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Sammendrag

Formålet med denne studien er å undersøke hvordan miljø-innovasjon har blitt påvirket på kort sikt ett år inn i Covid-19-krisen. Studien tar utgangspunkt i prosessindustrien i Nord-Norge, der mange miljø-innovasjoner startes. I denne studien bruker jeg kvalitative intervjuer for å øke vår forståelse av miljø-innovasjoner under en krise, med data fra tre selskaper i prosessindustrien. Analysen avdekket fire forskjellige utfall av miljø-innovasjoner under Covid-19-krisen: pauser og forsinkelser, tilbaketrekninger, akselerasjoner og ikke påvirket. I tillegg til disse resultatene ble det funnet at nye «drivers» og «barrierers» som påvirker miljø-innovasjoner under kriser. En betydelig økning i tilgjengelig finansiering er en driver som dukket opp under krisen – noe som gjør at miljø-innovasjoner ikke ble påvirket av økonomiske begrensninger. Nye barrierer dukket opp på grunn av reisebegrensninger og sosiale distanserings tiltak: mangel på tilgang til menneskelige ressurser og mangel på tilgang til utstyr. Økonomiske begrensninger er en annen barriere som forårsaket at en bedrift trakk seg fra en miljøinnovasjon. Imidlertid ble de fleste av miljø-innovasjonene, ti av femten, ikke påvirket negativt av Covid-19-krisen. Videre ble fem miljø-innovasjoner startet i løpet av det første året av krisen. Disse funnene bidrar til en mer nyansert forståelse av innvirkningene på miljø-innovasjon under en krise.

Preface

This master thesis is written as the final part of my Master of Science at Nord University Business School. The topic is related to my major in Innovation and Entrepreneurship, and the study was written as a research article with an adjoining introductory chapter. This study explores how eco-innovation is affected one year into the Covid-19 crisis. The process of writing this thesis has been fun and challenging, but most importantly, it has been educational. During the process of writing this thesis, I have increased my understanding of eco-innovation and how the process industry works to tackle environmental challenges.

I have had great support and help during my work on this thesis. I would especially like to thank my supervisor, Karin Andrea Wigger, for their commitment and availability throughout the process. She has contributed with great knowledge and enthusiasm for the research field. She has also provided constructive feedback and valuable advice for the thesis. I would also like to thank all of the informants for their participation in this study.

Innovation: Organization and Management is chosen as the publication journal.

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Table of Contents

Introductory Chapter 1
Motivation and Objectives 1
Theoretical framework 2
Definitions of Eco-Innovation 2
Drivers and Challenges 5
The Innovation Process and Crisis 6
Methodology 7
Epistemology 7
Research Design 8
Empirical Context 9
Data Collection 10
Selection strategy 11
Analysis 12
Limitations and Credibility 13
Conclusion 14
Literature 15
Article 18
Introduction 19
Theoretical Framework 21
Innovation and Eco-Innovation During Crisis 21
Drivers and Barriers 22
Innovation Process in Process Innovation 23
Methodology 24
Data Collection 25
Analysis 27
Strategic Empirical Setting 28
Companies in the Process Industry 29
Crisis and Regional Impacts 30
Analysis 31
Paused and Delayed Eco-Innovations 32
Withdrawal from Eco-innovations 34
Accelerated Eco-Innovations 35
Not Yet Affected Eco-Innovations 39
Discussion 41
Barriers 43
Drivers 44

Conclusion 47
Literature 49
Appendix 1 52
Interview Guide 1 52
Interview Guide 2 53

Introductory Chapter

This thesis explores what happens with eco-innovation in the process industry one year into the Covid-19 crisis. The study is presented as a research article with an adjoining introductory chapter. This introductory chapter presents the motivation for this study, including an extensive theoretical and methodological foundation for the research article. To conclude, the chapter ends with a criticism of methodology and reflections of the study's limitations.

Motivation and Objectives

The motivation for this study is the sudden emergence of the Covid-19 crisis along with companies' increased interest in sustainability (Ramus, 2002) and the role of eco-innovation in contribution to increased environmental performance (OECD, 2009). The coronavirus, SARS-CoV-2, was declared a pandemic by the World Health Organisation in March 2020 (WHO, 2020). In addition to being a global health crisis, measures to stop contamination of the virus, such as travel restrictions and lockdowns, have decreased economic activity and significantly impacting the global economy (World Bank, 2020).

At the same time, the interest in sustainability is growing, and one of the critical areas of sustainability is innovation (Saunila, Ukko, Rantala, 2018). Carrillo-Hermosilla, González, and Könnölä (2009) stated that eco-innovation could be a preventative solution for environmental issues such as climate change and pollution linked to manufacturing activities. The growing interest in eco-innovation as a means to tackle environmental issues and the sudden emergence of the Covid-19 crisis raises the research question: How is eco-innovation affected one year into the Covid-19 crisis?

To understand how eco-innovation is affected by the Covid-19 crisis, I conducted qualitative interviews with three companies in the process industry in Northern Norway one year after the Covid-19 crisis emerged (March 2020). This context is relevant because of the environmental impacts of the process industry, such as emissions and waste generation (Norgate, Jahanshahi, & Rankin, 2007). Companies in the region are interested in sustainability, and many of the companies in the region are part of an innovation cluster focused on sustainability. This study aims to understand how eco-innovation is impacted during a crisis and what impacts eco-innovations during a crisis. Thus, contributing to a more

nuanced understanding of eco-innovation. The findings are presented in the research article following the introductory chapter.

Theoretical framework

Since the topic of the thesis is eco-innovation and how it is affected during an economic crisis, I will present relevant literature regarding eco-innovation in this chapter. This chapter will explain and discuss definitions of eco-innovation and the innovation process. The chapter will additionally include literature about drivers and challenges for eco-innovation. The literature will give an overview of aspects related to eco-innovation and what can impact it during a crisis.

Definitions of Eco-Innovation

Fussler and James (1996) first introduced the term eco-innovation in the book called Eco-innovation: A Breakthrough Discipline for Innovation and Sustainability. Eco-innovation was defined as: «The process of developing new products, processes or services which provide customer and business value but significantly decrease environmental impact» (Fussler and James, 1996, p. 303). There are several definitions and terms to describe eco-innovation in today's literature. These terms include green innovation, sustainable innovation, and environmental innovation. Previous research found that these different terms can be used interchangeably since they examine the same topic (Herstatt, Schiederig, & Tietze, 2011). The terms environmental innovation and eco-innovation are the most popular, and the term used in this thesis is eco-innovation. Some of the most used definitions for eco-innovation is presented in Table 1.

Definitions of Eco-innovation	
OECD (2009, p. 1)	«Eco-innovation can be generally defined as an innovation that results in a reduction of environmental impact, no matter whether or not that effect is intended.»
Kemp & Pearson (2007, p. 7)	«Eco-innovation is the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives.»

Rennings (2000, p. 322)	«Eco-innovations are all measures of relevant actors (firms, politicians, unions, associations, churches, private households) which; develop new ideas, behavior, products and processes, apply or introduce them and, which contribute to a reduction of environmental burdens or to ecologically specified sustainability targets.»
Carrillo-Hermosilla, Del Rio González, & Könnölä (2009 p. 8)	«We define eco-innovation as referring to an innovation that improves environmental performance.»

Table 1: Definitions of eco-innovation

As shown in Table 1, all of the definitions for eco-innovation focus on the reduction of environmental impact or improved environmental performance. Carrillo-Hermosilla, Del Rio, and Könnölä (2010) explained that different definitions of eco-innovation had in common that they focused on reducing environmental impact. Nevertheless, the motivation for doing the innovation in the first place did not need to be environmental in order for the innovation to be called an eco-innovation. Kemp and Pearson (2007) also explained that an innovation could be called an eco-innovation whether sustainability was intended. This also corresponds with the OECD (2009) definition, as shown in Table 1. However, the innovation needs to reduce its environmental impact in order to be called an eco-innovation. For instance, a regular innovation aiming to make a production process more effective could also reduce its environmental impact. According to the literature, this innovation can be called an eco-innovation because of its reduced environmental impact (Carrillo-Hermosilla et al., 2010, Kemp and Pearson, 2007, OECD, 2009).

For clarity, this thesis will focus on eco-innovations with a sustainable intention and not unintended eco-innovations. Concentrating on eco-innovations with a sustainable intention will make the sampling and data collection process more manageable. Also, eco-innovation initiated to reduce the environmental impact of a product, process, or service can have other characteristics than regular innovation initiated for other reasons than sustainability. Thus, an explanation of the similarities and differences between eco-innovation and regular innovation is included to review the concept of eco-innovation further.

There are many definitions for innovation, and no commonly agreed-upon definition exists yet. Baregheh, Rowley, and Sambrook (2009, p. 1334) proposed a broad definition for innovation: “Innovation is the multi-stage process whereby organisations transform ideas into

new, improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace". Innovation and eco-innovation are also similar in the form of novelty. Where innovation aims to improve or develop new products or processes (Baregheh et al., 2009), eco-innovation also aims to improve or develop new products or processes (Kemp and Pearson, 2007). Innovation can create value, for example, by increasing competitive advantage (Munodawafa and Johl, 2019). Eco-innovation can also create a competitive advantage and bring value to companies, according to Porter and Linde (1995). Innovation is a multidisciplinary concept consisting of different attributes such as nature, type, stages, and aim of the innovation (Baregheh et al., 2009). Similarly, to regular innovation, Eco-innovation consists of stages, such as idea generation, development, testing, and market introduction stages (Herstatt and Verworn, 2001).

One of the main differences between eco-innovation and regular innovation is the end result. The solutions created by innovation does not need to be environmentally friendly. As discussed earlier, eco-innovation can, according to Kemp & Pearson (2007), be an unintended regular innovation that results in a more environmentally friendly solution. However, the solution needs to provide a more sustainable solution that reduces the environmental impact of a product, process, or service. The motivation for doing regular innovation can be different from the motivation for eco-innovation. For instance, regular innovation could be motivated by creating a new or better product or creating better solutions. Eco-innovation could be motivated by regulations, higher tax for climate gas emissions, or customer demands.

Another difference between innovation and eco-innovation is that the return might not benefit the company directly. The return being positive spillovers in the innovation and diffusion stages (Rennings, 2000). Positive spillovers can be, for instance, less environmental impact of a product or a process. This is called the double externalities problem, and it was mentioned by Rennings (2000) as one of the peculiarities of eco-innovation. It states that eco-innovation benefits the environment and the company, but the company is paying the price of the innovation (Garcia, Wigger, & Hermann, 2019). In contrast to regular innovation, that mainly benefits the company because the focus is on creating new solutions for products or production processes for the company. According to Rennings (2000), this problem reduces incentives for doing eco-innovations, and in an economic crisis, the motivation for doing eco-innovation could be reduced even more. Other factors drive eco-innovations that can impact it during a crisis, such as drivers and challenges.

Drivers and Challenges

Drivers are essential factors for starting eco-innovations, and an economic crisis might impact these drivers. Hojnik and Ruzzier (2016) divided them into motivating factors and facilitating factors. Meaning, some drivers motivate companies to do eco-innovation, like reduced costs, and other drivers make it easier to do eco-innovation, such as the company's resources. Drivers can be why companies continue with eco-innovation in times of crises, but drivers can also be affected by the economic crisis. Another peculiarity of eco-innovation is the regulatory push and pull effect, which relates to different eco-innovation drivers. Rennings (2000) argues that technology push and market pull is not strong enough to drive eco-innovation; therefore, regulatory support is needed. Technology push factors are, for instance, technologic development that increases incentives for eco-innovation, and market pull factors relate to demand and competition. Porter and Linde (1995) also stated that environmental regulation could stimulate more resource productive innovations. Reviewing drivers can help analyse how the crisis has impacted eco-innovation, but there are already challenges with eco-innovation. It is also necessary to look at what challenges exist because they can also influence eco-innovation during the crisis.

Eco-innovation has challenges in a stable economy, and challenges related to eco-innovation can impact it more during crisis times. One challenge for eco-innovation found in a study by Garcia, Wigger, Hermann (2019) is the double externalities problem, where firms take the cost for research and development of eco-innovation, but the environment gets the benefits. This problem could impact eco-innovations more in a crisis. Since a company does not get an immediate advantage from the innovation, companies could choose to cancel eco-innovation projects during an economic crisis to reduce costs. If the advantage only benefits the environment, it could reduce the motivation to continue with eco-innovation projects. Other challenges for eco-innovation found in this study was goal setting and resource withdrawal (Garcia et al., 2019). During an economic crisis, it could be less motivating for companies in an open innovation network with no clear goals to participate and share their resources, especially if they are looking to reduce costs within their company. If one company decides to withdraw its resources because of financial trouble, it might be easy for other companies to do the same.

The Innovation Process and Crisis

When a crisis emerges, the stage an eco-innovation is in can impact if companies choose to continue or cancel eco-innovation projects. The innovation process consists of different stages of developing new products, processes, or services. There exist many different models explaining this process. Herstatt and Verworn (2001, p. 4) explained the innovation process using five different stages: idea generation, concept development and planning, development, testing and prototyping, and production and introduction of the product to the market. Another model proposed by Rogers (1983, p. 136) included six stages: needs and problems, research, development, commercialization, diffusion and adoption, and consequences. The innovation process is not always linear. Since it consists of research and development stages, it is normal to move from different stages during the innovation process. It is also normal to repeat stages if one idea or test fails or does not go as planned. Inspired by the models of the innovation process presented by Herstatt (2001) and Rogers (1983), I now discuss the innovation process and its different stages.

The first stages identified in the different models involved generating ideas (Herstatt & Verworn, 2001) and finding solutions for problems or needs (Rogers, 1983). In these first stages, it could be easy for companies to cancel eco-innovations when a crisis occurs because the innovation has not yet been realized. Continuing or starting innovation projects during a crisis would also depend on the financing and resources available. The middle stages of the innovation process are research, planning, development, and then testing. If an eco-innovation is in these stages, it could be a financial loss for a company to cancel its eco-innovation project if money and resources have been used for research and development. The last stages of the innovation process involve the production and introduction of the innovation (Herstatt & Verworn, 2001) and its diffusion and adoption (Rogers, 1983). If it has already been spent time, money, and resources on a project, it would be unlikely to cancel a project if it is in its last stages.

This theoretical framework presented literature about eco-innovation, regular innovation and its similarities and differences from eco-innovation, drivers and challenges, and the innovation process. The included theory concerns literature about aspects that can impact eco-innovations in times of crises. Innovation and eco-innovation can, for instance, be affected differently during times of crises. Drivers and challenges can impact decisions to start eco-

innovations or to cancel them. Plus, the innovation process could also impact eco-innovation during times of crisis, where different stages can have different challenges. While this theoretical framework presents a broad view of the existing literature, the research article following the introductory chapter will include a more detailed theoretical framework about eco-innovation concepts.

Methodology

This study aims to explore how eco-innovation is affected one year into the Covid-19 crisis. The qualitative method is suitable for studying eco-innovation on a project level because it provides a more extensive investigation and understanding of the research phenomena (Johannesen, Tufte, & Christoffersen, 2016). In qualitative research, an inductive approach is used for explaining the relationship between theory and research. Using an inductive approach means that the theory derives from the research, and new knowledge is generated (Bryman, 2012). The remainder of this chapter will explain and justify the chosen research method, epistemology, research design, data collection method, and study limitations.

Epistemology

Epistemology is a philosophical discipline that explains how knowledge about the physical and social world is generated (Easterby-Smith, Thorpe, and Jackson, 2015). It questions what knowledge is and how it can be generated. In research, epistemology is the perspective a researcher applies for understanding knowledge about the social reality and how knowledge is generated. This study is inspired by the interpretivist approach, an epistemological position that assumes that social order emerges from intentional action and interaction at the individual level (Packard, 2017).

Interpretivism assumes that knowledge emerges from sources of experience and imagination, and explanations of the social world are grounded in people's self-understanding (Leitch, Hill, and Harrison, 2010). Interpretivism allows the researcher to view the research holistically by interpreting the informants understanding of the research problem (Leitch et al., 2010). Thus, this approach allows for an understanding of how the Covid-19 crisis impacts eco-innovations through the informant’s perspective and their personal understanding of the research phenomena, which is suitable when aiming to understand eco-innovation during a crisis.

Interpretivism questions why and not just what and how (Packard, 2017). In addition to explore how the Covid-19 crisis impacts eco-innovation, this study aims to analyse why eco-innovations are impacted the way they are. Leitch et al. (2010) explained that the social world could be explained as it is seen subjectively by informants. When including informants working in the process industry and informants who collaborate with the process industry on eco-innovation projects, the interpretive view of the social reality is suitable. An interpretive approach allows for understanding the informants' subjective reality when researching eco-innovation during the economic crisis. This is an interesting approach when using informants from both inside and outside of the selected companies in the process industry since these informants can experience different social realities during the Covid-19 crisis.

Research Design

Research design explains how a study will be conducted to answer the research question (Johannesen et al., 2016). The research design chosen for this study is a qualitative case design. This design generates a detailed analysis of a single case or multiple cases (Bryman, 2012). The case study is relevant when it is necessary to understand a case that exists in the real world, and this understanding could include relevant contextual conditions for the selected case (Yin, 2009). According to Yin (2009), conditions for using a case study are that the researcher has little or no control over the events, and the focus is on a contemporary phenomenon within a real-life context.

The case of this study is a contemporary phenomenon regarding what happens with eco-innovations during an economic crisis, and using this research design, allows for a thorough explanation and examination of the research phenomena. With a case design, a considerable amount of information is collected from one or a few cases through a detailed and comprehensive data collection (Johannessen et al., 2016). Using a case study, it is possible to examine what happens with eco-innovation projects in one or more organisations and gather extensive data about these selected companies. The unit of analysis is the process industry in Northern Norway, and three companies in this industry will be included in the case study. Some criticisms of the case study are that it is difficult to make generalizations from the specific to the general (Easterby-Smith et al., 2015).

Although there are different approaches for conducting a case study, researchers have no consensus on the design and implementation of the case study method (Yazan, 2015). However, there are different views on which approaches are appropriate for conducting case studies. Yin (2009) and Stake (2006) have contrasting positions when it comes to their view on how to conduct case studies (Easterby-Smith et al., 2015). While Yin offers a positivist approach for case studies, Stake favors a social constructivist position. Yin emphasizes the design of the case study and explains in great detail how every step of the case study process should be conducted (Yazan, 2015). Stake, on the other hand, favors a more flexible design for case studies. When using a flexible case design, it is possible to make extensive changes after starting the research process (Yazan, 2015).

As for all research, it is challenging to find a perfect fit for research design, especially considering case study approaches. Thus, this thesis will only be inspired by Stake's approach for case studies. Even if it is suitable does not mean that every aspect of Stakes case design approach is appropriate for this thesis, such as the empirical characteristic of Stakes case study approach. Empirical meaning basing the study on observations done in the field (Yazan, 2015). The case will be explained by information collected through interviews and online documents, but field observations are not possible because of social distancing measures. The pandemic's impact on eco-innovations and the selected companies in the process industry are better explained through interviews, and this particular research phenomenon is not necessarily something that could be easily observed in the field. Other characteristics of Stakes case study approach that is appropriate for this case study is the interpretive and holistic characteristics. According to Stake, the interpretive characteristic of the case study is that the researcher, through their intuition, views research as an interaction between the researcher and the subject (Yazan, 2015). The holistic characteristic implies that the relationship between the research phenomenon and the context of the research phenomenon should be considered in the case study (Yazan, 2015).

Empirical Context

The empirical context of the case study is the process industry in Northern Norway one year into the Covid-19 crisis. The process industry in Northern Norway is diverse and dates back to the 1800s, and today the process industry is an essential part of the economy in the region. The process industry is a relevant context for studying eco-innovations because of its

environmental impact, such as emissions and pollution, and the interest in eco-innovation as a means to tackle environmental challenges. In March 2020, the Covid-19 crisis caused lockdowns in Northern Norway, but the contamination of the coronavirus in the region has been low through the first year of the crisis. Thus, production has not been impacted by contamination of the coronavirus until now.

The process industry has been growing in the past years leading up to the Covid-19 crisis, but during 2020 the turnover decreased by 1.1 billion NOK, and it constitutes a two percent decrease in turnover in this sector from 2019 (Indeks Nordland, 2019). The market situation for the process industry in the region depends on international demand for products used in the manufacturing and construction industry, and some companies could therefore be impacted more than others. However, the market situation for the process industry is still uncertain since the Covid-19 crisis is still ongoing at the end of data collection (April 2020).

Data Collection

Case design favors data collection methods that can generate detailed information about the research phenomena. Methods like unstructured interviewing are often used for data collection when using a case design since they can generate intensive and detailed information on cases (Bryman, 2012). For that reason, the qualitative interview is the selected method for collecting data. The qualitative interview is a structured conversation between an interviewer and an informant, and the purpose is to understand and describe a phenomenon (Johannesen et al., 2016). It is a suitable method when studying the experiences and opinions of informants (Johannesen et al., 2016). It is an appropriate method to gain an understanding of what happens to eco-innovation during a crisis. Using interviews as a research method makes it possible to gather detailed information about eco-innovation and identify what impacts eco-innovation during a crisis. In addition to interviews for case study research, Stake suggests observation as a data collection method (Yazan, 2015). Because of social distancing measures, it was not possible to conduct observations.

The interviews used in this study is semi-structured. The interview guide of semi-structured interviews contains questions and topics that should be covered, but there is also room to ask questions outside of the interview guide (Bryman, 2012). The semi-structured interview is suitable because important questions and topics are included in the interview guide, which all

of the informants should answer. The informants also have flexibility in how they reply to the questions (Bryman, 2012). Since it is a flexible research method, it is possible to get various information from the informants regarding different outcomes of the research question. If a structured interview were conducted, there would be no room to ask questions outside the interview guide. If, for example, different informants were to have different experiences, it would not be possible to ask questions outside of the planned interview guide. Getting informants to elaborate further on their answers can be difficult, and it is required to pay close attention to the informant (Bryman, 2012). By paying close attention during the interview, the interviewer can pick up on valuable information, making it possible to ask good follow up questions.

Selection strategy

The snowball method was used to find informants for the study. This method starts with an informant or a group of informants that meets the criteria for inclusion (Easterby-Smith et al., 2015). The first informants can present other relevant informants who have experience and relevant information (Bryman, 2012). Then the new informants can propose other relevant informants. This is a relevant sampling method to use when there are few informants, and it can be difficult to know who belongs to the population (Easterby-Smith et al., 2015). Since it is difficult to know who works with eco-innovation or sustainability in the process industry, the snowball method is suitable.

Two groups of informants were used as selection criteria. The first group is informants that work for the selected companies of the case study. These informants needed to have knowledge about eco-innovations in the selected companies and preferably be involved in eco-innovation. For example, leaders might not be involved in eco-innovations, but they do have knowledge about how the companies are affected and how eco-innovations are affected. But an engineer might have more detailed knowledge about eco-innovations on a project level. The selection criteria for informants collaborating with the process industry on eco-innovation are also that they have knowledge about, or are involved in, eco-innovations.

The first informants were found through acquaintances or by contacting relevant institutions and companies in the process industry. Contacting employees working for companies in the process industry resulted in finding relevant informants for the interviews. The first

informants were contacted by mail and phone, and some were happy to participate in the study. Others who were not involved with eco-innovations suggested relevant informants that had knowledge about eco-innovations. At the end of each interview, the informants had the opportunity to suggest other relevant informants for this study. In the end, I ended up with ten informants in three different companies, including three informants in companies collaborating with the process industry on eco-innovations.

Analysis

According to Johannessen et al. (2016), two purposes of data analysis are organising the data into different topics and analyzing and interpreting the data. Before the analysis can start, the data needs to be reduced. The challenge with the qualitative method is that it generates large amounts of data in the collection process, and it can be challenging to find useful information (Johannesen et al., 2016). One way of organising the data is by coding, which divides parts of the transcripts into specific labels. Coding involves writing marginal notes on the interview transcripts and turning the notes into codes while re-reading the transcripts (Bryman, 2012).

The first step was coding the transcribed data. I used NVivo to categorize all eco-innovations by environmental impact, including their outcomes during the Covid-19 crisis. I also categorized all of the data into nodes for each company, making it easier to know which eco-innovations belonged to which company. Each company included nodes for their eco-innovations, how the Covid-19 crisis impacted them, drivers, and barriers. The eco-innovation nodes contained all relevant information about the specific eco-innovation, including the innovation stage, effect of the Covid-19 crisis, drivers and challenges.

After the data is coded, it can be analysed. Thematic analysis can be used for analyzing the data (Bryman, 2012). After the coding in NVivo, I organised all of the eco-innovations in a table, including their type, effect by the crisis, innovation stage, drivers, and barriers. It is then possible to analyse the data using the different themes, which allows for an orderly analysis of the data. Bryman (2012) states that a theme can be a category found in the data or from codes in transcripts. By analyzing the eco-innovations in the table, it was possible to identify themes of how the Covid-19 crisis impacted eco-innovations.

Limitations and Credibility

Although interviews are good for obtaining extensive information about the research phenomenon, there are some limitations. One limitation of the qualitative interview is biased. This is when the interviewer imposes their own attitudes and beliefs on the informant during the interview (Easterby-Smith et al., 2015). Questions should be asked in a way where acceptable and unacceptable answers are not indicated by the interviewer (Johannessen et al., 2016). Bias can affect the questions during the interview and when the questions are interpreted (Easterby-Smith et al., 2015). Another factor that could affect the interview process is the trust obtained between the interviewer and the informant. If trust is not obtained, the informant could feel uncomfortable and tell the interviewer what they think is expected when answering the questions (Easterby-Smith et al., 2015). One way to build trust is to do research about the company and also presenting the research in a professional way (Easterby-Smith et al., 2015).

Credibility in qualitative research is about the trustworthiness of the data, and it equals internal validity in quantitative research (Korstjens and Moser, 2018). To increase credibility through observation and engagement, I gained background information through a seminar about innovation in times of crisis. I also had phone conversations with people who know the process industry and read about the selected companies and their projects online. Some of the eco-innovations in this study are published at "the project bank". This is a website provided by the Norwegian Research Council, where information about innovation projects are included. This was a way of triangulating the data, where I could check that the information provided by the informants about eco-innovations was correct. Another way of increasing the credibility of qualitative research is through transparent descriptions of how the research was conducted and thick descriptions of the context (Korstjens and Moser, 2018).

When dealing with personal information in research, it is important to see if the study has to be reported (Johannessen et al., 2016). Since the interviews were going to be stored on the university's one drive and included information about companies and their employees, it was required to report the study to the Norwegian Center for Research Data (NSD). NSD permitted the study to start in February. Following the ethical research guidelines on NSD, the informants were sent an informational sheet that included information about the study and a consent form. The sheet also included information about why they were selected as

informants, what data would be gathered, how the data would be gathered, and how it would be stored. Informants should always get information about their right to withdraw from a study when and if they want, and they have to consent to participate in the study (Johannessen et al., 2016). In addition to giving informants information about their rights through an informational sheet and getting their consent, they were also informed about their rights at the start of each interview.

Because of the coronavirus situation, the interviews were done through social media channels such as Zoom and Microsoft Teams. Although this is a safe way of conducting interviews during the pandemic according to infection control rules, using video calls to conduct interviews has its limitations. When interviews are done in person, it is possible to analyse the informant's reactions and body language more clearly. Since the interviews were done using video calls, these reactions are less clear and difficult to interpret. One limitation of using video calls is that you do not get information outside of your interview guide or the follow-up questions you ask. For instance, if interviews were done in person and at the location of the selected companies, it would be possible to get guided tours where it is possible to get more background information for the study. One minor problem that occurred during three of the interviews were problems with the internet connection. This resulted in some sentences missing from the audio. However, it mainly occurred at the end of the interviews, when we had talked through the questions in the interview guide. However, this problem would not have occurred if the interviews could have been done in person.

Conclusion

This introductory chapter presents the motivation, theoretical foundation, and methodology for the research article on how eco-innovation is affected during the covid-19 crisis. As presented in this introductory chapter, the theoretical foundation for the research article builds upon the theory on eco-innovation and innovation, drivers and challenges that can impact eco-innovation during a crisis, and the innovation process. As for the methodology, the research was conducted using qualitative interviews, and the findings are presented as a case study. The following research article presents a detailed analysis of how eco-innovations are affected one year into the Covid-19 crisis.

Literature

Baregheh, A., Rowley, J., and Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. *Management Decision, 47(8),* 1323-1339. 10.1108/00251740910984578

Bryman, A. (2012). *Social Research Methods.* (4th ed.). New York: Oxford University Press.

Carrillo-Hermosilla, J., Del Rio, P., and Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production, 18(10-11),* 1073-1083. https://doi.org/10.1016/j.jclepro.2010.02.014

Carrillo-Hermosilla, J., Del Rio González, P., & Könnölä, T. (2009). *Eco-Innovation. When Sustainability and Competitiveness Shake Hands.* New York: Palgrave Macmillan.

Del Río, P., Peñasco, C., and Romero-Jordán, D. (2016). What drives eco-innovators? A critical review of the empirical literature based on econometric methods. *Journal of Cleaner Production, 112(4),* 2158-2170. 10.1016/j.jclepro.2015.09.009

Easterby-Smith, M., Thorpe, R., Jackson, P. (2015). *Management and Business Research* (5th ed.). London: Sage Publications.

Fussler, C., and James, P. (1996). Eco-innovation: A Breakthrough Discipline for Innovation and Sustainability. (Found in the book: Eco-Innovation When Sustainability and Competitiveness Shake Hands)

Garcia, R., Wigger, K., & Hermann, R. R. (2019). Challenges of creating and capturing value in open eco-innovation: Evidence from the maritime industry in Denmark. *Journal of Cleaner Production*, *220*, 642-654. 10.1016/j.jclepro.2019.02.027

Herstatt, C. & Verworn, B. (2001). The 'Fuzzy Front End' of Innovation. Working Paper No. 4. DOI: 10.1057/9780230512771_16

Herstatt, C., Schiederig T., & Tietze, F. (2011). What is Green Innovation? – A quantitative literature review. *The XXII ISPIM Conference 2011.* Retrieved from: http://ssrn.com/abstract=1846882

Hojnik, J., & Ruzzier, M. (2016). What drives eco-innovation? A review of an emerging literature. *Environmental Innovation and Societal transitions, 19, 31-41*. https://doi-org.ezproxy.nord.no/10.1016/j.eist.2015.09.006

Johannesen, A., Tufte, P. A. & Christoffersen, L. (2016). *Introduksjon til samfunns-vitenskapelig metode* (5. utg.). Abstrakt forlag.

Kemp, R. & Pearson. P. (2007). *Final report MEI project about measuring eco- innovation.* UM-MERIT. Retrieved from: https://www.oecd.org/environment/consumption-innovation/43960830.pdf

Korstjens, I., & Moser, A. (2018) Series: Practical guidance to qualitative research. *Part 4: Trustworthiness and publishing, European Journal of General Practice, 24(1),* 120-124, 10.1080/13814788.2017.1375092

Leitch, C. M., Hill, F. M., and Harrison, R. T. (2010). The Philosophy and Practice of Interpretivist Research in Entrepreneurship. *Organizational Research Methods, 13, 67-84.* 10.1177/1094428109339839

Munodawafa, R.T., & Johl., S.K. (2019). A Systematic Review of Eco-Innovation and Performance from the Resource-Based and Stakeholder Perspectives. *Sustainability, 11, 6067.* doi:10.3390/su11216067

OECD. 2009. Eco-Innovation in industry: Enabling green growth. Executive Summary. Retrieved from: https://www.oecd.org/sti/ind/44424374.pdf

Packard, M. D. (2017). Where did interpretivism go in the theory of entrepreneurship? *Journal of Business Venturing 32,* 536–549. http://dx.doi.org/10.1016/j.jbusvent.2017.05.004

Porter, M. E., & van der Linde, C. (1995). Green and Competitive: Ending the Stalemate. *Harvard business review*. Retrieved from: https://www.academia.edu/2917976/Green_and_competitive_ending_the_stalemate

Rennings, K. (2000). Redefining innovation - eco-innovation research and the contribution from ecological economics. *Ecological Economics, 32,* 319–332. 10.1016/S0921-8009(99)00112-3

Rogers, E.M. (1983). *Diffusion of Innovations* (Third edition). New York: The Free Press Retrieved from: https://teddykw2.files.wordpress.com/2012/07/everett-m-rogers-diffusion-of-innovations.pdf

Saunila, M., Ukko, J., & Rantala, T. (2018). Sustainability as a driver of green innovation investment and exploitation. *Journal of Cleaner Production, 179,* 631-641. https://doi.org/10.1016/j.jclepro.2017.11.211

WHO. (2020). World Health Organization. Retrieved from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020f

World Bank. (2020). *Global Economic Prospects, June 2020.* Washington, DC: World Bank. 10.1596/978-1-4648-1553-9

Yazan, B. (2015). Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake. *The Qualitative Report, 20(2),* 134-152. Retrieved from https://nsuworks.nova.edu/tqr/vol20/iss2/12

Article

Eco-Innovation During the Covid-19 Crisis: A Case Study of the Process Industry

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Abstract

The purpose of this case study is to investigate how eco-innovation have been affected in the short-term one year into the Covid-19 crisis. The empirical setting of the study is the process industry in Northern Norway, where many eco-innovation initiatives are started. In this study, I use qualitative interviews to increase our understanding of eco-innovations during a crisis, with data from three companies in the process industry. The analysis revealed four different outcomes of eco-innovations during the Covid-19 crisis: pauses and delays, withdrawals, accelerations, and not affected. In addition to these outcomes, new drivers and barriers were found to impact eco-innovations during the crisis. A significant increase in available funding is a driver that emerged in response to the crisis— causing most eco-innovations not to be impacted by financial limitations. New barriers emerged because of travel restrictions and social distancing measures: a lack of access to human resources and a lack of access to equipment. Financial limitations are another barrier that caused a withdrawal from one eco-innovation. However, most of the eco-innovations, ten out of fifteen, were not impacted by the Covid-19 crisis. Furthermore, five eco-innovations were started during the first year of the crisis. These findings contribute to a more nuanced understanding of the impacts on eco-innovation during a crisis.

Keywords: Eco-Innovation, Crisis, Drivers, Barriers, Process industry

Introduction

Because of the increasing pressure from stakeholders and a growing concern for the environment, companies are taking action by, for example, doing eco-innovations to become more sustainable and reduce their environmental impact (Davis, 1991, Fussler, 1996, referenced in Ramus, 2002). But what happens to eco-innovation when a crisis happens? In March 2020, the novel coronavirus, SARS-CoV-2, was declared a pandemic by the World Health Organisation (WHO, 2020). The coronavirus's rapid spread caused many countries to enforce lock-downs, travel restrictions, and social distancing measures. These measures have decreased economic activity and caused a demand and supply shock (World Bank, 2020). There has additionally been a decline in consumption and investment, and when businesses shut down, it affected production, employment, and supply chains (World Bank, 2020). Consequently, the Covid-19 pandemic has had a significant impact on the global economy (World Bank, 2020), while the environmental crisis is still present. This paper studies how eco-innovations are affected during the Covid-19 crisis, where the Covid-19 crisis refers to the pandemic and the economic crisis.

Eco-innovation has been given attention for how it can contribute to sustainable development and increased environmental performance in companies (OECD, 2009). Companies have also experienced increased pressure to tackle climate change by various stakeholders (Coppola, Krick, & Blohmke, 2019). Because of different environmental issues, such as climate change and pollution, linked to manufacturing activities, Carrillo-Hermosilla, González, and Könnölä (2009) argues that eco-innovation could be a preventative solution without restricting economic activity. In this study, the definition of eco-innovation refers to all measures that develop and introduce new ideas, products, or processes that reduce environmental impact (Rennings, 2000). Along with the growing interest in eco-innovation to tackle environmental issues and the sudden emergence of the Covid-19 crisis, raises the research question: How is eco-innovation affected during the Covid-19 crisis?

Previous research found a decreased investment in eco-innovation during the economic crisis in Spain (García-Pozo, Sánchez-Ollero, and Ons-Cappa, 2016). The reduced investment was a measure to reduce costs and increase competitiveness during the crisis (García-Pozo et al., 2016). Financial limitations have also been shown to limit the likelihood of starting eco-innovation but not impact regular innovation (Cuerva, Triguero-Cano, and Córcoles, 2014).

There is an increased awareness of environmental challenges compared to when the last economic crisis happened. Because of these findings and the increased awareness of environmental challenges, this paper aims to analyse how the current economic crisis caused by the pandemic has impacted eco-innovation. It is unknown how long the Covid-19 crisis will last, and this study focuses on the short-term impacts on eco-innovations one year into the crisis.

The process industry is known to have environmental impacts such as emissions, unwanted byproducts, waste generation, and high energy consumption (Norgate, Jahanshahi, & Rankin, 2007). Because of increased awareness and interest in sustainability in the process industry in Northern Norway, it provides as a relevant context to increase our understanding of eco-innovations during a crisis. The data is gathered by interviewing informants with knowledge or involvement in eco-innovations in the process industry and companies collaborating with the process industry, such as funding agencies. The interviews are conducted one year after the Covid-19 crisis emerged, and the crisis is still ongoing at the time of data collection (March 2020). Therefore, the eco-innovations in this study could be impacted after the data is collected. This study focuses on eco-innovations in the early stages and process innovations. Since the environmental impacts generated in the process industry are generated through their production process, most eco-innovations initiated to reduce environmental impacts are process innovations.

This study contributes to eco-innovation research with a qualitative perspective on eco-innovation outcomes during times of crisis. Other researchers have studied how eco-innovation was affected during a crisis using a quantitative research method (García-Pozo et al., 2016). Research about eco-innovation drivers also favors a quantitative approach, for instance, by using econometric methods (Del Rio, Peñasco, and Romero-Jordán, 2016). Compared to the previous research, this study contributes to eco-innovation research by presenting a more nuanced understanding of eco-innovations on a project level. In particular, the outcomes of eco-innovations during a crisis, including pauses and delays, withdrawal, acceleration, and continuation. In addition to finding different outcomes of eco-innovations during a crisis, this study identifies new drivers and barriers emerging from the Covid-19 crisis. The study also contributes to research about process innovations during a crisis.

Theoretical Framework

This theoretical framework builds upon literature on eco-innovation and regular innovation during the economic crisis in 2008 and innovation during the Covid-19 crisis. The following sections present literature about the most reported drivers and barriers for eco-innovation, which can impact eco-innovation during a crisis. Since the eco-innovations in this study are in the start and middle stages, the last section explains these stages of eco-innovation and how they could impact it during a crisis.

Innovation and Eco-Innovation During Crisis

In this study, the definition of eco-innovation refers to all measures that develop and introduce new ideas, products, or processes that reduce environmental impact (Rennings, 2000). Eco-innovations and innovations share many of the same characteristics (Wagner, 2008, referenced in Hojnik and Ruzzier, 2016) and could share the same challenges during a crisis. Literature about regular innovation during a crisis is therefore included. Findings from the previous crisis can give insight into how eco-innovations are affected during the Covid-19 crisis. However, the crisis in 2008 was an economic crisis, and the Covid-19 crisis was caused by a pandemic that resulted in an economic crisis. Thus, eco-innovations could be impacted by both the pandemic and the economic crisis at the same time.

One study from the United Kingdom found the 2008 economic crisis to reduce the short-term willingness of companies to invest in innovation, and fewer resources were devoted to innovation when the crisis emerged (Archibugi, Filippetti, and Frenz, 2013). However, two groups of innovative firms increased their innovative efforts during the crisis, which were great innovators before the crisis and fast-growing new firms (Archibugi et al., 2013). Only a few firms increased their innovation expenses in the initial stage of the crisis. There was an average decrease in innovation expenses by 8 percent amongst the companies of this study (Archibugi et al., 2013).

A study on eco-innovation in Spain during the economic crisis in 2008 found that hotels reduced their investment in eco-innovations in times of economic crises (García-Pozo et al., 2016). The decline in eco-innovation investment was a way to reduce cost and increase competitiveness in an economic crisis (García-Pozo et al., 2016). The reduction in eco-innovation investments during a crisis is similar to the other study from the UK, where

investments in innovation reduced in the initial stages of the economic crisis (Archibugi et al., 2013). These studies confirm that there is a reduction in both regular innovation and eco-innovation during economic crises.

While a crisis can reduce the willingness to invest in innovation for some companies, others might find new opportunities during a crisis. According to Brem, Viardot, and Nylund (2021), home confinement as a response to the Covid-19 pandemic have increased opportunities for digital technologies such as streaming, video-conferencing, e-commerce, and home delivery. Innovation opportunities can be different depending on how industries are affected by the Covid-19 crisis. When digital technologies have experienced an increase in opportunities, industries like the travel and hospitality industry could have experienced fewer opportunities because of travel restrictions.

Innovations in response to the pandemic have been shown to go faster, and technological shifts that could take years before the crisis have been achieved in days in response to the crisis (Brem et al., 2021). Some companies have switched their production in response to the increased demand for medical equipment and started to produce face masks and hand sanitisers (Betti and Heinzmann, 2020). Lee and Trimi (2021) mention that Ford Motors has innovated faster during the crisis, and they started developing ventilators instead of electric vehicles. Some companies are able to exploit a changing market during a crisis, while other companies respond to budget constraints by reducing investments in innovation (Guderian, Bican, Riar, and Chattopadhyay, 2021).

Drivers and Barriers

Drivers and barriers can impact eco-innovation during a crisis, and they can increase or reduce incentives for doing eco-innovation. New drivers and barriers could also appear during times of crises. Drivers can be referred to as stimulus for eco-innovation (Hojnik et al., 2016), and barriers can be defined as obstacles to eco-innovation. There are various ways to classify drivers. Hojnik et al. (2016) divided them into motivational factors and facilitating factors, while Del Rio et al. (2016) split drivers into internal and external factors. Motivational factors could be the reason for doing eco-innovations, while facilitating factors makes it possible or more accessible for companies to do eco-innovations. Drivers vary depending on the characteristics of companies and eco-innovations (Carrillo-Hermosilla et al., 2009). Firm size

is, for example, found to be a driver for eco-innovations, where large companies are more likely to invest in eco-innovations than smaller firms (Kesidou and Demirel, 2012). Kesidou et al. (2012) argue it could be because of large companies' public visibility and pressures from governments and their availability of resources.

Regulations are found in other studies to have a strong influence on eco-innovations compared to regular innovation (Horbach et al., 2012). Regulations can, for example, determine how much CO2 emissions companies are allowed to emit without paying taxes. Hojnik et al. (2016) found that regulations and market pull factors were the most reported drivers of eco-innovations. Market pull factors can, for instance, be customer demand for products with low environmental impact. Government subsidies or grants were also frequently reported as a driver for eco-innovation Hojnik et al. (2016). Another relevant driver for eco-innovations is cost savings (Horbach et al., 2012, Kesidou et al., 2012, and Hojnik et al.,2016). Cost savings can result from eco-innovations when a process is more resource-effective or saves energy or materials. Availability of resources such as people, technology, and knowledge are important drivers (De Jesus Pacheco, Caten, Jung, Ribeiro, Navas, and Cruz-Machado, 2017).

There are also barriers to eco-innovations that can have an impact during a crisis. Cuerva et al. (2014) found financial restrictions to be a barrier for eco-innovations, compared with regular innovation that was not impacted by financial limitations in their study. This barrier can impact companies with financial troubles during a crisis. Financial barriers are also found to impact decisions to withdraw, stop, slow down, or not start innovative projects (Mohnen, 2008, referenced in Pinguet, Bocquet, and Mothe, 2015, p. 138). Cooperation can also be a barrier to eco-innovation if internal conflicts or coordination problems arise (Kiefer, Del Rio Gonzales, Carrillo-Hermosilla, 2018). Another barrier found in the study is organisational learning (Kiefer et al., 2018). This could impact eco-innovations if resources in a company during a crisis is prioritised differently.

Innovation Process in Process Innovation

Many innovations developed in the process industry are process innovations, making it relevant for this study. Kahn (2018) explained process innovation as changes in a method or a process to increase efficiency, create a faster process, or lower cost. The innovation process

for process innovations is different from the process for product innovations. When developing a product innovation, the customer is external, but for process innovation, the customer is internal for the company (Lager, 2016). While product innovation is developed for market launch and commercialisation, process innovation is developed into an internal process in the company (Lager, 2016). Thus, the processes for these innovation types are different. For example, development for design, customer trials, and market launch are activities in the product innovation process. In comparison, process innovation includes activities such as laboratory testing, pilot testing and industrialisation (Lager, 2016).

The term «development process» is, according to Lager (2016), misleading because the innovation process can be misinterpreted as a linear and logical process, although it is more complex. The innovation process is a nonlinear cycle of divergent and convergent activities (Van de Ven, 2016). The innovation process can start in a planned convergent direction and then develop into a divergent cycle with new directions and goals (Van de Ven, 2016). When new divergent directions are explored, problems and resource constraints can arise, and the innovation process will either end in convergent implementation or divergent termination (Van de Ven, 2016).

Lager (2016, p. 465) explains the innovation process in the industry in three stages, the pre-development stage, development stage, and post-development stage. Ideation and identification of production needs happens in the first stage, process development in the second, and technology transfer to production in the last stage (Lager, 2016). Ideation and idea development are essential in the pre-development stages, and laboratory testing is performed in both the pre-development and development stages (Lager, 2016). Eventually, the process develops into pilot testing during the development stage and then pre-design before it is eventually transferred to production (Lager, 2016). Because the innovation process is complex, it will change between divergent and convergent behavior. For innovations during the Covid-19 crisis, the start and middle stages could experience problems because testing and idea generation are important activities during those stages.

Methodology

The research design is a qualitative case study, and the unit of analysis is the eco-innovations of three companies in the process industry located in Northern Norway. The companies are

relevant because of their involvement in eco-innovations and innovation projects in the region. The case study explains how the companies are affected one year into the Covid-19 crisis, and it is presented in an own section called strategic empirical setting, following methodology. The case study explains how the eco-innovations of the three companies are affected by the crisis and analyse why the eco-innovations are affected as they are. The goal of the case study is not to make generalisations about eco-innovations but to gain a detailed understanding of how eco-innovations have been affected by the Covid-19 crisis in the given context.

The process industry in Northern Norway is a relevant empirical context for studying eco-innovations because of their interest in sustainability and importance in local communities. The process industry has a long history in this region, dating back to the 1800s, and it is now an essential part of value creation in the region. Because of environmental impacts such as carbon emissions and unwanted by-products (Norgate et al., 2007), there is an interest in being more sustainable. The case companies are a part of an innovation cluster focused on sustainability in the process industry. They are all committed to reducing their environmental impacts in the following years.

According to a 2018 report about the economy in Northern Norway, the industry is succeeding at an international level, contributing to prosperity in Northern Norway and Norway (Indeks Nordland, 2018). The process industry is included in the industry and construction category in the regional index report, which is published annually. In 2019 this sector accounted for 31,8 percent of the turnover in the region of Northern Norway (Indeks Nordland, 2019). The sector has been growing in the past years, but during 2020 the turnover decreased by 1.1 billion NOK, and it constitutes a two percent decrease in turnover in this sector from 2019 (Indeks Nordland, 2019). The two percent decrease in turnover is similar to other industries in the region. The section called strategic empirical setting will explain the market situation of the process industry one year into the Covid-19 crisis.

Data Collection

Following Stakes approach for data collection in qualitative case studies (Yazan, 2015), interviews and documents I used for data collection in this study. Detailed information is needed to explain the research phenomena when using a case study design. Thus, I draw on

two different sources for data collection, such as interviews and documents, which generates detailed information for the case study.

Documents are used to understand the empirical context, while semi-structured interviews are used for data collection and analysing the research phenomenon. Documents used to gather data for understanding the empirical context includes five sustainability reports and eleven newspaper articles. The semi-structured interview guide includes questions about how the companies have been affected during the Covid-19 crisis, and how the pandemic has affected their eco-innovation projects. It also allows for asking follow-up questions or new questions during the interviews, providing new and more detailed information to unexpected interview directions.

Informant	Company	Role of the informants
1	Funding Agency 1	Responsible for innovation development in the process industry
2	Innovation Cluster 1	Researching eco-innovation clusters
3	Innovation Cluster 2	Business developer and consultant for sustainability
4	Company 1	Responsible for process development
5	Company 1	Responsible for external environment
6	Company 2	Leader in the company
7	Comapny 2	Responsible for external environment
8	Company 2	Engineer of production
9	Company 3	Leader of production
10	Company 3	Responsible for external environment

Table 2: Informants

Table 2 includes the informants of this study. There are two types of informants used in the data gathering process. The first type of informant has extensive knowledge about the industry and their eco-innovation projects, which gives them a detailed understanding of what has happened with the process industry and their eco-innovations during the pandemic. They also have more information about application and funding processes for eco-innovations, than informants working for the selected companies. These informants work in funding agencies

and innovation clusters, as shown in Table 2. The second type of informant is employees in the selected companies for the case study. The chosen employees have first-hand experience on eco-innovations and their outcomes during the Covid-19 crisis, and they also know how the companies have been impacted. The employees' different roles in this study include leaders who have valuable knowledge about how the companies are affected, and engineers who have detailed knowledge about eco-innovations. The criteria used for selecting informants are their position in the companies and that they are involved with eco-innovation projects and decision making in their company.

Analysis

For the data analysis, I apply a two step-wise coding approach. In the first step of the analysis, I used NVivo to code and categorize the data. The findings from the transcriptions were divided into the different companies to know which eco-innovation belonged to each company. This was important because how the companies are affected by the crisis can also impact how the eco-innovations are affected. The categories for each company included how they were affected by the Covid-19 crisis. It also included all of their eco-innovations, how they were affected, what stages in the innovation process they were in, and what drivers and barriers affected them. During the coding, I also included general drivers and barriers for each company.

The second step of coding was to put each eco-innovation into a table. The second step of the coding process was inspired by the literature on drivers and barriers in eco-innovation and eco-innovation during a crisis. Fifteen eco-innovations were discovered in total, and they had enough information to be included in the study. Such as eco-innovation type by environmental impact, effects from the Covid-19 crisis, innovation stage, drivers, and barriers. Each eco-innovation is put in a table with these categories allowed to identify patterns on how eco-innovations were affected one year into the Covid-19 crisis. Thus, the analysis section is divided into the outcomes of eco-innovations: paused and delayed, withdrawn, accelerated, and not affected yet. Each part of the analysis includes a table with all of the eco-innovations in each category.

The fifteen eco-innovations identified in the transcriptions are the most prominent eco-innovations the companies are doing. They are the eco-innovations mentioned the most by the

informants. Other eco-innovations were also mentioned, mostly small projects, but those included in the table are the eco-innovations that the informants had substantial information about. The eco-innovations that informants have talked about are ongoing projects, including projects that were started before and during the crisis. Because of this, most of the eco-innovations are in their start and middle stages.

Inspired by Horbach, Rammer, and Rennings (2012), the fifteen eco-innovations in the tables of the analysis sections are distinguished by their area of environmental impact. Horbach et al. (2012) used different environmental impact areas such as recycled waste and materials, replacement of hazardous substances or other harmful inputs, reduced water pollution, and reduced CO2 emissions. Some of the eco-innovations have more than one environmental impact area, such as E1C1 and E4C3. Furthermore, other eco-innovations found in this study have other environmental impact areas than those used by Horbach et al. (2012). In this study, the companies have eco-innovation projects with an environmental aim to be circular, for example, by reusing waste from other companies or reusing recycled waste materials in their production process. Therefore, a new environmental impact category that includes circularity is added, called «reused».

Other eco-innovation types identified are new methods for measuring emissions that can be harmful to the environment. These include known emissions such as CO2, unknown emissions such as fugitive emissions, or emissions where the environmental impact is unknown. Although an innovation aiming to find new measurement methods for emissions does not fit into the definitions of eco-innovations that exist today, it is still an innovation related to sustainability. Definitions of eco-innovations focus on reducing environmental impact, and methods for measuring emissions cannot reduce environmental impact. However, the nature of this innovation is environmental because it can reduce environmental impact in the future. Therefore, the development of measurement systems for emissions are included as an eco-innovation in this study. It is categorized as «measuring emissions».

Strategic Empirical Setting

This section addresses the strategic empirical setting of the study, which is the process industry in Northern Norway during the Covid-19 pandemic. The process industry is a relevant setting for researching eco-innovations and how they are affected by the Covid-19

crisis because of the innovation activity in the region. But most importantly, because of the process industry's focus on sustainability and eco-innovations. The following sections includes the case study of the three companies, then the market situation for the process industry and the contamination in the region during the first year of the Covid-19 crisis is explained.

Companies in the Process Industry

The first company, referred to as Company 1, has not been affected by the pandemic or the economic crisis. At the start of the pandemic, the price of their products declined because of low demand according to Informant 4. However, the price increased again when factories around the world closed down and supplies were low. The company has also managed to readjust and produce more of the products in demand during the crisis. One problem Informant 5 mentions is delays of projects because of travel restrictions. Some eco-innovations require external labour for doing tests, which have been difficult with travel restrictions. Nevertheless, Informant 4 mentions that some projects are more effective when working online than traveling for meetings. According to informant 4, it is the economy and operating within the environmental frameworks that is the main reasons for them doing eco-innovations.

> *"What still drives our decision-making processes, it is of course the economy that weighs heaviest as long as you operate within the given frameworks. So, it is really that simple and that difficult that the political structure must be in place, so there must be rules and frameworks, the noble motive is not strong enough for large international companies like the one that owns us". Informant 4.*

The second company, which is called Company 2, have been considerably affected by the economic crisis caused by the pandemic. The company was in a difficult financial situation before the crisis, and when the pandemic hit, half of their market disappeared. This resulted in reduced production and lay off of employees. And now, the company is in a strained financial situation. The financial situation and the market situation have been the greatest challenge for Company 2 during the pandemic.

> *«The economy and the market are what are most important to us. When we have a company established with a certain size, it is dimensioned in relation to the fixed costs, such as staffing. Everything is dimensioned in relation to an operation. And then suddenly half of the market is*

gone, and that means that the fixed cost, we can reduce, but we can never halve it. So financially, the pandemic has been dramatic». Informant 6.

Company 2 still aim to be a company with a low environmental impact, but they also operate within strict environmental regulations. Informants of this company claim that there are stricter environmental requirements for companies in the Norwegian process industry than in Europe. During the crisis, the company focused on saving and generating money instead of doing research and development, according to informant 6 and 7.

Company 3, the third company in this study, have not been affected by the pandemic or the economic crisis. Their market situation has been uncertain during the Covid-19 crisis, but it has been going well the first year of the crisis. According to informant 8, their most significant challenges have been the delivery of supplies from other countries because of longer delivery times across the world, which has resulted in a lack of available resources like equipment. Other challenges during the pandemic are related to external labour and high costs with quarantine for international workers. Overall, the company have not been affected by the pandemic or the economic crisis yet. Company 3 is also owned by a large international company, and they can apply for funding through their owners. This large international company is also concerned with getting a return on investments, according to informant 9.

"In such a large company, they set aside quite a few billions, […] it is distributed to all the factories in the whole world. And there is a lot of bureaucracy within the company, so we have to fight for the funds, we need to have good projects. Because they spend the money where they get the most return, whether it is finances or whether it is the environment". Informant 9.

Crisis and Regional Impacts

Informant 1, who collaborates with companies in the process industry, states that the market situation for the process industry is going well. However, some companies are affected by longer delivery times and a decrease in demand. A report on the economic situation in Northern Norway provides insight into the overall market situation for the process industry during 2020 (Indeks Nordland, 2020). According to the report, the process industry in Northern Norway has maintained its margins during 2020, but there was a moderate fall in export production volumes in 2020. For example, the Covid-19 crisis caused lower demand for metals and chemical products, and some companies did not operate at total capacity because of the decreased demand (Indeks Nordland, 2020). However, the industry and

construction sector, which are in the same category in this report, creates the most value in Northern Norway. Even with a two percent decrease during the Covid-19 crisis (Indeks Nordland, 2020).

The infection rates in the region have been low during the first year into the Covid-19 crisis. The companies are therefore not impacted by contaminations among their employees. Contamination amongst employees could, for example, halt the production process and cause problems for companies that operate around the clock. According to informant 6, contaminations amongst their employees could have enormous consequences for their production process because of the around the clock operation and relatively few employees. Stricter regional lockdowns can be introduced in Norway if contamination rates are high, and this can potentially impact eco-innovations where people are needed in the process. However, the region has not been affected by high contaminations, thus not impacting companies' production processes.

In response to the Covid-19 crisis, the Norwegian Government introduced measures to help businesses and secure jobs, including a green transition package worth 3.6 billion Norwegian kroner (Government, 2020). A funding agency called Innovation Norway has received more funds for innovation grants during the Covid-19 crisis, aimed at small and medium-sized companies. However, larger companies can apply for funding if their innovation projects are related to social or environmental challenges (Innovasjon Norge, 2021). Other funding agencies also support eco-innovations in Norway, and according to informant 1 who works for a funding agency, their funding have doubled the last year.

Analysis

In the previous sections, I highlighted how the three companies in the study had been affected by the crisis. While in this section, I will address how their eco-innovations have been affected. I found that the eco-innovations in the process industry had been affected by the Covid-19 crisis in different ways, such as delays, pauses and withdrawals. However, eco-innovations were also started during the crisis, and some eco-innovations was not effected within the first year of the Covid-19 crisis. Accordingly, the following sections are categorised after the different effects the crisis has had on eco-innovations: paused and delayed,

withdrawal, accelerated, and not affected yet one year into the Covid-19 crisis. The reasons for the effects are analysed in the different categories.

The findings from the interviews are illustrated in tables showing the fifteen eco-innovations in the start and middle stages and how they have been affected by the crisis. They are given the names from E1C1 to E15C3. The table is divided into eco-innovation types, the effect from the crisis, stages in the innovation process, drivers, and barriers. A table with the eco-innovations and the different ways they have been affected by the crisis are included in each category.

Paused and Delayed Eco-Innovations

This section presents the findings of eco-innovations that was paused and delayed during the first year of the Covid-19 crisis. The eco-innovations are presented in Table 3. The number of each eco-innovation contains which company it is related to. For example, E1C1 is an eco-innovation in Company 1, and E4C3 is an eco-innovation in Company 3.

No.	Eco-Innovation Type	Effect	Stage	Drivers	Barriers
E1C1	**Replacement of hazardous substances, and reduced water pollution.** Developing new solutions to replace the release of chemicals into the sea.	**On pause.** It is indirectly affected by the pandemic because the restructuring of the responsible department is taking more time than expected.	**Middle stage.**	**Concern for the environment, biodiversity in the sea.** Developed after a report on their emissions into water and how it affects biodiversity.	**Social distancing measures** makes the restructuring of the responsible department take more time, indirectly affecting the eco-innovation.
E2C1	**Measuring emissions.** Develop a new way for measuring and calculating carbon emissions.	**Delayed.** Because of difficulties for testing and analysing when staff is working from home.	**Start phase.**	**Reduce the amount of measured CO_2 emission, and cost savings.**	**Lack of access to human resources.** Caused by home office, making it difficult to do tests and analyses.
E3C2	**Measuring emissions.** Develop a new measurement system for different particle emissions.	**Delayed.** Because of travel restrictions. And it is therefore not possible to take measurements of the particles.	**Middle stage.**	**No available technology for measuring these types of particles.** Future ability to improve their emissions.	**Lack of access to human resources,** caused by travel restrictions
E4C3	**Alternative fuel, reduce CO_2 emissions.**	**Delayed for 6 months.** Requires foreign consultants, or foreign workers to do the project.	**Start phase.**	**CO_2 Regulations and cost savings** by saving money on expensive fuel.	**Lack of access to human resources,** caused by travel restrictions

Table 3: Paused and Delayed Eco-Innovations

Out of the fifteen eco-innovations, four has been delayed or paused because of the crisis. E1C1 has been paused, and the pandemic indirectly caused it. The pandemic made the restructuring of the responsible department for the eco-innovation project take more time than expected, which is why the eco-innovation project is paused. For eco-innovation E2C1, the delay is caused by social distancing measures. One social distancing measure the companies have taken during the crisis is that employees are working from home. This has resulted in a lack of access to human resources because employees cannot do tests and measurements on-site in the start and middle stages of the innovation process. Informant 5 mentions difficulties with testing and analysing in the start phase of eco-innovations because staff have been working from home. «When people are sitting at home, it is difficult to get samples taken and have them sent for analysis».

This shows that the lack of human resources available to do testing and analysing is a barrier for eco-innovations caused by the crisis and the social distancing measures. However, the barrier is reduced when employees can go back to work and perform the tests on-site, and the eco-innovations can proceed as planned. The last two eco-innovations that were delayed are E3C2 and E4C3, and they were delayed because of travel restrictions established during the pandemic. Travel restrictions make it difficult for remote workers to travel and do measurement campaigns for the company on site. This is the same barrier as for eco-innovation E2C1, a lack of access to human resources, but it is caused by travel restrictions and not social distancing measures. According to informant 9, some processes in eco-innovations take more time because of the travel restrictions. Informant 4 also mentions travel restrictions as a reason for the delay in measurement campaigns in Company 1.

> *"Some processes are much slower. Measurement campaigns done by remote workers might not have been possible. We have one example of (eco-innovation E3), where we will have someone […] who will make a measurement, and it has been delayed and then delayed again because they have simply not had the opportunity to travel here". Informant 4.*

Informant 5 mentions travel restrictions and home office as reasons for delays in eco-innovation projects in Company 1, without mentioning any specific eco-innovation projects. It looks like travel restrictions have a more significant impact on eco-innovations than employees working from home since E4C3 is delayed for six months. This makes sense because international travel restrictions last longer than regional social distancing measures.

The findings illustrated in Table 3 indicate that eco-innovations have been affected by these new barriers to an extent without having a lasting impact on them because the eco-innovations can be continued after the delays caused by the new barriers. Another barrier for eco-innovations during the crisis has been longer delivery times for equipment and products required in the innovation process, which has resulted in a lack of resources. Informant 9 states that this is a reason for delays in some eco-innovation projects, where some eco-innovations are delayed because of longer delivery times. Without mentioning the specific eco-innovations.

Summing up, new barriers that cause delays for eco-innovation in their start and middle stages are barriers that prevent testing, measurement campaigns, and the delivery of parts and equipment needed for the innovation process. Furthermore, they are caused by travel restrictions, social distancing measures, and longer delivery times. The barriers emerging from the crisis are a lack of access to human resources and access to equipment.

Withdrawal from Eco-innovations

In addition to barriers resulting in a lack of access to resources, other barriers impacted eco-innovations during the Covid-19 crisis. This section presents the one eco-innovation that was withdrawn during the first year of the crisis. Company 2 withdrew from this eco-innovation as presented in Table 4, and the reason for the withdrawal is analysed further.

No.	Eco-Innovation Type	Effect	Stage	Drivers	Barriers
E5C2	Recycled emissions, and reused in the process. Using gas generated in the production process as fuel.	Withdrew from the project. Because of a lack of finances. There was also not enough gas to use because of the reduced production caused by the crisis.	Start phase.	Shrinking market for disposal of the gas. And the ability to recycle the gas and save money.	Finances and lack of raw material for testing because of the crisis.

Table 4: Withdrawal from Eco-Innovations

Company 2 had to withdraw from a collaborative eco-innovation during the pandemic. It is the only company in this study had to withdraw from an eco-innovation during the first year of the Covid-19 crisis. The main reason for their withdrawal is the financial limitations caused by the crisis and their reduced production, which caused a lack of the test materials. One

informant involved in eco-innovation E5C2, illustrated in Table 4, mentions the two reasons for their withdrawal.

> *«When we stopped, we did not have that gas available because that gas is a product of our process. That is one thing. And the second was that there were such large costs associated with it that we did not have the opportunity to provide such a large cash contribution in the phase we were in» Informant 6.*

This statement shows that a lack of resources like test materials is a barrier in the start phase of the innovation process. Without enough test materials to develop an eco-innovation in its start phase, it is impossible to go ahead with developing the eco-innovation. These findings also show that financial limitations are a barrier to eco-innovations. Some eco-innovations are expensive to participate in, even when there is financial support available from government agencies. Of course, the costs for doing eco-innovations can differ, and the payback time for eco-innovations are also important aspect companies consider. This eco-innovation was expensive to participate in, according to informant 6, however other projects can be less expensive to participate in. Informant 6 states that some collaborative eco-innovation projects only require their presence. However, it is difficult for them to do eco-innovations when cash contributions are required because of their difficult financial situation.

The crisis resulted in a new barrier for eco-innovation, a lack of resources in the form of test materials. While another barrier caused financial limitations, making it difficult to participate in expensive eco-innovations. Although there were barriers that made Company 2 withdraw from an eco-innovation, they were able to start two eco-innovations during the crisis.

Accelerated Eco-Innovations

In addition to eco-innovations being delayed or cancelled, new eco-innovations were started during the crisis, as shown in Table 5. Many drivers make companies do eco-innovations, and informants from all of the companies in this study mention regulations, cost savings, competitiveness, and responsibility for the environment as reasons for doing eco-innovations. These drivers are not affected by the crisis. However, they are still motivational factors for companies to do eco-innovations in times of crisis, and the benefits are also the same. This could be some of the reasons why they have started eco-innovations during the crisis. Other

reasons are that Company 1 and 3 have not been affected financially by the crisis. There are also facilitating drivers in this region that could decrease barriers to doing eco-innovations.

No.	Eco-Innovation Type	Effect	Stage	Drivers	Barriers
E6C1	**Recycled waste.** Recycling of waste generated by the process.	**Not affected.** The project was stared during the pandemic.	**Start phase.** The project is currently being tested in a lab.	**Shrinking market** for selling the waste material. **Strict regulations** for storing waste. **Costs savings** related to waste disposal.	**No barriers mentioned.**
E7C1	**Recycled materials.** Recycling of materials used in the process.	**Not affected.** The project was stared during the pandemic.	**Middle stage.** The next stage is an industrial pilot.	**Closure of disposal facility** for waste. **Strict regulations** for storing waste. **Costs** related to waste disposal.	**No barriers mentioned.**
E8C2	**Measuring emissions.** Develop a new system for measuring dust emissions.	**Not affected.** The project was stared during the pandemic.	**Start phase.**	**Regulations**, collaborative project, and the project did not require financial input. Future ability to improve their emissions.	**No barriers mentioned.**
E9C2	**Recycle and reuse materials.** Recycle waste generated the process, for then reusing it in the process.	**Not affected.** The project was stared during the pandemic.	**Middle stages.**	**Cost savings and fast payback.** Reduce deposits, and get free inputs for the production process.	**No barriers mentioned.**
E10C3	**Replace CO2 input in the process, and recycle waste.** Use another company's waste as fuel to replace coal, and build a new facility for burning this type of fuel.	**Accelerated.** Because the factory that supplied the waste had a spillover of this waste. Unknown if it was because of the crisis.	**Start phase.** The facility will be built this year.	**Regulations.**	**No barriers mentioned.**

Table 5: Accelerated Eco-Innovations During Crisis

Other reasons why companies have started eco-innovations during the crisis could be facilitating drivers such as collaborative networks for innovations and government funding. Informant 7 stated that it was easier to get funding when collaborating with other companies and research institutions. The two eco-innovations Company 2 has participated in during the Covid-19 crisis are collaborative eco-innovations that has received funding. The first eco-innovation, E8C2, did not require a large financial contribution. The second eco-innovation, E9C2, had a potential for fast payback in such as cost savings from recycling the materials and reusing them in the production process. For Company 2, the financial aspect of doing eco-innovations have been both a driver and a barrier. Because cost savings makes them do

eco-innovation, and high costs and financial limitations are reasons for not doing eco-innovation.

> *"Getting a result, a financial result in the current situation is critical for us. It's easier for me to put the emphasis on making money on something rather than having a project […] that might give us something in 5 or 10 years. […] So, economics is, of course, a very important topic in this type of discussion. The more difficult your financial situation is, the more important that aspect in the discussion becomes". Informant 6.*

Other eco-innovations in Table 5 were started because of regulations, and eco-innovation E6C1 and E7C1 are projects Company 1 needs to do because of the strict regulations for waste storage. Another reason is that their current opportunities for waste disposal will disappear in a few years. According to informant 4, finding new solutions for waste disposal or recycling is something they need to do. They also mention that the regulations for storing waste do not change when there is a crisis. Another reason for these eco-innovations starting during the crisis and possibly being accelerated is the increase in available funding for eco-innovation. Informant 4 stated that it was possibly easier to access fund during the Covid-19 crisis, which could have accelerated their eco-innovations.

> *"The pandemic has made it easier to access funds, possibly, but we would have had to work on this regardless of whether it was done now or next year. […] In other words, we are only allowed to store waste for one year on our own plot, while by-products we are allowed to store for three years. And that in itself is a motivation that you just have to fix. By the end of the year, you must have a solution". Informant 4.*

Although some drivers have not been affected during the crisis like regulations, one driver has increased. The government has granted an extraordinary innovation fund to increase activity (Innovasjon Norge, 2021). Moreover, informants involved with funding processes and applications states that there has been a considerable increase in funding for innovation and eco-innovation during the crisis. Funding is an important driver for eco-innovations, and financial resources have been found to have effects in the development stages of eco-innovation (Hojnik and Ruzzier, 2016). The findings from the study show that most of the eco-innovations are not affected by the Covid-19 crisis, with five eco-innovations started and five eco-innovations not affected yet one year into the crisis. Since the available resources for funding have increased substantially during the crisis, it could have been a facilitating driver

for eco-innovations during the crisis, and it could also have accelerated eco-innovations. One informant that works for a funding agency explains how much the funding has increased during the crisis.

> *"I think that there has been momentum on more eco-innovation projects among those who have the opportunities to do it, meaning resources to do it, because they have seen the opportunity to get funding in a development phase. In total, in Norway, we have distributed 7 billion, while this year we have distributed 14.7 billion, and everything has been distributed to the industry. But not just the process industry". Informant 1.*

Even though the funding has increased substantially during the crisis, causing a funding bonanza, informants from the companies are not sure if they got funding for their eco-innovations because of increased available funds. Informant 4, who are involved in application processes for funding, mentions that there is more financial support available, but it is difficult for them to know if that is the reason their eco-innovations got funding. They do not know if the eco-innovations they got funding for was at «the bottom of the list» for applications or if they would get funding regardless of the substantial increase in funds.

> *"Research institutions (funding agencies) have received a lot of extra funding. So, it may be that some of the projects we have started this year, because we have started a good number of projects, would not have become a reality if they did not have extra funds. But what we do not know is whether we were on the bottom of the list or if we had received funding anyway". Informant 4.*

Informants from the other companies are not involved in the application processes for eco-innovations because they are involved in collaborative eco-innovations, and other companies or agencies for innovation are responsible for the application process. Thus, they cannot know if it is easier to get funds in any way. Nevertheless, the evidence shows that one funding agency has doubled their funding during the crisis, with 7 billion kroner. It could have affected eco-innovations in this study and decreased barriers such as financial limitations. This could also be why Company 2 has been able to participate in two new eco-innovations during the crisis. Informant 4 did not know if their projects have received funding because of the increased funds. Still, 7 billion more in funding has been distributed to both regular innovations and eco-innovations the last year, and that is only from one funding agency. Other agencies not included as informants in this study could have received more funding from the

government, which means that more eco-innovations could have been realised from other agencies because of the funding bonanza.

E10C3 was accelerated because of an increased oil spill in a supplier's factory. Company 3 chose to accelerate this eco-innovation because they were planning to do it either way, according to informant 10. Instead of the oil being sent out of the country to be disposed of, it will be recycled in their production process, which is better for the environment.

The analysis confirms that there has been an increase in funds for eco-innovation projects, a funding bonanza. Moreover, this increase in the availability of funds for eco-innovations could have kept the eco-innovations going as normal during the crisis or could have accelerated eco-innovations. The increased funding could have been a facilitating driver during the crisis because the funding agencies have experienced an increased interest in eco-innovations the last year. Even though new barriers emerged during the crisis, the increased funding could have reduced the effects of these new barriers.

Not Yet Affected Eco-Innovations

Five eco-innovations are not yet affected by the Covid-19 crisis. «Yet» is because they can still be affected after the data was gathered since the Covid-19 crisis is not over. This section will analyse why the eco-innovations in Table 6 are not yet affected. As found in the previous section, there has been a funding bonanza in response to the Covid-19 crisis. This could have decreased barriers for eco-innovations during the crisis, making the eco-innovations unaffected. Other reasons can be that the companies have used resources to participate in collaborative eco-innovations, and it would be inconvenient to withdraw from eco-innovations because of the already committed resources.

No.	Eco-Innovation Type	Effect	Stage	Drivers	Barriers
E11C2	**Reduced CO2 emissions.** Replace fossil fuels with new fuels to reduce emissions.	**Not affected yet.**	**Start phase.** The project is currently being tested.	**Regulations,** and it is a low cost project that do not require many resources.	**No barriers mentioned.**

E12C2	**Reduced CO2 emissions.** Develop ways for capturing CO2.	**Not affected yet.**	**Middle stage.** The first stage is done and the second stage is being planned.	**Regulations** (CO2 quota) and cost savings. Anticipated stricter regulations.	**No barriers mentioned.**
E13C3	**Reduced CO2 emissions.** Find other inputs to substitute harmful additives in the product.	**Not affected yet.**	**Start phase.**	**Reduce CO2 emissions.**	**No barriers mentioned.**
E14C3	**Alternative fuel, reduce CO2 emissions, and recycle waste.** Improve a facility to burn larger amounts of imported waste, and reduce problems.	**Not affected yet.**	**Start phase/ planning phase.** The facility will be built this year.	**Regulations,** reduction of CO2 and cost savings. Also being able to sell their product in the future by reducing their CO2 emissions.	**No barriers mentioned.**
E15C3	**Alternative fuel, reduce CO2 emissions, and recycle waste.** Replace a facility for using imported waste as fuel.	**Not affected yet.**	**Start phase/ planning phase.** The facility will be built this year.	**Regulations,** reduction of CO2 and cost savings. Also being able to sell their product in the future by reducing their CO2 emissions.	**No barriers mentioned.**

Table 6: Not yet affected eco-innovations

As seen in table 6, many drivers are the same as before the crisis, such as regulations, cost savings, and demand for products with low environmental impact. Because of regulations, the environmental goals of the companies did not change because of the crisis. According to Informant 4, it is why they continued their eco-innovations during the crisis. All of the companies have set goals to reduce their emissions by 2030. In order to reach their environmental goals and reduce their emissions, the companies have to invest resources in eco-innovations, even when it is a crisis. As shown in Table 6, the drivers of the not affected eco-innovations are regulations and reduction in CO2 emissions, which are drivers confirmed in previous research (Horbach et al., 2012). These drivers do not change during a crisis.

As shown in Table 6, Company 2 are doing eco-innovations that saves costs. E11C2 and E12C2 are both affected by regulations as a driver for eco-innovation. The first eco-innovation is a low-cost project, and the second eco-innovation can decrease costs because of the reduced CO2 emissions. For a company with financial limitations, drivers like cost savings can have an impact during a crisis. Company 3 is also doing eco-innovations driven by regulations and costs savings during the crisis, as shown in Table 5. According to Informant 10, the eco-innovations was already planned before the crisis, and that is why the eco-innovations has proceeded. Another finding is that the not affected eco-innovations did not have any reported barriers.

Another reason for eco-innovations not being affected can be the funding bonanza. The increased funding could have decreased barriers for all companies, making it easier to do eco-innovations during the Covid-19 crisis. 7 billion more in funding have been distributed to innovations and eco-innovations during the first year of the Covid-19 crisis, according to informant 1. The informants of Company 2 are not involved in funding processes for eco-innovations and therefore do not know if it was easier to get funding during the crisis. However, informant 10 mentions that their last application for funding went faster than before, which could be because of the funding bonanza.

To sum up, there are four reasons for eco-innovations not being affected by the Covid-19 crisis: First, drivers are still present during a crisis, such as regulations and cost savings, and the companies' goals do not change. Second, there has been a funding bonanza that could have decreased barriers for eco-innovations during the Covid-19 crisis. Thirdly, the low infection rates in the region. For instance, companies in regions with higher infection rates could experience more barriers during the Covid-19 crisis, such as a lack of access to resources or financial barriers. The fourth reason is that the not affected eco-innovations did not have any reported barriers.

Discussion

This case study explores how eco-innovations have been affected the first year into the Covid-19 crisis. As found in the analysis section, new drivers and barriers in the start and middle stages of eco-innovation emerged during the Covid-19 crisis. Some drivers are the same as before the crisis, such as regulations and cost savings, as previous studies have found (Horbach et al., 2012). A new driver during the Covid-19 crisis is the significant increase in available funding for innovation and eco-innovation for the industry in Norway. The increased driver is illustrated in Figure 1.

Eco-innovation is found to be affected in four different ways the first year into the Covid-19 crisis: paused and delayed, withdrawn, accelerated, and not affected yet. Four eco-innovations is found to be paused and delayed because of a lack of access to human resources and a lack of access to resources such as equipment. One eco-innovation was withdrawn from because of financial barriers and a lack of test materials, as shown in Figure 1. Five eco-innovations are potentially accelerated during the first year of the Covid-19 crisis, as presented in Figure 1. It

can be because of the increased funding or that the companies were not significantly affected by the crisis. Another five eco-innovations are not affected yet by the Covid-19 crisis. This can be because of increased funding, that drivers are still there during the crisis, or that the companies are not negatively affected by the crisis.

There are new barriers as well, shown in Figure 1, such as a lack of access to human resources and resources like equipment and materials. These are all important resources needed in the start phases of the innovation process. All of the companies reported eco-innovations being affected by these new barriers. Another barrier during the crisis is financial limitations. However, only Company 2 reported that they were financially affected by the crisis and had to withdraw from an eco-innovation. Similarly, to García-Pozo et al. (2016), who found a reduction in investments in eco-innovations during the financial crisis in 2008 in order to reduce costs.

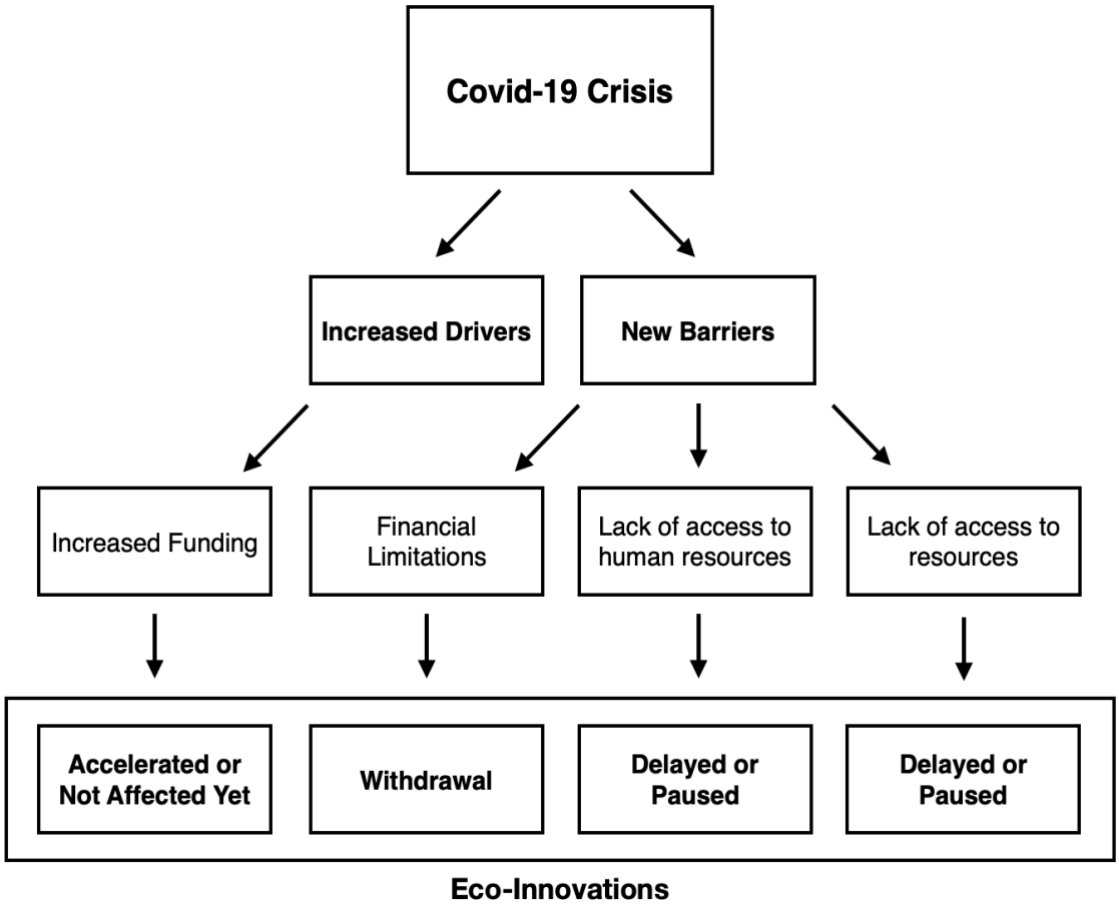

Figure 1: New drivers and barriers during the Covid-19 crisis and their impact on eco-innovations

Barriers

One eco-innovation was *paused* during the middle stages of the process because of a department's restructuring taking longer time than usual because of the pandemic. Three other eco-innovations in the start and middle stages were *delayed* because of a lack of access to resources. The availability of resources such as people is an important driver for eco-innovations (De Jesus Pacheco et al., 2017). Without access to employees, it is challenging to do tests and analyses in the start and middle stages of the eco-innovation process. The other barrier causing delays for Company 3 is a lack of access to equipment because of longer delivery times. These findings show how vital access to resources is in the start and middle stages of eco-innovations since tests are performed in both the pre-development stage and the development stage, according to Lager (2016).

Compared to Archibugi et al. (2013), where fewer resources were devoted to innovation during the crisis in 2008, the resources reported in this study are already devoted to innovation, but the companies do not have access to them because of travel restrictions, working from home, and longer delivery times. The difference is that companies in this study are still able to continue their eco-innovations, even if they are delayed or paused because of the lack of access to resources. The measures are lifted when local contamination of the coronavirus is low, making it possible to continue delayed and paused eco-innovations. Still, the findings from Company 2 responds to the findings from Archibugi et al. (2013), where they devoted less financial resources to eco-innovation during the Covid-19 crisis.

As for the eco-innovation Company 2 *withdrew* from, the barriers were financial limitations and a lack of resources in the form of test materials. Financial limitations were found to impact eco-innovations in previous crises. García-Pozo et al. (2016) found a reduction in investment in eco-innovations during the financial crisis in 2008 in order to reduce costs and increase competitiveness. Company 2 is focusing on cost savings because of their difficult financial situation, and the main reason for their withdrawal was that the costs for the eco-innovation were too high. This eco-innovation was in the start phase, and it can be easier to withdraw from an eco-innovation before any financial commitments are made. This finding is also similar to other studies on regular innovation. Mohnen reported that financial barriers significantly affects companies decision to stop innovative projects (Mohnen, 2008, referenced in Pinguet et al., 2015). The other reason for Company 2 to withdraw was because

of a lack of test materials for the eco-innovation project, which also makes it challenging to perform enough tests.

Drivers

Despite their difficult financial situation, Company 2 started two eco-innovations during the Covid-19 crisis. Both eco-innovations were collaborative, which could have decreased barriers for them to participate in these eco-innovations. However, their main reasons for doing these eco-innovations, other than regulatory drivers, was that the first eco-innovation did not require financial input. The second eco-innovation reduces costs and give them a fast payback, even when it required financial input from the company. Other studies have found cost savings to trigger eco-innovations (Frondel et al., 2007; Horbach, 2008; Rave et al., 2011, referenced in Horbach et al., 2012). For companies in financially difficult situations, cost savings and fast payback are important decision-makers for doing eco-innovations.

Compared to the eco-innovation Company 2 *withdrew* from because of the high costs related to the project, it is interesting that they were able to start two new eco-innovations during the crisis. The reports from Company 2 on their eco-innovations correlate with other studies where eco-innovations have been driven by cost savings (Horbach et al., 2012). At the same time, the reports from Company 2 also correlates with barriers for eco-innovation found in previous studies, where financial restrictions are found to be a barrier for eco-innovations (Cuerva et al., 2014). These findings show that some eco-innovations requires too many financial resources during a crisis. In contrast, other eco-innovations can result in cost savings during a crisis, all in the same company. However, Company 2 starting two eco-innovations during the Covid-19 crisis to save costs are contrary to the findings by García-Pozo et al. (2016), where companies reduced their investments in eco-innovations to reduce costs.

Five eco-innovations were *accelerated* during the Covid-19 crisis in all of the companies. This is contrary to what Archibugi et al. (2013) found: a decline in innovation investments during a crisis. However, they also found that a small number of companies increased their investments in innovation during the crisis, such as companies that were great innovators before the crisis (Archibugi et al., 2013). This can be one reason why eco-innovations were started during the Covid-19 crisis. Great innovators were defined as companies innovating persistently before the crisis (Archibugi et al., 2013). The companies in this study were all

involved in many eco-innovations before the crisis, and they could fit into the category of companies persistently doing innovations. Which are the companies found to increase their investments during a crisis.

There are other reasons why eco-innovations were *accelerated* during the Covid-19 crisis. One reason is that the drivers for eco-innovations from before the crisis are still present during the crisis. Informants in this study reported regulations, demand, increased competitiveness, cost savings as reasons for doing eco-innovations, and these drivers are already confirmed in other studies (Horbach et al., 2012, Hojnik et al., 2016, Kesidou et al., 2012). A second reason is that two of the companies in the study are not financially impacted by the Covid-19 crisis, making it easier for them to do more time-consuming eco-innovations with longer payback times.

One driver increased during the Covid-19 crisis, an increase in available funding, which have caused a funding bonanza. This can be one of the reasons companies have *started* eco-innovations during the crisis. This driver emerged as a response to the Covid-19 crisis, where the government granted an extraordinary innovation fund in order to increase innovation activity (Innovasjon Norge, 2021). The available funding has doubled, meaning that funding for eco-innovations and regular innovations in Norway have doubled during the Covid-19 crisis. This is an essential response to the Covid-19 crisis since government subsidies, or grants are reported as drivers for eco-innovations (Hojnik et al., 2016). An increase in available funding for eco-innovations can also reduce barriers such as financial limitations.

According to informant 2, who are involved in application processes for eco-innovations, it is difficult to know if the increased fund impacts their eco-innovations or not. Nevertheless, informant 3, who works for a funding agency, stated that the distributed funds for innovation and eco-innovation had doubled the last year, so there has been an increase in eco-innovations. Other studies about innovation and eco-innovation during the crisis did not report an increase in available funding, or if that was a reason companies could do eco-innovations in times of crisis (García-Pozo et al., 2016, Archibugi et al., 2013).

Five eco-innovations are *not affected* by the Covid-19 crisis yet. As mentioned before, one possible reason is that Company 1 and 3 are not financially affected by the Covid-19 crisis. Financial barriers are found to impact decisions to stop or pause innovations (Mohnen, 2008).

Nevertheless, Company 2 also has eco-innovations that are not affected by the crisis, even when facing financial troubles. The funding bonanza could have decreased financial barriers for all companies in this study, thus making eco-innovations unaffected. The region has not been greatly affected by the Covid-19 crisis either, and this could cause fewer barriers and challenges for eco-innovations. Although the companies have reported barriers such as lack of access to human resources due to home office, this barrier only occurs in times of high contamination where stricter lockdown measures are implemented in the region. Since the region is not affected by the Covid-19 crisis, the barrier of a lack of access to human resources has occurred only a few times during test stages in the eco-innovation process.

The five *accelerated* and the five *not affected* eco-innovations reported in this study contradict previous research in this field, where investments in eco-innovation and innovation are reduced during a crisis (García-Pozo et al., 2016, Archibugi et al., 2013). Some of the eco-innovations in this study have been affected by new or existing barriers such as financial limitations. However, most of the eco-innovations in this study are unaffected by the Covid-19 crisis. Out of fifteen eco-innovations, only one eco-innovation is affected by financial barriers. The other four eco-innovations that were *delayed* or *paused* are affected by new barriers caused by measures to handle contamination of the coronavirus and not by financial barriers.

Another reason for eco-innovations not being affected and accelerated during the Covid-19 crisis could be the context of the study. The process industry in Northern Norway is not deeply affected by the Covid-19 crisis nor the economic crisis. Still, the process industry is affected to some degree, where Company 1 had to change their production in response to a changing market. Plus, Company 2 was affected financially by the crisis to the point where employees were laid off. Compared to the study by García-Pozo et al. (2016), where the context is eco-innovations during a deep economic crisis in the Spanish hotel industry, the process industry in Northern Norway is not deeply impacted by economic crises. This could also be why only five out of fifteen eco-innovations were negatively affected by the Covid-19 crisis in this study.

Conclusion

The research revealed that companies in the process industry are still doing eco-innovations one year into the Covid-19 crisis. Only five out of the fifteen eco-innovations found in this study were affected. Four eco-innovations were paused and delayed because of new barriers causing a lack of access to human resources and resources like equipment and materials. Only one eco-innovation was negatively affected by financial limitations, making a company withdraw from the eco-innovation. Ten other eco-innovations were not affected one year into the Covid-19 crisis, and five of them were potentially accelerated. There are many reasons why eco-innovations were not affected by the Covid-19 crisis, such as the funding bonanza, where the funding increased by 7 billion the first year of the crisis. Other reasons are that the drivers such as regulations and cost savings still exist during a crisis, and the companies still have to reach their environmental goals. Drivers such as cost savings and inexpensive eco-innovations also made a company facing financial limitations start two eco-innovations during the Covid-19 crisis.

This study contributes to eco-innovation research by offering a detailed analysis of how eco-innovations are affected during a crisis, presenting four outcomes of eco-innovations during a crisis. New drivers and barriers were also identified, and they highlight the importance of regulations and funding for eco-innovations during times of crises. The funding bonanza could also be why ten out of fifteen eco-innovations are not affected by the Covid-19 crisis. Another reason for eco-innovations not being affected is, of course, the regional context, where infection rates have been low the first year of the Covid-19 crisis. Still, the one company affected by the crisis reported interesting details about drivers and barriers for eco-innovations during crises.

This study could have implications for funding since the significant increase in funding for eco-innovations can be why many are not affected by the crisis. Thus, this increase in funding seems to be efficient for eco-innovations in companies impacted by the crisis and companies that are not impacted by the crisis. However, the increased funding did seem to work on the eco-innovation that was withdrawn. Neither does it decrease barriers caused by travel restrictions and social distancing measures.

Since the process industry is not the most affected industry during the Covid-19 crisis, other industries more affected by the crisis could provide a more relevant context, such as the hospitality industry. The low infection rates of the region is a limitation of this study, and barriers caused by social distancing measures could, for example, last longer in regions with stricter lockdown measures. To increase our understanding of eco-innovations, I suggest further research on eco-innovations in regions that are more impacted by the Covid-19 crisis.

Literature

Archibugi, D., Filippetti, A., & Frenz, M. (2013). Economic crisis and innovation: is destruction prevailing over accumulation? *Research Policy, 42(2),* 303-314. 10.1016/j.respol.2012.07.002

Betti, F., & Heinzmann. (2020). From perfume to hand sanitizer, TVs to face masks: how companies are changing track to fight COVID-19. World Economic Forum. Retrieved from: https://www.weforum.org/agenda/2020/03/from-perfume-to-hand-sanitiser-tvs-to-face-masks-how-companies-are-changing-track-to-fight-covid-19/

Brem, A., Viardot, E., & Nylund, P. A. (2021). Implications of the coronavirus (COVID-19) outbreak for innovation: Which technologies will improve our lives?. *Technological forecasting and social change, 163,* 120451. https://doi.org/10.1016/j.techfore.2020.120451

Carrillo-Hermosilla, J., Del Rio González, P., & Könnölä, T. (2009). *Eco-Innovation. When Sustainability and Competitiveness Shake Hands.* New York: Palgrave Macmillan.

Coppola, M., Blohmke, J. & Krick, T. (2019, 12. December). Feeling the heat? Companies are under pressure on climate change and need to do more. Deloitte Insights. Retrieved from: https://www2.deloitte.com/us/en/insights/topics/strategy/impact-and-opportunities-of-climate-change-on-business.html

Cuerva, M. C., Triguero-Cano, A., & Córcoles, D. (2014). Drivers of green and non-green innovation: empirical evidence in Low-Tech SMEs. *Journal of Cleaner Production 68,* 104-113. https://doi.org/10.1016/j.jclepro.2013.10.049

De Jesus Pacheco, D.A., Caten, C.S., Jung, C.F., Ribeiro, J.L., Navas, H.V., & Cruz-Machado, V.A. (2017). Eco-innovation determinants in manufacturing SMEs: Systematic review and research directions. *Journal of Cleaner Production, 142(4),* 2277-2287. https://doi.org/10.1016/j.jclepro.2016.11.049

Del Río, P., Peñasco, C., & Romero-Jordán, D. (2016). What drives eco-innovators? A critical review of the empirical literature based on econometric methods. *Journal of Cleaner Production, 112(4),* 2158-2170. https://doi.org/10.1016/j.jclepro.2015.09.009

García-Pozo, A., Sánchez-Ollero, J.L., & Ons-Cappa, M. (2016). ECO-innovation and economic crisis: a comparative analysis of environmental good practices and labour productivity in the Spanish hotel industry. *Journal of cleaner production, 138,* 131-138. https://doi- org.ezproxy.nord.no/10.1016/j.jclepro.2016.01.011

Guderian, C. C., Bican, P. M., Riar, F. J., & Chattopadhyay, S. (2021). Innovation management in crisis: patent analytics as a response to the COVID-19 pandemic. *R&D Management, 51(2),* 223-239. https://doi.org/10.1111/radm.12447

Government. (2020). Economic measures in Norway in response to Covid-19. Retrieved from: https://www.regjeringen.no/en/id4/

Hojnik, J., & Ruzzier, M. (2016). What drives eco-innovation? A review of an emerging literature. *Environmental Innovation and Societal transitions, 19,* 31-41. http://dx.doi.org/10.1016/j.eist.2015.09.006

Horbach, J., Rammer, C., & Rennings, K. (2012). Determinants of eco-innovations by type of environmental impact - The role of regulatory push/pull, technology push and market pull. *Ecological Economics, 78,* 112-122. 10.1016/j.ecolecon.2012.04.005

Indeks Nordland. (2018). Indeks Nordland. Retrieved from: https://indeksnordland.no/wp-content/uploads/2019/01/2018.pdf

Indeks Nordland. (2019). Indeks Nordland. Retrieved from: https://indeksnordland.no/wp-content/uploads/2020/01/Indeks-Nordland-2019.pdf

Indeks Nordland. (2020). Indeks Nordland. Retrieved from: https://indeksnordland.no/wp-content/uploads/2021/03/IndeksNordland2021-1.pdf

Innovasjon Norge. (2021). Våre krisetiltak for norske bedrifter. Retrieved from: https://www.innovasjonnorge.no/no/tjenester/finansiering2/krisetiltak/

Innovasjon Norway. (2021). Ekstraordinært Innovasjonstilskudd 2021. Retrieved from: https://www.innovasjonnorge.no/no/tjenester/innovasjon-og-utvikling/finansiering-for-innovasjon-og-utvikling/ekstraordinart-innovasjonstilskudd-2021/

James, P. (1997). The sustainability cycle: a new tool for product development and design. *The Journal of Sustainable Product Design, 2,* 52-57. Retrieved from: https://cfsd.org.uk/journal/archive/index.html

Kahn, K.B. (2018). Understanding innovation. *Business Horizons, 61(3),* 453-460. https://doi.org/10.1016/j.bushor.2018.01.011

Kesidou, E. & Demirel, P. (2012). On the drivers of eco-innovations: Empirical evidence from the UK. *Research Policy, 41,* 862–870. 10.1016/j.respol.2012.01.005

Kiefer, C.P., Del Río González, P., & Carrillo-Hermosilla, J. (2018). Drivers and barriers of eco-innovation types for sustainable transitions: A quantitative perspective. *Business Strategy and the Environment, 28,* 155–172. https://doi.org/10.1002/bse.2246

Lager, T. (2016). Managing Innovation & Technology in the Process Industries: Current Practices and Future Perspectives. *Procedia Engineering, 138,* 459-471. 10.1016/j.proeng.2016.02.105

Lee, S. M., & Trimi, S. (2021). Convergence innovation in the digital age and in the COVID-19 pandemic crisis. *Journal of Business Research, 123,* 14-22. https://doi.org/10.1016/j.jbusres.2020.09.041

Norgate, T.E., Jahanshahi, S., & Rankin, W.J. (2007). Assessing the environmental impact of metal production processes. *Journal of Cleaner Production, 15(8-9),* 838-848. https://doi.org/10.1016/j.jclepro.2006.06.018

Pinguet, A., Bocquet, R., & Mothe, C. (2015). Barriers to Environmental Innovation in SMEs: Empirical Evidence from French Firms. *Management, 18(2),* 132-155. https://doi.org/10.3917/mana.182.0132

Ramus, C.A. (2002). Encouraging innovative environmental actions: what companies and managers must do. *Journal of World Business, 37(2)*, 151-164. https://doi.org/10.1016/S1090-9516(02)00074-3

Van de Ven, A.H. (2016). The innovation journey: you can't control it, but you can learn to maneuver it. *Innovation: Organization & Management, 19(1),* 39-42. http://dx.doi.org/10.1080/14479338.2016.1256780

WHO. (2020). World Health Organization. Retrieved from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020f

World Bank. (2020). *Global Economic Prospects, June 2020.* Washington, DC: World Bank. 10.1596/978-1-4648-1553-9

Yazan, B. (2015). Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake. *The Qualitative Report, 20(2),* 134-152. Retrieved from https://nsuworks.nova.edu/tqr/vol20/iss2/12

Appendix 1

Interview Guide 1

Topic	Questions
Introduction	- Introduce the project to the participant, and explain what the goal of the data collection is. - Inform about consent to participate in the interview. - Inform about anonymity. - Inform about other ethical guidelines, such as the right to withdraw and leave the interview at any time.
The Company	- Tell us briefly about the company - What is your position in the company, and what is your responsibility? - What is the company's vision and approach to the environment and the environmental challenges? - What is the company's motivation for tackling environmental challenges? - What is your connection to eco-innovation?
Crisis and Impact	- How has the pandemic affected the company? - How has the pandemic affected the industry - Have there been any changes due to the crisis? - What measures have been taken to deal with the changes or challenges caused by the pandemic? - Have there been any new opportunities for the company during the pandemic?

Eco-Innovation	- What is the company's motivation for doing eco-innovation?
	- What is the company's eco-innovations?
	- What is your plan to develop this innovation further?
	- Has this plan been changed? And if so, why?
	- How far in the innovation / development process are the projects?
	  - Has this influenced the choice to continue / pause / stop the project?
	  - What has possibly influenced the choice to change the innovation plan / process?
	- What is the reason why these eco-innovations are still continued during the crisis? (If the informants do not mention challenges.)
	- Is there anything that has helped to keep the eco-innovations going?
	- Have new eco-innovations started during the pandemic?
	- Has anything made it easier to start new eco-innovations?

End	- Ask if the informant has more to add. - Ask if they know other relevant informants. - Thank them for participating.

Interview Guide 2

Topic	Questions	
Introduction	- Introduce the project to the participant, and explain what the goal of the data collection is. - Inform about consent to participate in the interview. - Inform about anonymity. - Inform about other ethical guidelines, such as the right to withdraw and leave the interview at any time.	
Innovation Cluster / Funding Agency	- What is your position in the company and what responsibilities do you have? - Say something about the Funding Agency / Cluster. - What is the goal of the Funding Agency / Cluster - What is the «company's» motivation for tackling environmental challenges? - How do the companies collaborate in the cluster program? - How do the funding agency collaborate with the companies?	
Crisis and Impact	- How do you experience the crisis? For instance, impact on collaboration, or impact on the companies you collaborate with. - Has there been challenges because of the crisis? - Has there been new opportunities? - How have you experienced applying for support during the pandemic? (Innovation cluster) - Hs there been more funding during the crisis? (For both innovation clusters and funding agencies)	
Eco-Innovation	- **(For innovation clusters)** - Which eco-innovations do you know of? - How far in the development process are the projects? - Have any of the projects been affected by the pandemic? - And what has affected these eco-innovations? - Have new Eco-innovations been started during the crisis? - Is there anything that has made it easier or more difficult to carry out eco-innovation during the pandemic? - Has the collaboration in the cluster been affected by the pandemic?	- **(For Funding Agencies)** - How has eco-innovations been impacted during the crisis? - And what has affected these projects? - Have new eco-innovations been started during the pandemic? - Is there anything that has made it easier or more difficult to carry out sustainability projects during the pandemic? - Is there anything that has made it easier or more difficult to carry out eco-innovations during the pandemic?
End	- Ask if the informant has more to add. - Ask if they know other relevant informants. - Thank them for participating.	