

Subject	Management Accounting	Date	18.11.2018
Author(s)	Martin Tessieri	Student number	504079
		Number of pages	94
Title	Carbon Accounting - How and why do Nordic companies utilize carbon accounting in risk evaluation and investment decision making?		
Supervisor(s)	Lauri Lepistö Ph.D & Associate Professor Kirsi-Mari Kallio		

Carbon accounting is going through the same development phases as did traditional accounting, where it developed from only bookkeeping to a more strategic role. Currently carbon accounting is in the same phase, developing from the measurement of carbon to using this accounted data for strategic investments and risk evaluations. This study looks at current carbon accounting schemes and their strategic roles using the material gathered from the Carbon Disclosure Projects (CDP) data bank and a close-up interview with one carbon intense company that uses internal carbon pricing. The sample companies consist of companies whose headquarters are located in the Nordics. The CDP material was analyzed using the coding method of the consolidated narrative interrogation (CONI) system. The interview used a theme-based approach. The results show that companies practice carbon accounting mainly to communicate towards investors and rating agencies, but also from the requests of their business partners. The study also suggests that carbon intense sector companies show more interest towards carbon accounting, but also that low carbon sectors like the financial sector use carbon risk management approaches for their carbon-intensive customers. Currently still the usage of carbon accounting in a strategic manner in the Nordic companies is not widespread, even though companies face risks regarding regulation and rising carbon costs from carbon taxes and Emission trading systems. In the face of such uncertainty, companies should better prepare to face such risks.

Key words	Carbon, Carbon Accounting, Environmental management accounting, Control systems, Environmental risk management, Internal carbon pricing
Further information	



**UNIVERSITY
OF TURKU**

Turku School of
Economics

CARBON ACCOUNTING

How and why do Nordic companies utilize carbon accounting in risk evaluation and investment decision making?

Master's Thesis
in International Business

Author:
Martin Tessieri

Supervisors:
Lauri Lepistö Ph.D
Associate Professor Kirsi-Mari Kallio

18.11.2018
Turku

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

Table of Contents

1	INTRODUCTION	6
1.1	Introduction to the subject of the thesis	6
1.2	Research objectives	9
1.3	Methodology, execution and contribution	11
2	THEORY OF CARBON ACCOUNTING.....	17
2.1	Introduction to carbon accounting.....	17
2.1.1	The definition of carbon accounting.....	18
2.1.2	The pick and mix frame	19
2.1.3	The collection of carbon data.....	23
2.2	Stakeholder requirements for carbon accounting.....	28
2.2.1	Different organizational fields and accounting approaches in carbon accounting.....	30
2.3	Organizational motives for carbon reporting	34
2.4	Carbon price in Investment decisions making	37
2.5	Management control systems and carbon	39
2.6	Carbon management accounting and traditional financial analysis	43
2.7	Sociological perspective of carbon as a number	47
3	EMPIRICAL PART	50
3.1	CDP survey material background	50
3.2	CDP questionnaire frame	51
3.2.1	Analyzing methodology.....	53
3.3	Answering organizations background.....	54
3.4	Interpretation of the empirical material.....	57
3.4.1	carbon accounting methods.....	57
3.4.2	Internal carbon pricing (ICP).....	59
3.4.3	Interview with a CDP responding organization.....	71
4	CONCLUSIONS AND THE ASSESSMENT OF THE STUDY	81

4.1	Discussion and conclusion	81
4.2	Limitations	86
4.3	Future Studies.....	86
5	SOURCES	87

Figures

Figure 1	The GHG protocols three scopes	26
Figure 2	Map of national and subnational development around carbon pricing	27
Figure 3	Framework for carbon management control	42
Figure 4	Nordic organizations by sector which practice carbon accounting	55
Figure 5	The titles of the answerers or approvers of the answers.....	57
Figure 6	how ICP is used in Nordic organizations	60
Figure 7	Average relative CO2 ton amount emitted per sector (scope 1 & 2)	64

Tables

Table 1	Pick and mix	21
Table 2	Stakeholder Requirements	29
Table 3	Examples of key types of carbon accounting in organizations	33
Table 4	Sectoral differences between organizations on how carbon reporting is being influenced	35
Table 5	Decision making process model	37
Table 6	Inclusion of a carbon expense in NPV	39
Table 7	Conceptual model of financial analysis and carbon risks	45

Table 8 Model of integrating traditional financial analysis and carbon risks	46
Table 9 Carbon accounting standards used	58
Table 10 Scope 1 and 2 total emissions by sector and country	69

1 INTRODUCTION

1.1 Introduction to the subject of the thesis

Conventional accounting concentrates into noticing predominantly profit factors but lacks in taking into account major business factors such as climate change. Environmental management accounting (EMA) concentrates in the non-disclosed factors by the traditional accounting and connects them with business operations. Through the proper implementation of EMA tools businesses can take into account the economic and ecological factors together in the entire business, including the whole supply chain. EMA tools are seen as the possible way to reduce the long-lasting tension within economic development and environmental factors. Carbon accounting, as one part of the EMA toolkit, brings forth the recognition of nonmonetary and monetary evaluations and the enabling of the possible monitoring of the effects that emissions have. This study focuses on overviewing the form that carbon accounting take's inside organizations and the factors surrounding the organizations that have an effect on it. Carbon accounting in itself does not really message anything else than the numeric counting of emissions, this study contributes to the view on what it can be used inside organizations. (Qian & Jacob 2018, p.1609)

In the rising awareness and increased regulation to climate change related issues, organizations are in growing pressure to disclose their greenhouse gas emissions (GHG) information and to take concrete measures. The first wave of carbon disclosing came after the Kyoto protocol in 1992 when some companies first started to rationalize climate change as a real risk factor into business operations. International climate agreements like the Kyoto Protocol rely on quantitative targets, which requires the calculation of emissions in businesses. Meanwhile when the US declined to join the Kyoto protocol the European front was less hostile towards it and was more responsive for climate measures in an earlier stage (Kolk et al. 2008, p.720) and in 2005 the EU-presented the first cap and trade system (Stechemesser & Guenther, 2012, p.17). This is where carbon was made as a calculative factor for the European businesses.

Organizations reporting concerning climate change issues have made a vast shift from the 1990s, when businesses mainly neglected the issue (Kolk et al. 2008, p.720). It must be noted that some of the oil sector businesses were an exception in this. BP, Shell and ExxonMobil chose to break away from the sectors general way of reacting to climate

issues (Pulver 2007, p.53) and made an impact in the development of differing measurement systems for carbon and to the notion that organizations can have internally driven transformational leadership even without external stakeholder pressures (Pulver, 2007, p. 46). The reality still for most organizations is that this kind of internally driven transformational leadership is not always long-lasting or the mainstream way for businesses greening efforts. This is why external stakeholders are usually behind an organization steering towards greener policy. As one of the most recent and impactful acts the UK government became the first jurisdiction in the world to make GHG disclosing mandatory in financial reporting for publicly listed companies. (Tang and Demeritt, 2018, p. 438)

The financial markets have started to recognize, in a growing trend, the risk factors related to climate change. Investors, insurers and bankers are naturally concerned of the financial risk factors that are posed upon organizations business and so organizations globally have started to recognize that through the voluntary disclosure of these risk factors they can provide actual shareholder value. This added shareholder value can occur as example through lower cost of equity capital (Dhaliwal et al. 2011, p.94). But the measuring of these environmental factors for investors has been hard to take into account, this why also in collaboration with investors around the world the Carbon Disclosure Project (CDP) was launched.

The CDP's purpose is to gather data from organizations around the world, into a shared databank which investors, bankers and insurers can use in assessing the risk factors in the organizations they do business with. Although there has been criticism over how and if investors actually use this information in decision making (Pfeifer & Sullivan 2008, p.245). What has been missing is a more quantitated form of this data usage for assessing business risk. It also comes from the interest of organizations themselves to measure quantitatively their emissions to better follow their set objectives in order to achieve more efficient operations in the field of emissions. Still some have pointed out that external reporting platforms are too detached in their current form, from internal decision-making processes (Qian & Jacob 2018, p.1616). This might lead businesses to report only for the sake of reporting without any concrete action.

From the increasingly mounting climate related public and regulatory pressures that organizations find themselves in, it has been seen by many businesses that it's good for business to record, communicate and reduce their emissions in the whole value chain. Emerging governance mechanisms such as in the field of cap and trade systems, like the EU:s Emissions Trading System (ETS) and the potential future Federal cap and trade

system in the US are signs of a trend which organizations react to by disclosing their emission (Callon 2009, p. 537). Cap and trade systems are a market-based system solving the market failures through the inclusion of externalities. Another way to connect the externalities is through carbon taxation, which has the same objective as cap and trade systems but comes in the form of taxation. To this day many of the countries that have some climate cost, have their own carbon tax systems which are not linked globally the same way that the cap and trade systems are. Often times the organizations suffering from carbon related taxes are also heavily subsidies in the other hand.

There is increasing recognition that these markets are in need of a process for the accounting and calculation which determine which organizations are accountable and what to account (Lohmann, 2009 p. 500). In order for the setting of targets, tracking of progress, creation of markets and the imposing of sanctions and incentives from different sources, which all require the accounting of carbon as their base. This has been addressed by various communities, like, governments, businesses, accountants and scientists. This is why the future evolution of carbon accounting are the sums of interests, expectations and goals from multiple actors. (Ascui, 2014, p. 13)

Carbon accounting is seen as a relatively new field and a way of dealing with environmental impacts from business activities. The field has been seen to have received more attention through the development of different emissions cap and trade systems which have induced a price for carbon, but also different carbon registers, like the data bank collected by the CDP, have been said to have an effect into the rising popularity for carbon accounting (Gibassier and Schaltegger, 2015, p. 340). Carbon accountings popularity have put businesses into a situation where they have had to analyze where it could be implemented so that it would have actual steering effects and support the businesses climate strategy, since for some organizations carbon accounting can be of strategic importance in their missions to manage their carbon performance. It has been recorded that the managing of carbon performance, can lead companies to reduce their emissions and the risks related to it and even result to competitive advantages (Hendrichs & Busch 2012, p.70)

It was seen in this study that most of the organizations have concentrated their carbon price towards the calculations of investments and thus using carbon cost in the decision-making process. The organizations in this study had a strong relation to the European ETS-market, which many had derived their price from. Through the implementation of carbon as cost in investment calculations, these organizations are taking a self-

motivated role in the pursue to prepare their business to the risks evolved around emissions regulation and future pricing of it. The organizations that prolong the notification of the possible cost effects, especially in very carbon dense sectors, might drive their businesses towards a more riskier surrounding in the future. This is why some of most carbon dense sectors in the Nordics are taking more initiatives towards the realization of carbon as a cost and also implementing it deeper into the management's decision-making process.

Not many research papers point out how businesses internal carbon management accounting has been implemented in decision making or provide actual concrete information on what carbon management accounting means in a business's everyday process (Gibassier and Schaltegger, 2015, p. 340). Although there are some exceptions, like Burritt et al. (2011) which investigated the internal carbon management accounting processes inside German organizations, Vesty, Telgenkamp and Roscoe, (2015) studied through a case study the implementation of carbon cost into investment calculations in a state owned Australian water utility organization and Gibassier and Schaltegger (2015) studied the integration of carbon accounting systems in a multinational company. More research should be done in the field of carbon management accounting and especially concrete case studies should be published, that show in dept how these systems are implemented into organizations.

1.2 Research objectives

The objective of this research is to look at the current situation of the carbon accounting scheme in the Nordics, through the secondary analysis of a questionnaire data held by the Carbon Disclosure Project (CDP) and through the a closeup interview with one of the answering organization to the CDP questionnaire. According to the questionnaires gathered by the CDP from the Nordic organizations, there were 5 Finnish, 6 Swedish, 5 Norwegian, 3 Danish and 0 Icelandic companies that said to have included internal carbon pricing in some form. This study looks closer at the responses from these organizations to further analyze them and find occurring themes from them. The ultimate objective is to present a Nordic view of the form that carbon accounting can take in organizations. This might vary a lot depending on their sector, carbon intensity and regulatory environment (Tang & Demeritt 2018, p.452). This subject is important since the whole alternative

use of carbon accounting is being done voluntarily. The new aspect of this also means that the whole definition of the scheme and what form carbon accounting takes inside and organization differs.

The eighteen Nordic companies were selected from a list provided by the CDP report of 2017 “Putting a price on carbon” (Bartlett et al, 2017, p. 37-42), that have included a carbon price into their daily operations. By getting an overview of their carbon pricing systems, through analyzing their answers in a qualitative manner this study will present the reader an overall view on how carbon accounting and internal carbon pricing has been adopted in the Nordic companies and what other possible forms of use it has taken in these organizations. It also educates the reader on how carbon accounting can be noted in different ways and contributes to the ongoing conversation on best practices of implementing carbon pricing into an organization. This study will also help the reader to conclude to what extent Nordic companies want to calculate the amount of emissions that their emitting and make strategic decisions to better prepare themselves for the risks involved to emitting. (Bartlett et al, 2017, p. 36-43)

This research study from the field of carbon pricing has been partly motivated by the CDP report “Putting a price on carbon” and “CDP climate change report” which are released annually. CDP operates as a non-profit organization and is backed by 827 investors with more than 87 trillion in assets. Its mission is to “collect and distribute high quality information that motivates investors, corporations and governments to take action to prevent the dangerous of climate change.” (CDP, 2018c). According to a SustainAbility (2010, p. 16) report called “rate the raters” CDP was ranked as the most influential organization on the carbon management scheme.

One part of this study’s empirical data is from the CDP’s database as it makes sense to amass the material from this database, since CDP has already cropped the companies, which say to have implemented a carbon pricing system and asked them questions related to internal carbon pricing which is then used by different stakeholders to asses a company’s strategy and commitment towards issues evolving around climate change. For the years 2017 questionnaire the CDP contacted all of the 260 largest (by market capitalization) companies in the Nordics, which include companies from Finland, Sweden, Norway, Denmark and Iceland. From these 260, 222 answered their climate change questionnaire and from these 222, 18 companies reported using the internal pricing of carbon (CDP Worldwide, 2018d). The questionnaire data is available for everyone who is a member for the CDP.

The second part of the empirical data comes from a closeup interview with one of the companies that have reported to the CDP questionnaire. The company interviewed is a Finnish materials company that has reported using an internal price for carbon in their operations. The interview was conducted in the company's offices. The interviewed organizations also wanted to stay anonymous, so it will be only referred by their sector and country classification.

This study's research questions are the following:

- How is carbon accounting used in Nordic organizations that practice internal pricing of carbon?
- What is the level of involvement and the motives behind using internal carbon accounting and pricing in the Nordics?

1.3 Methodology, execution and contribution

This research is by its research methodology a qualitative study. The purpose of a qualitative study is to represent real life characteristics. In a qualitative study the material can be gathered only using one case or through a group of different cases. This study's empirical material comes from two sources; material from a databank provided by the CDP and material from a conducted interview with one Finnish materials organization. The data from the CDP's databank was analyzed using the secondary analysis method and it was analyzed before conducting the interview. The interview was conducted by using the theme-based interview structure. By firstly going through the secondary analysis process with the CDP data, it supported the actual interview process, since the information from the CDP data helped in the preparation for the interview. By already reviewing and analyzing eighteen other organizations from the CDP data before a closeup interview with one organization, the interview questions could be focused right away into themes that rose from the CDP data, it also helped in the better execution of follow-up questions during the interview situation.

The CDP's databank holds questionnaire answers from thousands of organizations around the world (Tang, 2014, p. 2–3). The answers analyzed from the CDP for this study were from a questionnaire called the "Climate change questionnaire 2017" gathered by the CDP. This study selected to analyze all the answers from the Nordic organizations

who had mentioned using internal carbon pricing in their organization. After this cropping there were eighteen organizations whose answers were analyzed from four different countries, Finland, Sweden, Norway and Denmark. Iceland did not have any organizations that mentioned using internal carbon pricing in their CDP questionnaire. The closeup interview conducted with the Finnish material organizations was also one of the organizations in the group of eighteen organizations from the CDP data. This closeup interview was done in order to get a deeper representation of some of the themes that occurred from the secondary analysis of the CDP data. All the answers given to the CDP data and the interview were given by representatives of the organizations, usually representing a director, specialist or manager role in the organization. It is believed that by having a closeup interview to support the themes in the CDP data, gives more credibility for the whole empirical material used in this study to support the research results.

According to Hirsjärvi et al. (2007, p.177) through studying individual cases closely enough, a researcher can find the most significant and commonly found effects which repeat in representation when looking at a phenomenon generally. In a qualitative research the tool for analyzing the material is very closely linked to the researcher itself. During the research process the researcher develops and becomes better in analyzing the material, this is also why the research process is always a learning process as well.

This study's CDP material has been originally carried out as a questionnaire by the CDP. It has been mentioned that the questionnaire method might suffer from a low response rate, which might undermine its validity and reliability (Al-omiri, 2007, p. 510). The CDP questionnaire material had 4765 responses from different organizations around the world of a 6086 sample group. This results into a response rate of 77% (Bartlett et al. 2017, p.8). The questionnaire method can be said to be a traditional and widely used form of methodology in business and administration (Al-omiri 2007, p.512). Normally in a questionnaire study you study several sides. The sides should be selected only if they present a crucial role for the study. As an example, a party in the study can be a group of companies and its operational processes which are involved in the studies overall subject and can help the researcher get answers to the research questions. In this study all the study participants practice carbon accounting in one form or another and are part of the cropping.

The questionnaire methodology has a strong role in the science field of business and administration but has lost in popularity to the newer more softer methods of qualitative research. This said the questionnaire methodology has a strong position in certain

study approaches and its use is very justified. (Aaltola and Valli, 2007, p. 102). A research methodology's starting point is its research problems and task's, but occasionally this might go the other way around, like in this study. Since this study will consist partly of an already existent material, the research firstly studied the material and the same time looked for the right research problems and task's. This is a constant process where the researcher studies the material closely before locking the actual research questions. This way the material is being used in the most fruitful way, since it will tell in time what is the most meaningful content in the material. (Saaranen-Kauppinen & Puusniekka 2006)

Often times researchers are surrounded by material that could be used for further study and looked from new perspectives. This is why the researcher should notice and look if there might already be a gathered dataset that would be used to conduct the research. Too often the material gathered for the original study is only partly utilized and might hold valuable information for further research. Not all ready material is ready to be used for a study in their original form, often times they need to be modified and cropped to serve the study's interest (Hirsjärvi et al. 2007, p. 175). Using a ready material has gained in popularity and using it is very justified, especially like in this case, where the researcher is making he's first thesis study. It might be the case with some study's, when a researcher is making he's or her's first research, that too much time is being used to gather the empirical part, but not enough time is used to analyze it. (Saaranen-Kauppinen & Puusniekka 2006)

The question on how a research material should be gathered is steered by the needs of the actual research. A researched should ask the following question; which material can be thought to offer the best perspective and solution to the set research- task and problem. In the end a researcher should always try to look for the best way to gather the material for the needs and resources made available. There is no single best research method, but rather each method has its pros and cons, it's always more dependent on the research, time or resources. (Silva 2011, p.92)

The core strength of the questionnaire study is its way to gather large quantities of data from multiple sources. Through the questionnaire methodology it is possible to test already established beliefs, concepts and theories, through which new hypotheses and thoughts can be produced. The questionnaire method brings specificity and generalizability into the science of business and administration. In the case of the CDP data companies make an effort to review what they answer, since it will be displayed for large audiences and be open for criticism from multiple sources. Interview responses might suffer

from this same detail to answers, since they aren't open to such criticism. The questionnaire directed by the CDP was sent in the Nordics to the 260 largest companies, by market capitalization. From these 260 companies 18 answered to be involved in carbon accounting either through internal or external accounting factors. Through the close analysis of the answers given by the companies, this study will bring comparison and a well-covered view of the overall current status of carbon accounting scheme in the Nordics.

Often times the participating organizations benefit from their cooperation with the researcher. In this study one of the aims is to also produce relative information to the organizations and to the whole subject field. Through this study the Nordic organizations can make peer reviews on what their competing organizations are doing related to carbon accounting and present how the Nordics as a region are interested in pursuing carbon accounting by organizations.

In the study the observations are viewed from a certain explicitly defined point of view, which is called the theoretical framework (Alasuutari 2011, p.79). This framework defines which material should be gathered in the study and what methods should be used to analyze it. The gathered material can also put restrictions to what methods can be used and which theoretical framework the study should have and because of these points it is important to choose a theoretical framework and method which are in tune with one another. (Alasuutari 2011, p.83). The theoretical framework used in this study consist of the fields earlier literature and research papers.

The theoretical framework consists of earlier research on carbon accounting in how it formed its meaning and what different stakeholders request from the organizations that use carbon accounting. The later chapters focus on presenting the actual carbon accounting financial models from case studies and developed theoretical models than can be used for integrating sustainable factors into a ratio based pyramid model presented by Castro and Chousa (2006) which was motivated by the DuPont model of Chandler (1977). The two different case studies concentrated into looking into two different organizations that have integrated carbon accounting model into their operations. All of these research studies are enhanced by reinforcing the theories with their earlier theory. The carbon accounting still lacks concrete and widely accepted models. Because of fragmentation of the whole carbon accounting scheme, the theory of this study is heavily dependent on going through earlier actual cases in different organizations that can provide valid evidence of their functionality not only in theory but also in real life situations.

By closely analyzing through the answers, the researcher comes close to the subject studied. Many of the possible results become clear when going closer to the subject. When gathering the material for the subject the researcher should lean towards the most appropriate method. The most popular qualitative materials are interviews and written materials. In the occasion of case studies, it is important to use various different sources, which provide triangulation with which the study subject can enhance its constructivist validity. The point is to make the study reliable by presenting the reader the researchers chain of reasoning and the readers job is to decide on if he believes this chain of reasoning. (Koskinen et al. 2005, p.157–158)

As mentioned earlier one of the most used forms for collecting the empirical part to a research are through written materials and from different forms of interviews. (Aaltola & Valli 2007, p.25) In this study the approach to analyzing the already existent material, which was collected following the questionnaire methodology, is going to be analyzed through the thematic approach. The thematic approach is usually a very data-driven approach, by searching certain themes from the text mass. Through the CDPs questionnaire answers this research tries to look for certain themes on how carbon accounting appears in the Nordic companies that have taken first steps to measure their carbon emissions. When using the thematic approach to analyzing the data, it is often reasonable to use certain quantitative traits like coding and quantifying, for example through tables. This helps the researcher to find the links between certain themes in the data. It is also very common to bring forth quotes in the research from the data, through which the study can assure the reader firstly that there actually was a material to begin with, which the researcher went through. The quotes also connect the reader with the actual object being studied by bringing actual examples to the reader. To add on this note the study is not supposed to be a consecutive line of constant quotes from the data, they must be there for a reason and the researcher should assure this through he's own comments that connect the data into the subject being studied. (Saaranen-Kauppinen & Puusniekka 2006)

The thematic approach has two further distinctive terms for coding methods, the deductive coding and inductive coding. These two approaches differ in how they link the background information to the coded material. The deductive approach links earlier theoretical information with the empirical data, which allows the researcher to build themes from earlier discoveries from earlier literature (Boyatzis, 1998, p. 29). The inductive approach is built from the raw information that are drawn from the data. The inductive approach is used often in new research areas where prior theoretical framework is very little.

Though it can be said that no study can be fully inductive, since the researcher's own background information will inevitably have an effect to the drawn themes. This study will consist of both inductive and deductive approaches, but the deductive approach will have a much greater effect on to the overall themes. (Marks and Yardley, 2004, p. 57–58)

2 THEORY OF CARBON ACCOUNTING

2.1 Introduction to carbon accounting

Carbon accounting is a relatively new area of research but has gained more momentum especially after the development of carbon emission trading scheme, like the one launched by the European union, the EU-ETS. Also, environmental regulation has tightened steadily, and many companies are taking measures by internalizing certain sustainability aspects. CO₂ emissions have been in the center of regulative actions. Companies are adopting carbon accounting to better understand where their CO₂ emissions derive from. Understanding where companies CO₂ emissions derive from will help them better prepare themselves for the future and better manage their legal compliance questions surrounding the issue. This is seen as active risk management and the companies adopting carbon accounting are gaining competitive advantage (Burritt et al. 2011, p. 81). Here below are some concrete examples on why companies include carbon accounting (Burritt et al. 2011, p.81)

- For some companies it is the amount of emissions trading certificates that can be avoided, thus resulting in direct savings
- For other companies it is the energy saved that pays off for the effort invested
- Yet other companies have sought to achieve market advantage by labeling their products carbon-neutral
- Another reason for engaging in carbon management, has been the pressure on the industry to provide information on their emissions and also to reduce these emissions as an act of environmental commitment.

Corporations have started to look for ways on how to measure CO₂ emissions since the end of 1990. Companies, of the likes of BP, Shell, Monsanto and Ford have experimented with calculating their emissions for reporting purposes in the early 1990's. This lead them and other institutions to look for ways on how to integrate the measurements into an accounting system. (Gibassier and Schaltegger, 2015, p. 341–342; Ascui 2014, p.128)

Currently the field of carbon accounting scheme is a fairly fragmented one. The global community holds a very decentralized governance structure on climate regulation, which brings benefits but also problems to the overall objective of reducing greenhouse gas emissions worldwide. A decentralized accounting structure makes it harder for organizations to produce meaningful data which can be compared to one another, this for example makes it harder for governments to engage in co-operation on this issue. On the other hand, the benefit of this fragmented field is its flexibility, which allows organizations to choose a CO₂ emissions accounting structure that suits them best, regarding their strategy and objectives. This flexibility might push organizations to take the first step towards carbon accounting. But then also, institutions such as the European emissions trading system (EU ETS) might require, or at least be more credible, if behind it would be a common metric system. In the same way as stock market data relies on the financial statements of organizations. For a carbon market to be efficient and accurate it would need to rely on some form of global carbon accounting system. This would enhance accuracy, liquidity and credibility into a market-based emission trading scheme like the EU ETS. This is probably an issue that will be tackled as carbon accounting becomes more popular and globally accepted. To sum this up, carbon accounting is widely accepted as a way to calculate for company specific greenhouse gas emissions, but it still lacks credibility and needs stronger institutions behind it. Also the possible uses for carbon accounting data has still not developed to its full potential. (Young, S.B. & Abbott, C.L., 2013, p. 273)

2.1.1 The definition of carbon accounting

The methods for carbon accounting amount of a wide range of different practices. Many of these different practices derived in relative isolation from each other. Originally scientists used the term carbon budget for the measurement of the global carbon cycle starting from the 1960s, this method involved a level of accounting for carbon. It can be said that the first group to practice some level of carbon accounting were the scientific group, this built the foundation for carbon accounting. In 1988 climate change was starting to gain attention from the wider audience, which meant that the issue started to spread from the scientific scheme to the political spectrum. At the same time this was also the period when carbon accounting started to gain attention. (Ascui 2014, p.142)

The term carbon accounting is used throughout in this whole thesis, even though the field holds other definitions. Ascui (2014, p. 135) uses the cited arguments for the usage of carbon accounting as the right term:

“I therefore use the term ‘carbon accounting’ as a provisional marker for something amorphous and contested, rather than seeking to reduce and contain its scope within a narrow, essentialized definition. Other terms such as ‘greenhouse gas accounting’ or ‘climate change accounting’ could also be used as such a marker, but I believe ‘carbon accounting’ is both more appropriate and gaining wider recognition. The term ‘carbon’ is widely recognized as shorthand for carbon dioxide or greenhouse gases more generally, in addition to making more specific reference to elemental carbon in certain circumstances” (Ascui 2014, p.135)

Carbon accounting more commonly refers to the whole list of possible greenhouse gases (GHG) that companies might emit to speed climate change. The list of GHG gases is according to the IPCC’s report (Brander et al. 2012, p.2) Carbon Dioxide, Methane, Nitrous oxide, Hydrofluorocarbons, Perfluorocarbons, Sulfur hexafluoride and Nitrogen trifluoride. This study will also use the term carbon accounting but refer to all the possible GHG emissions.

2.1.2 The pick and mix frame

When companies talk about carbon accounting, it is wrong to automatically link it with terms such as sustainably- or environmentally successful, this is not what carbon accounting automatically results to. Overall carbon accounting as a term lacks a clear definition of what it actually means and what it is to be sustainable and perform well environmentally. At times carbon accounting might be used as the bridge with which companies justify the usage of these terms even though there is no clear definition on what it means to perform well environmentally. (Gibassier and Schaltegger, 2015, p. 343)

Currently the overall usage of the term carbon accounting is fairly wide, which can partly at least be a result of the fragmented field of the whole scheme. Accounting for

carbon is a wide concept and it takes place in various different levels in the whole economy. It can be the accounting of the global carbon cycle from space, through a satellite (Ascui 2014, p.111) or concentrate in one single product in a company's product portfolio (Haslam et al. 2014, p.208). Ascui (2014, p. 138) presented a "pick and mix" table that sums up the definition of carbon accounting through an expanded view. Carbon accounting thus can be seen as any sequence of the chosen lines (reading from left to right) in the pick and mix table 1 (Gibassier & Schaltegger 2015, p.343)

The pick and mix tables idea is that through combining terms the reader can form more specific definitions that will better help understand carbon accounting. As an example, a quote from Ascui & Lovell

"for example, physical carbon accounting is primarily concerned with estimation, direct measurement or modelling of carbon stocks and flows or greenhouse gas emissions and removals, primarily at the global level, for research purposes, whereas carbon disclosure mainly involves reporting of greenhouse gas emissions and impacts on and impacts from climate change at the organizational/corporate level, for voluntary disclosure purposes" (Ascui & Lovell 2011, p.980).

<p>measurement</p> <p>estimation</p> <p>calculation</p> <p>modelling</p> <p>monitoring</p> <p>reporting</p> <p>validation</p> <p>verification</p> <p>auditing</p>	<p>of</p>	<p>carbon dioxide greenhouse gas</p>	<p>emissions to the atmosphere</p> <p>removals from the atmosphere</p> <p>stocks</p> <p>flows</p> <p>emission reductions</p> <p>enhanced removals</p> <p>legal or financial instruments linked to the above</p> <p>trades/transactions of any of the above</p> <p>financial equivalents of any of the above</p> <p>impacts on climate change</p> <p>impacts from climate change</p> <p>related actions, such as implementation of policies and measures</p>	<p>at</p>	<p>global</p> <p>national</p> <p>sub-national</p> <p>regional</p> <p>sectoral</p> <p>municipal</p> <p>household</p> <p>individual</p> <p>organizational</p> <p>corporate</p> <p>installation</p> <p>project</p> <p>programme</p> <p>policy</p> <p>activity</p> <p>event</p> <p>product</p> <p>process</p> <p>service</p> <p>supply chain</p> <p>building</p> <p>or other</p>	<p>Level , for</p>	<p>mandatory</p> <p>voluntary</p>	<p>research</p> <p>compliance</p> <p>offsetting</p> <p>trading</p> <p>reporting</p> <p>disclosure</p> <p>benchmarking</p> <p>auditing</p> <p>information</p> <p>marketing</p> <p>or other</p>	<p>Purposes</p>
---	-----------	--------------------------------------	---	-----------	--	----------------------------	-----------------------------------	---	-----------------

Table 1 Pick and mix

(Asci 2014, p.138)

In summary the pick and mix table takes into account a wide spectrum of accounting practices that are evolving together with the evolution of carbon accounting. The earlier definitions around carbon accounting have been somewhat limited, which can be partly because of how new the whole scheme is. The definition of carbon accounting is constantly broadening and evolving, the pick and mix tables multi-option definition is good because of this aspect. It can be developed and evolve together with the schemes future turns. It might be that already in the near future the Pick and Mix table might be outdated or in need for modification, but until that time the pick and mix table is one of the most covered definitions of carbon accounting. (Ascui 2014, p.141)

The most notable influencer for the current development for carbon markets has been the cap and trade systems. The companies that operate under the ETS systems, have found to have new liabilities, assets and financial flows to account for in their reporting. Till this day there has not been some internationally recognized guide that would support businesses in the accounting or development of different risk and control systems around carbon. This in part has had its effects on how companies have recognized carbon accounting or the possible uses of that data for the managing of environmental factors. There was a guidance released in 2005 just when the EU-ETS's first phase started, which was requested from the well-known International Accounting Standards Board (IASB). The IASB is an independent body that approves and developed standards regarding IFRSs reporting. This guide provided by the IASB was withdrawn within six months after its release, because of the concerns around possible inconsistencies surrounding it. If carbon accounting would have a widely recognized accounting method in the major accounting standards, it would provide a base and start developing a more solid meaning. (Ascui & Lovell 2011, p. 988–989)

Through the framing, such as the pick and mix table, the field of carbon accounting can better try to create understanding around the subject. And to understand why certain developments around carbon accounting have risen, why some issues are fiercely contested and others not. Through the acknowledgement and understanding of these different framings, it can bring about a more effective way of understanding carbon accounting, which might also lead to more effective societal responses. (Ascui & Lovell 2011, p.981)

2.1.3 *The collection of carbon data*

In carbon accounting carbon itself is usually not measured by companies as they are calculated. Carbon is often being calculated as an average through using estimates from pre-determined conditions that replicate the normal environment of the carbon pollutants. This form of calculating of the carbon pollutants has come into criticisms because of the sheer diversity surrounding in the economy. This calculated way of accounting for carbon will have difficulties because of the required various different methodologies which have to be suited for various sectors, practices and technologies, as just an example. According to Young & Abbot (2013, p. 237) this is in the core of the complication surrounding carbon accounting and will in the long run create tremendous variation in the accuracy of carbon calculation. According to Ascui (2014, p. 126) while it is technically possible to measure the carbon dioxide flow directly through continuous monitoring, it is rarely used and not worth the effort in certain situations. In the measurement of fossil fuels and its carbon emissions there is a very close correlation, this means that the emissions estimation can be done very accurately especially in the calculation of energy's emission amounts. However, when you look at the whole company and not just an energy producing plant, where the stream is very predictable, it all becomes a whole lot complicated. Determining which methodology fits best for each organization causes diversity in the carbon data and the whole scheme. (Young, S.B. & Abbott, C.L. 2013, p.273; Ascui 2014, p.126)

The one model presented by Ascui (2014, p. 127) on how to calculate the estimated emissions amount is presented below (Ascui 2014, p.127)

$$E = AD \times EF \times OF$$

“E = Emissions (in tons of CO₂)

AD = Activity data (for example tonnes of coal, converted to energy equivalent on a net calorific value basis) ¹

EF = Emissions factor (An appropriate emission factor for that particular fuel, expressed in tonnes of carbon per unit of energy and then multiplied by 44/12 to convert to tonnes of CO₂; and

¹ “Net calorific value (NCV) is also sometimes referred to as the lower heating value (LHV) of a fuel, and refers to the usable energy available after vaporizing the fuel's moisture. NCVs are approximately 95 per cent of the gross calorific value (GCV) for liquid fossil, solid fossil and biomass fuels, and 90 per cent of the GCV for natural gas” (Ascui 2014, p.127)

OF = Oxidation factor (An appropriate oxidation factor for that particular fuel, representing the percentage of carbon which is oxidized to carbon dioxide (e.g. the IPCC default value for coal is 0.98)).

The ways how companies build carbon accounting systems is currently very disconnected from one another. This can be a result of all the different accounting standards in the whole carbon accounting scheme and the lack of governmental regulation. This is also probably one of the reasons to why carbon accounting takes many forms, depending on the organization you look into. For example, it might not always be integrated into a company's operations through a continuous accounting system. Many companies that are not fully committed or/and don't want to invest so much time and effort into a concrete system, might find alternative ways to integrate the disclosing of carbon into their operations. Many companies might use just a very simple excel based spreadsheet in which they take into account carbon as a cost, through calculating the net present value in investment decisions. (Vesty et al. 2015, p.313)

Carbon accounting, other than just having controversies on its definition it has a strong stakeholder perspectives to it. Carbon accounting systems are affected by different requirements coming from different stakeholder groups. Often times these requirements differ a lot from each other. These different requirements might partly be a result of the fragmented field around the whole carbon accounting scheme. This is why companies who practice any sort of carbon accounting need to understand well themselves for which purposes they are setting the system for. As an example, the Ford Motor company's early experience on the issue, raised questions on where to draw the boundaries in terms of what to calculate and what not to. But the most important factor they pointed out was the uncertainty on what methodology can be deemed to be seen credible with the stakeholder groups. (Ascuí 2014, p.128; Wintergreen & Delaney 2006, p.1)

In the year 1997 the WRI together with the World Business Council for Sustainable Development launched an NGO partnership to come up with a standardized method for carbon accounting, this was the first in the world. This standardized method was called the Greenhouse Gas Protocol (GHG Protocol), which is a corporate accounting and reporting standard. The GHG protocol uses the greenhouse gas protocol rather than carbon accounting term. As a reporting standard the GHG protocol combines both internal accounting and external reporting functions and it was designed to closely model the

ISO14064-1 standard. The ISO14064-1 standard is a guide for the private and public sector to help them navigate on the development of GHG inventories. As pointed in the earlier chapter 2.2.1 the carbon accounting scheme lacks an internationally recognized guide that would support businesses in the accounting of EU ETS rights, and even though the ISO14064-1 provides a guide for GHG inventories, it does not go to the length in providing guides for ETS rights accounting. (Ascui & Lovell 2011, p.988–989; Wintergreen & Delaney 2006, p.1; Gibassier & Schaltegger 2015, p.343; Ascui 2014, p.128)

One of the GHG protocols introductions was the concept of the three different scopes, which are presented in the figure 2 page 25. The logic behind these scopes was to make it possible for organizations to incorporate the different levels of accountability. Scope 1 covers all direct GHG emissions in the organizations. These direct emissions are a result from the sources the organization owns or controls, as an example the combustion from the company's vehicles or owned power sources like boilers and furnaces. Scope 2 and 3 covers all indirect emissions that are affiliated with the organization's operations. Scope 2 covers all indirect emissions occurring from purchased electricity that is also used by the company. This leaves the Scope 3 to cover all other indirect GHG emissions. Scope 3 emissions are all the emissions that come as the consequence of the organizations action from sources that are not owned or controlled by them, as for example employee business travels made by vehicles not owned by the organization. Covering the scope 3 sources is optional for organizations in the GHG standard. (The Greenhouse Gas Protocol 2000a, p.25)

The GHG protocol has also been criticized for its scope model and because of the influencing powers that lie behind the protocol. Researchers have criticized the scope 1 calculation, in where an organization accounts for the emissions from only the sources that they control. Mózner (2013, p.84) has challenged the scope 1 and would suggest that the responsible of accounting for emissions should always be the end user. He's argument is that since many of the developing countries work as the factories for the western world, where then also the energy intensive products are being shipped to and sold to, they should be the ones accounting for the emissions as well. In this current situation, this model makes sure that developing countries are made the ones who produce relatively more of the carbon emissions, even though the culture of consumption is partly the root cause for the growing emissions. The developing countries are only meeting the demand for this consumption.

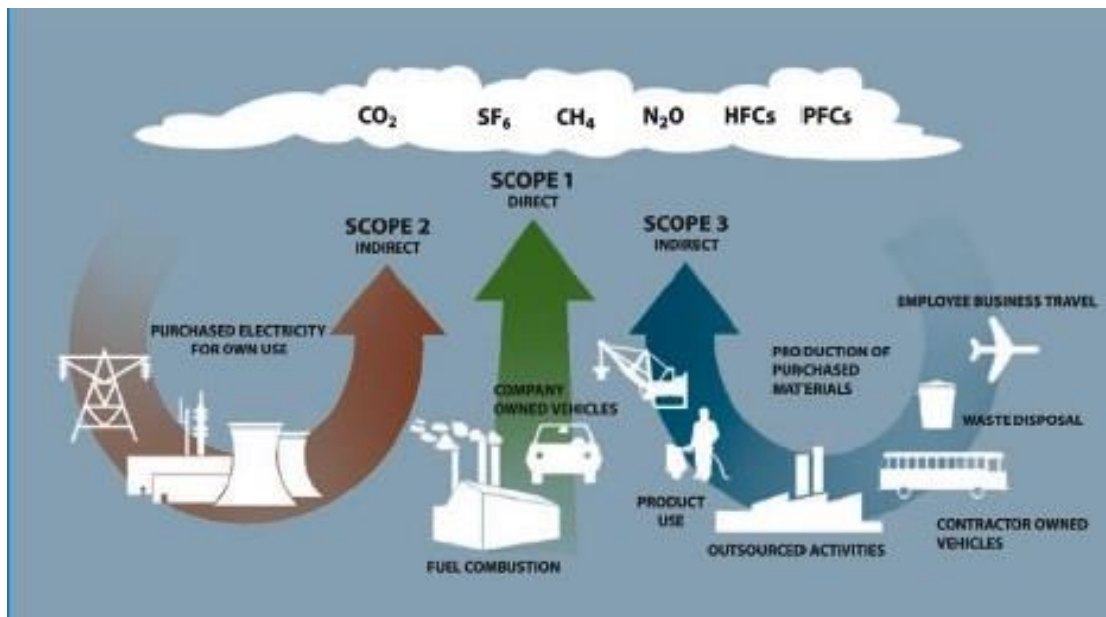


Figure 1 The GHG protocols three scopes

(Asci 2014, p.129)

Andrew & Cortese (2011, p.135) pointed out a dilemma in the optional reporting of scope 3 level emissions. Since scope 3 level emissions are optional in the GHG protocol, they are often also left out by organizations. These scope 3 emissions include all other emissions not covered by scope 1 or 2, which includes things such as business travel, transportation of products, waste and other outsourced activities. These scope 3 sources of emissions can be substantial and thus the exclusion of scope 3 emissions, can cause a situation where actual emission amounts calculated don't reflect clearly enough the businesses role in emitting GHGs.

GHG protocol has been developed from various industry contributors, it has also had an abundant influence from the corporate sector. Andrew & Cortese (2011, p.134) especially criticized the heavy influence that the corporate sector has had in the development of the GHG protocol. A team of advisors were gathered from KPMG, PriceWaterhouse-Coopers, UN Framework Convention on Climate change (UN-FCCC), US EPA and the WRI. This team included only one independent expert for the revision of the protocol, and the same situation was by large during the development and trial phases. The carbon accounting scheme is going through active conversation about the pros and cons of different carbon accounting methods. (Andrew & Cortese 2011, p.134)

The important factor in the whole carbon accounting scheme is to develop consistent assessment methods, so that organizations can tackle climate-related issues in a level

playing field. This level playing field needs to reach out also between industries and different trading systems. Currently the organizations operating under ETS systems are making a contribution that is not met by most other organizations not operating under an ETS system. (Bowen & Wittneben 2011, p.1027)

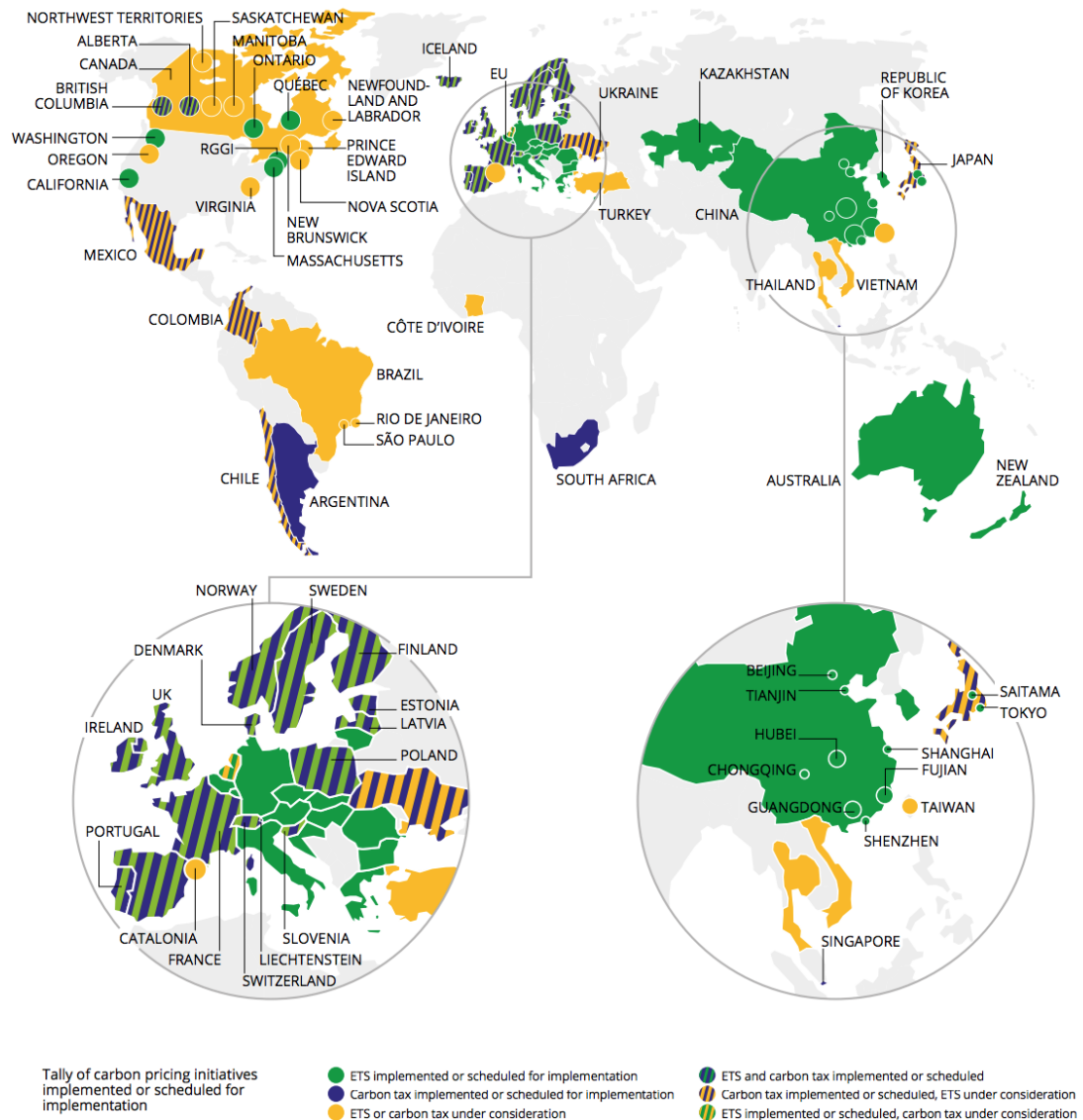


Figure 2 Map of national and subnational development around carbon pricing (WorldBank 2018, p. 9)

The figure 2 gives an overall picture of the development around carbon tax- and the carbon ETS systems. It can be seen that Europe together with China, Australia, New Zealand, Canada and parts of Japan and the US are leading the way towards making carbon a cost.

2.2 Stakeholder requirements for carbon accounting

Carbon performance is looked from different angles depending on whether the stakeholder is internal or external. External stakeholders, like investors, might have different requirements for the measurement of carbon performance when compared to internal stakeholders, such as company employees or managers. The requirements between external stakeholders such as NGOs and investors differ a lot. The table 2 looks at the different stakeholders and their requirements for carbon accounting, it highlights the different and often times contradicting needs between different stakeholders. These requirements are based on their requested information needs and as the table points out, different stakeholders look at carbon accounting with different requirements. This means that different accounting approaches need to be designed depending on which stakeholder the organization wants to communicate to. (Gibassier & Schaltegger 2015, p.343)

The accounting characteristic, comparability, which is requested often by external stakeholders like investors, rating agencies and governmental labeling programs comes to conflict with the accounting characteristic of connectivity, which is often preferred by internal stakeholders such as managers and employees. Internal stakeholders want connectivity because of the need to link carbon accounting with the organizations financial management accounting systems. This makes it often hard for comparability since each organizations management accounting architecture differs from one another. Comparability is a characteristic that is crucial for external stakeholders such as investors, because of their standard database type modeling practices. Investors evaluate different companies inside and between industries, this is why they want comparability with different organizations. (Gibassier & Schaltegger 2015, p.343)

Comparability through standardization has its downs, an example of the kinds of problems that arise through standardization; the GHG requires that the carbon is measured in the production phase and often time's managers responsible of selling the products are responsible for a certain area or a region, which might differ from where the products are being produced. Say for example if a company's production is located in Vietnam and the manager responsible of selling the product is responsible and measured for the sales in the Nordics. This usually means that the manager has none or very little possibility to affect the production phase. Certain stakeholders such as NGOs want to see concrete measures of reduced carbon emissions, often times implementing a simple carbon accounting system can contradict with principles such as accuracy and with the scientific

complexity of the topic. Creating a simple and even inaccurate carbon accounting system can come to criticism of greenwashing by NGOs and other environmental rating performance institutions such as the CDP. (Gibassier & Schaltegger 2015, p.343)

<i>Stakeholder</i>	<i>Requested accounting method</i>	<i>Main requested characteristics for accounting</i>	<i>Auditability</i>
<i>Investors</i>	GHG Protocol Corporate Standard	Comparability of results (between companies)	Yes
<i>Rating Agencies</i>	GHG Protocol Corporate Standard or equivalent ^[1] _{[5][6]}	Comparability of results (between companies)	Yes
<i>Governmental programs</i>	Life cycle based (PAS 2050, BPX 30-323-0)	Comparability of results (between products)	Yes
<i>Distributors</i>	Life cycle based, sometimes private scheme	Readability	Private auditing approaches exist
<i>Consumers</i>	Life cycle based	Readability	Certifiable (based on a labeling system)
<i>NGOs</i>	Life cycle based or GHG Protocol corporate standard (disclosure)	Must translate action of emissions reduction into accounting numbers (accuracy)	No specific auditability required
<i>Managers</i>	Flexible “management accounting” method that can reflect their own work structure and that is based on a legitimate accounting standard	Readability and connectivity with financial management accounting structure. Must translate action of emissions reduction into accounting numbers (accuracy)	Certifiable (based on standard)
<i>Employees</i>	Flexible “management accounting” method that can reflect their own work structure	Readability and connectivity with financial management accounting structure. Must translate action of emissions reduction into accounting numbers (accuracy)	No specific auditability required

Table 2 Stakeholder Requirements

(Gibassier & Schaltegger 2015, p.344)

According to Gibassier and Schaltegger (2015, p. 343-344) the three main characteristics that the stakeholders pay most attention to, are comparability, readability and connectivity. With comparability stakeholders can compare the data within accountings systems from different companies. Readability refers to how understandable a carbon accounting method is to a consumer or a distributor of the product being measured. Readability is especially important when a company’s carbon accounting is being used as a marketing tool. Connectivity in this frame refers to the aspect of how well can the carbon accounting system be integrated together with the company’s other accounting tools. (Gibassier and Schaltegger, 2015, p. 343-344)

Comparability, readability and connectivity is what the stakeholders mainly want, but when looking at the requirements from the ratings institutions perspective they look at disclosure, compliance and actions taken to reduce carbon emissions, when measuring a company's carbon performance. Disclosure in this frame means how well a company discloses its carbon accounting according to the accounting standard it follows. Compliance looks at how well does a company comply with the accounting standard protocols and actions taken refer to concrete actions taken, such as steering the company's strategy towards a more sustainable path. (Gibassier and Schaltegger, 2015, p. 343-344)

A study by Qian et al. (2017, p. 1616) showed results that carbon accounting tools with all their differences and flaws are either way seen useful by companies in managing carbon. Companies according to Qian et al. (2017, p. 1616) most commonly implement first the systems that provide auditing and benchmarking aspects. These tools are mostly used by the companies to meet external auditors needs such as the ratings agencies also mentioned in the table 2, to meet reporting purposes. It is after this system that companies develop their carbon accounting systems to meet other more complex requirements, such as strategic aspects. (Qian et al. 2017, p. 1616)

Carbon accountings control systems are usually the next step that companies take on their carbon systems to bring strategic aspects in addition to meeting auditing and benchmarking needs. It has also been said that when companies take this development the quality of the data improves together with the ability make use of the data in a broader perspective. It has been said that the reason for the lower quality of the data in auditing and benchmarking systems results from how detached the reporting requirements guidelines are from a company's internal processes. (Qian et al. 2017, p. 1616)

2.2.1 Different organizational fields and accounting approaches in carbon accounting

As mentioned earlier, the same way how different stakeholders have different requirements about the characteristics for carbon accounting, the same way also different fields have differing perspectives on how they want to incorporate their views on the ongoing conversation of carbon accounting. Here with different fields, Bowen & Wittneben (2011, p. 1025) refers to three different communities which interact with each other on the issue of carbon accounting:

- (1) Scientific community that look for ways to identify GHG emissions.
- (2) Accounting professionals which try to mold GHG emissions into data that can be used as decision-relevant data for accounting systems,
- (3) Policy makers, lobbyists and nongovernmental organizations which are planning carbon accounting systems for countries and companies.

Achieving a common view about accuracy, consistency and certainty is difficult in carbon accounting because these different fields prioritize their separate goals. Each pointed out that each community representatives highlight different priorities across key dimensions, which leads to these communities seeing carbon accounting in different ways. This might not be ideal for the future development and credibility of the whole scheme, so a more unified stance is needed in the talks surrounding the issue of carbon accountings accuracy, consistency and certainty. (Bowen & Wittneben 2011, p.1023–1026)

For a carbon accounting system to function, the system needs to have a measurement technique which accurately reflects the actual emissions that are released as a result from the company's operations. These systems need to be consistent in its measurement and contain indicators of certainty for a valid interpretation of the data. As talked in the stakeholder scheme in the chapter 2.2, organizations encounter different requests from their carbon accounting data. Each of these three communities are developing different strategies on how to meet the demands for accounting. Many of the companies are pressured to take actions on carbon accounting through competition, public perception, regulatory environment and monetary savings. (Bowen & Wittneben 2011, p.1023–1025)

Even though there are different approaches and standards for carbon accounting, Gibassier & Schaltegger (2015, p.346) points out that there are three major types which organizations take. These three approaches are (Gibassier & Schaltegger 2015, p. 346)

- (1) Organization carbon accounting
- (2) Product carbon accounting and
- (3) Project carbon accounting.

Organizational carbon accounting looks at carbon emissions of an organization as a legal entity and its first carbon accounting standard was released in 2001 by the Greenhouse Gas Protocol (GHG Protocol), this is also the most widely used carbon accounting

method currently (Gibassier & Schaltegger 2015, p.346) . The GHG Protocol still does not make sure that every single accounting approach within that standard would be similar to one another, many of the different selection possibilities between organizational boundaries make it possible so that the accounting results may differ much from each other. (Gibassier & Schaltegger 2015, p. 346)

Product carbon accounting as its name brings out, concentrates on measuring carbon emissions only from the products point of view. Its measurement is based on a life cycle assessment (LCA) concept and is often used for products eco-labeling. The most used standard methods for product carbon accounting are Publicly Available Specification (PAS) 2015 which the British Standards Institute (BSI) has launched and the Product Life Cycle Standard from the GHG Protocol Initiative. (Gibassier & Schaltegger 2015, p.347)

The third major approach for carbon accounting, project carbon accounting, concentrates on attempts to reduce carbon emissions, storage more carbon or enhance the reduction of carbon emissions through a project point of view. The most used standard method is the Project Accounting Standard from the GHG Protocol. Here the word project is not looking at carbon accounting from a company's project perspective, but rather setting up projects in which the attempts is to achieve a new carbon goal through the project. As an example, this approach can be taken to modifying an organizations existing production processes, or management systems in a delivery process. It can also be a creation of a totally new system, which helps the organization in achieving a new carbon goal. (The Greenhouse Gas Protocol 2005b, p.11)

Ascui and Lovell (2012, p. 57) presented in table 3 what carbon accounting consists of, since it can reach to internal and external accounting and reporting and also be measured as either physically, which refers to the carbon flow itself, or measurement using monetary values. While accounting as a profession is engaged more and more towards strategic management in carbon accounting, this trend has not yet reached its full potential, but subjects like internal carbon pricing which is supported largely by the CDP are gaining larger popularity between companies. Internal carbon pricing is setting a price on carbon internally and using it for example together with investment calculations. As environmental management in business has grown, also interest towards better understanding the financial costs and benefits as an input to management accounting has grown. This is fueled by the evidence of the positive financial factors that environmental factors can have to a business. Also, the probability that these effects will grow in the future, both through public and market forces is in growing. The future requirements for organizations

include higher levels of capital and operating expenses for pollution control through legislative factors or the introduction of more and tighter eco-taxes and incentive-based forms of regulation, like subsidizing greener production. For internal accounting and reporting purposes companies need to present the financial effects of environmental factors to investors, lenders and other financial stakeholders, this is what the CDP is largely trying to achieve, through the gathering of a databank. So far governments are failing to gather such data and provide them to different stakeholders. (Bartolomeo et al. 2000, p. 35)

	Internal (management accounting)	External (accounting and reporting)
Physical	Carbon flow accounting Strategic carbon management accounting	Carbon footprinting and labelling (products) Carbon Footprinting and reporting (organisations) Climate risk, opportunity and governance disclosure
Monetary	Carbon cost accounting	Financial carbon accounting and reporting

Table 3 Examples of key types of carbon accounting in organizations

(Ascui and Lovell 2012, p. 57)

The next chapters will concentrate in looking more closely on what carbon accounting can mean especially in the concepts surrounding in strategic carbon management, carbon cost accounting, financial carbon accounting, control systems and reporting.

2.3 Organizational motives for carbon reporting

Whereas the chapter 2.3 concentrated into looking on what are the stakeholder's requirements for carbon reporting/accounting this chapter looks closer on what are the organizations motives towards reporting.

As mentioned already carbon accounting has been in an upward trend, the CDP for example has increased its amount of reporting organizations from 221 in 2003 to over 4700 organizations in 2017 (CDP, 2018d; Bartlett et al. 2017, p.8) and the UK government in pursue of promoting better environmental performance now requires as the first country in the world, for publicly listed organizations to disclose their GHG emissions in their financial reporting. Still past research has shown that having firms reporting different carbon reports has not been seen to directly make organizations lower their emissions, there are many other factors that have an effect on this, like the sector and energy intensity. (Tang and Demeritt, 2018, p. 438, 453)

How is carbon reporting actually motivated, was studied by Tang and Demeritt (2018, p. 438-439) where they concluded interviews with 168 different sector organizations and ended up creating the table 4 below, which presents how different organizations react towards carbon reporting. This study shows that rather than acknowledging that carbon reporting has a similar effect on all organizations, it affects some more than others, and that a very important factor is the stakeholders behind the company's perception on it. According to Tang and Demeritt (2018, p. 437) the organizations most inclined to carbon reporting are the energy intensive and economically regulated organizations. These organizations can be in the field of energy sector or heavy industry. The incentives are the highest for these organizations since by reporting their carbon emissions they can themselves follow their energy usage and make it more efficient which leads to savings. Companies which are run in a very regulated field were incentivized to be proactive as a result of the possible sanctions and reputational damage that could result of noncompliance. (Tang and Demeritt, 2018, p. 451)

	Non-energy intensive	Energy intensive
Non-Economically regulated	<p><i>Performative legitimacy seeking</i></p> <p>Reporting shaped by reputational concerns and liable to be de-coupled from actual practice without strong brand differentiation or consumer pressure for emission reduction.</p>	<p><i>Competitive eco-modernism</i></p> <p>Strong financial pressures to reduce emission, but degree of disclosure will depend on reputational concerns.</p>
Economically regulated	<p><i>Compliant legitimacy-seeking</i></p> <p>With little direct financial incentive to reduce emissions, reporting shaped by reputational concerns and opportunities for regulatory arbitrage, which will determine the degree to which reporting is closely coupled to effective mitigation action.</p>	<p><i>Compliant efficiency-seeking</i></p> <p>Mutually reinforcing economic and regulatory incentives to couple detailed reporting to substantial emission reduction.</p>

Table 4 Sectoral differences between organizations on how carbon reporting is being influenced

(Tang & Demeritt 2018, p.452)

On the other side of the spectrum organizations that are non-energy intensive and non-economically regulated are not really affected by non-other factor than reputational aspects. These companies can't really have significant savings from cutting energy or be imposed by risks related from the regulators side. This means that they might find carbon reporting less beneficial and see less pressure to disclose. On the other hand, organizations in this segment could use carbon disclosing as a market differentiating factor. The sector companies that would fall into this category could be the financial sector. (Tang and Demeritt, 2018, p. 452)

While in the introductory chapter 2.1 Burritt et al. (2011, p.81) pointed out motives such as avoiding emissions trading certificates in cap n trade systems, energy saving efforts, product labeling and industry pressures. Tang and Demeritt (2018, p. 442-445) found in their study three different rationales for why organizations are motivated to report their carbon emissions: financial, reputational and regulatory factors. Many of the factors from Burritt et al. and Tand & Demeritt studies cross one another. The financial factors derive from the link between emissions and energy consumption, so many organizations who want to start energy saving programs can do so by calculating their emissions, so organizations can sort of do both at the same time and gain financial benefits while complying with carbon disclosing requests. In the interviews made by Tand & Demeritt (2018, p. 442) it came up that carbon reporting was seen by managers as a good

way to keep track of their emissions and overall energy usage in different parts of the company.

Reputational pressures were seen as an aspect where possible profit factors were not really there, but rather as a key aspect to respond to key stakeholders requests. So the motives behind an organizations carbon reporting can be seen as dependent on what stakeholders are associated with the organization. These days many investors are looking into organizations and how their reacting to climate issues. According to Tand & Demeritt's (2018, p. 443) study, over a third of 168 interweaved organizations mentioned external pressures coming from shareholders such as investors and clients have affected their carbon disclosing decision. Carbon disclosing was also used as a tool to help managers be on track of the whole emissions scheme and provide explanations for example if emissions have gone up. The CDP also has a ranking system between sectors, on emissions performances, which makes it possible for organizations to differentiate themselves by outperforming their peers and attract new investment. (Knox-Hayes & Levy 2011, p.92)

The regulatory environment was also seen as a major factor. According to Tand & Demeritt's (2018, p. 444) study, 60 percent of their 168 interviewed organizations mentioned practicing carbon reporting because they were in some regulatory level obligated to do so. Many of these organizations noted that they would do what is necessary to avoid the non-compliance in order to avoid possible reputational risk that could occur from it. Carbon reporting can help organizations to meet other regulatory requirements, such as government subsidized funding for green projects. Some energy utility sector companies are seen to have used carbon reporting and regulatory costs resulting from it, as reasons to justify higher prices. (Tang and Demeritt, 2018, p. 445)

Some organizations don't see any value in carbon reporting but are just doing it because they're following industry peers, so they do not run into the risk of departing from the norm. In these cases, it was found that while these organization participate in reporting they don't necessarily take the actual same efforts than what their peers take. This way these mimicking organizations can mask themselves into seeming to perform better than what is reality. (Ihlen, 2009, p. 257–258)

2.4 Carbon price in Investment decisions making

As mentioned earlier carbon pricing can be introduced in many different forms, depending on the overall scale of the process inside a company. But one way, which many organizations have found suitable to implement it, is in the investment decision-making phase. Often times many of the investment decisions made in a company impact its operations far into the future, these investments can by nature be large in their capital requirements but also in their uncertainty. A lot of time and recourses are spent on these decisions because of their nature. Poor investment decisions can affect a business's stability for a long term and usually the capital tied to a bad investment is difficult to recover. It is understandable because of these reasons for companies to integrate sustainability concerns into investments in a quantitative or qualitative manner. (Bhimani et al. 2012, p.411)

A company decides on their decision-making model, which is the controlling system for the method of making decisions. The model consists of gathered quantitative and qualitative data that is then compressed to analyses for the managers to make decisions. The decision-making tool for investments is one branch of the managements control system toolbox. The control system gathers data to which can be used in the decision-making process for further analysis. Table 5 below expresses the decision-making process which is; gather information, making predictions of the future variables that the models are built upon, choosing from the different options made available through analysis, implementing the decision and finally evaluating actual performance to provide feedback. Feedback is important for future development and evaluation of the decision making process. (Bhimani et al. 2012, p.304)

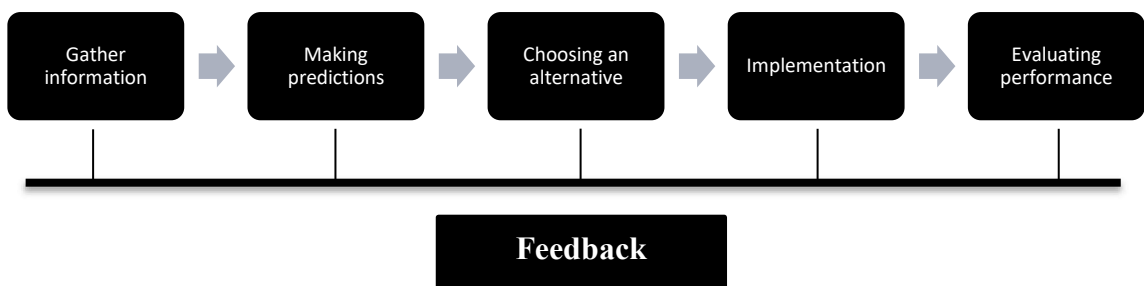


Table 5 Decision making process model

(Bhimani *et al.*, 2012, p. 305)

The carbon information flow coming from different departments of the company is important especially if sustainability is seen as a strategic objective. Different control systems ease the managers follow up on how the company wide objectives are being implemented in daily decisions. Also, possible incentive plans might rely on the data flowing to the control system. As avoiding and controlling carbon is becoming ever more valuable to companies, it needs to be measured and tracked to be controlled (Goldman Sachs 2009, p.5). This is why carbon accounting relies heavily on the company's control systems, which are crucial for achieving companywide targets. (Bhimani *et al.*, 2012, p. 601-602)

Vesty et al. (2015, p. 302-303) studied an Australian state-owned water facility company that implanted a carbon price in their net present value (NPV) calculations, so that their investment decisions would be steered more towards sustainable decision making. Through the NPV model the water facility could better evaluate its current infrastructure assets but also better evaluate future ones. Introducing a carbon expenditure into its NPV model meant in the water facility's case that through the re-valuation of the company's current assets, investment flows into newer more sustainable assets might come sooner than would otherwise have. This is why introducing the carbon expense into NPV calculations changes fundamentally how the company views its assets. This might be seen as too dramatic of a change for some companies, so it could be imagined that some companies only choose to apply carbon expense into only all new investment decision calculations. (Vesty et al. 2015, p. 302–303)

A carbon price can be implemented into an NPV model as seen in the table 5. The carbon emissions expenditure affects the operating income before tax and thus reflects into the net cashflow of the targeted investment. In the different stages of the capital budgeting, carbon expense comes to light in the Information-acquisition stage of the capital investment decisions. In this stage decision makers consider the estimated costs and predicted consequences of all the capital investment propositions, which can be quantitative and qualitative. Sustainability issues can be also included in these investment decisions models as in qualitative and/or quantitative form. In the case study of Vesty et al. (2015, p. 314) having carbon as a number was perceived to have an effect on how carbon was seen and taken into consideration inside the organization. A carbon expense may also be taken into account separately and thus not included into the NPV models, but this could have implications where the number could be seen to have less authority and would be

easier to dismiss in the decision making process. (Bhimani et al. 2012, p.411; Vesty et al. 2015, p.314)

Non Deductible Expenses										
Carbon emissions Expense			115	164	181	94	97	109	111	57
Total Non Deductible Expenses	0	0	115	164	181	94	97	109	111	57
TOTAL OUTFLOWS	11 233	10 958	525	605	713	657	693	738	5 648	591
NET FLOW BEFORE TAX	(11 233)	(10 958)	(525)	(605)	(713)	(657)	(693)	(738)	(5 648)	(591)
TAX										
Operating Income before Tax	0	(288)	(411)	(441)	(532)	(563)	(595)	(629)	(664)	(534)
Depreciation	535	898	838	783	734	689	648	611	772	733
Taxable Income	(535)	(1 186)	(1 248)	(1 225)	(1 266)	(1 252)	(1 244)	(1 240)	(1 436)	(1 268)
TAX PAYABLE	(161)	(356)	(375)	(367)	(380)	(376)	(373)	(372)	(431)	(380)
NET CASH FLOW	(11 072)	(10 602)	(151)	(238)	(333)	(281)	(319)	(366)	(5 218)	(211)
Net Present Value (24 479,6)										

Table 6 Inclusion of a carbon expense in NPV

(Vesty et al. 2015, p.315)

In the case study of Vesty et al. (2015, p. 304) the regulatory environment only required organizations to have reported the emissions in a way that would have left out the carbon factor out from the internal management accounting systems. In this case of the water utility organization emissions would be modified into a carbon cost that would be used in the internal management accounting systems for asset valuation in and decision making for the organizations long term investments in infrastructure. (Vesty et al. 2015, p.304)

2.5 Management control systems and carbon

Carbon management control systems (CMCS) is a tool for companies to follow up on their carbon objectives. As mentioned in the beginning of the earlier chapter, companies need control systems to coordinate different strategic objectives, one of which can be the data flow coming from their investment decision processes. This chapter looks at carbon management control system (CMCS) framework (figure 2) developed by Bui and Villiers

(2017) which relies on the earlier work into MCS of Tessier & Otley (2012), but with an added emphasis on the employee perception. Company employees need high quality information and communication to help them view carbon objectives as more positively and understandably. These companies can for example communicate through their vision statements and/or guidelines. Vision statements are an especially good tool for this if they are also in line with the current company identity. These different channels and the used language of communication ensure the achieving of better carbon management strategy. (Bui and Villiers, 2017, p. 1287)

Control systems exist to help companies follow on the progress made on the objectives that they have set beforehand. MCS's can be used to follow objectives regarding compliance or performance and as mentioned these control systems also help in determining the incentivizing or punishing of the company objectives. Depending also how intensively managers use them, control systems are used either diagnostically or interactively, the difference between them is not technical but how they are used. Diagnostic ones being a more isolated set of measures from where the action happens, they are used for the monitoring of the overall performance. Interactive controls are used more interactively by managers, with which they involve themselves into the decision activities together with their subordinates. The interactive control measures are the ones which also employees follow, when diagnostic ones are usually only followed by managers. This is why interactive systems are the control systems that managers really pay attention in the achieving of the set strategic objectives. (Simons, 2014, p. 226–236)

Managers are especially interested in the critical performance variables that follow the development of the goals set to achieve the company strategy. This is why companies need to think which factors are the most important ones in achieving their set strategic objectives. Without the right performance measures managers can't communicate nor implement the strategy in an effective way. This is why the right variables need to be carefully analyzed and identified. One of the risks for a control system not working for the benefit of the strategy lie in measuring of wrong variables. Wrongly set variables can do actual harm to companies and building weak control systems for tracking carbon goals might backfire if the employees interpret the systems not as important. This might be an especially common problem for environmental control systems, if their importance is not communicated strongly enough. After the right goals have been set, managers really need to analyze the feedback from the systems in order to track performance. When companies

chose the best suited control measures for carbon, it could be that when the strategic objective is to control carbon or achieve a certain level of reduction, an interactive approach would be more in line with these needs. If the need is more compliance and disclosing related, then a diagnostic approach would be better suited. It was found by Bui and Villiers (2017, p. 1289) that interactive discussions can reduce the uncertainty around the carbon topic inside the organization and could also encourage further innovation. (Simons, 2014, pp. 227–231)

Figure 2 presents a framework for how companies can monitor, measure, report and control their carbon emissions. CMCS in a wider perspective follows the whole process in controlling carbon from two strategic levels; strategic performance (SP), strategic boundaries (SB) and two from an operational level; operational performance (OP) and operational boundaries (OP). In to the strategic performance controls box qualify the interactive performance tools such as the monitoring of carbon risk and their assessment of it, this involves the top-level managers and the whole rethinking of existing strategy direction. Strategic boundary controls represent the broader scale tools to setting boundaries by including carbon into the company's visions statement and thus preventing company employees in unethical opportunities. Operational level performance measures are the tools which are closely followed and measures which employees need to achieve, for the company to achieve it strategic goals. The operational boundary tools are those tools which inform employees of their concrete limits of their actions. Figure 2 by Bui and Villiers (2017, p. 1287) presents also under each level a list of examples of the concrete tools can be in the case of carbon. (Tessier and Otley, 2012, p. 178-179)

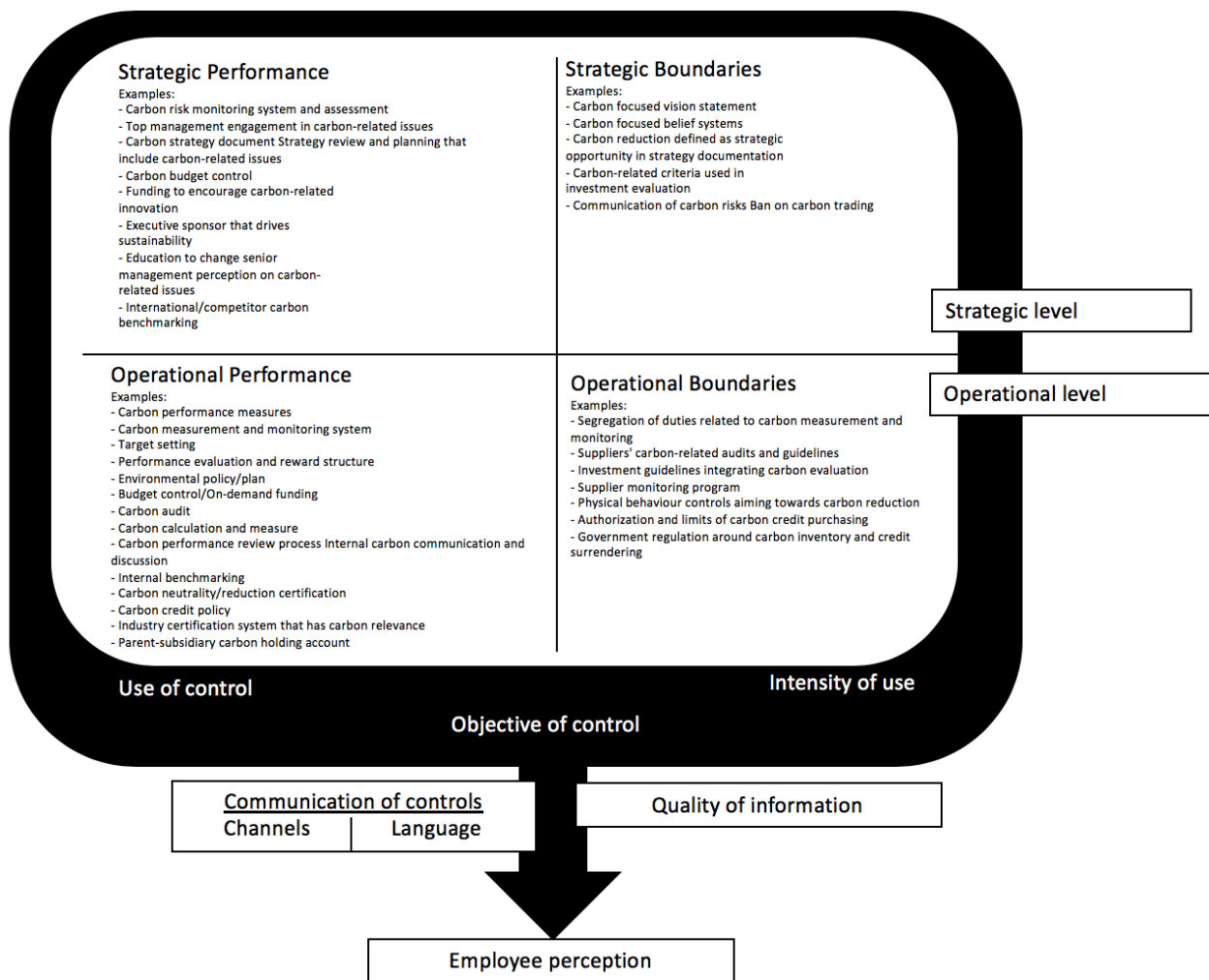


Figure 3 Framework for carbon management control

(Bui & Villiers 2017, p.1287)

Carbon control can through the different approaches (figure 2 examples) enable companies to recognize their carbon footprint and recognize the areas of improvement. In the most basic control system companies can at least meet the regulatory disclosing requirements. In a more strategic approach companies can implement control systems that monitor, incentivize, make risk assessments and allocate the responsibilities of carbon questions in a clear and straightforward way. Carbon management systems especially if implemented in a strategic way might cause problematic situations if the company decisions don't always align with the strategic goals for example some investments might seem too profitable in the short run to bypass, especially for those companies whose internal price for carbon is at a relatively low level. This is why the internal price for carbon also signals a message for employees of the level of commitment. Is the company steering its investment decisions and product design or will it be used in a limited way to achieve mainly

unhurried reductions in emissions. In an business environment where the price for carbon is rising (EU-ETS) and predicted to rise in the near future, companies need to make the decisions on their strategy for carbon (Stiglitz, 2017, p. 8). (Bui & Villiers 2017, p.1292)

2.6 Carbon management accounting and traditional financial analysis

The financial performance management is a constantly evolving field of research and it has no universally set to stone framework, even though it is a well-established process within a business. An organizations financial analysis is often dependent on the actual strategic objective that are set for the company to pursue. Ranganathan (1998, p. 8) noted that if the strategic objective is to pursue change in the organization the purpose of the financial analysis is to try to help the decision makers to detect possibilities inside their organizations that could create more value for the organization. And when the objective is to bring about change so that the organizations can solve some of the existing problems that are seen risky for business, the aim of the financial analysis is to try to detect these value depleting sources inside the organizations operations. (Castro and Chousa, 2006, p. 88–89)

Managing environmental, social and economic issues plays a crucial role in the survival of an organizations long term success to generate shareholder value. Carbon emissions are a central part of this and integrating it into traditional financial analysis is what many organizations currently do or try to do. The earlier chapters brought insight on how carbon can be added as a cost to investment decision making or into a company's control systems, but new emergent theories are arising on how organizations can solve this problem in a way that harmonizes carbon accounting and traditional financial analysis. (Castro and Chousa, 2006, p.83)

Even though it might be premature to say that there is prof between better profitability and good environmental performance, there are areas where good environmental performance or even adding it as a risk managing aspect to business helps companies to attract equity at a lower price which in turn results into lower cost structures. As many pension funds are setting environmental disclosing requirements to companies that they invest in, there is pressure for organizations to start noting the business risks of climate change. May these risks be because of the higher price for carbon in an ETS market, changes in the regulatory environment or through direct drastically changing weather af-

fects. In this chapter we will discuss a financial analysis model where sustainability affects are connected to the businesses overall main ratio figures such as ROA (return of assets) and ROE (return on equity). (Li, Eddie and Liu, 2014, p. 416–417)

There are different views on how environmental and economic performance go together, if they even do so. But it can be said that it is not all straightly correlated, many other variables affect the total outcome. Relation between economic and environmental performance is dependent of the strategies, management activities and different concepts and the implementation of these factors. It is not so fruitful to try to get a simple answer to the questions “is environmental management profitable”, but like any strategic business decision it is dependent more on the overall situation and circumstance and how environmental strategy contributes to competitiveness in those situations. Some companies might hold recourses or capabilities which are difficult to imitate and give them the strategic competitive edge which is very hard for peer competitors to imitate. (Schaltegger & Synnestvedt 2002, p.341)

Adding existing financial tools sustainable factors would be one way to measure sustainable strategies results into value for shareholders. Incorporating sustainable factors into organizations existing traditional financial analysis models would help organizations asses and plan the connections between these factors since many of these tools have room for improvement. The traditional financial analysis measures would concentrate not only in giving measures of the company’s past performance, but also of its future prospects which is especially important for strategic decision making. It has been stated that current sustainability scheme lacks theoretical frameworks or suggestions of how to incorporate them as quantitative measures, which as stated in earlier chapters is important if the objective is to incorporate carbon as a cost to business. Below (table 7) presents a conceptual model on how to incorporate sustainability factors into financial analysis. (Castro and Chousa, 2006, p.85)

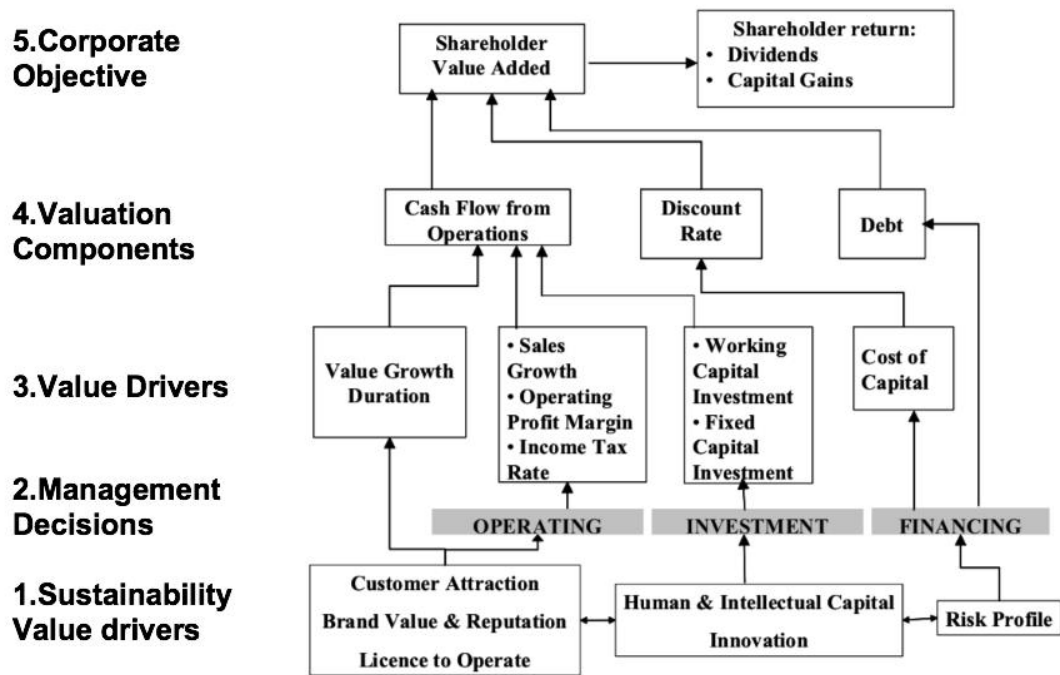


Table 7 Conceptual model of financial analysis and carbon risks

(Castro and Chousa, 2006, p.327)

Castro and Chousa, (2006, p. 92–93) noted six financial value creation factors in sustainability, which were; customer attraction, brand value & reputation, license to operate, human & intellectual capital, innovation and risk profile. These six value drivers can be seen to have an incendiary effect in linking sustainability issues and the decision-making process. All of the six factors through this model can be taken into consideration in an organization’s investment, operating and financing decisions. As was pointed in the second ladder of the model “management decision” of the table 6. From the point of view of carbon accounting, it can have an effect to all of the three management decisions factors, operating, investment and financing steps, it depends much on what use does an organization try to achieve through their disclosing of carbon emissions. In the financing factor, the company can assure their stakeholders of taking into consideration the climate change risk aspects, by having for example an internal price on carbon which steers the business decisions to more low carbon operations. Having an internal price on carbon also affects the investment factor the same way. The operating factors can be achieved through having their products being labeled as low emission products. (Castro and Chousa, 2006, p. 92–93)

In this chapter the viewed traditional financial analysis model to integrate the sustainability issue into is based on the ratio decomposition principle, also known as the DuPont model (Chandler 1977). The DuPont model is being used to analyze an organizations financial situation through the decomposition of key ratio figures into more detailed parts. The DuPont model unites the income statements and balance sheet to form two key factors of profitability, the return on equity ratio (ROE) and the return on asset ratio (ROA). These ratios together with the theory assemble the a pyramid on financial that is shown below (table 8) that resembles the DuPont models methodology. (Castro and Chousa, 2006, p.95)

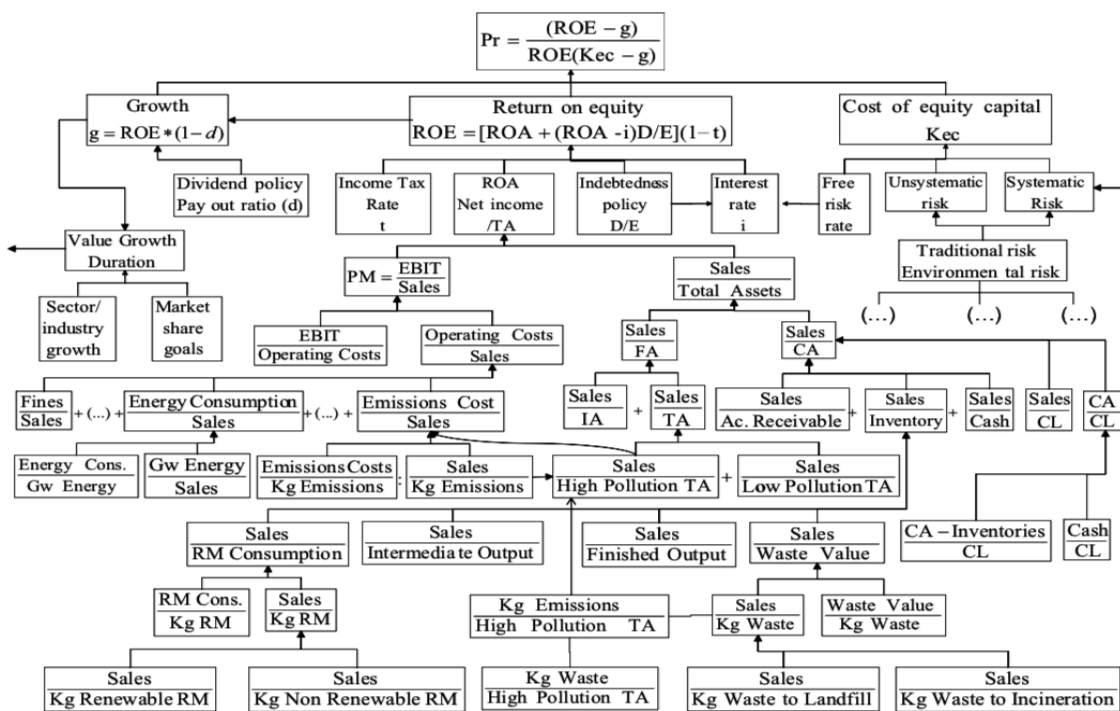


Table 8 Model of integrating traditional financial analysis and carbon risks

(Castro and Chousa, 2006, p.102)

In the modified DuPont model on table 7 the most important causes that deliver the results to the top ratio figures are in the base of the pyramid. The top-level ratio in the pyramid mirrors the relative price per share number, which is a direct causal effect of three lower ratios, ROE, cost of equity capital and the rate of growth. After the suitable ratios and relationships have been identified the next phase is to formulate all of the rules that explain the strengths and weaknesses to guide the organizations strategic decision-making

process. The purpose of formulating these rules is to make it possible to find the right cause-effect links so that they can be analyzed. All of this is done by taking into consideration the conventional financial theory together with the sustainability knowledge. (Castro and Chousa, 2006, p.102)

The whole analysis model should steer the organization in finding the right kind of sustainability management, so that decisions can be made on the base of what decisions result to value for shareholders. The model will also make clear of what kind of sustainability management will result into the depletion of shareholder value. The use of ratios seems so simple, since they produce one clear number which can be used in the decision making. Using these ratios thinking that they are easy to use can steer the decision-making process in a very wrong path. The use of ratios should always be used through skillfully interpreting the influencing factors. There are many artificial cognitive software capabilities that can be used to assist in finding the right and test the relationships between different factors behind the ratio. (Castro and Chousa, 2006, p.103)

2.7 Sociological perspective of carbon as a number

A number brings authority itself, but especially to the finance department, who are often very involved in the organization's investment decision-making process, it makes an issue like sustainability real. Numbers also disciplines the decision makers to consider the subject in the investment decision and look at it from an objective point of view. Having a carbon expense in different investment calculations brings consistency throughout all investment decisions, this way sustainability is taken into consideration in all projects with the same parity. Taking carbon in account only in a qualitative manner can cause inconsistent evaluations of carbon effects between projects. Although having qualitative perspectives is important because it brings flexibility on how carbon is being considered in different projects, since in some projects it is easier and more cost-efficient to take carbon factors in a greater degree than in others. Organizations should hold on to this flexibility even if carbon would be presented as a qualitative manner. This is why carbon should be presented as a number together with the qualitative factors in an organization. Many of the non-positivist research made on the field of carbon accounting also consists of the sociological literary view. (Vesty et al. 2015, p.316)

In the Vesty et al's. (2015, p. 316) case study of the state owned water utility company a environment & technology manager mentioned of not having a clear vision about sustainability factors before they included carbon as number into their NPV calculations. When it is presented as a number in the companys investment calculations, each one in the organization is forced to present that they have considered carbon as a cost in their decision making. And if they had not included it, they needed to explain why it was not used. This kind of implemenation of carbon as cost in a companys operations cahnges the whole past cahin of thought process around investment decision making. (Vesty et al. 2015, p.316)

From the quote it can be concluded that considering sustainability in organizations is not often so easy and can become more of an unwanted burden. In order for a company's employees to consider sustainability in their daily work, the workers need to have the right tools to include it according to Vesty et al. (2015, p. 316). It can be concluded that people might really want to contribute to sustainability in their organization and that they might take pride in that. In the case of the water utility organization carbon expense was both a number, in the sense of costs and a value source. Value meaning in this context, how responsible the company was with their assets and investments. (Vesty et al. 2015, p.316)

With numbers different parties can usually persuade the parties they wish to, which can be because of the nature how people grant authority to a number. The reason why numbers are granted this authority can be partly explained by using Espeland and Steven- ses (2008, p. 417) classifications of the sociology of quantification. Espelands and Sten- venses explain how numbers present accuracy and validity to different parties, but that they also provide a link to rational thinking in an objective manner. These are the charac- teristics that sustainability issues often times lack of. So having carbon in a quantifiable form presents more authority into it. Like it has been noted numbers have attributes that can contribute for the members of the organization to work and react in a certain way. (Espeland & Stevens 2008, p.417)

And what carbon markets are trying to achieve is to include emissions into the eco- nomic calculations through a price. In the carbon market economic participants either need to bear the costs directly or indirectly. Direct emitting costs come through the needed emission allowances that need to be purchased from the market. Indirect emitting costs come to organizations through the opportunity cost because organizations that manage to

lower their emissions can sell their emitting allowances that are given to them in the market, for a profit. Also organizations that manage to lower their emissions from the “business as usual” levels get credits. (MacKenzie 2009, p.441)

3 EMPIRICAL PART

3.1 CDP survey material background

CDP works as an independent non-profit organization which collects a databank regarding the accountability for climate change issues. CDP collects this data through questionnaires sent to companies, cities, states and regions for the reporting of their current practices regarding climate issues. The questionnaire consists of multiple parts around the climate issue subject. In the year 2017, from which this study's CDP data consists of, over 4700 organizations around the world responded to (Bartlett et al. 2017, p.8). The report is being mainly disclosed for the interests of investors around the world, but also for research purposes. Currently CDP has the most comprehensive self-reported data-storage in the world. CDP's objective has been to create a system that would make engagement possible on environmental issues between investors, companies, states and cities. The stakeholders requesting the material consist mostly of investors, which all together hold assets of around 87 trillion dollars. Since CDP is the largest voluntary databank of company carbon data and so far there has been little academic researches that have utilized the data, it makes sense to explore this data in closer depth. Although there are fairly recent studies like Matsumura et al. (2014); Blanco et al. (2016; 2017a); Ott et al. (2017); Luo and Tang, (2016); Timo and Stefan, (2017) that have used CDP data for research purposes. (Andrew & Cortese 2011; CDP 2018a)

The biggest users of the CDP data are pension funds, active equity managers, investment advisors, SRI funds, passive equity managers, index providers, broker dealers, data providers, third party research and academia. Since this study was partly built on the secondary analysis of an already gathered data, it is important to know which are the stakeholders that use the data of the CDP climate change report. This also affects the answering side, the companies that give the answers are aware of the stakeholders who want the information, which are mainly investors. Investors as stakeholders require comparability between results (between companies) as pointed in the chapter 2.2 in the theory review, so this might mean that numbers and more forward communication is mostly appreciated. This might make the CDP material also more pleasing to use for research, since the answers won't be presented in a marketable way from the organizations side, with information that would present itself in a more greener way than actually is. So, the

fact that organizations know that they are mostly communicating to investors, might incentivize them to just present the facts and used hard information rather than misleading presentation of material with the overstatement of actions or visually try to communicate a greener message of the organizations actions. There are studies to support that organizations CSR reporting might not be the best place to search for actual environmental performance and that they usually contain forms of greenwashing (Clarkson et al. 2011, p.53–55)

The Climate change 2017 questionnaire was sent in the Nordic segment to the 260 largest companies according to market capitalization, to which 222 responded. So there might be more companies in the Nordics who use carbon accounting and utilize it in different forms but this study has concentrated in looking into the reported companies by the CDP in the Nordics. The 18 companies from the 222 group that mentioned the practice of internal carbon pricing were located in Finland (5), Sweden (6), Denmark (3) and Norway (5). All of these countries are also part of the EU Emissions Trading System (ETS) (EU Emissions Trading System 2018) plus the companies located in Finland, Sweden and Norway also hold country specific carbon taxes. None of the of the organizations answers being used in this study are going to be solely pointed by their name. When a certain answer is highlighted, the companies will be referred only by their sector and country classification. (Bartlett et al. 2017, p.11; CDP Worldwide, 2018d)

According to the Terms of use of the CDP, the data available in the CDP database is free to be distributed and to be used in a non-commercial purpose. Is free to be produced for works in a non-commercial purpose and free to be modified, transformed for non-commercial purpose. All this can be done as long as CDP is being attributed as the original owner of the database. (CDP 2014a, p.2)

3.2 CDP questionnaire frame

The CDP Climate Change 2017 questionnaire which this study builds on are under the “CC2.2 Business Strategy” header. This study analyzes the answers under the questions CC2.2c and CC2.2d in the Climate Change 2017 questionnaire. The questions are the following:

“CC2.2c: Does your company use an internal price on carbon?”

If the company representative has answered that they do practice carbon accounting, the following question will follow:

“CC2.2d: Please provide details and examples of how your company uses an internal price on carbon”

This question only appears if you answer “Yes” to question CC2.2c. after which they asked the company representatives to provide details and examples of how their company uses an internal price on carbon. The form provided the answerer also with the following detailing:

“Scope that the emissions pertain to (i.e. Scope 1, Scope 2 and/or Scope 3)”

“Where and how the price(s) is used internally”

“Rationale for employing a price”

“Actual price(s) used and variance (e.g. by time or region, or by the way it is used across the business or in specific business units or corporate divisions)”

“Process to determine price(s) and business division responsible”

“Examples of how carbon pricing has affected your business (e.g. business strategy, risk assessment or evaluation, emissions reduction, investment decisions)”

“Challenges with this process”

(CDP-Climate-Change-Reporting-Guidance 2017b, p. 27–28)

To analyze where who has given the authority or written the actual answer this study will also include in its empirical part the answers from the section “CC15. Sign off” which includes the following question:

“CC15.1 Please provide the following information for the person that has signed off (approved) your CDP climate change response”

“CDP asks companies to identify the person that has signed off (approved) the CDP response. This information signals to investors that responsibility is being taken for the response and the information contained therein.

In the context of this section the Board (also known as “the Board of Directors” or “the Executive Board”) is the group of persons appointed with joint responsibility for directing and overseeing the affairs of the company.

Please provide your response in the table in the ORS and reproduced below.”
(CDP-Climate-Change-Reporting-Guidance 2017b, p. 177)

To present the picture of the most used carbon accounting measurement standard, this study also took into account the climate change 2017 questionnaires cc7.2 answers which was the following:

“Please give the name of the standard, protocol or methodology you have used to collect activity data and calculate Scope 1 and Scope 2 emissions”

3.2.1 Analyzing methodology

The answers given by the 18 organizations will be coded to find themes that come across from the answers. The coding technique used is partly influenced by Beck et al. (2010) developed CONI method (consolidated narrative interrogation) which was developed for analyzing content in a study where Beck et al. (2010) researched the sustainability reports of 24 UK and German organization. Even though the method has not been fully developed for theme base empirical analysis, after researching the model carefully I concluded that parts of it could be used for the coding of the empirical material for theme analysis. The theme analysis approach was partly used also in the CONI method as quoted in the below from the actual study

“Each disclosure narrative was initially interrogated for the sub-category of environmental message being conveyed (see Appendix 1), i.e. the content per theme. The purpose of this disaggregation into content themes was to increase the resolution of the method to capture all relevant meaning (see for examples Cormier & Gordon 2001; Gray et al. 1995; Warsame et al. 2002).” (Beck et al. 2010, p.212)

Content analysis is the used method for studying texts, especially in texts from document. As a example the CONI method studied texts of the companies CSR publications. The thematic analysis is very similar to content analysis, but it differs on how it takes a deeper qualitative look to the material, when the content analysis has some quantitative traits. The content alaysis has been critized for only studying the frequency of words in a text since certain words can have a different meaning in different contexts. According to Marks and Yardley (2004) the thematic and content analysis share many of the same principles and procedures. It was also pointed out by that the thematic analysis can solve parts of the content analysis flaws:

“Ideally, it is able to offer the systematic element characteristic of content analysis, but also permits the researcher to combine analysis of the frequency of codes with analysis of their meaning in context, this adding the advantages of the subtlety and complexity of a truly qualitative analysis” (Marks & Yardley 2004, p.57)

This is why in this research parts of the coding is motivated by the CONI method. The material available can be analyzed more deeply and make the analysis possible more precise, which in turn gives more from information out of the material for this research and helps to give more broad answer to the research questions.

3.3 Answering organizations background

There were 18 organizations in the Nordics who mentioned in the CDPs Climate change 2017 questionnaire to have an internal price on carbon. These organizations come from

sectors like, materials, utilities, energy, consumer discretionary, industrials, financials, consumer staples and health care. The figure 3 points the relative shares of the sectors which practice carbon accounting and internal carbon pricing. It can be seen that most of the companies are from very carbon intensive sectors rather than low carbon intensive sectors. According to a financial & risk white paper by Thomson Reuters (Lubin et al. 2017, p.3) of the global 250 biggest greenhouse gas emitting companies, the largest emitters by sector are the energy-, utilities- and materials sector. Three of the companies included in this study's empirical part were listed into the list of the worlds 250 biggest greenhouse gas emitters, all three were from the energy sector. The Thomson Reuters white paper study included also scope 3 emissions which are not taken into account in this study since they are voluntary in CDP's carbon accounting reporting.

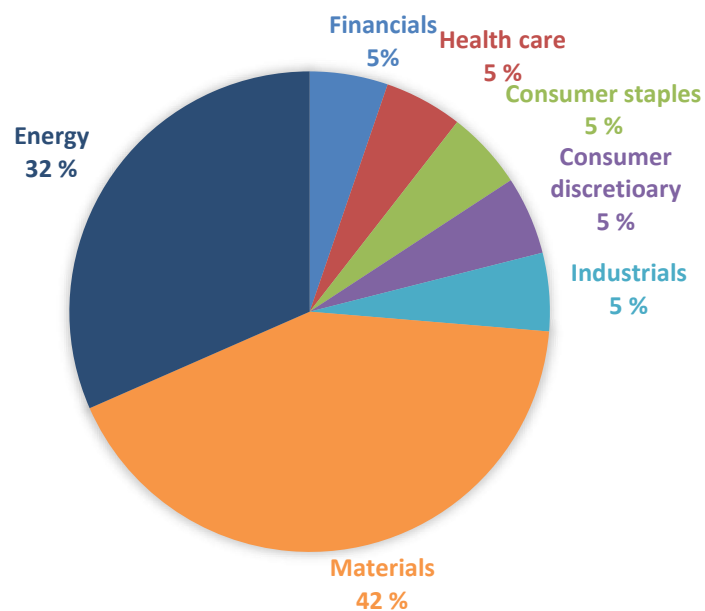


Figure 4 Nordic organizations by sector which practice carbon accounting

One reason why some of the most carbon intensive sectors are also the most represented in the list is because investors are seeing climate change as a high future risk for businesses and these sectors are reacting to the pressure from these stakeholders. Because of this reasoning, companies which are the most prone to the affects of climate change are also analyzing it as a bigger risk in their business. The more carbon intensive the business the higher the risk. Although lower carbon intensive sectors like the financial sector might not have comparatively high risks associated from their direct operations,

but since their future cashflows are partly dependent on financing sectors that are also carbon intense, they might be prone to higher risks.

These risks for the non-compliance of CSR issues can be reputational or regulatory. Organizations, especially in the sectors that are more prone to the risks related to carbon, can get economic restrictions or sanctions for their non-compliance. The news of carbon intensive sectors being associated to enhancing climate change is something that organizations will try to avoid as much as possible. Especially during these times many organizations want to promote their responsiveness towards climate issues and how there are acting responsibly.

By complying and reporting to different institutions organizations present their current customers and investors and possible future ones, that they are taking climate issues into account. The benefits from these kinds of actions are classified as more financial and strategic beneficial factors that can help organizations promote their business in the competition.

Figure 4 then shows the titles of the people who gave or at least approved the answers given by this study's sampling organizations, to the CDP questionnaire. As it can be seen, they mostly came from people who held very high-level positions in their organizations. This might mean many things, but it could show the power that CDP has as organization and how these organizations are taking this matter more seriously, or at least they want to message that stakeholders. CDP as a stakeholder represents investors so companies might see this as a very crucial stakeholder group, and that they want to please this group and communicate to.

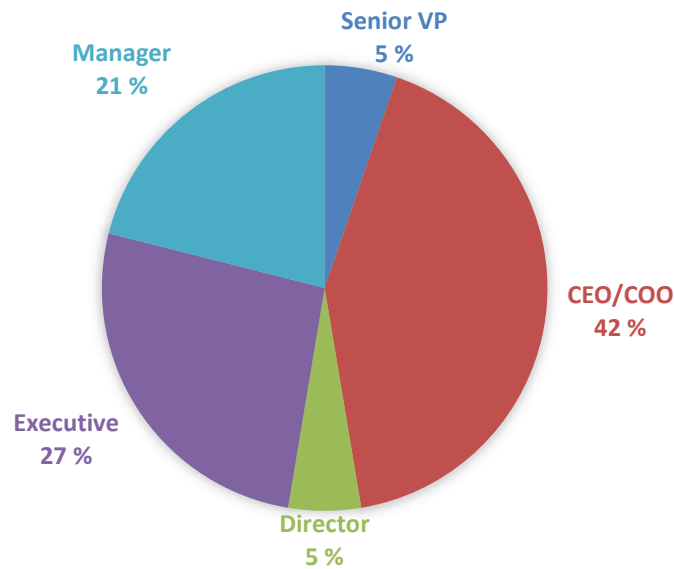


Figure 5 The titles of the answerers or approvers of the answers.

The answers given by the organizations were first read and then coded so that the answers could be divided into 11 different themes, depending what the answers held, and which direction has the organization taken. Even though the organizations were given in the CDP questionnaire the structure presented in the last chapter for the “CC2.2d: Please provide details and examples of how your company uses an internal price on carbon” question, it can be seen from the answers that the organizations did not follow the structure so much, but rather gave very wide responses, some of the content could not really be associated with internal carbon pricing or the whole scheme or carbon accounting. This is why in this research the material was coded in line with the thematic analyzing methodological approach to find certain repeating themes of the answers.

3.4 Interpretation of the empirical material

3.4.1 carbon accounting methods

When asked from the 18 organizations what standard did they use to collect the scope 1 and scope 2 emission data, 16 from 18 informed using the Greenhouse Gas Protocol. So almost all of the organizations relied on using one standard in calculating their emissions.

This would contradict the carbon accounting scheme’s view described earlier in some of the theoretical parts, that the whole carbon accounting field would be fairly fragmented. At least in the case of the Nordics this can’t be seen as the case since most of the organizations (16 out of 18) that took carbon accounting seriously or could be seen to be associated with it more deeply used the same GHG protocol for calculating their emissions. Below is the table (table 9) that presents the answers given by the 18 organizations to the question:

“Please give the name of the standard, protocol or methodology you have used to collect activity data and calculate Scope 1 and Scope 2 emissions”

Standard	Number of organizations used per country
The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)	5 - Finland 4 - Sweden 4 - Norway 3 - Denmark Total - 16
European Union Emission Trading System (EU ETS): The Monitoring and Reporting Regulation (MMR) – General guidance for installations	1 - Finland 2 - Sweden 2 - Norway Total - 5
ISO 140641	1 - Finland 1 - Sweden 1 - Norway Total - 3
US EPA Mandatory Greenhouse Gas Reporting Rule	1 - Sweden 1 - Norway Total - 2

Table 9 Carbon accounting standards used

It can be that the fields fragmentation comes from the continental differences, which may very well be true because of the different regulatory environments that come from different continental areas. As an example, it can be that the organizations inside the European ETS system are more in line with their reporting, but that differences may arise in areas where the regulatory environment is different. Also the usage of mainly only the GHG protocol shows that Nordic companies want to communicate to stakeholders such's as investors and ratings agencies. According to Gibassier & Schaltegger (2015, p.344) this suggests that companies do carbon accounting mainly to attract new investment and signal their carbon actions through rating agencies.

In Andrew and Cortese (2011) study of the used carbon accounting standards within the CDP material showed that there are multiple different standards being used globally by organizations even though the GHG protocol is the most popular one. The study also pointed out how the different standards are more popular in their birthplace area and thus are continentally linked. It was also reported by Andrew and Cortese, (2011, p. 135) that the implications of having multiple standards for carbon accounting may result in significant differences in the actual reported amounts of carbon, between standards. This might make the carbon accounting data hard to be comparable, or at least undermine the reliability of the carbon data between different regulatory areas.

3.4.2 Internal carbon pricing (ICP)

The largest recurring theme in the given answers were “investment projects”. Twelve out of the eighteen organizations mentioned the use of ICP in investment decision-making processes. But it is good to acknowledge that there were also other themes which showed that there are differences to what purposes an organization uses the ICP. Table 10 below shows all the different reasons how and why ICP was used.

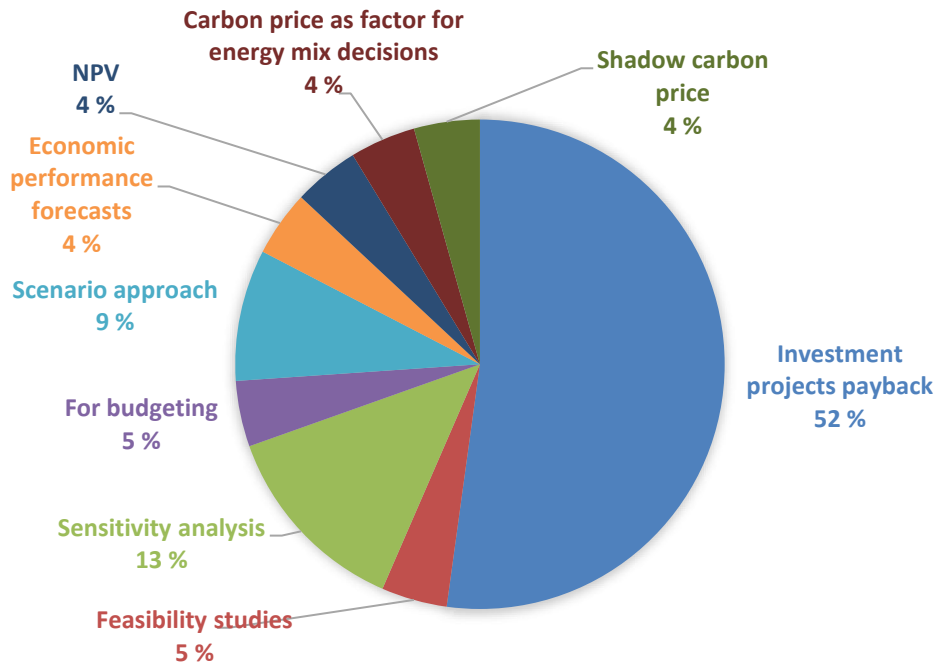


Figure 6 how ICP is used in Nordic organizations

Even though investment decision making and the ICP are closely linked together, other themes like budgeting, feasibility study, sensitivity analysis, return on investment (ROI), and the scenario analysis were themes linked to carbon pricing. The different approaches to using ICP might be because attributable to differing approaches on how organization's make investment decisions and do risk evaluation. Moreover, many of the other themes might play roles as supporting factors for investments and thus be a part of the investment decision making process in a broader scale. As an example, Staniskis & Stasiskiene (2006, p.1254) pointed out in their study, that in order to qualify for certain funding, such as the one mentioned in their study from the Nordic Environmental Finance Corporation (NEFCO), organizations need to follow a methodology developed by NEFCO which included the feasibility study together with the investment-decision process.

There are supporting signs that the meaning of carbon data for organizations will rise in the future. The study brought up by the IPCC on the current development of climate change, highlights that actions are needed now (IPCC PRESS RELEASE 2018). When I started to write this thesis (1.1.2018) the price of a carbon ton in the EU-ETS exchange was around 7.80 euros per ton and was below 10 euros from 2012. Ten months later (10.10.2018), the price per ton is presently at 21 euros per ton. (EUA Price 2018). The doubling of emission costs will likely increase the interest of organizations in general.

KPMG:s study of 2017 made bold statements that the tightening of the regulatory environment will likely increase the reporting requirements and require business leaders to prepare their organizations for change and enforce their internal systems to collect, analyse and disclose environmental data (King, A., & Blasco, J. L., 2017, p. 6-7). In the case of publicly listed companies, the UK has already made it mandatory to include carbon reporting into their annual reports. Norway is also following suit (Tang & Demeritt 2018, p.437). It could well be that voluntary carbon accounting in the Nordic region will turn into a mandatory procedure in the near future. The growing importance of data like carbon accounting and the overall importance of noticing financial risks that climate change poses to organizations may broaden carbon accounting data collection. This would not only incorporate such data collection with investment calculations, but to other usages if it occurred from the CDP data. Especially scenario- and sensitivity analysis could be seen as tools that organizations could use to incorporate future risks of possible costs related to the rising price of emitting carbon emissions and the ever-tightening regulatory environment. A Norwegian bank had addressed risks related to climate through the scenario analysis approach:

“In 2016, a common risk-based assessment process was developed for all corporate customers. A risk- based approach implies that customers and cases with serious potential consequences and a high probability of negative impacts on the environment and people require an extended review and documentation.” (Norwegian financial organization)

As mentioned previously, even though the financial sector might not have linear risks stemming from how much they as an industry release carbon relative to the energy or materials sector, but because their revenues can at least partly be linked through the financing of carbon-intense industries they might be subject to exposure and risks. This Norwegian bank addresses this problem through environmental risk evaluation in cases where customers might pose a higher risk to the bank. The financial sector could use internal pricing of carbon in models when assessing scenario analysis of their carbon-intense sector customers. Measuring is easier for banks when carbon-intense sectors have a clear understanding of their emissions and the costs of it in their operations. Since the financial sector is not a huge carbon emitter, the sector might not see it as an important issue to them, but rather than calculating their own carbon emissions, banks need to understand

the tools and the scheme if they want to evaluate the risks that their carbon-intense sector customers might pose to them. By having a long history in risk evaluation, banks could specialize in consulting their customers in the risks related to the usage of carbon. There are studies available that suggest that many organizations don't have an ample understanding of the possible risk factors that the environment might pose to their business (King, A., & Blasco, J. L. 2017, p.30).

The above-mentioned example shows that carbon accounting is not only limited to investment decision making, but more widely to risk evaluation as well. One of the largest banks in China, the Industrial and Commercial Bank of China (ICBC), uses a scenario analysis to measure the risks that climate change might present to their credit-risk department (Yin Hong, Ma Suhong, Yang Xing 2016).

Still it occurred from the CDP data that the largest recurring theme from the empirical data is investment-decision making. This theme is closely linked with the chapter 2.6, "carbon price in investment decision making", in the theoretical framework where carbon is presented in the calculations as an operative cost and is thus connected to investment decision making through NPV models. Here are some of the examples of how companies responded about the use of ICP in investment decisions:

"X company uses internal prices of carbon dioxide when making investment calculations and forecasts of our economic performance. The price depends on the actual European price of allowances (EUA) and an evaluation of the different sources of price forecasts. Price is important when deciding if and where we should invest." (Swedish materials organization)

"X company uses an internal carbon prices for calculating investment projects' payback time and the activity effect for saving actions in the assets (i.e. production units) that directly reduce fossil fuels usage such as natural gas used in coating drying to encourage internally transfer from fossil fuels to bio-based fuels" & "Internal CO₂ -price improves energy efficiency or bio-fuel investments' pay- back." (Finnish materials organization)

As mentioned earlier, the investment decision process was the most commonly used source for using ICP. A company uses an internal carbon price for calculating its investments payback time or some other short investment calculation that forecasts the

profitability of the investment. Having carbon included in investment decisions will help the organizations to better evaluate their investments in the short- and long-term horizon. Often poor investment decisions can affect a business's stability for a long term and the capital tied to a bad investment might be sometimes difficult to recover. Here, the company also points to the benefits of using the ICP in steering the company's operations towards using a less carbon-intensive energy source, which can be seen as a sign that climate change is really integrated into the organizations business strategy.

The use of ICP was especially seen to impact the decision-making process for company owned emissions sources (scope 1) as the paragraph below highlights:

“Internal coordination and financial benefit based on X company carbon price. The price issued to calculate the economical cost/savings of the CO2 emissions change of company's caused direct CO2 emissions (scope 1) from all operations. Harmonized component covering all business areas, this pricing element is also integrated to all emission and energy related investment plans and feasibility studies” (Finnish materials organization)

The price used for internal carbon measurement often derive from the EU-ETS system and include a national carbon tax. This can be seen in the response of five organizations in the sample material. Even though there were no differences between countries on the usage of a concrete price deriving from the EU-ETS, from the five organizations using a concrete price four were either materials or energy sector companies, which in turn are seen also more carbon intensive organizations as presented in figure 6 below. The figure presents the sampling companies average CO2 ton amount (scope1 and 2) emissions per company. It shows that the energy sector emitted 50 % of the total emissions from the sampling group and the materials sector 32 %, and in contrast the sector with the lowest CO2 emissions was the financial sector with basically a zero percent share of the CO2 emissions from the sampling groups total emissions.

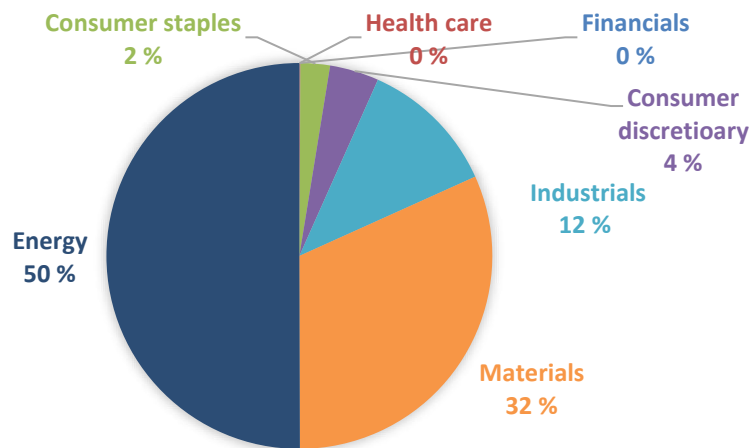


Figure 7 Average relative CO2 ton amount emitted per sector (scope 1 & 2)

It can be argued that many organizations base their price on carbon rationally by linking it to an actual fluctuating market price like EU-ETS, which is the largest carbon exchange market in the world. There are claims made in the scientific community that the price of a carbon ton should be much higher in organizations than what the EU-ETS currently reflects, which is around 21 euros per CO2 ton (EUA Price, 2018). In a report made by the Carbon Pricing Leadership Coalition with the Nobel laureate Joseph Stiglitz (2017, p 3), a CO2 ton should be priced by 2020 in the range of 40-80 US dollars and 50-100 US dollars in 2030, to reflect the set temperature targets in the climate Paris agreement of 2015. But having a price not reflected from the EU-ETS market would require organizations to evaluate a price of their own, which would still need to be based on a certain model. While we could conclude that this would require organizations to create a pricing system of their own, this would also require more recourses from organizations. We can conclude that organizations need more global governmental leadership in addition to their own efforts on the matter, here are some of the challenges presented by organizations:

“variances in prices over time and across geographies: the carbon price in the EU emissions trading scheme has varied significantly (from almost zero up to 30 euros) during the years 2005-2016. At the end of 2016, price was around EUR 5. Consequently, the internal price on carbon based on the EU carbon price has also varied. The key challenge of determining an internal price on carbon is the unpredictability of international and EU climate policy and targets” (Finnish energy organization)

“The CO2 price level we use internally is set up to 2035 and the level is influenced by our future supply and demand balance expectation and our views on future policy regulations. The great challenge when making CO2 price forecast is, in particular, new policy regulation both directly and indirectly influencing demand and supply balance and the future and unexpected changes in these regulations.” (Norwegian materials organizations)

It seems like Nordic organizations would call for clear determination from the EU and government officials of the targets to their respective organizations. Such targets would help the organizations to better evaluate their own price if a global price would remain as low as what the EU-ETS currently reflects.

Since this is a cost that really does effect business decisions, more solid guidelines would be needed for organizations in order for them to take actions against the lowering of their carbon emissions. Setting voluntarily the carbon price to 40-80 dollars effects the organization as a whole and involves a big strategic decision. However, if governments took a leader role in determining a precise target, it would help organizations to make and base their decisions with greater clarity. One risk of setting the price to the recommended level of 40-80 dollars is that it could undermine competitiveness, in the short run if their peers don't follow suit. It is still difficult to believe that there will be another way to hold companies to account on their carbon usage other than to put a price and thus make it unattractive. Waiting for a technological breakthrough is not a good strategy to hedge risk. If carbon pricing is not seen as a good option by an organization, they should most importantly use alternative ways to calculate the risks and future costs.

Some organizations have limited their use of carbon pricing to cover certain business operations and see carbon as a variable cost to their operations.

“X company uses the European cost of carbon in our internal calculations as our smelters and some of our rolling mills are part of the EU ETS directive. Carbon cost is an integrated part of all financial considerations, including all relevant investments and operations. The implementation of carbon cost in our analysis, makes CO2 costs become a variable operational cost at plant level and our expectation with regards to CO2 influence future investment decisions.” (Norwegian materials company)

“X Company use an internal price on carbon when assessing potential investments on breweries covered by the EU-ETS. This is relevant for Scope 1 emissions. Rationale for employing a price; We have a an internal price of carbon in order to be able to take potential monetary savings from reduced carbon emissions into consideration, in our investments.” (Danish consumer staples company)

“A price of carbon is included in X company’s decision making processes through the EU Emission Trading System. In 2016, 91% of X company’s sales originated from the company’s units in Europe. As we are exposed to real costs emission allowances are part of our financial calculations wherever appropriate. The financial impacts of emission allowances, including future projections, are always incorporated in investment planning processes as relevant” (Finnish materials organization)

As some companies limit their carbon cost only to the regions where their operations, other ones are taking more proactive positions and preparing their companies or the future where a global price for carbon is implemented. As an example, a Norwegian energy company had set a price that is targeted to the company’s operations which are not under any carbon tax or cap and trade system. By applying a carbon price to all investment projects in the whole organization, the organization is better adaptable to future regulatory changes in the areas where there are currently no regulation regarding emissions.

The same organization had also set a price of 50e/CO₂ ton, which is far higher than what the EU-ETS uses and currently reflects the 40-80 US dollar range recommended by the scientific community. Having this level of proactiveness shows as well that there are exceptions to the level that organizations take in their climate change strategy.

“For projects outside of Norway, we incorporate an internal price on carbon of USD 50/ tonne CO₂ in our investment analysis. Thus, a significant increase of the cost of carbon up to USD 140 per tonne of CO₂ equivalent in 2040 (as stipulated in the IEA 450 scenario) would only marginally impact the NPV for these projects.” (Norwegian energy company)

According to a paper by Pulver (2007, p. 46), organizations can have climate change strategies that come from inside the organization, without any outside stakeholder pressure. Organizations can differ from the general consensus of their competitors in their field, this is what happened when BP, Shell and ExxonMobil informed in the mid-1990s of taking climate change into account in their organizations' strategies and promoted a strategy where climate-friendly strategies could be profitable for business. BP and Shell both introduced significant investments for renewable energy and introduced an internal carbon trading system in their organizations to reduce their greenhouse gases (Pulver 2007, p.53). It could be concluded that the organizations whose business can suffer greatly from climate-change regulation might have a greater incentive to transfer their business into more climate friendly strategies, which might in turn also explain the Norwegian energy sector organizations high internal price of 50e/CO₂ ton.

There was no data available to give a more specific answer to how costs related to carbon emissions were divided inside the organization. The below quote, however, from a Norwegian financial sector organization presents a very simple way of calculating the costs that occur from carbon trading certificates. Through such costs, organizations can offer incentives to their divisions in order to make reductions like the example below. Systems like these are proof of how carbon prices would give incentives to organizations to look for more effective ways to lower emissions. In the rise of carbon prices, the departments of organizations would look more closely for different opportunities on reducing emissions. The rising prices would also make larger and more costly investments on emission reductions evermore profitable.

“The average cost we paid for 10494 quotas in 2016 was approximately 38.9 NOK/tCO₂ (total NOK 410.000) In 2016 we joined RE100 and bought local Guaranties of Origin (RECs and iRECs internationally) for all our electricity consumption worldwide. The cost of this was approx. NOK 140.000 in 2016 the cost of both these have been allocated to the companys business areas and divisions. A reduced use of energy consumption will therefore reduce their cost, incentivising such reductions when considering new Investments / measures” (Norwegian Financial sector)

The table 11 below shows the total emissions (scope 1 and 2) of the organizations that form this study's data. On the right side of the table, there is also presented those

organizations that had disclosed a concrete price and the actual one for internal carbon pricing. Sectors like the financial and health care are underrepresented with only one from each sector and also show the lowest total scope 1 and 2 emissions. A research made by Cho et al. (2012), concluded that organizations that had poorer environmental performance, disclosed more actively of voluntary environmental factors to outside stakeholders, meaning mostly CSR reporting. The results of this study could explain why sectors that have lower emissions are underrepresented in internal carbon pricing group within the Nordics and vice versa.

Even though the table shows, together with the earlier figure 6, the sectors with the highest emissions, like energy and materials, were the most represented in the data sheet; scope 1 and 2 emissions amounts did not have an effect on if organizations that decided to disclose a concrete price for carbon. This might suggest that internal pricing of carbon is still not sufficiently popular and only a rare amount of organizations have decided to disclose a concrete price. This all said, it is still good to point out that the organizations that disclosed a concrete price were mostly from the energy and materials sectors, which are more energy intensive sectors.

Emissions (scope 1 and 2)	Sector	Country	Disclosed priced
7 480,00	Financials	Norway	
25 593,00	Health care	Denmark	
194 961,00	Materials	Norway	
266 505,00	Energy	Sweden	Price 50e/co2t
554 610,00	Materials	Finland	Price 10e/co2t
580 560,00	Materials	Denmark	
836 380,00	Energy	Norway	
883 251,00	consumer staples	Denmark	Price EU-ETS
998 000,00	Materials	Sweden	
1 476 062,00	Consumer Discretionary	Sweden	
2 117 564,00	Materials	Finland	
3 348 268,00	Energy	Finland	
3 720 000,00	Materials	Finland	
4 149 202,00	Industrials	Sweden	
10 467 421,00	Materials	Sweden	Price EU-ETS
15 729 304,00	Energy	Norway	Price 50e/co2t
18 868 400,00	Energy	Finland	
68 526 026,00	Energy	Sweden	
72 209 359,00	Materials	Norway	

Table 10 Scope 1 and 2 total emissions by sector and country

Depending on how widely carbon pricing is included in the organizations' planning, projects and investment decisions, modifies the form that carbon pricing takes in an organization. As an example some companies might limit it to only be included in large investment decision-making processes. But as the answer below shows, it can be included into the design of new projects such as services, new products and even in the planning geographical locations of company departments and factories. If governments in the future require businesses to report their carbon footprint of the products they sell, which has been brought up in countries like Denmark (Clarke 2018), such changes and challenges would have to be addressed. The design decisions in materials in the research and development stage, and the geographical location of the production in terms of shipping distances and energy sources available in a location, organizations can effect what the carbon footprint of a certain service or product will be. Also, different taxes to high carbon footprint products can be implemented when they have their footprint details in them. In addition, customers can make more informed purchasing decisions, which in turn could result in lower consumption of high footprint products and services, if there is a substitute with a lower

carbon footprint. Organizations have a lot to think about as they go forward, since in the era of bigdata and analytics these developments might not be so far away.

“A carbon price, based on the combined cost of the quota and the tax, is factored into the economic planning and engineering design of new projects. The internal carbon price, based on what the Norwegian government set as regulated price, is incorporated into the company’s economic planning models approved by the CFO. vi. Investment decisions are made on a wide range of factors, which includes current and forward looking pricing of emissions.” (Swedish energy company)

In the case of most answers in the CDP questionnaire, they well cover and contain specific details of how ICP was used. But in some cases, organizations limited their coverage of the subject to very short or unclear answers. This might be due that some organizations just want to disclose to reporting systems like to the CDP so they can claim to be taking actions to decrease emissions. The answers below from three organizations are an example of the latter. In these three cases, the organizations informed in their websites of taking actions by disclosing the CDP questionnaire. Even so, their answers didn’t really reveal what kind of actions were taken. Also, the Finnish energy company was asked to participate through an interview into this study but admitted that they really don’t have much to give on the topic.

“Longer-term estimations on future emissions prices in the ETS are used to evaluate sensitivities of different alternatives for investment proposals. As the company has only two sites that are under the same ETS system in Finland, there are limited opportunities to utilize fully the potential of setting internal price of carbon. Additionally, as the refineries are in the process of joining operationally, the potential implications of internal carbon price remain limited” (Finnish energy company)

“A price on carbon is used in some cases as a component of financial models and simulations for energy related projects i.e. renewable energy investments, carbon-free heating solutions etc.” (Swedish consumer discretionary company)

“We have internal pricing of carbon regarding EU-ETS” (Swedish industrial company)

As pointed out by Papaspyropoulos et al. (2012) in their research, the organizations' environmental management tools can't work without an adequate data recording system integrated into their operations. The data collection should be a routine process in order for it to be used in decision-making inside the organization. Moreover, as pointed out earlier through the usage of the bigdata and analytics tools, much simpler systems can be built inside organizations for outside and inside reporting purposes. The study states that it is important for these internal systems to be easy to understand and used in daily decision-making. In order to steer organization in putting a price for carbon, or making sensitivity analysis, there needs to be quantitative data collected as well. The crucial part for measuring the reductions of emissions is being able to calculate how the organization is positioned currently and what actions reduce the cost of carbon usage in their operations.

3.4.3 Interview with a CDP responding organization

The final segment of empirical data consists of a direct interview with an organization that answered the CDP Climate Change 2017 questionnaire. In this chapter, we will look at a single case and analyze more closely one of the participant's situation on related to the answers and themes of CDP's climate change 2017 questionnaire. The answers of this interview came from two representatives of a Finnish materials company, whose titles were director of product safety and sustainability, and energy manager specialized in material efficiency. This organization had answered/stated in the CDP questionnaire that they include an internal price for carbon of 10e/co2t. Moreover their answers to the CDP questionnaire was detailed and included concrete examples of how they use the internal pricing of carbon. Their understanding of the topic was comprehensive and they also showed interest in further developing their current carbon-pricing systems. This made the organization also a good match to do a close-up interview since their sector is carbon intense and thus the risks higher due to carbon related costs. The interviewees were responsible for the following actions:

“My official title is director of product safety and sustainability and that in itself tells pretty well what my job role consists of and everything that is connected to product safety and sustainability. One big part in terms of sustainability is reporting.” (Director of Product Safety and Sustainability)

“I participate in the CDP’s annual reporting of water-and-climate-change issues and then also help and support the production level with energy efficiency programs; and partly with everything that is related with the reduction of carbon and water usage, I’m the link to the headquarter.” (Energy Manager)

The environmental department worked in the company’s headquarters where they had a team who was specialized in the field. One aspect of the team’s job is to review and give assistance to those who want/need help in implementing the company’s green policies in their daily operations. By organizing their operations this way, organizations grant or offer room for innovation and autonomous action especially if a green strategy is encouraged by the organizations’ management.-This could also be a good groundwork or foundation to develop future green policies; since it allows different parts of the organization to fit their policies the most effective way depending on how they are organized. One argument against having a department that supports green policies in the HQ is the possible lack of connection to the actual site where the actions are suppose to take place. This model could present problems especially if more complicated green policies are put into practice.

The representatives of the organizations responded using two well-known reporting systems, the CDP and ECO Vadis. They stated the following:

“We have chosen two of these reporting systems, where we report to annually, related to these ESG issues, meaning Environment Social Governance. The first reporting platform which has been in use for a longer time is the CDP and the CDP is connected purely on environmental issues, so another system where we report to is ECO Vadis which includes environmental subjects, but it also included social and ethical issues.” (Director of Product Safety and Sustainability)

The organization is involved in all of the four CDP's reporting questionnaires. Three of which report to investor stakeholders and one that they report from a request of their customers:

“Our organization participates in all of the four CDP programs, three of which is done for towards investors (climate, water and deep forestation) and then the fourth, supply chain we are in from the request of our customers.” (Energy Manager)

It was interesting to note that customers were one group that had an effect on why they do these voluntary questionnaires. This has not been brought up by earlier studies that have investigated the motives of voluntary disclosing (Tang and Demeritt, 2018, p. 451-452; Burritt et al. 2011, p.81). Customers could be a very impactful stakeholder group concerning how their linear relationship and the organizations' incentives to please such customers' needs. If contrarily they do not meet the standards of their customers, businesses can incur monetary losses form missed deals. This is revealed especially in the stance of large organization that present a key role in their industry and have a ripple effect on other players and how the whole industry evolves around these issues.

The organization presented the following reasons why they report to the CDP and ECO Vadis systems:

“Why we do this then? Well naturally we want to know where are we in terms of our competition but because it is also a way to demonstrate to our customers that we are a responsible supplier.” (Director of Product Safety and Sustainability)

So as came up in the CDP's questionnaire answers, organizations look at what their competition is doing and this motivates them to also participate in similar actions. This focus on peer companies might distort the actual possibilities of what organizations can do. In KPMG's report of 2017 (King, A., & Blasco, J. L. 2017, p.50), most organizations lack the linking of their targets to any climate goals. This might be where governments can help out a lot by setting and messaging clear targets for organizations to follow. According to these years (2018) Nobel Prize winner William D. Nordhaus, the marginal cost of reducing 10% can be done by extremely low costs (Nordhaus 1991, p.936). Even though

the study was made many years ago, some companies could find possibilities in lowering some of their emissions with low or minimal effort. It is good to acknowledge also from Nordhaus's study that the further the carbon reductions go the sharper the marginal cost rise for organizations will be. This means that many of today's locked decisions on chosen materials and energy can have a significant effect on the future occurring costs.

An interesting part of this research was to see more closely how organizations saw the recurring themes of the answers of the CDP climate change 2017 questionnaire and how carbon pricing is calculated in investments. This organization used carbon pricing more in investment decision-making rather than sensitivity tools or other risk-evaluation tools. Here are some of the answers linked to the topic:

“We have a standard form an investment application sheet which include several templates that need to be filled when applying for investments projects and one part in these templates is energy, electricity, fuels and in the same context there is also CO2 emission change.” (Energy Manager)

“As an example, since all factories have implemented a set average specific emission amount, which takes into account also the factory's market electricity production structure etc. as well as other factors, everything is done to simplify the process. This -would make the operations at the factory easier because it is not certain that each factory has a person who knows CO2 emissions trading, pricing never mind know how to calculate the emission factors for the factory” (Energy Manager)

“Since we have through a model of continuous improvement the objective to reduce our carbon footprint, for the purpose of simplicity of the overall process, we set annually a fixed internal price for our CO2 ton. This makes it easier for the factory when filling the investment application to take that price into account in the application” (Energy Manager)

“In development investments the payback is better for these more carbon neutral technologies” (Energy Manager)

To support the statement made earlier about the locking of certain futures with design decisions, the energy manager cites the production structure effecting carbon volumes and ties the factory's carbon emissions for a long period of time.

In these organizations, the first step where CO₂ emissions are taken into account is in the internal application of the investment-decision process. By having an average carbon price, each investment proposal from the factories to the HQ is being included as a carbon effect of the investment. In such a way the HQ can evaluate the investment proposal and in the situation of carbon emissions change, it can assess if it is in line with the organization's carbon objectives or strategy. These models also allow the organization to look closer at the internal carbon data of investments and make use of it to find correlations on possible profitability between investments and carbon volumes.

The organization promoted a continuous model reduction of its carbon emissions and tools to promote this objective was to set annually a fixed internal price for carbon. This fixed price for carbon was also seen as an easy way to promote the process of including carbon into investment decisions calculations so that it would be a simple method for the organization. The latter could be seen as part of the solution to a problem that carbon accounting may present. Inside an organization, carbon accounting is not a familiar subject to employees and there might not be any reward in it, or at least a financial one. Taking into account the employees of the organization, it would be important and crucial for the processes to be simplified for better understanding. Of course, organizations could possibly benefit from training their employees in this subject. Such a action could also be incentivized financially if the organization's strategy is to steer its operations towards lower emissions. Even so, technology could play a vital role in making the process easy by integrated management software such as ERP systems, which could be integrated with automatic calculation of the effects on carbon and the possible future real cost of the investment.

The organization in question had set a concrete price for their carbon and its use was taken into account in-investment decisions as shown in the interview answer below. The organization had already priced in energy in significant investments and was seen a good opportunity to implement a carbon price into the scheme as well and taken into account especially in new investments. But in addition to the latter, it was interesting to see how an organization considered this as an easy process. Certainly organizations differ in how they are organized, but internal pricing of carbon is not a complex process for organizations and can be implemented easily if the company collects carbon data. It is another

question if collection of carbon data is a difficult process. It has been shown that if an organization knows its energy usage and sources, the whole process can be calculated in a fairly easy way.

“We had implemented it in a way for the factories...since we had already defined so that in all relevant investments factories inform their effects for the energy side, fuels, electricity and steam, so in a way it was pretty easy to implement it so that we gave an internal value for the carbon dioxide and use a certain specific emission for that certain factory...So you can in a way automatically and in practice, when you know the energy effects for a certain action, turn it also into the carbon dioxide effects”. (Energy Manager)

When asked more in detail about which investments get the pricing of carbon in them as a cost, the response was the ones that have considerable effect. The company chose not to restrain itself with a certain amount or threshold on what size investments carbon would be included, as may be the case in some organizations. The price would be implemented in all investments that have considerable effect just like in the energy effect reporting below:

“It reads in the internal guide that if it has considerable effect”
(Energy Manager)

The organization has had the internal price for carbon for a bit over a year and a half and they used the EU-ETS exchange price as their base from which they set a somewhat higher price. The price is set annually. Prices have not typically been very volatile, but during 2018 the price of a EU-ETS certificate has risen from under 10 e to over 20 e. This may show a long-term price trend and could possibly better take more into account when calculating the future cost of emitting carbon. This would be especially true if the price is taken into account in long-term investment decision-making. It would be opportune to point out that this organization is in a much better place in terms of evaluating the future price of carbon emitting than many of its Nordic peers.

“We have had this internal pricing procedure since 14.12.2016”
(Energy Manager)

“The EU-ETS is the one where the price is built upon...” but we use a price which is somewhat higher than the EU-ETS.” (Energy Manager)

The organization said that it applies carbon pricing for all new investments but were not implemented in earlier ones. Thus we can conclude that all investments made after December 14, 2016 had a carbon expense implemented into them. A post audit is made to the investments, which could possibly affect the decision-making if further investments are made to them. Especially in the rise of prices, many carbon-intensive investments might not seem as profitable as they initially seemed. As mentioned in the theoretical parts of chapter 2.6, “Carbon price in Investment decisions making”, some organizations chose to evaluate all of the organizations ongoing investments.

“We have had this procedure now for about two years, so we don’t of course change investment calculations after they have been made. Surely, depending of the size of the investment, when a post-audit is done and where the investment is looked into and analyzed how it went, surely in them the calculation could be modified from the CO₂ part if there would be a need for it” (Energy Manager)

One reason for implementing the internal price for carbon and adding to it the whole investment process was its image effect as highlighted below. They also pointed to it being in line with the organizations’ overall objectives. As mentioned earlier, the organizations saw this as an easy way to take into account the costs of carbon. Knowing this is important since this might be seen as a difficult and unnecessary process for many other organizations, the fact that it can be easy as pointed by these organizations, could be a sign that companies aren’t very aware of the whole scheme and its possibilities.

“We saw that this is surely good for our image but also that these have real effects and we have before this already had a goal to reduce our carbon footprint; this was seen as a way to put this objective to the factory level as well” (Energy Manager)

The organization also pointed out that carbon as a cost was efficient in these linear sorts of energy-saving and streamlining projects. This situation might offer organizations to have the most effect with the lowest effort. The size of the project also matters but very small ones were deemed inefficient where carbon-savings are estimated to be very low. Excel was seen as an easy tool to calculate the carbon effect in investment calculations. The current cost of carbon still limits the economic effects that can be saved when only looking at carbon cost and investments. The organizations provide evidence that these kinds of carbon calculating projects can be implemented relatively easily, through the usage of excel and understanding the energy amounts being consumed together with the type of energy used. As mentioned in the theoretical part of chapter 2.5, “Organizational motives for carbon reporting”, the costs of carbon are much wider than only the linear cost coming from emissions-trading schemes as well as from reputational, regulatory and future cost of capital.

“It is an agile way of course to use in these linear energy savings and streamlining projects...we have these four squares, where it is easy to directly calculate, from the energy numbers that are brought to these boxes. Usually we do a payback calculation into the excel where you have also emissions as one component. Maybe it would be exceptionally tricky in small scale projects” (Energy Manager)

It was pointed out that implementing the carbon price for investments is also dependent on the factory workers and their skills and awareness on the matter. The usage of these tools and the whole of carbon accounting might require resources to education concerning these matters.

“Well yes much depends on who is making the investment calculation there locally...but usually when paybacks are calculated for investments, all stones and stumps are turned to find all the possible sources of savings...But yes it is dependent on the person who is doing the payback calculation and partly relies on his-awareness...But my job description is to support our factories with this matter and the messages has been tried to

sent to them that they can contact me if they have problems in calculating investments” (Energy Manager)

“Each realized investment in practice ends up for approval here in our headquarters so it is also in a sense dependent on our awareness here. Who goes through them [investment decisions], I don’t personally belong directly to that team. I’m more in the supporting side of helping the factories in filling their investment applications. But people here also recognize it [the importance], so they do contact me if the effect of the CO₂ has not been taken into account...But like I said, it is possible that for some unknown reason a project would go through without us noticing it”. (Energy Manager)

One of the reasons for the implementation of these energy-efficiency programs is the science-based target for their emissions that the company aims to achieve. Those interviewed in this thesis also pointed out that there is a limit to what reductions can be incentivized with carbon pricing as an internal tool taking into account current prices. In a sense this is pretty unsettling. Even so, the reality is that if carbon will be priced higher, or at much higher levels than today, businesses may have to rethink their industry and business model and strategies again. The above example derives from a very carbon-intense sector and they will be the ones whose future earnings will suffer the most from higher carbon prices compared with those whose carbon intensity is much lower. To ensure the businesses future in a high-carbon-price environment, it may require totally new breakthroughs in technology and production for some of these organizations.

“Through these energy-efficiency plans we will be able to reduce CO₂ emissions and of course we want to measure it, since it’s our objective ... We have the following situation, where I referred to you that we count this specific emission for factories, so in many cases we are in a position where our targeted specific emissions are already so low. Even if we would do relatively significant energy efficiency projects of many thousands of megawatts per hour, the relative emission because of our usage of biofuels in our power plant is very small. For these biofuel energy plants the big energy efficiency measures can be relatively small. This is why in our case

the direct effects are not hugely significant. The price would have to be pretty high before it would impact directly our operations.” (Energy Manager)

As the answer below shows, the current prices for CO₂ emissions at the time of these interviews were around 10 e/co₂t and therefore the company does not see the price as an economic strain on its operations or investments. But this has been in line with what the experts are saying and who state that in order for carbon prices to have an actual effect they should be priced around 40-80 e/co₂t (Stiglitz, 2017, p 3):

“It is part of the profitability calculations, but it does not remarkably steer [a company] one way or another...of course it starts to steer; if the CO₂ price, would rise to some level above of fifty-sixty euros; it is clear that it would then start to have a significantly bigger impact when looking at our own financial calculations”. (Energy Manager)

The company representatives did not comment specifically how the rise of the EU-ETS price would affect other than it would have an impact.

4 CONCLUSIONS AND THE ASSESSMENT OF THE STUDY

4.1 Discussion and conclusion

This study was of the Nordic carbon accounting scheme and more closely about the organizations that were practicing not only carbon accounting but using this data to either steer their business or monitor future risks. The objective of this study was to look at organizations usage of carbon accounting and get a sense of the motives behind it. The answers in the empirical part can't be seen as straight results for this study (Alasuutari 2011, 81) but rather only after close analysis and perceptions of the material results.

This thesis was a theme based empirical study and the material gathered from the 18 organizations was coded. The coding method was motivated by the use of the CONI method (consolidated narrative interrogation) developed by Beck et al. (2010). Through the coding of the themes which rose in the company's answers, this study was able to deeply analyze the answers but also connect them with each other and put it in a larger perspective, that helped find different recurring themes. This puts a lot of the responsibility to the thesis writer since the analyzing of the material will be the most crucial part. This study contributed to the scientific conversation around carbon accounting, and especially how it can be used and benefited in organizations. Studies of this sort are very rare still in the and I believe that this is exactly what the scientific community would need to provide in order to help different organizations look closely at what they can use carbon accounting for and how have other organizations used it. Since this study was constructed from the CDP data of 18 organizations and a closeup interview with one of the CDP answering organizations, it was able to reveal the occurring themes from the CDP material and a deeper understanding of these themes through the interview. This is why I believe that the interview with one of the organizations from the sampling group brought validity to the results. Some of the findings of this study are supported by other research papers from the field, but it also raises new points that I have not come across at least. The 18 organizations had all set an internal price for carbon, which can be seen as a deeper level of commitment to account carbon as a cost and risk.

Most of the organizations in this sampling group came from sectors which could be seen as very carbon intense, actually over 70% of the sampling group organizations

were from the material or the energy sector. This is an interesting finding and it shows that very carbon intense sectors take into account carbon as a risk more than non-carbon intense sector organizations. Because of the high energy and carbon intensity of these organizations, there are a lot more possibilities in their managing of carbon. It also makes more economic sense for carbon intense sectors to manage carbon. For low carbon sectors it might in comparison make little economic sense when the price for the EU-ETS certificate has been below 10 for most of its time since the year 2012, even though the price has risen this year (2018) (EUA Price, 2018). One crucial way to reduce emissions in very carbon intense companies was to do energy savings projects. To a financial sector company there is little to be saved compared to a steel manufacturer, but they see the risk in companies they lend money to. Aitken, Chapman and McClure, (2011, p. 757) also found that organizations which feel more powerless in tackling climate issues are also less likely to act upon it. This could be one reason why low carbon emitting companies were underrepresented in the sample group.

It would need to be studied with further material, but it was brought up in the case of the financial sector, which aren't themselves high emitters, that they could be still prone to risks coming from high emitting sectors which they finance. This resulted into the use of environmental risk evaluations for their customers. Banks could possibly also have an opportunity to gain future revenues from the environmental risk consulting of their customers. Especially when there are studies to support that many organizations don't have an understanding of the possible risk factors that the environment might pose to their business (King, A., & Blasco, J. L. 2017, p.30). This finding could be supported by some of the earlier studies (Dhaliwal et al., 2011 p 94) which have pointed out that companies which have evaluated some of the financial risks coming from environmental factors get capital at a lower interest.

In this sample group there were two organization from the energy sector who voluntarily priced their carbon ton into a level of 50 dollars per ton. This is close to the level for which different experts have said that the carbon ton should actually be priced in order to truly steer a business and affect decision making (Litterman 2013, p.41). These two organizations can be classified as transformational leaders of their industry. These transformational leaders can have a big role in modifying the industry to reach out for a higher standard in taking action against the risks and costs associated to carbon. If they request the same or at least a higher level of action from their business partners and suppliers it

can prompt them to take more action, as was brought up in the case of the closeup interview organization which mentioned customers as one stakeholder to why they disclosed to the CDP.

The actual risks linked to carbon that these sectors may face, can be allocated to regulatory, financial or reputational factors (Tang and Demeritt, 2018; Burritt et al. 2011). In addition to these three factors this study found that also customers may propose a risk as one factor. As some of the findings from the empirical part presented, stakeholders such as customers are initially requesting some of the sampling organizations to report to some of these climate related databanks. The high share of energy intense sector organizations in the sampling group can be explained by the aspect that they are most prone to risks associated by regulatory and reputational factors but also because they can actually do energy savings plans through the tracking of carbon data, which leads to also cost savings. This statement was supported by interview. The material would support the statement that keeping track of carbon data in an organization is also helpful in calculating the energy usage and the true cost of it, in high carbon intense organizations. In these cases, energy savings plans were seen to realize into actual cost savings. To sum this up, while energy intensive firms calculate their carbon and report this data to regulators or institutions, they can mutually use the same data to also prepare internal energy savings plans, which result into internal cost savings and also help meet customer requirements for doing business. This finding shows that there's multiple factors that together can incentivize energy intensive organizations for carbon accounting.

The actual carbon flow in most of the cases were being calculated through estimations since it has been proven to be fairly accurate and while the actual continuous calculation of carbon flow is possible to calculate, it is also proven to be a heavy process for organizations (Ascui, 2014, p. 127-128). And one reason why carbon reduction through energy savings plans were seen so favorable among the sample companies, derived simply from their convenience for organizations to calculate. While energy saving plans can be implement in all parts and levels of the organization, in the sample cases most energy savings plans were directed to heat boilers, production- and energy plants, where the stream is somewhat predictable. It might also be easier for organizations to set the savings plans into these sources since they are easier to calculate. This also further supported how some organizations in the sample group pointed to specifically using ICP for only investment calculations that classify under scope 1 & 2. This might also explain why so few of the sample organizations reported their scope 3 emissions, which come as

indirect emissions to organizations and are much harder to calculate. All this would suggest in some matter at least, that the pure ease of calculating and putting a price to steer a business could have a big effect on the form that carbon accounting in an organization takes. One finding for this study was that putting a price for carbon can be an easy process, and that it does not require big resources from companies. This is a message to those organizations that don't have any carbon accounting or pricing system in place, that they can possibly make economic savings with a fairly easy process, while at the same time prepare their organization at least in some level for future risks regarding carbon. This concerns especially companies in very carbon intense sectors.

Internal carbon pricings realizes carbon as a cost and allocates it to the right source inside the company and systems like the EU-ETS and carbon tax bills the company depending how they emit as a whole. This way a company can better acknowledge the source of these costs coming from these outside institutions. A company that operates under the EU-ETS is checked for the right amount of carbon certificates once a year, and if the company does not hold the right number of certificates, they need to buy them from the market and vice versa. But in order to incorporate this cost so that it is rightly allocated to the departments that are the main source for it, the company needs to account for their carbon and through the implementation of a system to which the internal pricing of carbon can be noted, it would further help them evaluate the cost that already occurs every year. This could motivate more departments inside an organization to think about how carbon might affect their operations. In this study a large majority of the sample companies used internal carbon pricing as a way for organizations to add carbon as a cost to investment calculations. Other occurring themes evolved around risk measuring and forecasting tools, such as sensitivity analysis, budgeting and scenario approaches. It is good to point out that even though all of the sample organizations mentioned using ICP, but that only five had an actual price they announced, one of 10e/co2t, two of 50e/co2t and two followed the EU-ETS market price. The 50e/co2t price is close to the levels where experts suggest that carbon starts to have an effect on real business decision making and new investments. So even though all organizations in this sample group had informed about the practice of ICP, most of them did not disclose the actual price. It can't be known for sure what was the reason for this, but one reason might have been because of how low the price is in some of these organizations or because it varies so much in different projects, it can also be used just for image boosting regarding environmental issues. The CDP

ranks the answering organizations regarding their mentioned actions, so some companies might just try to get better ranking.

Most of the sample organizations used the same carbon accounting calculating standard, the GHG Protocol (16 out of 18), this finding might be a sign that there is an accepted standard, at least in those organizations which use ICP. Regarding to Gibassier & Schaltegger (2015, p.344) table 2 on page 29 of the theoretical part shows sings that Nordic companies that practice ICP implement carbon accounting systems to meet the requirements of investors and rating agencies. This suggests that companies do carbon accounting mainly to attract new investment and signal their carbon actions through different rating agencies. The three most popular rating agencies are the CDP, Dow Jones sustainability sustainability index and FTSE4Good Index Series (SustainAbility, 2010, p. 15)

Even though the whole carbon accounting scheme seems to be in an upward trend (Knox-Hayes & Levy 2011, p.1) and carbon data gathering is becoming ever more common, it was conducted in this study that in a more broader scale usage of carbon data for other than reporting purposes appears in a relatively small group of companies. In the year 2017 only 18 from the 222 Nordic companies that answered to the CDP questionnaire using ICP. In an interview conducted by the Harvard Business Review with Dominic Barton, a partner from the McKinsey & Company, he pointed out when discussing organizations sustainability matter, “Again, I think the momentum is there. It’s just more back to this point about I just don’t think it’s scaling fast enough” (Nickisch, 2018). Apart from certain exceptions, such as the transformational leaders, this study’s sample companies messaged that the price in the EU-ETS has been too low to have had actual large-scale changes in their organizations.

This study contributes more into the possibilities that carbon accounting can have and what are the ways in which the leading companies in environmental actions utilized carbon in acknowledging future risks. So far there have been very few studies worldwide that have studied the usage of carbon data inside organizations, even though there are strong sings that organizations could really face substantial risks, especially in high emitting sectors.

4.2 Limitations

The limitations which occurred in this study evolved around finding the right data to work with. Many organizations are not willing to talk over these matters since these kinds of studies might pose a risk to their image or expose their shortages on some of the presented statements made by them. This study would could have possibly benefitted from another company interview. It would have also been really rich for this study to have more concrete models from organizations, for example investment calculation models or different analysis papers. This I believe is also the kind of information the carbon accounting scheme lacks currently and could benefit for future development of the field. In order to tackle the climate issue companies need concrete examples to work with.

4.3 Future Studies

After reading through multiple research papers and analyzing company answers surrounding the subject of carbon accounting it could be noted that the current scientific community and private sector participating in the conversation don't hold a dialogue. The field would need many more case studies where future studies could gain more direction for the problems that organizations face and how have they solved some of the problems.

Another subject group that would bring a lot for future development in the field would be to look at more closely at the transformational leaders, like the two which appeared in this study's sample group. They are an especially interesting group since they have made efforts and invested time and resources, so they have had to really think about possible solutions to problems. In addition to this future studies could look at the the financial industry and how they tackle their environmental risks concerning their customers.

- Aaltola, J. & Valli, R., (2007) *Ikkunoita tutkimusmetodeihin 1* 2nd ed., Juva: PS-kustannus.
- Aitken, C., Chapman, R. & McClure, J., (2011) *Climate change, powerlessness and the commons dilemma: Assessing New Zealanders' preparedness to act*. *Global Environmental Change*, Vol. 21(2), p.752–760.
- Al-omiri, M., (2007) *A preliminary study of electronic surveys as a means to enhance management accounting research*. *Management Research News* Vol. 30(7), p. 510-524.
- Alasuutari, P., (2011) *Laadullinen tutkimus 2.0*, Tampere: Vastapaino.
- Andrew, J. & Cortese, C., (2011) *Accounting for climate change and the self-regulation of carbon disclosures*. *Accounting Forum*, Vol. 35(3), p.130–138.
- Ascui, F., (2014) *Making carbon count: The role of carbon accounting in carbon management and markets*. The University of Edinburgh.
- Ascui, F. & Lovell, H., (2011) *As frames collide: making sense of carbon accounting*. *Accounting, Auditing & Accountability Journal*, Vol. 24(8), p.978–999.
- Ascui, F. & Lovell, H., (2012) *Carbon accounting and the construction of competence*. *Journal of Cleaner Production*, Vol. 36, p.48–59.
- Bartlett, N., Cushing, H. & Law, S., (2017) *Putting a price on carbon Integrating climate risk into business planning*. Carbon Disclosure Project US
- Bartolomeo, M., Bennett, M., Bouma, J. J., Heydkamp, P., James, P., & Wolters, T. (2000) *Environmental management accounting in Europe: current practice and future potential*. *European Accounting Review*, Vol. 9(1), p.31–52.
- Beck, A.C., Campbell, D. & Shrides, P.J., (2010) *Content analysis in environmental reporting research: Enrichment and rehearsal of the method in a British-German context*. *British Accounting Review*, Vol. 42(3), p.207–222.
- Bhimani, A. T. Horngren, C. Foster, G. Datar, S. (2012) *Management and Cost Accounting*, New Jersey: Prentice-Hall Inc.

- Blanco, C., Caro, F. & Corbett, C.J., (2017) *An inside perspective on carbon disclosure*. Business Horizons, Vol. 60(5), p.635–646.
- Blanco, C., Caro, F. & Corbett, C.J., (2016) *The state of supply chain carbon footprinting: analysis of CDP disclosures by US firms*. Journal of Cleaner Production, Vol. 135, p.1189–1197.
- Bowen, F. & Wittneben, B., (2011) *Carbon accounting certainty across organisational fields*. Accounting, Auditing & Accountability Journal, Vol. 24(8), p.1022–1036.
- Boyatzis, R., (1998) *Transforming qualitative information: Thematic analysis and code development*, Thousand Oaks, Sage Publications.
- Brander, M. & Davis, G. (2012) Greenhouse Gases , CO₂ , CO₂ e , and Carbon : What Do All These Terms Mean? *Econometrica*. p.2–4.
- Bui, B. & Villiers, C. De, (2017) *Carbon emissions management control systems : Field study evidence*. Journal of Cleaner Production, 166, p.1283–1294.
- Burritt, R.L., Schaltegger, S. & Zvezdov, D., (2011) *Carbon Management Accounting: Explaining Practice in Leading German Companies*. Australian Accounting Review, 21(1), p.80–98.
- Callon, M., (2009) *Civilizing markets : Carbon trading between in vitro and in vivo experiments*. Accounting, Organizations and Society, Vol. 34, p.535–548.
- Castro, & Chousa, P.J., (2006) *An integrated framework for the financial analysis of sustainability*. Business Strategy and the Environment, Vol. 15(5), p.322–333.
- CDP, (2014a) CDP Open Database License. <<https://data.cdp.net/terms-of-use>> retrieved 27, 2018.
- CDP-Climate-Change-Reporting-Guidance (2017b) CDP Worldwide
- CDP, (2018c). CDP. CDP website. <<https://www.cdp.net/en/info/about-us>> retrieved August 27, 2018.
- CDP Worldwide, (2018d) SCORES 2017. <<https://www.cdp.net/en/scores-2017>> retrieved August 20, 2018.
- Chandler, A., (1977) *The Visible Hand: Managerial Revolution in American Business*. Boston, Harvard University Press.

- Cho, C. H., Guidry, R. P., Hageman, A. M., & Patten, D. M. (2012) *Accounting , Organizations and Society Do actions speak louder than words ? An empirical investigation of corporate environmental reputation*. *Accounting, Organizations and Society*, Vol. 37, p.14–16.
- Clarke, H., (2018) Denmark discusses labeling food for climate impact. CNN. <<https://edition.cnn.com/2018/10/09/health/denmark-climate-food-intl/index.html>> retrieved October 13, 2018.
- Clarkson, P.M., Overell, M.B. & Chapple, L., (2011) Environmental Reporting and its Relation to Corporate Environmental Performance. *Abacus*, Vol. 47(1), p.27–61.
- Cormier, D. & Gordon, I.M., (2001) *An examination of social and environmental reporting strategies*. *Accounting, Auditing & Accountability Journal*, Vol. 14(5), p.587–617.
- Dhaliwal, D.S. Li, O. Z. Tsang, A. Yang, Y. G (2011) *Corporate Social Responsibility Reporting Voluntary Nonfinancial Disclosure and the Cost of Equity Capital : The Initiation of Corporate Social Responsibility Reporting*. *The Accounting Review*, Vol 86(1), p.59–100.
- Espeland, W.N. & Stevens, M.L., (2008) *A sociology of quantification*. *Archives Europeennes de Sociologie*, Vol. 49(3), p.401–436.
- EU Emissions Trading System (EU ETS). <https://ec.europa.eu/clima/policies/ets_en> retrieved August 27, 2018.
- EUA Price. Sandbag Climate Campaign CIC. <<https://sandbag.org.uk/carbon-price-viewer>> retrieved October 10, 2018.
- Gibassier, D. & Schaltegger, S., (2015) *Carbon management accounting and reporting in practice*. *Sustainability Accounting, Management and Policy Journal*, Vol. 6(3), p.340–365.
- Goldman Sachs, 2009. *Change is coming : A framework for climate change – a defining issue of the 21st century*. Global Investment Research
- Gray, R., Kouhy, R. & Lavers, S., (1995) *Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure*. *Accounting, Auditing & Accountability Journal*, Vol. 8(2), p.47–77.

- Haslam, C., Butlin, J., Andersson, T., Malamatenios, J., & Lehman, G. (2014) *Accounting for carbon and reframing disclosure: A business model approach*. Accounting Forum, Vol. 38(3), p.200–211.
- Hendrichs, H. & Busch, T., (2012) *Carbon management as a strategic challenge for SMEs*. Carbon management as a strategic challenge for SMEs. Greenhouse Gas Measurement and Management, Vol 2(1), p.61-72.
- Hirsjärvi, S., Remes, P. & Sajavaara, P., (2007) *Tutki ja kirjoita*. Kustannusosakeyhtiö Tammi, Helsinki
- Ihlen, Ø., (2009) *Business and Climate Change: The Climate Response of the World's 30 Largest Corporations*. Environmental Communication, 3(2), pp.244–262.
- IPCC PRESS RELEASE (2018) *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments*. Geneva <https://www.ipcc.ch/pdf/session48/pr_181008_P48_spm_en.pdf> retrieved 8 October 2018.
- King, A., & Blasco, J. L. (2017). *The road ahead: The KPMG Survey of Corporate Responsibility Reporting 2017*. KPMG
- Knox-Hayes, J. & Levy, D.L., (2011) *The politics of carbon disclosure as climate governance*. Strategic Organization, 9(1), p.91–99.
- Kolk, A., Levy, D. & Pinkse, J., (2008) *Corporate Responses in an Emerging Climate Regime : The Institutionalization and Commensuration of Carbon Disclosure*. European Accounting Review, Vol. 17(4) p. 719-745.
- Koskinen, I., Alasuutari, P. & Peltonen, T., (2005) *Laadulliset menetelmät kauppatieteissä*. Vastapaino, Tampere.
- Li, Y., Eddie, I. & Liu, J., (2014) *Carbon emissions and the cost of capital: Australian evidence*. Review of Accounting and Finance, Vol. 13(4), p.400–420.
- Litterman, B.B., (2013) *What Is the Right Price for Carbon Emissions?* Energy & Environment.
- Lohmann, L., (2009) *Toward a different debate in environmental accounting : The cases of carbon and cost – benefit*. Accounting, Organizations and Society, Vol. 34(3-4), p. 499-534

- Lubin, D., Moorhead, J. & Nixon, T., (2017) *A New Business Logic*. A Thomson Reuters Financial & Risk white paper.
- Luo, L. & Tang, Q., (2016) *Determinants of the Quality of Corporate Carbon Management Systems : An International Study*. International Journal of Accounting, Vol. 51(2), p.275–305.
- MacKenzie, D., (2009) *Making things the same: Gases, emission rights and the politics of carbon markets*. Accounting, Organizations and Society, Vol. 34(3–4), p.440–455.
- Marks, D. & Yardley, L., (2004) *Research methods for clinical and health psychology*. Sage.
- Matsumura, E.M., Rachna, P. & Vera-Munoz, S.C., (2014) *Firm-Value Effects of Carbon Emissions and Carbon Disclosures*. The Accounting Review, Vol. 89(2), p.695–724.
- Móznér, Z. V, (2013) *A consumption-based approach to carbon emission accounting e sectoral differences and environmental benefits*. Journal of Cleaner Production, Vol 42, p.83–95.
- Nickisch, C., (2018) *McKinsey's Head on Why Corporate Sustainability Efforts Are Falling Short*. Harvard Business Review. <<https://hbr.org/ideacast/2018/03/mckinseys-head-on-why-corporate-sustainability-efforts-are-falling-short.html>> retrieved August 27, 2018.
- Nordhaus, W.D., (1991) *To Slow or Not to Slow : The Economics of The Greenhouse Effect*. Royal Economic Journal, The Economic, Vol. 101(407), p.920–937.
- Ott, C., Schiemann, F. & Günther, T., (2017) *Public Policy Disentangling the determinants of the response and the publication decisions : The case of the Carbon Disclosure Project*. Journal of Accounting and Public Policy, Vol. 36(1), p.14–33.
- Papaspyropoulos, K. G., Blioumis, V., Christodoulou, A. S., Birtsas, P. K., & Skordas, K. E. (2012) *Challenges in implementing environmental management accounting tools : the case of a nonprofit forestry organization*. Journal of Cleaner Production, Vol. 30, p.132–143.
- Pfeifer, S. & Sullivan, R., (2008) *Public policy, institutional investors and climate change : a UK case-study*. Climatic Change, Vol. 89, p.245–262.

- Pulver, S., (2007) *Making Sense of Corporate Environmentalism: An Environmental Contestation Approach to Analyzing the Causes and Consequences of the Climate Change Policy Split in the Oil Industry*. *Organization & Environment*, Vol. 20(1), p. 44-83
- Qian, W., Hörisch, J., & Schaltegger, S. (2018). *Environmental management accounting and its effects on carbon management and disclosure quality*. *Journal of Cleaner Production*, Vol. 174, p. 1608-1619.
- Qian, W. & Jacob, H., (2018) *Environmental management accounting and its effects on carbon management and disclosure quality*. *Journal of Cleaner Production*, Vol. 174, p.1608–1619.
- Ranganathan, J., (1998) *Sustainability rulers: Measuring corporate environmental and social performance. Sustainability Enterprise Perspective*. World Resources Institute. Washington DC.
- Saaranen-Kauppinen & Puusniekka, (2006) *KvaliMOTV - Menetelmäopetuksen tietovaranto*. Tampere: Yhteiskuntatieteellinen tietoaarkisto. <<http://www.fsd.uta.fi/menetelmaopetus/kvali/L6.html>> retrieved August 21, 2018.
- Schaltegger, S. & Synnestvedt, T., (2002) *The link between 'green' and economic success: environmental management as the crucial trigger between environmental and economic performance*. *Journal of Environmental Management*, Vol. 65, p.339–346.
- Silva, T. De, (2011) *Mixed methods : a reflection of its adoption in environmental reporting*. *Qualitative Research in Accounting & Management*, Vol. 8(1), p.91–104.
- Staniskis, J.K. & Stasiskiene, Z., (2006) *Environmental management accounting in Lithuania : exploratory study of current practices , opportunities and strategic intents*. *Journal of Cleaner Production*, Vol. 14, p.1252–1261.
- Stechemesser, K. & Guenther, E., (2012) *Carbon accounting : a systematic literature review*. *Journal of Cleaner Production*, Vol. 36, p.17–38.
- Stiglitz, J.E. (2017) Report of the high-level commission on carbon prices. *Carbon Pricing Leadership Coalition*.
- SustainAbility (2010) *Rate the Raters Phase Two Taking Inventory of the Ratings Universe October 2010 About Rate the Raters*. London, SustainAbility.
- He, Y., Tang, Q., & Wang, K. (2014) *Carbon disclosure, carbon performance, and cost*

- of capital*. China Journal of Accounting Studies. Vol 3-4, p. 190-220.
- Tang, S. & Demeritt, D., (2018) *Climate Change and Mandatory Carbon Reporting: Impacts on Business Process and Performance*. Business Strategy and the Environment, Vol. 27(4), p.437–455.
- Tessier, S. & Otley, D., (2012) *A conceptual development of Simons ' Levers of Control framework*. Management Accounting Research, Vol. 23(3), p.171–185.
- The Greenhouse Gas Protocol (2000a) *A Corporate Accounting and Reporting Standard*. World Resources Institute.
- The Greenhouse Gas Protocol (2005b) *The GHG Protocol for Project Accounting*. World Resources Institute
- Timo, B. & Stefan, L., (2017) *Corporate Carbon and Financial Performance*. Journal of Industrial Ecology, Vol. 22(4), p.1–15.
- Vesty, G.M., Telgenkamp, A. & Roscoe, P.J., (2015) *Creating numbers: carbon and capital investment*. Accounting, Auditing & Accountability Journal, Vol. 28(3), p.302–324.
- Warsame, H., Simmons, C. V & Neu, D., (2002) *Responding to "Discrediting" Events: Annual Report Disclosure Responses to Environmental Fines*. Accounting and the Public Interest, Vol. 2(1), p.22–40.
- Wintergreen, J. & Delaney, T., (2006) *ISO 14064 , International Standard for GHG Emissions Inventories and Verification*. 16th Annual International Emissions Inventory Conference, Raleigh, NC., <<http://www.epa.gov/ttnchie1/conference/ei16/session13/wintergreen.pdf>> retrieved 20.4.2018
- WorldBank (2018) *State and Trends of Carbon Pricing*, World Bank Publications. Washington
- Yin Hong, Ma Suhong, Yang Xing, Q.M., (2016) *Impact of Environmental Factors on Credit Risk of Commercial Banks*, ICBC
- Young, S.B. & Abbott, C.L., (2013) *Developing Integrated Carbon Accounting Systems. In Climate Change Policy in North America. Designing Integration in a Regional System*. University of Toronto Press, p. 273–300.

Interview

Energy Manager, Finnish material company. 8 of May 2018

Director of Product Safety and Sustainability, Finnish material company. 8 of May 2018

CDP materials

CDP's "Climate change 2017" questionnaires from the following companies:

Finland Metsä Board Neste Oyj Fortum Oyj Outokumpu Oyj Stora Enso Oyj	Sweden SSAB Vattenfall Group SAS Ikea Boliden Group Lundin Petroleum
Norway Norsk Hydro Statoil ASA Aker BP Borregaard	Denmark Novozymes A/S Carlsberg Brewery Lundbeck