

Business incentives for sustainability: A property rights approach

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Abstract

Public and private demands for sustainable development put pressure on firms to develop strategies that include environmental concerns. Environmental effects from products often appear as externalities, outside the legal boundary of the producing company. These companies often possess the best competence to optimise the total life cycle environmental performance of its products. They are, however, neither obliged nor stimulated enough by policy incentives to do so from a sustainable development perspective. The policy instruments used today are mostly of a control-and-demand type, i.e. they do not create sufficient incentives to go further than hedging over set requirements.

Environmental concerns and tightened environmental policy parameters have mostly been associated with the notion of additional costs and thus a restriction on economic performance. However, since the mid 1990s, several papers have called for corporate *win-win* situations as well as instruments giving up-stream incentives for change, but not enough abatement of environmental impacts have emerged in reality. Perhaps this is due to the lack of proper connection between economic theory on the one hand, and incentive advocating articles and instruments on the other.

We propose a concept for trading of product life cycle (PLC) emission rights, based on property rights and transaction cost theories considering the problem with asymmetric information over the value chain. The initial financial impacts from such PLC instruments are shown to be significant for the system provider, since emissions – and resource use – become production costs. This provides economic incentives to take an increased responsibility for information flow as well as initiatives for product innovations.

Keywords

Business incentives, sustainability, property rights, transaction costs, asymmetric information, social costs, Coase theorem, product stewardship and product life cycle emission rights.

1 Introduction

Increasing demand for a sustainable development during the last decades has initiated actions from governments as well as firms and individuals. Governments have reacted by translating these demands into policies and laws, mostly of a command-and-control type. Firms have expanded the scope of corporate responsibility to include environmental issues in all levels of their operation, and a major development of environmental corporate strategies (Welford, 1996), as well as a green-washing of industry has been observed (Welford, 1997). Porter & van der Linde (1995a; 1995b), Jaffe *et al.* (1995) and Palmer *et al.* (1995) suggest corporate strategy changes to enhance environmental as well as business performance of firms. Despite all these preventive actions a continuous increase in environmental impact has been observed. Global warming, in particular, has been considered as one of the most severe and difficult to handle (see for example UNFCCC and Kyoto 1997). An important question is if actions taken have been optimally designed viewed from a holistic environmental perspective, and consequently, if there is a need for policy instrument changes as suggested by OECD (1991), OECD (1993), OECD (1995), OECD (1996), OECD (1998), OECD (1999), Opschoor *et al.* (1994), Paras (1999) and the European Commission (2001).

Ownership rearrangements of life cycle emissions and the responsibilities that comes with it, central to our theoretical analyse, is one potential method to allocate responsibility for environmental harm. In practice however, barriers to such a policy principle is likely to be considerable due to the influence by powerful stakeholders in society, opposing radical changes.

The paper is structured as follows: *section two* outlines the economic theoretical foundation for this paper with a focus on social costs, transaction costs and property rights. The *third section* discusses different environmental policy instruments beginning with command-and-control measures concluding with business incentive solutions based on property rights rearrangements. The latter solutions are further discussed in the *fourth section*. Thereafter, the concept of the Kyoto Protocol is explained in *section five*. In the *sixth section*, pros and cons regarding trade with product life cycle (PLC) emission rights are discussed. In *section seven* the potential financial impacts on firms are calculated under our proposed holistic ownership conditions. Finally, we conclude our findings in *section eight*.

2 Economic Theory

2.1 A brief historic perspective

Adam Smith (1776), in "*The Wealth of Nations*", presents the economic man as acting in his self-interest, solely co-ordinated by the external price mechanisms of the market, known as the invisible hand, producing a total outcome that is best for all partners. Later Pigou (1920) included negative external effects as disturbances in Smith's price mechanism. The outcome was no longer one-sidedly positive because price signal become distorted. Pigou suggested that environmental policy instruments, taxes, might adjust or correct distorted control signals (price). The aim of these instruments was to internalise the costs to those responsible for the external negative effects in order to compensate those negatively affected. Hence, the internal cost for the polluter could be made equal the cost for the caused damage in monetary terms. The pigovian tradition soon became well-established in economic theory (cf. Bohm, 1997; cf. Brännlund & Kriström, 1998; cf. Dixon et al., 1994; cf. Pihl, 1997) and implemented in numerous environmental policy instruments. In 1972 OECD established the polluter pays principle (PPP) influenced by Pigou's writings.

2.2 Social cost, transactions cost and property rights

Coase's (1960) article on "*The Problem of Social Cost*" criticises Pigou (mainly 1932; but also 1912) for a too narrow view on externalities. The Pigovian tradition, he argued, entirely neglects the reciprocal dimensions of the problem. The Coase Theorem, coined by Stigler (1966; cf. Coase, 1988) states that the problem is not, one hurting the other, but instead, a situation with incompatible allocations of resources, viewed from a society perspective. Reciprocity means that causality is dual, both sides of the problem are liable and should be considered. The optimal solution is to minimize the damage. Stigler uses Coase's example (1960) on the cattle raiser and the farmer when defining the Coase theorem:

"... the correct social results ... would arise if the cattle and grain farms were owned by the same man. The Coase theorem thus asserts that under perfect competition private and social costs will be equal."

(Stigler, 1966)

Coase points out, transactions costs for inspection and control may be costly (also identified and further developed by Eliasson, 1996 as a key aspect in the dynamic economy) and should be considered. The advantage of governmental command and control type regulations may then be overestimated since, with them neither the firm nor the market has to seek efficient abatement solutions. In his Nobel prize lecture 1991 Coase states that the best solution, if transaction costs are present and low, is to give property rights to the players such that incentives are established for them to use the production factors in the most productive manner. Fullerton (1995), furthermore, demonstrates that compliance costs are usually high

relative to revenues or benefits from separate environmental taxes since regulated areas are too narrow. He and OECD (1999) conclude that the large industrial polluters are often exempted from policy and sometimes, in fact, even receive subsidies to avoid eventual competitive disadvantages to firms of other nations.

The duality issue raised by Coase and the evidence on compliance costs shown by Fullerton may explain why the current methods of internalisation of costs are inefficient. Coase also points out (1960) that property rights is an even more important aspect than the product itself when different actions should be stimulated, and suggests that property rights should be seen as a production factor in economic analysis. If treated in this way it is easier to understand that the right to pollute (a property right) must also be treated as a production factor. The cost to use this property right is then equal to the loss somewhere else when used. No transaction costs presume defined property rights and, if so, it does not matter who initially owns the rights. Hence the presence of property rights is of key importance. The more incomplete contracts, thus higher uncertainties, the higher transaction costs. This observation opens up for the theory of ownership (Hart, 1993).

Arrow (1970) argues that the sum of all individual's utilities, which is proper to him alone, is lower than the total utility available under the assumption of externalities. These optima would, however, equal if the premium were the same for all individuals. Transactions costs are important in reality, but they are not so much treated in economic theory and Demsetz (1993) claims that the costless information assumed in the perfect competition model makes the model itself ineffective. Transactions costs are all costs connected to the use of the price mechanism driving a wedge of welfare loss between buyer's and seller's prices (Arrow, 1970). One reason for these costs is asymmetric distribution of information (Barney & Ouchi, 1986) which also affects the order of power among the participants (Eisenhardt, 1989) and the constantly expanding state space, making the amount of attained information a strategic choice (Eliasson, 1996).

Thus, in a positive transactions cost environment Coase explained in his Nobel lecture (1991):

"It is obviously desirable that these rights should be assigned to those who can use them most productively and with incentives that lead them to do so and that, to discover (and maintain) such a distribution of rights, the costs of their transference should be low, through clarity in the law and by making the legal requirements for such transfers less onerous."

(Coase, 1991)

The conclusion from this short theoretical review is that the design of an efficient policy system, enforcing responsibility for the resource inefficiencies that create environmental problems, should consider many different types of aspects. These aspects span from social aspects, like user preferences and equity issues, to more technical issues, like minimizing life cycle impact of products and services. We will however delimit our discussion to the product life cycle environmental impacts, by analysing the impact from both PLC stewardship and property right perspective, assuming policies enabling low transaction costs for environmental information.

3 Present Environmental Policies

3.1 Traditional environmental policies

Environmental policy instruments have been increasingly implemented during the last couple of decades. The most common instruments are command-and-control (CAC) and market-based-incentives (MBI) (Turner et al., 1994). CAC type of approaches has been found to be efficient for example in handling hazardous waste risks and in the process of banning hazardous substances. CAC based instruments force the regulated firms to hedge over the set polluting limit, often based on best available control technologies (BACT), but no further radical improvements are stimulated. However with MBIs i.e. taxes, subsidises and charges, firms may chose how to adjust to policy by paying for abatement, install BACT or implement radical new innovations (cf. Porter & van der Linde, 1995a; 1995b).

Fullerton (1995), however, shows that environmental taxes may be designed for different purposes; to discourage an activity that causes harm, to place the impacts on those responsible for the problem or to minimise the administrative cost for the taxes. A common use for environmental policies, he continues, has not been to discourage pollution, but to (the second objective) collect income from those responsible. Paras (2000), furthermore, identifies a tendency of environmental taxes to be designed to pursue revenue-raising objectives for the policy maker. These environmental policy instruments have mostly been associated with a notion of additional costs and thus a restriction on economic prosperity.

Traditionally, policy instruments have mostly been designed to decrease local and regional pollution such as heavy metals, sulphur dioxide and organic substances. These substances are often relatively easy to measure both as emissions and resulting impacts. Major environmental impacts do however also occur during the use of products produced – especially for energy consuming products - and spill outside the national jurisdiction with which they originate – a *global spillover* of environmental impact. Consequently polluting products keep being produced, and the emissions creating global impacts have continued to increase.

3.2 Product stewardship and extended producer responsibilities

Products and services are fundamental in creating both economic development and quality of life, but in the same time they are the source of considerable global environmental impact. The globalisation of environmental problems has among other issues provided a concern for the full life cycle environmental impact from products. One potential solution to this problem could be to extend the limits for the producers' property rights to the use of the product. One argument for this is information asymmetries within the value chain i.e. the fact that the manufacturer of a product often possesses the best information how to improve the environmental performance over the products life cycle.

Change of focus in legislation in the industrial communities has extended the liabilities for the producer to include the effects from end of life treatment of the products/services. Take-back systems have been implemented in Sweden and Germany for beverage packages. Similar take-back systems are now also developed and implemented for other product groups. For example Switzerland, the Netherlands, Norway, Sweden and Japan (for some electronics) have now extended producer responsibilities for electronic equipment covering terminal scrapping. These producer responsibilities will probably also be implemented in all EU countries. The use phase, e.g. the product energy consumption, that often gives the dominant global environmental impact over the full life cycle is, however, not at all addressed by these take back system or any other currently used extended producer responsibility systems.

The European commission (February 2001) has presented a more holistic approach, *Green Paper on Integrated Product Policy (IPP)*. The goal is to propose a strategy to strengthen and refocus product-related environmental policies to promote the development of a market for "greener" products. A mix of instruments is suggested to support this development. This proposal focuses on the following issues: ecodesign of products, information and incentives. Their conclusions fit very well into the thoughts and suggestion outlined in this theoretical paper, since one major question is how to support the greening process with market forces by creating economic incentives. One sub goal in the IPP proposal is the internalising of external costs through various policy instruments, resulting in a price also reflecting environmental impacts.

4 Business incentives

Viewed from the business perspective the environmental awareness influences the competitiveness of companies. Porter and van der Linde (1995a; 1995b) discuss the changes in competitiveness on industrial organisations driven by environmental regulations. Innovative solutions from the regulatory pressure not only decrease the environmental problem but also result in more eco-efficient products and better competitiveness. They also stress that the legislation must be based on a long-term governmental policy so that companies can adapt the requirements within their corporate strategy in an orderly way. Porter and van der Linde

argue that the dynamic perspective is necessary for promoting innovations contrary to current more static regulation and policies. Also, those environmental strategies pro-actively adopted among companies must and presumably may be developed to live up not only to sustainability and eco-efficiency but to competitiveness as well.

'Factor four - doubling wealth, halving resource use' by von Weizsäcker *et al.* (1997) is in line with the findings of Porter and van der Linde. They present 50 concrete examples or success stories where higher resource efficiency has improved both the technical and the economic performance of the product. In many of the discussed examples economy and ecology "goes hand in hand", and the authors identify a unique possibility for both business leaders and the society to grab the possibilities and make both money, technical and social benefits out of them.

There are two major issues to deal with:

1. The above described win-win situations are not usually obtained in reality. Often since the largest environmental impacts and costs of product/system/service occur outside the responsibility of the company setting the product parameters. Hence, the firm responsible for the major part of the environmental impacts, by design, does not have the **property rights** for them.
2. The asymmetric information among the actors (cf. Barney & Ouchi, 1986; cf. Williamson, 1975) within the product value chain makes it difficult for consumers to obtain a clear picture of the product characteristics (environmental included), which are set by the product designers (cf. Eisenhardt, 1989). In accordance with Coase's Nobel lecture, those actors that can use environmental impact property rights most efficiently should be given those rights and the possibility to decrease overall **transaction costs**. Here, a vertical integration (internalisation) is in place (cf. Joskow, 1990).

Either the life cycle stewardship should be integrated into one firm, if transaction costs are too high to internalise environmental degradation efficiently (cf. Coase, 1937), or rules to create an efficient market with low costs should be set up. Domeij (2000) states the importance of judicial stability and predictability in policies to enable efficient and decentralised decision making regarding resource use.

5 The Kyoto Protocol

During the last decade global warming has been paid a lot of attention, not least from the United Nations (UN). In the 1992 UN Framework Convention on Climate Change (UNFCCC) no concrete undertaking were accomplished by the signing countries to restrict their own emissions of carbon dioxide and other greenhouse gases (GHG), with potentials of creating global warming. Therefore, another climate meeting (UNFCCC) was held in Kyoto 1997. There are 160 signatures to the Kyoto protocol, but only countries within the industrial world

have committed to abate their own emissions, in other words, none of the developing countries (140) has signed the protocol (Edin, 1999). For the period of 2008 to 2012 the industrial world shall have their GHG emissions reduced by 5 per cent relative to their 1990 levels. Corresponding numbers are for the OECD 7 per cent. Nevertheless emissions have been rising in most countries, contradicting the set reduction targets. Where GHG emissions have fallen, it is usually due to collapses in output in transition countries of the former communist world (OECD, 1999).

6 Trading of product life cycle (PLC) emission rights

Based on the social costs of Coase (1937) and Coase theory (Stigler, 1966) the first concept of allowing rights to pollute was put forward by Dales (1968) suggesting the province authorities in Ontario to sell transferable rights to pollute provincial watercourses. Hence, the authorities control the total amounts of emissions, while the companies themselves decide the allocation of emissions among the actors. Later on Montgomery (1972) mathematically showed the economical cost efficiency of the tradable permits instrument.

We suggest that the possibility to develop the concept of PLC emission rights should be explored further. Since this is a multidisciplinary global issue, several actors in the society providing a wide range of perspectives should take consideration. One idea valid for emissions causing global impacts, i.e. GHGs, could be to use intergovernmental bodies such as branches of the UN to determine the necessary abatement of emissions. The market of tradable permits itself, however, determines the most efficient allocation of these abatements. How such markets may impact on firms is described in chapter 7. We do not attempt to outline a detailed suggestion for a product life cycle (PLC) emission rights trading policy instrument. Instead we aim to provide a theoretical foundation – underpinned by some industry specific examples - that may be used as one input in such development.

7 Potential initial financial impacts on firms

We select CO₂ emissions as a base for the calculation of life cycle emissions since a number of bodies have stated the importance of emissions creating global warming. We use the estimation done by OECD for a carbon price on USD 100 - 300 per tonne carbon emission (For CO₂ = 0.27 times total weight.) that is needed to fulfil the goals from Kyoto without trade. Thus, the average CO₂ emission price USD 200 per tonne is used in the calculations in this paper. In 7.1 we show that even though different manufacturing sectors have somewhat similar potential emission costs per turnover their customers using the products have an immense difference in potential emission costs per turnover. In 7.2 we give an example on potential initial financial impacts for one manufacturing company, designing the product. These two subchapters illustrate the importance of a life cycle perspective if striving towards sustainability.

7.1 Potential financial impacts on different business sectors from judicial emission

The ratio of carbon dioxide emissions to company turnover is a relevant indicator for two reasons. *Firstly*, from a sustainability perspective, a high value could potentially represent a financial risk if policy actions are taken to achieve the Kyoto targets. The financial risk may both be direct, by a high CO₂/net sales rate on judicial company, or indirect, by high CO₂ emissions during use of products. *Secondly*, reductions of this indicator may induce a competitive advantage, especially so, if the performance of products decreases the CO₂ emissions for customers.

A closer look at the table below shows typical carbon dioxide release for Swedish companies on the OM Stockholm Exchange. The carbon dioxide emissions per line of business show that there are immense differences in financial risks. Even though, the CO₂ emissions per net sales ratio is quite similar for those production companies that manufacture equipment, corresponding ratios for their customers are quite different. The emission cost per net sales may vary between one tenth of a percent to ten percent. These differences in financial risk will also affect the financial outcome of the production companies indirectly.

Table 1. Potential company CO₂ emission costs per net sales, described per business sector.

	Line of business	Tonne CO ₂ / net sales MUSD	Potential emission cost (%) / net sales
Manufacturing companies			
	Home appliance	0.41	0.19
	IT and telecom	0.43	0.20
	Vehicle manufacturer	0.46	0.21
	Chemistry	2.6	1.2
	Electric power	3.6	1.7
	Mining	34	16
Service producers (product users)			
	Broadcasting	0.02	0.01
	Mobile telecom provider	0.06	0.03
	Air line	12	5.4
	Road transport	22 *	10

Potential emission cost / net sales for companies in table 1. illustrates the large difference between business sectors and, hence, a variance in economic risk if carbon dioxide is charged per legal entity. Another observation is the similar economic risk among

manufacturing companies. The risk picture will, however, be totally different if the risk of their customers - service providers, the product users - is also included.

If a product stewardship instrument is implemented the PLC costs will be shared among the actors within - as well as between - value chains. The actual cost sharing depends on e.g. power, information and innovation advantages.

7.2 Potential initial financial impacts on the telecom company Ericsson

During fiscal 1999 Ericsson emitted 0.8 million tonnes of carbon dioxide from its activities, sites, travel (including commuting) and transports. These emissions constitute, however, only 11 per cent compared to the total 7 million tonne emissions from its products' entire life cycles, that are produced during 1999 (Ericsson, 2000).

Using the USD 200 per tonne CO₂ emission costs as stated earlier with the Ericsson data shows a potential life cycle CO₂ costs for Ericsson (see Table 2.) if a product stewardship is implemented, and consequently, a large economic incentive for decreasing CO₂ emissions.

Table 2. Potential life cycle CO₂ emission costs per net sales and net income of Ericsson.

Delimitation	CO₂ emission (tonnes)	Cost (US \$)
Ericsson 1 (judicial entity [JE] hence only primary energy)	200 000	11 000 000
Ericsson 2 (JE + bought energy & bought transp. + commuting)	800 000	43 000 000
Total life cycle of products	7 000 000	378 000 000

Delimitation	Sales and Income	
Judicial entity	Net sales (US\$)	25 252 000 000
Judicial entity	Net income (US \$)	1 422 000 000

Delimitation	Potential emission cost/	
Judicial entity per product life cycle	Net sales (US\$)	1.5 %
Judicial entity per product life cycle	Net income (US \$)	27 %

The Ericsson gross margin for fiscal 1999 was (SEK 89 522 million) US \$10 494 000 000. Thus, the CO₂ emission cost for entire life cycles of the products produced during 1999 equals 13 percent of Ericsson's gross margins (which was the best gross margin in the

company's history). The emission costs from the company scope were not neglectable but much smaller, 0.38 % (Ericsson 1) [1.5 % (Ericsson 2)] of gross margin.

Even if the products in this case have minor total emissions the potential financial impacts on the producer will be substantial. There are considerable amounts in CO₂ emissions, in relation to company net income, that could be avoided also here. However, the costs for carbon dioxide abatement are high compared to the potential costs for emission rights. In many cases there might not be any gains at all by exchanging powering from OECD electricity supply, i.e. installing solar power for a radio base station due to the present cost of solar equipment. However, IT and telecom firms has the potentials to affect other sectors in society, reducing the environmental impacts. Hence, this calls for a joint PLC CO₂ emission market covering more than one sector, increasing the probability for such solutions.

Another fact talking for intersectoral (between business sectors) emission bubbles is:

The transportation sector is responsible for 22 per cent of the global CO₂ emissions (IPCC, 1996). Corresponding numbers in the EU for telecommunications is 0.5 per cent (Ericsson, 2000). Improvements alone in the telecommunications sector would only incrementally abate the CO₂ emissions while interaction with other sectors has the potentials to accomplish larger savings.

8 Concluding discussion

Current strategies including environmental concerns have not lead to a clear path towards sustainable development. Since, the major environmental effects from products generally appear as externalities, social costs, outside the legal boundary of the company providing products and systems. These actors often possess the best competence to optimise the products total life cycle environmental performance; however, they are neither obliged nor stimulated enough to do so from a sustainable development perspective. This asymmetric information – over the value chain - may be used proactively in a market-based model, increasing the efficiency of future policy instruments. In the proposed concept for trading of product life cycle (PLC) emission rights the actor possessing most information, i.e. often the product and system provider, would be motivated by economic incentives to take an increased responsibility for information flow and initiatives for product improvements.

Even if a number of successful win-win business cases have been demonstrated there is no broad implementation of these kinds of actions in the business world, on the contrary, command and control instrument are still dominant. According to us, this is due to the lack of adoption of profound economic transaction cost and property rights theory, supporting proper actions by policy makers as well as by industry.

This paper points out a need for extending the property rights of firms' environmental impacts, covering not only the judicial entity, but also the entire PLC's of their services. This market based PLC stewardship could stimulate incentives for innovations that lowers global environmental impacts over the entire value chain. However, we see obstacles if implementing such an instrument due to the influence by powerful stakeholder groups opposing changes (even though some actors within those groups may support changes, i.e. companies seeing competitive advantages), which does not make this theoretical study less interesting. Such trading over the value chain could of course also cause unwanted effects – such as equity ones – which have to be explored. As with all policies this suggestion has to be put into the context of other policies and regulations.

The property rights for environmental impacts and, thus, the responsibilities to take actions should initially be assigned to the actors that have the largest possibilities to influence the PLC environmental impact most efficiently. Furthermore, a transparent market based instrument enables an efficient information flow, decreasing the transaction cost for regulated actors as well as for policy makers. If the instrument withholds too large uncertainties, i.e. is not predictable; transaction costs will rise in form of insurance and lawyer firm revenues. These market based instruments should provide the systems providers with clear and reliable incentives to decrease life cycle impacts of their products.

Trading of emission rights has been accepted as an effective market solution to solve local and regional environmental problems. Our suggestion is to further explore the possibilities to develop a trading instrument for these emissions e.g. per business segment or even in larger, joint-segment, markets, driven by each firm's own business incentives to reduce emissions. This concept for trading of product life cycle (PLC) emission rights is based on property rights and transaction cost theories considering the problem with asymmetric information over the value chain. This provides economic incentives to take an increased responsibility for information flow as well as initiatives for product innovations, making PLC emissions – and resource use – production costs for the system provider.

These product life cycle based policy instruments should preferable be implemented on an international level, in broad agreements e.g. in EC, UN or OECD, since the environmental problems are of a global character. The design and the implementation of such systems need to be further developed.

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