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Why constrain yourself?

A cross-industry analysis of Internal Carbon Pricing in relation to the regulatory framework.

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Abstract

This paper investigates the reasons that lead companies to introduce Internal Carbon Pricing as a way to internalize the impact of their GHG emissions in their processes. In order to do this, the usage of Internal Carbon Pricing (ICP) is observed across European industries and public carbon pricing policies. The analysis is based on the answers that organizations provided to the CDP 2021 Climate Change questionnaire, as well as insight from interviews held with some of the companies. This analysis found a strategic use of Internal Carbon Pricing, with varying goals behind its adoption across industries, depending on the degree of regulation they are subject to. Highly regulated and emission-intensive sectors use ICP as a means of evaluating and stress-testing their investments. In contrast, less regulated industries tend to use ICP as a way to meet stakeholder expectations and demonstrate their commitment to climate goals and efforts.

Keywords: Internal Carbon Pricing, Carbon Pricing Regulations, Industries.

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List of Abbreviations

- CDP: Carbon Disclosure Project
- CDP-ACS: Carbon Disclosure Project Activity Classification System
- CO2: Carbon Dioxide
- CO2e: Carbon Dioxide and Equivalents
- C2ES: Center for Climate and Energy Solutions
- EEA: European Economic Area
- EU: European Union
- EU ETS: European Union Emission Trading Scheme
- GHG: Green House Gases
- ICP: Internal Carbon Pricing
- R&D: Research and Development
- USD: US dollars

1. Introduction

In the last few decades, Climate Change has emerged to be one of the biggest concerns that afflict humankind. With countries and companies emitting more and more Greenhouse Gases (GHG) emissions, the impact of Climate Change is becoming more visible. These effects, resulting in social, economic and ecological costs, are usually unaccounted for by organizations, with a market failure that makes society bear those damages (World Bank, 2014). This negative externality is an example of market failure, setting the premises for policies to internalize it.

When agreeing on GHG emissions reduction, for instance, through the Paris Agreement goal of keeping global warming below 1.5° (UNFCCC, 2019), usually, it is the government's role to step into the market to put a price on GHG emissions. The traditional ways of doing so are through carbon taxes and quotas, which in recent years have been put under a lot of stress from the markets, with high prices and media attention, as the EU ETS's recent developments confirm. The fact that the carbon market has been so volatile in recent years confirms the need for action towards Climate Change mitigation (European Environment Agency, 2022).

In the meantime, the role of companies in climate change has been put in the spotlight, given the impact that organizations have on climate change. It is not surprising that companies might introduce initiatives and policies to reduce their CO2e emissions. One of the most innovative solutions is the introduction of an Internal carbon price, defined inside the companies' borders, rather than being just or solely imposed by a tax or a quota.

Internal Carbon Pricing (ICP) is an interesting approach to internalizing externalities, because it is voluntarily introduced by companies. The share of organizations adopting this approach is growing year after year, suggesting great potential for this mechanism (CDP, 2021). While CDP and the World Bank regularly publish reports on carbon pri-

cing and ICP, those take into account the overall global status quo, which is uneven, both in terms of public policies and activities.

The literature on ICP is still limited because this solution is relatively new. Some authors researched the main barriers to introduction and the effectiveness of the companies' climate strategy (Riedel et al., 2021), but this paper aims to clarify the reason behind the adoption of ICP and how that relates to the carbon regulation in place.

In particular, this analysis aims to relate the reasons that motivate the adoption of ICP with the regulatory framework companies to operate, particularly with regard to how regulations can affect various industries. The main focus is to highlight the correlation between regulatory requirements and the objectives of ICP across sectors. To do so, we performed an analysis of the data provided by companies in the CDP Climate Change 2021 Questionnaire, to highlight how ICP is introduced and used in European companies in the different industries. Insights from interviews we held with companies are also used to complement the information provided to CDP, especially regarding how the magnitude of the ICP is defined and the procedures in which ICP is used inside the organizations. Observing ICP in different industries enabled us, not only to relate it to the environmental impact of the activities performed but also to identify the relevant regulatory frameworks that might or might not enforce carbon pricing on these companies. The outcomes of this analysis presented interesting patterns in the use of ICP, which has different motivations and strategies in which those are accomplished. Specifically, ICP has been found to be used as part of profit maximization strategies, which differs based on the industry's emission intensity and the regulations in place.

This paper is structured in the following way: after this introductory section (1), a set of background information on ICP and the different dimensions that characterize it is presented (Section 2: Background). Thereafter, the methodology used to carry out this analysis is explained, describing the combination of qualitative and quantitative approaches which has been adopted (Section 3: Methodology). Section 4 details how ICP is introduced in each industry and includes insights based on the conducted interviews. (Section 4: ICP across Industries). Next, the results of the analysis are used in Section 5 (Results and Discussion) to draw conclusions and to elaborate on the reasons behind

the adoption of ICP, and how those vary across different industries and regulations. Finally, the conclusions of this paper are presented.

1.1 Literature Review

The literature around ICP is very limited, although it has been increasing in recent years, showing a growing interest in carbon pricing on a corporate level. Most of the existing papers on ICP are based on data and information collected by CDP. CDP is a global organization that works with companies, cities, and governments to help them disclose and manage their environmental impacts, particularly in relation to climate change. They publish several reports every year, evaluating organizations' efforts and policies used to fight climate change, deforestation and water pollution. CDP is the source of the data used for this analysis, together with information retrieved by interviewing companies that have ICP systems in place.

CDP reports on the state of ICP by corporates on a global level (2021). The report published in 2021 states that ICP is being introduced by an increasing number of companies, in most industries and areas of the world. Asian and European organizations are the biggest users of ICP, as well as the areas where introduction is growing the most. On the other hand, African and Oceanian organizations are the ones with fewer ICPs introduced. CDP detected driving low-carbon investments and energy efficiency as the most common objectives behind the adoption of carbon pricing. As for GHG emissions coverage, around 89% of the companies disclosed having Scope 1 being covered by ICP, as well as an increasing tendency of covering Scope 2 and, eventually, Scope 3. The CDP report elaborates on the data disclosed by companies answering their questionnaire, observing trends and directions of ICP only on a global level (CDP, 2021).

Similarly, The World Bank (2020) reports on the state and trends of carbon pricing globally, analyzing several initiatives and policies introduced by governments as well as private organizations. The report assesses how ICP is used across sectors and countries, but also the magnitude of the price in the different industries, showing that most of the industries adopted an ICP below the USD 40-80 price per ton range that is requi-

red to meet the Paris agreement target, defined by The World Bank in 2020 as the carbon price corridor (World Bank, 2020).

A study by Harpankar (2019) discusses three models for the introduction of ICP systems, elaborating on the incentives for companies in doing so, as well as the barriers that they face. (Harpankar, 2019)

Similarly, Riedel, Gorbach and Kost (2021) carried out a country-specific analysis of barriers to ICP in Germany. The authors concluded that measuring their GHG emissions and collecting information, in general, is the main obstacle, especially for small firms (Riedel, Gorbach & Kost, 2021).

Aldy and Gianfrate (2019) analyze the effectiveness of ICP as a tool for a company's climate strategy (Aldy & Gianfrate, 2019). Lister (2018) examines the potential of ICP, as well as target setting, and carbon reporting, in meeting the target set and adopted by governments and international organizations (Lister, J., 2018).

Another study by Chen, H., Shan, Y.G., Tang, Q. and Zhang, J. (2022) observe the influence of the physical environment on climate-related decisions, identifying spatial patterns and driving factors behind ICP systems (Chen et al., 2022).

The contribution of this paper to the literature is threefold. Firstly, this paper aims to analyze the state of ICP across different industries and sectors, highlighting differences in height, width and depth of the price, but also in the objectives behind the adoption of the policy in European countries. This enables us to understand why companies decide to introduce ICP, what patterns are there when observing different sectors and what influence regulations, emission intensity and stakeholders have on them.

Second, while prior literature lacks in connecting the regulatory framework with ICP, this paper intends to assess the role of carbon taxes and quotas on ICP and its objective, in relation to the different sectors in the analysis.

Third, this analysis focuses on the European context, whilst reports on ICP that CDP publishes are always assessing the state of things on a global level. Taking Europe into examination is particularly relevant as one of the areas in which ICP is growing the most and where carbon pricing policies are largely introduced on a government level.

Moreover, having a narrower focus on the European context enable us to correlate the impact of regulations across the industries and the way they introduce ICP

On top of these aspects, originality is given to the analysis by using a bigger and newer database to analyze and draw conclusions from, considering the growing number of companies adopting ICP every year and disclosing it to CDP. Additional insights and originality are given by the case studies based on the interviews, which shed some light on the processes that organizations use to determine how to introduce an internal carbon price, as well as the objectives behind it.

2. Background

With more and more countries all around the globe adopting climate mitigation targets, several strategies and policies to put a price on carbon are being introduced, especially in Western countries. This section aims to provide background information on the topic of Internal Carbon Pricing (ICP), detailing its dimensions and its usage. While carbon pricing initiatives are in most cases introduced on a public level, such as carbon taxes or quotas, the peculiarity of ICP is that it's introduced on a corporate level. ICP systems are being adopted by a growing number of companies, 661 European ones are pricing in 2019 or anticipate doing so within two years, about 35% of European companies (CDP, 2021). Undoubtedly, ICP is an effective tool to drive and manage the transition to low-carbon organizations, but there are several dimensions and aspects related to ICP that directly affect how efficient this policy is (World Bank, 2020).

2.1 The dimensions of ICP

Four dimensions should be considered when evaluating ICP and its effectiveness:

1. Price level (height)
2. GHG emissions coverage (width)
3. Influence (depth)
4. Time

Every company adopting an ICP system voluntarily or involuntarily decides on each of these dimensions, which sheds light on the objectives behind introducing this policy (CDP, 2021).

2.1.1 Price level

The first dimension, **height**, is very indicative of the commitments and the objectives behind the policy introduction. Some companies decide on a low internal carbon price to increase awareness of some GHG emissions that would not otherwise have a price.

Other companies opt for a higher price that reflects the costs of abatement for reaching their emission reduction goals, which could include the costs of lowering emissions all along the value chain or even reflect the social cost of carbon. Furthermore, some companies adopt a range of prices, considering different costs of abatements and regulations across departments (World Bank, 2020). This phenomenon of having several prices in different circumstances and evolving over time is known as variance, which reflects the idea that ICP should be unique to each department (CDP, 2021). The relation between the actual price and the objectives behind it is a close one and will be further investigated later on in this paper.

2.1.2 GHG emissions coverage

The width of the ICP, which measures the GHG emissions coverage, is often classified into 3 Scopes: Scope 1, 2 and 3. These scopes are determined by where these emissions originate from Scope 1 includes direct emissions, Scope 2 takes into account emissions resulting from bought electricity and Scope 3 covers indirect emissions along the value chain (Vallinder A., 2022). A detailed figure of what each scope includes can be found in Appendix A. When introducing an ICP system, we can observe a consistent coverage of Scope 1 in most companies, especially because those emissions are easier to track, and also because it's the natural starting point for new adopters of ICPs. Having a system in place that also considers the other two scopes, meaning indirect emissions, not only show a deeper knowledge of their value chain and its impacts but also due diligence towards every stakeholder's impact. Consequently, GHG coverage also sheds light on the objectives behind the ICP system and the company's commitment to the low-carbon transition.

2.1.3 Influence

The influence the internal carbon price has inside the company, the **depth** determines the way ICP is introduced and how that value influences the decision-making process. The way the price is used greatly impacts how the companies intend to meet their objectives and the impact that it has on the corporate level. There are several ways and

several degrees of influence, from qualitatively, financially, or as criteria for business decisions (CDP, 2021). The most commonly adopted types of ICP are:

- Shadow price:

  A shadow price mechanism is used for investment decisions, mostly in CAPEX, but also R&D and procurement decisions; no actual financial flow is generated, and the shadow price simply measures the impacts during the decisional process (CDP, 2021).

- Implicit price

  An implicit fee approach is related to how much the company is spending to comply with GHG emissions regulations in place, defining the ICP as the administrative costs that the company encounters. This approach clearly shows the relationship between the ICP system and the regulatory framework (C2ES,n.d.).

- Internal fee

  An internal fee mechanism results in an actual financial flow, imposing a fee on GHG emissions related to operational decisions. The way these revenues are then used varies a lot in different companies, some use them to establish a low-carbon fund, some others redistribute them in the company (CDP, 2021).

- Offsets

  Companies adopting this approach use ICP to set the budget reserved for purchasing carbon credits. This method, as with the internal fee one, entails a financial impact of the ICP for the company, allowing the integration of carbon value in the decisional process (Ecofys et al., 2017).

- Internal trading

  The internal trading system is comparable to a carbon tax imposed on a corporate level, defining a price for CO2 emissions that is imposed on the different departments. The ways in which this type of ICP is implemented vary a lot according to the business' structure and needs (C2ES,n.d.).

2.1.4 Time

As for every other dimension of the organization, ICP should also be something that develops and changes over time, adjusting to policies, regulations, and the environment to keep meeting the objectives. Especially for new adopters of ICP, the time dimension is important to show and strengthen the company's approach to ICP. How the ICP changes over time illustrates the organization's dedication to the objectives behind the policy. However, this dimension is not the focus of this analysis (CDP, 2021).

3. Methodology

In order to understand the usage of ICP across sectors and industries, as well as the reasons behind the adoption of such policy, it is necessary to collect information on which companies do ICP and what industry they operate in. This section presents the data sourcing and the methodology used to structure this analysis, detailing how the data is used to draw conclusions. While analyzing ICP, the magnitude of the price is an important factor, together with the other dimensions of the ICP (detailed in section 2.1), which all entail information on how each company employ it and the objectives behind the adoptions. Because of how multifaceted the research question is, a blended quantitative and qualitative approach is chosen for the analysis of the topic.

3.1 Data sourcing: CDP

This analysis is based on the data provided by companies through the CDP Climate Change 2021, which was made available to me by my institution, NHH Norwegian School of Economics. The CDP questionnaire aims to assess policies and strategies that are adopted by companies in relation to climate change risks and CO2 management. Participation in the questionnaire is voluntary, but, as the gold standard for corporate environmental reporting, CDP enables companies to disclose environmental data efficiently, meet stakeholder demands, protect reputation, gain a competitive edge, and prepare for regulations. (CDP, 2021).

Although all the information entailed in the questionnaire is relevant to this paper, a detailed examination of section C11: Carbon Pricing represents the core of the analysis. More specifically, section C11.3, Internal Price on Carbon, is taken into account first. In the database, the information is first cleaned based on the geographical location; given that this research only considered the European context. Companies in the following countries are investigated: Austria, Belgium, Bulgaria, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, Norway, Po-

land, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom. The choice of observing Europe as the subject of this analysis reflects the intent of observing ICP in relation to the regulatory frameworks, mainly the EU ETS and national-level carbon taxes. Observing other areas would have meant observing a way more fragmented regulatory framework, while in Europe, because of EU-level climate policies such as the ETS, the policies that affect companies are much more homogeneous, even across countries. Moreover, European countries are much more influenced by each other than ones in other geographical areas, making country-specific climate policies much more aligned. Europe also ranks second in terms of how many organizations use ICP, making this region the focus of this analysis (CDP, 2021).

Once the companies are filtered by their geographical position, they are also differentiated based on whether they have an ICP system in place or not. Question C11.3 in the CDP questionnaire provided three options for the companies: “Yes”, “No, but they anticipate doing so in the next two years” and “No, and they don’t anticipate doing so in the next two years”. For the sake of this analysis, only companies answering “Yes” are considered for further evaluation. The combination of this filter with the geographical one led to 376 companies being analyzed out of the 6008 answering the questionnaire. These companies were then used as a landmark for any further analysis.

3.1.1 Pricing levels

The CDP questionnaire asks the companies to provide the actual price used, in terms of Currency/Metric ton. Because of the multiplicity of countries involved, the values provided were expressed in different currencies. After the double filter, the different currencies present in the database are USD, CHF, CZK, DKK, EUR, GBP, HUF, NOK and SEK. The currency chosen to compare them all is USD, and the rates of exchange used in the conversion are the average rate of exchange for the year 2021, the one in which the questionnaire was answered. The different rates of exchange can be found in Appendix B. The choice of using USD is motivated by the fact that the currency is often more stable and widely used in international trade, making it easier to compare prices

across different countries and markets, especially when many of the companies operate internationally.

Comparing the different values the companies set for carbon is essential for the analysis. In doing so, two outliers were left out of the analysis on both extremes, on one side, two companies had an ICP of 0,00, and on the other two companies had carbon prices above 4'000 USD. It is unclear whether the companies actually have such values or if that was a typo when filling out the questionnaire. For this reason, these outliers are left out of the analysis.

3.1.2 Sector Classification

When comparing the usage of ICP among the different sectors, the companies are classified according to the CDP Activity Classification System (ACS). This framework takes into account the different revenue streams of the companies, associating them with their impact on Climate Change, water security and deforestation. This classification aims to ensure a better understanding of the company's actions, according to their impacts, environmental risks and opportunities. Using a framework developed by the data provider also ensures better comparability of data. The detailed industry and sector classification can be found in Appendix C, and in the next figure (Figure 1) an overview of the classification can be found (CDP, 2022).

Industry	Activities
Apparel	• Textiles & fabric goods
Biotech, health care & pharma	• Biotech & pharma • Health care provision • Medical equipment & supplies
Food, beverage & agriculture	• Crop farming • Fish & animal farming • Food & beverage processing • Logging & rubber tapping • Tobacco
Fossil Fuels	• Coal mining • Oil & gas extraction & production • Oil & gas processing • Oil & gas retailing • Oil & gas storage & transportation

Industry	Activities
Hospitality	• Bars, hotels & restaurants • Entertainment facilities
Infrastructure	• Construction • Energy utility networks • Land & property ownership & development • Non-energy utilities
International bodies	• Government agencies • Government banks • Government bodies • International bodies
Manufacturing	• Electrical & electronic equipment • Leisure & home manufacturing • Light manufacturing • Metal products manufacturing • Paper products & packaging • Plastic product manufacturing • Powered machinery • Renewable energy equipment • Transportation equipment • Wood & rubber products
Materials	• Cement & concrete • Chemicals • Metal smelting, refining & forming • Metallic mineral mining • Other materials • Other mineral mining • Wood & paper materials
Power generation	• Nuclear power generation • Renewable power generation • Thermal power generation • Waste power generation
Retail	• Convenience retail • Discretionary retail • Trading, wholesale, distribution, rental & leasing •
Services	• Commercial & consumer services • Financial services • Industrial support services • IT & software development • Media, telecommunications & data center services • Other services • Print & publishing services • Specialized professional services • Web & marketing services
Transportation services	• Air transport • Intermodal transport & logistics • Marine transport • Rail transport • Road transport

Figure 1: CDP-ACS Industry and sector classification (CDP, 2022)

3.1.3 Regulatory frameworks

As mentioned above, this analysis considers companies operating in Europe, but not limited to the EU or EEA. The carbon prices in the analysis, as well as all the other information provided, refer to the country the company operates in, not only the one they are based in. Because many of the organizations taken into account are international ones, when answering the questionnaire, the companies were asked to discuss the country or area for which they were providing data, providing information on which climate policy is relevant for them.

As mentioned in section 3.1, only European countries are considered, after the data are filtered based on country and ICP being introduced, the country left in the analysis were: Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK. In the countries presented in section 3.1 that are not listed in this paragraph, none of the companies reported using ICP, making the local carbon regulations not relevant to the analysis.

Having several countries involved in the analysis means that several policy frameworks must be considered. Even after the geographical filter is applied, many of the organizations still disclose being regulated by extra-European policies, because the same organization operates outside Europe as well. Taking into account most of these companies have to comply with European policies in the first place, this analysis only considers the European carbon pricing regulations. As for the currencies in section 3.2, the pricing level set by the regulations taken into account in this paper is the price of CO2e per ton in 2021. The different carbon prices set by the different regulatory frameworks and the share of emissions covered by them can be observed in the following table (Figure 2).

Regulatory Framework	Price per Ton of CO2 (USD)	Share of jurisdiction's emissions covered
EU ETS	49.8	39%

Regulatory Framework	Price per Ton of CO2 (USD)	Share of jurisdiction's emissions covered
Denmark carbon tax	23.6-28.1	35%
Estonia carbon tax	2.3	6%
Finland carbon tax	62.3-72.8	36%
France carbon tax	52.4	35%
Iceland carbon tax	19.8-34.8	55%
Ireland carbon tax	39.3	49%
Latvia carbon tax	14.1	3%
Netherlands carbon tax	35.2	12%
Norway carbon tax	3.9-69.3	66%
Poland carbon tax	0.1	4%
Portugal carbon tax	28.2	29%
Slovenia carbon tax	20.3	50%
Spain carbon tax	17.6	3%
Sweden carbon tax	137.2	40%
Switzerland carbon tax	101.5	33%
Switzerland ETS	46.1	11%
UK carbon tax	24.8	23%
Ukraine carbon tax	0.4	71%

Figure 2: Prices of CO2 across Regulatory Frameworks (April 1, 2021, USD/tCO2e) (The World Bank, 2021)

Although several carbon policies are regulating the companies in the analysis, 75% of the ones being regulated disclosed the EU ETS as one of the policies that regulate them. At the same time, the EU ETS and the Switzerland ETS are the only two carbon quota systems in place in Europe for the companies taken into the analysis; these two regulatory frameworks also have comparable carbon prices, as shown in Figure 2. The EU ETS is thus the one policy framework with the highest importance for this paper and is therefore used as a benchmark for further consideration.

From a legislative point of view, the EU ETS and the country-specific carbon taxes target different industries, with some companies being affected by both policies. Being the range of possibilities so broad, for this analysis, the main aspect taken into consideration is whether companies are regulated or not, the specific policy that affects them has secondary importance. To do that, questions in section C11.1[1] in the CDP questionnaire are essential. The first one enables us to distinguish between organizations being regulated, expected to be or not. The different industries are ranked based on the percentage of them that are regulated or expected to be in the next two years. This enables us to understand which sectors are affected by regulations the most and how those same industries use ICP. The findings are presented further in the paper when presenting the patterns around ICP across industries (Section 4. Internal Carbon Pricing across Industries).

Question C11.1a[2] provided a clear picture of which policies to consider and question C11.1b[3] reported the impact of those policies on the organizations in analysis.

3.1.4 Emission intensity

The CDP ACS aims to group companies into sectors based on their impact on Climate Change, water security and deforestation, and it is used in this analysis to group companies into industries. For the sake of this analysis, the main aspect taken into account is the emission intensity, which only considers CO2e, ignoring the effects of those industries on deforestation and water pollution.

The information regarding the emission intensity of the companies in the analysis is retrieved from the answers to the CDP questionnaire, especially in question C4.1a[4].

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[1] Are any of your operations or activities regulated by a carbon pricing system (i.e. ETS, Cap & Trade or Carbon Tax)? (CDP Questionnaire, 2021)

[2] Select the carbon pricing regulation(s) which impacts your operations. (CDP Questionnaire, 2021)

[3] Complete the following table for each of the emissions trading schemes you are regulated by. (CDP Questionnaire, 2021)

[4] Provide details of your absolute emissions target(s) and progress made against those targets. (CDP Questionnaire, 2021)

This section of the questionnaire provided the emissions in the base year (metric tons CO2e) that companies used to set the target for 2021. In most cases, the data provided represents the CO2e emitted by each company in 2020, which is an important driver of ICP, and therefore important for this analysis.

The CO2e emissions that each company provided are used to calculate the average emissions for each industry, giving a clear rank of the sectors according to their emission intensity.

3.1.5 Insights on ICP

The data analyzed in this paper is based on the information provided by organizations in section 11.3 of the CDP questionnaire, especially when observing how the different dimensions of ICP vary between the different sectors. Question C11.3a[5] contribute largely to this analysis, offering information on emission coverage, types of ICP used and objectives behind the adoption, which will be analyzed further in the paper. For each of the industries presented in section 3.1.2, the CDP data presented us with information on the magnitude of the price, the emission coverage and the approach adopted. Moreover, this section of the CDP questionnaire provided knowledge of the objectives behind the adoption of ICP. All this information is used to depict the status quo of ICP in each one of the industries taken into account, calculating the percentage of companies adopting specific behaviours in each of the industries. The findings will be presented further in this paper, in section 4. ICP across Industries.

[5] Provide details of how your organization uses an internal price on carbon. (CDP Questionnaire, 2021)

3.2 Case Studies: Interviews

Besides retrieving from the CDP database the organizations in Europe with an ICP system in place, this analysis also included knowledge from interviews held with some of the companies. The combination of the two sources of information is crucial to this analysis because it provides a double perspective on how ICP is used and perceived in the different sectors. While the database provides data from a broader range of organizations, the interviews represent a direct insight into the way ICP is adopted and what objectives and concerns stand behind the carbon pricing strategies. When observing the objectives provided by companies in the CDP questionnaire, it is clear that a less ambiguous approach is necessary in order to identify the primary objective of ICP. The interview also shed light on how the regulatory framework influences not only the objectives but also the decisions to introduce ICP and its future developments in the organizations.

The message used in the correspondence with the companies can be found in Appendix D. Out of the 338 European organizations that disclosed using an ICP, 6 responded positively and agreed on being interviewed, with a response rate of 1.78%. The low response rate represents one limitation to the analysis but still provides useful insight into ICP that could not be derived from the CDP data.

When being interviewed, the organizations were presented with a questionnaire, which can be found in Appendix E. During the interview, the questions asked to the company representative varied based on the information that they already provided in the CDP questionnaire, but also based on the industry they operate in and the climate policies relevant for them.

3.2.1 Questionnaire

Every question asked to the organizations during the interview was meant to acquire certain information. A detailed explanation of the questionnaire follows.

1. How did your company determine the magnitude of its actual carbon price?

With this question, the goal is to understand the process behind the choice of the ICP, whether it is reliant on external sources or if it's assessed based on the specific impact and requirements of the organization.

2. *To what extent is your ICP driven by competition in your industry, by specific competitors, and/or companies outside your industry but part of your value chain?*

The goal behind this question is to understand if competition inside and outside the industry plays a role in determining any of the dimensions of ICP.

3. Your company has indicated several objectives for implementing an ICP. Which is your main objective, and why?

In the CDP database, organizations could select multiple objectives behind the implementation of ICP. This question aims to understand which one is more relevant and why.

4. To what extent is your ICP driven by internal processes versus external regulations, pressure or influence from external stakeholders? If applicable, which stakeholders are key?

This question wants to draw a line between external and internal policies, to understand if the ICP was introduced to comply with the regulatory framework or other reasons as well, such as stakeholder pressure.

5. I can see in the CDP data that you are governed by XXX: to what extent does your ICP differ from the observed or expected carbon price in XXX?

This question was adapted to the case relevant to the organization being contacted, based on the information they disclosed to CDP. The aim is to understand the role of the regulatory framework in assisting the magnitude of the ICP.

6. How do you communicate your ICP? Is the price shared with any stakeholders, and why?

The degree to which stakeholders are involved and conscious about the ICP communicates not only the objectives behind the adoption but also to what extent the ICP is just used as a communication strategy, without any concrete action.

7. What benefit has the ICP brought? What costs does the ICP have? How are costs and benefits related?

Understanding how the ICP is used, the benefits that have been brought and the costs shed light on the objectives and the effectiveness of the system to reach them.

8. Do you have any further remarks on ICP?

This question enables the organization to add any information they believe is relevant, as well as putting the ICP in a time dimension.

3.3 Limitations to the Analysis

As stated above, the nature of this analysis is twofold, including both quantitative and qualitative aspects, which inevitably leads to some limitations.

Firstly, in terms of internal validity, the process of answering the CDP questionnaire might be subject to inaccuracy or mistakes, which might not be recognizable during this analysis. The blended approach could also be susceptible to bias, as subjective interpretations of qualitative data may influence the quantitative analysis.

In terms of sector classification, the number of companies in each industry is so uneven that the outcomes of this analysis might not be representative of the industry as a whole. The fact that some organizations operate across industries and sectors also is a strong limitation, mitigating the magnitude in which some patterns or behaviours differ across industries.

Furthermore, additional limitations are added by the fact that the response rate of organizations answering the questionnaire and agreeing to an interview is low. Consequently, the role of these interviews serves more as a case study rather than representing the industry they operate in. Moreover, the interviews that were held were not evenly spread through the industries, having 3 interviews for the Fossil Fuel industry and none for many others.

As for the external validity, limitations could arise if the study sample is not representative or if the findings are not generalizable to other populations or settings, such as geographical areas other than Europe.

4. Internal Carbon Pricing across Industries

In order to understand the objectives behind the introduction of ICP, and how those objectives vary across industries and sectors, it is useful to scrutinize the different dimensions of ICP and the regulatory frameworks in place. In the following sections, after some general remarks on the usage of ICP across Europe, different patterns and behaviours on how ICP is adopted across industries will be presented. As mentioned in Section 3 the results presented are based on the data set provided by CDP. For each industry, we depict the dimensions of ICP, together with the relevant regulatory framework and the objectives disclosed. To be able to understand the reasons why companies introduce an ICP, insights from the interviews held with the companies will be presented. These serve as examples of how companies in the industry behave, as well as an attempt to fill the gap left by the CDP questionnaire around some aspects of the ICP, such as the ways in which ICP is used.

4.1 General remarks

The information disclosed to CDP in 2021 by the 376 companies who reported using ICP presents interesting practices and configurations. The first aspect when considering ICP is the height of the price. In 2021, on average, the internal carbon price was 61,01 USD, which, compared to the value of EU ETS in April 2021 (World Bank, 2021), is just 22% higher. Even though the average value is comparable to the one set by EU regulations, the distribution of those ICPs across European organizations is very uneven, as may be observed in the following figure (Figure 3).

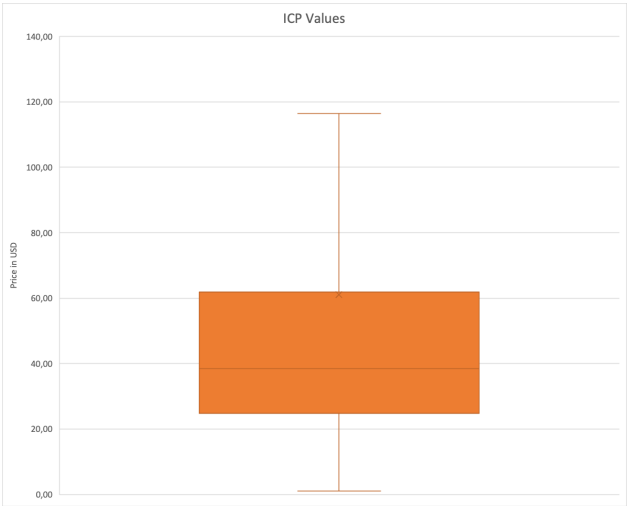


Figure 3: ICP values across European organizations in 2021. Boxplot presenting the average value and the range of distribution.

4.1.1 Country Analysis

While the uneven nature of the ICP is not so informative, observing the different prices across countries shows a clear distinction between Southern European countries and Northern ones, as may be observed in Figure 4. The reasons for this phenomenon are complex, we might suppose a correlation between the level of the average ICP adopted by companies in one country and the carbon pricing level defined by a carbon tax. Be-

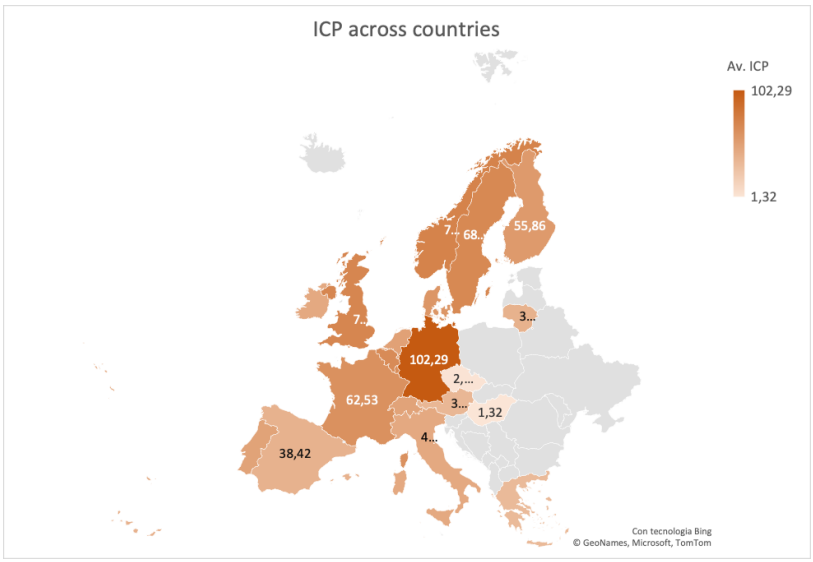


Figure 4: Average ICP across countries. Map presenting the average value of ICP in every country in analysis.

cause of how much carbon regulations and ICP vary across industries, considerations on these aspects will be presented later in the analysis.

4.1.2 Emission Coverage and Influence

As for the other dimensions of ICP, the average emission coverage values show interesting trends. 86.13% of organizations reported having Scope 1 emissions covered by their internal carbon price, while 67.47% reported having Scope 2 covered and 46.67% of companies reported covering Scope 3.

In terms of what the ICP is used for, the CDP data attest that most companies use ICP as a shadow price, which is the easier type of ICP to implement. Smaller percentages of organizations use ICP as an internal fee or implicit price, as shown in the pie chart below (Figure 5).

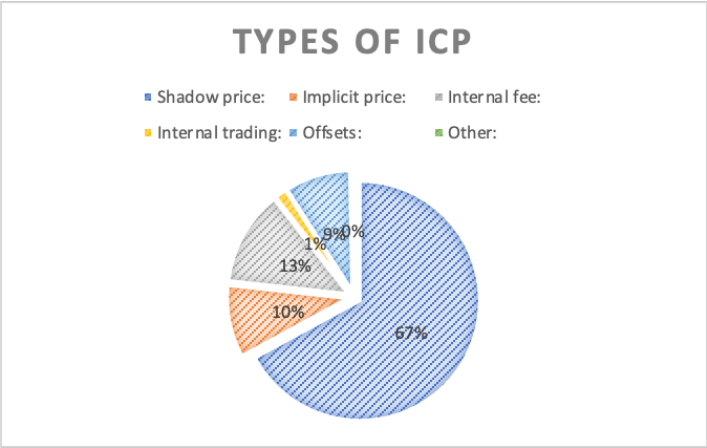


Figure 5: Types of ICP implemented.

Because of the clear tendency of most companies across all sectors to introduce ICP as a shadow price, this factor will not be taken into consideration for further analysis, especially in relation to regulations. Anyway, to present a complete overview of ICP across industries, this information will be mentioned when discussing the usage of ICP in each sector, in Section 4.2.

4.1.3 Objectives

Perhaps the most interesting aspect of ICP for this analysis is understanding why companies introduce it. Organizations answering the CDP questionnaire, in most cases, discoursed multiple objectives, which makes it challenging to comprehend which is the primary one. An attempt to do so is done by looking purely at organizations choosing a single objective, which suggested driving low carbon investments as the more frequently chosen one, but the picture is fragmented, as shown in the following chart (Figure 6).

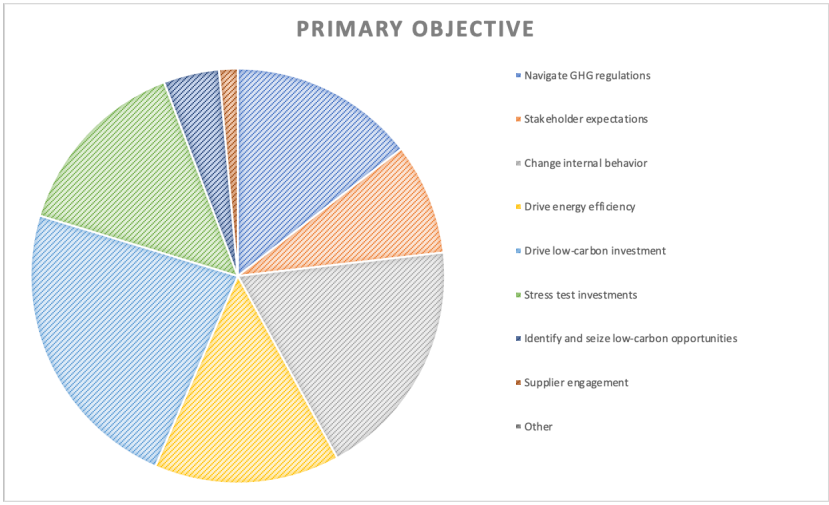


Figure 6: Primary objective behind ICP.

When considering the complexity of all the objectives indicated by companies, stress testing investments is the option that most companies mentioned, followed by stakeholders' expectations.

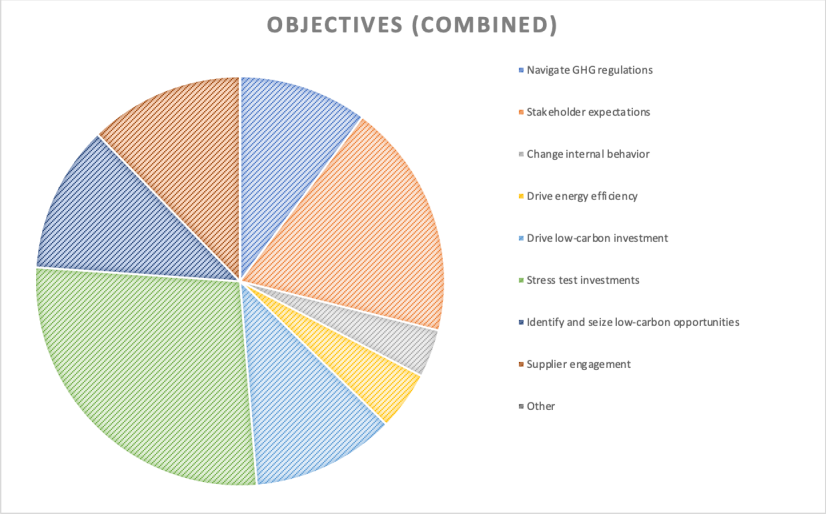


Figure 7: Objectives behind ICP (combined).

Once again, how the objectives vary across industries and regulatory frameworks will be discussed further in this chapter.

Before doing so, it is valuable to observe the heights of ICP in different industries, as presented in the box plot below (Figure 8).

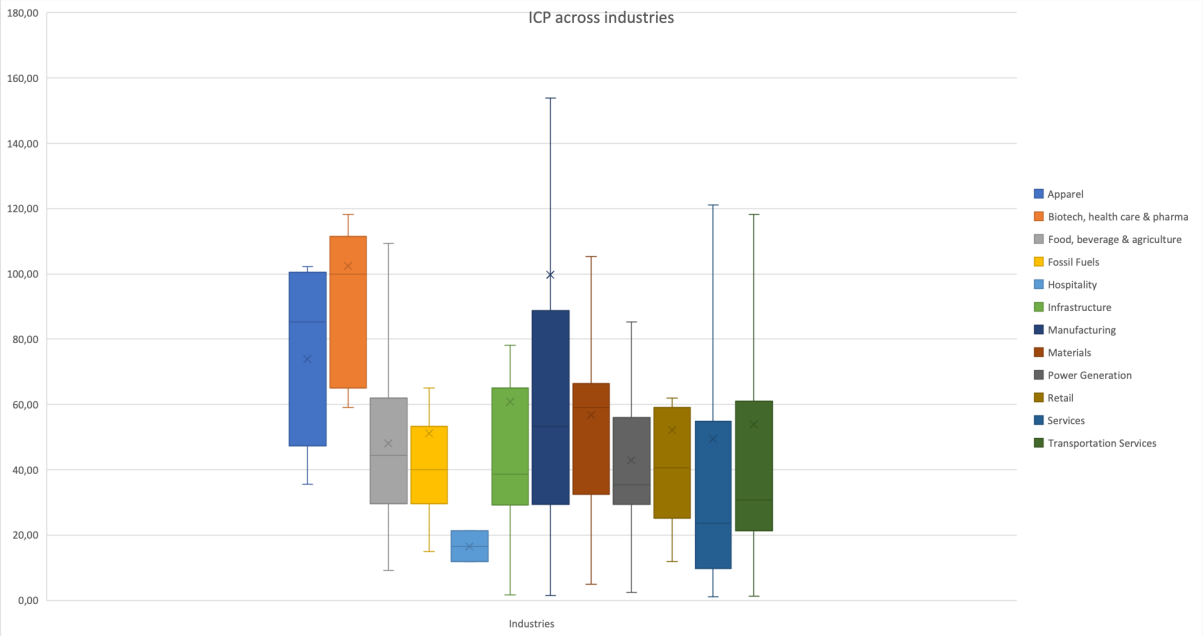


Figure 8: ICP across industries. Box-plot presenting the average ICP and the range for each industry

Figure 8 shows that the magnitude of Internal Carbon Prices varies quite considerably across industries, but also inside the same sector. The reason is to be found in how different activities, sometimes in the same sector, emit GHG in different degrees and are regulated accordingly, as will be discussed further in the analysis.

It is also interesting to note that ICP systems are implemented more frequently than others in some industries. The histogram below (Figure 9) presents an overview of how the companies observed in this paper are distributed in the industries, as determined by the CDP-ACS framework.

We observe that the industry with the bigger share of organizations with an ICP in place is the Service one, followed by Materials and Manufacturing. The industries that are most emission-intensive, such as Fossil Fuels, have fewer ICPs than less polluting

ones. Lastly, sectors such as Apparel or Hospitality are the ones where ICP is introduced by the smallest share.

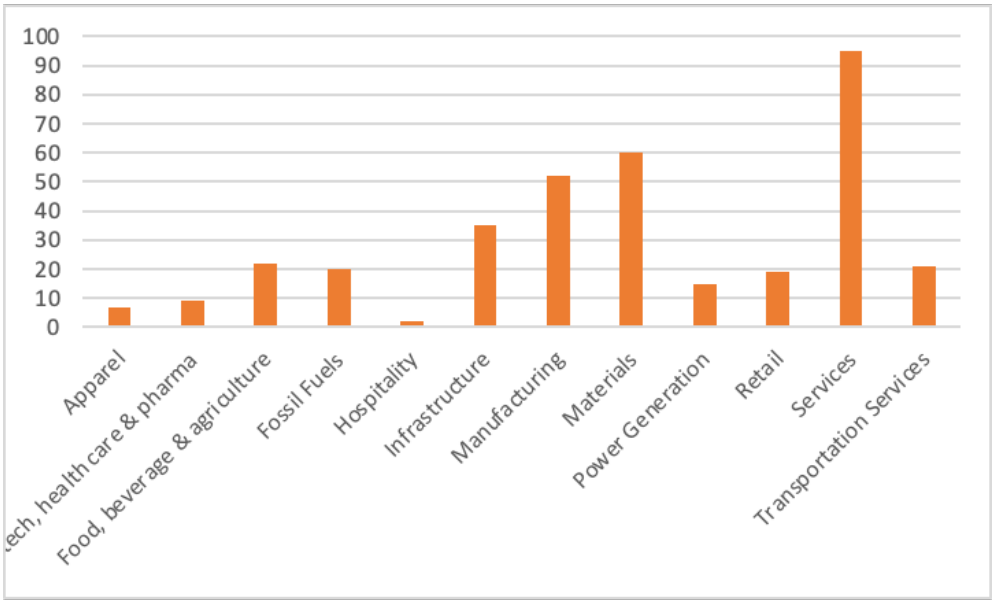


Figure 9: Number of companies with ICP in each industry.

4.2 ICP in different industries

In the following paragraphs, specific information on how ICPs are used in each industry will be presented. These insights are based on the answers to the CDP Climate Change questionnaire as well as interviews. The industries will be listed in alphabetical order, and details on ICP and the relevant regulations will be provided. While the majority of the countries in the analysis are regulated by the EU ETS, not all sectors are. This creates variations in regulation coverage which, together with the three dimensions of ICP, will be analyzed further and drawn conclusions from in Section 5.

4.2.1 Apparel

According to the CDP-ACS, the apparel industry includes a large share of activities being B2C, as detailed in Appendix C (CDP, 2022).

In this sector, the average ICP in the companies disclosing having one is 73.89 USD, with most organizations (85.71%) covering Scope 1 and 2. Roughly half of the companies in the analysis reported using an internal fee as ICP, followed by shadow pricing. None of the organizations in this industry is currently regulated by any kind of carbon pricing system, and only 15% expect to be in the next two years.

As for the objective behind the introduction, changing internal behaviour was reported as an objective by 100% of the organizations, driving energy-efficient and low-carbon investments are being disclosed by most companies, and stakeholders' expectations were mentioned by roughly 30% of the organizations.

4.2.2 Biotech, health care & Pharma

Inside the Biotech, health care and Pharma industry are several kinds of organizations and companies, as shown in Appendix C (CDP, 2022).

The average magnitude of ICP in this industry is 102.43 USD, which is relevantly higher than the overall average carbon price. 90% of companies reported covering Scope 1 and 2, but only 30% covering Scope 3 as well. Shadow pricing is the main type of ICP used in this industry.

Most (66.67 %) of the companies answering the CDP questionnaire reported being regulated by EU ETS on 27% of their Scope 1 emissions and 0% of their Scope 2 emissions. As for the objectives, driving energy-efficient and low-carbon investments are being disclosed by most companies, as well as changing internal behaviour. To that end, most companies reported ICP as a useful instrument to anticipate the effects of carbon regulations and to optimize the profitability of green investments.

4.2.3 Food, beverage & agriculture

The range of companies in the Food, beverage and agriculture industry is quite wide, as the table in Appendix C demonstrates (CDP, 2022).

In the industry, the average ICP is 48.13 USD, with 95% of organizations covering Scope 1 and 80% of them coving Scope 2, but only 36% covering Scope 3 as well. Most companies implement it as a shadow price (73%), but some of them use an implicit price (16%) or an internal fee (10%).

77% of the organizations in the analysis undergo regulations, showing to be one of the most regulated industries investigated in this paper. The EU ETS regulates roughly 50% of the Scope 1 emissions in this industry, while only 4% of Scope 2, showing that the implementation of the ICP on Scope 2 is mostly voluntary.

With the industry being so wide, analyzing the objectives does not show any clear trend towards specific objectives, as shown in the following figure (Figure 10).

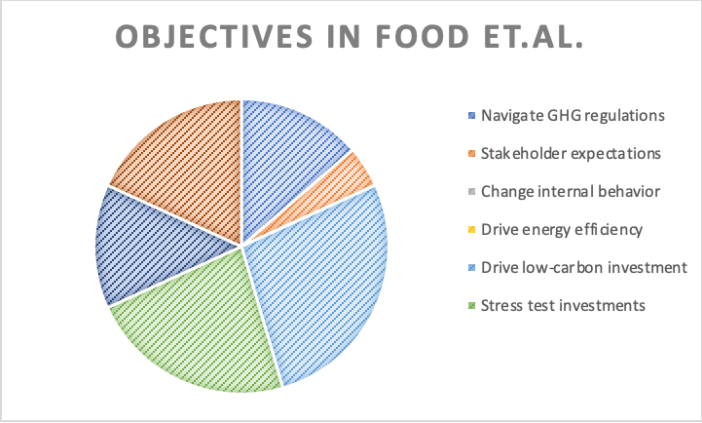


Figure 10: Objectives distribution in the Food, beverage & agriculture industry.

4.2.4 Fossil Fuels

This industry is crucial to the analysis as one of the most emissions-intensive, as shown in Appendix C (CDP, 2022).

The average internal price of carbon in companies in the fossil fuel industry is 51,11 USD, which in most cases covers Scope 1 (95%), but in fewer companies Scope 2 (62%) and Scope 3 (14%). The big majority of organizations use ICP as a shadow price, with very few implementing other approaches.

Not surprisingly, this industry is heavily regulated, with 95% of companies regulated by carbon pricing policies, in all cases EU ETS was one of those. On average, these policies regulate 62% of Scope 1 emissions, but only 18% of Scope 2 ones.

The objectives stated by companies as motivation for the introduction of ICP show a clear tendency for organizations to introduce an internal carbon price to stress test investments, which is also coherent with the type of ICP used. The interviews held with companies in this sector demonstrate that ICPs are used as an instrument to comply with regulations, align investments with climate targets, and evaluate the cost of future investments, as presented in more detail in Appendix F.

4.2.5 Hospitality

Among the ones in the analysis, this industry, detailed in Appendix C, is the one that includes the smallest amount of companies, making the conclusions derived about it less applicable to the industry in general (CDP, 2022).

The few companies disclosing having ICP have an average price of 16,56 USD, significantly lower than the overall average magnitude across industries. All the organizations reported their ICP covering all 3 Scopes and implementing it as a shadow price or as offsets.

None of the companies in the analysis is regulated or expected to be in the next years, for none of the scopes. As for the disclosed objectives, ‘stress-test investments’ was mentioned by all the organizations, but driving energy efficiency and stakeholders’ expectations were also mentioned.

4.2.6 Infrastructure

The CDP-ACS includes a wide range of companies in the Infrastructure industry, detailed in Appendix C. Such a vast industry covers many wide-ranging activities, with some of them being closely related to the energy transition and the de-carbonization process (CDP, 2022).

Internal Carbon Pricing in the Infrastructure industry has an average magnitude of 60.85, very much in line with the overall height. In this industry, we observe almost 92% of organizations covering Scope 1, while only 46% included Scope 2 and 30% covered Scope 3. 75% of organizations reported implementing ICP as a Shadow price, with the rest mentioning using approaches such as Implicit price, Internal fee, Offsets or tailor-made solutions.

While the industry is very diverse, 75% of the organizations part of it reported operating in some GHG emissions regulatory framework. The remaining 25% does not even expect to be regulated in the next years, which is probably because this industry includes several types of activities. The regulations these companies undergo prescribe the coverage of Scope 1 emissions, roughly 50% of them, whilst Scope 2 emissions are not often regulated, which is reflected in the number of companies covering them in their ICP.

As one might expect in such a wide industry, the objectives reported to be behind the introduction of ICP are diverse. The three that were mentioned by most companies are, respectively, ‘Stakeholders expectations’, ‘Stress-test investments’ and ‘Navigate GHG regulations’, as shown in the figure below (Figure 11).

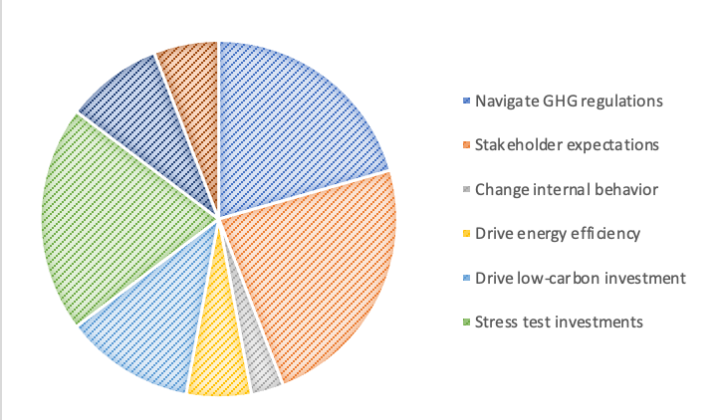


Figure 11: Objectives distribution in the Infrastructure industry

The interview held with a company in the infrastructure industry confirmed that ICP is used to anticipate and prepare for future regulations and manage the financial risks and opportunities associated with them. A full report of the case study can be found in Appendix G.

4.2.7 Manufacturing

The manufacturing industry is another very broad one, described in further detail in Appendix C (CDP, 2022).

In this industry, the average internal price of carbon is 99.64, one of the highest among the sectors in analysis. Almost the same portion of organizations, respectively 75% and 72%, in the manufacturing industry covers Scope 1 and 2, while only half of them cover Scope 3. Most of the companies in this sector implement ICP as a Shadow price, but other mechanisms are also introduced by companies in the sector.

With such a variegated range of activities in this sector, the regulatory framework is very uneven. 52% of organizations are regulated by some sort of carbon pricing policy, 12% are not yet regulated by expect to be in the next years, whilst 36% do not even expect to be regulated soon. The regulations in place in this industry cover around 50% of Scope 1 emissions and just about 2% of Scope 2 ones.

As for the objectives, the companies in this sector reported having multiple objectives, without one prevailing. The two most commonly reported ones were 'Stress-test investments' and 'Stakeholders' expectations', as presented in the pie chart below (Figure 12).

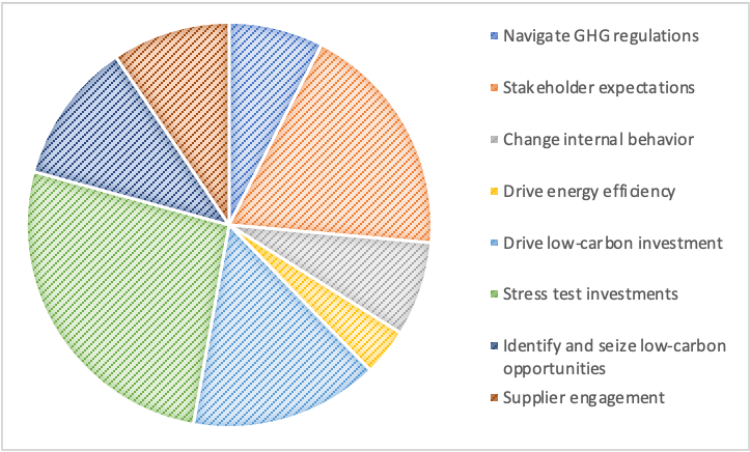


Figure 12: Objectives distribution in the Manufacturing industry.

4.2.8 Materials

The Material industry includes any type of company producing or refining natural resources and materials, as explained in Appendix C (CDP, 2022). It is also important to notice that this industry includes the second-highest number of companies in this analysis.

The average ICP in the Material industry is 56.83 USD, comparable to the overall European average. Almost 100% of these companies include Scope 1 in their ICP, for Scope 2 the percentage decrease to 75% and for Scope 3 it decreases even further to 25%. As for many other industries, most companies in Materials implement ICP as a Shadow price, followed by the Implicit price approach. It is interesting to notice that this industry has one of the highest percentages of companies implementing an internal trading mechanism for their ICP.

This industry is highly regulated, with 93% of organizations reported operating under carbon regulations, and only 2% not expecting to be. These regulations cover roughly 55% of the Scope 1 emissions in the industry and 10% of Scope 2.

In the Material industry, the reported objectives for ICP are nonuniform, but the majority of the companies disclosed using ICP to stress test investments, followed by driving low-carbon investments. The portrait of what organizations in this industry reported to CDP is presented in the following pie chart (Figure 13).

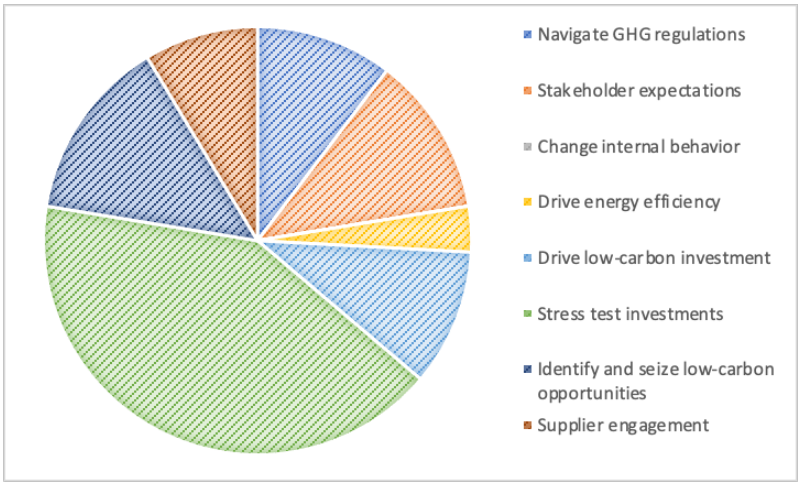


Figure 13: Objectives distribution in the Materials industry

An interview held with a company from this industry suggests that ICP in the organization is closely related to both financial aspects and the regulatory framework they operate, highlighting the close relationship between the company's carbon pricing and climate goals with the government's ones. A more detailed overview of the case study can be found in Appendix H.

4.2.9 Power Generation

The Power Generation industry entails companies producing electricity from several sources, as detailed in Appendix C (CDP, 2022).

This industry's average magnitude of ICP is 42.89 USD, lower than the general average. 93% of these organizations cover their Scope 1 emission with their ICP, while 13% cover Scope 2 and 33% cover Scope 3. The reason why more companies cover Scope 3 than Scope has to be found in the way the Scopes framework is built (Appendix A), in this industry Scope 1 and Scope 2 overlap, and therefore fewer companies purchase electricity from external providers.

Power generators mostly use ICP as a shadow price, followed by the implicit price, showing coherence with the rest of the industry in the analysis.

This industry is the most regulated in this analysis, 100% of organizations reported being regimented by carbon pricing policies. Roughly 86% of the Scope 1 emissions are regulated in this industry, mostly by the EU ETS framework.

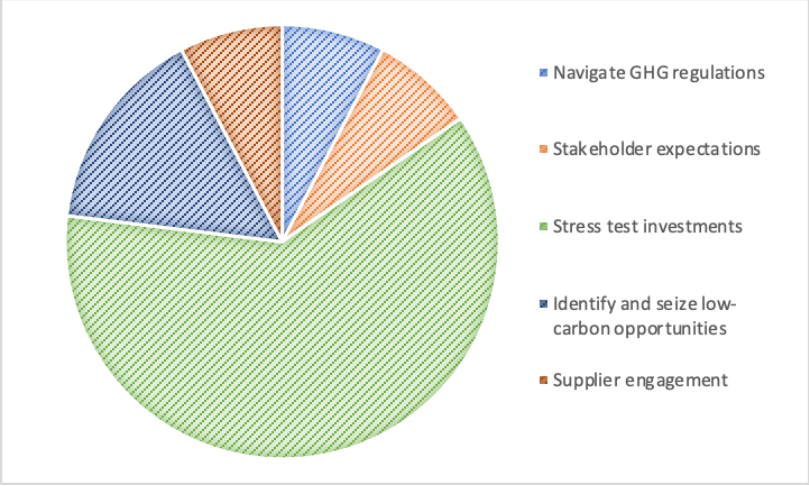


Figure 14: Objectives distribution in the Power Generation industry

The introduction of ICP in this industry has clear objectives, and stress-test investments, with 53% reporting this goal, while all the others are mentioned by considerably lower percentages, as presented in the figure above (Figure 14).

4.2.10 Retail

The organizations part of the Retail industry is detailed in Appendix C (CDP, 2022).

The average internal carbon price in this industry is 52,11 USD, covering on average 75% of Scope, 65% of Scope 2 and 45% of Scope 3. The most adopted mechanism is Shadow pricing, while all the other companies use ICP as either an Internal fee or an Implicit price. Most of these companies (58%) do not expect to be regulated by any carbon pricing policy, while only 35% are. Those policies cover 42% of the Scope 1 emissions for those that are regulated.

The objectives behind the adoption of ICP in this industry are uneven. To a limited extent, the objective that most companies disclosed is 'Identify and seize low-carbon opportunities', with 20% of companies reporting it. The second most reported objective is 'Drive energy efficiency. A portrait of the uneven objectives state in the retail industry is presented in Figure 15.

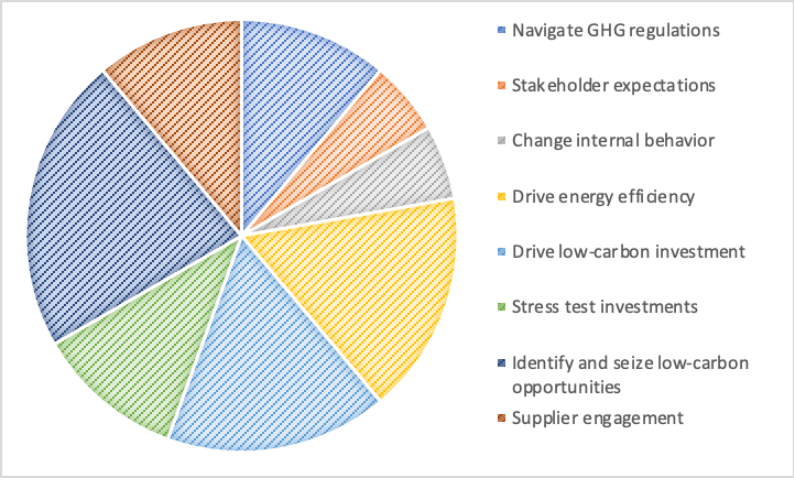


Figure 15: Objectives distribution in the Retail industry

4.2.11 Services

The Services industry includes a wide range of activities, which are, evidently, all associated with offering a service, not a product, as shown in Appendix C. The common thread in this industry is not the activity, but the way in which those activities are offered, as well as the fact that these are mainly B2C activities (CDP, 2022).

The average internal carbon price in the Services industry is 49,47 USD. On average, about 75% of companies cover Scopes 1, 2 and 3 with their ICP, the fact that the 3 Scopes are evenly covered across the industry is distinctive of this one specifically.

In this sector, as in most ones, the more common approach adopted to introduce ICP is Shadow pricing. The interesting trends in the Services industry are a wide share of companies using ICP to assess the emissions to offsets, but also one of the biggest shares of companies using ICP as an Internal fee.

The Services industry is one of the least regulated ones, with only 12,9% of them reporting operating under carbon pricing policies. These policies, on average, regulate 45% of Scope 1 emissions.

As for the objectives behind the adoption of ICP, most of the companies included in the Services industry reported 'Stakeholders' expectations' as a goal. Engaging suppliers was also mentioned by a large number of companies. The full picture of the objectives disclosed is presented in the next figure (Figure 16).

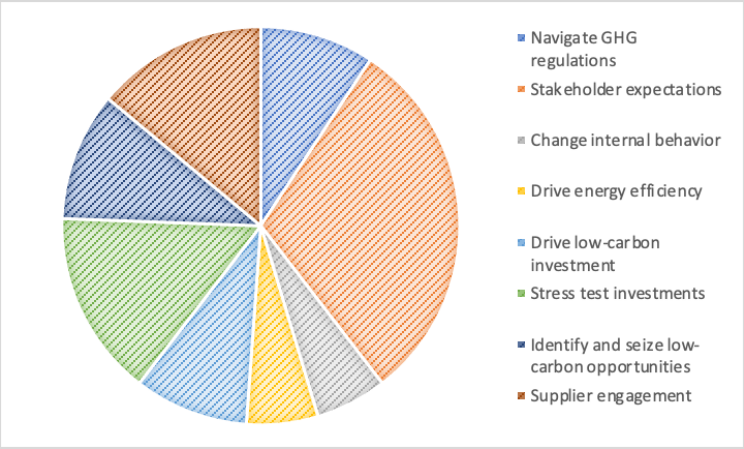


Figure 16: Objectives distribution in the Services industry

4.2.12 Transportation Services

The activities classified inside the Transportation Services industry are detailed in Appendix C (CDP, 2022).

The average price in this industry is 53,86 USD, which is used by 100% of the companies in analysis to cover Scope 1, but only by 52% and 43% to cover, respectively, Scope 2 and Scope 3.

The vast majority of companies use ICP as a shadow price (65%), followed by offsets (29%) and/or other approaches that companies came up with (24%). Transportation Services companies are considerably regulated, with 56% of them reporting undergoing carbon regulations. These policies, on average cover roughly 50% of Scope 1 emissions, and no Scope 2 emissions. The objectives reported by these organizations show that most companies are implementing ICP to match stakeholders' expectations, engage suppliers and stress test investments, as shown in the pie chart (Figure 17).

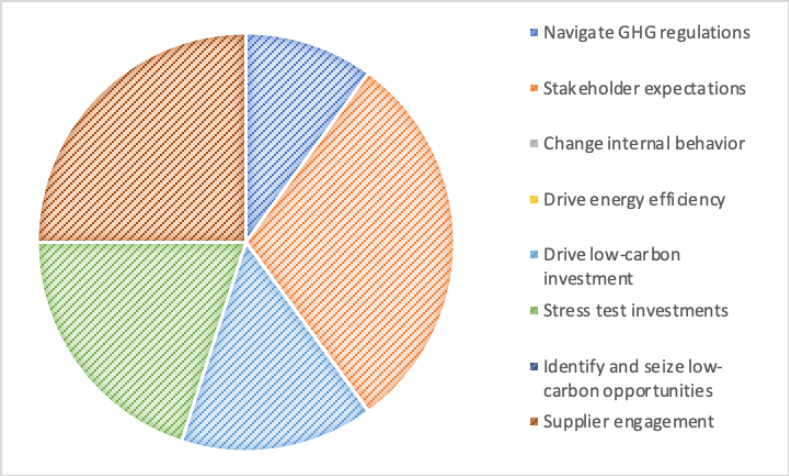


Figure 17: Objectives distribution in the Transportation Services industry

We interviewed one company from this industry, which demonstrated that the organization sees the ICP as a tool to promote sustainability and to raise awareness both inside and outside the organization about the environmental benefits of avoiding carbon emissions, as shown in the report in Appendix I.

5. Results and Discussion

The information presented prior to this point helps to understand the differences between how different industries introduce ICP systems, what role they have and how influential the regulatory framework is. In the following section, that information will be compared and used to draw conclusions form, in order to achieve a deeper understanding of the differences in ICP across industries. The sectors' carbon footprint and regulations coverage will be analyzed to better understand the usage and objectives behind ICP systems.

5.1 ICP across Countries

Firstly, the magnitude of the ICPs across countries reveals some interesting patterns. Countries where carbon taxes are higher also have, on average, higher ICP, which is the case of France and the Nordics in general. In Southern Europe, where public climate policies are lacking behind, by having a low carbon price or not having any policy in place, the companies introducing an ICP mechanism are fewer and, on average, introduce it with a lower value, for example, Italy or Greece. This shows a clear relation between the public pricing of carbon and the one privately introduced by companies. This analysis found a modest positive correlation (0.52) between the price of carbon set by a country's carbon tax, and the average ICP in the same country, considering all the companies regardless of the sector, as detailed in Section 3.1.1 and 3.1.3. That relationship is shown in the scatter plot below (Figure 18).

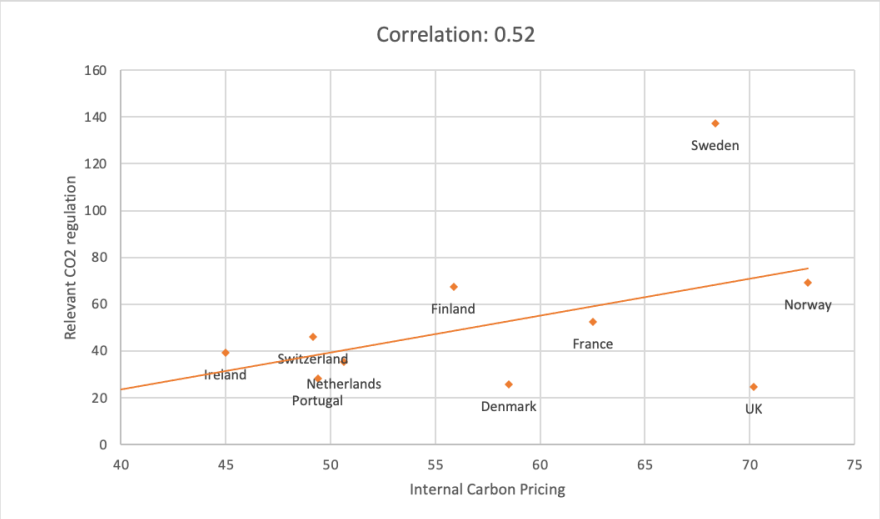


Figure 18: Scatter plot: country-specific regulations and average ICP

The regulations taken into analysis in the scatter plot are country-specific ones, the EU ETS is not considered for this precise result, as it is enforced in all EU members state, which is the majority of the countries analyzed in this paper. Sector classification and how regulations are enforced in each industry are also not considered. Anyway, this correlation suggests that companies operating in countries with high carbon taxes will most likely set a higher ICP, and vice versa.

5.2 Regulations across Industries

If we take into account whether a company is operating under carbon regulations or not, observing the different industries, we find that some sectors are heavily regulated, while others are not. The difference between the number of companies represented in each sector and the number of companies that are regulated (or expect to be in the next two years) is presented in the histograms below (Figure 19).

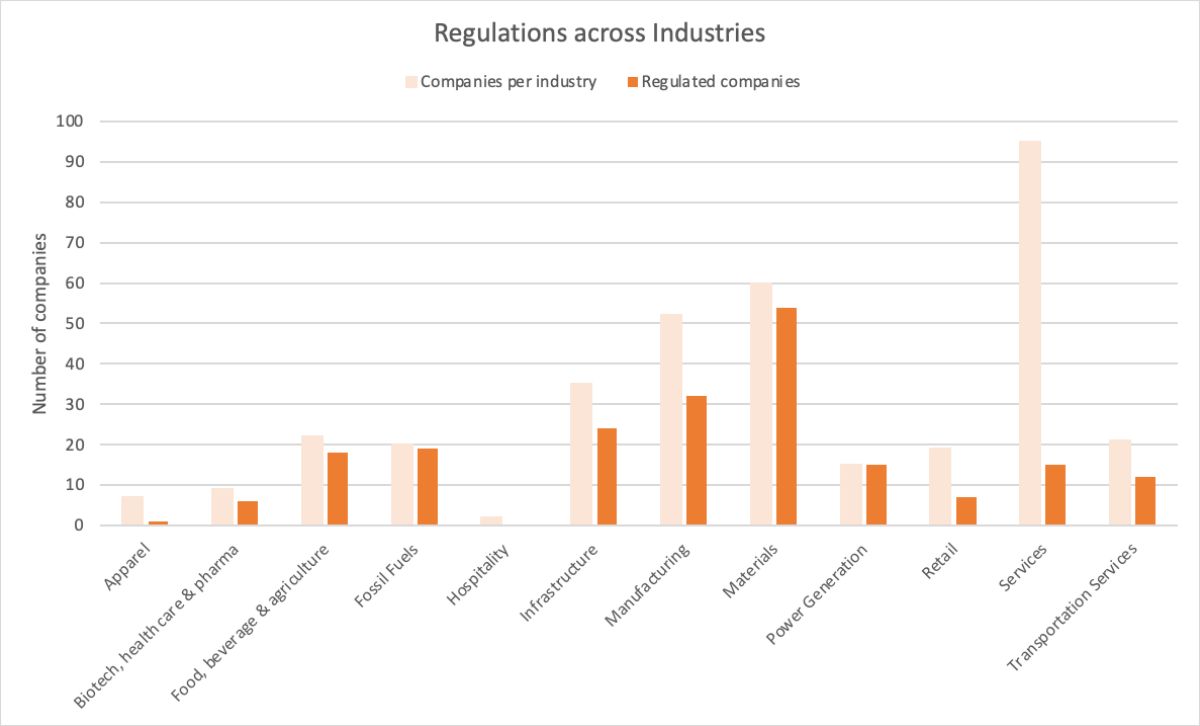


Figure 19: Companies per industry and percentage of them undergoing carbon regulations.

The correlation found between the percentage of companies undergoing carbon regulations, as explained in section 3.1.3, and the percentage of companies introducing an ICP in each industry is fairly strong (0.58), as shown in the scatter plot below (Figure 20).

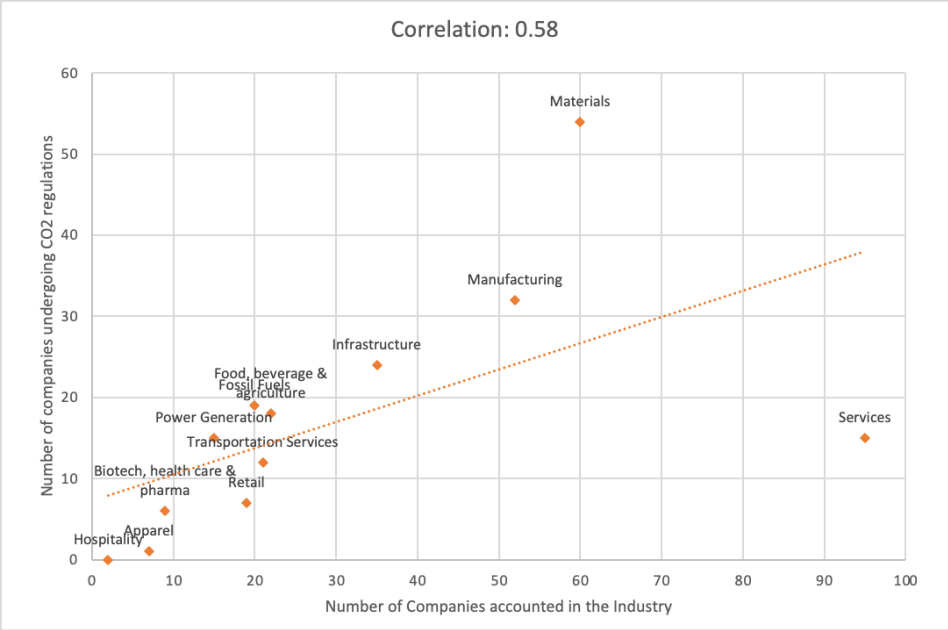


Figure 20: Scatter plot: percentage of companies regulated and percentage of companies having ICP in place.

This correlation suggests that regulated companies are most likely to introduce ICP systems, meaning that organizations use ICP to put a price on GHG emissions when the governments do or intend to. The Service industry is a special case, because, even though it is not regulated, it's the one with the highest number of companies introducing an ICP, the possible reasons for this phenomenon will be discussed later in this section.

5.3 GHG Emissions, ICP and Regulations

When relating the usage of ICP with one industry's environmental impact and carbon footprint, the data suggested that the most polluting activities had average magnitudes of ICP, while industries with lower impact had ICPs closer to the first or last quartiles. To do so, as mentioned in Section 3, the sectors were ranked based on their average

emissions per industry in the year 2020, with the rank detailed in Section 3.1.4, while their ICP height is based on the average industry level, as presented in the figure below (Figure 21).

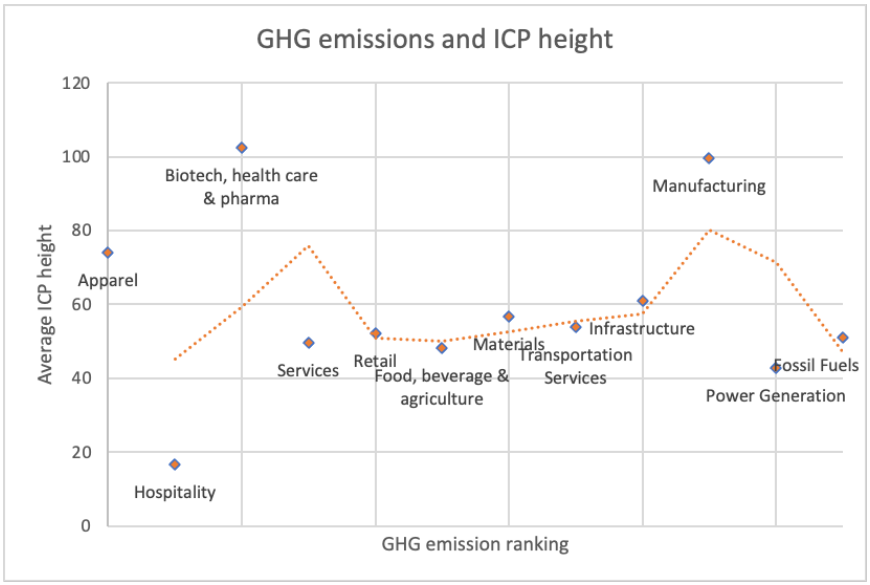


Figure 21: GHG emissions and ICP height

The ranking of sectors according to their average GHG emission also correlates positively (0.78) to the percentage of companies being regulated in the same industry, based on the methods explained in Section 3.1.3 (Figure 22). This proves that regulations are

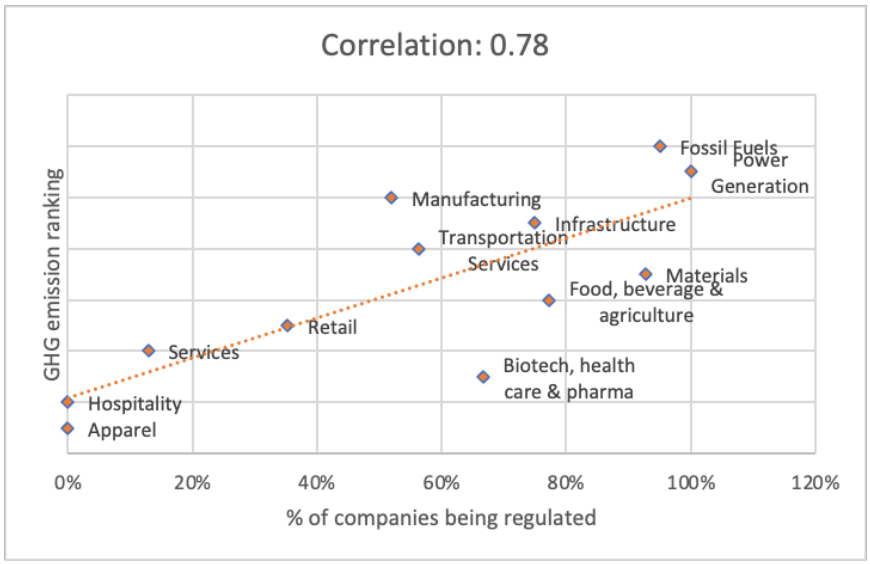


Figure 22: GHG Emissions and Regulations

targeting those activities which are more emission-intensive, such as Fossil Fuel or Manufacturing.

5.4 ICP's Emission Coverage and Regulations

In terms of emission coverage, this analysis found most industries include their Scope 1 emissions to be accounted for in their ICP. As for Scope 2 ones, companies having those emissions regulated are found to be most likely to include them in their ICP system as well, in these cases, Scope 3 emissions are rarely included. Organizations covering Scope 3 emissions are usually covering the other two as well, aside from the ones in the Power Generation industry, because of the reasons explained in section 4.2.9. This analysis found a significant negative correlation (-0.83) between the percentage of companies being regulated in each sector and the percentage of companies covering all three Scopes in their ICP, as shown in the scatter plot below (Figure 23). This correlation demonstrates that, whenever regulations are not in place, companies are more likely to cover all three Scopes with their ICP. Consequently, companies undergoing carbon regulations will only cover the same scopes that they are forced to include by the carbon tax or quota. This demonstrates the influential role of regulations on the ICP dimensions across the sectors in analysis, specifically the width.

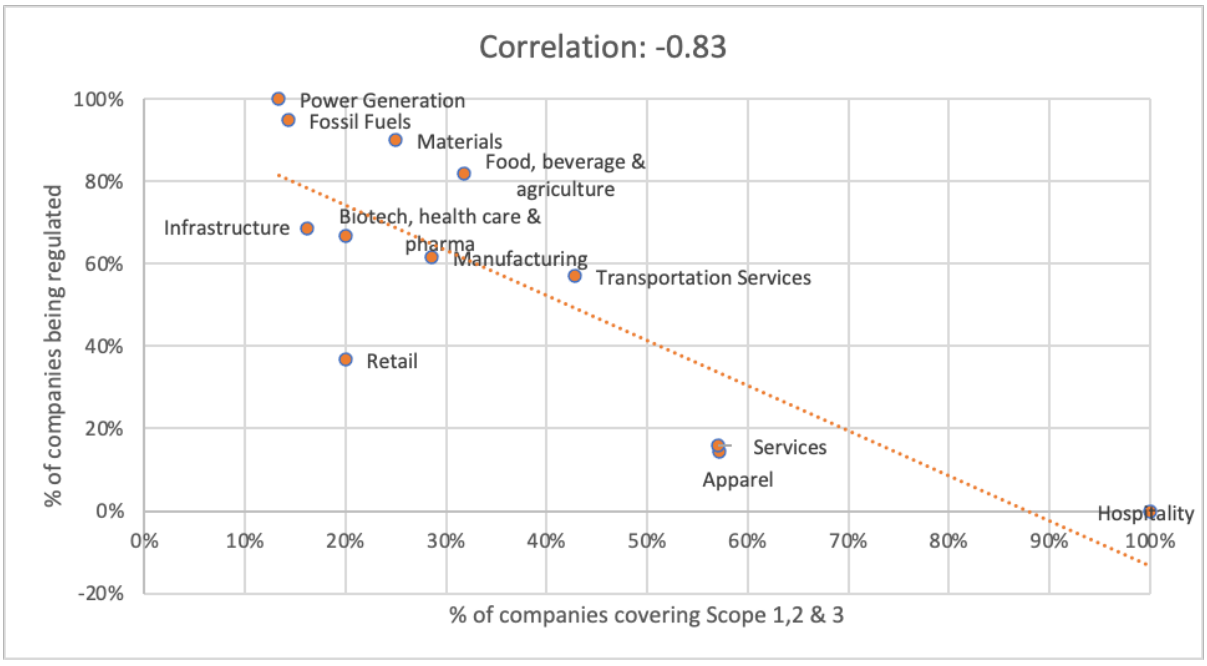


Figure 23: Scatter plot: ICP's emission coverage and regulations

5.5 ICP's Objectives and Regulations

When observing ICPs in different industries and the patterns mentioned in the paragraphs above, our analysis suggests that most companies introduce ICPs for instrumental purposes, but how that is carried out and the reasons for it vary across industries and, therefore, regulations. Starting from the premise that the carbon regulations in place target the industries with the bigger carbon footprint, as discussed in section 5.3, we observed a distinct difference in the goals of the ICP systems for different industries, based on how regulated they are.

This analysis suggests that ICP in sectors where most companies are regulated, ICP is used as an instrument to incentivize low-carbon and energy-efficiency investments, through stress tests of financial capability.

A modest positive correlation (0.66) was found between the percentage of companies in one industry being regulated, as detailed in Section 3.1.3, and the one of the organizations reporting using ICP as an instrument to navigate carbon emissions, as presented in the scatter plot below (Figure 24). This demonstrates that, oftentimes, ICP is used by companies because of the enforced regulations, as an instrument for them to internalize carbon pricing mechanisms.

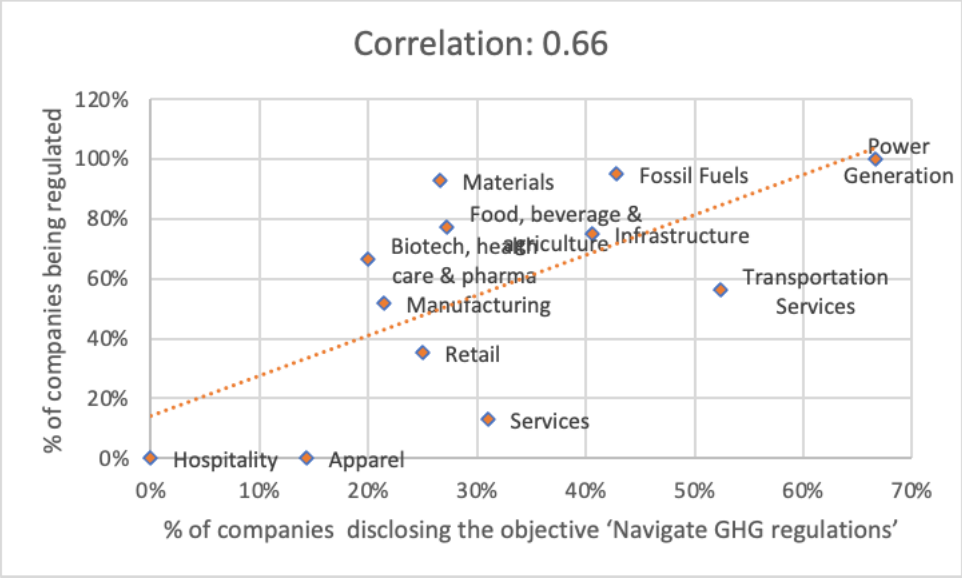


Figure 24: Scatter plot: % of regulated companies and % of companies disclosing the objective 'Navigate GHG regulations'

This is in line with the information provided by multiple interviewed companies, which reported using the ICP as a compass to protect future investments from expected regulations. For this reason, multiple companies reported using scenario analysis to set their ICP's height, based on the expected price of carbon set by future regulations.

A similar correlation (0.61) was found when observing companies using ICP to drive low-carbon investments (Figure 25).

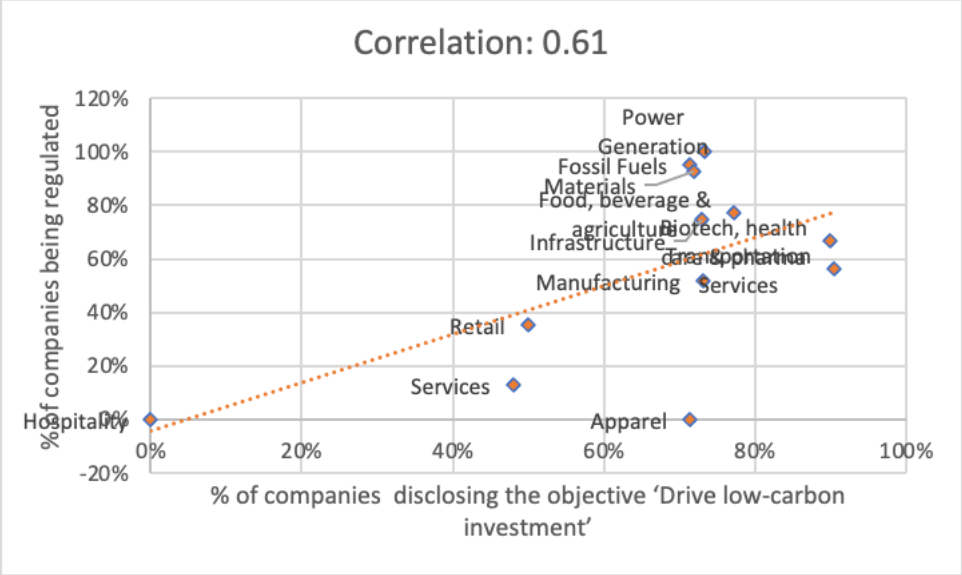


Figure 25: Scatter plot: % of regulated companies and % of companies disclosing the objective 'Drive low-carbon investment'

This indicates the tendency of companies to introduce ICP as a way to drive net-zero investments, as also confirmed by the interview held with companies operating in regulated industries. Multiple companies disclosed using ICP to make low-carbon investments more profitable when comparing them to traditional ones. This is usually implemented by adding the price of carbon, present or expected, set by the regulations to traditional investments, making the less carbon-intensive ones more profitable. As mentioned, the price used to evaluate and stress-test investments is, in most cases, not the one set by current regulations, but the one forecasted in the carbon market, especially the EU ETS one. During the interviews, several organizations detailed the use of ICP systems to internalize the costs of emissions in their financial processes. ICP is,

again, defined as a "compass for their investments", enabling organizations to evaluate them on a longer-term horizon, including both financial and environmental sustainability (Appendix F).

Positive correlations between those investment-related objectives and the industries' GHG emissions ranking, confirm a direct interdependence between regulations, emission intensity and the objectives behind the introduction of ICP systems. During the same interviews, companies also suggested the marginal role and involvement of external stakeholders other than the government and investors, stressing the significant role of regulations in ICP systems. Consequently, this analysis concluded that in highly regulated industries, ICP plays the role of mitigating the risk of future harsher regulations when evaluating investments.

On the other hand, this analysis found that less regulated industries appear to have different objectives behind the introduction of ICP mechanisms. A modest negative correlation (-0.5) was found between how much an industry is regulated and the percentage of companies reporting stakeholders' expectations as the ICP's objective. This correlation is presented in the scatter plot below (Figure 26).

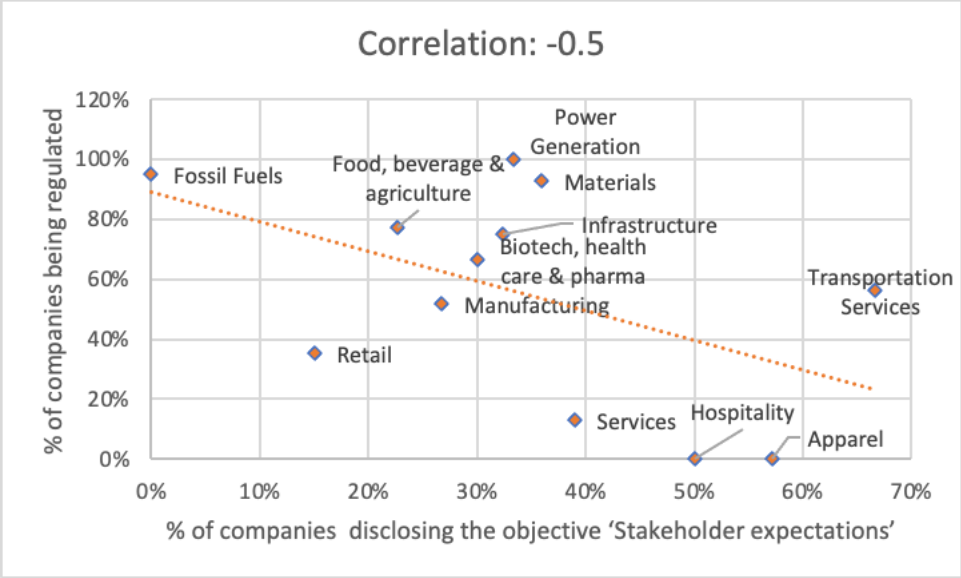


Figure 26: Scatter plot: % of regulated companies and % of companies disclosing the objective 'Stakeholder expectations'

This demonstrates that, when activities have a lower carbon footprint, the impact of carbon pricing regulations on ICP is considerably smaller. We also found a negative correlation between the GHG emission ranking, detailed in Section 3.1.4, and the percentage of companies introducing ICP to change their internal behaviour, showing that less regulated industries use ICP, not only to meet their stakeholders' expectations but also to change their activities, reduce their emission intensity, as shown in Figure 27.

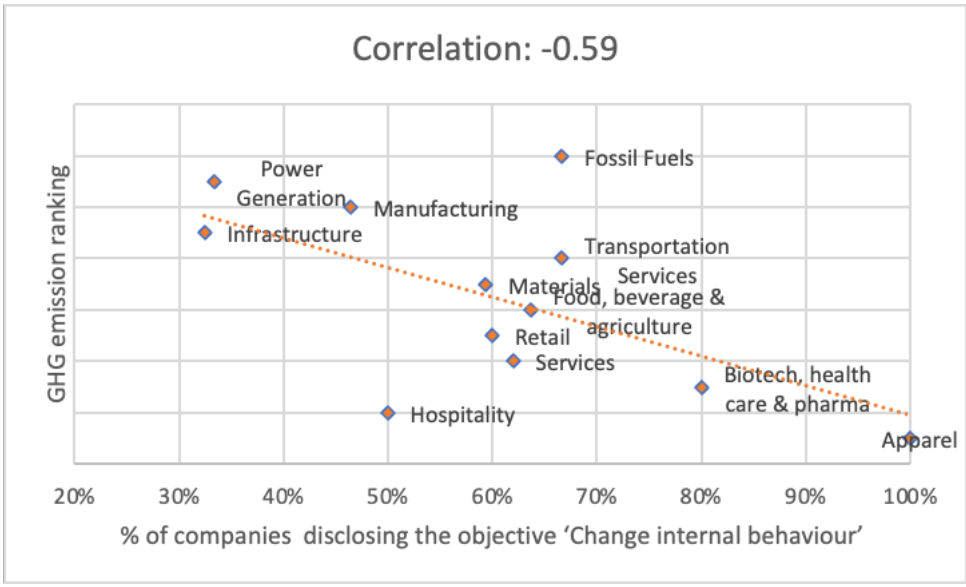


Figure 27: Scatter plot: industries' emission intensity and % of companies disclosing the objective 'Change internal behavior'

Combining those results, we can deduce that ICP can serve as an instrument to reduce their environmental impact in less regulated industries, in order for them to reach the stakeholders' expectations, primarily, their customers and clients. This strategy has been proven to be an important driver of revenues and profits (Eccles et al., 2014). This is also in line with the findings from the interviews held with companies operating in less regulated industries, such as the transportation service. Firstly, the benchmark for defining the height of the ICP is said to be other companies and not future or expected regulations.

Details on ICP were reported to be shared with stakeholders in these companies, which was not the case for more regulated industries, confirming the importance of the ICP, not only for the internal financial evaluations but also for external stakeholders. Additionally, ICP was described as an instrument that the interviewed company used to show their "environmental awareness and promote sustainable innovation" (Appendix I). Prior literature already confirmed and proved empirically the link between stakeholders' engagement and superior financial performance (Eccles et al., 2014), confirming the interests of companies operating in non-regulated industries in implementing ICP to build long-term relationships with their customers and competitive advantage. This confirms the interest of non-regulated companies to introduce ICP to communicate their net-zero targets and climate-related commitments.

5.6 Discussion

The findings of this analysis suggest a close relationship between internal and country-level carbon pricing systems.

When observing ICP across countries, we found a correlation between the average price set by organizations and the one set by governments. Where carbon taxes and quotas enforce higher prices on GHG emissions, organizations usually also introduce higher ICP in their systems.

Regulations also correlate positively to the number of companies in each industry that introduce ICP. Indeed, the sectors with the most ICP in place also have a bigger percentage of companies undergoing carbon regulations. This shows that it is much more common for organizations to constrain themselves if they are already constrained by regulations. This might be related to the fact that it is easier to introduce ICP if a company already has an emissions tracking system in place because of regulations.

The role of regulations also affects the emission coverage of the ICP systems in place among the sectors in analysis. Whenever carbon taxes or quotas impose prices on Scope 1 or 2 emissions, the ICP will be covering the same Scopes and not Scope 3. This is also in line with the negative correlation between regulations and the percentage of companies including Scope 1,2 and 3 in their ICP, which demonstrates that Scope 3

emissions are not accounted for in the ICP if the company is regulated for their Scope 1 and 2 ones. Once again, regulations are proven to play a crucial role in the ICP dimensions.

Regarding the objectives behind the adoption of ICP, the regulatory frameworks that apply to different industries have significant implications. This analysis found a clear difference between heavily regulated industries and those in which few companies undergo carbon pricing mechanisms. This contrast was observed based on data obtained from the CDP climate change questionnaire and insights gathered from interviews conducted with companies operating in both types of industries.

Our findings suggest an instrumental use of ICP, but in different ways and for different reasons. On the one hand, heavily regulated companies use ICP to protect themselves and their investments from future costs that the company would encounter if the costs of emissions rise, which are expected to. In contrast, less regulated industries introduce ICP to mitigate potential backlash from stakeholders and prevent profit reductions resulting from failure to meet emissions reduction expectations. In both cases, the motivation behind implementing ICP is profit maximization, either through cost-saving or revenue generation. Therefore, ICP implementation is driven more by strategic considerations than by ethical obligations to address climate change.

6. Conclusion

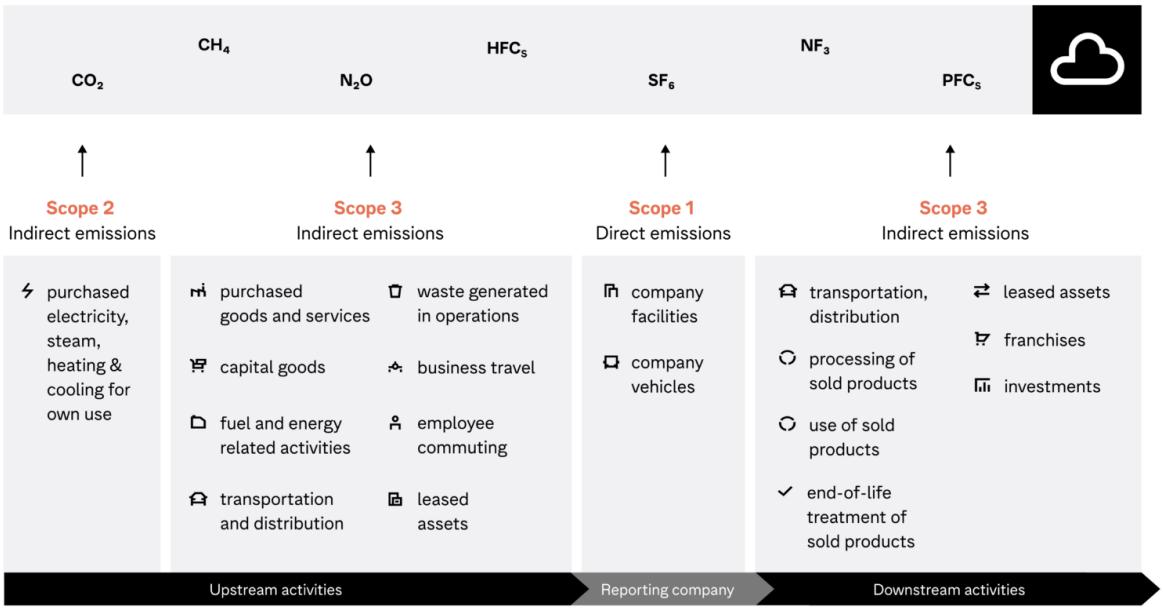
This dissertation tried to understand the reasons why companies introduce ICP and how those motivations vary depending on the regulatory frameworks and the sectors they operate in.

To do so, we carried out a cross-industry analysis, combining data disclosed by companies in the CDP 2021 Climate Change questionnaire and insights from interviews with some organizations. This analysis enabled us to depict the state of affairs of ICP in each industry, observing its different dimensions, price level, GHG emission coverage and approach adopted. The analysis also sheds light on how the objectives vary in different industries, and, through the interview, we were also able to understand the decisional process of determining the magnitude of the price and the way ICP is used inside the organizations. The results of the analysis presented in this paper suggested a general instrumental use of ICP in all industries as part of profit maximization strategies, but the environmental impact of the industry and the regulations in place appeared to influence how ICP is used. In highly regulated industries, which in most cases have bigger environmental impacts, ICP is used to evaluate their investments and to protect them from future carbon regulations. In less regulated industries, ICP seems to be used to drive emission reduction initiatives to match stakeholders' expectations to protect their revenue stream.

Consequently, we can deduce that ICP is used in both cases to drive profit maximization; for regulated companies, this happens on the cost side, while for non-regulated companies that happens on the revenues side. With ICP becoming more and more popular, further research on the topic is necessary. As for understanding the reasons why companies adopt ICP systems, more information on specific industries with which this analysis did not manage to get in touch, would be beneficial, especially considering the low response rate of the interviews and the low number of companies included in some of the industries. Further research is also necessary as carbon pricing regulations are constantly evolving, changing the intensity of the price and the industries covered by them.

7. Appendix

7.1 Appendix A



Appendix A: Classification of GHG emissions into scopes (Vallinder A., 2022)

7.2 Appendix B

Currency	Rate of exchange
USD	1
CHF	1,0941
CZK	0,0461
DKK	0,1591
EUR	1,183
GBP	1,3757
HUF	0,0033
NOK	0,1164
SEK	0,098348

Appendix B: Average rates of Exchange to USD in 2021 (World Bank, 2022)

7.3 Appendix C

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Apparel	Textiles & fabric goods	Apparel design & manufacturing	General
		Luggage & bags	
		Textiles	
Biotech, health care & pharma	Biotech & pharma	Biotechnology	General
		Pharmaceuticals	
	Health care provision	Health care facilities	
	Medical equipment & supplies	Health care supplies	
		Medical equipment	
Food, beverage & agriculture	Crop farming	Biofuel supply	Agricultural commodities
		Cocoa bean farming	General
		Cotton farming	Agricultural commodities
		Fruit farming	
		Grain & corn farming	
		Other crop farming	
		Other oilseed farming	
		Palm oil farming	
		Rice farming	
		Soybean farming	
		Sugarcane farming	
		Vegetable farming	
	Fish & animal farming	Aquaculture	
		Cattle farming	
		Fishing	
		Other animal farming & processing	
		Poultry & hog farming	

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Food, beverage & agriculture	Food & beverage processing	Alcoholic beverages	Food beverage & tobacco
		Animal processing	
		Baked goods & cereals	
		Chocolate confection	
		Coffee	
		Dairy & egg products	
		Fruit, nut & vegetable processing	
		Grain & corn milling	
		Non-alcoholic beverages	
		Non-chocolate confection	
		Oilseed processing	
		Other food processing	
		Palm oil processing	
		Seafood processing	
		Soybean processing	
		Sugar	Agricultural commodities
		Tea	
	Logging & rubber tapping	Logging	Paper & forestry
		Rubber farming	
	Tobacco	Tobacco products	Food beverage & tobacco
Fossil Fuels	Coal mining	Coal extraction & processing	Coal
	Oil & gas extraction & production	Natural gas extraction	Oil & Gas
		Oil & gas extraction	
	Oil & gas processing	Oil & gas refining	
	Oil & gas retailing	Oil & gas marketing & retailing	General
	Oil & gas storage & transportation	Oil & gas pipelines & storage	Oil & Gas
Hospitality	Bars, hotels & restaurants	Fast food	General
		Food & beverage amenities	
		Hotels & lodging	Real estate

Appendix C: CDP-ACS Industry and sector classification (CDP, 2022)

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Hospitality	Entertainment facilities	Gambling	General
		Recreation & entertainment facilities	
Infrastructure	Construction	Energy infrastructure construction	General
		Non-residential building construction	Construction
		Renewable energy construction	General
		Residential building construction	Construction
		Transportation infrastructure & other construction	General
		Utility line construction	
	Energy utility networks	Electricity networks	Electric utilities
		Gas utilities	General
	Land & property ownership & development	Infrastructure upkeep & management	
		Land sales & leasing	
		Real estate owners & developers	Real estate
	Non-energy utilities	Recycling	General
		Waste management	
		Waste water management	
		Water supply networks	
International bodies	Government agencies	Agencies local	General
		Agencies national	
		Agencies regional	
	Government banks	Government banks	
	Government bodies	Government local	
		Government national	
		Government regional	
	International bodies	Supranationals	
Manufacturing	Electrical & electronic equipment	Batteries	Capital goods
		Communications equipment	General
		Computer hardware	

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Manufacturing	Electrical & electronic equipment	Electrical equipment	Capital goods
		Electronic components	General
		Electronic equipment	
		Household appliances	
		Semiconductors	
	Leisure & home manufacturing	Accessories	
		Furniture	
		Homeware	
		Sporting goods	
		Toys & games	
	Light manufacturing	Automotive interior	
		Munitions	
		Other building products	
		Other containers & packaging	
		Pollution control equipment	
		Tires	
	Metal products manufacturing	Fabricated metal components	
		Metal containers & packaging	
	Paper products & packaging	Paper packaging	Paper & forestry
		Paper products	
	Plastic product manufacturing	Plastic products	General
	Powered machinery	Agriculture, construction & mining machinery	Capital goods
		Engines & motors	Transport OEMS – EPM
		Industrial machinery	Capital goods
		Other vehicle equipment & systems	General
	Renewable energy equipment	Other renewable energy equipment	Capital goods
		Solar energy equipment	
	Transportation equipment	Aerospace	Transport OEMS

Appendix C: CDP-ACS Industry and sector classification (CDP, 2022)

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Manufacturing	Transportation equipment	Alternative vehicles	Transport OEMS
		Automobiles	
		Heavy vehicles	
		Railroad rolling stock	
		Recreational vehicles	
		Shipbuilding	
	Wood & rubber products	Finished wood products	Paper & forestry
		Rubber products	General
Materials	Cement & concrete	Cement	Cement
		Concrete products	
	Chemicals	Agricultural chemicals	Chemicals
		Basic plastics	
		Biofuels	
		Inorganic base chemicals	
		Nitrogenous fertilizers	
		Non-nitrogenous fertilizers	
		Other base chemicals	
		Personal care & household products	General
		Specialty chemicals	Chemicals
	Metal smelting, refining & forming	Aluminum	Metals & mining
		Copper	
		Iron & steel	Steel
		Metal processing	Metals & mining
		Other non-ferrous metals	
		Precious metals	
	Metallic mineral mining	Bauxite mining	
		Iron ore mining	
		Other non-ferrous ore mining	
		Precious metals & minerals mining	

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Materials	Other materials	Ceramics	General
		Glass products	
		Other non-wood building materials	
	Other mineral mining	Other non-metallic minerals	Metals & mining
	Wood & paper materials	Pulp & paper mills	Paper & forestry
		Sawmills & wood materials	
Power generation	Nuclear power generation	Nuclear generation	Electric utilities
	Renewable power generation	Biomass generation	
		Geothermal generation	
	Renewable power generation	Hydro generation	
		Other renewable generation	
		Solar generation	
		Wind generation	
	Thermal power generation	CCGT generation	
		Coal generation	
		Non-CCGT generation	
	Waste power generation	Waste generation	
Retail	Convenience retail	Hypermarkets & superstores	General
		Supermarkets, food & drugstores	
	Discretionary retail	Apparel stores	
		Department stores	
		Discretionary delivery retail	
		Specialist retail	
	Trading, wholesale, distribution, rental & leasing	Agricultural products wholesale	Agricultural commodities
		Animal products wholesale	
		Chemicals wholesale & distribution	General
		Construction & building materials dealing & distribution	
		Consumer goods wholesale & rental	

Appendix C: CDP-ACS Industry and sector classification (CDP, 2022)

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Retail	Trading, wholesale, distribution, rental & leasing	Food & beverage wholesale	Food beverage & tobacco
		Home & office wholesale	General
		Industrial machinery distribution	
		Metals supply, wholesale & trading	
		Pharma & health care supplies wholesale & distribution	
		Technology hardware wholesale & distribution	
		Textile & apparel wholesale	
		Transportation equipment wholesale & dealing	
		Vehicles & machinery rental & leasing	
		Wood & paper products wholesale	Paper & forestry
Services	Commercial & consumer services	Commercial services	General
		Consumer services	
		Travel services	
	Financial services	Asset managers	Financial services
		Banks	
		Insurance	
		REIT	Real estate
	Industrial support services	Energy services & equipment	General
		Industrial services	
		Mining & metals support services	
		Transportation support services	
	IT & software development	IT services	
		Software	
	Media, telecommunications & data center services	Media	
		Servers & data centers	
		Telecommunications services	

CDP Industry	CDP Activity Group	CDP Activity	Questionnaire Allocation
Services	Other services	Education services	General
		Health care services	
		Real estate services	
	Print & publishing services	Print publishing	
		Printing services	
	Specialized professional services	Engineering services	
		Other financial	
		Other professional services	
	Web & marketing services	Marketing	
		Web-based services	
Transportation services	Air transport	Air freight	Transport services
		Passenger airlines	
	Intermodal transport & logistics	Intermodal transport	
		Logistics - transport	
		Logistics - 3rd party	General
	Marine transport	Cruise lines & ferries	Transport services
		Marine freight	
	Rail transport	Passenger rail	
		Rail freight	
	Road transport	Bus & taxi	
		Road freight	

Appendix C: CDP-ACS Industry and sector classification (CDP, 2022)

7.4 Appendix D

To Whom it may concern,

My name is Paolo Rossi, I am currently taking a master's degree in Energy, Natural Resources and the Environment at NHH Norwegian School of Economics. In my Master's thesis (supervised by Professor Dr. Paul Pelzl), I am conducting research about the use of internal carbon pricing (ICP) across different sectors and regulatory frameworks. Since interviews with companies form an integral part of my research strategy, I would be thrilled to interview one of your staff members on the motivation, benefits, and challenges around the use of ICP in your company. This would not take more than 30 minutes of your time, and the results would be presented in a fully anonymized way.

I am using data from the CDP questionnaire on Climate Change, which your company answered in 2021. The reason for approaching you (as well as other companies) is that your company has indicated to use of an internal carbon price. Your contribution would be very valuable to advance our understanding of ICPs and their effects. Attached to this message you can find the list of questions I intend to ask. If you would prefer not to answer one or more of the questions, I would fully understand that, and be happy to interview you nonetheless.

If you wish to accept my invitation, I could meet digitally with you and/or one of your colleagues at your earliest convenience. I look forward to hearing from you soon!

Kind Regards

Paolo Rossi

Appendix D: Message sent to contact organizations

7.5 Appendix E

Thesis Questionnaire:

Research question:

Why constrain yourself?
A multi-industry analysis of Internal Carbon Pricing in relation to the regulatory framework.

Questions:

- How did your company determine the magnitude of its internal carbon price?
- To what extent is your ICP is driven by competition in your industry, by specific competitors, and/or companies outside your industry but part of your value chain?
- Your company has indicated several objectives for implementing an ICP. Which is your main objective, and why?
- To what extent is your ICP driven by internal processes versus external regulations, pressure, or influence from external stakeholders? If applicable, which stakeholders are key?
- I can see in the CDP data that you are governed by XXX: to what extent does your ICP differ from the observed or expected carbon price in XXX?
- How do you communicate your ICP? Do you actively share it with any stakeholders, and why?
- Which benefit has the ICP brought to your company? What about the costs? How are costs
  and benefits related?
- Do you have any further remarks on ICP?

Appendix E: Questionnaire sent to organizations

7.6 Appendix F

Case studies for the Fossil Fuel industry:

Case study I

The first case study of the 3 that will be presented for the Fossil Fuel industry is a company with around 6’000 employees and a market cap of 3.377 Billion USD.

As disclosed to the CDP, the company has an ICP of 65,07 USD, covering Scope 1 and 2 emissions and it is used as an Internal fee.

From the interview held with the company representative, we discovered that the price is defined by looking at the different carbon pricing regulations of the countries they operate in, among them the EU ETS. Competitors and organizations in the petrochemical industry are also said to be observed, but the company was confident that its ICP is more ambitious. The ICP is also reported not to be shared with any stakeholders, nor yet in the yearly statements. The company representative was also unambiguous in underlining that the ICP was not subordinate to any external pressure, but exclusively an internal decision.

The interview also shed light on what the Internal fee is used for, which in the case of this organization appears to be very similar to a Shadow price mechanism. The company representative explained that the ICP is used in evaluating the cost of future investments, making low-carbon solutions comparable to traditional ones.

Although the company seemed very interested in decarbonizing its activity and reaching net-zero emissions while still growing economically, the impression given during the interview was that this transaction is needed to protect the activities from expected GHG regulations, as confirmed by the ICP objective reported to CDP and the use of policy explained during the interview.

In conclusion, the interview held with the company, combined with the data disclosed to CDP, creates the impression of an instrumental use of ICP to protect the activities from GHG regulation, which the company believes to have a large impact on its operations.

Case study II

The second company presented as a case study for the Fossil Fuel industry has about 4'000 employees and a market cap of 35.67 Billion USD.

In the CDP questionnaire, the company reported an ICP of 47 USD introduced as a Shadow price, covering Scope 1 emissions, which are also covered by the relevant carbon pricing policy in place.

The company representative explained that the internal price of carbon is defined by looking at the current regulations and the scenarios for future developments. External references on the forecast of the carbon pricing market are also observed, as well as carbon pricing mechanisms in the other countries they operate in.

During the interview, the role of ICP was also clarified as an instrument to stress test investment and align the investments with the carbon targets, internalizing the cost of emissions in the financial processes. The company also expressed its commitment towards emission pricing in line with climate targets.

The representative underlined the internal role of ICP in the company, even though they also share it in their yearly statements.

Overall, during the interview, the company detailed their ICP as an instrument to evaluate its investments and to make sure they are aligned with the regulations and with the firm's climate ambitions. Because of the regulations they operate under, ICP then becomes a compass for their investments, looking at them on a longer-term horizon, including both financial and environmental sustainability.

Case study III

The third interview relevant to the Fossil Fuel industry was held with a company which operates with 21'126 employees and has a market cap of 112.70 Billion USD.

The company reported to CDP having an ICP of 56 USD, with a Shadow price mechanism covering Scope 1 emissions. The company is regulated by the EU ETS and the country-specific carbon tax in the same emission coverage.

The company representative explained that the ICP is defined by looking at the regulations and their forecasts. ICPs in European competitors also play a marginal role in the

process of determining their price. During the interview, the representative also underlined that the ICP was introduced to match the ambitious carbon price set by the country's carbon tax in the 90s, showing the importance and influence of regulations in the company ICP.

The interview also confirmed the role of ICP in stress-testing investments, making sustainable innovations comparable to traditional solutions. The investors are also mentioned as the stakeholders with the bigger influence on the introduction of ICP.

Furthermore, confirming the primary role of investors, the representative explained that the ICP is solely shared in their yearly reports, not in any other channel. The main takeaways from the interview held with the company confirmed the role of ICP as a financial tool, similar to the way ICP is used in other companies in the industry.

7.7 Appendix G

Case study for the Infrastructure industry:

Case study

The organization that serves as a case study for the Infrastructure industry has about 31'000 employees and a market cap of 19.44 Billion USD.

As reported to CDP, the company is regulated by the EU ETS on 33% of its Scope 1 emissions. They have recently introduced an ICP system, but only for one of its subsidiaries, with a price of 30 USD per ton of CO2e. The company representative explained that the magnitude is defined by looking at the EU ETS market, its future developments and internal considerations. Competitors, scenario analysis and data from CDP and the IEA are used to make predictions about carbon pricing.

During the interview, the company disclosed using ICP as a Shadow price to anticipate future regulations and to evaluate investments. The goal of ICP is mainly financial, enabling it to make low-carbon investments comparable, in terms of profitability, to other projects. The firm expects further carbon regulations to be introduced soon, therefore, the ICP helps the company to be prepared for them. In light of this, there is an ongoing discussion about introducing the ICP across the company as a whole, but it does not seem to be prioritized over other financial issues.

The representative indicated that the ICP mechanism is limited to internal use for now, and not shared with any external stakeholder nor in the yearly statements, showing limited use of the instrument.

Overall, the interview created the impression that ICP in this firm is used to take into account the opportunity cost of greener investments, to protect their investments from becoming unprofitable because of future regulations. ICP is therefore an instrument to mitigate risks and exploit opportunities, with emission reduction as an effect more than a goal.

7.8 Appendix H

Case study for the Material industry:

Case study

The company that serves as a case study for the Materials industry has 17'000 employees and a market cap of 11.75 Billion USD. They reported to CDP having an ICP of roughly 50 USD, covering their Scope 1 emissions, also regulated by the EU ETS. ICP is introduced in the form of a Mandatory CO2 Scheme Price, described by the company representative during the interview as a Shadow price used for investments with costs above 25 Million USD.

In the interview, they explained that the price is based on internal and external analysis, adjusting regulations forecasts and pricing scenarios with internal considerations. The representative also detailed the process in which ICP is used, explaining the important role of prioritizing low-carbon investments over traditional ones, while still focusing on profitability. The reason why ICP is only used for investments over 25 Million USD, is related to the internal requirement of approval from the CEO or the Board, committing to ESG issues.

Currently, ICP is only kept internally, not shared with any other stakeholder. When asked about the most relevant stakeholders, the representative mentioned the public ownership as well as the European regulators, highlighting the importance of carbon pricing regulations.

ICP in this organization appears to be closely related to financial aspects and the regulatory framework they operate in. The important role of the government, both as regulators and shareholders, shows a deep close relationship between the company's carbon pricing and climate goals with the government's ones.

7.9 Appendix I

Case study for the Transportation Services industry:

Case study

The case study for this industry is based on a company with over 40'000 employees and a market cap of 959.40M USD.

The company is not being regulated by any carbon pricing policy, even though introducing an ICP that covers all 3 Scopes with a magnitude of roughly 60 USD, as reported to CDP in 2021.

During the interview held with the company, the process of defining the price is based on the carbon prices introduced by other companies, mainly outside their industry, but inside the country they operate in. The company also underlined the importance of pressures and trends in carbon pricing in the process of defining its own.

The company representative explained that the ICP is used to take into account the environmental benefits of avoiding carbon and incorporating it into the decision-making process. Since there is no carbon regulation influencing its activity, the company emphasized the role of ICP in raising and incorporating climate awareness inside and outside the organization.

The ICP, according to the company, is shared with many of the stakeholders, being present not only in the annual reports but also on the website and in other channels.

To summarize, during the interview the company mentioned the importance of the awareness that ICP has in and outside the company, helping to incorporate environmental benefits in the corporate mechanisms, describing it as an instrument to promote sustainable innovation.

7.10 Appendix J

Data overview

Based on elaborations from data retrieved from the answers to the CDP Climate Change Questionnaire 2021.

Industry	Average ICP height	Number of companies	Number of companies regulated (or expected to)	Percentage of companies regulated	GHG emissions in 2020	Ranking according to emissions	Percentage of companies covering all 3 Scopes
Apparel	73,8898	7	1	14,29%	500771,92	1	14%
Biotech, health care & pharma	102,432022	9	6	66,67%	2475336,39	3	67%
Food, beverage & agriculture	48,1256459	22	18	81,82%	3742907,66	6	82%
Fossil Fuels	51,1050847	20	19	95,00%	69211763,2	12	95%
Hospitality	16,562	2	0	0,00%	1628686,94	2	0%
Infrastructure	60,8490247	35	24	68,57%	7245024,27	9	69%
Manufacturing	99,6351453	52	32	61,54%	7649178,69	10	62%
Materials	56,828348	60	54	90,00%	3750256,85	7	90%
Power Generation	42,8865329	15	15	100,00%	29637335,4	11	100%
Retail	52,1050294	19	7	36,84%	3598180,63	5	37%
Services	49,4704355	95	15	15,79%	2750184,12	4	16%
Transportation Services	53,859	21	12	57,14%	5929036,86	8	57%

Appendix J: Overview of ICP across industries (CDP, 2021)

Industry	Percentage of companies disclosing the objective 'Stakeholder expectations'	Percentage of companies disclosing the objective 'Navigate GHG regulations'	Percentage of companies disclosing the objective 'Drive low-carbon investment'	Percentage of companies disclosing the objective 'Change internal behavior'
Apparel	57%	14%	71%	100%
Biotech, health care & pharma	30%	20%	90%	80%
Food, beverage & agriculture	23%	27%	77%	64%
Fossil Fuels	0%	43%	71%	67%
Hospitality	50%	0%	0%	50%
Infrastructure	32%	41%	73%	32%
Manufacturing	27%	21%	73%	46%
Materials	36%	27%	72%	59%
Power Generation	33%	67%	73%	33%
Retail	15%	25%	50%	60%
Services	39%	31%	48%	62%
Transportation Services	67%	52%	90%	67%

Appendix J: Overview of objectives of ICP across industries (CDP, 2021)

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