Setting Internal Price of Environmental Criteria, the Good Way to Transform Organization?

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Abstract In this communication, we present some lessons learned on the construction of an internal carbon price by businesses, based on the four-dimensional framework of the Carbon Disclosure Project. We illustrate the scheme with the example of a car manufacturer. Based on grey literature and the conclusions of exchanges with various companies, we discuss the different dimensions of the CDP framework within the scope of the automotive sector. We also analyse the various risk and success factors associated with the carbon pricing tool at organizational, tooling, business and cultural levels within a car manufacturer. We conclude that the carbon pricing tool requires many design choices and a reflection on the company's objective regarding climate change mitigation.

1 Introduction

Whether in the form of taxes, emissions trading systems or other mechanisms, there are currently 57 carbon pricing initiatives implemented or scheduled for implementation worldwide, covering 46 national jurisdictions [1]. However, the carbon prices emanating from them are very disparate and often not commensurate with the issues at stake. Indeed, they vary from less than US1\$/tCO₂e (Poland carbon tax) to 127US\$/tCO₂e (Sweden carbon tax), with 51% of emissions priced less than 10 US\$/tCO₂e. Therefore, some companies are proactively adopting non-regulatory (so-called internal) carbon prices. Even though this practice involved more than 1300 companies in 2017 [2], there is little research on how this price is constructed in practice and deployed internally by companies, which will be the subject of this communication.

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Fig. 1 Four dimensions of internal carbon pricing

2 Method

In order to grasp the implications of setting an internal carbon price in a company, we based our analysis on the Carbone Disclosure Project four-dimensional framework [3], illustrated in Fig. 1. Indeed, we considered that the integration of an ICP¹ by a company is determined by its (i) height, the carbon price level adopted; (ii) width, the emissions coverage in terms of indirect and/or direct greenhouse gas emissions and company's activities concerned; (iii) time, evolution of carbon pricing strategy through time; and (iv) depth, the business influence (informative or decisional ICP? In which form?). In the following, we describe our findings on each of the dimensions described above, in the case of a car manufacturer.

3 Results

Through our study of the grey literature as well as corporate practices in the private sector, our objective is to strengthen managerial knowledge about carbon pricing. Our results therefore make it possible to move a little further towards putting carbon pricing into practice, by highlighting various avenues for reflection in the case of a car manufacturer.

3.1 Height: Carbon Price Level

To reflect the cost of greenhouse gas emission-related externalities in the economic system, the monetary valuation of carbon has been the subject of concern among economists, public authorities and scientists [4]. This has given rise to a multitude of possible forms and values of carbon, which is reflected in the current regulatory

¹Internal carbon price.

Fig. 2 Regulatory carbon pricing initiatives affecting carmakers in France and other carbon prices

landscape. Because the automotive sector is one of the largest sources of greenhouse gas emissions in Europe (72% of transport CO₂ emissions [5]), some regulatory measures directly target this industry. Figure 2 presents the French regulatory context, where the dates in bold represent the date of application of the measure for regulatory prices, or the time horizon within which the prices should be applied (for non-regulatory prices).

The choice of the carbon price therefore comes down to a positioning in relation to regulations (a degree of anticipation), but also to the company’s ambition in terms of the objectives to be achieved (alignment with best market practice, alignment with the 2 °C objective or another company-specific objective). There is also a whole dimension related to internal feasibility, depending on whether the carbon pricing initiative comes from top management, in which case it is a question of deployment, or elsewhere in the company, where it is more of a negotiation process with the decision-makers.

3.2 Width: Emissions Coverage

Figure 2 shows that the carbon pricing regulatory initiatives tend to reduce CO₂ emissions on the use phase of vehicles, much less the emissions in the upstream stages of the vehicle’s life cycle. This can lead to a transfer of pollution to phases of the life cycle that are not covered by these regulations, in particular materials production. For this reason, the use of an internal carbon price makes sense within the scope of materials, whether to anticipate regulatory changes or to prevent the transfer of pollution.

Fig. 3 Materials production greenhouse gas emissions in an ICE vehicle

In order to prioritize relevant perimeters of carbon pricing of materials for a car manufacturer, we based ourselves on vehicles' LCA results. Figure 3 illustrates the greenhouse gas emissions due to the production of different materials for an electric vehicle, without the Li-ion battery. Figure 3 shows the same for an ICE vehicle.

On this basis, we have selected the following priority perimeters.

Besides, LCAs are conducted with a scope 3 perimeter, which means that both direct and indirect emissions are considered through the whole life span of the vehicles.

3.3 Depth: Business Influence

For the carbon price to play the role of a transformative tool, it must be embedded in the company's decision-making processes. This raises the question of making it consistent with existing tools and calls for examples of possible use.

For this reason, we conducted a survey with 13 companies that disclose their use of management tools involving monetary valuation of environmental externalities (including carbon). This allowed us to identify the following four categories of tools:

3.3.1 Assessing the Environmental P&L²

In the natural capital valuation movement pioneered by PUMA [6], several companies have calculated and communicated their Environmental P&L or Integrated P&L (including social externalities). It is a company's monetary valuation of its

²Profit and loss.

Fig. 4 Philips' 2017 Environmental Profit and Loss accounting

environmental impacts to see their magnitude, disclose them to stakeholders and possibly guide the company's strategy. Figure 4 shows the result of the EP&L calculation made by Philips in 2017 [7].

3.3.2 Including the Cost of Externalities in the TCO³

One way to consider the price of carbon in business decisions is to integrate it into cost indicators, such as TCO. Volvo Bus company applied this method to compare between electric and diesel buses in Sweden (Fig. 5), by including environmental and social externalities in the TCO calculation [8].

3.3.3 Including a Shadow Price in the NPV

Another method identified is the integration of a shadow price in the calculation of indicators for investment choices such as the net present value (NPV). This is a way of applying a pricing scenario on a resource or pollutant (in this case carbon). For example, Dow Chemical used this approach to introduce the hidden cost of water into their infrastructure investment choices [9].

³Total cost of ownership.

Fig. 5 Volvo Bus' true TCO of electric buses compared with diesel buses

3.3.4 Integrating the External Costs in the Portfolio Strategy

It is also possible to introduce external costs in general – or carbon price in particular – into business strategy through a portfolio management tool, in order to gradually eliminate the most impactful products from the portfolio and replace them with the most virtuous ones. Such a product-oriented approach has been developed by the chemical company Solvay [10] under the name of Sustainable Portfolio Management. Figure 6 shows how the SPM allows mapping the different PACs⁴ in the portfolio in two dimensions: (i) market alignment, which is a qualitative estimation of market early signals related to sustainability in the chemical industry, and (ii) operations vulnerability, which is the ratio of the external cost related to the product and its sales value. The blue colour scale represents the turnover associated with the PAC.

Based on the available materials in grey literature and our discussions with the companies, we classified the previous tools typical use according to these two axes:

- **External versus Internal:** indeed, some tools are rather designed for communication purposes with external stakeholders and are often mobilized as a means of enriching the sustainability report. On the contrary, some tools are rather intended to guide corporate strategy, investment or portfolio choices. However, it doesn't prevent a tool from playing both roles at the same time.
- **Prospective versus Retrospective:** if the tools use data from past activities, they are retrospective and therefore allow an a posteriori evaluation of the company's

⁴Product in an application.

Fig. 6 Solvay’s Sustainable Portfolio Management

Fig. 7 Typical tools’ use by businesses

activities. Similarly, if they are based on future projections (e.g. cost forecasts or future technological developments), then they are prospective.

Figure 7 shows the position of each tool described according to their typical use by the companies.

3.4 Time

The time dimension highlights the dynamic nature of the carbon pricing process in a company. Indeed, this makes it possible to envisage the construction of a roadmap for the implementation of an internal price in a progressive way, starting, for example, with a low price to minimize internal oppositions at the beginning and increasing it progressively. It is also more realistic to test the tool in a reduced scope (pilot project) to identify risks and opportunities and refine the tool's design choices before considering its generalization in the organization.

4 Discussion

To illustrate the potential oppositions to the implementation of an internal carbon price within a car manufacturer, we used the following framework as a reading grid. We considered that an induced change in the routines of an actor – or a category of actors – can be subdivided into changes in its (i) culture, (ii) competences, (iii) organization and (iv) tools. This allows identifying the possible oppositions and adapting the proposed solutions to each category of actors.

In our analysis, we considered the following categories of actors based on their influence on materials use: materials buyers, materials experts and environmental experts. Our conclusions concern the introduction of an internal carbon price in the form of an NPV and are shown in Table 1.

Table 1 indicates that introducing an internal carbon price requires the development of an often new expertise to understand this concept of environmental economics and to determine the price level in line with the company's objectives. However, moving from theory to practice means for different actors accepting to change the time horizon of decisions, by incorporating a hidden cost that is a kind of anticipation of future risks. This may conflict with immediate financial objectives, hence the need to reflect on both the relevant perimeter (e.g. considering that R&D and innovation gives more latitude to include the long term in decisions) and also the discourse and rhetoric that accompanies this tool.

Table 1 Analysis of the change due to the integration of an internal carbon price in the form of a NPV

Materials buyers		Familiar with the NPV tool NPV is already a decision criterion Difficulty to consider a shadow cost on the same level with internal costs (cultural gap)
Environmental experts		Already aware of environmental issues Familiar with environmental impact assessment tools Need for learning in the field of carbon pricing
Materials experts		Are used to favouring materials with the best technical-economic performance Need to be more in touch with environmental experts

5 Conclusion

In this communication, we exposed some learnings about the practice of internal carbon pricing, and its potential application in the automotive sector. We showed that the choice of the height of the price was ultimately a choice of target concerning the reduction of CO₂ emissions over a given time horizon. We also demonstrated that the perimeter of materials was a relevant field of application for a car manufacturer and proposed different forms of integration based on companies’ practices. However, we have also illustrated the potential difficulties in implementing this tool in a company, especially if it is not a top management initiative. This is why this tool must be an element of a more global approach involving the dissemination of long-term strategic thinking with regard to sustainability issues.

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