Corporate Strategy of Danish Companies towards EU Emission Trading Scheme

-- 10th semester master thesis

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Project Title	**Corporate Strategy of Danish Companies towards EU Emission Trading Scheme**
Project Period	February 2, 2009 -- June 11, 2009
Project Team	Feng Zhang & Minh Than Tran Thi
Supervisor	Per Christensen
Synopsis	This project explored "how do Danish companies establish strategies towards EU ETS" and "what are their corporate strategies" by conducting empirical survey with industrial firms. Among all 65 firms on the list of Danish NAP II, information from 20 respondents was collected for the analytical study. Three sorts of theories were adopted in the research. The environmental economics elucidated the mechanism of EU ETS, while the institutional theory and the rational behavior theory depicted better the institutional environment and companies' decision-making pattern in reality. Survey results shown that the impact of EU ETS to Danish companies was mostly evident in companies' increased production cost and the competitiveness loss of their products. Most firms developed strategies with a top-down decision-making approach while following the logic of appropriateness. Their corporate responses towards EU ETS in principle are to comply through trading CO_2 quota, switching energy suppliers/sources, and maybe technology innovation; their strategic plans were predominantly on a short-term basis, and would probably be further adapted according to institutional changes. Such findings provide valuable information about the implementation of EU ETS at the organization level, and shed light for both policy-makers and organizations' decision-makers.
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Preface

This report "Corporate Strategy of Danish Companies toward EU Emission Trading Scheme" was conducted during the 10th semester of the Environmental Management as a master thesis in Department of Development and Planning, Aalborg University, in the spring of 2009.

Two main research questions "1) how Danish companies establish strategies towards EU ETS" and "2) what are their corporate strategy" were explored through empirical survey with industrial firms. Respondents from all 20 companies have been very helpful in answering questionnaires as well as staff from the Danish Ministry of Climate and Energy in clarifying climate policy and tax issues. On this note we would like to convey our gratitude to them and hope that more companies will be open for students.

We acknowledge and express our sincere thanks to Professor Per Christensen, for his constructive comments and supervision throughout the working period. And we also appreciate very much all the comments and suggestions from our colleagues in the department.

References in the report are organized according to the Chicago Style. Each cited reference in the text is therefore stated with the author's surname and the year of publication. Two authors are stated by their surnames. Three or more authors are stated as the first authors surname and the paragraph "et. al". In the list, Internet references are provided with the websites and accessed dates. References with same author and year of publication are separated alphabetically. The report's numbering of the figures and tables is done separately and chronologically within every chapter.

Feng Zhang ----------

Minh Than Tran Thi ----------

List of Abbreviations

CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CHP	Combined Heat and Power
CO_2	Carbon dioxide
EC	European Community
ECX	European Climate Exchange
EU ETS	European Union Emission Trading System
ETS	Emission Trading System
EUA	European Union Allowance
GHG	Green House Gas
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
MAC	Marginal Abatement Cost
MS	Member State
Mt	Million tons
NAP	National Allocation Plan
NAP I	National Allocation Plan for the 1st period of EU ETS (2005-07)
NAP II	National Allocation Plan for the 2nd period of EU ETS (2008-12)
NOx	Nitrogen Oxides
SO_2	Sulfur Dioxide
UNFCCC	United Nations Framework Convention on Climate Change

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1 Introduction

Chapter 1 provides an overview of current literatures about EU ETS, and they concentrate on three focal issues: the regulatory design, the economical impact and a comparison of EU ETS with other ETSs worldwide. However, empirical research at the organizational level is rare. Thereby, this research is conducted to investigate how Danish companies set up corporate strategy towards EU ETS by means of empirical study.

Climate change is a pressing issue representing great environmental, social and economic threats of the planet; it is mainly resulted from the substantial anthropogenic emission of greenhouse gas (GHG) through burning fossil fuels, deforestation, livestock farming and so on. Although GHG refers to several sorts of gas, Carbon dioxide (CO_2) is the main contributor. In 1997, the first global agreement on GHG emission restriction, Kyoto Protocol, set a target of reducing at least 5% GHG from 1990 level by 2012. Correspondingly, the European Union (EU) launched an Emission Trading Scheme (ETS) in 2005 to control industrial CO_2 emissions at the EU level.

As being the world largest emission trading program covering around 12,000 installations in 25 member states (MSs), EU ETS has caught broad attention. Along with the regulation's coming into effect, extensive researches have been conducted. Emerging literatures can be categorized into 3 groups (see figure 1-1): firstly, a substantial amount of studies focused on EU ETS itself like the context, the regulatory design at both EU level and MS national level, interpretations of this regulation, and so forth. Secondly, lots of other researches explore the economic impact of EU ETS regarding the industrial competitiveness, transaction costs and the carbon (CO_2 quota) market. Thirdly, there are a relatively small number of literatures comparing the EU ETS with other trading programs, especially the American ones. Industrial sectors are the main actors under EU ETS; yet, their responses have been largely overlooked.

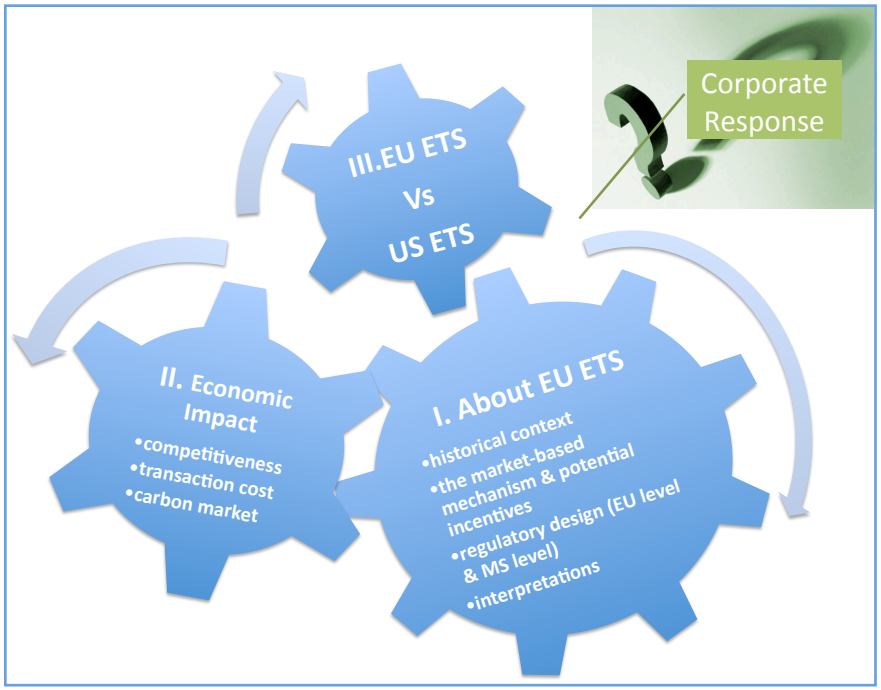


Figure 1-1 Three groups of current lituratures regarding EU ETS

Specifically, among the majority research of EU ETS, Braun (2008) presented an evolutionary review of how and why ETS became a cornerstone of the EU climate policy; and he concluded three main reasons: "1) the integration of international emissions trading into the Kyoto Protocol; (2) the failure of the 6th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and the withdrawal of the United States from the Kyoto Protocol negotiations; and (3) the unsuccessful attempt to introduce an EU-wide CO_2-tax" (Braun 2008, p1). Schleich et al. (2009) explored the incentives for energy efficiency under the EU ETS by studying the market-based mechanism of EU ETS, and they concluded that the carbon price and cost-effectiveness for improvements in the energy and industry sectors would be stronger in phase 2 than in phase 1 due to the substantial reduction of allowances. As for the regulatory design, various issues have been discussed either at a national (MS) level or a regional (EU) level since 2003, when EU announced to bring about the EU ETS. Yet, the current setting is still severely criticized, "particularly the lack of transparency on the role of carbon-offset projects in the scheme" (Pinkse 2008, p205-206).

Studies in the second group take mainly an economic point of view to examine such issues like competitiveness loss, transaction costs, and the efficiency of carbon market due to the enforcement of EU ETS. For instance, Demailly & Quirion (2007) conducted a case study of iron and steel industry to quantify how EU ETS impacted the industrial competitiveness in terms of production and profitability; their results showed the competitiveness losses were small for this sector, so that the arguments against tightening the regulation stringency in the 2nd phase were groundless in this respect. Schleich & Betz (2004) distinguished two types of transactions cost (administration/implementation-related and trading/abatement-related), and pointed out that as transaction cost was not proportional to the company size, it became especially burdensome to small and medium sized enterprises. Daskalakis & Markellos (2008) examined the efficiency of the European market for CO_2 quota through "econometric testing procedures and trading strategies based on technical analysis and naive forecasts" (p103), and they uncovered the immaturity of EU ETS and the short-selling and banking period (within one phase) were not in consistent with market efficiency. However, most economic analysis are based on modeling or scenario analysis with little concern about the political bargaining among government, companies and the environmental NGOs; that's why ETS in practice always differs from the optimal economic design.

Comparison studies in the third group shed lights on improvements for EU

ETS by examining others' experience. The US has very early movements in setting up market-based environmental regulations, and the sulfur dioxide (SO2) and nitrogen oxides (NOx) trading programs turned out to be of great success. Kruger (2008) explored the key factors making those programs effective, and then compared such factors with those in the EU ETS. Although there were institutional difference between the US and the EU, his findings gave rise to reflective thoughts for the implementation of EU ETS. Meckling (2008) conducted a relatively general study about the different corporate policy preferences in the EU and the US. He stated that since the agreement of Kyoto Protocol, companies in the US promoted voluntary commitments to mitigate climate change, while EU companies largely accepted mandatory emission controls.

"Carbon strategies – how leading companies are reducing their climate change footprint" (Hoffman 2007) was considered as the first comprehensive how – to manual for organizations that are interested in developing suitable climate change strategies. In the US, related studies embrace a wide range of valuable experiences and best practices of several large corporations, yet it may not be necessarily applicable for the EU situation.

In terms of EU ETS, responses from companies are rare among the emerging literatures, except for some firms' (eg. BP and Shell in Meckling 2008) direct engagement during the initial designing period and others' lobbyism for grandfathering free allowance in the first two phases of EU ETS. There are some studies in the field of organization populations such as the iron, steel and combustion industries in German. However, investigation at organizational level accounts for a smallest proportion, and is mainly on the ground of economical theoretical framework rather than empirical studies. Taking such as a departure point, this project aims to conduct empirical study to explore the strategic responses from Danish companies at the organizational level, and interpret findings with a solid theoretical framework.

In the following, chapter 2 consists an economic perspective on environmental regulations, introduction of EU ETS, as well as the GHG emissions and climate policies in Demark; so as to form up the conceptual background for the empirical study. Chapter 3 reviews two theories—institutional theory and rational choice theory, as they provide two complementary angles for interpreting corporate strategies. Chapter 4 clarifies two main research questions, the scope and structure of the project, as well as the applied research methodology. Chapter 5 presents results from the empirical study systematically with theoretical interpretations. Finally, chapter 6 draws conclusion of the whole project.

2 Conceptual Background

Chapter 2 introduces the economic mechanisms of environmental regulations, the regulatory interpretation of EU ETS, and the Danish climate policies regarding CO2 emission, so as to form an conceptual background for the project

2.1 Economic Mechanisms of Environmental Regulations

"The principle that total abatement costs are minimized when marginal abatement costs are equalized across polluters is fundamental to understanding the differences among pollution control policies. "

Kahn (2005, p 67)

2.1.1 Command-and-control environmental regulations

Traditional command-and-control environmental regulations with an assigned level of pollution or specified abatement technology have been criticized because they generate higher abatement cost than necessary to achieve a given level of emission, and discourage the motive for research and development of lower-cost methods. This can be well illustrated if assume there are only two 2 polluters in the society.

Firstly, figure 2-1 displays the marginal abatement costs (MACs) for the two polluters as well as for the whole society. These MAC curves are in the relation of abatement cost (the vertical axis) and amount of pollution emitted (the horizontal axis). The social MAC is aggregated from the functions of the two polluters.

When there's no environmental regulation, polluter 1 will emit 10 units and polluter 2 will emit 6 units; and the total emission for the society is 16 units after aggregation.

If there's a command-and-control regulation requires each polluter commit a 50% reduction of pollution, then polluter 1 needs to cut its emission down to 5 units and polluter 2 to 3 units. Nevertheless, the marginal abatement cost for both polluters are not the same: its 2$ for polluter 1 while

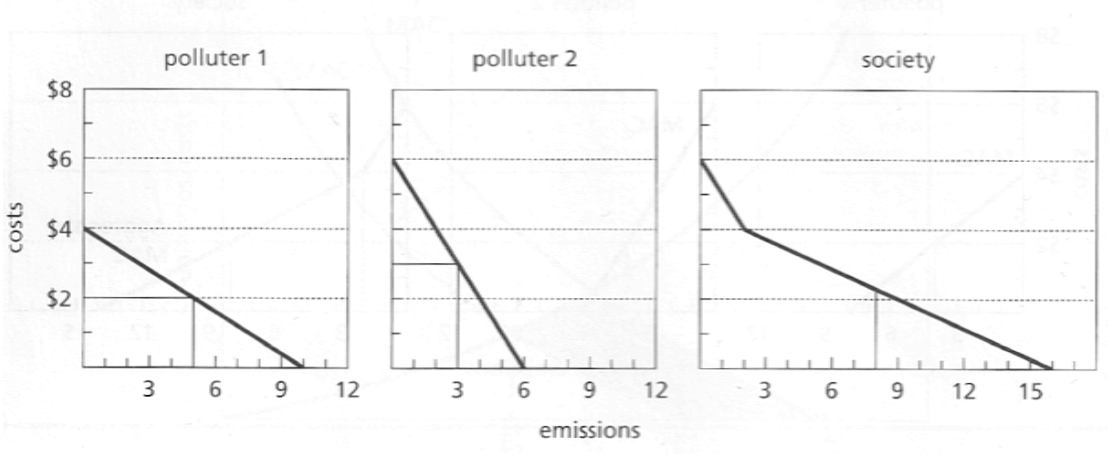


Figure 2-1 Pollution reductions through a regulation of equal percentage (Kahn 2005, p66)

3$ for polluter 2; and this is a "misallocation of resources from society's point of view" (Kahn 2005, p65). Figure 2-2 gives a correction in order to lower down the society's total abatement cost while keeping total emission units constant. That is,

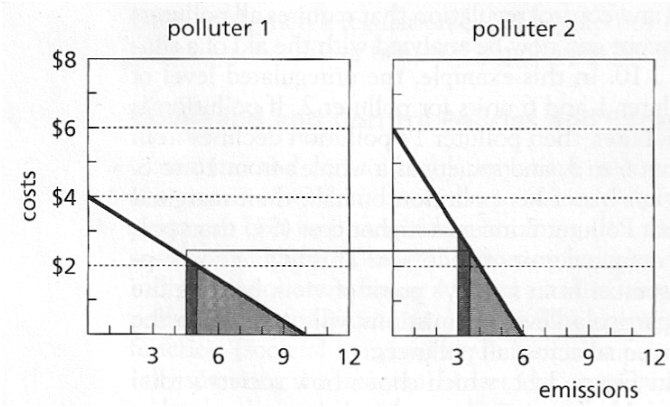


Figure 2-2 Minimizing total abatement cost by equating marginal abatement cost (Kahn 2005, p66)

polluter 1 emit 1/2 pollution unit less and polluter 2 emit 1/2 unit more (shown as the heavily shaded areas); thus, the marginal abatement cost of polluter 1 increased while that of polluter 2 decrease. Since polluter 2's saved cost is greater than polluter 1's increased cost, the total social abatement cost is reduced. The cost-saving reallocation can be further improved until the marginal abatement costs of both polluters become equal, and then the overall social abatement cost is minimized.

Command-and-control environmental regulations came into existence since early 1970s in most developed countries. Under such regulations, the minimal level of abatement cost can hardly be achieved because the heterogeneous industries have distinct MACs and the government is not able to know that. Therefore, command-and-control has been criticized as inflexible, "inherently inefficient and cumbersome way to control pollution"(Elliott 1994 in Gunningham et al. 1998), "many of the gains have been achieved at an unnecessarily high social and economic cost" (Gunningham et al. 1998, p7). This gave rise to the market or property-rights based approaches in environmental regulations.

2.1.2 Environmental regulations with economic incentives

Regulations based on economic incentives have been advocated by economists for two main reasons: "1) economic incentives minimize total abatement costs by equating the marginal abatement costs across polluters and encouraging a broader array of abatement options; 2) economic incentives encourage more research and development into abatement technologies and alternatives to the activities that generate the pollution" (Kahn 2005, p72).

There are many economic incentives being suggested, such as pollution tax, pollution subsides, marketable pollution permits, deposit-refund system, performance bonds, liability

systems and so on. As CO_2 tax and the CO_2 trading scheme have been mostly discussed in EU to mitigate climate change, an environmental tax and an emission trading scheme (ETS) are discussed in the following.

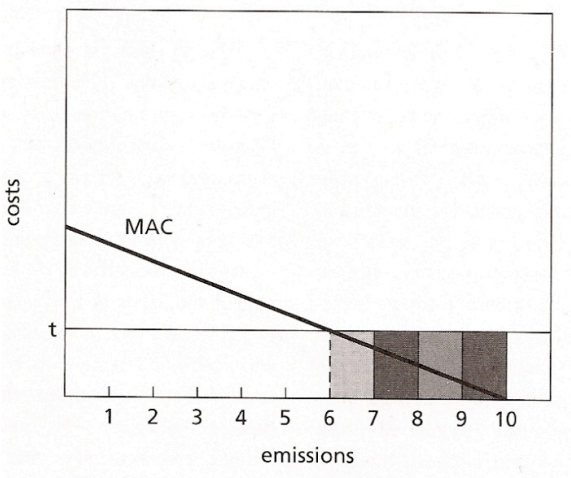


Figure 2-3 Pollution tax (Kahn 2005, p71)

Firstly, figure 2-3 shows an example of environmental tax being introduced to a polluter, whose abatement cost follows the MAC curve. The uneven dark color distinguishes each single unit of emission. Under an unregulated circumstance, the polluter emits 10 units; once a tax at the price of t (per unit of emission) is introduced, the polluter began to reduce its emission because the abatement cost is lower than the tax payment. Yet, the more emission the polluter reduces, the higher its abatement cost goes. The abatement cost becomes the same with the tax when the polluter cuts the emission down to 6 units. As any further reduction will be more costly than paying for the tax, the polluter would rather remain its emission at this level.

This principle is true for all polluters in the market. No matter what technology is applied and no matter how much pollution is emitted, all firms have no other choice but paying for the corresponding tax.

Consequently, individual polluters will adjust their respective levels of emissions to the point where marginal abatement cost equals to the tax per unit; so that their marginal abatement costs will finally be equalized. In this sense, the tax minimizes the total social cost. However, there's no incentive for further reduction beyond this. Although the tax level can be adjusted once a while, "pollution abatement and production technologies that are optimal under one set of taxes would not be chosen under a different set of taxes"(Kahn 2005, p76); and what tax level will be the optimal for both the environment and the industries remains uncertain.

As for the ETS, where a limited cap of total emission quotas is set up and distributed among all subjected firms, Gunningham et al. (1998, p72) considered its providing firms "greater flexibility in tailoring responses to their individual circumstances"; while the government retains effective control by determining the allowable emission and quantifying the overall permission quotas.

The creation of an emission trading market is to exploit difference in the marginal costs of pollution abatement. Figure 2-4 illustrates an example of how the emission trading works between two firms (A and B) with distinct MAC curves. In this case, A and B used to emit 120 and 90 tons/year respectively; and due to the ETS now, A has a free quota of 60 tons/year and B has 45 tons/year. The different MAC curves imply that the emission reduction is more costly for B than A, if they both need to comply with their respective allowance.

As the marginal cost for a 45 tons/year emission cut in firm B is 4000$, buying quotas with price less than that would get better off. In firm A, however, the marginal cost for a 60 tons/year emission is 1200$; if it could sell a permit for some price above that, the firm would be better off by increasing the revenue from selling quota. Thus, trading will make both firms better off, and as long as there's constant overall quota and difference in firms' respective marginal cost, trading will going on.

This two-sources trading example can be applied in a market with more participants. In general, the emission quota would flow from sources with relatively low abatement costs to those with higher costs. The eventual trading price would then depend on the amounts of supply and demand in the market. The demand may come from new comers into the market or the expanding operations of the existing sources, so that more quota will be required; whereas the supply may stem from the leaving of some polluters or other firms that have invested in better abatement technology, so that excess permits will be available in the market. And the ETS represents a built-in incentive for innovation and technology development, as firms with better emission reduction solutions can always make profit through trading excess quota in the market.

While creating an emission trading market, firms will no doubt want as

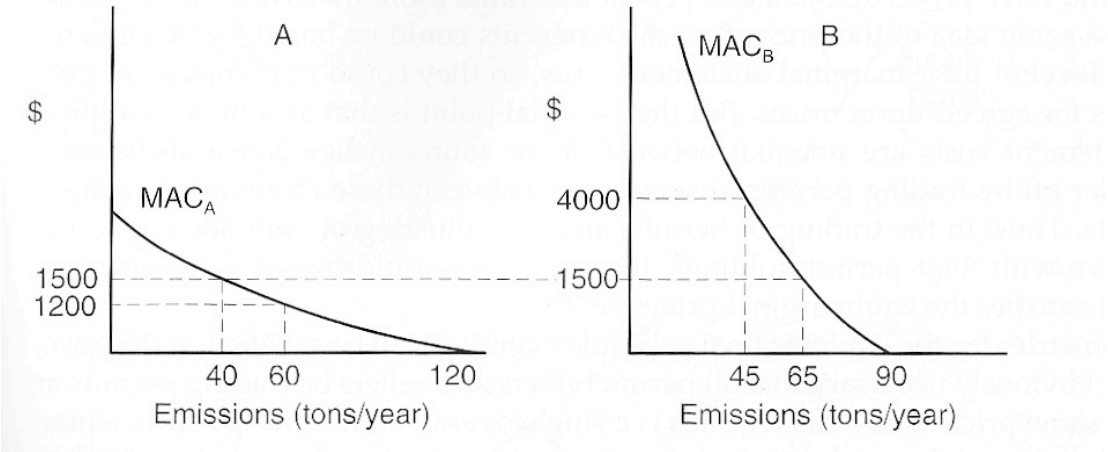


Figure 2-4 Marginal abatement cost curves (Field B. C. & Field M. K. 2006, p259)

much quota as they can get during the first distribution, and the controversy lies in what formula can be used to make the initial quota distribution. In the case of EU ETS, historical emission levels were largely referred for the quota allocation. This might sound equitable, but the level of abatement technology applied in different firms was not taken into consideration. As it is more difficult for firms who have already worked hard in emission reduction to reach further abatement, such allocation "tends to reward firms who have dragged their feet in the past" (Field B.C. & Field M.K. 2006, p262). Yet, it is also argued that the market efficiency is irrelevant with the initial quota distribution. "The major difference between a command-and-control system and a system of marketable pollution permits, however, is that once the initial allocation of pollution is made, polluters are free to buy and sell the rights to pollute" (Kahn 2005, p77). Firms are flexible to choose between reducing (increasing) pollution and selling (buying) quota for their compliance; and under the EU ETS, firms can also choose to save the quota for the future year within each period as well as participate in CDM/JI projects to get extra CO_2 credits.

In the trading market, some intermediaries, public agencies and environmental communities can also participate. The environmental communities may buy and retire some quotas for the purpose of reducing the overall marketable quota. This is criticized as market failure from an economic perspective; yet it favors the environment's sake. In the case of EU ETS, the EU commission also reduced the total amount of free CO_2 quota in the 2nd period, and the saved quotas are not transferrable between different periods. It is expected that much less free CO_2 quota will be allocated to firms in the 3rd period of EU ETS after 2013; instead, firms can buy through auctions. The difference between free allocation and auctioned quota goes to the initial cost for polluters, and this may be especially burdensome for small-and-medium size companies.

2.1.3 The limitation of environmental economics

Although ETS bears advantage over other environmental regulations in many ways in theory, such economic assumptions are based on a perfectly competitive market where all actors behave rationally, and information and knowledge are open to all actors in the market.

However, there are discrepancies between the theory and the reality for two reasons. Firstly, the premise of a perfectly competitive market is groundless in effect, because industrial actors always respond strategically to regulations for their maximum profit and their rationality are bounded. On one hand, human have confined capability in collecting and processing information; and on the other hand, potential competitions and conflicts among members within an

organization preclude its rational response. Secondly, the economic perspective isolates actors from the general institutional environment by elaborating the effect of only one single environmental regulation while overlooks other co-existing rules and the interactions among all actors. As a matter of fact, the actual institutional environment is much more complex and will be further explained in chapter 3.

2.2 An Introduction of EU ETS

The EU ETS concerns only CO_2 emission rather than all GHGs. Although the economic analysis indicates that a comprehensive trading system can significantly save the cost, lack of experience as well as the uncertain scientific knowledge of both fluorinated gases' emission and the absorption of CO_2 by sinks prevented EC from adopting an all inclusive system (Parker 2007).

2.2.1 Regulatory settings

At the industry level, nine sectors are caped by EU ETS. That includes mineral oil refineries, power generation, coke ovens, iron and steel and factories produce cement, glass, lime, brick, ceramics, pulp and paper and all the combustion activities with the thermal input higher than 20MWh (Alberola et al. 2008). In the 1st stage from 2005 to 2007, so-called pilot phase, almost 11500 installations were covered and they accounted for 45% of overall CO_2 emissions within Europe (Egenhofer 2007). Up to 95% allowance was allocated for free initially; while later on, the amount was limit to 90% in the 2nd phase (2008-2012).

For individual firms under EU ETS, they can either sell their unused allowances or save for further use in the same period, yet it is not allowed to transfer allowance from period to period. If an emitter produces more CO_2 than its quota and rejects to purchase for the surplus quantity at the end of each year, not only the high sanction cost but also fewer allowances in the following year will be applied. Non-complying sources would incur a penalty of 40 Euro/t CO_2 in the 1st phase and 100 Euro/t CO_2 during the 2nd phase. According to Parker (2007), Italy and Germany are the two member states that had highest number of non-compliance enterprises after the first year of EU ETS.

At the national level, it is somehow flexible for each MS to set up compliance strategy as well as action plan, so-called National Allocation Plan (NAP). It is up to each MS to decide amount of allowances will be allocated, ways of allocation, share percentage between EU ETS and non-ETS coverage and other means in order to achieve its commitment under Kyoto protocol. NAP is assessed by the EU Commission in accordance with criteria clarified in Annex III of the Directive, and EU Commission has the right to reject or accept NAP in case it infringes with those criteria. Such criteria partly ensure that the emission cap and measurements are sufficient for MS to reach its CO_2 reduction target, and also to protect new entrants, clean technologies and early action enterprises.

A large number of researches were conducted to analyze the 25 NAPs in the 1st period generally present two main shortcomings of EU ETS. First,

more free allowances were allocated than "business as usual" (Demailly and Quirion 2008). After the pilot phase most MSs were judged as being over generous in allocating permits to individual industrial facilities so that prevented the market from well functioning; however, these lacks of stringency are resulted from the fear of the competitive disadvantage of European economies vis-à-vis countries without such CO_2 regulations. In 2005, for example, all emitters participated in EU ETS received app. 80 Mt CO_2 equal to 4% permit more than their actual emissions (Kolshus and Torvanger 2005). In addition, the value of 73.4 Mt allowances reserved for new entrants from several MSs also needed to be added to the over allocation, as it helps neither the achievement of CO_2 emission target nor the development of carbon market. The largest over-allocation happened in Germany where industries obtain 21Mt allowances more than required (Brunner 2008). Therefore, from 2008 to 2012, German industries have 29 Mt CO_2 less than requested. Scaling back emission permits led to resistance from German industries, as they were concerned of potential loss in international competitiveness and additional production costs. Despite of such oppositions, Germany included auctioning procedure voluntarily into its NAP for the 2nd period (NAP II), which envisages 8.8% of its overall allowance will be set aside for sale since 2008. After that, Germany has the highest percentage for auctioning among all MSs followed with the 7% in Britain.

Second, several MSs, like Germany or Netherland, intended to bring "ex-post adjustment" into their NAPs, which means, MS plans to intervene the trading market after the allocation is done, and redistribute the issued allowances among the participating companies (EU Commission 2008). Ex post allocation can disrupt the market, and add more uncertainties to trading firms in the sense that, if companies think they can get additional allowance from government, they prefer to do business as usual rather than turn into the market; therefore, it is prohibited by the EU Commission.

In comparison with the US CO_2 trading market, EU ETS differentiates itself from several features. In the US, companies participate in CO_2 trading market voluntarily; therefore, participation is driven by the normative pressures, and participants are mostly large sized or international companies. In contrast, European companies are subjective to coercive pressures from both national EU level. Moreover, approximately 11% of installations receive 75% of total allowances allocated in EU ETS, therefore, it is clear to see that a majority of installation covers by EU ETS are small/medium size (emit <500000 ton CO_2/year) (Graus and Voogt 2007). Other differences lie in the ways to handle with new and closure installations. New plants, for example, in most MSs, are granted credits for

free; whereas in US, they have to buy every necessary permit. Plant closures, in addition, are tent to be forfeiture more often in EU ETS than in the US one (Ahman et. al 2005).

2.2.2 The carbon market

In order to establish strategies towards EU ETS, organizations need to take many different factors into account. Decision maker can focus on either improvement in their business activities by means of technological innovation to improve organization's performance and competence, or a "compensatory approach" to get CO_2 credits by participating in JI or CDM projects under the Kyoto Protocol (Pinske and Koln 2009).

Despite the two EU ETS shortcomings mentioned previously, CO_2 trading market has been expanding significantly. In 2005, 362 Mt CO_2 corresponding to 7.218 billion Euros were traded; brokers, exchange markets and bilateral transactions are main actors in the trading that are responsible for 57%, 15% and 28% of successful deals respectively. Of all the exchange markets, the European Climate Exchange (ECX) shares the largest proportion of nearly 60%, followed by Nord Pool (24%) and Powermext (7.9%). In 2008, 2.8 billion tons of CO_2 was traded via only ECX (ECX 2009).

Figure 2-5 exhibits the CO_2 prices transacted in ECX from March 2007 to January 2009. Here, the European Union Allowance (EUA) is the tradable emission credit/quota under the EU ETS, the Certified Emission Reduction (CER) is the amount of atmospheric carbon reduction through CDM projects under the Kyoto Protocol; and the red line, spread, presents the difference between CER

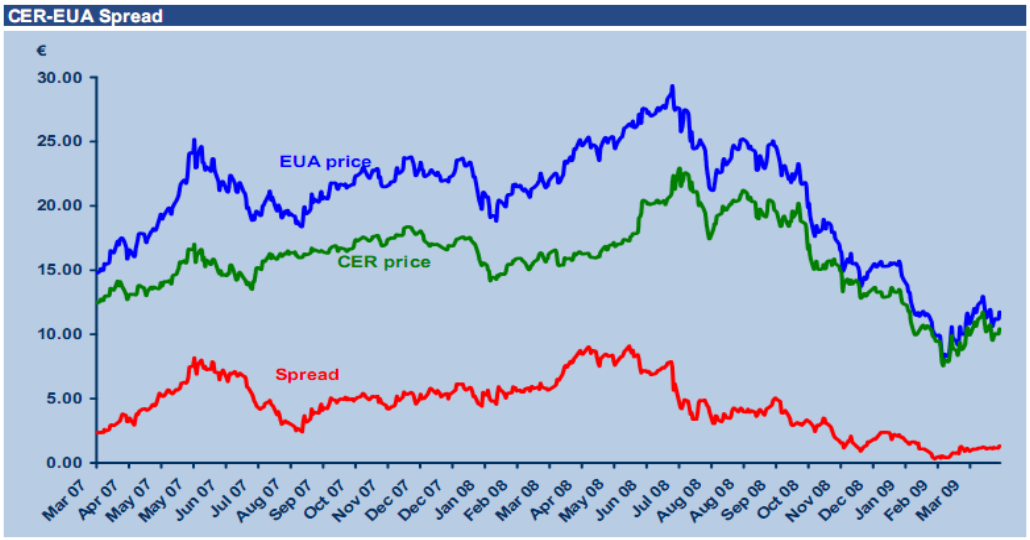


Figure 2-5 CO_2 prices in the ECX from March 2007 to March 2009 (Source: European Climate Exchange Market 2009)

and EUA prices in EUX.

It is clear that the prices of EUA and CER were not stable during the reported period. Generally, the CER price was lower than EUA because of the limitation of CDM/JI credits to prevent carbon leakage. The EUA price reached the highest value in June 2008, which was around 30 Euros/ton and then reduced sharply to nearly 10 Euros/ton in January 2009. Actually, the similar trend also occurred in 2005 when the price dropped from almost 30 Euros to 9-11 Euros/ton in April and May. Two reasons for the fluctuation of CO_2 market are explicated. First of all, although the EU ETS has come into force for several years, the market is still limited with a small number of players. Experience from the US SO_2 market revealed that it took several years of operation for the price to be explicable. Second, the trading market responds to a wide range of signals, such as regulation, climate and economic events. For instance, such climatic signal as cold winter will incur high consumption of electricity for heating, and the CO_2 price may also increase as a consequence. Nowadays, however, the global economic crisis can be the reason of low CO_2 price. Moreover, CO_2 price can also vary in accordant with the fuel price. The Point Carbon analysis showed that 79% of variance in the quota price is resulted from the fuel price and 21% of variance are because of climate signals (weather). According to Parker (2007), prices of natural gas and coal can also heavily affect the quota price in market at least in a short term.

Uncertainties of the future regulation, such as whether ETS will be adopted in others developed countries, how the centralized allocation will affect business and so on, are considered as barriers for organizations to make long-term strategies and long-life investments. As for the 3rd period of EU ETS (2013-2020), companies are likely to face more challenges and stresses because EC is going to tighten the amount of free allowance and increase significantly the proportion of auctioned quota rather than grandfathering; hence, companies should take proactive actions so as to get ready for the forthcoming regulations.

In short, with the volatile CO_2 price, each enterprise needs to develop flexible business climate strategies in terms of both market and non-market strategy to enhance its competitiveness, product development or reputation. Under EU ETS, the CO_2 market prices can partly influence the entrepreneurial decision in both short and long terms (Letmathe & Wanger 2006). Therefore, appropriate levels of commitment, integration of climate goals with other objectives, and relevant measurement methods are necessary for enterprise to handle with CO_2 price fluctuation and increase its "competitive landscape" (Hoffman 2007).

2.3 GHG Emission and Climate Policies in Denmark

The Danish Meteorological Institute observed a mean temperature increase of about 1.5°C since the end of the 19th century, which is "more than double the increase in the global mean temperature for the same period" (Rasmussen & Jørgensen 2005b, p199).

2.3.1 The GHG emission

According to the Danish Environmental Protection Agency, the energy sector (energy production and supply) accounts for almost half of the total GHG emission, while the business sector (industry, building and construction, and services) shares about 13% (see figure 2-6). Among the business sector, the largest industries are the food, drink and tobacco, engineering, electronics, and chemical industry.

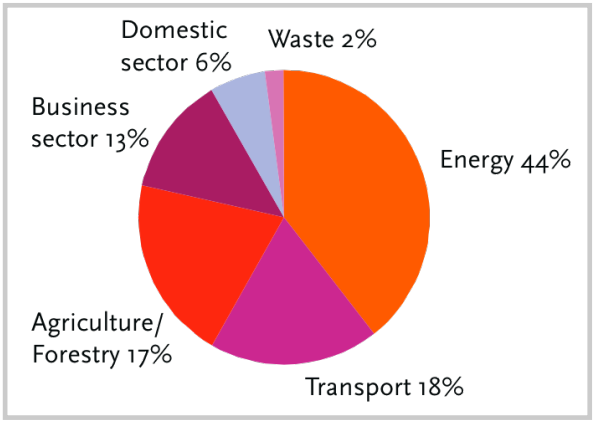


Figure 2-6 Denmark's GHG emission in 2003 by sectors (source: Rasmussen & Jørgensen 2005b, p111)

In 2003, "the total GHG emission level rose from 69.6 million tonnes CO_2 in the base year (1990) to 73.9 million tonnes CO_2" (SetatWork 2008, p4); CO_2 was the most important GHG (accounting for 80% GHG), and its emission came mostly from the combustion of coal, oil and natural gas. Among the business sector, 82% CO_2 was a result of industrial energy consuming activities (Rasmussen & Jørgensen 2005b).

Referring to the Danish official statistics, future CO_2 emission from both the energy sector and the business sector have been projected and compared with the base year level (see figure 2-7).

Obviously, the CO_2 emission from the energy sector is expected to decrease from 2003 to 2030; while for the business sector, a booming trend is anticipated. This clues little potential for Danish business sector to cut down CO_2 emission; instead, the emission level will increase due to the economic growth. Actually, the oil crisis in the 1970s induced changes in Danish energy system and the energy policies, and it also set an alarmed for industries. With the ever-increasing price of oil and the imposing of environmental taxes, companies have already started to improve energy

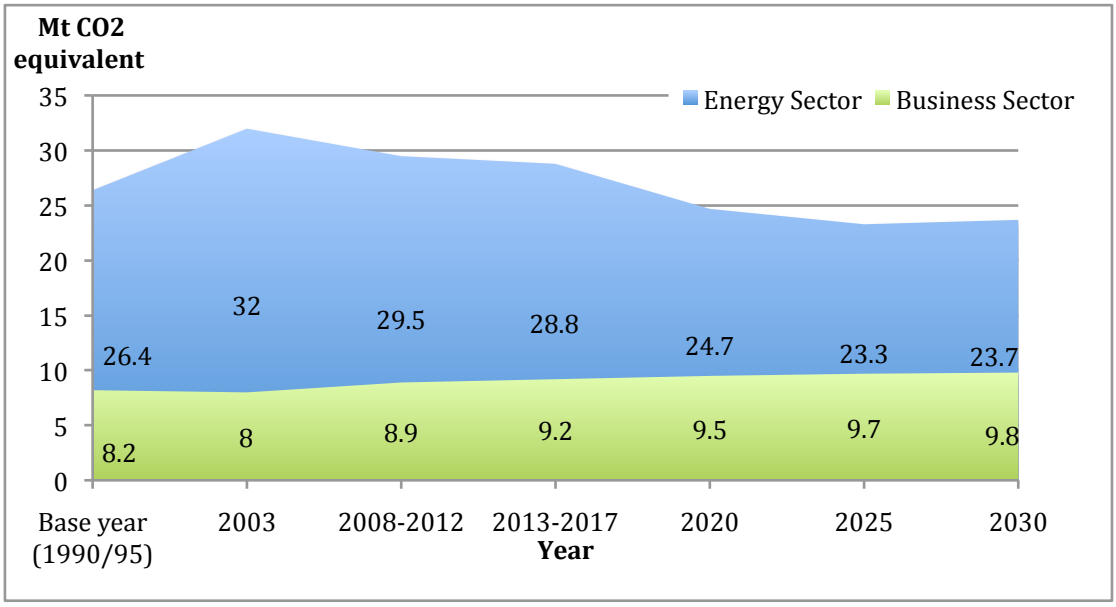


Figure 2-7 Denmark's historical and projected CO_2 emission levels (based on data from Rasmussen & Jørgensen 2005a, p52)

efficiency and develop cleaner technologies; they initiate bilateral voluntary agreements with the government about energy efficiency and saving activities for the purpose of CO_2 reduction. Therefore, further CO_2 reduction from the business sector may be difficult.

2.3.2 Climate policies in Denmark

Ever since the oil crisis in 1973, Denmark began to reduce its dependency on imported fuel, and managed to be self-sufficient with oil and gas from the North Sea in 1980s. Meanwhile, the development of renewable energy, mainly from wind power and biomass, has received political priorities for the purpose of releasing carbon intensive energy production. Today, the renewable energy comprises 19% of overall energy consumption, and the government determined to further reduce country's dependency on fossil fuels (oil, coal and gas) in the near future.

Denmark has committed itself to several international climate targets under the Kyoto Protocol and the subsequent Burden Sharing Agreement in the EU; and the Danish climate policies are set at both national and global levels.

Early in 1990s, goods that causing pollution or discharging polluting substances such as CO_2, HFC_s, PVC, SF_6, SO_2 and so on began to be taxed. In the business sector, some substances causing GHG emission have been phased out. Other environmental taxes on fuel and energy (i.e. oil, natural gas, coal, electricity, etc.) have also been

carried out. In 2000, Denmark reduced its CO_2 emission by 5% compared to the corrected level in 1990. During 2001-2004, Denmark started a national wide CO_2 trading scheme, which was discontinued and replaced with the EU ETS in 2005. Whilst the domestic program engaged merely 8 companies, EU ETS includes more than 300 Danish production units. For other sectors outside the EU ETS, the government has set "a benchmark at 120 DKK/t CO_2 as a basis for the implementation of domestic measures, so as to ensure the correlation of emission reduction effort across sectors and measures (Rasmussen & Jørgensen 2005b, p88).

Following the Kyoto Protocol, Denmark committed to have a 21% reduction in 2008-2012 by means of both domestic measures and the Kyoto Protocol's flexible mechanisms like JI projects (joint implementation of projects in emerging industrialized countries) and CDM projects (collaboration with developing countries on the development of cleaner technology (Rasmussen & Jørgensen 2005b, p87). The government allocated DKK 1,130 millions for purchasing CO_2 via JI/CDM projects in 2003-2008. With a mean allowance price of 50 DKK/t CO_2, the fund provided about 4.5 Mt CO_2 annually. So far, 5 projects have been launched in Eastern European countries; private actors can offer CO_2 credits as the government instigates tenders; enterprises can have a shared interest with others in buying CO_2 credits abroad so as to stand less risk and complex handling procedures.

As the CO_2 tax and the previous domestic ETS are closely related to Danish companies strategy towards EU ETS, more details about these two regulations are provided in the following.

CO_2 Tax

On 1 March 1992, the CO_2 tax was brought into effect in Denmark; though, a EU-wide CO_2 tax was finally rejected. Such tax level calculation is based on the consumed fuel: its energy and sulphur content, the resulting CO_2 emission, and the purpose of the energy use. Generally, the tax level of space heating energy is 100%, that of the energy for most other processes is 20%; and a 5% tax is applied to some energy-intensive processes (Togeby 1998). Although both residential and industrial fuel consumers are subjected to CO_2 Tax, the offshore industry is exempted. An Effort Analysis conducted in 2005 for the period 1990-2001 revealed "the total effect of the introduction of CO_2 taxes and raised energy taxes meant a reduction in annual emission of about 1.5 mill. tonnes of CO_2 equivalents in 2001" (Rasmussen & Jørgensen 2005b, p108).

In relation to EU ETS, however, companies under the trading scheme are not exempt from the taxation. "…the CO_2 tax on energy consumption related to space heating remains 85-128€ per tonne, whereas the CO_2 tax

on energy consumption related to production remains 12€ per tonne" (Miljøstyrelsen 2004a in Perdersen 2006); but the Danish national energy policy has set an agreement to raise the CO_2 tax on non-EU ETS sectors (Danish Energy Policy 2008, p3). According to Mason (2006), "Denmark had proposed to grant exemptions from its national carbon dioxide (CO_2) tax on fuel consumption to companies involved in the ETS…" that is, the energy-intensive businesses under EU ETS would be fully exempted from the tax levy while a 50% reduction would be applied to other non energy-intensive quota-subjected sectors. Yet, this amendment is still pending approval by the EC (Mason 2006).

Domestic CO_2 ETS in 2001-2004

The Danish domestic CO_2 emission cap & trade scheme was launched after the 1999 Electricity Reform, contributing to the 21% GHG reduction target under the Kyoto Protocol. The scheme entered into force in July 2000.

Under the domestic ETS, a total cap of 22 Mt CO_2 was set for 2001 while 20 Mt for 2003 and 2004 respectively; 8 electricity production companies were engaged as their total emission mounted over 90% of total CO_2 emitted from electricity production in Denmark. These 8 companies were: Energi E2 A/S, Elsam A/s, EON/Preussen Elektra, I/S Avedøreværket 2, Østkraft Produktion A/S, Energi Randers Prod. A/S, Dansk Shell A/S, and NEGI Amba (Anholt); companies were registered with a fairly low cost, and their allowances were charged 0.079 DKK/t as administration fee.

Similar with EU ETS, there was initial allowance grandfathering in the domestic scheme, and the allocation was also based on historical emission level (1994-1998); yet, the domestic trading quotas were allocated on a company basis rather than the installation basis in EU ETS. As almost 50% of Danish electricity was produced from CHP, allowances were first distributed to CHP electricity producers that had made early reduction before; then to the remaining producers. Table 2-1 above lists

Table 2-1 Final allocation of CO_2 quota in the domestic Cap & Trade Scheme (Pederson 2006, p3) Unit: Mt of CO_2

Producer	2001	2002	2003	2004
Energi E2 A/S	8.221	7.577	7.135	7.135
Elsam A/S	10.533	9.873	9.420	9.420
EON/PreussenElektra	0.965	0.838	0.751	0.751
I/S Avedøreværket 2	0.094	0.527	0.510	0.510
Østkraft Produktion A/S	0.062	0.060	0.058	0.058
Energi Randers Prod. A/S	0.198	0.198	0.198	0.198
Dansk Shell A/S	0.102	0.102	0.102	0.102
NRGI Amba (Anholt)	0.001	0.001	0.001	0.001
Without allowances	1.825	1.825	1.825	1.825
Total cap	**22.000**	**21.000**	**20.000**	**20.000**

detailed allocation for all companies.

Actually, during 2001-2004, a clear downward emission trend was observed, mainly due to the "increased efficiency of CHP and increased use of natural gas and biomass". (Pederson 2006, p3) Elsam and Energi E2 were two main power companies, and they dominated the trading CO_2 market. Trading was conducted mainly through bilateral agreements of either clean trades (trade allowance for money) or swaps (exchange allowance for JI/CDM project credits). Although the specific prices traded of CO_2 quota were not published, the average was lower than the non-compliance penalty (40 DKK/t). According to Pederson (2006), "the swaps were quite experimental in nature" as companies were not clear about the usage of the credits. In 2002 and 2004, there were some companies paid non-compliance penalties; but the overall allowances were sufficient to cover all emissions. In 2003, however there was a 4.47 Mt total excess due to the low rainfalls in neighbor countries and more electricity was exported.

After all, as there were only 8 companies engaged in the Danish domestic ETS and the total trading volume was fairly low, it was not sufficient for a third party like brokers to exist. Meanwhile, the non-compliance penalty was set too low to secure the overall compliance. Therefore, the Danish experience is more experimental in nature; it provides the Danish industry chances to prepare for a larger scale trading like EU ETS, and sets a model for the development of future trading schemes.

2.3.3 Denmark National Allocation Plans (NAPs) for EU ETS

In order to fulfill the commitment of 21% CO_2 reduction, Denmark needs to reduce at least 54.8 Mt CO_2 annually during 2008-2012 (Danish EPA 2006). The determination of sectors' share and the total allowances under EU ETS depend on comprehensive scenarios analysis of emissions from different sectors, costs to fulfill Denmark's climate commitment and the government's climate strategies (Danish EPA 2008).

Table 2-2 (see next page) illustrates the distribution of CO_2 emission from various sectors in Denmark. It is obvious that the caps for electricity sectors, energy intensive industries and new entrants are significantly tightened in the 2nd phase; and non-ETS sectors are expected to contribute 38.1 Mt CO_2 emission annually. As there's an expected deficit of 13 Mt CO_2, Danish government also implemented other programs including both the central government initiatives (JI/CDM credits, monitoring CO_2 removals by sinks, new national measures within non-ETS sectors) and enterprises' own commitments.

Table 2-2 Distribution of CO_2 emissions in Denmark during 2008-2012 (Source: European Commission 2007)

		Expected annual emissions 2008-12 (Mt)	Annual allowance in 2008-12 (Mt)	Annual allowance in 2005-07 (Mt)
CO_2 emission/allowance in	Electricity sector	20.5	15.8	21.7
	Energy intensive industries, incl. offshore	9.2	8.2	9.2
	New enterprises		0.2	1.7
	ETS sectors in total	29.7	24.5	33.5
	Non-ETS sectors in total	38.1		
Total GHG emissions		67.8		
Emission target		54.8		
Deficit		13.0		

Table 2-3 (see next page) indicates the difference between NAP I and II in four aspects. Firstly, during the 1st stage, Denmark, together with Lithuania and Ireland are the 3 countries that set part of the total allowances a side for auctioning; and Denmark had the highest proportion (5%) among the three countries. The revenue was used as administrative costs. However, from 2008, only surplus allowances from closure facilities are available for auction. Secondly, free annual allowance is substantially lowered from 30.15 Mt in the 1st phase to 24.5 Mt the 2nd period. Thirdly, during the 2nd phase, industrial production units can obtain CDM/JI credits no more than 7% of its free allowance; such a threshold ensures that the overall allowances that installations receive from free quota and JI/CDM credits would be around 98% of its historical emission. Lastly, in the case of installation closure, allowance will be discontinued unit in the following year. Yet, unused allowances were auctioned off in the 2nd phase while in the 1st stage they were setting aside for new entrants.

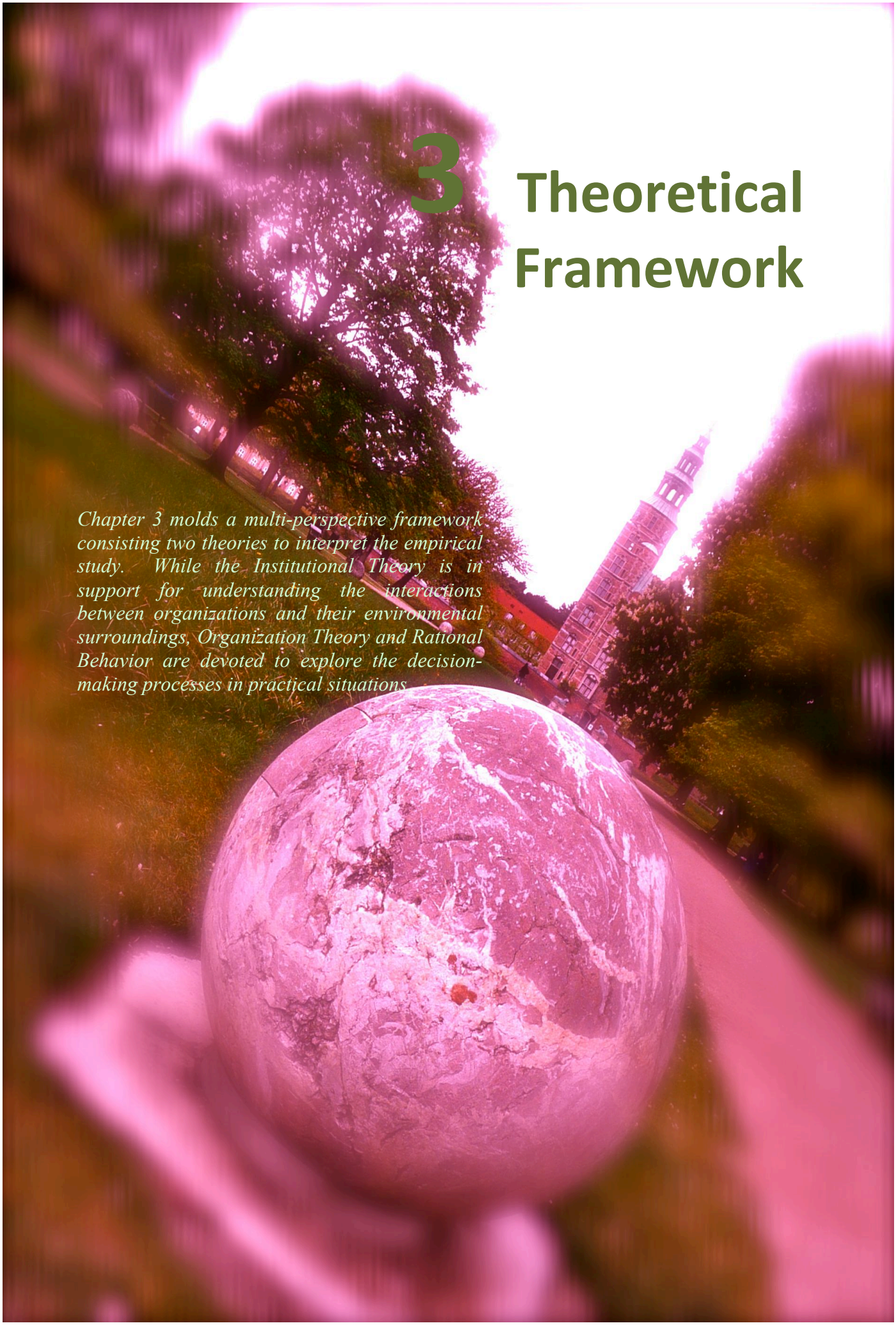
Following NAP II, allowances for industries are distributed according to their respective average historical emission during 1998-2004 or the emission in 2004 if it's higher than the average. For the industries (incl. offshore), although the overall allowance covers almost 92% of the historical emission, the amounts of free allocation for fuel–related CO_2 sources (87%) and process-related CO_2 sources (98%) are different; because CO_2 emission from the former can be reduced relatively easier by switching to less carbon-intensive fuel like natural gas or biomass. After all, an

installation may excess its cap in one single year but not throughout the whole period. Among all industrial sectors, allowance for combustion installations counts for the most (nearly 85% of all), following by that for cement producing installations.

Table 2-3 Comparison between Danish NAP I and II (Source: European Commission 2004 & 2007)

	NAP I (2005-2007)	NAP II (2008-2012)
Target		Reducing 21% GHG in the year 2008-2012 compared with the reference year 1990
Allocation budget	Total allocation: 100.5 Mt Annually: 40.2 Mt (2005), 30.15 Mt (2006 & 2007 respectively)	Total allocation: 122.5 Mt Annually: 24.5 Mt
Number of facilities	Covers 357 installations (234 in energy sector and 123 in industrial sectors included off-shore)	Covers 374 installations (251 in energy sector and 123 in industrial sectors included off-shore)
Method of allocation	Grandfathering for existing facilities. Benchmark for sub-sector electricity. Unequal distribution based on exposure to competition, economic effects of ETS, and reduction potentials. Reduction from industries is less stringency than that from the energy sector	For the energy sector: based on historical electricity production. For industries: differentiate fuel-related and process-related CO_2 emissions
Allowance for Industries (incl. offshore)	9.2 Mt CO_2/year	92% of allowances basis
Auctioning	5% (1.7 Mt CO_2/year)	0%
New entrants	1 Mt CO_2/year for new entrants. Allocation accordingly to proportions of new production unit capacity	2% of allowance set aside for new entrants and new capacity of existing installations depend upon their capacity or capacity expansion, based on benchmark. Allocation is independent of fuel consumption; surplus will be auctioned off
Closure	Unused allowances will transferred to the pool for new entrants	Allowances from closure or cease production will be auctioned off
JI/CDM	Budget for 2003-2007: the government set 125 Million Euros for purchasing projects to fulfill Kyoto target	Overall limit for industrial use of JI/CDM credits is 7% of their allowance, and 32.5% for energy sectors.

3 Theoretical Framework



Chapter 3 molds a multi-perspective framework consisting two theories to interpret the empirical study. While the Institutional Theory is in support for understanding the interactions between organizations and their environmental surroundings, Organization Theory and Rational Behavior are devoted to explore the decision-making processes in practical situations.

3.1 Institutional Theory

"Organizations require more than material resources and technical information if they are to survive and thrive in their social environments. They also need social acceptability and credibility."

Scott et al. (2000 in Scott 2001, p59)

Regarding to this project, the introduction of institutional theory covers two parts: 1) the basic analytical framework & levels of institutional processes, and 2) institutional processes and organizations. The former will be presented in brief while a relatively detailed review is given to the latter.

3.1.1 The analytical framework & levels of institutional processes

Scott (2001) identified three contrasting elements that compose institutions: regulative systems, normative systems and cultural-cognitive systems. As is shown in the table (3-1) below, each of them represents a distinctive basis of compliance, basis of order, mechanism of diffusion, type of logic, cluster of indicators, and foundation for legitimacy claims; all of them may work in combinations but through heterogeneous mechanisms and processes.

Table 3-1 Three Pillars of Institutions (Scott 2001, p52)

Types of Characteristics	Pillar		
	Regulative	Normative	Cultural-Cognitive
Basis of compliance	Expedience	Social Obligation	Taken-for-granted
Basis of order	Regulative rules	Binding expectations	Constitutive scheme
Mechanism	Coercive	Normative	Mimetic
Logic	Instrumentality	Appropriateness	Orthodoxy
Indicators	Rules, Laws, Sanctions	Certification Accreditation	Common beliefs, Shared logics of action
Basis of legitimacy	Legally sanctioned	Morally governed	Comprehensible, Recognizable, Culturally supported

Table 3-2 Institutional Pillars & Carriers (Scott 2001, p77)

Types of Carriers	Pillar		
	Regulative	Normative	Cultural-Cognitive
Symbolic systems	Rules, Laws	Values, Expectations	Categories, Typifications, Schema
Relational systems	Governance systems, Power systems	Regimes, Authority systems	Structural isomorphism, Identities
Routines	Protocols, Standard operating procedures	Jobs, Roles, Obedience to duty	Scripts
Artifacts	Objects complying with mandated specifications	Objects meeting conventions, Standards	Objects possessing symbolic values

Institutions are embedded in various types of repositories, Scott also identified four types of carriers that serve to cross-identify the 3 pillars (see table 3-2).

Among several varieties of institutional theory, one of the major differences is the level the institutional analysis is applied. That is, whether the investigation is focused on more micro or more macro phenomena. For the purpose of this research, three institutional levels are made out as 1) the national level, 2) the regional (EU) level, and 3) the global level; because Danish companies are facing with different environmental regulations coming from these three dimensions. Since the agreement on Kyoto Protocol, the Danish government has committed itself to mitigate climate change; various environmental taxes, including CO_2 tax, have been imposed on industrial sectors. Later, when the EU-wide CO_2 tax failed to be brought about, quick actions on EU ETS were took by the EU Commission; it came into force in 2005 and covered all EU MSs include Denmark. Since then, most surveyed Danish firms have been subject to dual regulations for the same issue (CO_2), while almost all other MSs have no CO_2 tax. Turning to the global market, Europe is the only region with a limited cap of CO_2 emission. However, their competitors in US are subjected to mainly voluntary agreements, and those in developing countries may deal with far less regulatory issues. Figure 3-1 (see next page) illustrates the institutional environment of Danish companies with reference to different institutional levels and heterogeneous actors.

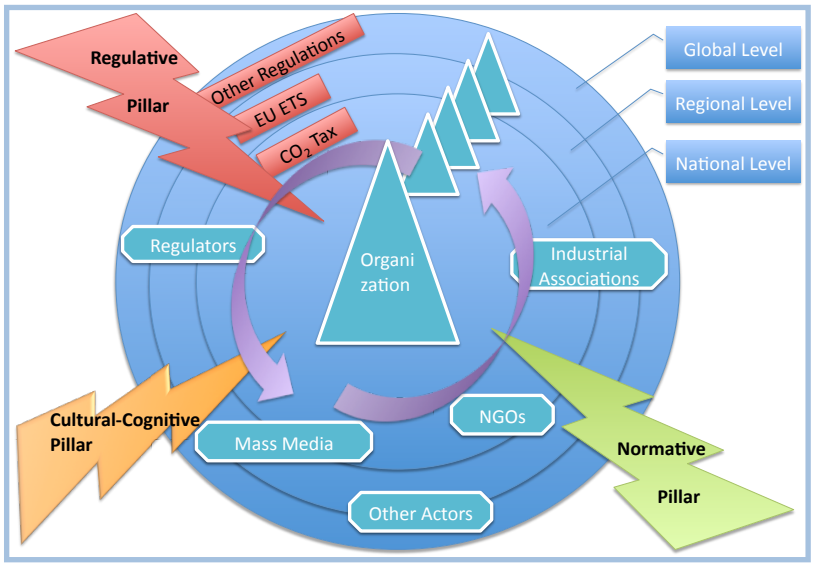


Figure 3-1 Organizations and the institutional environment

3.1.2 Institutional process and organizations

Generally speaking, organizations need to meet with institutional demands at various levels. For the contemporary organizations, two notable features can be concluded from various studies and arguments: firstly, there is significant similarity in the structural of organizations within a same organizational field; and secondly, both formal and informal structures co-exist in organizations (Scott 2001, p153). The formal structure refers to officially sanctioned offices and ways of conducting business, while the informal structure refers to the organization's actual patterns of behavior and work routines.

As Scott (2001) attempted to investigate features of the effect from institutional processes onto organizations, he concluded that there were varying elements and mechanisms as well as varying sources and salience. Hence, general effects might be overlooked and trends were mostly visible when a longer time period was considered. Nevertheless, complex environment in the institutional context was likely to generate complex organizational structures such as large administrative components and boundary-spanning units.

Dobbin et al., Sutton et al. and Edelman et al. (in Scott 2001, p170) conducted a series of studies about the response of a diverse sample of U.S. organizations to equal opportunity action laws passed in the early 1960s, and these studies exemplified the mutual interactive process between the institutions and organizations. Initially, all laws were subjected to variable interpretation so that being too ambiguous for the cooperative organizational managers to see what compliance meant. Then the managers and their counterparts underwent a sense-making process to figure out their acceptable measurement towards the laws, and consequently, they formed up proposal which later being evaluated by the federal courts. After

the programs being declared to meet the requirement of the laws, they diffuse quickly among organizations within the field. Such a process of legal change could be seen as organizations' endogenous process because it was guided more by normative constructions among the professional actors. While the state induced institutional regulative changes on one hand, the organizations' interpretation reshaped the rules and defined compliance behavior across the field on the other hand.

Organizations are affected, or sometimes penetrated, by their environments; and they need to adapt themselves to be the same with others. Numerous researches find a positive relation between the increasing prevalence of a form or a practice and the increasing legitimacy. The adoption practice at an earlier stage may represent a choice of the organization; yet, "as institutionalization process proceeds, normative and cultural pressures mount to the point where adoption becomes less of a choice and more of a requirement" (Scott 2001, p163) Thus, Scott (2001) stated three classes of variables affecting organizations' adoption--attributes, linkages, and reference groups, as well as five strategic responses of individual organization towards institutional requirements as acquiescence, compromise, avoidance, defiance, and manipulation (see figure 3-2).

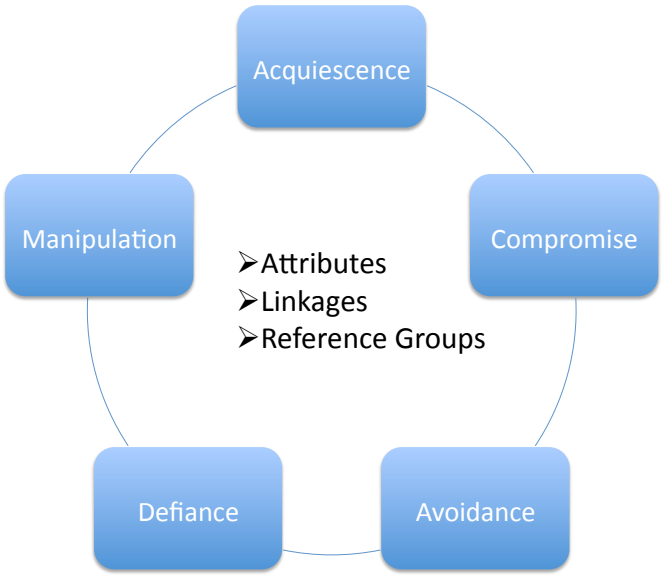


Figure 3-2 Adoption variables & types of strategic response

Specifically, for the adoption variables, he firstly gave examples like the organization's size and the role of the CEOs in the attributes category. He stated that large-size organizations are prone to early adoption, more resource rich, more sensitive to environmental changes, and more visible to external publics. Meanwhile, he pointed out that CEOs affect adoptive behavior especially in private sectors. For the linkage variables, being connected was differentiated from being similar. As the former meant cohesion whereas the latter meant structural equivalence, the similar ones were more likely to be influenced each other by their behaviors. Lastly, the variable of reference groups was to investigate

whom an organization might choose to imitate. The suggested targets were those organizations being geographically proximate, being similar as operating in the same industry, being closely related as sharing resources, information, and/or board interlocked, having high status or prestige, as well as being more visibly successful.

For the five types of strategic responses from acquiescence to manipulation, they are largely dependent on firms' individual characteristics and interpretations of the institutional environment. To be specific, acquiescence is responded when the institutional pressure offers a "lion's share"; a firm's compliance is probably motivated by "anticipation of enhanced legitimacy, fear of negative sanctions, or hope of additional resources" (Scott 2001, p171). Compromise is responded when a firm finds room to maneuver, to bargain or to compromise with the institutional demands, while conflicting issues are likely to occur in the environment. Avoidance is a symbolic compliance strategy when a firm decouples the structural feature from technical activities to signal its conformity; by means of developing some specialized administrative units, the firm's operating units can remain independent from the external pressures. This happens especially when the firm perceives significantly high adoption cost. Defiance is a firm's resist response in a highly public manner mostly because its interest will be substantially diverged under the required condition. However, such strategy may incur imposed compliance from the external power. Lastly, manipulation is responded when a firm attempts to co-opt, to influence or to control the environment on purpose and such opportunity is perceived; the organization's bargain power can be improved by developing linkages to other important sources of power, for example, the mass media.

In sum, institutional theory provides a broad overview of organizations facing external requirements from distinct systems and at different levels. It clarifies that an organization's strategic response is largely shaped by its perception and expectation of the institutional demands; while subject to institutional pressure, organizations are able to reshape the institutional structures.

3.2 Organization Theory & Rational Behavior

Rational choice approach, which is able to generate an array of specific theories and testable hypotheses of a wide range of human behavior, relies on fundamental assumptions about the individual actors and on the social world that they embedded in (Pollack 2006). According to Snidal (2002, p74) rational choice is "a methodological approach that explains both individual and collective outcomes in terms of individual goal-seeking under constraints". In general, firm needs to deal with problem once it arises by making suitable decision in the condition of uncertainties and then wait for other problems to appear. Every decision is formulated on the ground of how a firm defines the problem; by doing so, potential alternations, existing rules and other factors that can affect firm's aspiration are carefully pondered (March 1999).

In most of rational models, goals play crucial role in shaping the decision making process, which is seen by Simon (1997) as the mechanism that confines the ends (goals) towards which activities are directed. Moreover, goals can generate both "value premise"- the preferred ends (so-called goal specificity) and factual premises-means for achieving desired ends. In this context, how firms make decision to deal with EU ETS is investigated; herein two essential views of decision-making process are presented: one is based on the logic of consequences, and another is based on logic of appropriateness.

3.2.1 Logic of consequences

Decisions are made on the logic of consequences (so-called rational choice) are portrayed by the following

Figure 3-3 Model of rational choice

4 steps: 1) frame potential alternatives, 2) forecast consequences of every alternatives, 3) figure out values to evaluate pros/con of every outcome of alternatives and 4) indentify sets of law to select decision (see figure 3-3).

How these 4 steps are actually implemented depends upon the existing conditions of each organization, for instance, business market, technological level, resources, culture and so on. In terms of EU ETS, alternatives and their outcomes can be initiated from data, risk or scenarios analysis of applied technology, market trend, regulation alternation, and uncertainties or by examining all the possible actions that might be taken by other players in the field. Within its boundary, organization develops structured process to deal with the problem and avoid internal uncertainties. In addition, a systematic mean is formulated to figure out how to define the problem, as well as ways in which the solution is accepted and adopted. In the light of EU ETS, organization needs to face with a large number of uncertainties mainly from its surrounding environment, for instance, unstable political framework, CO_2 allowance price, fuel and electricity price…therefore, it is necessary to carefully consider about all the possible alternatives and their outcomes.

Meanwhile, organization relies on its goals, value premises and factual premises to indentify decision rules to evaluate those alternatives, which again depend upon its own situation and expectation. Logical values and decision rules are rationally employed by decision markers to compare the pros and cons as well as risk preferences among different alternatives to discover the most potential one. The action is selected as the possibility with highest expected value. Actually, decisions are influenced by former preferences and are bounded by organization/individual significant restraints on finding and implementing optimal solutions. This model illustrates that all potential alternatives, means to achieve the goals, possible outcomes, and subjective value of each possible actions are under consideration when making a decision (March 1999).

3.2.2 Logic of appropriateness

This approach does not follow the rule of critical and logical thinking; rather, it bases on existing rules, procedures, routines, roles and identities. Thereby, choice is made simply by matching existing rules, identities… to a set of contingent trend in the field. Decision makers, who are adhere to rule-based action or logic of appropriateness can pursue the model from rule development to implementation. The appropriateness of rules includes both cognitive and normative components (March and Olsen 1995). Embedded in a social collectivity, organizations do what they see as appropriate for themselves in a specific type of situation. In this context, situations are

classified into "distinct categories that are associated with identities or rules" while particular identities "are conceptualized based on the personal, professional background of decision-makers and are evoked in particular situation" (March 1999).

Some theorists acknowledged that in high level of uncertain situations, behaviors are more likely to be driven by appropriate assumptions rather than conscious anticipation of consequences, calculation of cost and benefits. This is resulted from the difficulties in predicting precisely the consequences of every action and future trend of the surrounding environment. Following are the 4 different usual ways that organization can apply to search for the relevant rules.

- Organization can consciously choose and rationally adopt others' rules to follow with, and the outcomes of their activities have already been judged.
- Organization can learn from previous experience and adjust existing rules to be suitable for further activities based on feedback from surrounding environment.
- Decisions can be copied from good practices; or rules that wide spread throughout a large number of organizations.
- A group of rules can be considered as an evolution of population of invariant rules, which means rules depend upon the history. Although some theorists argue that survival rules are optimal, it not fully guaranteed that rule is optimal at any arbitrary point in time (Carroll and Harrison, 1994).

Rules, however, are often ambiguous and axiomatic, besides a wide range of rules might be applied to particular situation. Individual or organization identifies what rules and identities exist, which are relevant and what different rules and identities demand in specific situation. Implementation of rules in fact, is another form of rational action which choice is made among the interpretation of actors' interest and sentiment. Therefore, rules are chosen and implemented in favor of decision-makers.

3.2.3 Bounded rationality

Logic of consequences and logic of appropriateness are two basic models of rational behavior. In both models, decision is shaped and adopted in favor of decision-makers; therefore, bounded by decision-makers' individual background and perceptions. Obstacles that can probably create boundaries on rational decisions are 1) amount of information they can access and process, 2) number of potential alternatives they can entertain, and 3) ability to predict the consequence of their actions (March and Olsen in Jaffee 2001). Because of those barriers, human tend to simplify the problem and break it into sub-problems without considering the interaction among the

sub-problems without considering the interaction among sub-problems. Besides, on the way to find alternatives, and rules organization has potent inclination to seek for information to support their existing solution rather than figure out the unconfirmed data; information which is applicable to specific case instead of general situation; relies on few supportive clues and exclude the others and concreted information is more favorable than statistics data. However rational decision-making, in reality, offers an organization a chance to exercise greater control over not only decisions but also behaviors of organization's members.

One of the possible solutions to reduce biases in making decision is by introducing the notion of organization as coalitions made up of individuals that have diverse interest and goals to avoid self rationalization, meaning "self streamlining, that is, the systematic application of functional rationality to the self to attain certain individual ends" (Jaffee 2001, p105). However, by doing so, organization can evoke other difficulties such as communication, coordination and conflict among participants. Another way to get over is by searching in terms of learning from its own or others' experience, which is aroused by the aspiration to find the best alternative to satisfy the existing goals.

In sum when applies the logic of appropriateness, an organization can identify the rules within or outside its boundary and match those rules to its own situation. In contrast, rational choice offers the logic of consequence, by which decision is made upon evaluating the values and consequences of alternatives. Although the two methods are rational and bounded by human limitation, by applying the logic of consequence, firms can actively predict and adapt to the movement in surrounding environment.

4 Problem Formulation & Research Methodology

Chapter 4 elaborates two main research questions of this study, outlines the scope and the structure of the research, and brings up the methodological consideration for investigating the research questions.

4.1 Problem Formulation

From the perspective of environmental economics, setting up an ETS will not only reduce the social abatement costs for mitigating climate change to the lowest level, but also provide flexible approaches for firms to comply with the regulation, as well as continuous incentives for innovation & technology development. Based on such assumptions, this project conducts an empirical study of corporate strategies from Danish companies towards EU ETS following two main research questions:

1) How do Danish companies develop strategies to handle with EU ETS?
2) What are their strategies?

These two questions closely related, as the latter is the outcome of the former. In detail, the first question aims to investigate the procedure of companies' decision-making processes. This process covers information collection to establish their cognition and interpret their situations, main approaches to set up corporate strategy towards EU ETS, as well as the difficulty they experienced during the process.

The second question aims to depict a general picture of companies' corporate strategy including their main strategic considerations, and the time span of their strategies. To be comprehensive, the strategic considerations cover both internal factors like the production cost and the technology advancement, and external factors like the EU ETS regulation setting, the market price of CO_2 quota and so on; the significance of these factors within a short term (< 5 years) and long term (5-10 years) will also be explored. Meanwhile, the investigation of time span refers to three aspects: the time span of companies' general climate strategy, the time span of companies' specific strategy for EU ETS, and the time span of technology investment payback.

Thus, the following sub-questions are developed to ensure a systematic research.

- What are companies' general perceptions of EU ETS?
- So far, what impact has been incurred from EU ETS to companies' business?
- What are the sources companies take advantage of to get relevant knowledge and information about EU ETS?
- What are the main approaches companies applied to establish their strategies?
- What is the predominant decision-making pattern among Danish companies?
- What are the obstacles challenged companies during their decision-making processes?
- What are the actions that companies are likely to take as a response to EU ETS?

- What is the time span of corporate strategies?

As an attempt to answer the two main research questions, following hypotheses are developed on the basis of conceptual background as well as theoretical framework.

#1. As EU ETS regulates only CO_2, one single target out of all environmental related issues, companies' may not spend great effort on systematic analysis to work out their strategy. Instead, the managers' decisions of what to do based on their own perceptions; such a decision-making process follows the logic of appropriateness.

#2 Companies receive plenty of free quota during the 1st period, and about 90% of their historical emissions for free during the 2nd period. Such exceeding allocations may have undermined the effect of EU ETS so that only limited impact has been imposed onto industrial populations so far. Considering the allocation for the 3rd stage is still of uncertain, companies will probably just trade quota rather than initiating large-scale actions for emission reduction; and the institutional uncertainty will induce isomorphic responses among the organizations.

These two hypotheses will be examined through the empirical study.

4.2 Scope of the Research

The Danish NAP II provides a comprehensive list of production units that are subject to EU ETS and their respective allowances during 2008-2012; hence, corresponding companies can be figured out. Except for four production units from hospitals, the majority of the production units belong to the energy sector; yet, this project concerns only the non-energy sectors because the latter are more vulnerable in the institutional environment as they are also subject to the changing of electricity price, they have a broader market with more competitors, and they have more strategic choices such as relocating production units and changing production manners to deal with the regulation. Therefore, the term "Danish companies" in this project refers to the industrial sectors subjected to EU ETS while excludes the energy sector. Although every targeted company is contacted by phone for the maximum participation within a short period, the final analysis and conclusion will base on those willing to participate the survey via answering a questionnaire.

As it is now the second period of EU ETS, most companies should have already got familiar with the regulation and administrative routines, looked deeper into the issue of CO_2 quota trading, and balanced their respective advantage with disadvantages, so as to keep the business revenue growing under the CO_2 cap. Therefore, findings

from the empirical data would represent a matured strategic behavior among the Danish industry.

4.3 Structure of the Project

Figure 4-1 illustrates the general structure of this project.

In general, this project began with a literature study to overview current studies regarding EU ETS as well as to form a conceptual background for this research; meanwhile, several sorts of theory were explored so as to understand the mechanism of emission trading and formulate a theoretical framework for the empirical study; based on these, more detailed research questions were developed. The second step of the project is to carry out a survey for the empirical study, and then analyze the results to examine the hypotheses. After that, the conclusion of the project will come out.

In detail, the conceptual background was the starting point of the project as all basic issues were organized here. It included two main subjects from the literature review. One was about the EU ETS regulation and the carbon market, so as to see how companies were supposed to do under EU ETS, how much was the quota price and how it changed; the other was about the Danish industries, that is, their GHG emissions in general and their climate policies.

The three sorts of theory being studied were 1) the environmental economics theory, which explained mechanisms of various environmental regulations, and illuminates why the ETS is

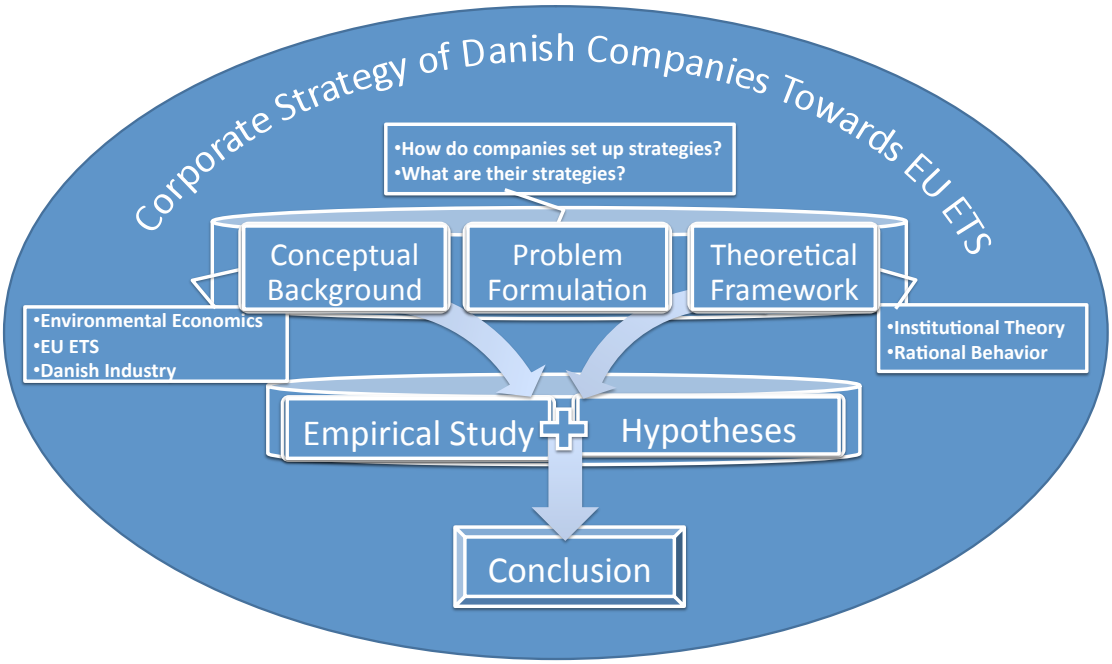


Figure 4-1 Structure of the project

preferred than a tax; 2) the institutional theory, which explained the multiple external institutional fields that a firm is engaged in simultaneously; and 3) the rational behavior theory, which explained a firm's decision-making process for setting up strategies and told the fact of limited rationality.

Actually, the environmental economics explanation was part of the conceptual background while the latter two theories form up the theoretical framework for analyzing the empirical study; because the economic perspective referred in this research was simply a static and isolated viewpoint and generated discrepancies between theoretical assumptions and the reality, while the other two theories gave either a broad view of the organizations' external environment or a micro insight on their internal decision-making processes. Thus, the empirical findings could be better interpreted, the hypotheses could be tested, and the conclusion would be drawn out.

4.4 Research Methodology

In order to get a concrete picture of the corporate strategy from Danish companies, enhance the validity and credibility of the report, two research methods, literature reviews and survey, are applied in this project.

Literature review

The literature review is applied throughout all phases of the research. Insight knowledge of theoretical background, understanding the EU ETS at both EU level and national level, and designing the survey are mainly inspired by the literature research. According to Silverman (2000), theories provide a set of concepts in order to understand the phenomenon. Take this as a point of departure; the research's framework was formulated in the relation to theoretical framework.

Moreover, official documents regarding EU ETS are taken as the references for the report. For instance, the Danish NAP for the first and second period respectively, the Danish Law on CO_2 Allowances (Nr. 493) together with the EU Directive 2003/87/EC were employed as rules for companies to comply with and guide for participating the carbon market.

Understanding the regulation settings is essential to look deeply into the actual impact of EU ETS upon industries as well as the corporate strategies. Exploring current researches in the same field is an effective tool for literature studies of practical part.

Survey

The purpose of survey is to ask for the companies' participation in the empirical study so as to explore the operational information regarding CO_2

emission and corporate responses towards EU ETS.

In the survey questionnaire (see Appendix I), although it consists 23 questions, all are multiple choices so that companies' staff will be more likely to answer them. While designing the questionnaire, choices regarding the tendencies and possibilities are provided with choices in 4 levels, because an even number gives clearer clues towards either side; and similar wording of different questions are arranged far apart so as to avoid confusion. For example, there are 3 questions concerning time span for expected investment payback, general climate change strategy and specific plan towards EU ETS respectively, and they are arranged as question 6, 15, and 22 in the survey. In case of not all possible answers are available under the question settings, an extra choice of "others" is provided necessarily with open space for further statement in most questions. After all, the survey starts with factual questions regarding the production unit(s), such as, "what is/are the dominant source(s) of energy" and "is CO_2 emitted mainly from fuel combustion or production process", so that the respondents may find it easy to start with. And the final layout includes a cover page stating the purpose of this survey as well as a confidential statement that companies are always sensitive with.

Following the list in Danish NAP II, there are 108 production units belonging to 68 industrial firms under EU ETS. As the survey asks for more corporate strategic information, questionnaires were sent to individual firms rather than each single production units. In order to reach firms' participation to the greatest extent and find the right personnel to give the answers, phone calls are made in ahead. Questionnaires are saved in electronic version, and being sent out and received back via emails.

The survey was stared on March 12, 2009 and closed on March 31, 2009. Of all those being contacted, one firm's production unit had moved to outside Denmark, another firms' production unit had already closed, and a third company's strategic plan was subjecting to the foreign mother company; therefore, the valid sample size reduced to 65 industrial firms. During the survey period, answered questionnaires from 20 firms were collected representing 31% of all Danish industrial firms that are subject to EU ETS. Meanwhile, these 20 firms are among diversified industries producing food products, animal products & by-products, machinery, chemicals, ceramic, steel, horticultures and so on.

Data analysis and validation

Raw information obtained from literature review and survey is focused, simplified, abstracted and transformed; this data reduction step is mainly to get rid of unnecessary information and decide about which chunk data will provide the initial focus (Silverman

2000). By organizing data in network and tables, the main directions and also the missing information in the research can be easily clarified. Analyzing the meaning of collected data, noting patterns, and possible configurations are for the purpose of final data analysis-conclusion drawing.

5 Empirical Study

Chapter 5 presents the survey results in three parts.

The first part reviews companies' perspectives and the observed impact from EU ETS.

With an attempt to unmask companies' decision-making processes, the second part exhibits such issues as companies' sources of knowledge, the organizational responsibilities for decision-making, main approaches for establishing strategies, and difficulties they experienced when making the decisions.

Finally, the corporate strategy, differentiated as market-strategy and non-market strategy, is presented in the last part.

5.1 Companies' Perspectives & the Impact of EU ETS

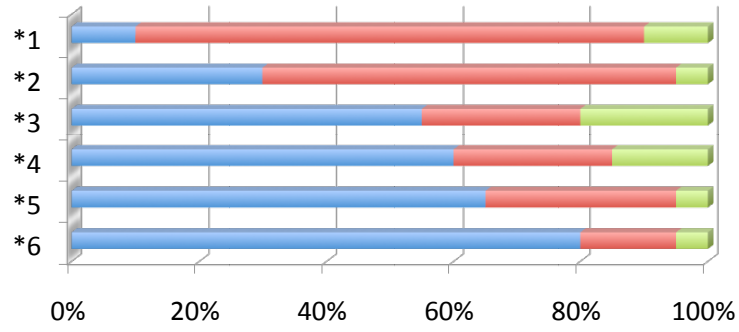
To start with, this section compares how companies perceive EU ETS and how EU ETS has actually affected their business.

5.1.1 Companies' perspectives on EU ETS

Figure 5-1 unveils a general picture of Danish companies' viewpoints towards EU ETS.

In detail, the majority (80%) of companies did not consider the compliance with EU ETS would be profitable in the long run; though, an equivalent percentage agreed EU ETS bearing incentives for innovation. Referring to environmental economics, companies under an ETS can make profit in the trading market by means of technology change. However, in this case, companies might see the cost for innovation would be too high to be surpassed by the revenue from trading, especially when quota price is fairly low; or companies regard technology innovation as a cost-saving approach rather than drawing extra revenue.

Meanwhile, although over half of them remained their production patterns unchanged under EU ETS, some companies did identify production transformations; thus, EU ETS is exemplified as being able to incur radical changes at the firm level.



Statements
*1 EU ETS will make our company profitable in the long run.
*2 EU ETS has changed/is changing our production pattern.
*3 ETS makes our company less competitive than intra-EU companies.
*4 EU ETS makes our company less competitive than extra-EU companies.
*5 The compliance of EU ETS is costly in a short term.
*6 EU ETS promotes incentive for our innovation and further development.

Figure 5-1 Distribution of companies' perspectives on several statements

Besides, more than 50% companies agreed on competitiveness loss in either intra-EU or extra-EU market due to EU ETS. Since each MS interprets EU ETS differently into their respective NAPs, companies in different countries are facing challenges at distinct levels. For Danish companies, their adverse position may also be resulted from the dual CO_2 regulations (tax and EU ETS), and thus becoming less competitive within EU. Also, since EU ETS is the most substantial ETS covering the largest number of installations, EU companies are challenged by much stronger and more complicated institutional pressures than other firms outside EU.

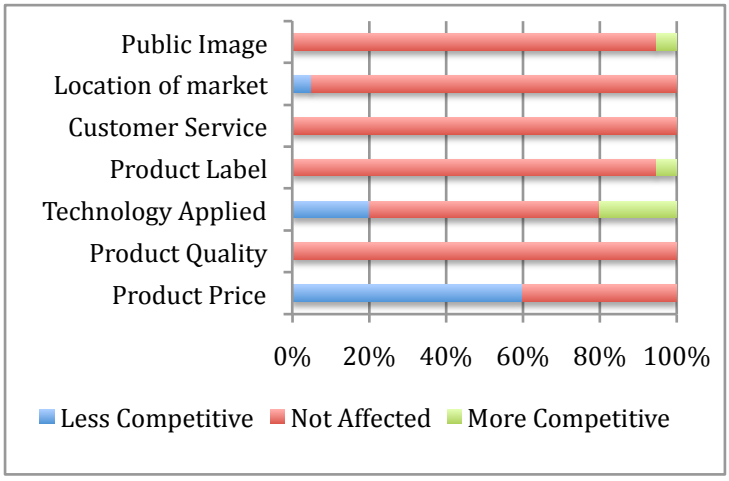


Figure 5-2 Impact of EU ETS on several competitiveness-related factors since 2005

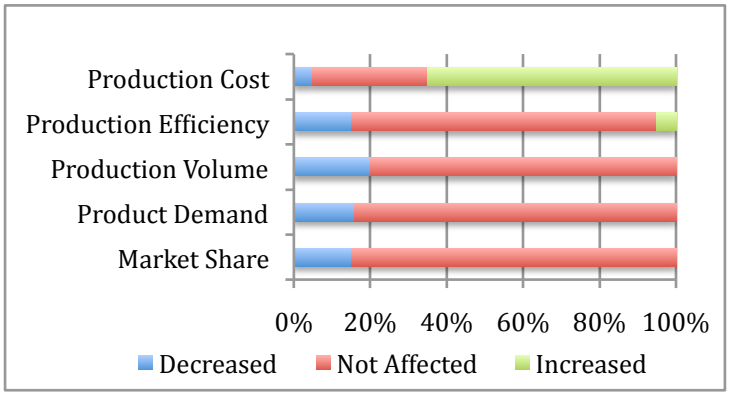


Figure 5-3 Impact of EU ETS on several product/production-related factors since 2005

However, after all, on the question of voluntariness for reducing CO_2 emission, 65% of companies claimed to be willing to commit due to the their own values and/or their anticipation about the arrival of such regulations sooner or later. This signaled the notable reputation of Danish companies in pursuing sustainable development.

5.1.2 The observed impact

Since the enforcement of EU ETS in 2005, companies have already identified its impact in several aspects of their business. Herein, such aspects are categorized as competitiveness-related factors and product/production-related factors (see figure 5-2 and 5-3 respectively).

In accordance with what is perceived, there are substantial percentages of companies do have witnessed that EU ETS undermined the competitiveness of their products' prices and incurred

increase in their production cost. These two factors are somehow cause-and-effect related; as the augment in production cost will lead to corresponding augment in the product's price, and the resulting higher market price may drive customers away to their competitors' products. Indeed, it is not only the CO_2 cap that challenges companies, but the transaction cost for both administrative expense and trading also makes the compliance of EU ETS burdensome, especially for small and medium size firms because such cost is not in proportion to the company size (Schleich & Betz 2004).

The negative impact on all other product/production related factors has also been observed by 15% to 20% of companies. The decrease in product demand, production volume and market share can be understood as a sequence of ripple effect resulted from the loss in competitiveness; the smaller percentages means such effect didn't happen to all those companies that observed an increase in operational cost. Probably, companies' operational costs were affected to different extents; and only those experienced a great increase suffered further ripple effects. Regarding companies' efficiency change, the reason might be their internal changes in production manners, which has also been recognized by some of the companies from their perspectives.

In addition, there are also firms who reported loss in the competitiveness of their applied technology; as an equivalent percentage observed the opposite, the impact of EU ETS upon organizations' production technology depends also on their respective circumstances, their own industrial fields and the technology levels of their competitors rather than the regulation alone.

In the following, details about companies' decision-making processes and their corporate strategy towards EU ETS are presented.

5.2 Decision-making Processes

The following section was designed to investigate a comprehensive procedure of companies' decision-making for the purpose of handling EU ETS. The following analysis is supported mainly by organization behavior and institutional theory.

5.2.1 Sources of knowledge

Getting necessary knowledge is the 1st step for all decision-making processes, no matter how the results come out. Such knowledge helps to shape companies' perception of EU ETS, provides them successful experience of others, and hints the consequences of their possible actions.

Figure 5-4 shows the percentages of companies picking up various sources to get knowledge supporting their decision-making. Here, all sources are categorized into 4 different institutional levels; those at the organizational level are internal sources within the organization's boundary and sources at the rest 3 levels are considered as external ones.

Apparently, the internal sources of knowledge sources play a crucial role in shaping organizations' vision of EU ETS; and knowledge embedded at the departmental level counts a higher percentage than that at the top management level for the main contribution. The predominance internal knowledge implies that companies may rely on rules from their pervious experience to make decisions.

By seeking for information from external sources, companies can overcome the limitation of being subjective. In fact, companies in the institutional environment interact and connect with not only other firms and

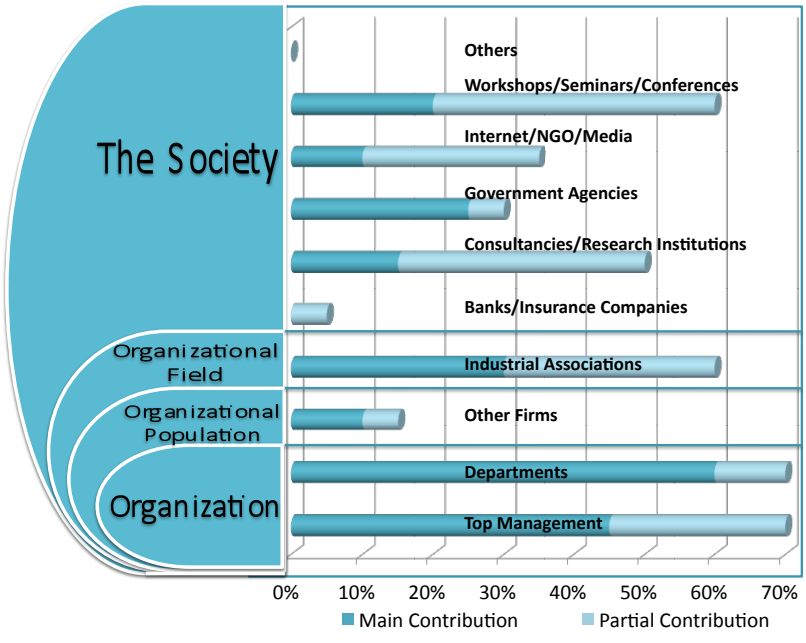


Figure 5-4 Distribution of companies choosing difference sources of knowledge for establishing EU ETS strategies

industrial association, but also media; NGOs, banks and insurance companies etc.; and they have accesses to conferences, seminars and workshops. Among all the external sources, those at the societal and organizational field levels are largely referred. 60% of companies obtain necessary information from industrial associations and via attending conferences/seminars/workshops; and half of them consulted research institutions. However, government agencies, banks, and insurance companies played a minor role in providing knowledge.

Such results reflect both sides of the coin. On one hand, it indicates that companies adopt a "learning by doing" approach to handle EU ETS; they look back to their pervious experience and exchange knowledge with others. On the other hand, the multi-level institutional environment provides companies chances to interact with heterogeneous actors in the field so that knowledge can be diffused widely and decision-makers can capture others' successful practices and better technologies, procedures and routines to match them with their own situations. As the percentages of companies obtaining information from workshops/seminars/conferences and industrial associations are relatively high, a strong tendency of imitation among them is foreseeable.

5.2.2 Who is responsible for decision-making?

This question attempts to uncover which decision-making approach (top-down or bottom-up) is predominant among Danish companies; in this context, decision-making refers to the process of formulating strategy towards EU ETS.

Herein, the top-down decision–making (so-called centralization) means the decision-making power rests in one or a few individuals within a highly centralized organization; thus, the decision is made by one member and is implemented "through the channels of authority" (Stroh 2002, p 402). In fact, following this approach decision-makers are likely to have only limited information and unable to transmit decision down to lower rank; consequently, the corporate respond to institution pressure slows down. Meanwhile, decentralization (spreading the decision-making power and authorities to a broad group of individuals) enables individuals to "concentrate on their tasks that can add value to the organization" (Stroh 2002, p 403).

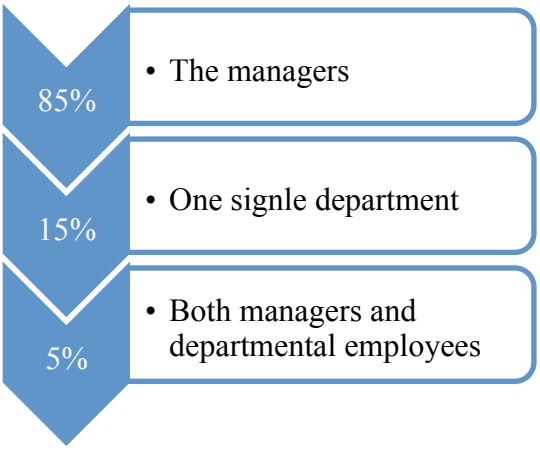


Figure 5-5 Distribution of companies' responsibilities for decision-making

Referring to figure 5-5 above, there's a strong entrepreneurial trend that the strategy towards EU ETS is developed at management level, and the top-down decision-making approach is therefore predominant. Indeed, the top-down approach provides managers an effective way to control the whole process from strategy setting to implementation, through which conflicts or dissents can be avoided by managers' quick responses; it is especially appropriate for small and medium size companies. Moreover, such an approach implies the centralization of organizations in terms of knowledge and thoughts, which will be cascaded town to others members from the top level once a decision is implemented.

However, the departments' engagement in decision-making is considered as a bottom-up approach, by which uncertainties are better managed and biases are avoided; yet, only 20% of companies followed this manner. Actually, 15% of companies assign single department to take the decision-making responsibility, while only 5% of companies integrated both top management and department into the decision-making process.

In addition, research found that EU ETS was handled by people from the environmental/sustainable department in most big companies, while in small companies, the responsibility was taken by the technical personnel.

The limited number of personnel in decision-making processes implied the "personal mastery", which means an individual process of establishing visions or means to achieve goals; this would result in coping strategy instead of generative thinking (Jaffee 2001).

5.2.3 Main approaches

This section aims to explain whether decision-making is based on the logic of consequence or the logic of appropriateness. Therefore, several decision-making approaches indicating both logics were examined. Figure 5-6 (see next page) shows the distribution of companies' choices.

Following the logic of consequences, decision-makers can adopt risk management, scenarios analysis and IT data management to figure out possible actions towards EU ETS; as the post-2012 period has not yet been clearly visualized, analyzing future scenarios, as well as potential risks and consequences make it easier for

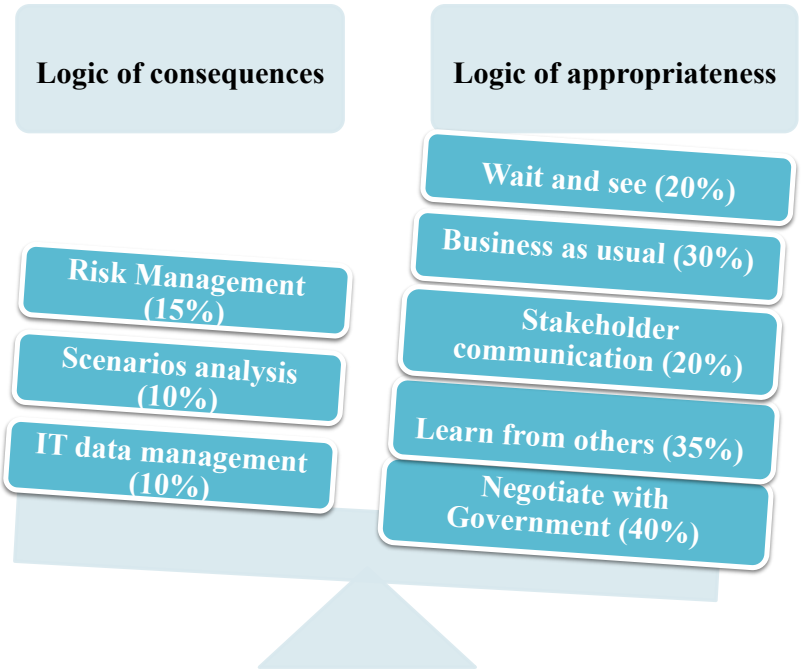


Figure 5-6 Distribution of companies that chose different approaches for developing strategies

companies to adapt themselves to future changes. Yet, these approaches were shared by a small numbers of companies, though they were supposed to behave rationally according to the environmental economic theory. It is probably because of high demand in human and financial resources that prevent companies from adopting such comprehensive methods, since most of them are small and medium size enterprises. In addition, the exceeding of free allowances and the current low price of CO_2 quota may also preclude companies from applying systematic analysis.

However, without the consideration of such issues as possible alternatives, outcomes and uncertainties, organizations may have strong tendency to make decision upon superficial evidence or insubstantial information; thus, they would easily accept the most ready short-range solutions, or make decisions upon axiomatic assumptions and past experience.

As for approaches following the logic of appropriateness, they were adopted by a larger number of companies. Posing a wait-and-see attitude (20%) and running business-as-usual (30%), companies adjust themselves when it's necessary; it seems easier and saves more time and resources than applying the former methods. Such result is in accordance with what was concluded from a previous study of Danish companies' response during the 1st period, that was, most of them held a wait-and-see stance (SetatWork 2008). Besides, 35% of the respondents mentioned searching for experience from others; this again signals the mimetic mechanism, which will lead to isomorphism in the field. Moreover, negotiating with the Government (40%) was found to be the most popular approach companies chose while setting up strategies; this indicates companies are not just passively react to the institutional pressure, but trying to reshape the institutional requirements.

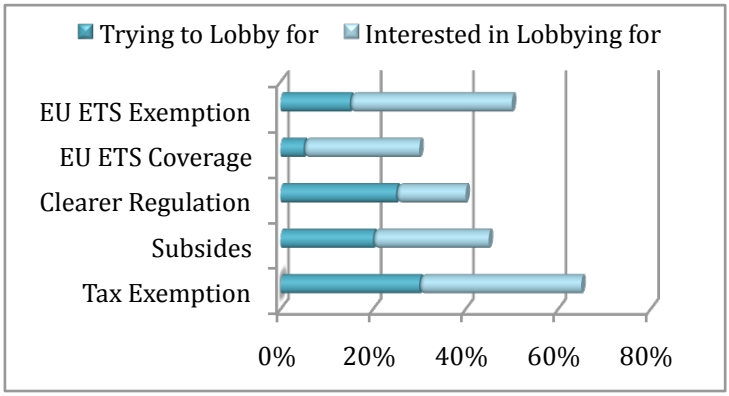


Figure 5-7 Distribution of companies' interest in lobbyism

For a detailed picture about companies' lobbyism, figure 5-7 above presents a distribution of their interest in several related topics. Because of dual regulations about CO_2 and 90% of these companies are currently subject to both, it is understandable that they want most to be exempted from the CO_2 tax; or at least receive subsidies as the compensation from the Danish Government to lessen their burden.

In terms of EU ETS related issues, companies concerned mainly about the regulatory ambiguity and wanted to reduce the future uncertainty.

5.2.4 Difficulties

This section provides an insight about common barriers that decision-maker identified. Figure 5-8 below exhibits the distribution of companies' various difficulties in percentages.

Generally speaking, more than 40% of those companies were challenged by production related obstacles (production cost and technological barriers) as well as the future uncertainty of EU ETS.

To be specific, as most surveyed companies have been subject to CO_2 tax for more than 5 years, they may have already adopt certain low-cost abatements such as switching energy sources, pollution prevention, and cleaner production; hence, it is

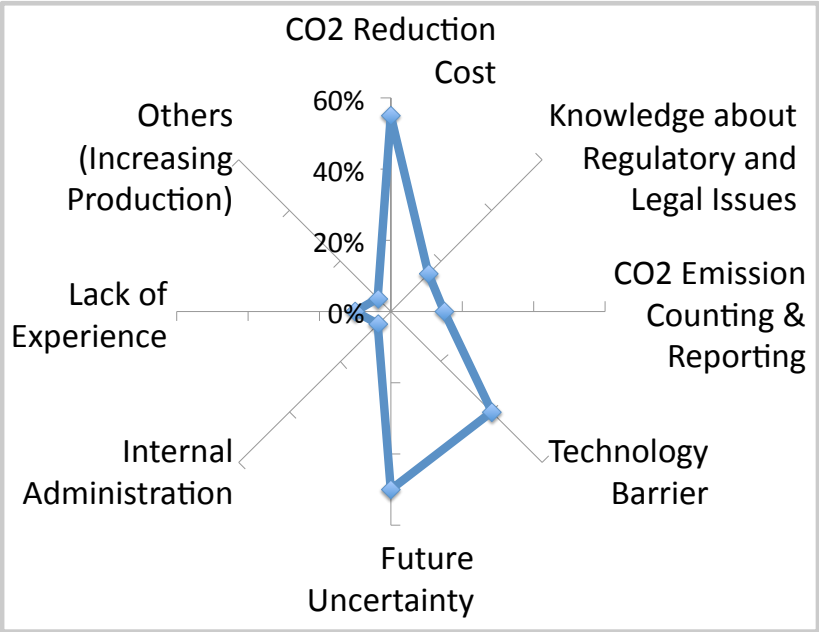


Figure 5-8 Distribution of companies' difficulties in making decisions

difficulty for them to further reduce emission with a relatively low cost, especially for companies operating in high technology business like the steel or ceramic industry, whose technology payback takes a longer time. That's the reason for why 40% of companies reported technology barriers as an obstacle.

Regarding future uncertainty about EU ETS, several issues like the coverage, possible subsidies, and free quota allocation are of companies' main concern. Indeed, most companies are now waiting for the result of debates on the percentage of auctioned quota for the 3rd period. Delay in substituting grandfathering by auction quota openly will lead to companies' delay in taking abatement action as they wouldn't invest for further reduction until the free quota is tightened up. Such uncertainty prevents companies from making rational decisions; as a consequence, they choose to wait-and-see without taking further action.

All other obstacles were referred by only a few respondents. Yet the difficulty of CO_2 accounting and reporting was probably resulted from companies' lack of professional knowledge as all the corresponding companies haven't had an environmental department; the reason of companies' lack of knowledge about regulatory and legal issue may lie in the fact that only limited numbers of personnel were engaged in the decision-making process in most companies. Companies can easily make it up by engaging more staff in establishing EU ETS strategy.

5.3 Corporate Strategy towards EU ETS

Before presenting corporate strategy, how companies ponder the importance of future factors is firstly examined in this section.

Being designed as a market-based environmental regulation, EU ETS provides companies flexible ways to comply: they can proceed either market strategy in trading CO_2 quota or earning CO_2 credits through CDM/JI projects; or implement internal abatement techniques to cut down CO_2 emission as non-market strategy. Hence, the later discussion of corporate strategy is separated into two categories: market-strategy and non-market strategy.

5.3.1 Strategic consideration

EU ETS is a long-term based regulation, yet hasn't been clearly defined for the post-2012 period; thus, how companies weigh the importance of several main factors during both a short term and long period is investigated here, as an attempt to disclose the way companies tackle future uncertainty and give clues to their corporate strategy.

Figure 5-9 shows the numbers of companies that considered provided factors as important during different periods in percentages.

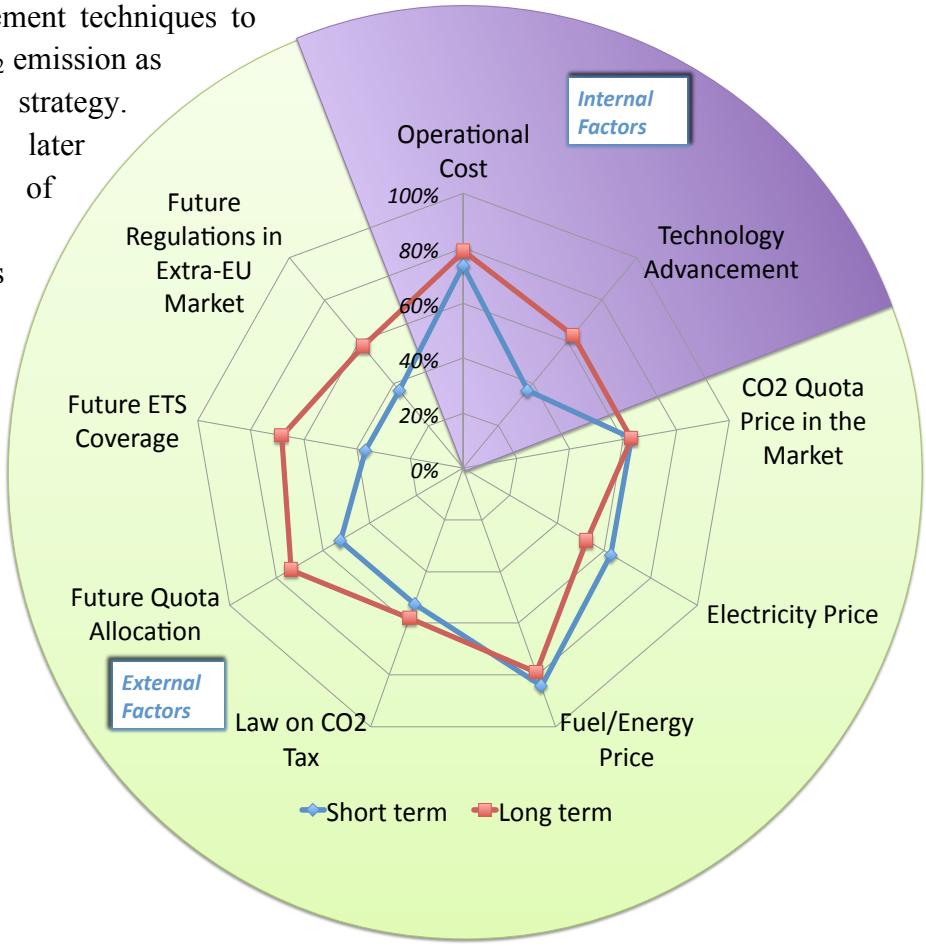


Figure 5-9 The importance of several factors in both short and long terms

Among all these factors, the two highlighted in purple color are internal factors as companies can largely take control over them; the rests are external factors depending on the complex circumstances in the institutional environment.

It is evident that the most number of companies (80%) regard their operational cost and the fuel/energy price as important for developing the EU ETS strategy. While the percentages of companies pointing up such factors as the CO_2 quota price in the market, and the law on CO_2 tax remained more or less unchanged during both terms, there's a perceptible increase in the significance of the technology advancement and all EU ETS related factors. As mentioned elsewhere before, Danish companies have already made effort in improving energy efficiency and cleaner production, the current technology advancement maybe somehow bottlenecked; yet after a longer period, technological breakthrough is of high prospective; that's why its importance gains more votes in the long term. For the latter—EU ETS related factors, the observed increment reveals companies' keen attention on 3rd period after 2012, as the current setting doesn't depict a clear picture for that; indeed, the post-Kyoto situation worldwide is hardly predictable. According to Levy & Rothenberg (2002), institutional uncertainty would increasingly influence organizations within the institutional environment, while the impact of economic and competitive factors would decrease. Uncertainty in climate change policies will make it difficult for companies to develop rational strategies, but become more subjected to institutional pressure; and companies facing uncertainties are more likely to imitate others' successful experience.

5.3.2 Market strategy

Generally speaking, research finds most companies' market strategy lies in quota trading rather than gaining credits through CDM/JI projects.

Actually, there was only 1 (out of 20) company joined JI/CDM projects during 2005-2007. Although the number of participants goes up to 4 in the 2nd period representing a 300% percentage growth, the overall percentage remains low. If it is not because of companies' insufficient knowledge about these projects, such result implies the complex administrative issues and high transaction cost in gaining CO_2 credits.

On the contrary, 75% companies participated in trading CO_2 quota during the 1st period; some of them were both seller and buyer indicating firms can take advantage of the fluctuating quota price in the market and make profit by trading quota as one commodity. Although 5% of the overall quota was auctioned during the 1st period, none of the surveyed companies bought quota through the auction. Instead, they made transactions through bilateral exchange

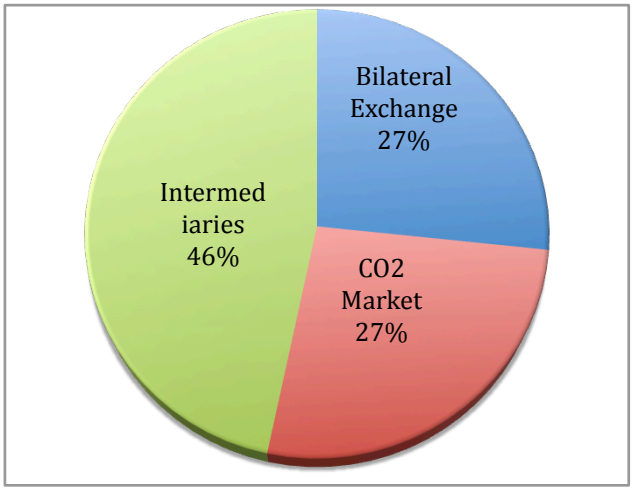


Figure 5-10 Distribution of companies that chose different ways of trading during the 1st period

with other firms, the CO_2 market, and the intermediaries.

Figure 5-10 above shows the distribution of the three different ways companies chose to trade their quota during the 1st stage; trading through intermediaries turned out to be the most popular one.

As the first stage of EU ETS was basically a trial period and companies received free allowances covering almost all their emission, most of them played a role as seller in the trading market (see figure 5-11). In the current stage, however, the overall cap was cut down and companies received fewer quotas than before; they should then adjust their production to meet with the emission cap, balance their marginal abatement cost with the trading cost, and make up their minds for a proper role in the trading market. According to the survey results, although some companies are not sure about buying or selling quota for the 2nd period, a stronger tendency of being a buyer than seller is observed. Referring to companies' keen attention on the operational cost revealed in their strategic consideration, establish market strategy towards EU ETS could be an easy and cheap choice for two reasons. On one hand, the current quota price in the market is relatively low and the grandfathering allocation in the 2nd period leaves companies not even a 10% shortage of CO_2 quota; on

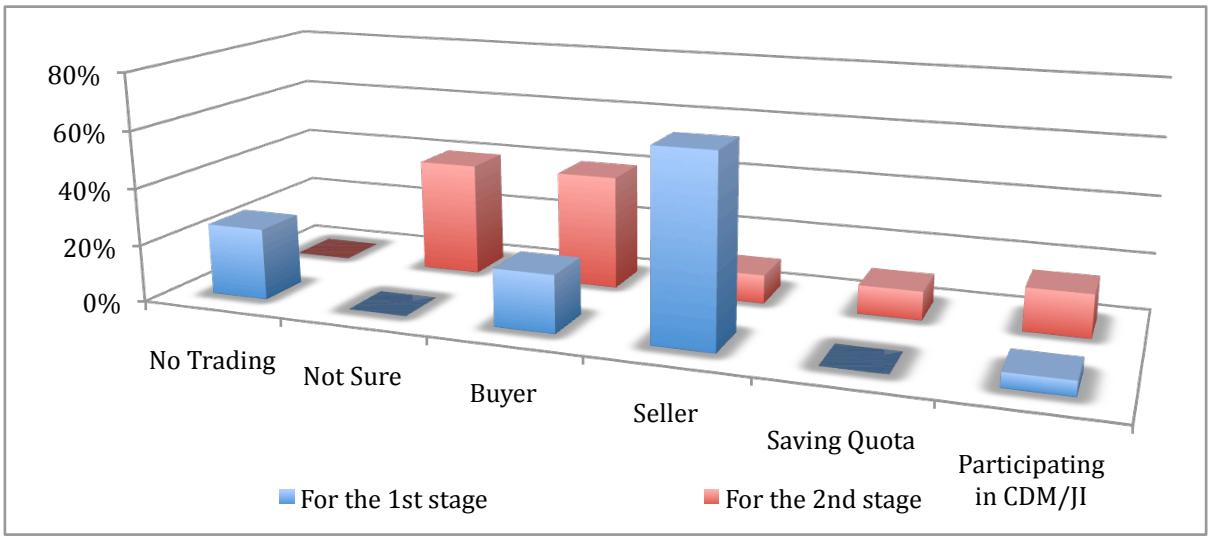


Figure 5-11 Distribution of companies' different roles in trading during both periods

the other hand, future uncertainty regarding both the amount of free allowance for the 3rd period and the overall institutional environment remains ambiguous and the prediction is difficult and costly.

5.3.3 Non-market strategy

In order to investigate companies' non-market strategy towards EU ETS, possible approaches are provided in the survey; the resulting distribution of companies choosing "likely to" take each action is illustrated in figure 5-12.

Obviously, there's no strong signal showing any strategy companies preferred to enact, except for "finding cheaper energy supply" that mentioned by over half of the companies. Such results echoed to their substantial concern about the fuel price as was mentioned in the strategic considerations.

Indeed, most companies made it clear that they would not respond passively with closure, slowing down business, or relocating production units due to EU ETS. Although several energy-intensive industrial associations like Eurofer and Cembureau argued EU ETS would undermine industries' profitability so that causing them slowing down investment and relocating production (Eurofer et al. 2004), these do not seem to happen to the Danish companies.

As for companies' energy consumption, figure 5-13 (see next page) exhibits the distribution of their dominant sources in relation to that of the CO_2 emission sources. Within the 20 surveyed firms, most discharge CO_2 when combusting fuel (70%), 15% emit CO_2 during production process

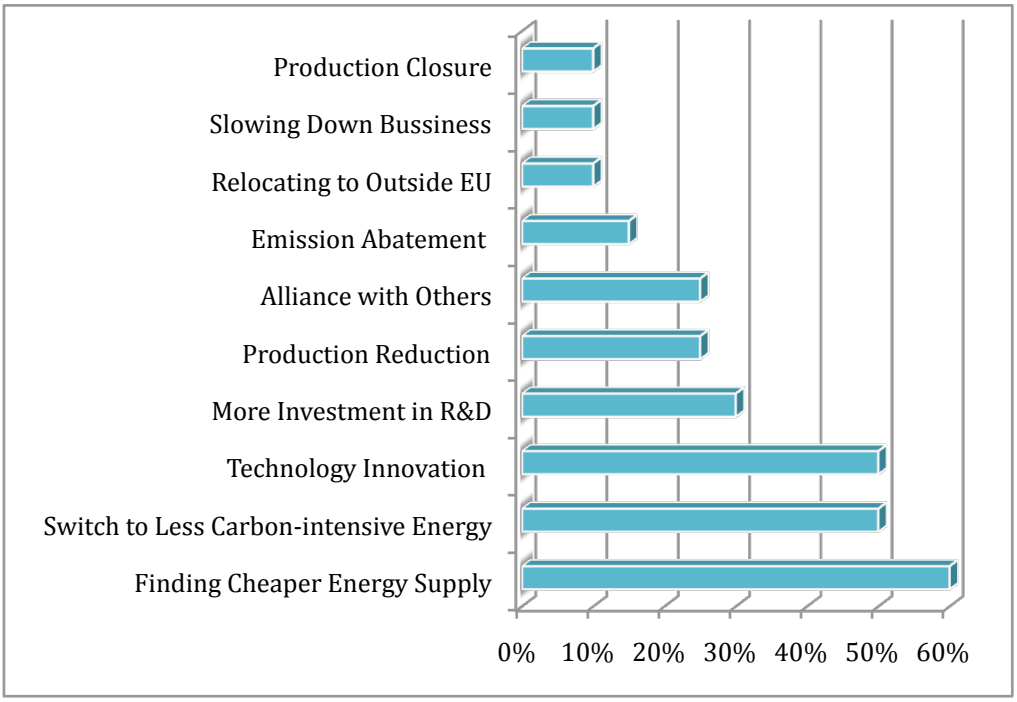


Figure 5-12 Distribution of companies that chose "likely to do" as non-market strategies in the 2nd stage

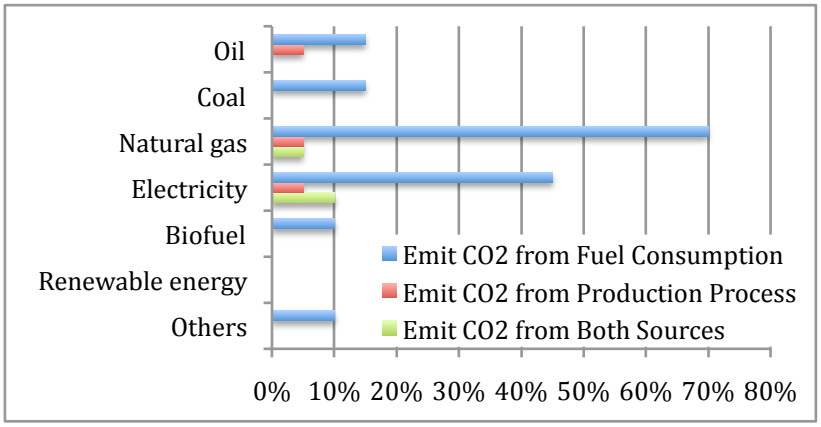


Figure 5-13 Distribution of companies' dominant energy sources in relation to that of their CO_2 emission sources

and another 15% have the CO_2 emission from both sources. Considering the various energy sources, natural gas, a less-carbon intensive energy than oil and coal, is the most popular one utilized by 80% of companies; probably owing to the early regulations at the national level like the CO_2 tax, as theoretically the amount of CO_2 emitted from one ton of natural gas equals to half of that emitted from one ton of coal. However, the fact that none of these companies mentioned renewable energy and only 2 of them utilized biofuel (CO_2 neutral) reveals a great potential for them to further reduce CO_2 emission by switching to environmental-friendly energy sources; and 50% of companies were likely to do so.

Meanwhile, in accordance with the fact that 60% of companies did not think technology advancement important during a short period (refer to figure 5-9), most of them wouldn't increase research investment and only half of them would pursue technology innovation in the current period. Such trends imply that EU ETS has not yet provided strong incentive for companies to adopt technological change. In addition, as companies reveal a weak tendency in alliance with others, they may not take advantage of collective action in responding to EU ETS. Since they are fairly interested in lobbyism and negotiations with the government, a collective effort would actually make their voice stronger than react individually.

5.3.4 Time spans

Time spans of companies' general strategy towards climate change, their current EU ETS strategy, and their expected payback time for technology investment are examined as part of their strategic plan.

According to figure 5-14 (see next page), companies' strategic plans varied widely from having no specific strategy to considering for a long-term blueprint; and the majority of firms sketched their future for only a short term in all three aspects. Actually, regarding the EU ETS strategy, nearly half of the companies are still in preparation for the 2nd period, as they haven't yet set clearly what to do.

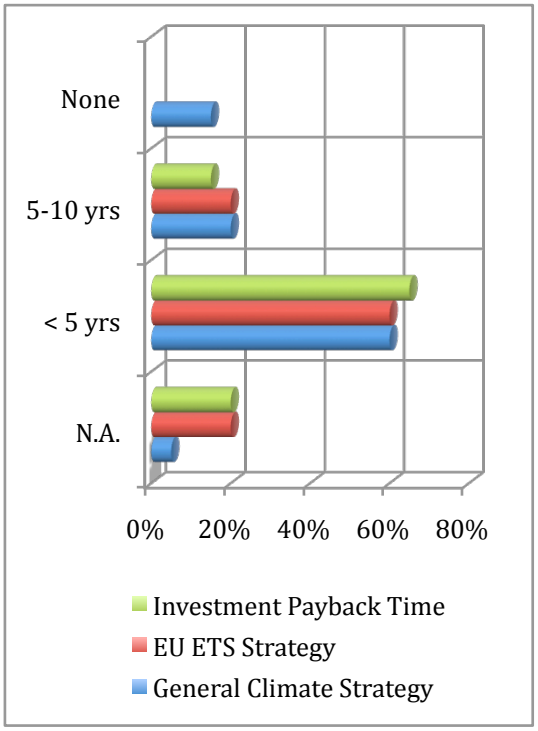


Figure 5-14 Distribution of companies' strategic time spans

Moreover, there's no evident correlation between the investment payback time and the strategic time span. Although most of the companies that set strategies for a short term expect their investment to be paid back within 5 years, half of those setting a long-term strategy anticipate the same; and there's no any company respond a payback time over 10 years. The short investment payback time unveils companies' reluctance of funding researches in technology and echoes what was observed in figure 5-12. The predominant short-term focus of these companies' strategic plans was probably resulted from the future uncertainty in the institutional environment.

To conclude, Danish companies are complying with EU ETS with keen attention on the operational cost and fuel price. They were not likely to cut off their production, slow down business, relocate production units, let alone closure; they revealed more a business-as-usual stance than suffering from regulatory burden. Despite some companies' complaints about increased production costs and loss in competitiveness, their strategies are simply participating in trading quotas, searching for to cheaper/less carbon-intensive energy, and maybe technology innovation as well. Considering the fact that negotiating with the Government was a relatively popular approach firms undertook while developing strategies; and their attention in lobby for tax exemption, subsides and a clear future of EU ETS, these companies response fall into the "compromise" category as was defined by Scott (2001).

There are two reasons why companies respond with "compromise". On one hand, companies in EU have been regarded as largely accepting mandatory emission control regulations; and they were not aware of the issue of climate change until 1990s (Levy & Rothenberg 2002, and Meckling 2008). Therefore, the EU institutional culture shaped EU companies being accommodated to regulatory demands. On the other hand, the empirical study reveals that companies are more or less going to continue their business as usual. Considering the fact that nearly 90%

historical emission is grandfathered by free CO_2 quota, firms may probably see little challenge for their compliance with EU ETS, at least, not difficult during the current period.

5.4 Summary

Hereby, corporate responses of Danish companies towards EU ETS are summarized based on the survey results.

Figure 5-15 provides a graphic overview about the main findings in three aspects as 1) the observed impacts from EU ETS onto companies' business, 2) the predominant decision-making pattern, and 3) companies' strategy towards EU ETS.

To be specific, 80% of surveyed companies resonated EU ETS provided incentive for technology innovation and about 30% of them perceived EU ETS would change their production patterns, though EU ETS has brought about impact onto their business in several ways, among which, the competitiveness loss (60%) and production cost augment (65%) were two mostly observed factors. According to companies' perspectives, such competitiveness loss would happen to markets both intra- and extra- EU. In addition, some 15% of companies also reported a wane in production efficiency, production volume, product demand and market share in line with the increase in production cost. Therefore, it is necessary for companies to develop proper strategies so as to handle with EU ETS.

Regarding the first research question, companies' decision-making processes were investigated in the support of institutional theory and rational behavior. And four features during such processes were being focused in the research, and they were 1) the sources of knowledge, 2) responsibilities for making decisions, 3) main approaches for developing strategies, and 4) experienced difficulties.

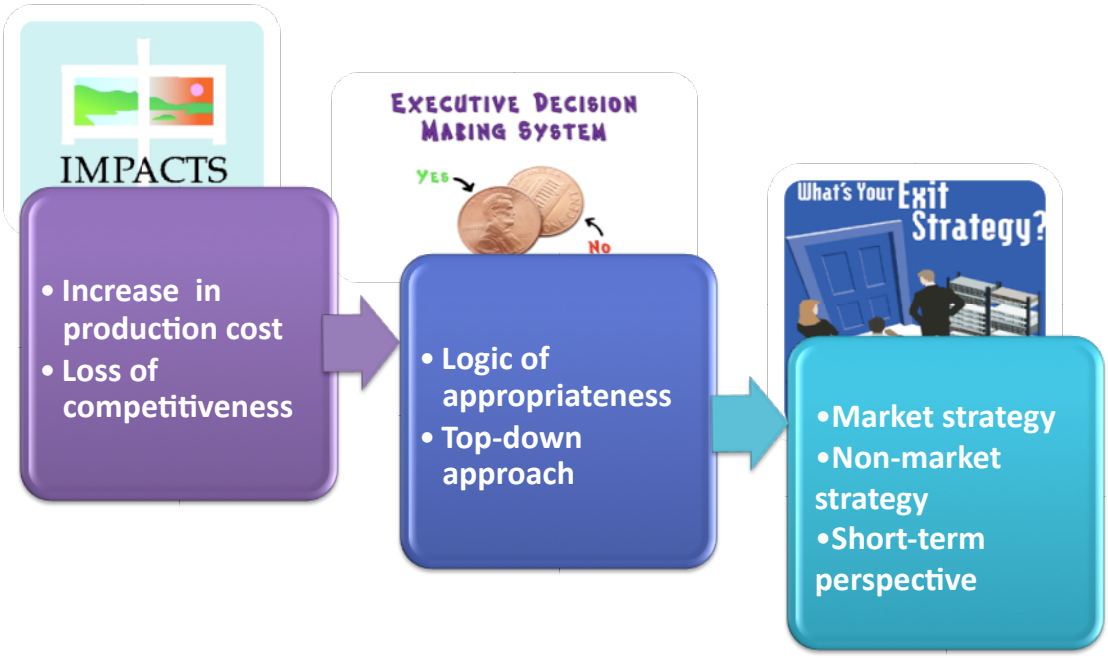


Figure 5-15 Main findings from the empirical study

In detail, firstly, companies got relevant knowledge from various sources, among which, top managers and departments are predominant; this unveiled that most companies referred substantially to internal knowledge when facing with EU ETS, and they were likely to react through "learning-by-doing". Meanwhile, of all the external sources of knowledge, workshops/seminars/conferences and industrial associations were essentially concerned; that's how companies' common believes and logic of actions were spread, and indicated the mimetic mechanism resulting in isomorphic corporate responses among organizational populations. Secondly, when developing corporate strategies, the responsibility was highly concentrated in the management level with only a few other cases refer to a departmental effort; this implies that the top-down pattern of decision-making was primary among all companies. Thirdly, regarding the main approaches for developing corporate strategies, "learning from other companies" and "business-as-usual" shared much more percentages than those based on the logic of consequences (scenario analysis, IT data management, risk management); this indicated firms set up their strategies on a rule-based pattern, and echoed the mimetic mechanism. Besides, 40% of companies negotiated with government while establishing corporate strategy, and they revealed great interest in lobbying for exemption from CO_2 tax or EU ETS as they were subject to both at the moment. Some 40% of companies also made an effort to unmask the future regulatory uncertainty through lobbyism. Lastly, main difficulties that companies identified while making decisions are the high CO_2 reduction cost, technological barriers and the future uncertainty. For the former two aspects, they were resulted from other regulations in Danish institution that came earlier than EU ETS, like the CO_2 tax; and the companies have already made effort to reduce CO_2 emission as a response; hence, it is now an unfavorable situation for them to further progress at a low cost. For the latter, future uncertainty concerns not only the EU ETS regulation and the market price of CO_2 quota, but also the institution environment at the global level where other countries' political decisions may play a big difference. The ambiguity of such factors challenged companies' decision-making and prevented them from adopting the logic of consequence or implementing long-term strategies.

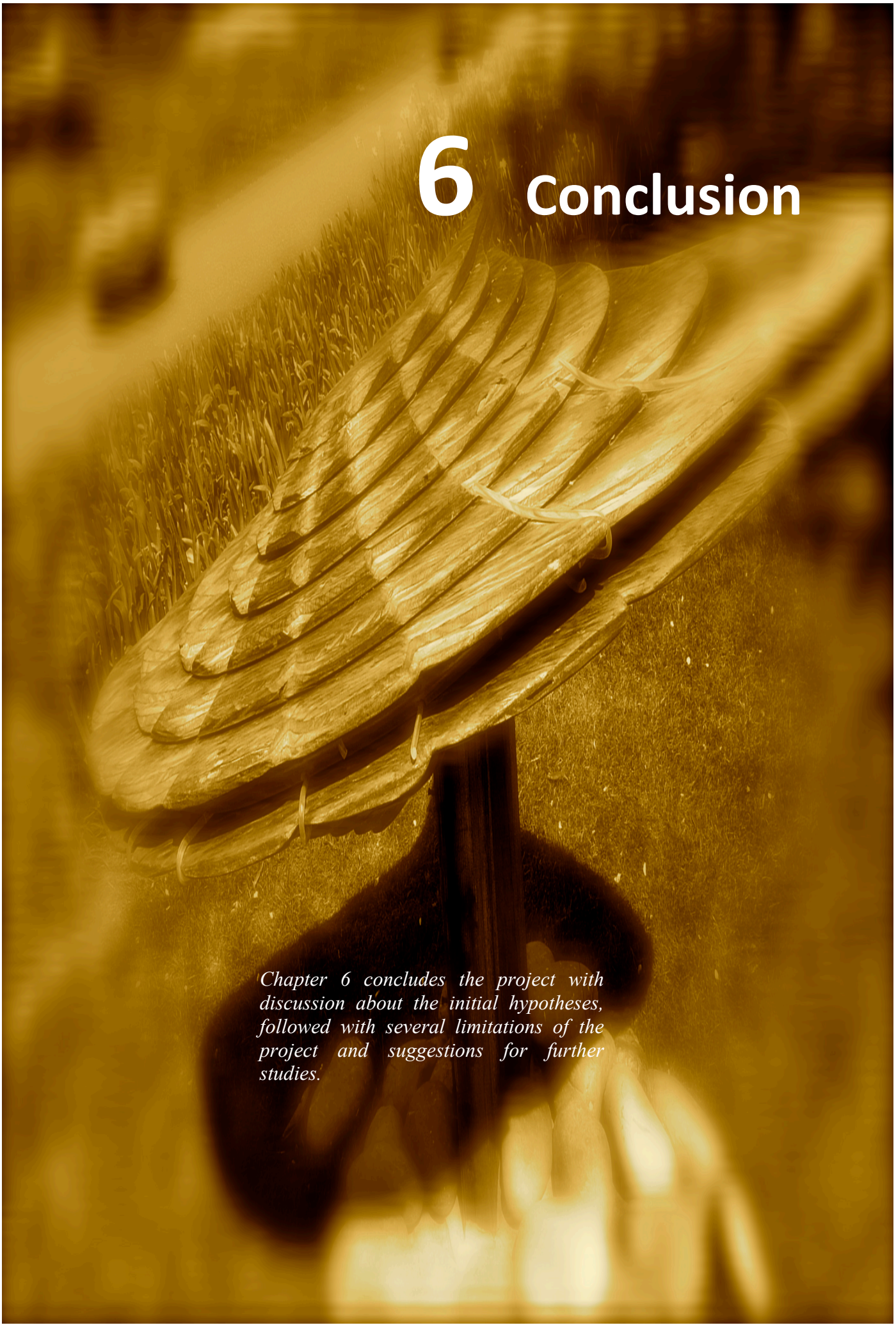
The second research question was brought out to explore the market strategy, the non-market strategy, as well as the corresponding time spans. Referring to the strategic consideration, the most number of companies regarded the production cost and fuel price as important factors in both short and long terms. Meanwhile, much more companies consider technology advancement and the regulatory setting of EU ETS

essential in a long-term, rather than for a short-term. This reflected their concern about the future regulation, and echoed the current technology barriers they are facing with; they are expecting technological breakthrough during a longer period.

In this context, their market strategy showed a stronger tendency of being a "buyer" than "seller" comparing with their previous experience in the 1st period, mainly because of the regulatory adjustment in the amount of free allowance for the 2nd phase. However, comparing with trading, the percentage of companies that decided to participate in CDM/JI projects during the 2nd phase was far more less. Companies' scarce interest in these flexible mechanisms was probably resulted from the complicated procedure and the high capital investment in doing so, as well as the limited credits earning afterwards.

Meanwhile, as for non-market strategy, it offers companies a large number of ways to handle with EU ETS. Of all the provided actions, finding cheaper energy supply, switching to environmental-friendly energy sources and pursuing technology innovation were likely to happen in the most number of companies (accounting for 60%, 50% and 50% respectively). Considering the fact that 80% of companies employed natural gas as (one of the) dominant energy source(s) and most of them emitted CO_2 from fuel consumption, there's great potential for them to cut down emission by simply switching to less carbon-intensive energy sources like renewable energy, which has not yet been utilized in any of the surveyed companies. Moreover, the fact that less 30% of companies planed to increase investment for R&D and just half of them would initiate technology innovation implies EU ETS has not yet provided strong incentive for them to adopt technological change. After all, these companies made it clear that they were not likely to respond passively due to EU ETS; they wouldn't reduce their production or slow down business, neither would they relocate the installations to outside EU or close productions. The current carbon caps hasn't challenged these companies, so that they would continue their business as usual; and the potential carbon leakage is not likely to happen, at least, not in the case of Denmark.

Regarding the strategic time span, most companies focused on merely a short-term. They prepared themselves for just the current period of EU ETS and they expected their technology investment would be paid back within 5 years. Actually, there wasn't any company set investment for a longer period than 10 years. Such results were again brought about by the future uncertainty of the institutional environment, and reveals companies might further adapt themselves according to the institutional changes.



6 Conclusion

Chapter 6 concludes the project with discussion about the initial hypotheses, followed with several limitations of the project and suggestions for further studies.

This research explores the answer for "how do Danish companies set up strategies towards EU ETS" and "what are their strategies" by means of survey, which was responded by 20 companies subjecting to EU ETS in Denmark. Survey results was then analyzed and interpreted under a solid theoretical framework consisting of institutional theory and rational behavior theory. Thereby, the initial hypotheses established on the ground of conceptual background can be examined and discussed here.

The first one that states companies' decision-making follows a top-down approach and bounded by managers' perspectives is justified. By analyzing empirical data, research found out that the top-down approach was overwhelming as the companies' managers were responsible for developing strategies in most cases. Avoiding systematical analysis under the logic of consequences saves firm substantial time and human resources. However, the limited number of participants in the top-down decision-making process incurred "personal mastery" without generative thinking, so that the established strategies were bounded by managers' visions and their individual backgrounds. Considering the high level of uncertainty in the institutional environment, especially that of the EU ETS, rule-based rationality may expose companies to potential risk resulting from further institutional change.

The second hypothesis regarding the impact of EU ETS onto Danish companies and their corporate responses is also approved. Although EU ETS is somehow undermined by the exceeding free allocation and low quota price in the market, it has imposed several aspects of impact on companies' business, especial in increasing production cost and loss of price competitiveness.

Nevertheless, although 30% of companies have identified change in their production patterns due to EU ETS, it has not yet successfully induced firms to initiate substantial technological changes. Factual information unmasked that there's great potential for companies to further reduce CO_2 emission. Yet, neither long-term technology investment nor long-term strategy was of companies' current concern. Instead, they practically chose to conduct low-cost abatement and participated in the trading market to compromise the institutional demand. In addition, other flexible mechanisms (CDM and JI projects) have not been well functioned either, as most companies expressed no interest in them; probably, the complicated process for technology transfer, the high capital investment, and the limited credit earning drove companies away from so. Thus, companies kept their business-as-usual stance while taking such actions into

consideration as trading CO_2 quota, finding cheaper energy supply, and perhaps substituting the current energy with more environmental friendly ones or initiating technology innovation.

Such response can be categorized as "compromise strategy" according to Scott (2001); since they chose to meet with the institutional requirement by adjusting themselves, and at the same time, tried to redefine such requirement through lobbyism. Their compliance in general can be explained with two reasons. On one hand, the European institutional environment has already shaped companies into accommodating to regulatory demands. On the other hand, the exceeding free allowance makes it relatively easy for companies to comply with EU ETS. Actually, 40% of them haven't had any specific strategy to deal with it. Since companies are determined to maximize their economic revenue; as long as EU ETS hasn't threatened their business-as-usual, a weak commitment would be foreseeable. Therefore, policy-makers need to ponder seriously about the future adjustment of EU ETS (eg. the percentage of free allowance) in order to activate stronger incentive while avoiding carbon leakage due to companies' relocating their production units as well.

Indeed, the post-2012 period is currently non predictable; not only the EU ETS regulatory setting is under debate, but also the stance of other countries may change the institutional environment. Such institutional uncertainty induces organizational isomorphism; and this has been reflected by the diffusion of knowledge within the organizational field and companies' mimetic responses with rule matching. Yet, Danish firms are advised to be more proactive in responding to intuitional changes for two reasons. On one hand, EU Commission is going to significantly cut off the amount of free allowance as well as centralized allocation at the EU level in the post 2012 period; thus, the quota price in the market would probably surge up, and a substantial impact on industrial companies would be brought about. It's better to be a first-mover than waiting until the challenge comes. On the other hand, being proactive in exploring future scenarios and innovating technology reduces companies' dependence on environmental surroundings, and enhance not only their capability in reshape the institutional requirement, but also their competitiveness in both the EU and the global markets, no matter whether the United State or other emerging economies would possibly take part in the ETS.

Limitation is the supremacy of all natural process, and this research is not an exception. The study embraces 20 companies accounting for nearly one third of all Danish industrial firms subjecting to EU ETS, and they share relatively a small percentage of the overall Danish CO_2 allowance; therefore, the findings shed light on only part of the overall situation. Also, the empirical data was collected

through surveying one respondent from each company; thus, information was somehow irrational and bounded by the individuals' perceptions.

After all, this research contributes empirical findings to the pool of EU ETS studies, provides valuable reference for both policy-makers and other industrial populations, and paves the way for further research on related topics. As the main purpose of this research is to explore companies' decision-making processes, how they translate the corporate strategies into actions is still in doubts. To depict a concrete picture of Danish industries, researches can be conducted on a wider range of organization populations and cover electricity producers that account for more than 80% of the Danish allowances. Or, studies on mutual interactions between companies and the intuitional environment through different mechanisms are also worthy pursuing as they provide decision-makers a more precise and detail image about the impact of EU ETS. In addition, due to the fact that Danish companies are subject to dual regulations on CO_2 emission, it is interesting to compare the competitiveness loss due to EU ETS between them and companies in other MSs.

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Appendix I: Survey Questionnaire

Survey for "Corporate Strategy of Danish Company towards the EU Emission Trading Scheme"

Dear Sir or Madam:

This is a survey from the Department of Development and Planning, Aalborg University, Denmark.

We are master students doing final thesis under the topic of "Corporate strategy of Danish company towards the EU Emission Trading Scheme (EU ETS)"; and this survey covers the empirical part of the investigation.

We kindly invited you to participate in the survey, and your company's strategic thinking will be highly appreciated.

Please send this back to <fzha08@plan.aau.dk> or <mttt07@plan.aau.dk> by email after answering.

Best regards,
Feng Zhang & Minh Than Tran Thi

Department of Development and Planning
Aalborg University
Fibigerstræde 13, Aalborg Ø, 9220, Aalborg, Denmark

*** Privacy Announcement**

All the information from this survey will be kept strictly for university study only.

Survey results will be referred anonymously in the study report.

*** For multiple-choice questions, please click the box "☐" and make it "☒"; please click more than one choice when necessary.**

*** For written answers, please type here "[ ]".**

•Since 2007, a EU wide Emission Trading Scheme came into force. All 25 EU member states join the burden-sharing agreement to reduce CO2 emission. Demark committed a 21% reduction of CO_2 emission based on the level of 1990.

•Under the EU ETS, all energy sectors and most energy intensive industries are subjected to a limited amount of emission quota. The first "warm-up" phase of EU ETS was 2005-07, and 2008-2012 is the second period. Companies now are more familiar with the scheme, but having less amount of CO_2 quota …

About EU ETS

*** Before answering questions, please state:**

- Date of today: **[ ]** (dd-mm-yy)
- Name of your company: **[ ]**
- Size of your production unit (depending on energy input):

☐ Small (20-50 MW)
☐ Medium (51-75 MW)
☐ Large (>75MW)

- Following answers are given by staff from [ ] Department/Section. (Please state the name of the department)

Survey Questions

1. **What is/are the dominant source(s) of energy/fuel used in your company?**

☐ Oil ☐ Coal
☐ Natural Gas ☐ Electricity
☐ Renewable energy (eg. solar, wind) ☐ Biofuel/biogas
☐ Others (please specify) **[ ]**

2. **CO_2 is emitted mainly from:** ☐ Fuel combustion; ☐ Production Processes.

3. **a) Was your company subject to CO_2 Tax before 2005?** Yes☐; No☐.
b) Is your company subject to CO_2 Tax now? Yes☐; No☐.

4. **With the enforcement of EU ETS** (EU Emission Trading Scheme) **since 2005, who is monitoring your CO_2 emission?**

☐ Our own staff ☐ External companies/parties
☐ Others (please specify) [ ]

5. **During the 1st period of EU ETS in 2005-2007, did you trade any CO_2 quota?**

	Through bilateral exchange with other companies	Through the CO_2 market	Through intermediaries (eg. Brokers)	Through Auction
Yes, we bought quota	☐	☐	☐	☐
Yes, we sold quota	☐	☐	☐	☐
No, we didn't trade	☐			

6. **How long is the time span of your corporate strategy for climate change?**

☐ We plan for a short term within 5 years
☐ Our plan bases on a long term for 5-10 years
☐ We have no specific plan at the moment.

7. **Facing the EU ETS, who is/are preparing your corporate strategies?**

☐ The Top Managerial level
☐ The Section/ Department of **[ ]**
☐ A working group with members from several departments like **[ ]**
☐ Jointly cooperated with other companies (eg. consultancy, research institutions) under the Department of [ ]
☐ An external specialized company/organization
☐ Others (please specify) **[ ]**

8. **Who is/are responsible for the decision-making on emission trading?**

☐ The Executive board/ Board of directors
☐ The manager of the production unit
☐ The Department of [ ]
☐ A specialized working unit
☐ No explicit responsibility
☐ Others (please specify) **[ ]**

9. **Do you check and revise your strategic plan?**

☐ Yes, we check and revise for new adaptations regularly.
☐ Yes, we revise our plan when necessary.
☐ Not really, we just follow what has been decided in the plan.

10. **During the 2nd period of EU ETS in 2008-2012, which role is your company going to play in the trading market?**

☐ CO_2 quota Buyer ☐ CO_2 quota Seller ☐ Saving quota ☐ Not sure yet

11. Considering the following aspects of uncertainty, to what extends do they affect your strategic decision? (during a short / long term respectively)
(1 for "with the LEAST importance", 4 for "with the MOST importance")

In a short term				Aspects of Uncertainty	For a long run			
1	2	3	4		1	2	3	4
☐	☐	☐	☐	▪ Market Price of the CO_2 Quota	☐	☐	☐	☐
☐	☐	☐	☐	▪ Price of Electricity Supply	☐	☐	☐	☐
☐	☐	☐	☐	▪ Fuel/Energy Price	☐	☐	☐	☐
☐	☐	☐	☐	▪ Production/Operating Cost	☐	☐	☐	☐
☐	☐	☐	☐	▪ Technology Advancement	☐	☐	☐	☐
☐	☐	☐	☐	▪ Law on Environmental Taxation (eg. CO_2 Tax)	☐	☐	☐	☐
☐	☐	☐	☐	▪ Future CO_2 Quota Allocation	☐	☐	☐	☐
☐	☐	☐	☐	▪ Future Coverage of ETS (eg. EU-wide or world-wide)	☐	☐	☐	☐
☐	☐	☐	☐	▪ Future Regulation in Non-ETS Countries/Areas	☐	☐	☐	☐

12. **To what extend do you agree with the following statements?**	Totally Agree	Agree	Not Agree	I' not sure
▪ The compliance of EU ETS is costly in a short term.	☐	☐	☐	☐
▪ EU ETS will make our company profitable in the long run.	☐	☐	☐	☐
▪ EU ETS has changed/is changing our production pattern.	☐	☐	☐	☐
▪ EU ETS makes our company less competitive than **intra**-EU companies.	☐	☐	☐	☐
▪ EU ETS makes our company less competitive than **extra**-EU companies.	☐	☐	☐	☐
▪ EU ETS promotes incentive for our innovation and further development.	☐	☐	☐	☐

13. Is your company engaged in any CDM (Clean Development)/JI (Joint Implementation) project?

	Yes	No	Not yet, but under consideration	Not sure yet
During 2005-2007	☐	☐		
During 2008-2012	☐	☐	☐	☐

14. Due to the EU ETS, are you going to take the following actions during 2008-2012? (1 for "the LEAST likely", 4 for "the MOST likely")

	1	2	3	4
▪ Buying CO_2 Quota	☐	☐	☐	☐
▪ Selling CO_2 Quota	☐	☐	☐	☐
▪ Saving CO_2 Quota for the following years	☐	☐	☐	☐
▪ Participating More CDM/JI Projects	☐	☐	☐	☐
▪ Reducing Overall Production	☐	☐	☐	☐
▪ Emission Abatement (end-of-pipe solutions)	☐	☐	☐	☐
▪ Technology Innovation	☐	☐	☐	☐
▪ More investment in R&D	☐	☐	☐	☐
▪ Switching to Less Carbon-Intensive Energy/Fuel	☐	☐	☐	☐
▪ Searching for Cheaper Energy Supply	☐	☐	☐	☐
▪ Relocate Production Unit to Non-ETS Country/Area	☐	☐	☐	☐
▪ Slow down business expansion in EU	☐	☐	☐	☐
▪ Production Closure	☐	☐	☐	☐
▪ Alliance with Other Companies/Associations	☐	☐	☐	☐

15. In terms of technology/R&D investment, how long is the expected payback time? (please go to the next question if it is not your case)

☐ <5 years ☐ 5 -10 years ☐ >10 years

16. By which way(s) are you preparing the strategies towards EU ETS?

☐ An interdepartmental approach
☐ Sophisticated scenario analysis
☐ Information technology for data management
☐ Risk management
☐ Negotiating with the government
☐ Stakeholder communications (including investors, regulators, brokers, media, etc.)
☐ Attending relevant Seminars/Conferences
☐ Learning from other companies' experience
☐ Wait-and-See
☐ Business as usual, with no specific analysis for EU ETS
☐ Others (please specify) **[ ]**

17. How is your setting of climate strategy to deal with the EU ETS?

☐ Our strategy is set up separately from existing strategy
☐ Our strategy is integrated into existing strategy.
☐ No such specific strategy has been set up so far.

18. In preparing for the EU ETS, which unit(s) within your company and which external organization(s) have provided knowledge /advice / support?

	Main contribution	Partial contribution
▪ The top management level	☐	☐
▪ The section(s)/department(s) of [ ]	☐	☐
▪ Consultancies, Research institutions …	☐	☐
▪ Other companies (emitters)	☐	☐
▪ Industrial associations	☐	☐
▪ Banks, Insurance companies	☐	☐
▪ Government agencies	☐	☐
▪ Internet, Mass Media, NGO …	☐	☐
▪ Workshops, Seminars. Conferences. …	☐	☐
▪ Others (please specify) [ ]	☐	☐

19. Are you interested in lobbying for the following cases?

	Yes, we're trying to lobby	Yes, we're interested in lobbying	Yes, we'll support the lobbyist	No, we're not interested
▪ For subsides due to ETS	☐	☐	☐	☐
▪ For CO2 Tax exemption due to dual regulations	☐	☐	☐	☐
▪ For EU ETS exemption	☐	☐	☐	☐
▪ For extending the ETS coverage with more countries	☐	☐	☐	☐
▪ For clearer longer term regulatory statements	☐	☐	☐	☐

20. Which of the following makes it difficult for your company to comply with EU ETS?

☐ Cost for emission reduction	☐ Knowledge for regulatory & legal issues	☐ Emission counting & reporting
☐ Technology barrier	☐ Future uncertainty	☐ Internal Administration
☐ Lack of experience	☐ Others (please specify) [ ]	

21. Which of the following factors are affected by EU ETS since 2005?

Factors	Yes, became more competitive	Yes, became less competitive	No, not affected
▪ Price of the product	☐	☐	☐
▪ Quality of the product	☐	☐	☐
▪ Technology applied	☐	☐	☐
▪ Product label	☐	☐	☐
▪ Customer service	☐	☐	☐
▪ Location(s) of the market	☐	☐	☐
▪ Public/Brand Image	☐	☐	☐
Factors	**Yes, increased**	**Yes, reduced**	**No, not affected**
▪ Market share	☐	☐	☐
▪ Product(s) demand	☐	☐	☐
▪ Production cost	☐	☐	☐
▪ Production volume	☐	☐	☐
▪ Production efficiency	☐	☐	☐
▪ Others (please specify)	[ ]	[ ]	[ ]

22. Up to now, how far have you planned for the EU ETS?

☐ We are now preparing strategic plans for the second phase (2008-2012).
☐ We've set a clear plan for 2008-2012.
☐ We started considering further plans for post 2012.

23. If there is no CO_2 Tax or ETS, will you reduce the emission VOLUNTARILY?

☐ Yes, we commit ourselves to mitigate climate change.
☐ Yes, we see CO_2 reduction as a trend that will come sooner or later.
☐ No, emission reduction is very costly and difficult.
☐ Well, it's hard to say.

Appendix II: List of Surveyed Companies

The 20 surveyed companies are listed here following the alphabetic sequence.

No.	Name of the companies
1	Alfred Pedersen og Søn
2	Arla Foods
3	Daka
4	Danfoss
5	Danisco
6	Danogips
7	DanSteel
8	Dragsbaek Maltfabrik A/S
9	Duferco Danish Steel
10	Gartneriet Hjortebjerg Kraftvarme I/S
11	Haldor Topsøe A/S
12	Hanstholms Fiskemelsfabrik A/S
13	Munck Asfalt A/S
14	Novo Nordisk A/S
15	Novozymes A/S
16	Palsgaard A/S
17	Pedershvile Teglværk
18	TripleNine Fish Protein
19	Vedstaarup Teglværk A/S
20	Vesterled Teglværk A/S

Appendix III: Summary of the Survey Data

1. *Question 1 & 2*. What is/are the dominant source(s) of energy/fuel used in your company? And what is CO2 emitted from?

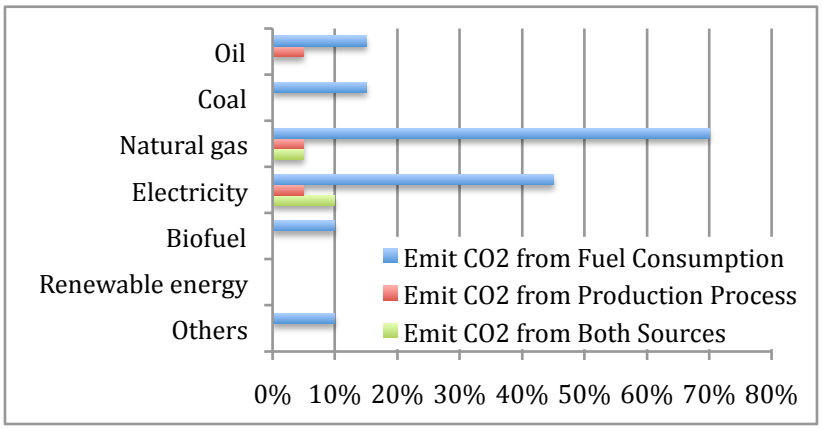


Figure 1. Companies' dominant energy sources and CO2 emission sources

2. *Question 3*. Is a company subjected to tax before 2005 and now

Table 1. Distribution of companies subject to CO2 tax regulation

		Subject to CO2 tax before 2005		
		No	Yes	N.A*
Subject to CO2 tax now	No	1	0	0
	Yes	2	16	0
	N.A	0	0	1

(*: Missing information)

3. *Question 4.* With the enforcement of EU ETS since 2005, who is monitoring your CO_2 emission?

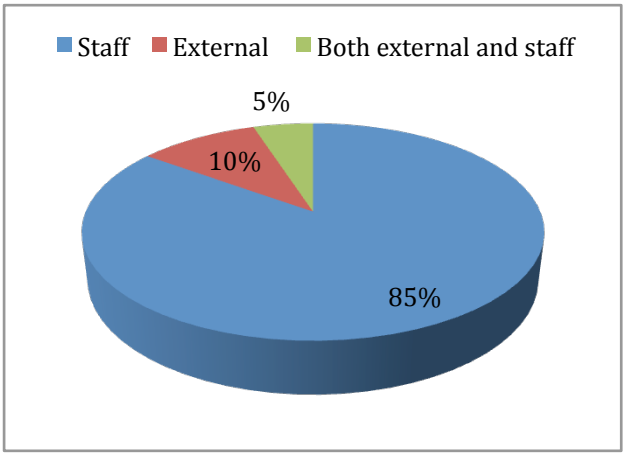


Figure 1. Responsibility for CO2 monitoring

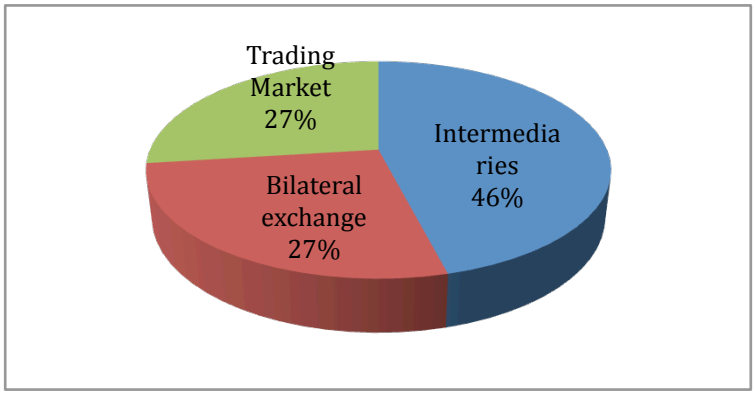


Figure 2. Ways of trading allowance in the 1st phase

4. *Question 5.* During the 1st period of EU ETS in 2005-2007, did you trade any CO_2 quota?

5. *Question 5 &10.* During the 2nd period of EU ETS in 2008-2012, which role is your company going to play in the trading market?

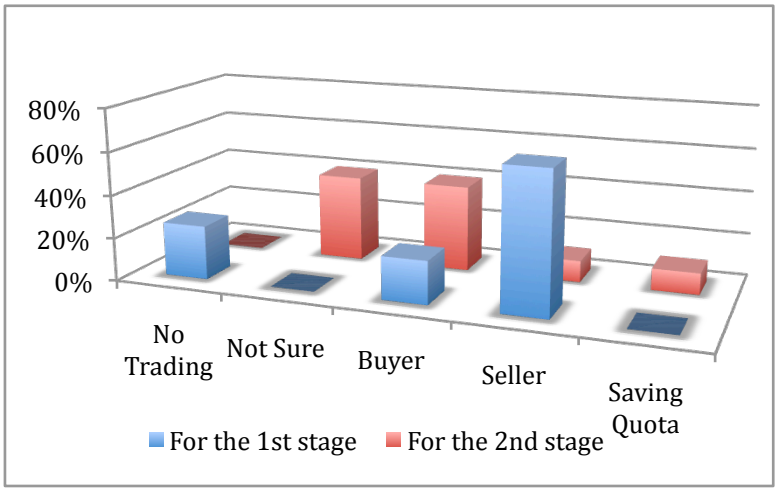


Figure 3. Companies' roles in trading in the 1st and 2nd phase

6. *Question 6.* How long is the time span of your corporate strategy for climate change?

   Question 22. Up to now, how far have you planned for the EU ETS?
   Question 15. In terms of technology/R&D investment, how long is the expected payback time?

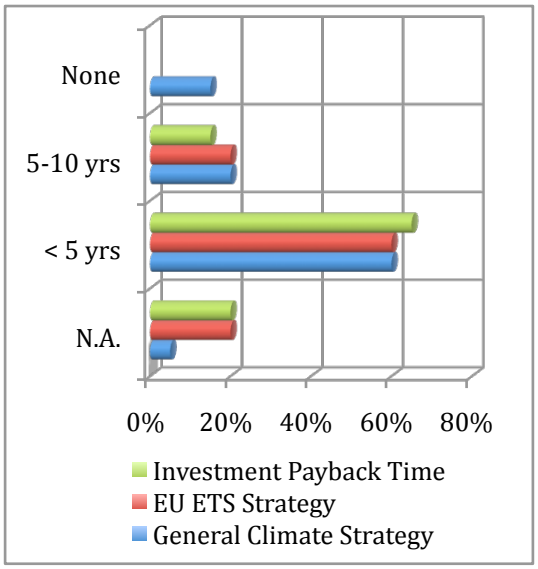
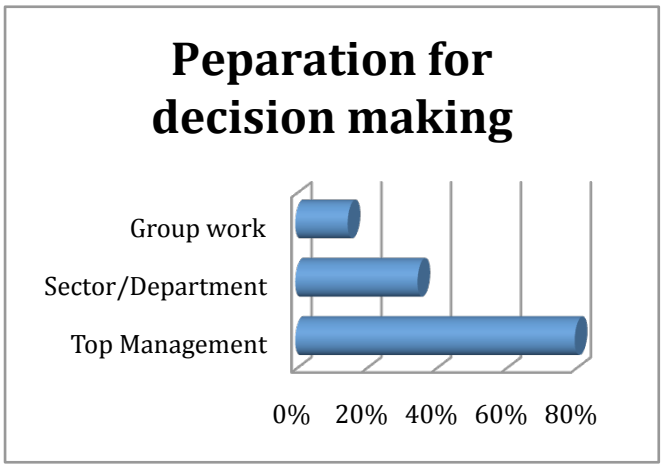


Figure 4. Distribution of time span of EU ETS strategy, climate change strategy and technological pay back time

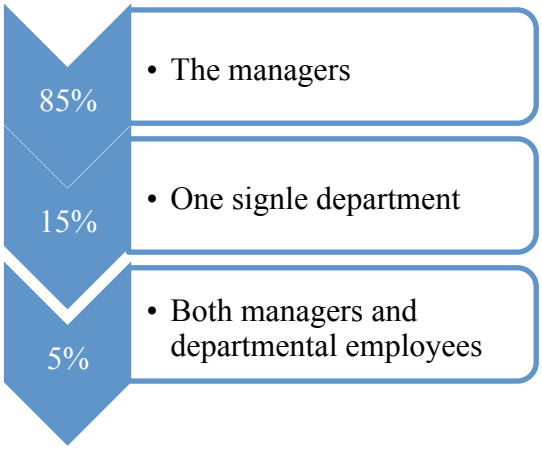


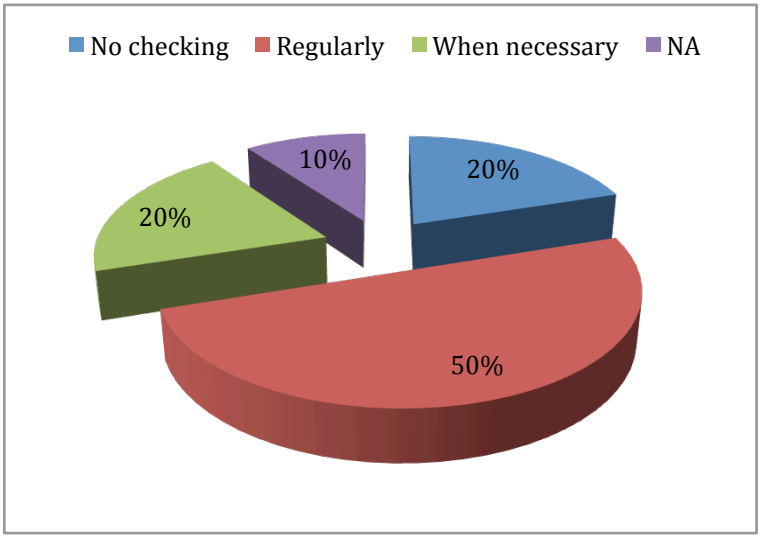
7. *Question 7.* Facing the EU ETS, who is/are preparing your corporate strategies?

Figure 5. Responsibility for decision preparation process

8. *Question 8.* Who is/are responsible for the decision-making on emission trading?

Figure 6. Responsibility for decision making process





9. *Question 9*. Do you check and revise your strategic plan?

Figure 7. Regularity of EU ETS strategy checking

10. *Question 11*. Considering the following aspects of uncertainty, to what extends do they affect your strategic decision? (during a short / long term respectively)

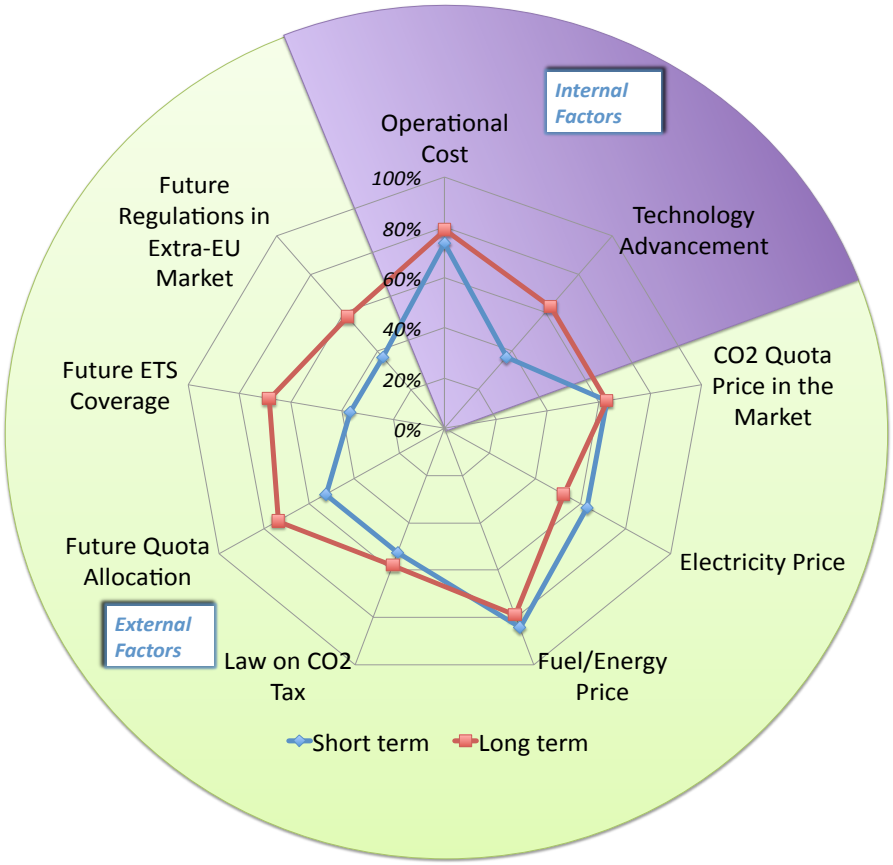
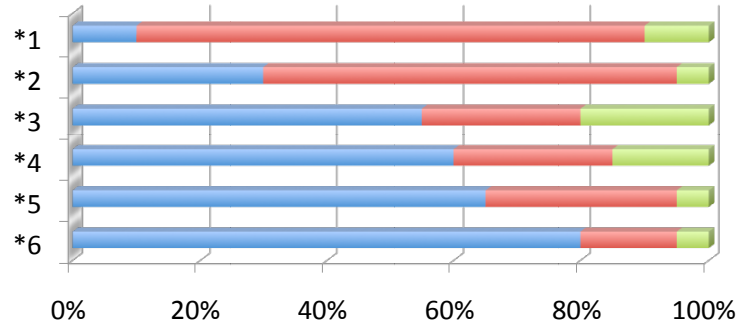


Figure 9. Importance of several factors in a short/long terms

11. *Question 12*. Companies' perspectives about EU ETS



Statements
*1 EU ETS will make our company profitable in the long run.
*2 EU ETS has changed/is changing our production pattern.
*3 ETS makes our company less competitive than intra-EU companies.
*4 EU ETS makes our company less competitive than extra-EU companies.
*5 The compliance of EU ETS is costly in a short term.
*6 EU ETS promotes incentive for our innovation and further development.

Figure 10. Distribution of companies' perspectives on several statements

12. *Question 13*. Is your company engaged in any CDM /JI project?

Table 2. Distribution of companies participate in CDM an JI

Period	Participation	Frequency	Percentage
1st period	Yes	1	5%
2nd period	Yes	4	20%
	Under consideration	1	5%
	Not sure	3	15%
	N.A	12	70%

13. *Question 14*. Due to the EU ETS, are you going to take the following actions during 2008-2012?

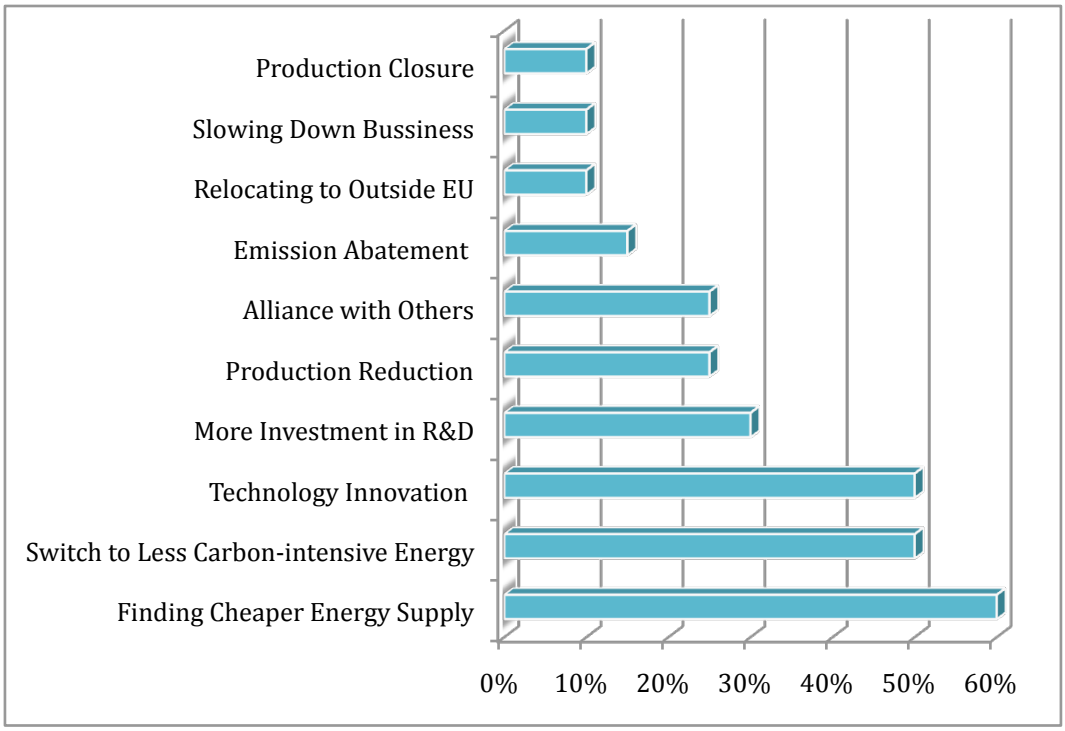


Figure 11. Distribution of firms choosing possible actions as non-market strategies in the 2nd stage

14. *Question 16.* By which way(s) are you preparing the strategies towards EU ETS?

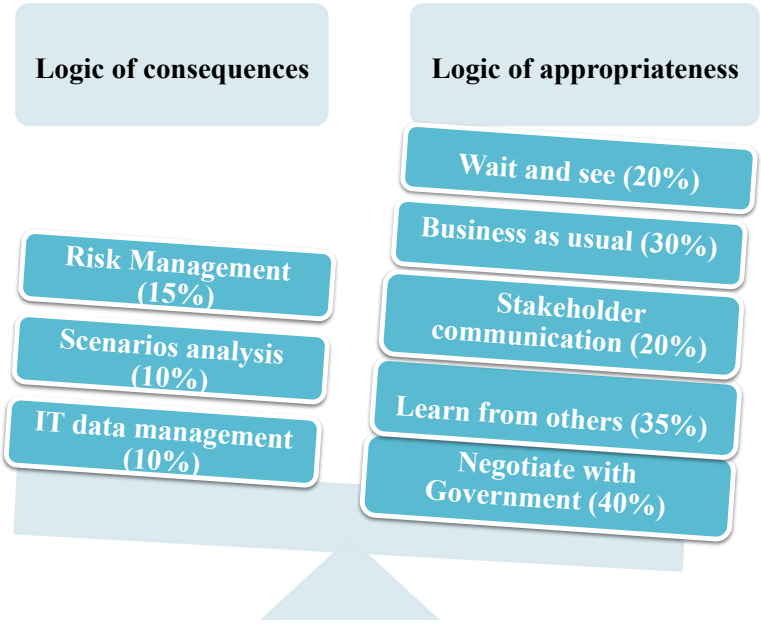


Figure 12. Distribution of approaches to set up EU ETS strategy

15. *Question 17*. How is your setting of climate strategy to deal with the EU ETS?

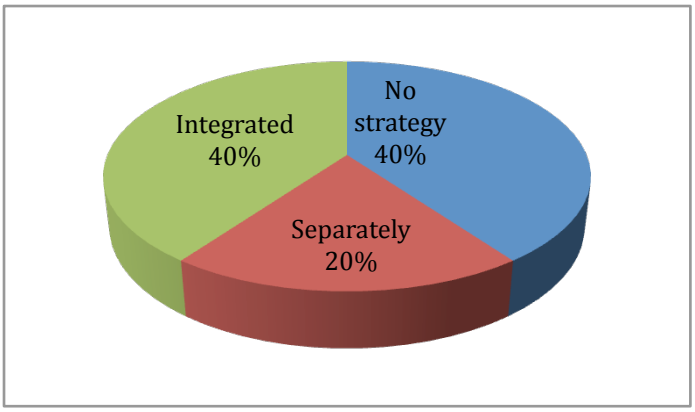


Figure 13. EU ETS in relation with general business

16. *Question 18*. In preparing for the EU ETS, which unit(s) within your company and which external organization(s) have provided knowledge /advice / support?

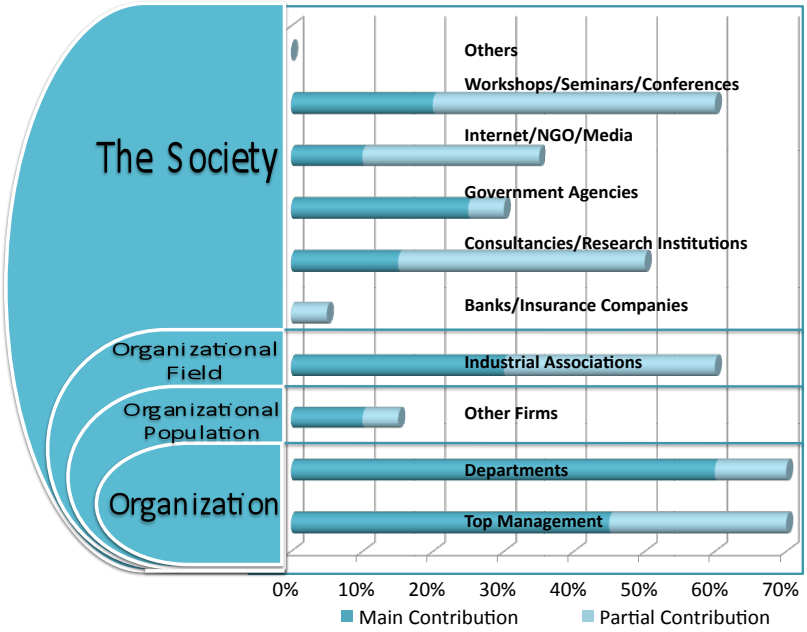


Figure 14. Sources of knowledge

17. *Question 19*. Are you interested in lobbying for the following cases?

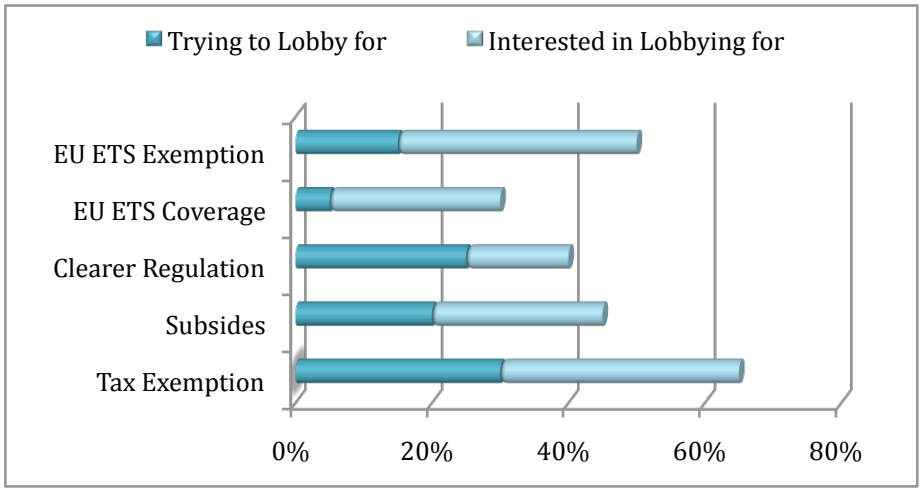


Figure 15. Distribution of interest in lobbyism

18. *Question 20*. Which of the following makes it difficult for your company to comply with EU ETS?

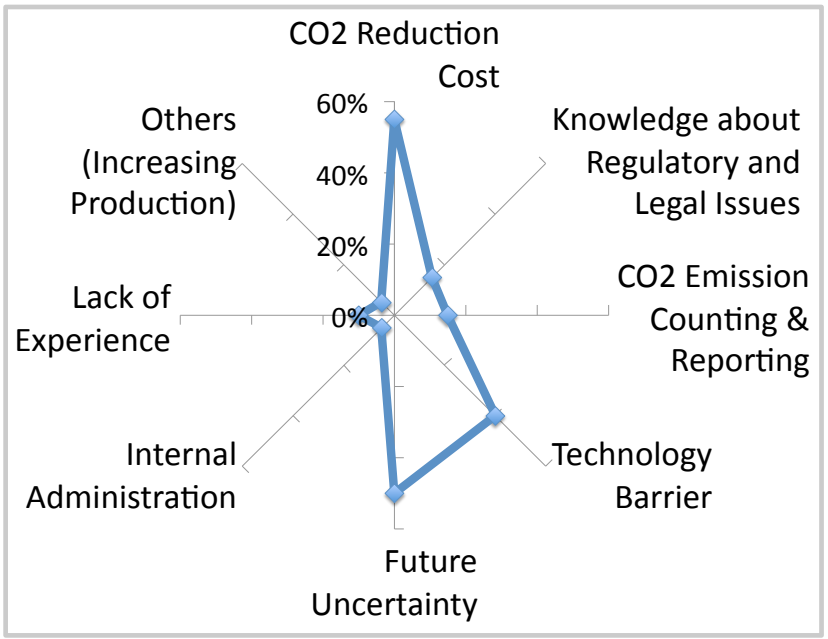


Figure 16. Distribution of difficulties in handling with EU ETS

19. *Question 21*. Which of the following factors are affected by EU ETS since 2005?

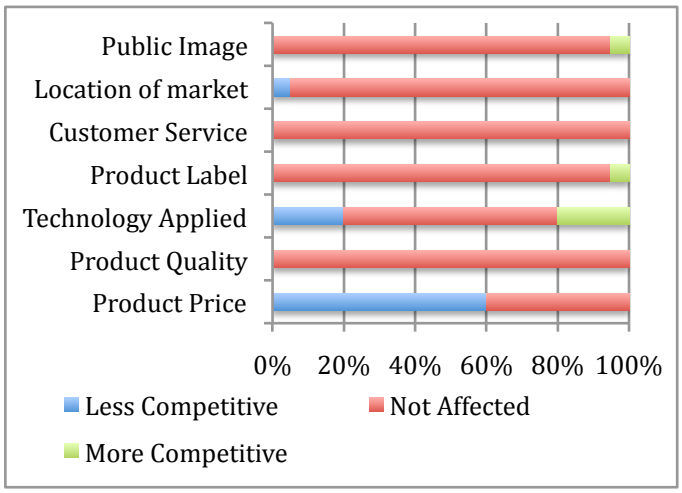


Figure 17. Impact of EU ETS on several competitiveness related factors since 2005

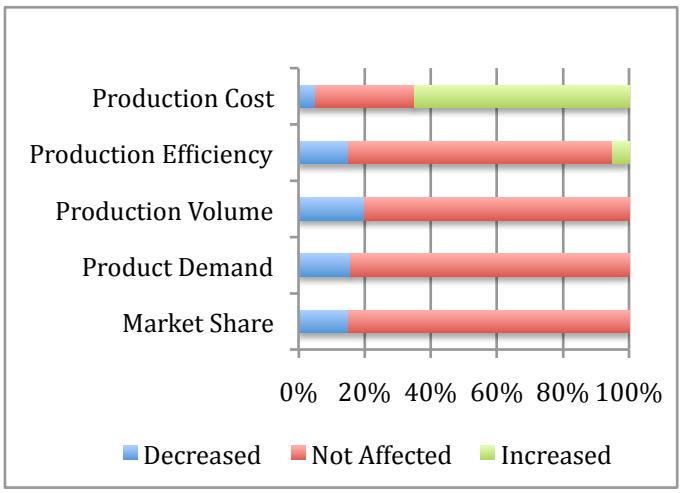


Figure 18. Impacts of EU ETS on several product/production related factors in 2005

20. *Question 23*. If there is no CO_2 Tax or ETS, will you reduce the emission VOLUNTARILY?

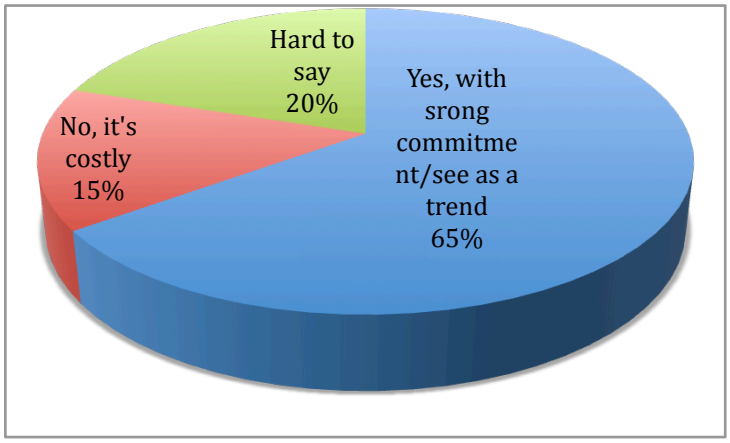


Figure 19. Distribution of companies' self commitment to reduce CO2 emission