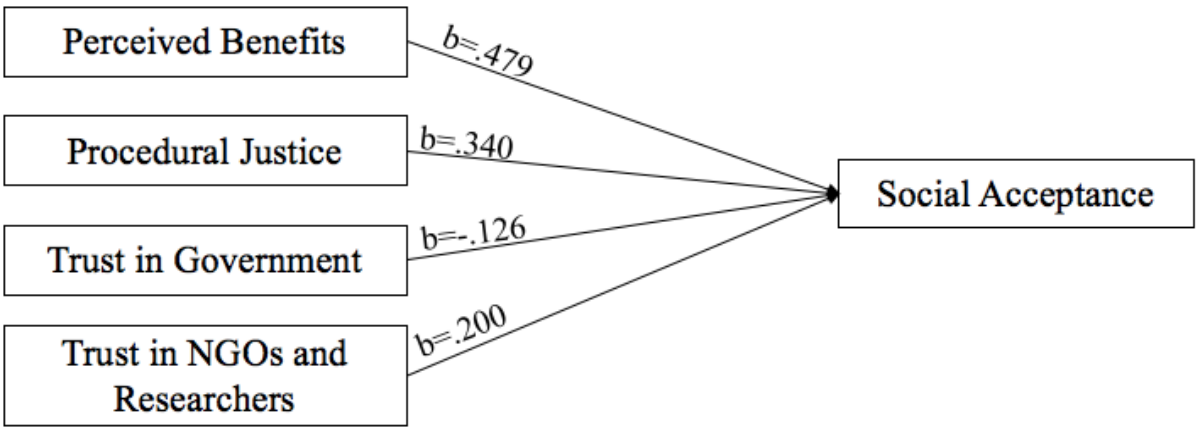

Figure 2. Final Research Model

5. Discussion

The main goal of this study was to identify what factors influence social acceptance of bioenergy in the Netherlands and in Germany. Additionally, the aim was to find out how the countries differ in social acceptance as well as in the given predictors. While the answer to that question has been answered, it is also important and interesting to discuss the details of the findings.

5.1 Regression Analysis

Even though previous studies predicted otherwise, only four variables had a significant effect on social acceptance. This might be explained by the fact that, in general, the participants were not familiar with the topic and were not able to answer all questions with full certainty. Additionally, it is possible that some variables did not show an effect due to the unequal division of the demographics. Since most of the participants were younger and students, it might be possible that the answers were biased. However, 'Procedural Justice', 'Perceived Benefits', 'Trust in Government' and 'Trust in NGOs and Researchers' did have an effect on social acceptance. In general, the results showed that bioenergy is perceived as relatively good and that the social acceptance of bioenergy is relatively high. This means that people do not only approve bioenergy, but that they also would support bioenergy or would be willing to use it.

To begin with, the participants thought that bioenergy is beneficial for themselves as well as for the society. This is also in line with the association question, since the benefits of bioenergy were very prominent and many participants associated bioenergy with sustainability, indicating that people have a favourable attitude towards bioenergy. Moreover, the strong effect of 'Perceived Benefits' on 'Social Acceptance' is in line with previous literature of Liu et al. (2013) who stated that people who are more aware of the benefits are also more likely to accept renewable energies. However, in the study of Bang et al. (2000), it was stated that the more informed people also perceive the benefits as stronger. In this study, this is not the case, since 'Knowledge' and 'Perceived Benefits' did not correlate. This might be due to the fact that the knowledge level of this sample was quite low. In addition to that, Aitken (2010) stated that the opportunity to participate in the process facilitates social acceptance towards renewables, which can also be confirmed in this study. This means that people need to feel considered in the decision-making process in order to accept bioenergy. Moreover, the high trust in NGOs and researchers and the effect on social acceptance might indicate that people think that NGOs and researchers are not interested in making money, but

rather on bringing renewable energies to a next level. In contrast to other stakeholders, they are also the ones trying to fight the climate change and not the ones who cause it (Klaas, 2012). Lastly, surprisingly, 'Trust in Government' had the only (significant) negative effect on 'Social Acceptance', meaning that when the trust in government increases, the social acceptance towards bioenergy decreases. Since 'Trust in Government' also correlated with 'Procedural Justice', it could be that the participants only think that the government acts in their own interest without considering the citizens' interests or concerns. This is also supported by the fact that, out of all results, 'Trust in Government' scored the lowest, which means that on average, the participants did not think that the government acts in the best interest of society.

For the rest of the model, there could not be found any significant effects. For instance, Moula et al. (2013) stated that there could be found effects of demographics on 'Social Acceptance'. However, in this study, there could not be found any effect of the demographics on 'Social Acceptance'. This might be due to the fact that the demographics were uneven and that most of the participants were younger students and, therefore, the results might have been biased. Furthermore, the results showed that the knowledge level among German and Dutch citizens was relatively low. This is also in line with the association question, since many participants only associated bioenergy with energy, but did not answer anything more precise. In previous studies, it was stated that the most informed people have a more favourable attitude towards bioenergy (Khambalkr, Katkhede, & Dahatonde, 2010). However, surprisingly, 'Knowledge' did not have a significant effect on 'Social Acceptance'. This might be due to the fact that people first answered how much they know about bioenergy and then got some information about it. Thereafter, they answered all the other questions. Moreover, Bang et al. (2000) stated that people with a heightened knowledge are also more concerned about the environment. This cannot be confirmed in the present sample either, since the participants indicated to have a low knowledge level but a high concern for the environment. Additionally, Thogersen and Noblet (2012) stated that people with a higher environmental concern have a more favourable attitude towards bioenergy. However, in this study, surprisingly, environmental concern did not have a significant effect on social acceptance. A possible explanation would be that, in contrast to other renewable energies, the impact of bioenergy on the environment is still disputed, since it is still not sure whether bioenergy is beneficial or harmful for the environment (Berndes, 2010). Therefore, it can happen that people with a high environmental concern are still against bioenergy. Moreover, out of all results, the trust in private companies scored relatively low and there could not be

found a significant effect on social acceptance. A possible explanation might be that since the renewable energy resources development aims to reduce the negative impact of climate change, the public tends to distrust the businesses that have caused the climate change in the first place (Klaas, 2012). In other words, companies are regarded as inconsistent since they are causing and combating the climate change at the same time (Woonink, 2014).

5.2 Mediation Effect

In previous studies, it was found that the impact of procedural justice on social acceptance was mediated by trust and that both factors are interrelated concepts (Mercer-Mapstone et al., 2018). However, in this study, the mediation effect could not be confirmed. This might be due to the fact that 'Procedural Justice' had an effect on 'Social Acceptance' while 'Trust' did not. However, due to the correlation analysis, it can be agreed that both factors are interrelated concepts. Therefore, it can be said that perception of fairness is needed in order to reach trust and the other way around.

5.3 Comparison between the Netherlands and Germany

Furthermore, it was tested how both countries differ in the level of social acceptance towards bioenergy. There could be found several significant effects between Netherlands and Germany. First of all, it can be said that in Germany, the social acceptance towards bioenergy was higher than in the Netherlands. This might be explained by the approach of Germany towards energy transition. It can be said that German citizens are more affected by the energy transition individually by having higher energy costs and by seeing renewable energies more often in their everyday life. This means that the whole approach also might affect the citizens' awareness about the urgency of renewables in general. In contrast, in the Netherlands, the approach towards energy transition is criticized due to its slow diffusion of wind energy and biomass technologies (Laes et al., 2014). Since renewables in general and bioenergy are neither applied nor seen so much, Dutch citizens might not feel affected by the energy transition in general. This is supported by the study of Kollmuss and Agyeman (2002) who state that a person that does not recognize the need to personally act in an environmentally friendly way will also miss out to do so. The result is also in line with the analysis of the association question, since many citizens from Germany associated bioenergy with other renewables, such as wind- or solar energy while Dutch citizens did not have such a strong focus on it. Moreover, German citizens also indicated to be more environmentally concerned. According to that, Laes et al. (2014) state that the renewable energy policy in Germany has

led to a large number of people playing an active role in the energy transition by becoming energy producers. Therefore, several German communities live an environmentally friendly lifestyle in order to become energy autonomous. Moreover, in this study, the German citizens perceived the benefits of bioenergy as stronger than the Dutch citizens. This also might relate to the different approach of the German government, since in the policy plan of Germany, it is explicitly stated that the goal is to minimise the costs to consumers when using renewable energies (Pegels et al., 2014). This might have let the German citizens think that they can also benefit individually from bioenergy. While on average, the benefits were perceived as stronger than the risks, this does not account for the Netherlands, since the Dutch citizens perceived the benefits weaker and the risks stronger than German citizens. This is also in line with the previous results, since Dutch citizens also scored lower on social acceptance of bioenergy. Lastly, on average, German citizens indicated to be more left oriented than Dutch citizens. This, in turn, supports the study of Moula et al. (2013) who stated that people supporting the green or left party are also more likely to accept renewable energies. In the current context, the German participants indicated to be rather left oriented and also indicated to have a higher acceptance towards bioenergy.

However, the countries did not differ in their level of knowledge. According to a conducted focus group and the present study, it can be concluded that people living in the Netherlands and in Germany do not feel affected by bioenergy individually and, therefore, do not know much about it. However, according to the association question, the citizens still knew more about other renewable energies, which might be due to the fact that they can see wind wheels every day or that they are also more affected by it individually. Moreover, it can be said that neither Dutch nor German citizens feel involved in the decision-making process. This also relates to the almost equally low trust in the government. Regarding the Dutch government, it was stated that ETP goals and priorities are inconsistent with the energy policy mix, which also might have led to a loss of trust. Related to that, regarding the German energy transition, recently some doubts were mentioned as well, since the expansion is faster than planned. This inconsistency could have led to a low trust as well (Pegels et al., 2014).

5.4 Theoretical Implications

There were already some previous studies related to bioenergy, including the social acceptance of bioenergy as renewable energy resources in some countries. In addition to that, there could also be found some studies related to social acceptance of bioenergy in the Netherlands. Moreover, there was also already literature about the comparison between the

German and the Dutch energy transition. However, so far, there could not be found any literature about the difference in social acceptance towards bioenergy between the Netherlands and Germany, that could be explained by different approaches of the countries towards energy transition. Therefore, it was important to conduct one to see how the Dutch and German citizens perceive bioenergy and reveal the factors that make them think so and, additionally, how different approaches of the energy transition can affect those factors. It turned out that, indeed, there could be found differences between both countries in this topic. However, since this study is the first one researching this, it is advised to conduct further research about this topic in order to get more reliable results. Based on previous literature, in this study, it was predicted that social acceptance consists of seven predictors, which were knowledge, perceived benefits, perceived risks, proximity, environmental concern, procedural justice and trust. However, not all factors did have an effect on social acceptance. Four significant effects could be found. However, for example, Bang et al. (2000) stated that people with a high environmental concern are more likely be informed about bioenergy and to accept it. This could not be found in the present study, since the present sample stated to be environmentally concerned, but not knowledgeable about bioenergy. Additionally, environmental concern did not predict social acceptance. Therefore, it is to say that environmental concern might influence the acceptance of renewable energies, but since the environmental impact of bioenergy is still not clarified, this effect does not account for bioenergy in particular. Moreover, in opposition to previous results of Cheikh et al. (2014), in this study, there could not be found any effect regarding knowledge. This might be due to the fact that most of the participants did not know anything about bioenergy. Therefore, in the future, it is advised to conduct the research with people who have more interest in the topic. Furthermore, Moula et al. (2013) could find effects of demographics on social acceptance. However, in this study, there could not be found any effect, which might be due to the fact that the demographics of this sample were not equally distributed. However, even though perceived risks, environmental concern, trust in private companies and knowledge did not have a significant effect, it does not mean they should be ignored because they are still elements of social acceptance. This is also supported by the fact that those factors also correlated with the other factors. For instance, people need to know something about bioenergy in order to perceive its benefits in order to socially accept it. For future researches, it might be interesting to go one step further and to ask people to participate that have a high level of knowledge and interest in bioenergy, since the lack of knowledge also influences all other predictors of bioenergy.

5.5 Practical Implications

Currently, the aim of the Dutch and German government is to expand the use of renewable energies (Laes et al., 2014). Therefore, gaining a high level of social acceptance is crucial. Some recommendations were presented in the discussion part. This study was designed in order to give the company BEON, bioenergy cluster Oost Nederland, recommendations for the future. BEON is a cluster of 25 companies and knowledge institutions and is committed to sustainable energy in general and bioenergy in particular. Companies work closely together in initiating new initiatives and developing new technologies. BEON is part of the New Energy Alliance Overijssel and is a co-signatory of the Gelders energy agreement.

Based on the given results, the following recommendations can be made. Firstly, most importantly to note is that people do not know much about bioenergy, which also leads to the fact that they do not know anything about its benefits and do not want to accept it. This means, that the first step is to inform the public about bioenergy and to make them aware of it. For example, bioenergy must be promoted in the media as well as on the street in order to get more popular and in order to raise awareness of its existence. Other than that, awareness programs must be started by local engineers and scientists in order to raise awareness of the importance of renewable energies. Moreover, people must also be engaged to use renewable energies and to stop using fossil fuels. Furthermore, courses on renewable energies must be offered and made mandatory to students at school, college and university levels, in order to make students aware and more knowledgeable about bioenergy (Shahzad, 2012).

Furthermore, it can be seen that people do not feel involved in the decision-making process towards bioenergy. Therefore, it can be said that citizens should be asked for their opinion via interviews and/or questionnaires. Additionally, they should be made aware of the opportunity to vote. Regarding the stakeholders involved, it could be seen that citizens generally trust NGOs and researchers, meaning that NGOs should be encouraged to promote bioenergy. Furthermore, for German and Dutch private companies, it is important build trust towards the citizens by being more consistent and transparent in communication as well as action (Kang & Hustvedt, 2013). In particular, this means that private companies should not promote to fight the climate change while being one of the reasons for it.

Moreover, the trust in the government should be improved. As already mentioned, it is stated that the ETP is inconsistent and incongruent with the energy mix, which might have led to a loss of trust in the government (Laes et al., 2014). In this aspect, Germany can be taken as an example, as its goals are more ambitious and consistent. It would be of advantage to create a precise plan that does not involve any experiments but only focuses on specific goals that

the citizens can also benefit from. More precisely, the governments should review the policies to deal with the energy crisis and to make full use of renewable energy sources. For instance, experts must come up with innovative solutions in order to solve the energy catastrophe (Shahzad, 2012).

Lastly, for citizens, it is important to actively participate in the process of bioenergy. More precisely, this means that people should actively search for information about bioenergy and should live more environmentally friendly. Apart from that, they should voice their opinion when they have the opportunity to do so, for example when they have the option to vote.

5.6 Limitations

There were some limitations of the study. Firstly, with around 234 participants, the sample size could be increased in the future in order to get more reliable results. Especially, since the sample was divided into two different groups, the sample size per group automatically decreased. Secondly, some participants dropped out of the study which could be due to the fact that they did not understand some questions or items of the questionnaire. In addition to that, the questionnaire was distributed in three different languages, which could have led to the fact that the questionnaires were not completely identical which, in turn, could have made the results less valid. Furthermore, this study focused on the general public without any age limitations or educational conditions. However, in this study, it could clearly be seen that the majority of the participants were students, meaning that the data collection could have been biased. In the future, it would be interesting to also target older people since, in previous studies, some differences could be found there as well. Lastly, the results of the factor analysis were not fully considered. Even though the factor analysis stated to combine 'Perceived Benefits' and 'Social Acceptance', the result got ignored due to existing literature which might have made the results less valid too.

5.7 Conclusion

This study aimed to investigate the perception of citizens in Germany and the Netherlands towards bioenergy. Additionally, it was aimed to find out how both countries differ from each other, since those countries differ in their approach in terms of energy transition and it can be said that the attitude towards bioenergy is relatively positive. To sum up, it is to say that, since Germany can be regarded as an experienced, environmental frontrunner, the country has been able to create successful longer-term sustainability visions. As a result, German citizens

generally have a more positive attitude towards bioenergy. This can be explained by the fact that the topic is so pressing for the German citizens that it influences their opinion and thinking. This also supports the above-mentioned idea that the thinking of Germans towards renewable energies is already more modern. Therefore, it can be said that the Netherlands can learn several things from Germany when it comes to the perception of bioenergy. Due to the far-reaching approach of Germany, German citizens are more aware of the current environmental situation which makes them, in turn, also more aware of the urgency of a solution, of which an example is bioenergy. However, fact is that bioenergy is not well-known in Germany and the Netherlands. To inform the public about bioenergy is crucial, since the implementation of bioenergy is needed in order to preserve the earth.

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7. Appendix

Appendix A – Final Questionnaire

Table 8.

Questionnaire

Variable	Items
Demographics	What is your age?
	What is your gender?
	What is your nationality?
	Where do you live?
	What is your annual income?
	What is your highest completed level of education?
Political Affiliation	What is your political affiliation?
Knowledge	I understand how Bioenergy is produced.
	I understand how Bioenergy works.
	I understand the impacts of Bioenergy.
	I have heard about Bioenergy in the Netherlands/Germany.
	I am experienced with Bioenergy.
	When I think about Bioenergy, I think of...
Perceived Benefits	Bioenergy is beneficial for me.
	Bioenergy is beneficial for society as a whole in the Netherlands/Germany.
	Bioenergy helps to reduce reliance on foreign oil import.
	Bioenergy results in more industries and job opportunities.

	Bioenergy results in more industries and job opportunities.
Perceived Risks	Bioenergy causes the depletion of natural resources.
	Bioenergy leads to a lower food security.
	Bioenergy is more expensive.
	Bioenergy results in a competition for land-use.
	Not all emissions from biofuels are environmentally friendly.
Proximity	I would be willing to accept (more) Bioenergy facilities nearby my home.
	Bioenergy is fine as long as it is not nearby my house.
	If Bioenergy facilities would be nearby my home, it would threaten my personal life.
	I feel at home where I live.
Environmental Concern	If things continue on their present course, we will soon experience an ecological catastrophe.
	The so-called 'ecological crisis' facing humankind has been exaggerated.
	I am concerned about the effect of global warming in the Netherlands/Germany.
	Thinking about the environmental conditions our children and grandchildren have to live under, worries me.
	We should become more environmentally friendly in order to preserve the earth.
Procedural Justice	Local authorities conduct the planning of Bioenergy facilities in a fair manner.
	When making decisions concerning Bioenergy, the needs of all citizens are considered.

	When making decisions concerning Bioenergy, the concerns of all citizens are considered.
	When making decisions concerning Bioenergy, there is the opportunity for public participation.
Trust in Government	I think that the government carries out its work regarding Bioenergy successfully and well.
	I think that the government is honest when carrying out its work regarding Bioenergy.
	I think that the government acts in the best interest of society.
Turst in Private companies	I think that the private companies carry out its work regarding Bioenergy successfully and well.
	I think that the private companies are honest when carrying out its work regarding Bioenergy.
	I think that private companies act in the best interest of society.
Trust in NGOs	I think that the non-government organizations carry out its work regarding Bioenergy successfully and well.
	I think that the non-government organizations are honest when carrying out its work regarding Bioenergy.
	I think that nongovernment organizations act in the best interest of society.
Trust in Researchrs	I think that the researchers carry out its work regarding Bioenergy successfully and well.
	I think that the researchers are honest when carrying out its work regarding Bioenergy.

	I think that researchers act in the best interest of society.
Social Acceptance	All things considered, I approve Bioenergy in general.
	I would support the building of a new Bioenergy facility.
	In general, I have a positive attitude towards Bioenergy.
	I would be willing to use Bioenergy.

Appendix B – Validity Factor Analysis

Table 9.

Validity factor analysis

Items	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Factor 1: Knowledge								
I understand how Bioenergy works.						.85		
I understand the impacts of Bioenergy.						.86		
I have heard about Bioenergy in the Netherlands/Germany.						.72		
I am experienced with Bioenergy.						.70		
Factor 2: Perceived Benefits								
Bioenergy is beneficial for me.	.67							
Bioenergy is beneficial for society as a whole in the Netherlands/Germany.	.69							
Bioenergy helps to reduce reliance on foreign oil import.	.52							
Bioenergy results in more industries and job opportunities.								

Bioenergy improves the quality of the environment.	.72			
Factor 3: Perceived Risks				
Bioenergy causes the depletion of natural resources.		.73		
Bioenergy leads to a lower food security.		.80		
Bioenergy is more expensive.		.73		
Bioenergy results in a competition for land-use.		.77		
Not all emissions from biofuels are environmentally friendly.		.64		
Factor 4: Proximity				
I would be willing to accept (more) Bioenergy facilities nearby my home.	.68			
Bioenergy is fine as long as it is not nearby my house.				.59
If Bioenergy facilities would be nearby my home, it would threaten my personal life.				
I feel at home where I live.				
Factor 5: Environmental Concern				
If things continue on their present course, we will soon experience an ecological catastrophe.		.73		
The so-called 'ecological crisis' facing hamankind has been exaggerated.		.54		
I am concerned about the effect of global warming in the Netherlands/Germany.		.73		
Thinking about the environmental conditions our children and grandchildren have to live under, worries me.		.79		
We should become more environmentally friendly in order to preserve the earth.		.71		
Factor 6: Procedural Justice				

Local authorities conduct the planning of Bioenergy facilities in a fair manner.	.62			
When making decisions concerning Bioenergy, the needs of all citizens are considered.	.79			
When making decisions concerning Bioenergy, the concerns of all citizens are considered.	.80			
When making decisions concerning Bioenergy, there is the opportunity for public participation.	.51			
Factor 7: Trust in Government				
I think that the government carries out its work regarding Bioenergy successfully and well.	.64			
I think that the government is honest when carrying out its work regarding Bioenergy.	.68			
I think that the government acts in the best interest of society.	.53			
Factor 8: Trust in Private Companies				
I think that private companies carry out its work regarding Bioenergy successfully and well.				.69
I think that private companies are honest when carrying out its work regarding Bioenergy.				.70
I think that private companies act in the best interest of society.				.59
Factor 9: Trust in NGOs and researchers				
I think that NGOs carry out its work regarding Bioenergy successfully and well.		.71		
I think that NGOs are honest when carrying out its work regarding Bioenergy.		.79		

I think that NGOs act in the best interest of society.	.74
I think that researchers carry out its work regarding Bioenergy successfully and well.	.54
I think that researchers are honest when carrying out its work regarding Bioenergy.	.56
I think that researchers act in the best interest of society.	.55
Factor 10: Social Acceptance	
All things considered, I approve Bioenergy in general.	.83
I would support the building of a new Bioenergy facility.	.81
In general, I have a positive attitude towards Bioenergy.	.84
I would be willing to use Bioenergy.	.81

Appendix C – Literature Study Log

Table 10.

Search Actions and Results

Nr.	Date	Database	Action & Terms	Results
1	10.03.2020	Google Scholar	Climate Change	3.940.000
2	11.03.2020	Google Scholar	Bioenergy Definition	62.3000
3	11.03.2020	Google Scholar	Bioenergy supply	218.000
4	14.03.2020	Google Scholar	Social acceptance renewable energy	184.000
5	14.03.2020	Google Scholar	Antecedents of Social	15.500

			Acceptance Renewables	
6	15.03.2020	Google Scholar	Definition	2.980.000
			Social Acceptance	
			General Public	
7	27.03.2020	Google Scholar	Definition	3.020.000
			Environmental Concern	
8	28.03.2020	Google Scholar	Social Acceptance	3.510.000
			Community Acceptance	
9	28.05.2020	Google Scholar	Energy Transition	1.230.000
			Germany Netherlands	
10	29.05.2020	Google Scholar	Visibility effect on reputation	222.000
11	02.06.2020	Google Scholar	Convenience Sampling Disadvantages	159.000

Appendix D – Word clouds

Figure 3. Word cloud for Germany

Figure 4. Word cloud for the Netherlands