Universiteit Leiden

Faculteit der Sociale Wetenschappen

The Effects of Communicating (Un)certain Risk Information on Public Acceptance of Wind Parks

Muhamad Irfan Agia

In collaboration with Martin McArdle

Master thesis Psychology, specialization Economic and Consumer
Institute of Psychology
Faculty of Social and Behavioral Sciences – Leiden University

Date: 4 November 2016
Student number: 1683845
First examiner of the university: Emma Ter Mors
Second examiner of the university: Esther van Leeuwen

Acknowledgement

Undertaking this Master program has been a truly life-changing experience for me and it would not have been possible to do without the support and guidance that I received from many people. I have received a lot of kindness from people whom I met throughout this journey and for that it is a pleasure for me to express my gratitude for them.

I would like to first say many thanks to my supervisor Dr. Emma ter Mors for all the support and encouragement she gave me. Without her guidance and constant feedback this Master thesis would not have been achievable. Thank you to my thesis partner, Martin McArdle, for becoming such a helpful and supportive partner.

Many thanks also to my Mum, Dad, and Sister for always believing in me and encouraging me to follow my dreams. I gratefully acknowledge the funding received towards my Master study and I would like to thank the *Lembaga Pengelola Dana Pendidikan* (LPDP) Indonesia, for providing me with the financial support to finish my Master study.

I am indebted to all my friends and family in Leiden who opened their homes to me during my time at Leiden and who were always so helpful in numerous ways. Thank you also for helping me with the data collection and making those first few months easier and interesting.

Abstract

It is important to understand why people take action in favor or against renewable energy technologies, especially wind park projects. It will give valuable insights in how the technology should be communicated to the local people, so acceptance rates of the technology increases and the implementation will be more successful. Using an experimental design ($N = 62$), we examined the effect of communicating (un)certain risk information (uncertain versus certain risk information about adverse local impacts of wind park project) on public acceptance of wind parks. We also examined perceived expertise of the project developer as a potential moderator for the effect. Contrary to our hypotheses, our results demonstrated that communicating (un)certain risk information did not affect public acceptance of wind park project. Furthermore, we also found that perceived expertise was not a significant predictor for public acceptance of wind park project. Possible explanations and implications of the results are discussed.

Keywords: (un)certainty, risks, perceived expertise, public acceptance, wind park

Introduction

Renewable energy sources are ready to play a central role in future energy provision. These technologies become fundamental in mitigating climate change and can contribute to the security of energy supply (Dresselhaus & Thomas, 2001). For instance, wind energy is considered as a valuable energy resource and one of the cleanest energy resources in the world. Wind park projects are known to generate renewable energy and can contribute to sustainable development. This has led to an impressive growth of wind energy around the world in recent years. In the European Union, 12,800 megawatt ("MW ") of wind energy capacities were installed in 2015, with an increase of 6.3 percent compared to the installations in 2014. 9,766 MW of wind energy capacity were installed onshore and 3,034 MW offshore (European Wind Energy Association, 2015).

The attempt to produce wind energy increased significantly, especially in the Netherlands. The Social and Economic Council of the Netherlands (SER), an organization that acts as the main advisory body to the Dutch government and the parliament on national and international social and economic policy, intends to increase a renewable energy generation. Subsequently, the Dutch government aims to achieve a significant growth of wind energy including both onshore and offshore projects before 2020 (Bakker et al., 2012).

Public support for wind energy is generally high in all major wind-power producing countries (Krohn & Damborg, 1999). However, despite this public support project developers still often face resistance when they propose a wind park project to the local people (Smith & Klick, 2007). For example, Ontario, a leading Canadian province regarding installed wind facilities, has encountered great community opposition for its wind energy development. Some wind energy projects in Ontario have been delayed or even canceled because of the public resistance. Several canceled projects include Huron Country, Kingsbridge II in Goderich, and Blue Highlands (Jami & Walsh, 2014). Ontario residents who opposed wind park projects stated that noise emission, ecological risks, and property values are their primary concerns to reject the project (Hill & Knott, 2010). There are some adverse impacts of the wind park installation for the local residents living near wind parks that may result in a lack of local public acceptance.

The impacts on the aesthetic of the landscape, the presence of noise emissions, the impacts on birds and wildlife, the occupation of land, the wind turbines' shadow flicker and electromagnetic interference are specified and listed in previous studies as the most severe environmental risks of a wind park project (Katsaprakakis, 2012). Furthermore, the noise from wind turbines potentially can result in dizziness, nausea, the sensation of ear pressure, headache and other symptoms (Schmidt & Klokker, 2014). These environmental and human impacts can elicit significant negative public reactions during the wind park's licensing, installation or operation (Lubbers, 1988).

Public acceptance is recognized as an important issue associated with the implementation of renewable energy technologies (Devine-Wright, 2007). Public acceptance is the degree to which a phenomenon is taken by the general public and the extent to which the phenomenon is liked by individual citizens (Wolsink, 2013). Low public acceptance can delay or obstruct the implementation of the project (Huijts, Molin, & Steg, 2012). It is crucial to improve public acceptance rates of wind park project so wind energy technology can live up to its technical and economic potential.

In this present research we will focus on the impact of perceived certainty versus uncertainty of risk information about adverse local impacts on public acceptance of a wind park project. We will also examine the potential mediating role of perceived expertise of a project developer on public acceptance of the wind park project.

(Un)certain Risk

People will face uncertainties when it comes to dealing with a new technology, especially like a new windpark in their environment. Uncertainty about the costs and benefits of the new technology make the decision to accept it a risky one (Chatterjee & Eliasberg, 1990; Donnelly, 1970). The characteristics of the new technology play a role in how a local community reacts to a proposed installation, as they determine the extent to which adverse negative impacts occur.

In a wind park context, the distance between a wind turbine setback from homes is an important element to consider. Different countries have different policies regarding the appropriate wind turbine setback distances from homes. For example, in Denmark, it is recommended that wind turbine setback distances from buildings should be at least four times the total height of the turbine (Haugen, 2011). Spain suggested that wind turbine setback should be 500 meters (1,640 feet) from residences and towns. These distances are recommended due to safety concerns (Haugen, 2011) and to protect the local residents from the risk of adverse impacts. However, there is no worldwide agreement regarding the appropriate and certain wind turbine setback distances from houses. Consequently, it means that the appropriate distance is an uncertain condition that a project developer may face to estimate the risk and can also be seen as uncertain by local residents. How does this uncertain risk information of adverse local impacts affect public acceptance of a wind park project?

Uncertainty has various definitions in different domains and disciplines (Walker et al., 2003). Dewulf, Craps, and Dercon (2004) defined uncertainty as the ambiguity that happens from the simultaneous presence of multiple frames of reference about a particular phenomenon.

Funtowicz and Ravetz (1990) describe uncertainty as a situation of inadequate information. Uncertainty is assumed to be an influential mediator of human responses in situations with unknown outcomes (Sjöberg, Moen, & Rundmo, 2004).

A study from Visschers and Siegrist (2013) is an example of how an uncertainty of the nuclear power plant’s situation and adverse outcomes influences acceptance of nuclear power. For instance, when the situation at the power plants in Fukushima was not stable, laypeople were tend to initially think that a catastrophic event and risk such as an explosion was still likely to occur. They also might think that the problems in the reactors would soon be solved. This uncertainty may have resulted in attitudes and beliefs that are more negative, than had the situation been stabilized. Prior negative nuclear attitudes were associated with a decrease in acceptance (Visschers & Siegrist, 2013).

In the wind park context which we focus on in the present research, we predict that when a company or organization is communicating uncertain risk information about adverse local impacts of a wind park project, this shall result in a lower public acceptance rate of the project compared to when it communicates certain risk information.

Perceived Expertise

People’s trust in an organization that manages the use of the technology is an important factor, which can influence their perceptions of the risks and benefits from the technology. A study from Siegrist (2000) found that people’s trust in organizations that are responsible for the use of gene technology affected their perceptions of the risks and benefits related to this technology. He further showed that trust in organizations or persons doing genetic modification research would affect acceptance of the biotechnology.

Trust that is based on organizational experience and expertise can be referred to competence-based trust. This perspective on trust recognizes that people may trust an organization because they think it has a lot of expertise and experience with the issue under consideration (Terwel, Harinck, Ellemers, & Daamen, 2009). This kind of trust may depend on several factors according to how the organization is perceived. For example, as accurate and objective, consistent and predictable, honest and fair, and to have expertise relevant to the issue at hand (Poortinga & Pidgeon, 2003). However, in the case of accuracy, organizations cannot always be precise in predicting risks when managing the use of a technology due to uncertain situations. For example in the wind park context, the project developer will face uncertainty in determining the proper wind turbine setback distances from homes. Therefore it hinders the project developer in providing accurate risk information to the local people. How does communicating uncertain risk information of wind park affects local people's perceived expertise of project developer?

Communicating uncertainty may affect people's perceptions of the source of risk information (Johnson & Slovic, 1995). A study by Johnson and Slovic (1995) showed that an agency in the health sector was perceived less competent when discussing uncertainty in health risk assessment. In their study, scientists could not estimate the precise risk estimates of getting cancer over a lifetime of drinking water that might be contaminated. They announced the true risk could be as low as zero, or as high as one in a hundred. Communicating uncertainty in risk estimates may be a signal of incompetence of the agency (Johnson & Slovic, 1995).

Another research also found that communicating uncertain risk potentially affects perceived expertise of the source of information negatively (Longman, Turner, King, & McCafery, 2012). Accordingly, people will perceive a company as less competent when it fails to provide accurate and exact risk estimates of adverse local impacts caused by their project. Based on previous studies, we assume that people will perceive a project developer to have a low level of expertise when a project developer communicates uncertain risk information of adverse local impacts compared to when a project developer communicates certain risk information.

In the present research, we also focus on perceived expertise as a potential mediating factor in the predicted relationship between (un)certain risks and public acceptance of the project. The competence of an organization is closely related to the people's trust, which in turn affects the public acceptance of new technologies (Terwel et al., 2009). For instance, a study from Luarn and Lin (2005) showed that a trust-based construct (perceived credibility) significantly increased acceptance of technology in banking service.

People tend to weigh positive information about competence more heavily than negative information about competence (Reeder, Hesson-McInnis, Krohse, & Scialabba, 2001). Accordingly, a company or an organization is seen as an expert when it can provide accurate and exact risk estimates of their project. Subsequently, if a company is not perceived as technically competent, public acceptance of their project is likely to decrease (Neerdael, 2007).

Consequently, we expect that when a company is able to provide certain risk information, the people's perception of their expertise shall rise. Subsequently, they will have higher public acceptance rates of the project.In other words, our study suggests that perceived expertise of a project developer is expected to mediate the influence of communicating (un)certain risk information on public acceptance of a wind park project.

The Present Research

The aim of the present experimental study was to examine how communicating (un)certainty about adverse local impacts affects public acceptance of a wind park project. We hypothesized that people will more likely to accept a wind park project when a project developer communicates certain risk information of adverse local impacts compared to when it communicates uncertain risk information (Hypothesis 1). We also hypothesized that people will perceive a project developer to have a high level of expertise when a project developer communicates certain risk information of adverse local impacts compared to when a project developer communicates uncertain risk information (Hypothesis 2). We further predicted that the effect of communicating (un)certain risk information about adverse local impacts on public acceptance as predicted in Hypothesis 1 would be mediated by perceived expertise of a project developer (Hypothesis 3).

We tested these hypotheses using an experiment in which the (un)certainty about adverse local impacts of wind park project was manipulated by varying the certainty of the risk estimates of the wind park's adverse local impacts. We made a scenario about a fictitious situation where a wind energy company plans a project to build wind turbines near a village with adverse local impacts (visual impact and noise nuisance) and participants would learn that there would be a minimal risk of noise emission from the wind park project within a certain distance.

In the certain risk condition, the project developer was certain about the risk estimate of noise emission levels from the wind park project, where in other condition the project developer was not certain about the risk estimate. After participants had finished reading the scenario, they were asked to indicate their acceptance of the proposed project and the extent of the project developer's expertise on running the wind park project.

Method

Participants and Design

Participants consisted of 62 Dutch speaking University students (35 Males, 26 Females, 1 Others). Their ages varied between 18-36 years (*M* = 23.68, *SD* = 3.50). Their educational level varied from Bachelor (23), Master (33), Ph.D. (2), and other educational level (4). They were recruited in public areas or faculties at Leiden University. Filling out the questionnaire took approximately ten minutes.

The study used a 2 (uncertain versus certain risk information about adverse local impacts of wind park project) x 1 (no consultation) between-subjects design[1]. The participants were randomly assigned into one of the two conditions: the certain risk information condition (*N* = 30) and the uncertain risk information condition (*N* = 32).

Procedure

The participants were recruited by an invitation to participate in a brief study about a situation that may take place in The Netherlands. Upon acceptance, participants were required to complete an informed consent form and were asked to read a scenario text. The scenario consisted of a set of instructions on how to complete the questionnaire and brief background scenario describing a wind park project (see Appendix A and B).

The participants were asked to imagine that they live in a fictitious village called Houtendal in the Netherlands. The scenario described an onshore wind park project to be developed by an energy company, named Syntex that will be installing wind turbines in a residential area. In the scenario participants would read that the wind turbines will be placed at a 500-meter distance from their house and that Syntex has unilaterally decided (so without consultation with local residents, the mayor, and aldermen of the municipality) that the 500-meter distance would be suitable.

[1] This research was a part of larger study that had 122 participants. The larger study used a 2 (uncertain versus certain risk information about adverse local impacts of wind park project) x 2 (consultation versus no consultation) between-subjects design.

Participants then read that Syntex had informed the residents of Houtendal that there would be a minimal noise emission within this 500-meter distance. Next, the (un)certainty on the risk information about adverse local impacts was manipulated by varying the (un)certainty of adverse local impacts.

In the certain risk information condition, participants read that, according to Syntex, based on their experience from another wind park project, there would be a minimal noise emission within the chosen distance. Syntex was certain about what the exact maximum noise levels would be. Syntex assured the residents of Houtendal that the maximum noise levels would not exceed 40 decibels, and participants read that this is comparable to the sound that an average fridge produces.

In the uncertain risk information condition, participants also read that, according to Syntex, based on their experience, there would be a minimal noise emission within the chosen distance. However, Syntex was not certain about what the exact maximum noise levels would be. Participants read that maximum noise levels may or may not exceed that of 40 decibels, which was comparable to the sound that an average fridge produces. Noise levels could also be slightly higher, though.

After reading the scenario, participants were asked to fill out a questionnaire containing the dependent measures. Once the questionnaire was completed, participants were thanked for their participation, debriefed, and offered the opportunity to participate in a lottery to win one of three €10 VVV vouchers. Participants would be offered the opportunity to receive a summary of the research once it is completed.

Measures

Manipulation check: We used four items to check the manipulation of the perception of uncertainty (α = .92): "The maximum sound levels produced by the wind park are known", "The maximum sound levels produced by the wind park are unknown (recoded)", "The maximum sound levels produced by the wind park are certain", " The maximum sound levels produced by the wind park are uncertain (recoded)" (1 = *totally disagree*, 7 = *totally agree*).

Public acceptance. To measure public acceptance of the wind park project we adapted items from an existing public acceptance scale (Aas, Devine-Wright, Tangeland, Batel, & Ruud, 2014) (α = .87): "I think the plan of Syntex to build a wind park in Houtendal is a good idea", "As a resident of Houtendal, I would respond positively towards the wind park of Syntex", "As a resident of Houtendal I would accept the plan of Syntex to build a wind park in Houtendal", "I would demonstrate against the planned wind park of Syntex (recoded)" (1 = *totally disagree*, 7 = *totally agree*).

Perceived expertise. To measure perceived expertise of the project developer we adapted four items from an existing perceived expertise scale (Koot, Ter Mors, Ellemers, & Daamen, 2016) (α = .94): "I think the energy company Syntex knows a lot about the sound levels produced by wind parks", "I think Syntex is knowledgeable about the sound levels produced by wind parks", "I think Syntex is a specialist in the area of sound levels produced by wind parks", "I think Syntex has expertise in the area of sound levels produced by wind parks" (1 = *totally disagree*, 7 = *totally agree*).

Results

Manipulation Check

A manipulation check was used to assess if we had effectively manipulated perception of uncertainty between participants in two conditions. The participants in the certain risk information condition perceived the risk estimates of noise emission from the wind park project more certain (*M* = 4.29, *SD* = 1.69) than participants in the uncertain risk information condition (*M* = 2.72, *SD* = 1.51), *t*(60) = 3.87, *p* < .001, *d* = 0.97. The significant result confirmed that we were able to successfully manipulate perception of uncertainty between two conditions**.**

Test of Hypotheses

The first hypothesis was that people will more likely to accept the wind park project in the certain risk information condition compared to uncertain risk information condition. An exploratory data analysis was conducted to determine if the public acceptance score distribution was normally distributed. If the p values of the variables are greater than 0.05, the data are normally distributed (Ghasemi & Zahediasl, 2012). Results for the Kolmogorov-Smirnov test for normality indicated that the public acceptance scale had a non-normal distribution (*D* (62) = 0.13, *p* = .010). Pagano (2012) stated that if the size of each sample is equal to or greater than 30, the t-test for independent groups may be used without appreciable error despite moderate violations of the normality. The numbers of participants in both experimental conditions were greater than 30 so the t-test may be used without appreciable error despite moderate violations of the normality. Levene's test showed that the variances (*F* = 1.14, *p* > .05) were equal for the certain and uncertain condition.

The analysis employed a t-test for independent groups to compare public acceptance rate of wind park project in the certain risk information condition and uncertain risk information condition, with alpha set at the 5% level and two-tail test. The results showed that public acceptance scores in the in certain condition (*M* = 3.84, *SD* = 1.28) did not differ significantly from those in the uncertain condition (*M* = 3.63, *SD* = 1.46), *t*(60) = 0.60 *p* = .553, *d* = 0.15. These results suggest that (un)certainty in risk information of adverse local impacts does not have an effect on public acceptance of wind park project. People who perceived the risk of wind park project to be certain had no significant difference in public acceptance rates with people who perceived it to be uncertain. Thus, Hypothesis 1 was not supported.

The second hypothesis was that participants would perceive the project developer to have a higher level of expertise when it communicates certain risk information of noise emission from wind park project compared to when it communicates uncertain risk information. Results for the Kolmogorov-Smirnov test for normality indicated that the perceived expertise scale had a non-normal distribution (D (62) = 0.15, p = .001). The t-test for independent groups may be used without appreciable error despite moderate violations of the normality because the number of participants in both experimental conditions were greater than 30 (Pagano, 2012). Levene's test showed that the variances in perceived expertise scores (F = 0.88, p > .05) were equal for the certain and uncertain condition.

The analysis employed a t-test for independent groups, with alpha set at the 5% level and two-tail test. There was a non-significant difference in the scores for perceived expertise in certain (M = 4.77, SD = 1.57) and uncertain (M = 4.27, SD = 1.65) condition, t(60) = 1.20, p = .234. The size of this effect (Cohen's d = .31), as indexed by Cohen's (1988) coefficient d suggested a small to moderate significance. These results suggest that communicating (un)certain risk information of adverse local impacts did not have an effect on perceived expertise of the project developer. Thus, Hypothesis 2 was not supported.

Finally we predicted Hypothesis 3, that the effect of communicating (un)certain risk information about adverse local impacts on public acceptance as predicted in Hypothesis 1 would be mediated by perceived expertise of the project developer. The Hypothesis 3 was not supported because we did not find significant effect of our experimental manipulation on perceived expertise or public acceptance. As part of hypothesis, we assumed there would be a positive relation between perceived expertise and public acceptance. Multiple regression analysis was used to see if the (un)certainty of risk information and perceived expertise of the project developer predicted the public acceptance of wind park project. The results of the regression analysis indicated the two predictors explained 1.9% of the variance ($R^2 = 0.02$, $F(2, 59) = 0.57$ $p = .569$). We found that (un)certainty of risk information was not a significant predictor for public acceptance ($\beta = 0.11$, $p = .415$), nor for perceived expertise ($\beta = 0.06$ $p = .621$). Thus, Hypothesis 3 was not supported.

Discussion

The present experimental study examined the idea that communicating (un)certain risk information about adverse local impacts of the wind park will affect public acceptance of a proposed wind park project. In this study, we hypothesized public acceptance rates of the wind project to be higher when the project developer communicates certain risk information of adverse local impacts compared to when it communicates uncertain risk information of adverse local impacts. We also hypothesized that people will perceive the project developer to have a high level of expertise when it communicates certain risk information of adverse local impacts compared to when it communicates uncertain risk information of adverse local impacts. We further predicted that the effect of communicating (un)certain risk information about adverse local impacts on public acceptance would be mediated by perceived expertise of the project developer

Our results showed that public acceptance rates did not differ significantly between participants in the certain risk information condition and the uncertain risk information condition. Furthermore, our results suggest that communicating (un)certain risk information of adverse local impacts did not have an effect on perceived expertise of the project developer. Finally, we found that perceived expertise of project developer was not a significant predictor for public acceptance of wind park project. Our hypotheses in this study were not confirmed. In sum, we did not find support for our hypotheses.

These results seems to conflict with previous researches (Visschers & Siegrist, 2013; Longman et al., 2012) which stated that uncertainty of risk influences public acceptance and perceived expertise of actors managing a technology or hazard. Our results also differ from another study about acceptance of new technology, which stated that a trust-based construct ("perceived credibility") significantly increased acceptance of a technology in a bank service (Luarn & Lin, 2005). Contrary to previous studies, our study found that in the wind park context, communicating (un)certain risk information of adverse local impacts did not have an effect on public acceptance and perceived expertise. Perceived expertise was also not a significant predictor for public acceptance of a wind park project. As the present findings show different results than those expected, it is important to discuss what might explain these results.

There is a possible explanation of why (un)certain risk information did not have a significant effect on public acceptance of wind park project. When people are faced with uncertain risk information, there is a possibility that they will discount the information and it will have only a little effect on their decision making whether to accept the proposed project or not. Sometimes decisions have to be made based on insufficient data or a high degree of uncertainty (Cowlrick, Hedner, Wolf, Olausson, & Klofsten, 2011). Risk in a wind park project implies an uncertainty about the probability of consequences of adverse local impacts . Based on the study from Bernasconi and Loomes (1992), uncertainty about the distribution of probabilities can be referred to ambiguity. According to Frisch and Baron (1998), ambiguous information will be discounted by decision makers and have little effect on their decisions. It is because decision makers may treat ambiguous and inexact information as insufficient information. As a result of the discounting of ambiguous information, the decisions of people confronted with uncertain information may resemble those of others who have no information at all (Van Dijk & Zeelenberg, 2003).

A possible explanation why perceived expertise did not significantly correlate with public acceptance is that people seem to rely more on social trust towards a project developer when assessing risks and benefits of the technology (Siegrist & Cvetkovich, 2000) rather than competence (Earle, 2010). The trust, confidence, and cooperation (TCC) model distinguishes between trust and confidence (Earle, 2010). Based on this model, confidence is determined by past performance of the actor and competence, whereas social trust is determined by value similarity. According to the study from Earle, Siegrist, and Gutscher (2007), it is not performance information and competence, but value similarity that influenced people's trust and acceptance of nuclear power. Social trust in the actors managing a technology and hazard has been found to be an important determinant of the perceived risks and benefits of technologies and hazards which in turn influences acceptance (Earle, 2012).

Theoretical Implications

Our study about communicating (un)certainty of risk and the role of perceived expertise on public acceptance of wind park project contributes to the literature in several ways. Researches of public acceptance mostly discussed topics in regards to NIMBY opposition (Smith & Klick, 2007), perceived fairness (Upham & Shackley, 2006), and place attachment (Devine-Wright, 2005). However, the topic of (un)certainty of the adverse local impacts from the wind park project as an important factor in public opposition is still relatively new.

Research on the role of uncertainty and risk in the acceptance of technologies is still scarce (Van Ittersum et al., 2006). However, the consensus of the existing research is that risk decreases the acceptance of technologies (Featherman & Pavlou, 2003; Hsu & Chiu, 2004; McKnight, Choudhury, & Kacmar, 2002). Contrary to the consensus, the current study gave a new insight as it suggests that communicating risks to local people did not significantly affect public acceptance whether the risks were certain or uncertain.

The present study was the first to examine the relationship between communicating (un)certain risk information and public acceptance of wind park project. Furthermore, to the best of our knowledge, there is still no research that adds the perceived expertise component to the role of public acceptance of renewable energy technologies. We think the result from this present study will broaden our existing knowledge in the area of renewable energy research and project.

Practical Implications

Risk communication is a challenging task for project developers of renewable energy projects because they often have to manage complex situations related to the planning process and the implementation of the technology. Uncertain risks of adverse local impacts, decreasing trust in authorities, and uneven distribution of risks and benefits of the project are factors that need to be considered in order to approach the local people in order to increase the acceptance of the technology and thus have a more successful implementation.

At some point, a project developer will face uncertainty like choosing the appropriate setback distances between the energy sources and local residents' homes as it determines the extent to which adverse negative impacts occur and the estimation of all possible risks. Reflecting from our results that indicated communicating uncertain risks did not affect public acceptance, they do not have to worry about the uncertainty of adverse local impacts because it is not a relevant factor that affects public acceptance of the wind park project.

It could also mean good news for the project developers of renewable energy technology that our results also suggest that they do not have to be perceived as an expert when proposing a project to the local people, as it is not the most important factor. Instead, they can focus more to the value similarity with local people. Lay people will have social trust in a project developer who appears to hold similar values (Siegrist, Cvetkovich, & Roth, 2000). Social trust might be increased if a technology is framed to reflect the public's values. For example, in the application of gene technology it has been shown that certain food applications can be framed in such a way that they are perceived as similar to common medical applications (Siegrist & Bühlmann, 1999). As a result, the technologies were assessed as more beneficial and had higher public acceptance than other food applications.

Limitations and Future Directions

There are some limitations to the interpretation of the findings of this research. First, this research was conducted only on a small population of University students. Future research should involve more participants in order to generalize the research to larger groups. Another advice for future research is to also expand this study from an experimental setting into a field study to establish a real life setting to this research. In this study the participants were not actual people who lived in the village near the wind park project, but they were university students placed in the role of local people of fictitious village.

This may also have affected the affective aspect of people-place interactions. The relevance of the concept of 'place' has been recognized in literature on risk and wind energy conflicts. For example, Devine-Wright (2005) noted there is a possibility that emotional attachments to places are implicated in public responses. He suggested that high levels of place attachment can serve to motivate both public support and opposition to proposed technology developments. In our study participants did not have such attachment to the place affected by the wind park project.

However, we mitigated this limitation by providing the participants with a clear and detailed scenario regarding the fictitious situation about their role as the local people in the village and specified the placement of wind parks near their homes. Highhouse (2009) stated that the generalizability of experiments is more dependent on the degree to which the constructs are true to the constructs themselves, rather than the degree to which the experiment mirrors the situation in real world. In this present study, it is proven that the scales we used in have good internal consistency and therefore able to measure the constructs as intended.

Furthermore, future researches are advised to examine social trust that might also become the important mediating variable for predicting public acceptance. According to Earle et al. (2007), social trust is an important determinant rather than competence of the actors managing a technology in predicting acceptance. It influenced risk and benefit perceptions directly and acceptance indirectly. Focusing on this variable may help to add a more fruitful explanation and insights in public acceptance of renewable energy technology, especially wind park technology.

Conclusion

In conclusion, the present study highlights the effect of communicating (un)certain risk information about adverse local impacts on public acceptance of wind park project with perceived expertise as a potential moderator of the effect. The study examined how people who received certain risk information of a wind park project rated their acceptance of the wind park project compared to people who received uncertain risk information. However, the results suggest that communicating uncertain risks and perceived expertise did not affect public acceptance. Furthermore, we also we did not find a relation between perceived expertise and public acceptance.

Our study is important in relation to current literature in several ways. First, this was the first study to examine the relationship between communicating (un)certain risk information with public acceptance of wind park project in an experimental setting. Second, it provides contrary results relative to previous studies and presents a beneficial aspect of practical implication for renewable energy project developer that uncertainty and perceived expertise may not be important factors to worry about in order to gain public acceptance. We hope that this study can be a start of a more comprehensive future research about (un)certainty and public acceptance of renewable energy technologies.

References

Aas, Ø., Devine-Wright, P., Tangeland, T., Batel, S., & Ruud, A. (2014). Public beliefs about high-voltage powerlines in Norway, Sweden and the United Kingdom: A comparative survey. *Energy Research & Social Science, 2*, 30-37.

Bakker, R. H., Pedersen, E., Van den Berg, G. P., Stewart, R. E., Lok, W., & Bouma, J. (2012). Impact of wind turbine sound on annoyance, self-reported sleep disturbance and psychological distress. *Science of the Total Environment*, *425*, 42-51.

Bernasconi, M., & Loomes, G. (1992). Failures of the reduction principle in an Ellsberg-type problem. *Theory and Decision*, *32*, 77–100.

Chatterjee, R. A., & Eliasberg, J. (1990). The innovation diffusion process in a heterogeneous population: A micromodeling approach. *Management Science*, *36*, 1057.

Cohen, J. (1988). Statistical power analysis for the behavior science. *Lawrance Eribaum Association.*

Cowlrick, I., Hedner, T., Wolf, R., Olausson, M., & Klofsten, M. (2011). Decision-making in the pharmaceutical industry: analysis of entrepreneurial risk and attitude using uncertain information. *R&D Management*, *41*(4), 321-336.

Devine-Wright, P. (2005). Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy*, *8*(2), 125-139.

Devine-Wright, P. (2007). Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review. *Manchester: School of Environment and Development, University of Manchester.*

Dewulf, A., Craps, M., & Dercon, G. (2004). How issues get framed and reframed when different communities meet: a multi-level analysis of a collaborative soil conservation initiative in the Ecuadorian Andes. *Journal of Community & Applied Social Psychology*, *14*(3), 177-192.

Donnelly Jr., J. H. (1970). Social character and acceptance of new products. *Journal of Marketing Research*, *7*, 111.

Dresselhaus, M. S., & Thomas, I. L. (2001). Alternative energy technologies. *Nature*, *414*(6861), 332-337.

Earle, T. C. (2010). Trust in Risk Management: A Model-Based Review of Empirical Research. *Risk Analysis*, *30*(4), 541-574.

Earle, T. C. (2012). *Trust in cooperative risk management: uncertainty and scepticism in the public mind*. Routledge.

Earle, T., Siegrist, M., & Gutscher, H. (2007). Trust, risk perception and the TCC model of cooperation. *Trust in risk management: Uncertainty and scepticism in the public mind*. Earthscan Publications Ltd.

European Wind Energy Association. (2015). *Wind in Power: 2015 European Statistics*. EWEA.

Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. *International Journal of Human-Computer Studies*, *59*, 451- 474.

Frisch, D., & Baron, J. (1988). Ambiguity and rationality. *Journal of Behavioral Decision Making*, *1*, 149–157.

Funtowicz, S.O., & Ravetz, J.R. (1990). *Uncertainty and Quality in Science for Policy*. Kluwer Academic Publishers.

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: a guide for non-statisticians. *International Journal of Endocrinology and Metabolism*, *10*(2), 486-489.

Haugen, K. M. B. (2011). International review of policies and recommendations for wind turbine setbacks from residences: setbacks, noise, shadow flicker, and other concerns. *Minnesota Department of Commerce: Energy Facility Permitting. 42p*.

Highhouse, S. (2009). Designing Experiments That Generalize. *Organizational Research Methods*, *12*(3), 554-566.

Hill, S.D. & Knott, J.D. (2010). Too close for comfort: Social controversies surrounding wind farm noise setback policies in Ontario. *Renewable Energy Law and Policy Review, 2*, 153-168.

Hsu, M.-H., & Chiu, C.-M. (2004). Predicting electronic service continuance with a decomposed theory of planned behaviour. *Behaviour & Information Technology*, *23*, 359-373.

Huijts, N. M., Molin, E. J. E., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and Sustainable Energy Reviews*, *16*(1), 525-531.

Jami, A. A., & Walsh, P. R. (2014). The role of public participation in identifying stakeholder synergies in wind power project development: The case study of Ontario, Canada. *Renewable Energy*, *68*, 194-202.

Johnson, B. B., & Slovic, P. (1995). Presenting uncertainty in health risk assessment: Initial studies of its effects on risk perception and trust. *Risk Analysis*, *15*(4), 485-494.

Katsaprakakis, D. A. (2012). A review of the environmental and human impacts from wind parks. A case study for the Prefecture of Lasithi, Crete. *Renewable and Sustainable Energy Reviews*, *16*(5), 2850-2863.

Koot, C., Ter Mors, E., Ellemers, N., & Daamen, D. D. L. (2016). Facilitation of attitude formation through communication: How perceived source expertise enhances the ability to achieve cognitive closure about complex environmental topics. *Journal of Aplied Social Psychology, 46,* 627–640.

Krohn, S., & Damborg, S. (1999). On public attitudes towards wind power. *Renewable Energy, 16*(1), 954-960.

Longman, T., Turner, R. M., King, M., & McCaffery, K. J. (2012). The effects of communicating uncertainty in quantitative health risk estimates. *Patient Education and Counseling*, *89*(2), 252-259.

Luarn, P., & Lin, H.-H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior*, *21*, 873-891.

Lubbers, F. (1988). Research program concerning the social and environmental aspects related to the windfarm project of SEP. *Journal of Wind Engineering and Industrial Aerodynamics*, *27*(1), 439-453.

McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research, 13,* 334.

Neerdael, B. (2007). Factors affecting public and political acceptance for the implementation of geological disposal. In *The 11th International Conference on Environmental Remediation and Radioactive Waste Management* (pp. 219-224). American Society of Mechanical Engineers.

Pagano, R. R. (2012). *Understanding statistics in the behavioral sciences*. Cengage Learning.

Poortinga, W., & Pidgeon, N. F. (2003). Exploring the dimensionality of trust in risk regulation. *Risk Analysis*, *23*(5), 961-972.

Reeder, G. D., Hesson-McInnis, M., Krohse, J. O., & Scialabba, E. A. (2001). Inferences about effort and ability. *Personality and Social Psychology Bulletin*, *27*(9), 1225-1235.

Saner, M. A. (2003). On the Public Controversy Over the Regulation of Risk. *Professional Ethics, A Multidisciplinary Journal*, *11*(4), 79-85.

Schmidt, J. H., & Klokker, M. (2014). Health effects related to wind turbine noise exposure: A systematic review. *PloS One*, *9*(12), e114183. http://dx.doi.org/ 10.1371/journal.pone.0114183.

Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis*, *20*(2), 195-204.

Siegrist, M., & Buhlmann, R. (1999). Perception of different applications of gene technology: Results of an MDS-analysis. *Zeitschrift fur Sozialpsychologie*, *30*(1), 32-39.

Siegrist, M., & Cvetkovich, G. (2000). Perception of hazards: The role of social trust and knowledge. *Risk Analysis*, *20*(5), 713-720.

Siegrist, M., Cvetkovich, G., & Roth, C. (2000). Salient value similarity, social trust, and risk/benefit perception. *Risk Analysis*, *20*(3), 353-362.

Sjöberg, L., Moen, B. E., & Rundmo, T. (2004). Explaining risk perception. *An evaluation of the psychometric paradigm in risk perception research*. Trondheim.

Smith, E. R. A. N., & Klick, H. (2007). Explaining NIMBY opposition to wind power. In *Annual Meeting of the American Political Science Association* (pp. 1-19).

Terwel, B. W., Harinck, F., Ellemers, N., & Daamen, D. D. (2009). Competence-based and integrity-based trust as predictors of acceptance of carbon dioxide capture and storage (CCS). *Risk Analysis*, *29*(8), 1129-1140.

Upham, P., & Shackley, S. (2006). The case of a proposed 21.5 MWe biomass gasifier in Winkleigh, Devon: Implications for governance of renewable energy planning. *Energy Policy*, *34*(15), 2161-2172.

Van Dijk, E., & Zeelenberg, M. (2003). The discounting of ambiguous information in economic decision making. *Journal of Behavioral Decision Making*, *16*(5), 341-352.

Van Ittersum, K. O. E. R. T., Rogers, W. A., Capar, M., Caine, K. E., O'Brien, M. A., Parsons, L. J., & Fisk, A. D. (2006). Understanding technology acceptance: Phase 1–literature review and qualitative model development. *Technology Report HFA-TR-0602). Atlanta, GA: Georgia Institute of Technology, School of Psychology, Human Factors and Aging Laboratory*.

Visschers, V. H., & Siegrist, M. (2013). How a nuclear power plant accident influences acceptance of nuclear power: Results of a longitudinal study before and after the Fukushima disaster. *Risk Analysis*, *33*(2), 333-347.

Walker, W. E., Harremoës, P., Rotmans, J., van der Sluijs, J. P., van Asselt, M. B., Janssen, P., & Krayer von Krauss, M. P. (2003). Defining uncertainty: a conceptual basis for uncertainty management in model-based decision support. *Integrated Assessment*, *4*(1), 5-17.

Wolsink, M. (2013). Wind Power: Basic Challenge Concerning Social Acceptance wind power social acceptance. In *Renewable Energy Systems* (pp. 1785-1821). Springer New York.

Appendix A

Certain Condition Scenario (In Dutch)

U krijgt dadelijk een beschrijving van een fictieve situatie te lezen die zich op dit moment ergens in Nederland voor zou kunnen doen. Lees de tekst alstublieft goed door en leef u in de situatie in. Daarna stellen wij u een aantal vragen over deze situatie. Geef alstublieft antwoord op alle vragen.

Stelt u zich voor, u woont in het dorp Houtendal, en het energiebedrijf Syntex is van plan vijf windmolens naast uw dorp te bouwen. Deze locatie is uitermate geschikt voor de windmolens, onder andere vanwege de sterke en continue windstroom in dit gebied. Er wonen 1000 huishoudens in de nabije omgeving van de windmolens, waaronder uw huishouden.

Het bedrijf Syntex heeft eenzijdig (dus zonder overleg met inwoners en met de burgemeester en wethouders van de gemeente Houtendal) besloten om het windmolenpark op 500 meter afstand van het dorp te plaatsen.

Over de lokale impact van het windmolenpark zegt Syntex het volgende in een informatiebrief aan alle inwoners van Houtendal: “Het plaatsen van de windmolens op 500 meter afstand betekent dat de windmolens zichtbaar zullen zijn vanuit het dorp. Daarnaast betekent het plaatsen van de windmolens op 500 meter afstand ook dat het geluid dat geproduceerd wordt door de windmolens hoorbaar is als u buiten bent. We weten van onze andere windmolenparken dat op een 500 meter afstand de geluidsoverlast van het windmolenpark minimaal zal zijn. Op deze afstand weten we zeker dat het maximale geluidsniveau 40 decibel is, wat vergelijkbaar is met het geluid wat een gemiddelde koelkast maakt.”

Appendix B

Uncertain Condition Scenario (In Dutch)

U krijgt dadelijk een beschrijving van een fictieve situatie te lezen die zich op dit moment ergens in Nederland voor zou kunnen doen. Lees de tekst alstublieft goed door en leef u in de situatie in. Daarna stellen wij u een aantal vragen over deze situatie. Geef alstublieft antwoord op alle vragen.

Stelt u zich voor, u woont in het dorp Houtendal, en het energiebedrijf Syntex is van plan vijf windmolens naast uw dorp te bouwen. Deze locatie is uitermate geschikt voor de windmolens, onder andere vanwege de sterke en continue windstroom in dit gebied. Er wonen 1000 huishoudens in de nabije omgeving van de windmolens, waaronder uw huishouden.

Het bedrijf Syntex heeft eenzijdig (dus zonder overleg met inwoners en met de burgemeester en wethouders van de gemeente Houtendal) besloten om het windmolenpark op 500 meter afstand van het dorp te plaatsen.

Over de lokale impact van het windmolenpark zegt Syntex het volgende in een informatiebrief aan alle inwoners van Houtendal: “Het plaatsen van de windmolens op 500 meter afstand betekent dat de windmolens zichtbaar zullen zijn vanuit het dorp. Daarnaast betekent het plaatsen van de windmolens op 500 meter afstand ook dat het geluid dat geproduceerd wordt door de windmolens hoorbaar is als u buiten bent. We weten van onze andere windmolenparken dat op een 500 meter afstand de geluidsoverlast van het windmolenpark minimaal zal zijn. Op deze afstand weten we echter niet zeker wat precies het maximale geluidsniveau is. Het kan zijn dat het maximale geluidsniveau 40 decibel is, wat vergelijkbaar is met het geluid wat een gemiddelde koelkast maakt. Maar het maximale geluidsniveau kan ook (iets) hoger zijn.”