



SCHOOL OF
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The Effects of Uncertainty on Decision Making Processes regarding Companies' Carbon Footprint

A qualitative interview study

by

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Abstract

The purpose of the study is to contribute with knowledge of how uncertainty affects decision making processes regarding carbon footprint. This study explores companies' perspectives on what uncertainties they experience, how these uncertainties affect their decision making processes and how the companies handle these uncertainties.

The study's data is generated through semi-structured interviews with informants involved in decision-making regarding carbon footprint from ten different companies.

The result shows that companies experience several uncertainties in the decision making processes regarding carbon footprint. Uncertainty slows down the decision-making process, creates a need to gather more information and manage contradictions in the gathered information as well as creates opportunities for innovation. Companies also experience that the processes regarding carbon footprint are sometimes incompatible with their traditional decision-making systems. In order to handle the uncertainties and their effects, this study shows how companies use reducing and coping strategies. Companies reduce uncertainty through research, proactive collaborations and networking. Companies cope with uncertainty through being flexible, imitating other companies, controlling through agreements, delaying decisions and through reactive collaborations aimed at shifting uncertainty onto competitors and stakeholders. Companies' organisational structure and their decision making processes influence how companies handle uncertainty in decision-making regarding carbon footprint.

Recommendations for further research includes further investigation of the potential possibilities of uncertainty, of how to build an organisation that can handle uncertainty and further investigation of the integration of sustainability into companies' existing decision making processes.

Keywords: decision making under uncertainty, uncertainty, greenhouse gas emissions, carbon footprint.

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1 Introduction

We are getting acutely aware that we only have one planet. In 2015, 196 countries adopted the Paris Agreement, an international treaty on climate change. The agreement's goal is to reduce greenhouse gas emissions as soon as possible, and by 2050 achieve a climate-neutral world (United Nations, n.d.). However, what determines whether we will succeed is if we can reduce emissions by half until 2030 since it is the total amount of greenhouse gases in the atmosphere that matters (Naturskyddsforeningen, n.d.). Lowering emissions is urgent, and to reduce greenhouse gas emissions by half, we argue that companies will need to reduce their total amount of greenhouse gas emission. The total amount is referred to as a company's carbon footprint (Selin, 2020).

At the same time, Bennett & Lemoine (2014) argue that we live in a VUCA world. This world is characterised by an increasingly volatile, uncertain, complex and ambiguous environment. While it is urgent to reduce emissions, we will need to do the changes in an increasingly uncertain environment.

This study derives from a curiosity for how uncertainty affects the business sector and their decision-making. This study explores what effect uncertainty has on decision making processes regarding companies' carbon footprint. We are interested in knowing more about this managerial challenge since sustainability decisions can be argued to be our time's most significant issue.

We argue that the effects of uncertainty on companies' decision making processes regarding the carbon footprint have not received enough attention in research. Yet, addressing these effects is a vital part of understanding challenges and solutions to reach a more sustainable world. By contributing with empirical data and a more profound knowledge, we hope to be part of a development making it easier for companies to navigate sustainability decision-making processes under uncertainty in the future.

1.1 Aim and Objectives

The following study aims to describe how uncertainties affect the decision making processes regarding carbon footprint. Therefore, our study explores ten companies' perspectives on what uncertainties they experience, how these uncertainties affect their decision making processes and how the companies handle these uncertainties.

1.2 Research Purpose

The purpose of the study is to contribute with knowledge of how uncertainty affects decision making processes regarding carbon footprint. It is relevant to provide more empirical data because a few attempts have been made to describe how uncertainty impacts carbon footprint decisions.

The study aims to answer the following research questions:

- How are companies' decision making processes regarding carbon footprint affected by uncertainty?
 - What uncertainties do they experience?
 - How do the uncertainties they experience affect their decision making processes?
 - How do they handle these uncertainties and their effects on the decision making process?

By contributing with new empirical data and a deeper knowledge we hope to be part of a development making it easier for companies to navigate sustainability decision-making processes under uncertainty in the future.

1.3 Delimitations

This study describes the aspects of the uncertainties companies experience and the effects of these uncertainties in their decisions about companies' carbon footprint. It does not consider other topics surrounding uncertainties, decision making processes or sustainability, such as ethics or morals of what is more sustainable or what can be described as greenwashing, where a business or product is falsely promoted as environmentally friendly (Cruger, 2021). We have excluded these topics because we want to reach a qualitative understanding, and taking a wider perspective could result in a less deep understanding of our main questions. Thus, this study does not focus on questioning companies' work regarding sustainability or what they should do more of.

To reach a thorough understanding of the issue, semi-structured interviews were conducted with an interview guide to focus on the interviewed companies' experiences on decisions about their carbon footprint. The companies chosen for the study were selected on the basis that they have activities in Sweden and a stated vision of working with sustainability.

1.4 Outline of the Thesis

This thesis is divided into six main sections. The Literature review, chapter two, gives a contextual understanding to know where the study has its foundation, and reviews existing literature in the field. The Theoretical Framework, chapter three, presents the theoretical framework that is the basis of the analysis of the data. The fourth chapter, Method, outlines and defends the method of the study. Thereafter, Findings in chapter five presents an analysis of our findings from the data collection. In the sixth chapter, Discussion and Conclusion, we discuss the findings in relation to Sniazhko's framework and other relevant literature and present the conclusions drawn from this study.

2 Literature Review

In this chapter, relevant research in the field of decision-making under uncertainty is presented. The section describes and defines the concepts of decision making, VUCA and uncertainty as well as presenting literature which has supported our discussion about decision making under uncertainty.

2.1 The concept of decision making

One of the main concepts we needed to study in the beginning of the process to conduct our thesis was decision making. The concept of decision making is thoroughly described in the literature.

One widely accepted description was created by the Nobel Prize winner Herbert A. Simon. Simon's (1960) developed an interdisciplinary approach to decision making by drawing attention to studying organisational and decision-makers behaviour during decision making processes. Simon acknowledges that people diverge from what is strictly rational when making decisions. Simon also describes decision-making as similar to managing. It comprises three phases: finding occasions for making a decision, finding possible courses of action, and choosing among those courses of action. He describes the first phase as an intelligence activity, as it entails searching the environment for conditions calling for a decision. The second phase, which he describes as a design activity, includes inventing, developing and analysing. He describes the third and final phase as a choice activity which entails selecting one of the possible courses of action. He also makes the point that each of these phases may in themselves contain its decision making process, resulting in a very complex process in its entirety.

2.2 The concept of VUCA

The acronym VUCA is becoming increasingly used in business and academia (Bennett & Lemoine, 2014). The acronym originates from the U.S. Army War College to describe the world after the Cold War when new strategies were needed to respond to the enemy (Whiteman, 1998). The VUCA world is characterised by an increasingly volatile, uncertain, complex and ambiguous environment. Bennett & Lemoine (2014) further state that the understanding of VUCA can help identify and distinguish what type of unpredictability is experienced in a situation.

Raghuramapatruni & Kosuri (2017) argues that the rapid pace of change in the business environment impacts the organisations not being able to keep up the pace or making it more challenging. The consequences of the conditions are that it becomes more difficult to make decisions both short and long term. The organisation is highly under pressure. To thrive in a VUCA world, the organisation should adapt to the changes by thoughtful decision making, be flexible, experimental and encourage engagement within the organisation (Raghuramapatruni & Kosuri, 2017). Hence to the difficulty of predicting in a VUCA environment, organisations should navigate and adapt to change by being flexible, resilient and updating capabilities within the organisation (Millar, Groth & Mahon, 2018). Additionally, Sattar (2016) states that the challenge lies in creating flexible organisations that can adapt to the changing business environment.

2.3 The concept of uncertainty

Bennett & Lemoine (2014) describe uncertainty as when it is hard to know if a certain event will create significant change and its consequences. Another understanding of uncertainty is the gap between available knowledge and what knowledge a decision-maker needs to make the best choice (Marchau et al. 2019). An additional definition is that uncertainty arises when we have limited information about the possible outcomes of our actions (Preuschoff, Mohr, & Hsu, 2015).

Uncertainty can evolve when experts do not know or agents cannot agree on how the system works and its boundaries, and the outcomes of interest. This refers to situations, where actions in response to unfolding and uncertain situations can create deep uncertainty (Marchau et al. 2019).

2.3.1 Decision-making under uncertainty

In general, there is a continual development regarding decision-making under uncertainty, although literature describes how more literature should examine practical guidance for tools used in decision making under uncertainty (Lourenco et al. 2014).

Many of our decisions are influenced by incomplete information and are characterised by uncertain consequences. A typical trade-off in these decisions is the balance between expected rewards and the uncertainty of obtaining the reward. A decision-maker might settle for the lower expected reward since uncertainty is less significant in that option (Preuschoff, Mohr & Hsu, 2015). The authors argue that little is known about how different forms of uncertainty as risk or ambiguity impact decision-making processes. An additional challenge is that making future decisions depends on predicting change (Marchau et al., 2019). According to Marchau et al. (2019), this anticipation becomes more complex, creating anxiety and individuals seeking conformity in short-term decisions to long-term goals.

Thorén & Vendel (2019) argues for the technique of backcasting to predict the future and address long term goals back to the present to manage strategic challenges. This technique is useful for strategising to prepare for a predicted future since it addresses situations or decisions that are impacted by uncertainty and its drivers.

2.3.2 Climate change and uncertainty

In addition to decision-making under uncertainty, we will shortly introduce the connections between decision-making under deep uncertainty and climate change.

Marchau et al. (2019) argue that climate change is a source of deep uncertainty. Examples of when this uncertainty occurs are the consequences of climate change, selecting sustainable energy sources. Gough (1988) also describes that environmental decision making is

characterised by uncertainty. Furthermore, environmental decision making is characterised by a long lead time before the effects of uncertainty can be evaluated (Gough & Ward, 1996).

A key challenge that has been acknowledged is dealing with uncertainty related to climate and climate changes, and Lourenco et al. (2014) argue it is a growing interest in academia and practice.

2.3.3 The risk of ignoring uncertainty

Marchau et al. (2019) argue that if decision-makers do not consider deep uncertainty, this might affect decisions negatively, since ignoring deep uncertainty is ignoring a reality of the world today. A consequence of ignoring deep uncertainty is that it can become more costly both for taking the decision and society at large (Marchau et al. 2019, Courtney, Kirkland & Viguerie, 1997, Sniashko, 2019).

3 Theoretical framework

This study uses Sniashko's (2019) *integrative conceptual framework of how multinational corporations describe and manage uncertainty* (referred to as Sniashko's framework in this thesis). Sniashko's framework is used to analyse the collected data in order to describe uncertainties and ways of handling uncertainty in the decision making process regarding companies carbon footprint.

This chapter provides a description of Sniashko's framework, the reasoning behind the choice of framework and how the framework is used in the analysis.

3.1 A Description of Sniashko's Framework

Sniashko's framework is based on a systematic literature review with a broad view of uncertainty. In her article from 2019, she describes how current research lacks a comprehensive view of the role of uncertainty in international decision-making and multinational companies' behaviour. She identifies thirteen dimensions of uncertainty and eight uncertainty management approaches based on the classifications of Miller (1992), Simangunsong et al. (2012) and additional international business literature.

In this study, we use Sniashko's classifications but Miller's (1992) article is used in order to understand the meaning of the categories she uses. Therefore, the description of the uncertainties in this presentation of the framework is referenced to Miller's article. Regarding the management methods for handling uncertainty, we refer to Sniashko (2019) to describe these methods.

The figure 3.1 illustrated below, is an overview of Sniashko's framework where the thirteen categories of uncertainty are presented and the eight management methods for handling uncertainty are stated. Sniashko (2019) also includes a section of *individual decision-makers characteristics* that do not relate to our research purpose and is therefore excluded.

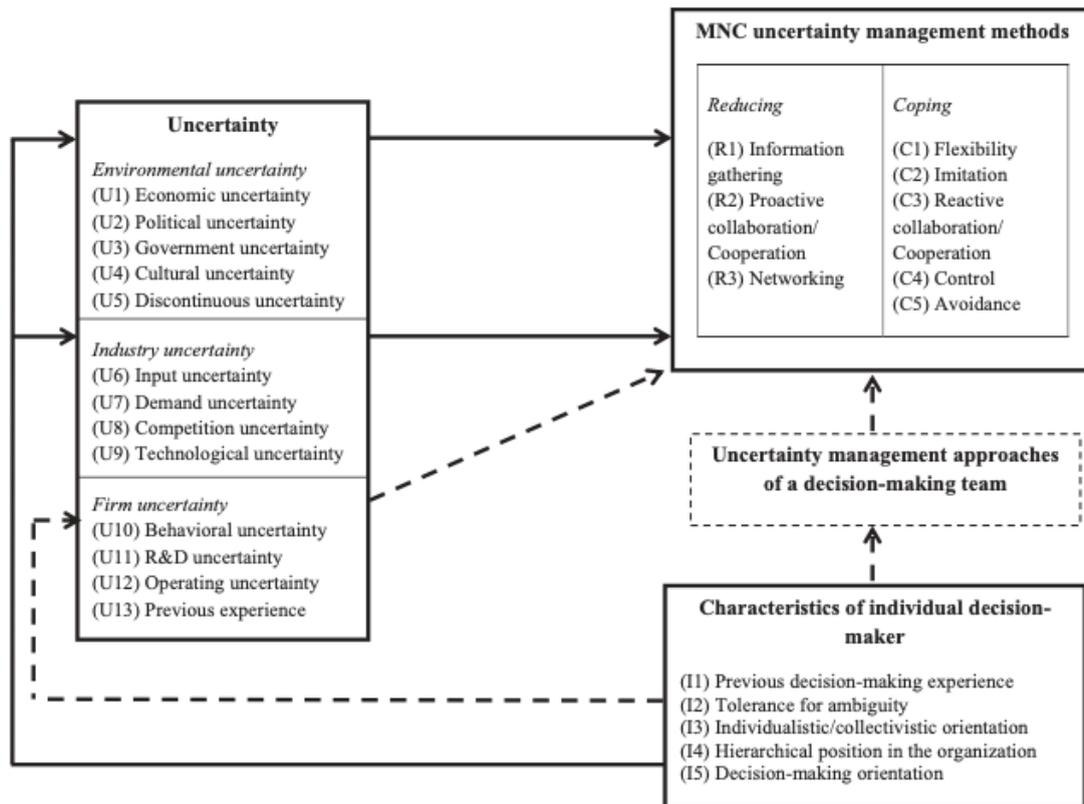


Figure 3.1 Integrative conceptual framework (Sniazhko, 2019)

3.1.1 Categories of Uncertainty

The framework categorises different uncertainties that firms face when operating internationally. First, Sniazhko (2019) groups 13 dimensions of uncertainties into three categories, *general environmental uncertainty*, *industry uncertainty* and *firm uncertainty*. The name of the categories (presented in cursive) is referenced to Sniazhko and the examples (presented in brackets) are referenced to Miller's (1992) descriptions of the categories.

General environmental uncertainty is factors that affect business context across the industry. Environmental uncertainties are defined as; *political* (war, democratic changes), *Government* (government regulations, fiscal and monetary reforms), *Economic* (inflation, changes in relative price), *Cultural* (changing social concerns, beliefs and values of the population that are not reflected in current business practice or regulations), and *Discontinuous* (natural phenomena that impact economic output, such as natural disasters).

Industry uncertainty refers to *Input* (quality, shift in market supply), *Demand* (changes in consumers tastes, availability of substitute products) and *Competition* (rivalry among existing competitors, new entrants), and *Technological* (product and process innovation).

The third category of uncertainty is associated with the specific firm, labeled as *Firm uncertainty*. The subcategories are *Behavioural* (managerial or employee behaviour as self-interest), *Research and Development (R&D)* (technological, uncertain result from R&D activities), *Operating uncertainty* (labour unrest, input supply, raw material shortage, quality change, production, machine failure, accidents).

Sniazhko's (2019) framework includes an additional category, *Previous experience*, which is not described by Miller. This category includes uncertainty related to earlier experiences that has had an impact on how the firm perceives risks related to operating in another country.

3.1.2 Categories of Uncertainty Management Methods

This section provides an outline of two potential responses, reducing and coping, to handle uncertainty as presented by Sniazhko (2019).

Reducing refers to methods that reduce companies' exposure to uncertainties without changing the company's strategy. These are divided into the categories of *information gathering*, *proactive collaboration/cooperation* (referred to as proactive collaborations in this thesis) and *networking*. *Information gathering* refers to gathering data until it is considered enough to make a decision. *Proactive collaboration* refers to actions taken in order to increase the predictability of the environment, such as sharing information between companies. *Networking* refers to collecting data through relationships with external parties.

The *coping* method describes the strategic managerial responses used to handle various environmental uncertainties and can include changing strategy. Sniazhko divides the coping method into the categories of *flexibility*, *imitation*, *reactive collaborations/cooperation* (referred to reactive collaborations in this thesis) *control* and *avoidance*. *Flexibility* refers to operational adaptation that is achieved through the adaptation of organizational structure or strategy. *Imitation* refers to imitating a rival organisations' strategy or actions. *Reactive collaborations* refers to actions made by the company that shift the uncertainty to their collaborators. *Control* refers to choosing to control uncertainty rather than accept its

conditions. *Avoidance* refers to companies deciding on postponing actions until the level of uncertainty has decreased.

3.2 The implementation of Sniazhko's framework in the analysis

Sniazhko's (2019) framework is used for the presentation and analysis of our data. In the analysis presented in the findings chapter, the uncertainties and the ways of handling the uncertainties and their effects are categorised according to Sniazhko's framework.

The framework is developed for international businesses or multinational corporations, and the framework's description of concepts relates to an international context. This study focuses on companies with production in Sweden, but the categorisation of uncertainties and management methods were still useful. The categories constitute a comprehensive and sufficient framework allowing us to describe the complexity of the data collected in this study. Making us even more confident in using the framework is the fact that the interviews showed that all companies included in this study have international connections.

4 Method

This chapter presents the qualitative research approach of the study and argues for its appropriateness. The chapter also describes how this approach has shaped the questions asked, the form of data collection and the analysis process. To increase the transparency of the study, a timeline of the study divided into five phases is presented below:

Phase one - Deciding on research aim, objectives and purpose. Clarification of research approach. Review of literature regarding decision making under uncertainty. Decision on the design of the study.

Phase two - Continued review of the literature and the development of interview questions. Conducting expert interviews. Making a decision regarding sample size and characteristics. Decision on the design of the interview guide.

Phase three - Conducting one pilot interview and revising the interview guide. Conducting 11 interviews which constitutes the empirical data of the study.

Phase four - Systematic review of collected data and the creation of a raw-data document based on the three research questions. Initial analysis using the PESTLE¹ framework. Identification of the need for further analysis using a different framework.

Phase five - Further review of literature and decision on the use of Sniazhko's (2019) framework. Conducting the analysis using the framework which proved to be useful. Final analysis leading to the conclusions presented in the thesis.

¹ A method for gathering information about external factors and its impact on business, the acronym PESTEL stands for: Political, economic, social, technology, environment, legal (Post, 2018).

4.1 Research Approach

This study is designed and conducted with an approach based on a pragmatic view of research. Creswell (2009) describes a pragmatic worldview in research as having a focus on the solutions to problems and what works to solve these problems. Creswell further argues that the debate between whether to focus on an external world independent of the mind or a world embedded in the mind is less relevant when conducting research based on a pragmatic worldview.

For our study, this approach entails a focus on identifying problems regarding decision making under uncertainty that companies face in various situations, without discussing if these problems stem from an external world or an internal world of the mind. Our approach originates from a wish to better understand problems companies face to ultimately solve these problems. The benefit of this approach has been that we have been able to use the research methods most suitable for the purpose of this study.

4.2 Research Design

To describe the effects of uncertainty, we decided on a qualitative research design and an abductive approach to the relationship between theory and empirical data. This section presents the reasoning behind these decisions.

Qualitative research is useful when conducting research with the aim of describing a phenomenon which there is limited research about. It is also suitable when it is unclear which variables are important to study (Creswell, 2009). While exploring research about decision making under uncertainty regarding companies carbon footprint we did not find comprehensive research examining this from the perspective of multiple companies, which is why we decided on a qualitative research design.

Regarding the relationship between theory and empirical data, this study takes an abductive approach. An abductive approach combines elements of induction and deduction, moving between empirical data and theory to create clarity in the selection of theoretical framework

as well as avoiding gathering large amounts of data that still cannot enable theory building (Dudovskiy, 2021). Bryman and Bell (2011) describe this as an iterative approach. In this study, the abductive or iterative approach resulted in us reviewing existing literature on decision making under uncertainty before and after the data collection process.

4.3 Data Collection Method

This section describes the reasoning behind the sample of informants, the use of expert interviews, the development of the interview guide, choices regarding interviews and trust between researcher and informants.

This study uses a qualitative data collection method, semi-structured interviews. The semi-structured interview method enables the researcher to ask open-ended questions, which allows the researcher to have a discussion with the informants instead of strictly structuring the questions. Semi-structured interviews allow spontaneous follow-up questions to informants (Sekaran & Bougie, 2016).

4.3.1 The sample

To understand how companies decision-making processes regarding carbon footprint are affected by uncertainty, this study focuses on companies as the unit of analysis. To access the companies perspectives regarding decisions the company has made or is about to make we have interviewed company representatives involved in decision making processes regarding carbon footprint.

We identified attractive companies based on the following parameters:

- a production company operating in Sweden
- recently having made a decision or being in the process of deciding on actions regarding the company's carbon footprint.

The reason to focus on companies operating in Sweden is the geographical and cultural proximity that made it easier for us to get in contact and identify informants. The companies

have been selected through a purposive sampling method (Sekaran & Bougie, 2016) where relevant companies were identified through research on company websites, through the sustainability network of Sydsvenska Handelskammaren, through personal contacts and contacting people on LinkedIn.

Gatekeepers played an important role regarding the choice of each individual informant. Creswell (2009) defines gatekeepers as individuals at the research site that provide access to the site and allow or permit the research to be done and recommends presenting gatekeepers with a brief description of the study in order to gain access to the proper person to interview. We supplied our initial contact at each company with a description of the topic of the interview outlining a basic definition of both decision-making and uncertainty to increase the probability of reaching informants that were involved in decision-making processes affected by uncertainty.

The companies from which we interviewed informants are from the following production industries; electric power, industry machinery, beverages, kitchen interior, streaming, and chemical maintenance. We interviewed two additional companies producing private goods. For these companies we cannot specify the industry they operate in, because the industries are too narrow and therefore would make it possible to identify the companies.

The informants had similar positions within the organisation, such as sustainability manager, Head of sustainability or quality managers. Secondly, all were involved or responsible for sustainability matters in the organisation. Thirdly, the informants were involved in decision making processes regarding the company's carbon footprint.

4.3.2 Expert interviews

We have conducted three expert interviews in order to discuss our research. The first expert interview was conducted in phase one with a sustainability strategist. The aim of this interview was to evaluate if a deeper understanding of the effects of uncertainty would be interesting for companies making decisions regarding carbon footprint. After the interview, we felt more confident in the relevance of our study and were able to better formulate our interview questions in preparation for the interviews.

The second and third expert interviews were conducted with a researcher at a Swedish university whose research focuses on business administration, sustainability and innovation. The first interview was conducted during phase two with the researcher where we discussed how to define our sample. The second interview was conducted in phase five and was a possibility for us to clarify the presentation of the study's result through describing it for an external part. During this interview we also discussed questions that we were not able to address in this study but that could be investigated in further research and these are presented in the discussion chapter.

4.3.3 Interview guide

According to Bryman (2011), the researcher should review existing literature to prepare what the interview questions should include. In preparation for the interviews we therefore explored research on decision making, decision making under uncertainty and uncertainty. Our aim was to formulate questions clear enough and not too specific to hinder alternative perspectives when conducting the interviews.

The interview guide was designed to include three parts. The first part of the interview guide was designed with introduction questions about the company and the person's position in the organisation. Followed by the main questions, where the informants were asked to describe examples of decision making processes affected by uncertainty, how these uncertainties affect the company's decision making processes and how they handle these uncertainties. The last section of questions aims to finish up the interview by checking that aspects identified as important by the informant are addressed. In all the interviews we used the categories of the PESTLE (political, economical, social, technological, legal, and environmental) as a tool to ask additional questions, and made sure possible uncertainties in all of these areas were addressed in the interviews. Sniazhko's framework has not influenced the interview guide. The interview guide can be found in appendix A.

4.3.4 Interviews and transcription

Bryman (2011) argues that a pilot interview can help the researcher to review their interview guide and to get experience of the method. Therefore, we conducted a pilot interview after the

development of the interview guide. The result of the pilot interview was considered acceptable but with the possibility to add more questions to better answer the research questions. Hence, the question: *Does uncertainty have any positive effects on your decision-making processes?* was added to the interview guide and we decided to exclude the pilot interview from the result presented in this thesis.

After the pilot interview, we conducted 11 interviews with 10 different companies through Zoom. The interviews were 30-60 minutes long depending on the informant and their answers. One of us took extensive notes while the other person interviewed. After the interviews, we reflected upon the interview and made a summary that was sent out to the informant.

Bryman (2011) points out that when conducting interviews some information can be missed out, therefore it is useful to return to the audio files. Therefore, we listened to the audio files and completed the notes that were taken during each interview.

Sekaran & Bougie (2016) argue that as an informant it is easier to express and communicate their experiences and thoughts more extensively in their native language. For that reason the interviews were conducted in Swedish. The quotes presented in this thesis are translated from Swedish to English. They are also shortened to improve readability and words like “eh” and “like” are excluded for that reason. The translation and shortening of the quotes have been done carefully, using the Nationalencyklopedin dictionary for support. Creswell (2009) recommends including quotes in the language the interviews were conducted in and therefore our quotes are presented in appendix C in Swedish.

4.3.5 Trust between researchers and informants and ethical considerations

A potential problem we identified for the study was if a potential lack of trust for us as researchers would lead informants to answer differently than they would have done otherwise or withhold information during interviews. This section describes what we did to build trust between us and the informants to prevent this.

When conducting our pilot interview and communicating with the companies beforehand, we identified that it is important for companies how they come across in regards to sustainability

issues, since it is connected to their brand image. To ensure companies were comfortable participating in this study we provided clear information about the purpose of the study and the interview and a broad definition of decision making and uncertainty before the interview. We also offered an initial phone call or meeting before the interview if there were any questions. We also stressed that we were prepared to not record the interview and rely on note-taking if the informant did not consent to recording. All informants agreed to be recorded and did not see it as an issue after we had explained more about the interview and what type of questions we wanted to ask them. The consent form and information sent out to informants about the interview can be reviewed in appendix B.

Participants gave their informed consent before engaging in the interview, which is highly relevant in qualitative research and to respect the participants according to Creswell (2009). First, we sent out the information beforehand about the interview and the anonymisation of the company and name of the participant and assurance that participants could withdraw at any time. Secondly, in the beginning of each interview the interviewer started with presenting a summary of the consent form and asked for the informant's consent. We also informed the participants that we would delete the audio files when the study had been reviewed and graded by the examiner.

4.4 Data analysis

Sekaran & Bougie (2016) describe that there are generally three steps in analysing qualitative data. The first step is *data reduction* which is done to make sense of the data. The second step is *data display*, which can illustrate patterns in the data that might help the researcher to understand the data. The final step is drawing *conclusions* from the data.

Creswell (2009) and Sekaran & Bougie (2016) argue that the aim of the analysis is making sense of the data. The analysis in this study is our way of understanding the data collected to be able to present a description of the effects of uncertainty on the decision making processes regarding carbon footprint.

Data reduction

In phase four the initial analysis was conducted. We systematically went through all notes from the interviews asking our three research questions and collecting the answers to these in a separate document. The categories were created before analysing all the answers from the informants and are presented in the following table:

Category	Research question
Uncertainties experienced	What uncertainties do they experience?
What happened to their decision making processes	How do the uncertainties they experience affect their decision making processes?
What were the ways of handling uncertainty	How do they handle these uncertainties and their effects on the decision making process?

This resulted in a document containing our collected raw data which was the basis for going forward with the analysis. Creating this document made it possible to get an overview of the data connecting to the three research questions.

Data display

Using the raw data document we proceeded to create a list of uncertainties using the categories of the PESTLE analysis. Structuring the data collected according to these categories however did not further our understanding of the findings since parts of the data collected were not compatible with the broad categories of PESTLE.

In phase five, the unsatisfying result of the categorisation according to PESTLE made us return to reviewing theories that could be used to understand our findings. Since there was a focus on uncertainties and their effects in the collected data, we focused the literature review on uncertainties instead of decision making which was the initial search focus in phase two. The second literature review led us to Sniazhko's (2019) framework which is described in more detail in the Theoretical framework chapter. We categorised our data in relation to Sniazhko's (2019) framework using the listed uncertainties, effects and ways of handling uncertainty from the raw-data document.

Conclusions

Through categorising the data through Sniazko's framework it was possible to create a description of the effects of uncertainty on decision making processes regarding carbon footprint. This description is presented in the Findings chapter.

4.5 Reliability and Validity

This section describes the strategies used in this study to increase the accuracy and credibility of our findings.

Creswell (2009) describes a higher reliability in qualitative research as when the researcher has used strategies to make sure that the approach can be repeated and consistent among different researchers. He recommends checking transcripts from interviews for mistakes, defining codes clearly to avoid drifting definitions as well as comparing coding results that are developed individually by researchers. To increase the reliability of this study we have checked each other's notes from the interviews, adding where we found that things were missing or corrected mishearings in the notes from the interviews. In addition to this, we created the document collecting raw data and categorised the data according to the PESTLE analysis and Sniazko's (2019) framework together.

Creswell (2009) defines validity in qualitative research as the extent to which the data and the interpretation of the data are credible and identifies eight methods used by researchers to ensure the validity of their findings. These methods include allowing informants to comment on findings referred to as member checking, giving a comprehensive description of the findings to readers and including aspects that might be used to counter the researchers hypothesis (Creswell, 2009). In this study we have sent out summaries from each interview to the informant as well as asking them to consent to the quotes we are using. The findings chapter provides a broad range of descriptions of uncertainties, their effects and how they are handled by the companies that were addressed in the interviews. In the instance where an informant has stated something that counter-argues another informant, this is also included.

In addition to these strategies, Creswell (2009) also recommends clarifying the potential biases the researcher might have in conducting the study. We are both interested in sustainability issues. Therefore we decided to be careful not to judge the potential strengths or

weaknesses of the companies' sustainability work, hence minimizing the risk for biases while conducting this study.

4.6 Limitations

We found Sniazhko's (2019) framework towards the end of the process in phase five. If the framework would have been available for us when formulating our research questions it would potentially have been easier for us to identify relevant concepts to study. However, using this framework to shape the data collection could have meant that we would have missed the additional findings and the category of how the uncertainties affect the companies described in the Finding chapter since this is not part of Sniazhko's framework.

In order to capture the companies' perspectives rather than the perspectives of individuals, we aimed to interview 1-3 representatives at each company. However, only one company had the possibility to have more than one person interviewed, and hence, two informants were interviewed at one of the companies and one informant at the following 10 companies. The interviews with the two informants from the same company are included in the study since they came from different parts of a large company, had different roles and the informants brought up different aspects in the interviews.

We are aware that there are disadvantages with interviewing individual informants in order to gain access to the perspective of companies. What role the specific individual has and where they work in the organisation will probably affect their answers. However, in order to fulfill the purpose of this study, the company perspective was sought through the perspectives of individuals. We present our findings in this thesis with the acknowledgement that the perspective of the individuals interviewed will not be identical to what might be seen as the perspective of the company as a whole and make the judgement that this is close enough for the purpose of this study.

5 Findings

This chapter includes a presentation of the analysis of the data, in relation to Sniazhko's framework (2019). We present our findings in three sections that refer to our research questions. The first section describes *the uncertainties experienced by the companies*, and the third section describes *uncertainty management methods* in relation to Sniazhko's framework. The second section, describing *the effects of uncertainty*, which do not correlate to Sniazhko's framework and is therefore not presented in relation to the framework.

5.1 The uncertainties experienced by the companies

In this section, we list the uncertainties mentioned in our interviews structured by the frameworks' three categories *Environmental*, *Industry* and *Firm*.

5.1.1 Environmental Uncertainties

In this section, we list the uncertainties mentioned in our interviews structured by the framework's categories: *economic*, *governmental*, *cultural*, *discontinuous* and *political uncertainties*.

Economic Uncertainties

The first subcategory relates to economic uncertainties. A number of informants described uncertainties in regards to changes in price and the availability of sustainable alternatives for fuel to decrease the company's carbon footprint. The informants describe uncertainty regarding how the market for sustainable fuel will look in the future and how competitors will invest.

Governmental Uncertainties

The governmental uncertainties we have listed in our findings include both uncertainties regarding legislation and regulations the companies must comply with. In addition, there are uncertainties connected to optional regulations, such as ecolabels for products.

Regarding regulations and legislations the companies must comply with, the informants discuss uncertainties to the Swedish interpretation and implementation of the directive from EU regarding single-use plastics as a way of lowering the impact on the environment. The following quote exemplifies this uncertainty:

“It's these EU-legislations, when they are published (relisead), they are not distributed to all companies in a way that would be obvious when you do something like this. The swedish government offices are also a bit uncertain what applies when it comes to a EU-directive. (...) It doesn't say (in the information made public) if you have to stop selling or producing (single-use plastic). The differences between those two are huge.”

For some companies it is rather the lack of legislation and regulations that creates uncertainty. For companies producing or selling products in other countries, the difference of legislation and regulations in these countries is a source of uncertainty.

The informants also mention that there are uncertainties connected to ecolabels. For some companies there is uncertainty regarding which certification would be the best fit to their products. Another example of uncertainty connected to certifications is when there is a bad fit between the product and the certification demanded by consumers. This creates uncertainty in whether the company should make changes to the product with the risk of lowering the quality as the following quote illustrates:

“For example, nowadays customers ask for things, maybe they want to have a Nordic Swan Ecolabel, EU Ecolabel etc. All this is not so easy. If you are about to make a product of high quality, or shall you make one that succeeds these (certifications as) Nordic Swan Ecolabel and EU Ecolabel.”

Cultural Uncertainties

Uncertainties relating to cultural aspects were brought up by a majority of the informants. These uncertainties are associated with consumers and other stakeholders, who are becoming more aware of sustainability issues. A number of informants discussed how the other trends in society promoting sustainable action can influence and create uncertainties for the companies. One informant described that a rising awareness creates a need to balance between a strategic

need to communicate regarding sustainability and avoiding being considered as a company involved in greenwashing.

One informant expressed concerns about stakeholders' lack of awareness regarding sustainability work which generated uncertainty for the company while setting direction for decisions, as illustrated by this quote:

“You can't wait forever before you act, somewhere you have to feel a certain safety in that your actions are in the right direction. That's why you get a bit frustrated when people debate in different contexts and they use this simplified image of everything, they make it sound like sustainability is simple. (...) But there is often a bit more behind what is said, there is often a lot more. What you hear in the debate is only the tip of the iceberg.”

This informant talks about how the company needs to balance, in their view, the simplified view of sustainability in the public debate with their own, deeper knowledge of what sustainability means for their product. They also need to balance this with the company's need to decide and act according to that decision.

Discontinuous Uncertainties

Regarding discontinuous types of uncertainty a number of informants brought up the long-term effects of events such as the Covid-19 pandemic. The informants describe how events such as the pandemic and climate crisis have created more uncertainty of what happens and what will happen globally. The effects events such as these could have are described as uncertain for the companies. Two informants mentioned being uncertain about how the climate changes will impact their business, the society or what risks and consequences it brings for the future.

Political Uncertainties

When asked about what is uncertain for them, the informants did not bring up uncertainties that are connected to political uncertainties. Because of how the category is defined in Sniazhko's framework as uncertainty created by state coups, war and riots, a possible explanation could be the current absence of these phenomena in Sweden.

5.1.2 Industry Uncertainties

In this section, we list the uncertainties mentioned in our interviews structured by the framework's categories: *Input*, *Demand*, *Competition* and *Technological* uncertainties.

Input Uncertainties

The first subcategory of industry uncertainty is the uncertainties related to input on the industry. A number of informants described how their suppliers were not able to deliver new technical solutions for certain products which lead to uncertainties.

The informants reported that they faced uncertainty when a supplier was not able to deliver whilst the deadline for implementing changes in their product were closing in because of a set date when the new regulation would come into effect, this can be illustrated briefly by this quote:

“(It is) extremely hard to create a decision basis when there is a law saying that we need to switch (a part of the packaging of the product), while there is no (such packaging) product on the market.”

The same informant that stated the quote above mentioned Covid-19 as adding to more uncertainty, which impacted delay in the delivery of these new products.

Other input uncertainties described by the informants included quality uncertainties because of regulations forbidding certain chemicals. Other uncertainties mentioned were shifts in market supply regarding sustainable alternatives for materials and fuel.

Demand Uncertainties

Changes in demand regarding ecolabels and a lack of clear wishes from consumers were described by the informants as uncertainties. These can be described as demand or product-market uncertainties.

Competition Uncertainties

In the category of competition uncertainties, the informants describe how new smaller companies entering the market can focus on special areas and develop sustainable solutions for these areas. The quote below describes the shifts in the market:

“I believe that we stand before a paradigm shift in how people see that (our product) should be used - that means you have to be quick, dare to invest in innovation and look at new solutions. In order to be future proof, to have a future, (otherwise) you will get passed by others who choose to invest. This company is a big colossos and we do a lot but we see that there are more and more specialised smaller (companies) entering who only do one single thing”

The shift the quote illustrates in the market is described as a source of uncertainty and a potential risk to the company, since competitors might lay hold of their market shares if they are not fast enough in adapting to this shift.

The informants also discussed uncertainty regarding the differences between companies and how they report their carbon footprint. One informant describes how their company reports their emissions through breaking it down into three scopes and reporting emissions in all of these scopes². Their competitors on the other hand did not report emissions in scope three, which meant that they communicated being climate neutral to customers even though this was only based on scope one and two. The informant describes how these differences in measuring between companies results in two companies having the same degree of carbon footprint communicating this differently towards consumers.

Technological Uncertainties

The first subcategory of industry uncertainty relates to product and process innovation uncertainties. The informants described several technological uncertainties. Some informants stated that contradictory aspects of reducing their carbon footprint in production created uncertainty. For example, the selection of materials with a lower carbon footprint would, in some cases, lead to a product with lower quality and, therefore, a shorter life cycle. A lower quality product would need replacing more often and would not live up to consumer expectations.

The absence of technology needed to lower their carbon footprint created uncertainty. Because there was not enough information about the capacity or material resources of a potential technology the decision to invest or not was complex. In addition to this, many

² The Green House Gas Protocol (GHG) breaks down emissions into three categories, scope one, two and three. Scope one includes emissions directly caused by the organisation. Scope two includes emissions resulting from the company's energy consumption. Scope three includes all other indirect emissions (European Commission)

respondents mentioned uncertainties about investments in machinery regarding which investments would be economically viable as well as sustainable in the long term. In some cases, suppliers who had promised to deliver a new solution had not been able to do so which created uncertainty for the companies in the study.

5.1.3 Firm Uncertainties

In this section, we list the uncertainties mentioned in our interviews structured by the framework's categories: *Behavioral*, *Research and Development*, *Operating* and *Previous experience*.

Behavioural Uncertainties

A number of informants described themselves as individuals who valued sustainability highly while knowing that others in the company might not prioritise actions to lower the company's carbon footprint as high as they do. This resulted in an experienced uncertainty regarding the size of investments that would be executed, as well as uncertainty regarding if actions will be taken after a decision has been made. The following quote illustrates this uncertainty:

“Then (I have to) sell this to my management team and the employees. (...) No one is disagreeing, but it never becomes top priority, and that is a dilemma. (...) In a small company you have to appeal a bit to your employees, not (to) persuade them that it is important, because they know that, but that you should work actively with it.”

Research and Development Uncertainties

The informants mentioned uncertainties in Research and development (R&D) regarding which technique about sustainable solutions will be used in the future. Informants described how it is hard to know which research to listen to when statements from scientists are contradictory. Some informants mentioned that it is hard to know if you have tested a material enough for a product that should last for a long time. Other informants described that the development of certain materials or processes were still in a pilot stage, resulting in uncertainty for the company whether it is wise to invest in these materials.

A number of informants mentioned the complexity of measuring sustainability and carbon footprint in a satisfactory way. There were uncertainties in the development of both the instruments you are using to measure and what units to measure in order to obtain correct measurements. As one informant describes it:

“If you compare sustainability data with financial data, there are incredibly good systems where everything is automated and there is no risk of missing something important for financial data. We are not there (with sustainability data), there is a lot of manual work with data collection, it builds on surveys, that employees fill in those surveys according to how much they really travel during a year and that kind of thing. There is a impending risk all the time, that we are not measuring correctly and we are not looking at the right numbers”

Operating Uncertainties

A number of informants mentioned uncertainties about the future availability of sustainable alternative raw materials. Knowing if certain materials would be available was important when deciding which investments to make, as a shortage of materials could put the production at risk.

Some informants discussed the issue of Corporate Social Responsibility (CSR)³ in connection to their supply chain. They describe uncertainties regarding the work environment for employees working for suppliers outside of Sweden. The informants describe how work environment issues as being regulated by an agreed-upon code of conduct, but there is still uncertainty present for the informants as they describe how there is a risk that agreements such as a code of conduct are not followed.

Another uncertainty connected to operations mentioned by the informants are how to organise managers and specialists working with sustainability and how many they should be.

Previous experience

Uncertainties regarding what would be categorised by Sniazhko’s framework as being connected to previous experience are not mentioned by the informants.

³ Corporate Social Responsibility is defined as the responsibility of businesses for their impact on society. Companies should comply with for example: environmental, ethical and human rights concerns and implement these responsibilities in their business strategy (European Commission).

5.1.4 Additional Findings

When conducting the analysis in relation to Sniazhkos' framework an additional category emerges, which we refer to as the timing of decision making. The informants express that they experience uncertainty when deciding when to make a decision because of a fast-paced technological development in regards to sustainability, which is exemplified by the following quote:

“And then there is an uncertainty regarding time and timing (...) It is not the decision itself that is hard, but when it should be made that is the problem.”

This informant describes how the difficulties sometimes do not lie in what decision to make but rather when to make it. The informant describes further how there is always the possibility that they might know more if they would postpone the decision. Deciding when to make a decision is also part of the decision making process and this quote shows how uncertainty regarding timing also needs to be taken into account.

5.2 The effects of uncertainty on the decision making process

The uncertainties described in the text above have different effects on the companies decision making processes and these effects are presented and analysed in this section. These effects are not related to Sniazhko's (2019) framework since there is not such a category in the framework.

Some informants report how decision making processes are being slowed down as an effect of uncertainty. The reason that the processes slowed down was that there is a need to collect more information and that the timing of decisions has to be considered. Implementation of what has been decided might also be delayed, especially in companies where decisions regarding carbon footprint were made by a small group of people or by a single individual. The informants also described how decisions are sometimes postponed and sustainability improvements are de-prioritised as a result of uncertainty. A number of informants describe uncertainties as being associated with greenwashing which affects their decision processes,

making them more careful when making decisions about what to communicate to consumers, as illustrated by this quote below:

“Then there is always a balance, how early do you dare to communicate what you are doing, because we always need to say that we are on a journey and we haven’t done everything. There we need to find the balance somehow in how early we dare to talk about it and what we dare to say without getting lots of critique and getting accused of greenwashing”

The informants described that a bigger effort is needed to make decisions under uncertainty regarding carbon footprint. They describe a need to conduct more research before making a decision, creating more substantiated decision proposals as well as being forced to manage contradictions in the information collected.

As a positive effect of uncertainty, the informants described that managing uncertainty forces the company to become more creative and innovative. Creativity is described as an effect of making decisions under uncertainty in regards to the carbon footprint as exemplified this quote below:

“But if you dare to challenge uncertainty, then it can create creativity. (You have to try and understand) where it lies, how we can get around it, what we can do to get rid of uncertainty and what that should be like?”

The informant also described how handling uncertainty can create creativity, as a need to find new solutions to “get around” the uncertainty. This beneficial effect of uncertainty is described as something that potentially makes uncertainty worthwhile. However, if uncertainty is not met with innovation it can become paralysing, especially in a larger organisation, as illustrated by this quote:

“But then uncertainty can become much more of a fuel into new thoughts. (...) But in a larger organisation, it (uncertainty) can probably tend to be more paralysing, but that depends on individuals, (organisational) structure and culture.”

The respondents also describe how uncertain aspects of sustainability are not compatible with their traditional decision making systems, resulting in a complex situation for the companies. One example of this is an informant's description of the difficulty to measure carbon footprint in a reasonable way that makes the measurement easier to compare with economical calculations of an investment.

“You’re a bit immature in the process and stuck in old structures, you’re not used to it... You get that you need to include for example carbon footprint but you don’t really

know how and don't put in the time to... You just talk about how we have to do it. It's not done just like that, you have to process it and think it through. We have developed the process for monetary follow up for how many years now..."

The immaturity that is described by this informant poses an obstacle for making decisions regarding the company's carbon footprint. The comparison with economic control systems shows that there is work left to be done before it is possible to achieve a decision making system that can include carbon footprint in a good way.

5.3 Uncertainty Management Methods

This section focuses on relating our data to the Sniazhko's framework of two approaches to handling uncertainty: reducing and coping strategies. This section presents data concerning our third research question - how the informants from different companies handle uncertainties and their effects in their decision-making processes.

5.3.1 Uncertainty Reducing Methods

In this section, we list the management methods mentioned in our interviews structured by the framework's categories: *Information gathering*, *Proactive Collaboration* and *Networking*.

Information gathering

The first technique described in the framework is information gathering as a strategy to reduce uncertainty. In our data we identified that many of the informants try to reduce uncertainty by collecting more data. A number of informants mention the effort companies make to create a more substantial basis for decision making by gathering additional information and exploring multiple alternatives.

A number of informants described how they wish for more information even though they knew more information might not always reduce uncertainty. The following quote illustrates that at some point when taking decisions regarding sustainability you have to accept the level of information you have available at the moment:

“You would always like to know, when you make a decision, that this is really the right direction from a sustainability point of view because you can always reason for forever but somewhere you just need to (make a decision). (...) But it’s very rare that you feel 100% sure about the decision.”

Proactive Collaboration

The second technique on how to reduce uncertainties is proactive collaboration. Some informants argued that one approach to handling uncertainty is to start collaborations with other companies in their industry or get support from industry organisations.

The informants also mention how they try to reduce uncertainties by cooperating through industry organisations in order to influence competitors to make similar changes as their companies have.

One informant described how their partner organisations influenced their decisions through how they worked proactively with these partners to reduce uncertainties around the company’s brand image.

Networking

The third technique to reduce uncertainty is through networking. A few informants described the importance of establishing new networks or using existing ones to gain information or input. One example of networking mentioned is an informant who tried to encourage their industry organisation and competitors to take action together to become more sustainable in their industry as a way of reducing uncertainty.

5.3.2 Uncertainty Coping Methods

In this section, we list the management methods mentioned in our interviews structured by the framework’s categories: *flexibility, imitation, reactive collaboration, control and avoidance.*

Flexibility

The informants mention the importance of creating a flexible organisation because of the changing environment. The informants described how they handle uncertainty through enhancing innovation. Some informants also mentioned the importance of employing the right

people. One informant also discussed how the uncertainty during the beginning of Covid-19 led them to enter a new market where they needed to be flexible to the new circumstances.

A few informants described how they had set internal goals for the net-zero carbon footprint without having all the information on how to reach these goals. Rather than focusing on how to get there, the companies created a flexible strategy around the goal. One informant also discussed setting the vision and deciding on a direction while at the same time being aware that it can change. Therefore, regular follow-ups were essential to keep up with the fast-changing environment. One other informant pointed out that the company needs to act even though new regulations might be introduced in the future. Therefore the organisational structure needs to adapt to the decision and the management needs to be aware of changes that can arise:

“But regarding the decisions we have made about our goals... We have (one goal) that is to become climate neutral as a company, but then there is also the goal of developing a climate neutral (product). And that goal was set without us knowing how to get there. That’s the case with most sustainability (issues), that you have to backtrack. (...) There’s no chance (that you can say) we are going there and here is a comprehensive plan and cost analysis. That’s not possible with sustainability.”

Imitation

The second coping strategy is imitating rival organisations’ strategy or actions. One informant described how they faced uncertainty when they wrote and implemented their sustainability report. The informant said they started researching other companies' reports to know what to include and that they imitated some of the other companies best practices. One informant described how to implement sustainability reporting with inspiration from other companies as the starting point for their internal sustainability work.

Control

The controlling strategy can be connected to how the informants discussed the value of having a code of conduct as a strategy to control or predict what happened in the supply chain.

Avoidance

A majority of the informants discussed avoidance as activities or decisions that needed to be delayed. One informant described that their company’s sustainability implementation needed

to be postponed because of the urgent situation with Covid-19. Another informant described how they had decided to lower their carbon footprint but these changes could not be implemented in some of their markets due to differences in countries' prerequisites. Therefore they needed to postpone activities and develop other solutions for renewable energy or other sustainability activities.

Reactive collaborations

When uncertainties increase in the environment and industry, companies tend to shift strategy so it becomes more uncertain for their partners (Sniazhko, 2019). Some informants described a wish to see aligned agreement and regulations on how to tackle sustainability issues. The informants wanted to get everyone in their industry to work in the same direction to handle uncertainty because they thought that this would make it possible to achieve a lower carbon footprint faster and easier.

5.3.3 Additional Findings

Two additional aspects emerged when analysing the collected data with reducing and coping strategies which did not correlate to Sniazhko's (2019) framework.

The first aspect refers to where to handle uncertainties regarding carbon footprint in the organisation. One informant argued that it was a matter of who and how many in the organisation should handle the issues related to carbon footprint. Another informant mentioned the difficulty in knowing where to place the responsible person for sustainability issues. The main issue concerned which department should be responsible for the decisions or the collection of information in order to deal with the uncertainties. Therefore some companies had a person or department responsible for sustainability questions, which has the overall responsibility when making decisions influenced by uncertainty. In order to make the decisions, they consulted other experts from the organisation and asked for complementary information if needed. A few informants argued that having someone responsible for sustainability was needed to integrate sustainability in the organisation.

The second aspect that emerged from some of the interviews was whether the organisation integrates carbon footprint issues into the organisational structures or if sustainability is seen as a separate process. There were some informants who described their companies strategies

for handling sustainability, and discussed that in order to integrate sustainability it should be seen as a filter throughout all decision making processes and organisational activities. One informant explained it followingly:

“I think it should be intertwined in what we live and learn. It shouldn't really be a dashboard, a parallel track, it should be in all KPI:s. It should be how we run our business, I think. But the road there... (that) I don't really know how...”

This quote illustrates how the informant wants to integrate carbon footprint issues in existing decision making systems rather than have them as a parallel track. However, how to achieve this is unclear to the informant.

5.4 Summary

The result shows that companies experience several uncertainties in the decision making processes regarding carbon footprint. In general, the informants described that they have experienced many different types of uncertainties. External factors influence these uncertainties, for example regulations and which ecolabel the company should comply with. Other external uncertainties refer to how trends influence their market and to what extent they need to be cautious about what to communicate, as not to be misunderstood for greenwashing.

Other uncertainties correlate with their industry, such as developing a more sustainable product can be challenging depending on if the technology exists. There are also examples of how the ecolabel does not align with what would be the most sustainable choice for the product in the long term according to the companies. The dependence on the supplier delivering a component to the product has also been stated. Most of these uncertainties were connected to the quality of the product.

Firm uncertainties included if it is a priority of becoming more sustainable as a company. Other factors which impact uncertainty are R&D, is the technology improved to develop sustainability products or how to calculate carbon neutral products. Most mention uncertainties about their operations and some are linked to CRS and the code of conduct.

The effects of uncertainty on the decision-making process shown in this study is that uncertainty slows down the decision-making process and creates a need to gather more

information, manage contradictions in the gathered information and creates opportunities for innovation. An additional effect of uncertainty is that companies experience that decision processes regarding carbon footprint, in some aspects, are not compatible with their traditional decision making systems. In order to handle the uncertainties and their effects, this study shows how companies use reducing and coping strategies. Gathering information reduces the gap between the current level and the desired level of knowledge through research, proactive collaborations and networking. Companies cope with the knowledge gap through being flexible, imitating other companies, controlling through agreements, delaying decisions and through reactive collaborations aimed at shifting uncertainty onto competitors and stakeholders. This study also shows that companies also see that their organisational structure and their decision making processes influence how they handle uncertainty in decision-making regarding carbon footprint.

6 Discussion and Conclusion

This study aimed to describe how uncertainties affect the decision making processes regarding carbon footprint. This study describes how these affect the decision making processes regarding carbon footprint and how the interviewed companies handle the uncertainties and their effects.

The overall research question for the study was:

How are companies' decision making processes regarding carbon footprint affected by uncertainty?

In this chapter, we examine our findings with existing research. This examination is divided according to the three research questions of this study. In addition to this, we discuss the limitations of this study and make recommendations for further research.

6.1 Examination of the findings in relation to existing research

6.1.1 The uncertainties experienced by the companies

This study has taken a broad perspective on uncertainties experienced by companies. The interrelationship between the uncertainties became apparent when we analysed the uncertainties following Sniazhko's (2019) framework. Looking at our findings in their entirety, we see different uncertainties, and many of these are related to each other. Many uncertainties relate to how a company should prioritise resources, where investing in one direction makes another direction non-viable. If this study had only described technological uncertainties, this interconnection might not have been visible for us. This interconnection further supports Sniazhko's (2019) argument that when including a broader spectrum of

uncertainties, the relationship between them can be understood. The result is also consistent with Miller (1992) that stresses that companies need to do trade-offs between different uncertainties when handling uncertainties.

Many uncertainties described in this study are, to some extent, connected to trying to predict which investments or decisions will be the most economically profitable in addition to lowering the company's carbon footprint. The prediction is consistent with Marchau et al. (2019), who emphasises the economic elements are influenced by uncertainty, making it difficult to predict the outcomes of investments.

While reflecting upon our research, it became clear that our study has identified many types of uncertainties the interviewed companies experience while taking decisions regarding carbon footprint. The uncertainty exists in many forms throughout the decision making process and could be identified in different parts of the organisation. The result aligns with Gough (1988) who stresses that environmental decision making is characterised by uncertainty and the uncertainty is visible in different stages of the decision making process.

6.1.2 The effects of uncertainty on the decision making process

The result shows that companies experience several uncertainties in the decision making processes regarding carbon footprint. The effects of uncertainty on the decision-making process shown in this study is that uncertainty slows down the decision-making process and creates a need to gather more information, manage contradictions in the gathered information and creates opportunities for innovation. Comparison of the findings with those of other studies confirms that it is increasingly difficult to anticipate the future when making decisions under deep uncertainty which include decisions regarding climate (Marchau et al., 2019).

Our result illustrates how some companies' processes are slowed down in regards to uncertainty both while taking the decision and during the implementation. According to Gough & Ward (1996) environmental decision-making problems have an extended lead time before being able to assess and evaluate the impact of uncertainty and its outcomes. We cannot make statements about the outcomes since the informants did not describe this as a problem. However, when we reflect upon the author's argument, the decision-making processes regarding carbon footprint could lead to a longer process as our result indicates.

This study describes the potential for innovation as an effect of uncertainty which aligns with Sniazkho (2019), which argues that a decision-maker with an entrepreneurial mindset can see opportunities in the unknown. Even though this study has not focused on the individual decision maker's mindset, we would argue that there is a possibility to find innovation while facing uncertainty. These results further support the idea that uncertainty is an outcome of innovation and a driver (Millar, Groth & Mahon, 2018). Furthermore, innovation as a potential effect of uncertainty also makes us agree with Miller (2019), who argues that not all uncertainty should be reduced. Concerning the argument that not all uncertainty should be reduced, can be supported in our results, where uncertainty has positive effects when dealing with its effects.

Bennett & Lemoine (2014) argues that since the VUCA world cannot be seen as one concept with one solution, there are different remedies to ambiguity or uncertainty. Innovation and experimenting are solutions for ambiguity. The solution for uncertainty is gathering adequate information through various methods and reviewing and interpreting the information differently. Uncertainty can also be solved by structuring and devoting resources to collecting, interpreting and sharing information differently internally and externally (Bennett & Lemoine, 2014). If we would have separated uncertainty and ambiguity in this study, we see a possibility that the informants would have discussed the solutions differently.

6.1.3 How are uncertainties and their effects handled by the companies

Besides taking the opportunities created to be innovative, this study shows how companies handle uncertainties in different ways by using reducing and coping strategies. The informants describe the importance of gathering more information to make decisions, guidance from networks could reduce uncertainty, and how the organisational structure impacts the company's ways of handling uncertainty.

The informants in this study describe that one aspect of handling uncertainty is building an organisation that can handle uncertainty. One aspect discussed as necessary for such an organisation was the potential to be flexible or adaptable. There is literature supporting how organisational culture does impact when making adjustments to prepare for a VUCA world. According to Millar, Groth & Mahon (2018), the organisational culture should be built on innovation and strong engagement, which is crucial for adapting to a “new normal”.

The findings of this study illustrate that the interviewed companies acknowledged the importance of creating a flexible organisation that can handle uncertainty. Our study is consistent with Raghuramapatruni & Kosuris' (2017) argument that being able to survive in the business world today requires organisations to be able to adapt and respond to change. Attracting and retaining talent is also an important factor for building a resilient organisation for handling uncertainty (Raghuramapatruni & Kosuri, 2017). The recruitment was a factor our informants did stress as important while dealing with uncertainty.

Our results share similarities with Thorén & Vendels' (2019) findings of the use of backcasting as a technique by addressing uncertainty to investigate future alternative paths. The authors argue the technique helps organisations widen their analysing scope of alternatives by challenging mindsets to assume being in the future and looking back to find a path. By this method, uncertainty decisions can be addressed in a structured manner. In our findings, some companies used similar techniques by setting the target for becoming carbon neutral and began to set the strategy from how this goal can be achieved.

6.2 Our contribution

This is the first study, to our knowledge, to examine how uncertainty affects decision making processes from the perspective of multiple companies regarding carbon footprint and therefore describing this subject is relevant to develop more knowledge around this topic.

This study describes a broad range of uncertainties but there are still many commonalities between what the informants describe when it comes to the effect of the uncertainties. This suggests that this description of the effects of uncertainty created in this study could be applicable to other situations, which is further strengthened by the alignment of our findings and those of existing research.

Our examination shows that there is existing research that supports our findings, suggesting that this study's description of how uncertainty affects the decision making process regarding carbon footprint could be generalisable to other areas. We are, on the basis of this study, able to pose several interesting questions for further research which are presented in the next section.

6.3 Limitation of the study

The description from our study regarding uncertainties, their effects and how the companies handle uncertainty does not enable us to determine what could be a way forward for companies. We see that we are a long way from finding a clear path forward for how companies could handle the uncertainties that occur regarding carbon footprint. Neither practitioners or literature present a complete “tool box” for handling uncertainty. Further research would be needed in order to further assist practitioners with handling uncertainty in decision making regarding carbon footprint.

The theoretical framework used for the analysis has not been used in research such as ours. Our understanding is that the framework has only been used to theorise uncertainty and assist a literature review. The framework originates from categorising uncertainty that multinational corporations experience. In comparison to our study that has been conducted in a real world context by examining experiences from companies with production in Sweden. Additionally, our study found additional uncertainties that could not be related to the framework. Therefore we would argue with Sniazhko (2019) that the framework should be tested more in practice and real life context.

6.4 Recommendations for further research

We see a few informants in this study who describe that their organisations focus on the opportunities for innovation that uncertainty creates. Marchau et al. (2019) argues that trying to predict the future is not useful while handling deep uncertainty. The authors further describe how there is a need for preparation and adaptation, how focus should be on monitoring developments and how knowledge is gained by allowing adaptation over time (Marchau et al., 2019). In addition to our findings which addresses this briefly, the argument creates an interesting question for further research. Could a possible way forward for handling the effects of uncertainty be to focus on the possibilities of innovation and the building of an organisation that can handle uncertainty, rather than focusing on reducing uncertainty?

The informants in this study describe that one aspect of handling uncertainty is to build an organisation that can handle uncertainty, however the result of this study does not describe how to create such an organisation. Sattar (2016) argues that creating organisations that are flexible and can adapt to the changing business environment is a true challenge in a more changing world. Therefore the question of how organisations who experience the effects of uncertainty on their decision making processes would be an interesting area of further research.

In addition to this, further research would be useful for investigating the integration of sustainability into companies' existing decision making processes which is discussed by our informants as a way of handling uncertainty. An interesting question to investigate would be if sustainability issues should be integrated in existing decision making systems or does the organisation need to make more significant changes beyond their traditional systems?

We would also suggest further research by conducting case studies with companies that have found interesting processes and structures for handling the effects of uncertainty on the decision making process in regards to carbon footprint.

6.5 Conclusion

The conclusion of our study is that the interviewed companies experience several uncertainties in the decision making processes regarding carbon footprint.

The effects of uncertainty on the decision-making process shown in this study is that uncertainty slows down the decision-making process and creates a need to gather more information, manage contradictions in the gathered information and creates opportunities for innovation. An additional effect of uncertainty is that companies experience that decision processes regarding carbon footprint, in some aspects, are not compatible with their traditional decision making systems.

In order to handle the uncertainties and their effects, this study shows how companies use reducing and coping strategies. Gathering information reduces the gap between the current level and the desired level of knowledge through research, proactive collaborations and networking. Companies cope with the knowledge gap through being flexible, imitating other

companies, controlling through agreements, delaying decisions and through reactive collaborations aimed at shifting uncertainty onto competitors and stakeholders. This study also shows that companies also see that their organisational structure and their decision making processes influence how they handle uncertainty in decision-making regarding carbon footprint.

This is the first study, to our knowledge, to examine how uncertainty affects decision making processes from the perspective of multiple companies regarding carbon footprint. However, there is existing research that supports our findings. How uncertainty affects decision making regarding carbon footprint needs further examination since it is urgent to find solutions to reduce carbon footprint to reach a climate-neutral world by 2050.

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Appendix A

The interview guide (translated from Swedish into English)

Introducing the interview

Start the interview by telling the informant how the interview is structured with introductory questions, main question and final questions. Tell the informant about the setup of one person conducting the interview and the other taking notes. Tell the informant about the consent form information, that the informant could withdraw at any time, and ask them if we can record the interview.

(If the informant consents to being recorded, start the recording)

Explain the purpose of the study:

The purpose of the study is to contribute knowledge of how uncertainty affects decision making processes regarding carbon footprint. By exploring and analysing the challenges related to uncertainty companies face while taking decisions regarding carbon footprint.

Our research question is:

How are companies' decision making processes regarding carbon footprint affected by uncertainty?

What we are interested in are your decision processes regarding carbon footprint and we are aware that this is broad. Therefore, we wish to talk about both small and large decision making processes that in some way are related to the company's carbon footprint.

By **decision-making** processes we mean the process of comparing alternatives, thinking about different possible outcomes and finally deciding to act or not to act.

By **uncertainty**, we mean being in a situation where you have less information about the consequences of possible actions than you would like. Uncertainty is of course broad but we are interested in whatever uncertainties you experience.

Short introductory questions:

Can you tell us shortly about your role and the company?

How involved are you in the company's decision making processes regarding sustainability and specifically carbon footprint?

What decision-making processes (regarding sustainability and carbon footprint) are your company in right now or what decision-making processes have you just finished? Can you give us an example, big or small?

Main questions regarding the effect of uncertainty on the decision-making process:

Describe an example of a decision-making process or a decision that was affected by uncertainty.

Which uncertainties affect you and which uncertainties do you need to handle? How do you see these uncertainties? Is there anything in the process that gets accentuated?

If you could remove one uncertainty, what would it be?

Does uncertainty have any positive effects on your decision-making processes?

What do you do to reduce or take the edge of uncertainties that you are affected by or that you need to handle?

Final questions:

For us: Control that all aspects of PESTEL (political, economic, social, technological, environmental or legal) are addressed by the informant. Example of question: We noted that you have not brought up any aspects regarding uncertainty in relation to, for example, technology, how does the company relate to uncertainties connected to this?

According to you, what are the most prominent challenges when you are making decisions regarding sustainability?

Is there anything else we need to know regarding how your decision-making processes are impacted by uncertainty?

Appendix B

Consent form for participating in the interview (translated from Swedish to English)

This interview will be a part of Cecilia Cedlöf and Emma Nordengrens master thesis at the Master in Management at School of Economics at Lund University during the spring of 2021. The purpose of the study is to contribute knowledge of how uncertainty affects decision making processes regarding carbon footprint. By exploring and analysing the challenges related to uncertainty companies face while taking decisions regarding carbon footprint. Our research question is

How are companies' decision making processes regarding carbon footprint affected by uncertainty?

This thesis will be available for the public and will be published at Lund University's website for student papers (LUPsearch).

The interview that you are accepting to participate in will take 45-60 minutes. The interview will be recorded to facilitate the analysis of the data. The recording will only be used for this master thesis and will only be saved until the thesis is handed in and graded. After this the recording will be deleted. You can always choose to end the interview, refuse to answer a question or withdraw your consent before the thesis is handed in.

The names of the companies will be mentioned in the thesis but not the names of the informants. The plan is to have the names of the companies participating in this study to be public if we don't agree on anything else together with the informant. However, answers by informants used in the thesis will be de-identified so that it is not possible to connect them to a specific company.

We will let the informant read a short summary of our interpretation of their answers after the interview. If we plan on using a quote from the interview we will let the informant see and comment on the quote before the thesis is handed in. We are of course happy to share our conclusions in the thesis when it is done.

When agreeing to take part in this interview I also accept that I have received information about the study and accept the information listed above.

Thank you for participating in our study!

Appendix C

Quotes in Swedish

The quotes in this list are in the order of appearance in the text.

Quote 1:

“Det är ju de här EU-lagarna, när dom kommer ut, så kommer de inte ut till alla företag på ett sätt som skulle vara självklart när man gör det här. Svenska regeringskansliet är också lite osäker vad som gäller när det är ett EU-direktiv” (...) Det står inte om det är säljstopp eller om det är produktionsstopp. Det är jättestora skillnader på det”.

Quote 2:

“Nu kommer det tex. kunder som frågar efter saker, kanske vill ha svanenmärkning, EU-blomman osv. Och allt sånt är inte så lätt. Ska man göra en produkt som är av hög kvalite, eller ska man göra en som klarar dessa (certifieringar såsom) svanenmärkning och EU-blomman.”

Quote 3:

“Man kan inte vänta hur länge som helst med att agera, nånstans måste man känna en viss trygghet på något plan att det är rätt riktning. Därför blir man lite frustrerad hur folk debatterar ur olika sammanhang och så använder dem den här förenklade bild av allting, folk får det att låta att hållbarhet är enkelt. (...) Men ofta finns det lite mer bakom allt det som sägs, där finns ofta väldigt mycket mer. Det är liksom toppen av ett isberg man hör i debatten.”

Quote 4:

“Extrem svårt att göra ett beslutsunderlag här pga finns en lagstiftning som säger att ja vi måste byta (en del av produktens förpackning) men det finns ingen produkt på marknaden.”

Quote 5:

“Sen tror jag, vi står liksom i ett paradigmskifte i hur man ser på (att vår produkt) ska användas - då måste man vara ganska snabbfotad och titta, våga satsa på innovation, nya lösningar. För att vara future proof, för att ha en framtid, för att man kommer bli omsprungna av andra som satsar bara på. Det som är med (företaget), det är en ganska stor koloss som gör väldigt mycket men det vi ser är att det kommer mer och mer specialiserade mindre som bara gör en grej”

Quote 6:

“Sen måste sälja in till min ledningsgrupp och anställda. (...) Ingen säger emot det här, men det blir aldrig högsta prioritet, och det är ett dilemma. (...) I det lilla bolaget så får man lite grann vädja till personalen, inte (för att) övertyga dem om att det är viktigt, för det vet dem, men att man ska jobba med det aktivt.”

Quote 5:

“Om man då jämför med miljödata med finansiell data, där finansiell data finns det otroligt bra system allt är automatiskt och finns liksom ingen risk att man missar något viktigt. Där är vi inte, det är mycket manuellt arbete i insamling, bygger mycket på enkäter, att anställda verkligen fyller i hur mycket de rest under året och allt sånt. Det är ju en överhängande risk hela tiden, att vi inte mäter rätt och att vi faktiskt inte tittar på rätt siffror.”

Quote 5:

“Och då finns det en osäkerhet i också rent tid och tajmning mässigt. (...) Där inte beslutet i sig är svårt, men när beslutet ska fattas är problemet.”

Quote 6:

“Sen (är det) alltid en avvägning, hur tidigt vågar man kommunicera det man gör, för vi måste ju också säga att vi är på en resa och inte gjort allt. (...) Så där måste vi hitta balansen på nåt sätt hur tidigt vågar vi prata och vad vågar vi säga utan att då få massa kritik och bli anklagade för greenwash.”

Quote 7:

“Men om man vågar utmana osäkerheten så kan det skapa kreativitet, försöka liksom förstå var ligger, hur kan vi komma runt den, kan göra själv för att ta bort osäkerhet och vad skulle det va?”

Quote 8:

“Men då osäkerhet mycket mer av ett bränsle in i nya tankar, ta bort osäkerhet, hitta lösningar, men i en stor organisation kan det nog tendera till att bli lite mer förlamande, men det beror på individer, strukturer och kultur”.

Quote 9:

“Man är lite omogen i processen och man är fast i gamla strukturer, man är inte van, man fattar att vi måste inkludera då tex klimatavtrycket i våra beslutsprocesserna, men man vet inte riktigt hur och man lägger inte tiden på att, det bara pratas om att vi måste göra det. det är ju inte liksom gjort bara sådär. Utan det behöver ju processas och tänkas igenom. Vi har ju arbetat fram modellen med monetär uppföljning i hur många år som helst...”

Quote 10:

“Det är ju alltid det här att man hade velat veta liksom, när man tar ett beslut att det här är helt och hållet den rätta vägen ur ett hållbart perspektiv för det är ju så att du kan ju resonera hur länge som helst om vissa saker, men nånstans måste man ta avstampet. (...) Men det är ju väldigt sällan man känner sig 100 % säker på beslutet”.

Quote 11:

“Men besluten vi tagit kring våra mål, vi har ju dels att vi ex vill bli klimatneutrala som företag, men sen ska vi också ta fram en klimatneutral (produkt), och det målet sattes det utan att veta hur vi skulle ta sig dit. Så är det mesta med hållbarhet, att du måste backtracka. (...) Det finns inte en chans, att (säga att) vi ska hit och här är en fullständig plan och kostnadsbedömning. Det går aldrig med hållbarhet.”

Quote 12:

“...för att jag tror att det ska vävas in i det vi lever och är liksom. Det ska inte egentligen vara en dashboard, som ett parallellt spår, utan den ska ligga i alla KPI:er, alltså det ska vara så vi driver ett företag tänker jag. Men vägen dit vet jag inte riktigt...”