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**EXTENDED PRODUCER RESPONSIBILITY FOR  
COMPLEX PRODUCTS - A RESEARCH ANALYSIS  
OF THE SOCIO-ECONOMIC AND TECHNICAL  
IMPLICATIONS OF DEVISING AND  
IMPLEMENTING A POLICY ON THIS PRINCIPLE  
(EXPRES)  
SUMMARY FINAL REPORT**

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## I. OBJECTIVES

The objective of this project was to analyse from socio-economic and technical perspectives, how responsibility for the life-cycle environmental impacts of complex, durable products might be allocated so as to reduce those impacts.

The project motivation stemmed from a context in which since the mid 1970s policy documents reflected some recognition that responsibility sharing for waste management needed restructuring to involve the manufacturer and product developer.

Until the beginning of the 1990s, when Extended Producer Responsibility was formally introduced in Sweden as a strategy concept to enable such restructuring, discussion of product-oriented issues had remained bogged down in questions of materials separation and recycling. The focus of such end-of-life product policy instruments as existed was still primarily on waste management for which central or local authorities and waste management companies were seen as responsible.

The research team aimed both at refining the Extended Producer Responsibility concept definition and at identifying implementation instruments, which would locate responsibility where the greatest potential for integrating design-for-environment of products with economic sustainability could be achieved.

One of the project goals therefore was to analyse and identify the most appropriate types of instrument to stimulate effective feedback to those actors whom the research team would identify as potentially the most effective and / or interested in reducing environmental impact along the total lifecycle of the product.

In order to determine the appropriate nature of these instruments – administrative, economic, legislative, informative – several other elements of the socio-economic and technical context required analysis:

- the specific character of complex durable goods
- the capacity of logistic and management (particularly environmental management) systems to effect product change
- the nature and extent of product morphology that was technically feasible and / or desirable
- the emergence of new actors and roles and relationships among the various actors.

To analyse the potential contribution of extended producer responsibility to societal sustainability, an important project objective was to identify the conceptualisation held by business actors of their responsibility. It was necessary to identify the effect of the pressures of an increasingly environmentally sensitive public and of accelerating legislation on their view of the economic costs and benefits implied in accepting any form of responsibility, whether extended or not.

## II. METHODOLOGY

The research mainly focused on the definition of a general model for different concepts of producer responsibility and on analyses of the policies for the end-of-life management of complex products in European countries.

Extended Producer Responsibility is a concept that aims to change the manufacturers' engagement in the entire life cycle of their products, including making them responsible for the management of their end-of-life products. The relationships between the different actors are therefore important factors, which must be firmly defined, as must the responsibilities connected to each actor. This raised the interesting issue of how incentives may be introduced for the different actors, stimulating product and system improvement in terms of material selection, disassembly, recycling, resource utilisation and management chains.

Cars, large electrical household appliances (dishwashers, fridges and washing machines) and the personal computer were selected as illustrative complex durable products. They were all widely distributed in the European consumer market and had been long enough in use to create significant life cycle and /or end-of-life environmental impacts; car scrapping has long since been carried out in European countries with a variety of more or less developed car scrapping systems.

Different European car scrapping systems were studied and the analyses derived from this study provided the basis for the development of a model for future car scrapping based on Extended Producer Responsibility. During the project, a working group, consisting of the IIIIEE research partner and the Association of Swedish Automobile Manufacturers and Wholesalers (BIL) with its member companies, provided a platform for the testing and discussion of ideas for this model. As a result of this collaboration with an industrial partner, the work maintained a close connection to socio-economic and industrial reality.

The outward and reverse product distribution flows for household appliances were analysed on a national (Italy) and a European scale. An analysis of similar flows for one branded personal computer manufactured in Ireland

and of the international network for recovery and recycling of its disassembled components and materials was conducted.

The capacity of environmental management systems to stimulate and facilitate producer responsibility for product life-cycle impact at company and sector level was studied by a range of in-depth interviews with manufacturers, industry association representatives, disassemblers, recyclers and a national standards authority. The interview analysis was supplemented by document analysis of the existing schemes and standards for environmental management systems. The development of the ISO 14001 standard specification and the ISO 14004 guidance “toolkit” was monitored to identify the extent to which responsibility for product lifecycle impact was promoted.

Morphology analyses of household electric appliances and of a personal computer system were carried out and used to develop techno-constructive classifications of these products.

In-depth interviews with key informants in business, consumer and environmental organisations and in the manufacturing, disassembly, recovery and recycling industries were conducted to identify and analyse actor-specific conceptualisations of environmental responsibility. These conceptualisations were investigated both in respect to global debates on sustainable development and to specific programmes and strategies, for example, Local Agenda 21 and Extended Producer Responsibility.

### III. MAIN RESULTS

The main findings may be summarised as follows:

EPR – a principle informing the choice of implementation instruments

Extended Producer Responsibility is not an unambiguous measure that can be generally applied. The concept of Extended Producer Responsibility can and must be implemented through the use of different concrete instruments. The character of the responsibility, or the set of responsibilities, which decision-makers intend to implement determines the choice of instrument(s) in each practical case. The choice of instrument(s), economic, administrative, legislative or informative, is really the decisive action when a society strives to extend the responsibility of a producer to embrace the whole life-cycle of a product.

#### Choice of Policy Instruments

The decision as to which type of instrument to choose depends largely on the type of responsibility policy makers wish to address. A producer may be responsible in several different ways and to different degrees. Different aspects of responsibility could be described in the following manner (see Figure A):

*Liability* refers to a responsibility for environmental damage caused by the product in question. The extent of the liability is determined by legislation and may embrace different parts of the life cycle of the product, including usage and final disposal.

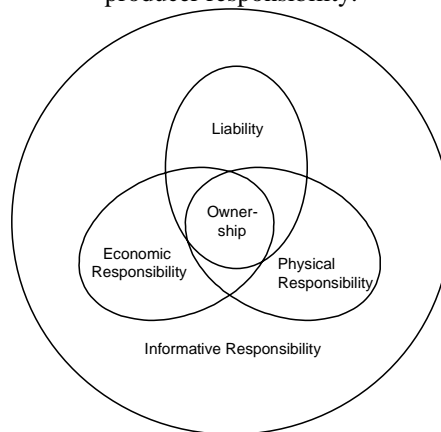
*Economic responsibility* means that the producer will cover all or part of the costs for e.g. the collection, recycling or final disposal of the products s/he manufactures. A special fee could pay for these costs.

*Physical responsibility* is used to characterise the systems where the manufacturer is involved in the actual physical management of the products or of the effects of the products. In some cases this only means that s/he has developed the necessary technology. In other cases the manufacturer manages the total system but on strictly commercial grounds, which may mean that s/he is charging for collection or disposal of the products s/he has manufactured.

In some cases the manufacturer is both organising and paying for the management of the discarded products, i.e. a total physical and economic responsibility. This is, for instance, the case in some of the deposit systems. In some cases this has led the manufacturer to *retain the ownership* of the products throughout their life cycles.

*Informative responsibility* signifies several different possibilities to extend responsibility for the products by requiring producers to supply information on the environmental properties of their products.

Figure A Different forms of extended producer responsibility.



Much of the debate and many of the legislative proposals, however, only address a single aspect of the responsibility. The disadvantage of such solutions is that too often they do not stimulate product development and new innovative ideas, but merely lead to the introduction of environmentally and economically suboptimised recycling systems, or even expensive clean-up and disposal measures.

**WHO IS THE PRODUCER?**

Extended Producer Responsibility addresses the possibilities of reducing the total environmental impact of the products (goods or services) consumed in society. Any integrated product policy must stimulate everyone who comes in contact with a product to act responsibly and co-operate to minimise the total environmental load of the product.

But product manufacturers are in the unique position of being able themselves to redesign the product and adapt it to new environmentally based requirements, including new distribution and inverse distribution systems. The challenge is to create a system, which makes a change towards more environmentally adapted product systems beneficial to the manufacturer.

It follows that the "producer" should be the actor who has most potential to redesign the product and the product system. Or in other words, the "producer" is the link in the product chain, who, if subject to the appropriate set of policy instruments, will guarantee development of a more sustainable product design.

**Need for systems changes**

Application of the Extended Producer Responsibility principle will cause changes in:

*Logistics management systems*

Logistics systems will have to adapt to reverse distribution of products, their components and/or their materials. This will entail the emergence of new economic actors such as managers of these flows, employed either within the producer company or as a contracted party within a new outward and reverse distribution network. Preliminary critical nodes for the efficient implementation of reverse flows have been identified.



The characteristics of complex products differ in many ways from products that traditionally are recycled. One of the main characteristics of complex products is that their inherent complexity may discourage recycling, i.e. they consist of several different components and materials. Another characteristic is their relatively long life prior to disposal.

The use of new materials with as yet unknown environmental properties and the long service life of durable products prior to disposal make prediction of the costs of handling and treating complex products difficult. These characteristics of complex durable products indicate that special consideration must be given when formulating systems for their handling and treatment and that it is important to implement incentives that facilitate these systems.

Incentives directed at eliminating or reducing environmental problems at the design stage are therefore especially important in an end-of-life management system for complex products.

## **ANALYSIS OF EXISTING EXTENDED PRODUCER RESPONSIBILITY MODELS**

Analysis of steering instruments in current and proposed European end-of-life management systems for complex products shows understandably different strategies and use of steering mechanisms, especially when comparing proposals from statutory authorities with proposals designed in co-operation with industrial stakeholders. The following components may be emphasised in light of their potential capacity to provide incentives for end-of-life management:

*Fees* - Upon purchase of a new complex product a fee is paid for the end-of-life management to a fund.

*Pay-as-you-go fund* - A fund where fees paid for newly purchased products are used for the end-of-life management of already existing old products.

*Product specific fund* - A fund where the fees paid for newly purchased products are ear-marked for the future end-of-life management of the specific products in question.

*Return deposit* - When the owner delivers the end-of-life product to an authorised dismantling or recovery firm, a refund is given.

*Handing-in duty* - By law, the owner is required to hand in the worn-out product to an authorised or otherwise certified dismantling or recovery firm.

*Authorisation/Certification of dismantling and recovery firms* - Authorisation/Certification means that environmental and professional demands are put upon the dismantling or recovery firms that are included in the system.

*End-of-life management certificates* - A certificate which is given to the last owner of a complex product as proof that the product has been taken care of properly.

*Cost-free end-of-life management for the last owner* - The owner of a complex product may hand in the product for end-of-life management without cost. The cost is covered by another party.

*Reclaim and recovery duty* - Producers are responsible, without cost to the last product owner, for the disposal of their worn-out products. Producers have a physical and economic responsibility for the end-of-life management of their products.

*Liability to render accounts for single producers* - The producers must show how they have disposed of their worn-out products and at the same time render an account of the quantities of material re-used or recovered, respectively.

*Recovery demands/goals* - Demands or goals which are set for the parties within the recovery sector.

*Differentiated end-of-life management fees* - Fees are paid for every newly sold complex product. In order to stimulate manufacturers to construct products adapted to scrapping, the fees are differentiated according to the degree of ease of end-of-life management.

*Subsidised recovery* - Certified dismantling or recovery firms may apply for allowances to retrieve product components that are difficult to recover.

The degree of steering provided by the different system elements is, to a large extent, dependent on how the elements are implemented and combined. A common feature of several of the different systems and system proposals examined is that they try, primarily, to solve problems of waste from products already in existence, rather than creating incentives for product design for environmental optimisation.

### **Reduction of end-of-life impact**

By making manufacturers responsible for end-of-life management of their products, a feedback loop regarding the end-of-life management properties is created. The driving force for manufacturers in such a system is obtained primarily through the introduction of economic steering instruments, which favour those manufacturers who assume responsibility. Thus, a manufacturer who produces products with little environmental impact during end-of-life management should be favoured economically in the system.

To avoid a situation where manufacturers might disappear from the market, e.g. for bankruptcy, before they have fulfilled their obligations, funds must already be reserved and appropriately invested when the products are sold. Therefore all manufacturers within a specific group of complex products should pay a fee, which is charged at the time of sale of the new product. If the fee were uniform it would minimise the risk that the fee could be regarded as a commercial impediment.

#### An illustrative economic instrument for individual responsibility

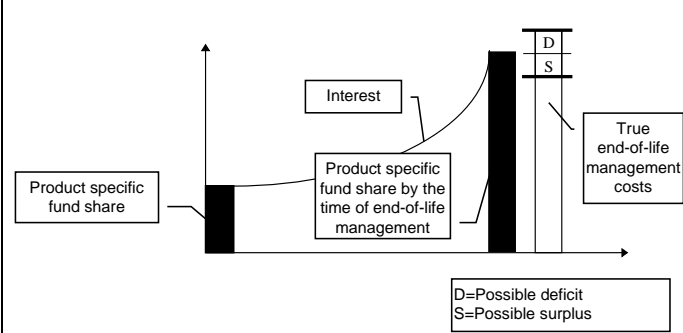
##### *Individual responsibility*

This concept implies that one actor is identified as the main responsible actor. This actor then negotiates economic agreements and arrangements with the other actors in order to fulfil the responsibility. The system would mainly be characterised by the following system elements:

**Fees** - For every complex product that is sold a fee is paid into a fund. The fee is set so that, with annual interest accrued, it will cover with a certain margin, the future costs for disassembly and recycling of the specific product.

**Product specific fund** - the fees collected are deposited in a product specific fund in which each specific manufacturer has his/her own fund share.

**Reclaim and recovery duty** - The manufacturers assume a physical and an economic responsibility for the management of end-of-life products. In order to provide treatment routes for their products every manufacturer will have to negotiate with dismantling and recovery firms to ensure that treatment routes for their end-of-life products exist.



##### *Cost-free end-of-life management for the last owner*

- The costs for end-of-life management will be covered by the respective fund share of the manufacturers. Where a surplus is generated in a specific manufacturer's fund share, due to less expensive treatment costs, the specific manufacturer can withdraw from the fund share (as illustrated). This technique provides a possibility to adjust the end-of-life management fee retroactively and hence a possibility of rewarding manufacturers who make an effort to construct products which are easy and cost effective to disassemble and recycle.

#### STIMULUS TO CHANGE CONSUMER BEHAVIOUR – FROM PURCHASE TO LEASING

While the most power to change product and production process design is located with the producer, the producer may also influence consumer behaviour by encouraging customers to lease a service rather than purchase a good, e.g. leasing climate control rather than buying a central heating boiler and air conditioner. In this way the producer enjoys extensive control over the recall of products and product components to optimize maintenance and exploit the potential for component recovery and cascade manufacture of lower specification products.

#### IV. SCIENTIFIC INTEREST AND POLICY RELEVANCE

Extended Producer Responsibility encourages reduction of the life-cycle environmental load from products (goods and services). It has the capacity to stimulate change in the way products, particularly complex durable goods, are produced, distributed and consumed.

As a principle which can be applied by a variety of instruments and combinations of instruments, it can be a co-ordinating mechanism for policy makers and researchers seeking orderly holistic integration of product-oriented issues into sustainable development.

Extended Producer Responsibility is much more than a mechanism to promote efficiency of take-back systems.

Extended Producer Responsibility expands the polluter-pays principle, beyond pollution prevention and control at the point of production, to incorporate information on resource depletion, pollution impact from product use and end-of-life waste management into product design.

The focus of Extended Producer Responsibility has to be expanded from its preoccupation with end-of-life management of goods towards efficient feedback mechanisms to those in whose interest it is to avoid the economic and social costs of product life-cycle impact.

Case studies of more or less successful implementation of Extended Producer Responsibility instruments need to be researched and widely disseminated in order to understand better where responsibility for “design-for-environment” should be allocated.