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DOCTORAL DISSERTATION

Extended Producer Responsibility in Cleaner Production

Policy Principle to Promote Environmental Improvements of Product Systems

Thomas
LINDHQVIST

Internationella miljöinstitutet
The International Institute for Industrial Environmental Economics

Extended Producer Responsibility in Cleaner Production

Policy Principle to Promote Environmental Improvements of Product Systems

Doctoral Dissertation, May 2000

Thomas
LINDHQVIST

The International Institute for Industrial Environmental Economics
Internationella miljöinstitutet

The picture on the front cover shows an oil painting, especially painted for this dissertation, by Tatyana Manninen. She was born 1954 in Kharkiv, Ukraine. She graduated from an art college in Kharkiv and completed her studies in St. Petersburg, Russia. She is since more than 20 years living and working in Helsinki, Finland. Her paintings are colour-rich and often in an impressionistic or expressionistic style. She has had personal exhibitions in Helsinki, St. Petersburg and Lund (Sweden). Her paintings are located in the collections of the Saara Hilden Museum, and in private collections in England, Finland, France, Russia, Sweden, and Ukraine.

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When I formulated the first definition of the extended producer responsibility (EPR) concept some ten years ago, I couldn't really foresee all that would evolve in connection with this policy principle. Today, almost all OECD countries have formulated EPR policies and it is now possible to get a clearer understanding of the way the EPR principle can work under various conditions. To interact with organisations and individuals became the best way to study the EPR principle in practice, and through this interaction to try to contribute to the necessary, as I sincerely believe, change towards more sustainable production and consumption patterns.

Throughout all the years I have worked with environmental research, I have been lucky to meet people who have been interested in my work and ideas. It has always been difficult to allocate time to put down the results of the studies in the form of a complete dissertation; the new fields have always been greener and more tempting. That this work has been completed now is a reflection of the fact that the EPR implementations have reached a level of maturity that make it possible to draw some first conclusions about their impact on product system change, and also, to a considerable extent, because of the constant, or at least periodical, reminders and encouragement of my supervisor, Karl Lidgren, and my colleagues at the IIIEE: Allan, Chris, Don, and Lars.

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Thomas Lindhqvist

Lund, April 2000

Executive summary

The Extended Producer Responsibility (EPR) principle, when officially formulated by the author in 1990, had emerged through the analysis of experiences from recycling and waste management systems, and the implementation of policy instruments to promote cleaner production. The dissertation is a synthesis of studies, starting with the initial work related to developing and defining the concept, and extending through the experiences of further exploring the principle and implementing EPR schemes for a variety of products in a number of countries. The need to gain a perspective on this implementation has required a study extending over a considerable time period.

The purpose of this research is to contribute to the understanding of how to create policies that encourage the development of more environmentally adapted products and product systems. In particular, the dissertation develops the concept of extended producer responsibility (EPR) as a policy principle to promote environmental improvements of products and product systems, and identifies possible approaches to key concerns in the implementation of EPR.

The statistical data available from implementation of recycling and EPR systems are often very rudimentary and, in many cases, of questionable quality. The systems have further been designed with varying scopes and objectives, and have been implemented in different geographical, political, social, and economic contexts. The EPR systems have also, for most products, not been in place for a very long period of time, or are indeed only in a discussion or preparation phase. These circumstances limit the possibility of basing conclusions on hard figures and statistical evidence, and justify an approach that is mainly qualitative and combines the data from existing systems with logical reasoning, knowledge and experiences from various disciplines. The multidisciplinary approach chosen for this research is a consequence of these factors.

The dissertation builds on the preventive environmental strategies as promoted by, for instance, UNEP in the Cleaner Production Programme. The reason why the area of products is important in the environmental discussions today is obvious, and the successful response to these challenges at the technical and company level have been various programmes for Design for Environment. However, there is also a need for a policy framework that stimulates such preventive activities.

EPR as a defined policy strategy was introduced by the author of this dissertation in a report to the Swedish Ministry of the Environment in 1990.[1] The concept was based on analysis of a number of Swedish and foreign recycling and waste management schemes, as well as the use of various policy instruments to promote Cleaner Production. The EPR concept was introduced at a time when several European countries, notably Austria, Germany, the Netherlands, Switzerland, and the Scandinavian countries, were preparing and commencing the implementation of various policy instruments to improve the management of end-of-life products. The concept implies that responsibilities, which were traditionally assigned to consumers and authorities responsible for waste management, are to be shifted to the producer of the products.

A formal definition of EPR was presented in a report prepared a year later:

> *Extended Producer Responsibility is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product. The Extended Producer Responsibility is implemented through administrative, economic and informative instruments. The composition of these instruments determines the precise form of the Extended Producer Responsibility.*[2]

In the latter report (April 1992) a model for characterising different schemes for implementing EPR was further developed out of the 1990 report. The model, illustrated in Figure 1-1, distinguishes different forms of responsibility.

---

1 Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products]. (Ds 1991:9).

2 Lindhqvist, Thomas. (1992). Mot ett förlängt producentansvar - analys av erfarenheter samt förslag [Towards an Extended Producer Responsibility - analysis of experiences and proposals]. In Ministry of the Environment and Natural Resources, *Varor som faror - Underlagsrapporter* [Products as Hazards - background documents]. Ds 1992:82. The definition was published in English for the first time in: Lindhqvist, Thomas. (1992). Extended Producer Responsibility. In Lindhqvist, T., *Extended Producer Responsibility as a Strategy to Promote Cleaner Products* (1-5). Lund: Department of Industrial Environmental Economics, Lund University.

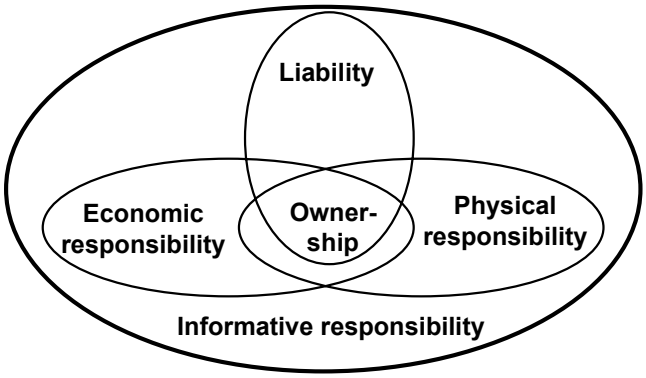

Figure 1-1. Models for Extended Producer Responsibility

Liability refers to the responsibility for proven environmental damages 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 expenses, for example, for the collection, recycling or final disposal of the products he is manufacturing. These expenses could be paid for directly by the producer or by a special fee.

Physical responsibility is used to characterise the systems where the manufacturer is involved in the physical management of the products and/or their effects.

The manufacturer may also retain the *ownership* of his products throughout their life cycle, and consequently be linked to the environmental problems of the product.

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

The above classification has helped to make the discussions concerning Extended Producer Responsibility more focused in Sweden. It has illustrated the need for specifying the responsibility, both in terms of who is responsible and for what is he responsible.

The EPR principle is consistent with the polluter pays principle and, moreover, a necessary condition for reflecting the essential life cycle costs in the price of the product. Without an EPR approach, it is not guaranteed that even those environmental costs that have been priced will be reflected in the final price of the product and, hence, signal the buyer that these qualities exist. With the exception of a few EPR systems, costs connected to waste collection, recycling, or final disposal, for instance, are not reflected in the price of the products. Consequently, these costs run the risk of being overseen by the consumer when he is making the buying decision. Indeed, they are beyond the control of the consumer today and will not be influenced by his actions. Equally important, the manufacturer of the product may oversee such costs when designing the product.

The existing experiences from the German Packaging Ordinance and other EPR-like systems all indicate that EPR systems can influence all three of the environmental objectives that have been discussed in this dissertation: well organised collection with high collection results, increased recycling, and promotion of DfE activities leading to overall life cycle environmental improvements of products and product systems.

EPR should be seen as a principle for preventive environmental policy-making. The main emphasis of EPR is to stimulate product and product system improvements. In order to reach this objective, various policy instruments must be used. It is by linking the economic responsibility to the individual manufacturers that the feedback loops for product improvement are constructed. Only allocating responsibilities will not necessarily be enough to secure the relevant feedback systems, and more research is needed to understand how best to organise the feedback loops.

To combine the economic responsibility with the physical responsibility is a way to secure a correct and reasonable inclusion of the costs for the handling of the product, and it is also a way to give control of the organisation of the system to the actors that are responsible for covering the costs. This is the most direct means of building incentives for cost optimisation and improvements into the product systems.

In many cases, the future costs are not known and it is difficult to estimate them with an accuracy that will allow for a fully relevant differentiation of fees in collectively organised collection and recycling systems. This is especially a problem for complex products with long life spans. To secure financing for end-of-life management through some kind of advanced

payment is in most cases necessary in order to avoid free riders, as well as problems related to bankruptcies.

An important milestone in the research were the studies of models for manufacturer-oriented systems, conducted in connection with the work with end-of-life vehicles, and the financial model for an EPR system that resulted from this work. The model of advanced payments and possibilities for retroactive compensation for excessive payments is a way to solve the dilemma of not knowing in advance the level of future costs. Erik Rydén also presented the latter model in his licentiate dissertation in 1995.[3]

EPR is an important concept if viewed as a principle for environmental product policies and not just as an alternative name for take-back policies. This does not exclude take-back policies from being a most interesting policy instrument to be used in order to implement an EPR scheme. A distinguishing and crucial element in such policies should be the feedback to product and product system development.

The revised definition of EPR presents the concept as a policy principle:

> Extended Producer Responsibility (EPR) is a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product.

A policy principle is the basis for selecting the mix of policy instruments that are to be used in the particular case.

> Extended Producer Responsibility (EPR) is implemented through administrative, economic and informative policy instruments.

It would be inappropriate not to have a life cycle perspective on all policies being implemented. It is, however, difficult to approach sustainability in small incremental steps if each step must be proven to be optimal in itself and not part of a more substantial change. Therefore, it is important that both the EPR principle and the implementation of policy instruments are viewed in a strategic attempt to reach sustainable solutions. The present evaluation tools are not equipped for determining the goals and targets.

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3 Rydén, Erik. (1995). *Car Scrap: Throw It Away or Make It Pay*. IIIEE Dissertations 1995:2. Lund: IIIEE, Lund University.

It is sometimes easier to reach the original manufacturer through other influential actors in the product group. The German Packaging Ordinance, which is primarily directed towards retailers, is a good illustration of how such an approach may influence the manufacturers very efficiently.

EPR is a vehicle for innovation in the design of products and product systems. An EPR implementation, allocating full physical and economic responsibilities to manufacturers, will encourage a shift towards providing the functions of the products in a more efficient way. This could be the necessary push for a shift towards product-service systems. It will definitely enhance the interest for re-manufacturing activities in the industry that is manufacturing and providing complex products. An EPR system with full responsibilities allocated to the original manufacturers will make the business opportunities connected to such re-manufacturing and product-service approaches more visual and comprehensible for the industrial entrepreneurs.

Finally, one should not fail to mention that EPR provides a financing solution for a government wanting to improve the waste management and recycling standards in its country. Contrary to the traditional ways of financing such activities, EPR provides a means of not raising taxes and municipal charges. This fact is attractive, and relevant, to developing countries and economies in transition, as well as to OECD member countries. Here is an explanation for the growing interest in many countries.

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CHAPTER
ONE

1. Introduction

1.1 Background

You can still find some people questioning the severity of environmental threats. However, for the most part, there is today consensus about the need for addressing environmental problems more vigorously. What problems to address with priority and how to address them are issues that are much debated and this is also where more knowledge and ideas are needed.

Preventive approaches to solving environmental problems have been presented as environmentally and economically beneficial for several decades now. The general interest was very limited throughout the 1970s and the 1980s, but has grown tremendously during the last decade. The work carried out by United Nations Environment Programme (UNEP) in the Cleaner Production Programme, and by many other international, national and local actors, has gradually begun to change the way businesses and organisations are approaching environmental issues. However, there are still many efforts to be made before the preventive approaches are both generally accepted and generally applied.

Preventive approaches were never really formulated to exclude a product-oriented approach, but the way preventive concepts developed made it natural to initially have a strict process-oriented approach. The focus was to improve and change production processes in order to minimise the environmental impact from manufacturing. The leading instrument has been various versions of a waste minimisation opportunity assessment (cleaner production assessment): a systematic approach to describe the manufacturing processes and to identify, evaluate, and implement preventive solutions.

In the late 1980s the organisation IACT (International Association for Cleaner Technologies) organised a well-visited conference on cleaner production in Vienna. During one of the sessions all participants were

divided into working groups, each focusing on one aspect or technology. When it was proposed to have one working group with the theme cleaner products, there was only a small group of not much more than some six or seven, including the author, who met to discuss what preventive approaches would mean when approaching environmental problems with a product-oriented focus. However, the following years saw much change and products gained more and more attention in environmental discussions and in policy making.

The interest in products had advanced for several reasons. The 1970s and 1980s had witnessed different attempts to approach solid waste problems. Large-scale mechanical sorting facilities for mixed household waste had been tried in several countries, but the technology had been largely disappointing as it generated materials that were not requested on the market.

Many projects were also carried out with the aim of developing new uses *for*, and new products *from*, various recycled materials. However, the attempts had only limited success, especially for materials from post-consumer products.

Several countries, including Sweden, started, instead, on a large scale to build waste incinerators with heat recovery technology. With reports about emissions of substances such as heavy metals and dioxins, the incineration technology was not accepted by large segments of the population. The NIMBY (Not In My Back-Yard) syndrome was extended equally to waste incinerators and landfills.

The attempts with recycling based on source separation proved to generate materials that could be more easily utilised. However, the revenues from selling the materials rarely covered the costs for the source separation activities. As soon as more than very small proportions of the household waste were aimed at, the collection had to be subsidised in some way, most often by waste charges or by local taxes.

The 1970s and 1980s also witnessed attempts from governments in several industrialised countries to counteract the development towards one-way beverage containers and, by legislation or voluntary agreements, to promote the use of refillable containers instead. These actions were only partly successful and were only addressing a very limited part of the total packaging flow.

The time for addressing the root of the problem, that is, the design of products and product systems, had come. The idea of doing this was not new; however, the methods and instruments had not yet been developed. Various approaches were taken to remedy the situation.

Life cycle assessment attracted much attention as a method to identify and evaluate the environmental impact of a product during its entire life cycle. Methods to systematically search for environmental improvement in the design process were developed under names such as Design for Environment (DfE) or Design for Disassembly (DfD).

Following the development of technical approaches and tools, the need for a comprehensive policy approach became obvious. During the 1990s, much attention has been paid to developing new, and adapting existing, policy instruments in order to incorporate them into preventive strategies. Environmental labelling, which had already been initiated in Germany in the mid-1970s, spread to most of the OECD countries and to several developing countries in a few years, from 1989 and onwards.

The concept of extended producer responsibility was formulated and developed in this context, and it gradually came to attract attention in the various OECD countries.

1.2 Purpose

The purpose of this research is to contribute to the understanding of how to create policies that encourage the development of more environmentally adapted products and product systems.

In particular, the dissertation develops the concept of extended producer responsibility (EPR) as a policy principle to promote environmental improvements of products and product systems, and identifies possible approaches to key concerns in the implementation of EPR.

1.3 Scope

The main contribution of the research leading to this dissertation is the introduction and definition of extended producer responsibility (EPR) as a policy principle, and the analysis of how EPR can be implemented to give incentives for product and product system change in a more environ-

mentally preferable direction. This involves issues concerning what responsibility various actors should have, but also questions how the process of developing an EPR policy should be organised.

In order to reach the objective of identifying policies that encourage the development of environmentally adapted products and product systems, the concept of EPR was developed and introduced at an early stage of this research. The development started with an initial definition and a model for the various forms of responsibility. This work was built on the analysis of existing systems for collection and recycling of various products.

The experiences with EPR implementations were subsequently used to refine the definition and to develop an understanding of which elements would give incentives for product and product system change.

The dissertation research approached the product systems from the end-of-life part of the life cycle of the product. The intention was, however, to explore policies that will lead to environmental improvement in an overall life cycle perspective through product and product system change initiated in the design phase.

Even though recycling systems are extensively described and discussed, the dissertation does not analyse whether or not certain recycling levels are the environmentally or economically optimal levels for a particular society. Recycling in itself is not treated as an objective, and recycling systems are only of interest if they form part of a policy leading to product and product system change.

The main emphasis of the studies has been on the development in Sweden. However, in order to exemplify various issues, references to other countries are made where appropriate. The dissertation makes no attempt to describe the various systems in all detail and all presentations of EPR implementations are limited to the information necessary for the purpose of the dissertation.

The role of informative instruments and responsibilities to supply information have not been analysed in this dissertation. Considerable attention was, however, devoted to informative instruments during the period of research leading to the dissertation and some general observations and conclusions about the role of informative instruments will be given in the concluding analyses and discussions.

1.4 Definitions

A product system means, besides the product as such, all the factors enabling the functionality of the product throughout its life cycle. It is necessary with a product system approach in order to understand the link between a product and the function provided by the product.

In this dissertation, the term recycling is used in the same way as in the EU Packaging and Packaging Waste Directive,[4] that is, to mean the reprocessing in a production process of the waste materials for the original purpose or for other purposes, including organic recycling but excluding energy-recovery.

Recovery will mean everything included in the term recycling, and, additionally, the use of waste to generate energy through incineration with or without other waste but with recovery of the heat. This definition is also in line with the EU Packaging and Packaging Waste Directive.

1.5 Methodology

The EPR principle, when officially formulated by the author in 1990, had emerged through the analysis of experiences from recycling and waste management systems, and the implementation of policy instruments to promote cleaner production. The dissertation is a synthesis of studies, starting with the initial work related to developing and defining the concept, and extending through the experiences of further exploring the principle and implementing EPR schemes for a variety of products in a number of countries. The need to gain a perspective on this implementation has required a study extending over a considerable time period.

Initially, this work built on the experiences of analysing take-back and recycling systems for mainly packaging, batteries, and construction materials. The author conducted several studies in this field during the latter half of the 1980s. In 1986 a report on policy instruments for the management of construction wastes was published.[5] This was followed by

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[4] European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. OJ L 365 31.12.94 p. 10-23.

[5] Brismar, Claes, Lindhqvist, Peter, & Lindhqvist, Thomas. (1986). *Styrsystem för byggavfallshantering.* [Systems of Policy Instruments for the Management of Construction Waste]. Report LTEM-3110. Sjöbo, Sweden: Stiftelsen TEM vid Lunds Universitet.

studies focusing on recycling systems for batteries, especially the deposit-refund systems for the collection of batteries.

In 1987 the Swedish Government commissioned the Swedish Environmental Protection Agency[6] for a comprehensive overview of waste issues. In this context the author came to work on several studies commissioned by the EPA. In the resulting reports published in 1988 by the EPA, the need for preventive policies was stressed.[7] The special role of the manufacturer of a product was the centre of the conclusions and recommendations from these studies.

The experiences from the studies for the EPA were further developed during 1988 and 1989. In 1990 the results from a study for the Ministry of the Environment were published and the concept of extended producer responsibility was formally defined for the first time.[8] Based on the experiences of existing take-back and recycling schemes, a model for various categories of responsibility was developed. This model was tested and further developed in a subsequent study for the Ministry of the Environment and Natural Resources,[9] which included a more detailed overview of Swedish and international experiences of recycling schemes that were linked to this model through different types and levels of responsibility.

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6 At that time the official translation was the Swedish National Board for Environmental Protection.

7 Backman, Mikael, & Lindhqvist, Thomas. (1988). *Pantsystem för batterier* [Deposit-Refund System for Batteries]. Report 3489. Solna: Swedish Environmental Protection Agency.
Backman, Mikael, Lindhqvist, Thomas, Lidgren, Karl, & Smitt, Rikard. (1988). *Miljö och förpackningar* [Environment and Packaging]. Report 3488. Solna: Swedish Environmental Protection Agency.
Backman, Mikael, Huisingh, Donald, Lidgren, Karl, & Lindhqvist, Thomas. (1988). *Om en avfallsstyrd produktutveckling* [About a Waste Conscious Product Development]. Report 3487. Solna: Swedish Environmental Protection Agency.

8 Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products] (7-44). Stockholm: Ministry of the Environment. (Ds 1991:9).

9 Lindhqvist, Thomas. (1992). Mot ett förlängt producentansvar - analys av erfarenheter samt förslag [Towards an Extended Producer Responsibility - analysis of experiences and proposals]. In Ministry of the Environment and Natural Resources, *Varor som faror - Underlagsrapporter* [Products as Hazards - background documents] (229-291). Stockholm: Ministry of the Environment and Natural Resources. (Ds 1992:82).

The work with studying EPR implementations was continued by analysing the experiences from the implementation of the Packaging Ordinance in Germany in 1991 and the Swedish EPR systems for packaging, newsprint, and tyres. The discussions concerning EPR implementations for these and others products, including cars, batteries, furniture, and electrical and electronic equipment in several European and a few non-European countries, added ideas and inputs to the elaboration of the various aspects of the EPR concept.

A substantial work, covering several years, was conducted by the author and Erik Rydén in co-operation with the Swedish Association for Car Manufacturers and Wholesalers (BIL – Bilindustriföreningen). The background for this work was an analysis showing that the existing system for car scrapping had substantial deficiencies. The system had been created in the mid-1970s to secure a high rate of organised collection, non-polluting scrapping and to combat the problems with car wrecks being abandoned in nature. However, the system lacked any real incentives for increasing the recycling of the materials in the cars and, more importantly, it lacked drivers for influencing the design of new vehicles in a more environmentally benign direction.

The work with the car industry-related problems, as well as studies of EPR for other complex products, extended over a wide field of issues related to EPR implementation and some of the findings have been reported in articles and conference papers.[10]

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[10] Kvist, Karin, Jansson, Ulf, Lindhqvist, Thomas, & Rydén, Erik. (1993). A Future Vehicle Recycling System: Recycling – Coordination and Planning are Necessities – Seen Against Experiences from the Swedish Car Scrapping System. In *First Annual World Car 2001 Conference*, 22 June 1993, College for Engineering, Center for Environmental Research and Technology, University of California.
Lindhqvist, Thomas & Rydén, Erik. (1994). The Trade Implications of Recycling of Automobiles. In *Life-Cycle Management and Trade* (149-158). Paris: OECD.
Lindhqvist, Thomas. (1995). *Förlängt producentansvar* [Extended Producer Responsibility]. AFR-Report 69. Stockholm: Swedish Waste Research Council.
Rydén, Erik, & Lindhqvist, Thomas. (1996). Strategies for the Management of End-of-Life Cars – Introducing an Incentive for Clean Car Development. In *Towards Clean Transport – Fuel Efficient and Clean Motor Vehicles* (601-607). Paris: OECD.
Lindhqvist, Thomas, & Rydén, Erik. (1997). Designing EPR for Product Innovation. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada.
Lindhqvist, Thomas. (1998). What is Extended Producer Responsibility. In K. Jönsson, & T. Lindhqvist, *Extended Producer Responsibility as a Policy Instrument – what is the Knowledge in*

Informative instruments can play a crucial role in an EPR approach. The author has conducted several studies devoted to various forms of such instruments. In the study commissioned by the Swedish EPA in 1987 the experiences with eco-labelling in Germany were analysed and a suggestion for a Swedish adoption of a similar system given.[11] In this study, the author also presented the idea of Environmental Product Declarations (EPD) (miljövarudeklarationer, MVD). These were introduced in English for the first time in a paper to a UN ECE seminar in 1989.[12] In 1989 the author, together with Danish colleagues, conducted the feasibility study for the European eco-labelling scheme.[13] In 1995 the author took part in a comprehensive evaluation of the Nordic eco-labelling system commissioned by the Nordic Council of Ministers.[14] The author also participated in organising several seminars devoted to eco-labelling and in editing the proceedings from some of these seminars.[15]

A wide range of EPR systems has been analysed in additional studies. An important contribution to the overview of the EPR systems has been the research conducted by many students participating in the IIIEE Master's Programme in Environmental Management and Policy in connection with preparing papers for the author's course in Environmental Policy and Law

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the Scientific Community? (3-10). AFR-Report 212. Stockholm: Swedish Environmental Protection Agency.

11 Backman, Mikael, Huisingh, Donald, Lidgren, Karl, & Lindhqvist, Thomas. (1988). *Om en avfallsstyrd produktutveckling* [About a Waste Conscious Product Development]. Report 3487. Solna: Swedish Environmental Protection Agency.

12 Lindhqvist, Thomas. (1989). *The Environmental Product Declaration, EPD*. UN ECE Seminar on Economic Implications of Low-waste Technology in the Hague, 16-19 October 1989. UN ECE. ENVWA/SEM.3/R.8.

13 Hirsbak, Stig, Nielsen, Birgitte, & Lindhqvist, Thomas. (1990). *ECO-Products: Proposal for an European Community Environmental Label*. Taastrup, Denmark: Danish Technological Institute.

14 Backman, Mikael, Lindhqvist, Thomas, & Thidell, Åke. (1995). *Nordisk miljömärkning* [Nordic Environmental Labelling]. TemaNord 1995:594. Copenhagen: Nordic Council of Ministers.

15 Lindhqvist, Thomas (edit.). (1989). *Environmental Labelling in the EFTA-Countries*. Invitation seminar, TEM-Centre, Sjöbo, Sweden, 28-29 August 1989. Sjöbo, Sweden: Foundation TEM at Lund University.
Department of Environmental Studies, University of the Aegean. (1992). *Global Environmental Labelling*. Invitational expert seminar, Lesvos, Greece, 24-25 September 1991. Mytilene, Greece: University of the Aegean.

to Promote Cleaner Production and in theses, which the author has had the privilege to supervise.

The dissertation is a compilation of experiences from the above-described studies. It builds on the concept of EPR as it was introduced and defined in the studies for the Ministry of the Environment. The dissertation is based on the assumption that environmental improvements of products and product systems are desirable, or indeed necessary, in order for society to have a chance to approach sustainability. The dissertation makes no scientific attempt to prove the necessity of sustainable development, nor does it justify the fundamental assumption just mentioned. However, the reader is provided with some examples of the profound impact of product systems on the environment.

The overall goal of environmental policies are related to issues such as to safeguard human health, to preserve well-functioning ecosystems, and to enable access to sustainable natural resources. In order to reach these or similar goals, governments must formulate various objectives on relevant sublevels. The dissertation builds on the model that society can pursue three main types of environmental objectives by instigating an EPR system that includes a scheme for collection and recycling of end-of-life products. These three objectives are described and discussed in the following paragraphs.

The first objective is to guarantee an organised collection of the discarded products. The aim can be to avoid that these products are abandoned in nature or in the streets – for instance car wrecks dumped in the forests or littering with waste packaging – or to avoid that the products create treatment problems for other waste streams when mixed with them – for instance, batteries containing heavy metals that impact considerably on the emissions from waste incinerators and risk leaking from landfills. Another aim of the collection scheme can be to improve the dismantling and treatment of collected products – for instance, the way toxic components are sorted out from electronic equipment, how car scrappers are taking care of electrical switches that contain mercury and the residues of petrol and various engine liquids, or to ensure proper destruction of the CFCs from refrigerators.

The second objective is to achieve an increased level of recycling of materials from the discarded products, or in general more reuse, recycling or energy recovery from these products.

The third objective is to give incentives for design changes of products or product systems that lead to overall improvements of their environmental qualities. This objective can be put into operation in the form of goals concerning material reduction, increased use of recycled materials, and more reuse of the product, or be more generally expressed as overall life cycle improvement of the product system.

Society, of course, is also pursuing other objectives that are not expressed in environmental terms. Examples of such objectives are abundant, and include for instance wealth distribution, national security, and gender issues. Even if the importance of these and other objectives is recognised, this dissertation will not explicitly address them.

The dissertation analyses the experiences from existing collection and recycling systems, whether they have been claimed to be EPR implementations or not, and identifies the way these systems have been developed and the results from their implementation.

An important milestone in the research were the studies of models for manufacturer-oriented systems, conducted in connection with the work with end-of-life vehicles, and the financial model for an EPR system that resulted from this work. The latter model was also presented by Erik Rydén in his licentiate dissertation in 1995.[16] These studies and the mentioned model also serve a fundamental role in this dissertation.

The statistical data available from implementation of recycling and EPR systems are often very rudimentary and, in many cases, of questionable quality. The systems have further been designed with varying scopes and objectives, and have been implemented in different geographical, political, social, and economic contexts. The EPR systems have also, for most products, not been in place for a very long period of time, or are indeed only in a discussion or preparation phase. These circumstances limit the possibility of basing conclusions on hard figures and statistical evidence, and justify an approach, that is mainly qualitative and combines the data from existing systems with logical reasoning, knowledge and experiences from various disciplines. The multidisciplinary approach chosen for this research is a consequence of these factors.

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16 Rydén, Erik. (1995). *Car Scrap: Throw It Away or Make It Pay*. IIIEE Dissertations 1995:2. Lund: IIIEE, Lund University.

1.6 Outline

Chapter 2 begins with a brief introduction to preventive environmental strategies and points to the main advantages attributed to a preventive approach to environmental problems. The second section of the chapter provides the reader with an understanding of how products and product systems influence the environment and the concerns related to their environmental impact. The last section of the chapter gives an overview of how design strategies incorporating environmental concerns have been developed, and discusses the possibilities for environmental improvement of existing products by re-design. The role of life cycle assessment in product improvement is also briefly discussed in the last section. The discussion in Chapter 2 points to the need for changes in the design of products and product systems to meet the challenge of sustainable development.

Chapter 3 introduces the concept of extended producer responsibility (EPR). The first section gives the background to the concept and shows that a principle understanding of the need of influencing the design of products can be documented way back to at least the 1970s, without being formulated at that time in any consistent policy framework.

The second section of Chapter 3 presents the initial model and definition of EPR as given when the author originally introduced the formal concept. Further, the model of various types of responsibility is included, forming a key tool for analysing various policy implementations.

The third section of Chapter 3 describes the further development of the EPR concept in Sweden up to the forming of the Ecocycle Commission at the Swedish Ministry of the Environment. The fourth section gives a brief overview of the early development of the EPR concept in various foreign countries. The fifth section introduces key concepts and issues discussed in Sweden and internationally in connection with EPR.

Chapter 4 gives an introduction to various systems incorporating elements of the EPR concept. The chapter serves as a source of background information for the discussion in the chapters following. The emphasis is on the EPR systems implemented and discussed in Sweden. Besides the Swedish systems, some key systems in countries such as Germany, the Netherlands, and Austria are introduced. The intention of the chapter is to provide the reader with a brief explanation of how the systems have been organised and what objectives and goals have been formulated for the

various systems, and in this way serves as a reference for the analysis in the subsequent chapters.

Chapter 5 discusses the experiences from EPR and recycling systems in obtaining high collection and recycling targets. The emphasis is on systems that obtain very high collection levels, typically in the range of 75-99%. This chapter identifies the factors that are influencing the consumers to return discarded products to the designated collection systems. It also discusses the experiences in mandating high recycling levels, especially based on the experiences from packaging recycling systems.

Chapter 6 examines the experiences and possibilities of achieving product improvement in the existing EPR systems. Connected to the various policy approaches and instruments, key factors for influencing the product development processes in the companies are identified and the results from selected systems, mainly for packaging, are presented.

Chapter 7 contains a comprehensive analysis of the experiences related in the earlier chapters and identifies the key issues to be addressed in policy-making. The chapter starts with a discussion about the roles of the various actors in the product systems, examines the specific problems of various product groups, and discusses the problems related to so-called historical products. The question of who is the producer with respect to the concept of extended producer responsibility is elaborated. The section following examines the various approaches to how the goals of an EPR system could be determined. The chapter concludes with some remarks about how to evaluate the implementations of EPR systems, including brief discussions about principal problems related to life cycle assessments and cost benefit analyses.

Chapter 8 starts by presenting the model and financing structure for the EPR system, which was developed for BIL (The Association of Swedish Automobile Manufacturers and Wholesalers) in the mid-1990s. The section following discusses the possibilities of expanding the EPR concept to incorporate policy instruments that are not focusing upon the end-of-life phase of the products, but instead upon other parts of the life cycle. From this, an ideal model for implementation of an EPR system, giving incentives for improvement of the environmental characteristics of products and product systems, is presented. This model is then adapted to real circumstances and its practical implementation is examined, using the findings from the preceding chapters. Some conclusions on how an

agreement about EPR implementation should be negotiated are given in a separate section. The chapter concludes with various ideas about the role of EPR in promoting more substantial changes of the product system, and more specifically in providing incentives to a change towards product-service systems.

Chapter 9 relates the main conclusions from this research and discusses the need for further research.

CHAPTER
TWO

2. A Preventive Approach and Products

2.1 The Cleaner Production Approach

When the enhanced environmental problems inherent to the development of the industrialised economy were first observed and eventually recognised, the methods to counteract them were, mostly, a question of diluting or dispersing the pollution in order to lower the risks to the health of humans and domestic animals. The anthropogenic impact continued to increase as industrial and other societal activities expanded. In the last century the problems became even more apparent and new measures to manage the environmental problems became necessary. Various technologies, aiming not only to spread the pollutants over larger areas, but also to destroy or control them, were invented and installed. Gradually, the knowledge basis of the environmental impacts of various substances grew, and with the knowledge came a more widespread acceptance of the need for more measures to be taken. More measures meant more environmental technology, that is, to a large extent technology to capture the pollutants and to transform them into a form in which they could be deposited, the so-called end-of-pipe technology.

Considerable reductions in the immediate impacts from manufacturing facilities were achieved by installing various filters to smokestacks, waste-water treatment units to the outlets for used water and liquids, and sanitary landfills to handle the solid wastes. The root of the problems was, however, not addressed and the price of the end-of-pipe technologies put restraints on what could be demanded from industries by government and societies. The need for new approaches became apparent.

Several of the international organisations and national governments, together with researchers and industry, began in the 1970s to develop preventive strategies for addressing environmental challenges. Strategies were developed under names such as low- and non-waste technologies, cleaner technologies, waste minimisation, and pollution prevention. All

focused on the cause of the pollutants, that is, the reasons for the generation of pollution were sought.

The first steps of the new approach were largely technology oriented. It was recognised that new technologies were very often connected to reductions in energy use and in the use of raw materials. Consequently, a cleaner technology approach became equivalent to a new technology approach. The technology transfer was complicated by financial constraints for investments and proprietary technology. The interest in this cleaner technology approach declined in many countries during the 1980s. However, some large enterprises, notably 3M and a few other multinational companies, adopted a preventive strategy with a broader approach that was not exclusively new technology-oriented. These companies reported considerable reductions in emissions of pollutants, and decreased amounts of solid and hazardous wastes. At the same time they claimed substantial financial savings that resulted from less loss of raw materials, reduced energy use, and decreased environmental abatement costs. The measures for achieving these results were numerous and were not only focused on the introduction of new technologies. Improvements at the housekeeping level were used alongside process optimisation.

Systematic approaches to identify these improvements were developed during the 1980s. The work carried out at the state level in the USA proved to be of particular importance. Waste minimisation assessments methodologies were used in small and medium sized companies, and environmental improvements were obtained together with substantial financial profits. The 3M programme called 3P, Pollution Prevention Pays, proved to be transferable to other companies.

The American experiences were transferred to Sweden, and from Sweden to the rest of Europe, beginning in the mid-1980s. The so-called Landskrona project, a pilot project introducing preventive approaches to six medium sized companies in the city of Landskrona in the Southern part of Sweden, was the first very successful attempt at implementing the new ideas.[17, 18] The project added to the existing activities in industry aimed at improving

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17 Backman, Mikael, Huisingh, Donald, Pehrsson, Eva, & Siljebratt, Lars. (1989). *Preventative Environmental Protection Strategy: First results of an experiment in Landskrona, Sweden.* Sjöbo, Sweden: TEM.

18 Siljebratt, Lars. (1994). *Pollution Prevention: A Profitable Investment.* Sjöbo, Sweden: TEM.

efficiency and was readily adopted in the company strategies during the coming years. The approach never did get formalised in national programmes in the Swedish context and most of the activities took place without any special framework. However, the logic of the preventive approach was gradually recognised by more and more companies and the industrial practices developed in a preventive direction.

Comparable successes with the preventive approach were soon reported from the Netherlands, Denmark, Austria, and Norway. In 1989, the United Nations Environment Programme Industry and Environment Office (UNEP/IEO) in Paris invited experts from various countries and international organisations to a workshop devoted to the establishment of a programme built on preventive approaches to industrial environmental problems. The result became the UNEP/IEO Cleaner Production Programme. This programme, together with initiatives from other international organisations, national governments, various organisations, and individuals led to the start of the global dissemination of cleaner production.

During the late 1980s and early 1990s the cleaner production approach continued to extend into more and more countries. Programmes initiated by Norway, USA, Denmark and Austria, among others, started activities in Central and Eastern Europe. In the same way various initiatives transferred the preventive strategies to developing countries in Asia, Africa, and Latin America.

The essential difference between pollution control approaches and cleaner production is a question of whether the measures will only stop pollutants from spreading to nature or will actually stop them from being generated. Cleaner production in production processes consists of one of the following measures or a combination of them: conserving raw materials, water and energy, eliminating toxic and dangerous raw materials, and reducing the quantity and toxicity of all emissions and wastes at the source during the production process.[19] Because the measures contribute to the efficiency of the company, they will also enhance the competitiveness of its products. The combined effects place cleaner production measures in the win-win category of environmental activities. Legislation and government require-

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[19] UNEP/IEO. (1994). *Government Strategies and Policies for Cleaner Production.* Paris: United Nations Environment Programme Industry and Environment, p. 4.

ments, as well as new consumer demands, are continuously stretching the profitable applicability of the preventive strategy.

Cleaner production can be implemented in a number of ways. The most important approaches involve changing attitudes, applying know-how, and improving technology.[20] An important barrier for the spreading of the strategy is connected with the lack of awareness of the potential for preventive actions in various industries. The traditional reactive approaches are still today well established in the minds of engineers and other decision-makers in industry. The end-of-pipe technologies and their application are also dominant in the teachings at technical universities and other educational institutions. At the same time as the process-oriented cleaner production approach is gradually overcoming these barriers and spreading in society, it is also encompassing new types of problems, including product-related environmental challenges.

A definition of cleaner production used today by the United Nations organisations is the following:

> *Cleaner Production (CP) is the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce the risks to humans and the environment.*
>
> *For processes, CP includes conserving raw materials and energy, eliminating toxic raw materials and reducing the quantity and toxicity of all emissions and wastes.*
>
> *For products, CP involves reducing the negative impacts along the life cycle of a product, from raw materials extraction to its ultimate disposal.*
>
> *For services, the strategy focuses on incorporating environmental concerns into designing and delivering services.*[21]

As can be seen, products, as well as services, are today part of the cleaner production approach. UNEP's definition of cleaner production has, as a matter of fact, incorporated products since the early 1990s.

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20 Ibid., p. 5.

21 UNIDO. (1998). *What is Cleaner Production.* [Online]. Available: http://www.unido.org/ssites/env/ncpc/envncpc33.html [18 March 2000].

2.2 Products and Environmental Problems

Production facilities, or other types of point sources, have been the focus of most of the pollution abatement – as well as pollution prevention – activities. Among the product-related areas that drew attention early on are exhaust gases from automobiles, CFC containing aerosols, household solid waste, and energy use from household appliances. Disregarding these examples, most of the interest of governments was directed to the point sources. The environmental protection activities in industries were very successful in several of the OECD countries and many of the problems had been considerably reduced before the end of the 1980s. In Sweden, it was estimated in 1990 that the 1000 largest and most polluting companies had reduced their emissions and discharges by more than 70% in the 1970s and 1980s. This meant that the emission levels were, in many cases, lower than in the 1950s.[22] However, attention was drawn to the environmental impacts from the entire life cycles of products.

It was clear that, besides the manufacturing stage, the product system constituted an important source of environmental disturbance. However, it was much more difficult to quantify the emissions related to usage and end-of-life management. Statistics had not been collected in a way that would facilitate such calculations. The problem was not simply a question of inefficient choice of statistical parameters. It was related to the almost infinite number of different products, as well as to the inherent, increasing complexity of many products. A considerable share of the products sold in Sweden was also imported and it was even more difficult to determine the relevant environmental properties of these products. The task of estimating the environmental impacts from the products was, additionally, made more complicated by the time aspect of the usage phase of durable products and the time dimension of impacts from, for instance, waste disposal sites.

A number of examples to illustrate the magnitude of the product-related environmental problems have been published in the last decade. Even though they are, in some cases at least, only approximate estimates of the true situation, they do provide a feeling for the extent of the problems.

- Figure 2-1 is an illustrative example of how the relative importance of the process-related emissions has diminished, while the level of the

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[22] Swedish Ministry of the Environment. (1991). *Hur mår Sverige? – en rapport om miljösituationen* [How Is Sweden Doing? – A report on the Environmental Situation]. Bilaga A till regeringens proposition 1990/91:90. Stockholm: Miljödepartementet, p. 178.

emissions from usage and end-of-life management has continued to grow. The figure demonstrates how the emission levels of chromium have developed in Sweden during the 20th century. The emissions from the manufacturing facilities were on the increase until approximately 1970. After this they dropped very radically and almost approached zero two decades later. However, the emissions from usage and the end-of-life phase continued to rise throughout the entire period, and after around 1970 it was estimated that they dominated the total for Sweden. In comparison, the emissions from manufacturing were negligible in 1990.

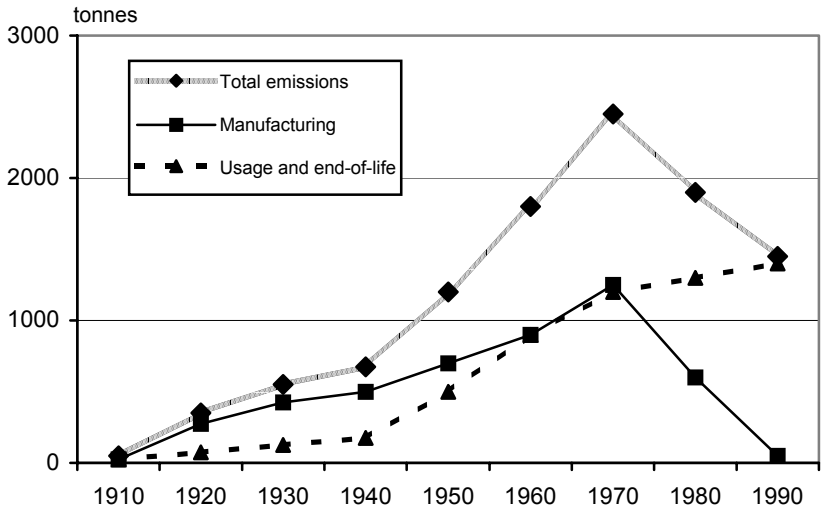

Figure 2-1. Estimated emissions of chromium in Sweden in the period 1910-90[23]

- In 1988, there were approximately 50 production facilities in Sweden for paints and varnishes. The total annual emissions of organic solvents from these facilities were 400 tonnes. The estimated amount of organic solvent emissions from the application of paints and varnishes was at the same time estimated to 38 000 tonnes. The figure from private households was in the order of 6 000 tonnes per year.[24]

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[23] Ecocycle Commission. (1997). *Strategi för kretsloppsanpassade material och varor* [Strategy for material and products adapted for ecocycles]. Kretsloppsdelegationens rapport 1997:14. Stockholm: Kretsloppsdelegationen, Miljödepartementet, Figure 21:3, p. 359.

[24] Swedish Ministry of the Environment. (1990). *Sätt värde på miljön! Miljöavgifter och andra ekonomiska styrmedel* [Put a Price on the Environment! Environmental fees and other

- Nail varnishes consist of 70% solvents. They also contain softeners, which, together with the colorants, are potentially hazardous compounds. All ingredients of a nail varnish will become waste or pollutants through vaporisation with wastewater from the sinks, or as solid waste in the mixed household waste. Additionally, other solvents are used to remove the varnish from the nails. The estimated amount of solvents contained in nail varnish in 1990 was approximately 300 tonnes per year. This means that the emissions from this one product correspond to a large manufacturing industry.[25]

Metals, as substances, are not decomposed. They are present in nature in more or less easily accessible form. There has always been a certain leakage from the earth crust to sediments, which in time has formed new minerals. However, man has considerably accelerated this process, especially in the last century. With a continuously increasing inflow of metals to the techno sphere and also an outflow to nature in the form of, for instance, leakages from mine piles and landfills, and as the result of acid rain, the processes of binding the metals to mineral structures proceed too slowly and, consequently, the amounts of easily accessible metals are increasing.

Several metals are essential for human beings and other creatures, and a lack of these metals can lead to various health problems. Excess amounts of metals can, on the other hand, create acute poisoning or negative long term effects.

The Ecocycle Commission in 1997 made an attempt to compare the emissions of metals from point sources with emissions from the usage of products in Sweden. The point sources included manufacturing facilities, waste treatment facilities and sewage water treatment plants. This means that leakage from decaying products at landfills, air emissions from the combustion of discarded products in waste incinerators, and dissolved products such as washing powders were counted as emissions from point sources.

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economic instruments]. Betänkande av miljöavgiftsutredningen. SOU:1990:59. Stockholm: Miljödepartementet, p. 367.

25 Nordin, Håkan. (1992). Varors miljöpåverkan – en problembeskrivning [The Environmental Impact of Products: A problem description]. In Ministry of the Environment and Natural Resources, *Varor som faror - Underlagsrapporter* [Products as Hazards - background documents] (7-57). Stockholm: Ministry of the Environment and Natural Resources. (Ds 1992:82), pp. 22-23.

The amounts of the various metals that were introduced into society in the form of new products were also estimated. These figures, as well as the figures for emissions from usage, were not accurate measurements, but the result of the best possible estimates using available data from all relevant studies and all relevant statistics. An attempt was also made to estimate the accumulated amounts of metals in the Swedish society, that is, what amount of the various metals was incorporated into the products, including houses, roads, and other infrastructures. The result is reproduced in Table 2-1.

Table 2-1. Point emissions of metals in Sweden in comparison to emissions by usage, virgin material used for new products, and total accumulated amounts in the techno sphere

Metal	Point emissions to air and water (tonnes/year 1992)	Emissions at usage (tonnes/year)	Virgin material in products (tonnes/year)	Accumulated in society (tonnes)
Aluminium			130 000	3 000 000
Lead	400	3 600	30 000	2 200 000
Iron / steel			1 - 2 000 000	>35 000 000
Copper	100	600 - 1 100	100 000	3 500 000
Chromium	40	760 - 940	50 000	2 000 000
Nickel	60	4 - 40	10 000	400 000
Zinc	1000	1 100 - 1 400	40 000	2 500 000
Mercury	1	4	14	9 000
Cadmium	3	0.12 - 50	170	5 000

The Ecocycle Commission report points to the considerable uncertainties in the estimates of many of the figures for emissions by usage and for accumulation.
Source: Ecocycle Commission (1997)[26]

The estimated annual emissions from point sources for six of the seven metals were lower, and in several cases considerably lower, than the estimated emissions from usage, as can be seen from Table 2-1. It is important to note the one or two magnitude higher amounts of these metals that were introduced into the techno sphere each year and the very high amounts that had been accumulated already at that time. For almost all

[26] Ecocycle Commission. (1997). *Strategi för kretsloppsanpassade material och varor* [Strategy for material and products adapted for ecocycles]. Kretsloppsdelegationens rapport 1997:14. Stockholm: Kretsloppsdelegationen, Miljödepartementet, Figure 21:2, p. 359.

metals there is a continuous accumulation, resulting in huge amounts of future metal waste that has to be taken care of at some point of time.

The focus on the waste treatment in the end-of-life management that was dominant in virtually all countries led to a search for more improved recycling and waste management technologies. It was also recognised that the quality of the separation of materials collected for recycling had to be improved. After largely unsuccessful attempts with automatic sorting facilities for mixed household waste, local communities in countries such as Sweden in the 1980s began concentrating their efforts in two directions. The first direction was towards increased waste incineration with energy recovery. The second aimed at source separation of recyclables.

Waste incineration, besides having a general negative reputation among the population, is also connected with a number of more tangible problems. Stricter demands on emission levels permitted from the smokestacks forced the use of more advanced pollution control equipment and hence higher costs for treating the waste. Some demands were, however, difficult to fulfil without measures taken before incineration. The air emissions of mercury in the 1980s, for instance, were largely connected to batteries. This led to the initiation of collection schemes, but also gradually to demands on the quality of the batteries being sold. The demand placed on battery manufacturers to reduce the amount of mercury was, however, an exception to the general rule. In almost all cases the problems were supposed to be solved in connection with the waste incinerator, more seldom by measures connected to the collection of wastes, and only very rarely by demands on the products to be sold.

The same situation was true for recycling activities. The problems connected to recycling, such as contamination of the recycled materials originating from the products collected, and the difficulty of finding markets for the recycled materials, were often seen as a problem only for the authorities responsible for waste management.

The need for a new strategy seems, in retrospect, obvious. However, new approaches were not formulated, and the local authorities and waste management companies that were responsible for carrying out the strategies largely favoured the traditional approaches. Large parts of industry also preferred a known traditional way of dealing with problems, instead of one that was new and unproved.

A limited number of products were fundamentally questioned in the public debate, notably the use of one-way beverage packaging, such as aluminium cans and PET-bottles, instead of refillable glass bottles. Governments that were reluctant to take action in other, principally, similar cases, were, because of the political dimension of these issues, forced to take initiatives. Special legislation and voluntary agreements were introduced in several countries. However, the sometimes low effectiveness of these measures and problems related with other products, such as batteries and tyres, paved the way for new ideas and new approaches.

2.3 Cleaner Products

Product development is the art of balancing a great number of competing and often conflicting demands regarding function, size, design, raw materials, production properties, product quality, durability, price, etc. There is, of course, no fundamental law that excludes environmental properties as an important criterion to comply with product development. In practice, however, the environmental qualities of most products have only been a factor of marginal importance in the product design phases.

It is possible to find some references to design strategies incorporating environmental concerns in the 1980s, but, largely, the systematic Design for Environment (DfE) strategies and approaches are a new feature of the 1990s.[27] The preventive-oriented design strategies have proven to be as successful as the process-oriented cleaner production activities. Demonstration and pilot projects were started in the beginning of the 1990s and soon substantial savings were reported.

The Dutch PROMISE project was one of the pioneer projects in the DfE, or, as it was called in the project, ecodesign area. This project and the PROMISE manual emanating from it were the basis for the English language manual published in 1997 by United Nations Environment Programme (UNEP).[28] This manual refers to ecodesign as:

> *… it implies that there is a need to balance ecological and economic requirements while developing products. Ecodesign considers environmental aspects at all stages of the product*

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[27] Karlsson, Mårten. (1997). *Green Concurrent Engineering: Assuring environmental performance in product development*. IIIEE Dissertations 1997:1. Lund: IIIEE, Lund University, p. 34.

[28] Brezet, J.C., & van Hemel, C. (1997). *ECODESIGN: A promising approach to sustainable production and consumption*. Paris: UNEP.

> *development process, striving for products which make the lowest possible environmental impact throughout the product life cycle. In the end, ecodesign should lead to more sustainable production and consumption.*[29]

Allenby (1994) discusses DfE by stating that:

> *The idea behind DFE is to ensure that all relevant and ascertainable environmental considerations and constraints are integrated into a firm's product realization (design) process. The goal is to achieve environmentally preferable manufacturing processes and products while maintaining desirable product price/performance characteristics.*[30]

The opportunities for product improvement are found in all phases of the life cycle. The ecodesign manual divides the strategies that could be applied into eight types of strategies:[31]

- New concept development;
- Selection of low-impact materials;
- Reduction of materials usage;
- Optimisation of production techniques;
- Optimisation of distribution systems;
- Reduction of impact during use;
- Optimisation of initial lifetime;
- Optimisation of end-of-life system.

The EcoReDesign project conducted at the Centre for Design at the Royal Melbourne Institute of Technology provides a similar division of main types of design strategies in the EcoReDesign Guide: [32]

- Design for resource conservation;
- Design for environmentally preferred materials;

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29 Ibid., p. 37.

30 Allenby, Braden R. (1994). Integrating Environment and Technology: Design for Environment. In B. Allenby, & D. Richards, *The Greening of Industrial Ecosystems* (137-148). Washington, D.C.: National Academy Press, p. 139.

31 Brezet, J.C., & van Hemel, C. (1997). *ECODESIGN: A promising approach to sustainable production and consumption.* Paris: UNEP, p. 143.

32 Gertsakis, John, Lewis, Helen, & Ryan, Chris. (1997). *A Guide to EcoReDesign™: Improving the environmental performance of manufactured products.* Melbourne: Centre for Design at RMIT, p. 44.

- Design for cleaner production;
- Design for efficient distribution;
- Design for energy efficiency;
- Design for water conservation;
- Design for minimal consumption;
- Design for low-impact use;
- Design for durability;
- Design for remanufacture;
- Design for reuse;
- Design for disassembly;
- Design for recycling;
- Design for degradability;
- Design for safe disposal.

These demonstration projects, as well as others, demonstrate a considerable potential for product improvement. Examples of products that have been improved through a DfE type of approach are numerous, and these examples are often, just as in the case of cleaner production approaches in manufacturing, connected to savings in economic terms. That is, the potential for win-win solutions is evident.

The examples of product and product system improvements based on DfE activities that are quoted in various articles and reports represent a broad spectrum of measures, as illustrated by the lists of design strategies above. It is, consequently, difficult to assess the results of DfE projects by one common standard. The Dutch ecodesign demonstration project was reported to have shown that substantial improvements in environmental impact in the order of 30-50% can be achieved even in a short time.[33] Ryan (1997) reported energy, water, and materials savings in the order of 25-60% from the EcoReDesign project.[34]

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[33] Geelen, Paul. (1995). Country Report: Product Oriented Environmental Policy in the Netherlands. In E. Rydén, & J. Strahl, *Green Goods.* (147-151). Ecocycle Commission Report 1995:5. Stockholm: Ecocycle Commission, p. 149.

[34] Ryan, Chris. (1997). Moving Beyond the Low-Hanging Fruit in DfE. *Journal of Industrial Ecology, 1*, no. 3, p. 3.

Morelli (1998) showed that replacing the present stock of household appliances, such as dishwashers, washing machines, refrigerators, and freezers, with the most energy efficient ones available on the market would lead to savings in the order of 30-60%. Similar results would be obtained if water usage or CO_2-emissions were focussed. [35]

The approaches to identifying the opportunities for product improvement have been presented in several publications, including the Dutch and Australian manuals referred to above. In many instances, life cycle assessment (LCA) can be seen as an instrument for DfE. The author, however, views LCA as an assessment tool. As such, LCA can play a role in product design, but is not in itself the tool for the DfE.

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[35] Morelli, Nicola. (1998). Scenarios for Eco-Efficiency: Technological Change and Factor 10 Reduction in Household Appliances. In *ENVENT: An International Summit on Innovation, Environment& New Economic Opportunities,* 10 December 1998, RMIT, Melbourne, Australia, pp. 27-33. [Online]. Available: http://www.cfd.rmit.edu.au/ee/eesummit.html.

CHAPTER

THREE

3. Extended Producer Responsibility

3.1 Towards Extended Producer Responsibility

Extended producer responsibility (EPR) as a defined policy strategy was introduced by the author of this dissertation in a report to the Swedish Ministry of the Environment in 1990.[36] The concept was based on analysis of a number of Swedish and foreign recycling and waste management schemes, as well as the use of various policy instruments to promote Cleaner Production. The EPR concept was introduced at a time when several European countries, notably Austria, Germany, the Netherlands, Switzerland, and the Scandinavian countries, were preparing and commencing the implementation of various policy instruments to improve the management of end-of-life products.

The concept implies that responsibilities, which were traditionally assigned to consumers and authorities responsible for waste management, are to be shifted to the producer of the products. The idea that the existing method of dividing responsibilities did not lead to environmentally optimal development was not new at that time, but was in the minds of several persons working with waste, recycling and product-oriented questions for a considerable time. In policy documents dating back to the mid-1970s and the 1980s, expressions of the need for involving the manufacturer and product developer in finding solutions to the waste and recycling problems were found on several instances. Some examples of such ideas formulated in official government reports will be given below. They have not been selected to give a full and comprehensive picture of the development in various countries. Instead, they illustrate an awareness of the fact that existing policies and practices did not comprehensively address a core

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[36] Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products]. (Ds 1991:9).

problem related to waste management. It is further illustrative for the understanding of the development of product policies to see that the formulation of an environmental policy principle, such as EPR, was in parallel to a growing awareness of the root of the problems and the implementation of various measures to deal with them at various levels.

In 1975 the Swedish Government presented bill 1975:32 on Recycling and Waste Management.[37] This comprehensive bill stated two leading principles for the future Swedish policy with regard to the waste question.

The first principle stated that waste was to be regarded as a resource, which should and could be reclaimed. This view, or more correctly the way this statement was interpreted by decision makers responsible for the development of the waste management, led to the bold and very expensive venture with central sorting facilities for mixed household waste. The failure to obtain marketable materials paved the way for mass incineration with energy recovery of household waste. Subsequently, it took the central authorities more than ten years to reconsider the definition of waste as a resource, despite the failure of recycling of mixed wastes and the environmental problems of all waste treatment processes.

The second principle in the government bill 1975:32 addressed the responsibility of the manufacturer:

> *The responsibility that the waste generated during the production processes could be taken care of in a proper way, from an environmental and resource-saving point of view, should primarily be of the manufacturer. Before the manufacturing of a product is commenced, it should be known how the waste, which is the result of the production process, should be treated, as well as how the product should be taken care of when discarded.*[38]

It is of special interest to notice that the responsibility is not limited to the production, but is extended to the actual products. This responsibility of the manufacturer was repeated in a number of official statements issued by the different governments following 1975. It was, however, at that time, difficult to find any examples of legislation or other regulations that forced the manufacturers to seriously consider what was happening with their products when discarded by the consumer. The Public Cleansing Act[39] from

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37 Regeringens proposition (1975:32) om återvinning och omhändertagande av avfall [Government Bill on Recycling and Waste Management]. Stockholm (Prop. 1975:32).

38 Ibid., p. 28. Translation from Swedish by the author.

39 Renhållningslag (1979:596) [Public Cleansing Act]. SFS 1979:596.

1979 was amended in 1993, three years after the introduction of the EPR concept, to incorporate a paragraph that explicitly addressed the responsibility of a producer. The Chemical Products Act[40] and the Ordinance on Chemical Products[41], both from 1985, could, under certain circumstances, be used for products containing chemical products or for products that had been treated with chemical products. However, the possibilities of using them in practice outside the area of chemical products were never explored.

The underlying reason for making the producer responsible for the products, and especially their environmental impacts throughout their life cycle, is, without doubt, closely connected to our society's experiences with the waste treatment and recycling activities. It has become increasingly evident that to ensure an acceptable treatment of the discarded products of our civilization we need a change, not only in our waste treatment procedures, but also in the characteristics of the products themselves. The officials responsible for waste treatment facilities have often repeated that they cannot be blamed for all the environmental impacts from waste handling, as they do not have any control over the actual cause of the problems, that is, the way the discarded products have been designed. Producers have the unique knowledge and opportunity to change the characteristics of their products and therefore bear a special responsibility.

The need for a new approach is not a unique Swedish experience. We meet the same reasoning in a number of other countries. This is well illustrated by the following paragraph from a report concerning the implementation of the 1986 Waste Law[42], enacted by the Federal Republic of Germany in 1986:

> *All products sooner or later will become waste. Therefore, producers should, already in the planning stage and during the manufacturing of the products, find satisfactory answers to the question of disposal of the products/materials after their lifetime. This already applies to waste generated in enterprises with the licensed installations (Art. 5, para. 1, No. 3, Federal Emission Protection Law) but not on the product side. Also, in this case the*

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40 Lag (1985:426) om kemiska produkter [Chemical Products Act]. SFS 1985:426.

41 Förordning (1985:835) om kemiska produkter [Ordinance on Chemical Products]. SFS 1985:835.

42 Gesetz über die Vermeidung und Entsorgung von Abfällen (Abfallgesetz – AbfG) vom 27. August 1986 (BGBl. I S. 1410 ber. S. 1501) [Law on Avoidance and Disposal of Wastes (Waste Law)].

> *principles of prevention and polluter pays should lead to the situation where the producers take part of the responsibility for handling/disposal of their products.*[43]

It is clear that the German Waste Law mostly addressed traditional waste management problems and paid less attention to preventive solutions. However, it was also the first real attempt to create a comprehensive legal framework to facilitate the implementation of policy instruments that also aimed at preventive measures concerning a broad spectrum of specified product groups.

Paragraph 14 Section 1 of the Waste Law empowers the Federal Government to issue ordinances, after consultation with the concerned parties, in order to "prevent or minimise the amount of harmful substances in waste or for their environmentally acceptable management".[44] Section 2 of the same paragraph concerns measures to prevent or minimise waste amounts and addresses a wider scope of products, in particular packaging. In both cases, that is, according to Sections 1 and 2, the Government can use a wide range of policy instruments to reach its goals, including demands on informative marking of products, separate collection, take-back and deposit-refund requirements, as well as restrictions and bans concerning the sales and usage of products. The implementation process is, in the case of Section 2 of Paragraph 14, considerably more complex, incorporating compulsory specified attempts to try to find a non-legislative solution to reach the desired goals. It also includes the approval of the Bundesrat (the Upper House of Parliament, consisting of representatives of the Länder, that is, the states).

The strategic importance of this legislation was already clearly recognised in 1986. The Government report from that year acknowledged that this was the first time the Federal Government had the power to prescribe legal waste-related measures with a preventive purpose. The prevailing situation, when companies did not have any incentive to incorporate considerations of waste management expenses, was expected to be changed with the

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43 Bundesregierung der Bundesrepublik Deutschland. (1987). *Bericht der Bundesregierung über den Vollzug des Abfallgesetzes vom 27. August 1986* [Report from the Federal Government on the Implementation of the Waste Law of 27 August 1986]. Deutscher Bundestag 11. Wahlperiode, Drucksache 11/756, 1 September 1987, pp. 4-5. Translation from German by the author.

44 Gesetz über die Vermeidung und Entsorgung von Abfällen (Abfallgesetz – AbfG) vom 27. August 1986 (BGBl. I S. 1410 ber. S. 1501) [Law on Avoidance and Disposal of Wastes (Waste Law)]. Translation from German by the author.

implementation of the new legislation. It was, however, recognised that unnecessary interference in the market process and unnecessary disturbances of the market competition had to be avoided. A voluntary approach was preferred, based on the conviction that real progress in the fields of prevention and recycling would hardly be achieved if facing resistance from the concerned parties (producers, distributors, and consumers). However, the co-operative approach had its limits "when real progress was blocked by the particular interest of individuals (groups)".[45]

The stage was set in Germany in 1986 for new policy measures aiming at improved waste management practices and preventive action in the product field. Besides an ordinance issued in December 1988 demanding a take-back and deposit-refund system for beverage containers made of plastics, the few actions taken in the late 1980s following the Waste Law were all aimed at waste treatment and recycling improvements.[46] It was through the Packaging Ordinance, presented in draft form on 12 June 1990, that the German Federal Government began a new phase of the product policy actions in the country.

In the Netherlands the discussion about the possible approaches for solving waste problems was very intense in the late 1980s. Following the renewed interest for preventive strategies in the country, the Government also formulated preventive oriented approaches for the products:

> … *policy is aimed at the (industrial) designers of products and product processes. The designer and producer should be aware of the effects of their product at the disposal stage and that certain responsibilities rest on their shoulders.*[47]

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45 Bundesregierung der Bundesrepublik Deutschland. (1987). *Bericht der Bundesregierung über den Vollzug des Abfallgesetzes vom 27. August 1986* [Report from the Federal Government on the Implementation of the Waste Law of 27 August 1986]. Deutscher Bundestag 11. Wahlperiode, Drucksache 11/756, 1 September 1987, p. 12. Translation from German by the author.

46 Wessel, Kerstin. (1991). The German "Dual System" – An instrument to promote waste minimization in the packaging sector?. In M. Backman, & T. Lindhqvist, *Packaging and the Environment – Policies, strategies and instruments* (44-52). Lund: Department of Industrial Environmental Economics, Lund University, p. 44.

47 Dutch Minister of Housing, Physical Planning and Environment. (1988). *Memorandum on the Prevention and Recycling of Waste*. Second Chamber, session 1988-1989, 20 877, nos. 2. The Hague, Netherlands: Ministry of Housing, Physical Planning and Environment, p. 12.

The National Environmental Policy Plan (NEPP) presented by the Dutch Government in May 1989 highlights the necessity for a change in the existing policies:

> *Integrated life cycle management implies a change in the responsibilities of producers and consumers in the chain. The responsibility does not cease at the moment when substances (raw materials, semifinished articles, products or waste) are passed along to others. Recent developments in jurisprudence indicate that these responsibilities continue through the chain.*[48]

The text continues by stressing the importance of information flow between the actors in the life cycle of products:

> *It is important that information about the substances be passed along with the substances themselves. When substances (raw materials, interim products, finished products) are passed from one owner to another, information about the relevant environmental aspects of recovery, use, reuse and waste handling should be passed along as well.*[49]

It was this flow of information, depicted under the concept of integrated chain management in the Dutch policy discussions, which was stressed in the NEPP. Integrated chain management was also the framework used by the Dutch in many of the discussions concerning shifts of responsibility of various actors.[50, 51]

The author of this dissertation introduced a rationale and foundation for the extended producer responsibility concept in 1988 in a report to the Swedish Environmental Protection Agency.[52] The product-related portion

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48 Dutch Minister of Housing, Physical Planning and Environment. (1989). *National Environmental Policy Plan (NEPP). To Choose or to Lose*. Second Chamber, session 1988-1989, 21 137, nos. 1-2. The Hague, Netherlands: Ministry of Housing, Physical Planning and Environment, p. 157.

49 Ibid., pp. 157-158.

50 Davis, Gary. (1994). Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention. In C. A. Wilt, & G. A. Davis, *Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention*, 14-15 November 1994, Washington, D.C. (1-14). Knoxville, TN: Center for Clean Products and Clean Technologies, The University of Tennessee, p. 2.

51 Reijnders, Lucas. (1993). Expanding Producer Responsibility for Reducing Environmental Impact. *Tijdschrift voor Milieu Aansprakelijkheid* [Environmental Liability Law Review], *7,* 69-72, p. 69.

52 Backman, Mikael, Huisingh, Donald, Lidgren, Karl, & Lindhqvist, Thomas. (1988). *Om en avfallsstyrd produktutveckling* [About a Waste Conscious Product Development]. Report 3488. Solna: Swedish Environmental Protection Agency.

of the report was aimed at demonstrating feasible approaches to "implement the producer responsibility that is expressed in the Government bill 1975:32".[53] The report stressed the need for finding general approaches and for not relying on measures implemented when it was recognised that a certain product was causing unacceptable environmental problems. It was concluded that "radical changes with far-reaching consequences" were necessary.[54] The report recommended a number of informative instruments to be introduced, as well as a more extensive use of administrative and economic instruments. It was stressed that the latter more intrusive instruments, including prohibitions, environmental fees, take-back duties, deposit-refund requirements, and recycling requirements, must be given a central role if strong incentives for product change were to be achieved.[55]

A paper, submitted to a UN Economic Commission for Europe (UN ECE) seminar in 1989, built upon the author's contribution to the 1988 report and conveyed the "principle of the extended responsibility of the manufacturer of products".[56]

The Swedish Government reacted to the EPA report, and in the budget proposal for 1990 a number of the issues from the EPA report were transferred to government proposals. Responsibility of the producer was, according to the proposal, to be given stronger emphasis. However, the emphasis was to be on chemicals control, mandatory information duties, internal company material balances, and environmental product declarations.[57] The latter is originally a suggestion from the author of this dissertation, presented in the 1988 report on environmentally conscious product development to the EPA.[58] The 1990 government budget proposal,

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53 Ibid., p. 36.

54 Ibid., p. 38.

55 Ibid., p. 85.

56 Lindhqvist, Thomas. (1989). *The Environmental Product Declaration, EPD*. UN ECE Seminar on Economic Implications of Low-waste Technology in the Hague, 16-19 October 1989. ENVWA/SEM.3/R.8.

57 Swedish Ministry of the Environment and Energy. (1989). *Bilaga 16 till budgetpropositionen 1990* [Appendix 16 to the budget bill]. Prop. 1989/90:100 Bil. 16. Stockholm: Riksdagen 1989/90. I saml. Nr 100. Bilaga 16, p. 28.

58 Backman, Mikael, Huisingh, Donald, Lidgren, Karl, & Lindhqvist, Thomas. *Om en avfallsstyrd produktutveckling* [About a Waste Conscious Product Development]. Report 3488. Solna: Swedish Environmental Protection Agency, pp. 43-44, 79-82, 85-87. Cf. also Footnote 56.

however, also approached the central issues related to the responsibility of the producer. It was proposed that:

> *The responsibility of the producer must be demanded more clearly than in the past. Products must be clean from the beginning. The one who generates waste should cover the costs connected to the waste management.*[59]

There was also a short reasoning about the allocation of responsibility. The producer was said to have the ultimate responsibility for the environmental impact and misuse of resources that might be the result of manufacturing, as well as use and waste disposal. However, the proposals for strengthening this producer responsibility were limited to a suggestion to develop economic instruments, limit the use of environmentally harmful substances, develop material balances and environmental declarations, and include an informational duty in the Public Cleansing Act.[60]

It must be noted that in the studies and publications presented so far, the words "producer" and "responsibility" are used in a general sense and it can almost be seen as a coincidence when they form a unity. The problems connected to a lack of preventive thinking in the product design were recognised at an early stage, but this problem awareness was not transferred into any elaborated discussion about how the problem could be approached, and it did not lead to any comprehensive policy approaches, nor to the introduction of any policy framework.

The challenge for the policy-making arena was to find guiding principles and strategies for future product-oriented measures, and suitable policy instruments to enact in line with the strategies. The policy instruments in the form of various administrative, economic and informative instruments were largely known, though not always comprehensively exploited, or, in the view of the author, fully understood. In order to communicate with decision-makers in society, it was necessary to define a logical framework, incorporating the identified problems and the emerging implementation of various policy instruments.

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59 Swedish Ministry of the Environment and Energy. (1989). *Bilaga 16 till budgetpropositionen 1990* [Appendix 16 to the budget bill]. Prop. 1989/90:100 Bil. 16. Stockholm: Riksdagen 1989/90. I saml. Nr 100. Bilaga 16, p. 43. Translation from Swedish by the author.

60 Ibid. Bilaga 16, p. 43.

3.2 Initial Model for Extended Producer Responsibility

The concept of extended producer responsibility (EPR) was formally introduced by the author in a report to the Swedish Ministry of the Environment in 1990. In this first report concerning EPR, the emphasis was already on achieving an influence on the design of products:

> *A successful model should give a strong incentive for developing the product in question in such a way that it minimises the total life-cycle environmental impact.*[61]

The importance of stressing all the stages of the life cycle is seen here, together with special attention to the end-of-life problems related to the products:

> *An important factor for the environmental qualities of a product is its longevity. The product should, in particular, be designed for an environmentally adapted end-of-life treatment, including easy repair, good recyclability, possibilities for reuse of components, etc.*[62]

The report built upon the experiences of the existing recycling systems for post-consumer products. Examples of an obvious lack of incentives for product change and the corresponding environmental problems were compared to cases when feedback from the recycling phase was noted and had led to product re-design. The report further discussed the advantages and disadvantages of various forms of responsibility and a number of implementation problems connected to an EPR strategy.

A more formal definition of EPR was presented in a report prepared a year later. This report was also prepared for the Ministry of the Environment and Natural Resources[63]:

> *Extended Producer Responsibility is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product. The Extended*

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61 Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products]. Ds 1991:9, p. 16. Translation from Swedish by the author.

62 Ibid., p. 16.

63 The ministry changed its name several times in the late 1980s and in the 1990s.

> *Producer Responsibility is implemented through administrative, economic and informative instruments. The composition of these instruments determines the precise form of the Extended Producer Responsibility.*[64]

In the latter report (April 1992) a model for characterising different schemes for implementing Extended Producer Responsibility was further developed from the 1990 report. The model, illustrated in Figure 3-1, distinguishes different forms of responsibility. Short characterisations of the different types will be given below.

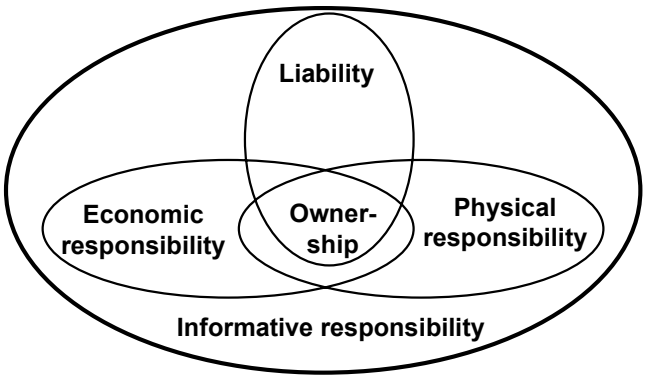

Figure 3-1. Models for Extended Producer Responsibility

Liability refers to the responsibility for proven environmental damages 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 expenses, for example, for the collection, recycling or final disposal of the products he is manufacturing. These expenses could be paid for directly by the producer or by a special fee.

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64 Lindhqvist, Thomas. (1992). Mot ett förlängt producentansvar - analys av erfarenheter samt förslag [Towards an Extended Producer Responsibility - analysis of experiences and proposals]. In Ministry of the Environment and Natural Resources, *Varor som faror - Underlagsrapporter* [Products as Hazards - background documents]. Ds 1992:82. The definition was published in English for the first time in: Lindhqvist, Thomas. (1992). Extended Producer Responsibility. In Lindhqvist, T., *Extended Producer Responsibility as a Strategy to Promote Cleaner Products* (1-5). Lund: Department of Industrial Environmental Economics, Lund University.

Physical responsibility is used to characterise the systems where the manufacturer is involved in the physical management of the products and/or their effects.

The manufacturer may also retain the *ownership* of his products throughout their life cycle, and consequently be linked to the environmental problems of the product.

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

The above classification has helped to make the discussions concerning Extended Producer Responsibility more focused in Sweden. It has illustrated the need for specifying the responsibility both in terms of who is responsible and for what he is responsible.

The 1990 report to the Ministry of the Environment introduced a set of factors that could be used to evaluate whether a system for implementation of EPR was successful or not. The five factors stressed were:[65]

- *To promote product changes through product development*
  The successful implementation should include strong incentives for improvement of the life cycle impacts of the product
- *To steer the consumption towards more environmentally adapted products*
  The consumer should be stimulated to choose more environmentally adapted products. The ultimate goal is to have all societal costs included in the price of the product.
- *To guarantee a high secondary use of the qualities and materials of a product*
  Reuse and recycling should be stimulated and take place in a way that environmental concerns are not compromised.
- *To minimise the necessary bureaucracy*
  The system should be realised with a minimum of administrative superstructure.

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[65] Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products]. Ds 1991:9, pp. 16-17.

- *To enable control of target achievements*
  A control system should be built into the implementation in a way that objective control is enabled and that relevant adjustments can be carried out.

The 1992 report gave a more extensive review of international experiences relevant for EPR development. Besides formalising the definition of EPR, the report also reviewed the conclusions from the 1990 report.

It should be noted that the EPR concept in Sweden soon lost the 'E' in most contexts and is referred to as producer responsibility (producent-ansvar). The same is noted in Danish publications. The start of the more extensive spread of the concept internationally seems to be connected to the expert seminar "Extended Producer Responsibility as a Strategy to Promote Cleaner Production", that was organised by the author and Mikael Backman on 4-5 May 1992 at Trolleholm Castle, not far from Lund, as part of the activities of the Working Group on Policies, Strategies and Instruments to Promote Cleaner Production in the framework of the UNEP IE Cleaner Production Programme.[66]

3.3 From Concept to the Ecocycle Commission

The author's 1990 report, formally introducing the EPR concept, was followed by a number of activities in Sweden. The Swedish Government, in May 1990, had given the Minister of the Environment the task of forming a commission to investigate measures to promote reusable packaging, and to suggest relevant measures. On 15 June 1990, the special investigator of the Packaging Commission (förpackningsutredningen) was appointed. On 21 June 1991, the Government gave additional tasks to the Packaging Commission. The Commission was to elaborate the proposal for "a complete responsibility for manufacturers, distributors and trade concerning take-back and reuse, recycling and energy recovery of packaging".[67]

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[66] The seminar was supported by the Jan Wallander and Tom Hedelius' Foundation for Social Science Research and the proceedings were published in 1992 by the Department of Industrial Environmental Economics, Lund University. The proceedings are available online from the IIIEE homepage: http://www.lu.se/IIIEE/.

[67] Swedish Government. (1991). *Tilläggsdirektiv till förpackningsutredningen (M 1990:03)* [Additional Instructions to the Packaging Commission]. Dir. 1991:17. Stockholm: Regeringskansliet, p. 1. Translation by the author.

The Packaging Commission concluded in its final report that producer responsibility "should be flexible because its ultimate purpose is to stimulate recycling of the packaging raw materials".[68] However, this statement was modified in another section of the final report of the Commission. It was said that the ultimate justification for producer responsibility is the fact that producers, who design, manufacture, transport and sell packaging, make decisions that determine the total environmental impact. It was further concluded that only the producers can, in an effective way, develop new products from the recycled material and find new markets for such products.[69]

Reasons of control, that is, practical considerations, were said to motivate the limitation of producer responsibility to a limited number of actors and a certain part of the packaging chain. However, the risk of reduced competition was pointed out.[70]

The report 'Hazardous Goods' was issued by the Ministry of the Environment and Natural Resources in mid-1992. It emanated from an inter-ministerial group. Among the studies commissioned by this group was the author's report that formally defined the EPR concept. However, the report from the inter-ministerial group did not use the EPR concept; instead it focused on take-back obligations. Overall, it paid limited attention to these issues and referred to parallel work.[71]

Later in 1992 the Swedish Ministry of the Environment and Natural Resources, in a report addressing producer responsibility for waste paper and nickel-cadmium batteries, pointed to the fact that there was no possibility for any public authority to keep track of all substances and products and to evaluate the environmental impacts from them. The authorities had even less ability to investigate each product in order to eliminate the prospective negative environmental impacts in the waste

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68 Swedish Ministry of the Environment. (1991). *Miljön och förpackningarna* [The Environment and Packaging]. SOU 1991:76. Slutbetänkande av förpackningsutredningen. Stockholm: Miljödepartementet, p. 255. Translation by the author.

69 Ibid., p. 298.

70 Ibid., p. 263.

71 Swedish Ministry of the Environment and Natural Resources. (1992). *Varor som faror* [Hazardous Goods]. Stockholm: Miljö- och naturresursdepartementet. (Ds 1992:58), p. 108.

management phase. It was concluded that this must be the task of the companies, and that moral responsibility would not be enough to trigger the necessary actions. Measures must be taken to ensure that environmentally adapted product development would be profitable for the companies.[72]

The managing director of Swedish Association for Waste Management, Mr. Håkan Rylander, wrote in the preface of a report issued in November 1992:

> *The principle of economic and physical responsibility should be put in practice, but initially only for a limited number of materials, and for materials that are recyclable and continuously marketable.*[73]

The fact that the local authorities in Sweden were, in many cases, subsidising recycling activities was presented as a weakness. The fluctuating market prices were pointed out as adding to the planning problem on a municipality level.[74]

The Association for Waste Management and the largest municipal waste management companies asked the Government several times for intervention in the waste paper area. Extended responsibilities in this area were, however, not accepted by the industry represented by the Swedish Forest Industries Federation.[75] Observers expressed concern that cost-

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72 Swedish Ministry of the Environment and Natural Resources. (1992). *Producentansvar för avfall. Förslag till ett lagstadgat producentansvar och dess tillämpning på returpapper samt förslag till återlämningspremier för nickel-kadmiumbatterier* [Producer responsibility for waste. Proposal for a legislated producer responsibility and its implementation for waste paper, and proposal for return premium for nickel-cadmium batteries]. Stockholm: Miljö- och naturresursdepartementet. (Ds 1992:59), p. 9.

73 Rydén, Erik. (1992). *Förlängt producentansvar inom svensk pappersåtervinning* [Extended Producer Responsibility in Swedish paper recycling]. RVF Rapport 92:9. Malmö: Svenska Renhållningsverks-Föreningen, p. 3.

74 Swedish Ministry of the Environment and Natural Resources. (1992). *Producentansvar för avfall. Förslag till ett lagstadgat producentansvar och dess tillämpning på returpapper samt förslag till återlämningspremier för nickel-kadmiumbatterier* [Producer responsibility for waste. Proposal for a legislated producer responsibility and its implementation for waste paper, and proposal for return premium for nickel-cadmium batteries]. Stockholm: Miljö- och naturresursdepartementet. (Ds 1992:59), p. 22.

75 Ibid., pp. 19-20.

efficiency would not be assured as market competition was not secured and, consequently, that the prices for waste paper would be unnecessarily high.[76]

In February 1993 the Swedish Government presented the Ecocycle Bill.[77] An important part of this government proposal was devoted to the introduction of EPR in Swedish law and specific proposals for packaging and newsprint. The producer was defined as "anyone who manufactures, imports or sells a product or a packaging for his livelihood" and also "anyone who, in the course of his occupational activities, generates waste that calls for special measures from the environmental standpoint".[78] It was stressed that the government should refrain from detailed regulations and instead provide individuals and companies with clear long-term legal frameworks. The importance of promoting environmentally conscious product development was recognised and in this context the Ecocycle Bill acknowledged that such measures must be rewarded on the market.[79] A combination of economic and physical responsibility for the producers was given preference, and it was clearly stated that to allocate only economic responsibility must be an exception.[80]

The Ecocycle Bill should be seen as the first step in systematically introducing EPR in Sweden. Besides proposing specific ordinances for packaging and newsprint, the bill announced measures for several other product groups, including tyres, cars, plastics, construction materials, and electric and electronic equipment. A government commission, the Ecocycle Commission, also presented in the following years a number of studies and proposals concerning these and other product groups. Several of the reports of the Ecocycle Commission will be referred to in this dissertation.

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76 Rydén, Erik. (1992). *Förlängt producentansvar inom svensk pappersåtervinning* [Extended Producer Responsibility in Swedish paper recycling]. RVF Rapport 92:9. Malmö: Svenska Renhållningsverks-Föreningen, p. 20.

77 Regeringens proposition (1992/93:180) om riktlinjer för en kretslopps anpassad samhällsutveckling (Kretsloppspropositionen) [Government Bill Laying down Guidelines for Ecocycle-Oriented Development (Ecocycle Bill)]. Stockholm (Prop. 1992/93:180).

78 Ibid., p. 5.

79 Ibid., p. 55.

80 Ibid., p. 57.

3.4 Early Development Outside Sweden

The German Government used paragraph 14 section 1 of the Waste Law from 1986 to introduce an ordinance on waste oils in October 1987 and an ordinance on halogen containing solvents in October 1989. In December 1988, the Government used section 2 of the same paragraph for the Ordinance on Plastic Beverage Packaging demanding take-back and deposit-refund for such packaging. The EC Commission did not receive this ordinance favourably, as it was only regulating one material for beverage packaging. A number of documents concerning the targets for recycling of packaging materials and some products were published in 1989 and 1990.[81]

In mid-1990 the German Government presented the first public draft of a packaging ordinance based on the Waste Law. After a year of discussion the Ordinance on the Avoidance of Packaging Waste (Packaging Ordinance) was adopted.[82] It could be noted that even though the actions in Germany had a decisive influence on the development of the EPR concept, the concept as such was not used in Germany in the first years of the 1990s.

The activities concerning packaging were followed by draft ordinances and discussion for several other products including automobiles, electrical and electronic equipment, and newsprint. However, these drafts were not realised in the following years. The weak economy and rising unemployment made it difficult to get approval for new legislation in the EPR field.[83] Concerning automobiles the Government reached a voluntary agreement with considerably revised targets only in 1998, while there is still no decision concerning electrical and electronic equipments.

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81 German Federal Minister for Environment, Nature Protection and Nuclear Safety. (1990). *Entwurf: Verordnung über die Vermeidung von Verpackungsabfällen (VerpackVO): Begründung* [Draft: Ordinance on Avoidance of Packaging Waste (Packaging Ordinance)]. WA II 3 – 530 114 – 1/7. Bonn: Bundesminister für Umwelt, Naturschutz und Reaktor-sicherheit, pp. 1-5.

82 Verordnung über die Vermeidung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 12. Juni 1991 (BGBl. I 1991 S. 1234) [Ordinance on the Avoidance of Packaging Waste (Packaging Ordinance)].

83 Jaeckel, Ulf. (1997). EPR in Germany. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada, p. 6.

On 8 July 1994 the new German Closed-Loop Economy and Waste Law (also translated as Closed Substance Cycle and Waste Management Act)[84] was adopted by the Bundesrat, and it came into force in September 1996. Under this law the waste avoidance strategy cannot be based on end-of-pipe measures for waste disposal; instead responsibility under the waste law must be transferred to the very beginning of the production chain. The new law is clear on who is responsible for what. Whoever produces, markets or consumes goods is responsible for the avoidance, recycling, reuse and environmentally sound waste disposal of these goods.[85]

In June 1991, the Danish EPA was commissioned by the Environmental and Planning Committee of the Parliament to evaluate, among other issues, take-back duty as an instrument for introducing producer responsibility in the entire waste and recycling field. The study was clearly influenced by the development in Germany and other European countries, and also by the EPR terminology used in the Swedish discussions. The report from the study that was published in December 1991 was doubtful of the applicability of the EPR concept in Denmark, and concluded that take-back duties were only useful for a limited part of the total waste stream.[86] A report published by several Danish ministries in August 1992 estimated that 15-25% of the total waste amounts could, in a long-term perspective, be covered by take-back obligations based on an EPR approach.[87]

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84 Gesetz zur Förderung der Kreislaufwirtschaft und Sicherung der umweltverträglichen Beseitigung von Abfällen (Kreislaufwirtschafts- und Abfallgesetz – KrW-/AbfG) vom 27. September 1994 (BGBl. I 1994 S. 2705, BGBl. I 1996 S. 1354) [Law for Promotion of a Closed-Loop Economy and to Secure Environmentally Sound Disposal of Wastes (Closed-Loop Economy and Waste Law)].

85 Rummler, Thomas. (1995). The Environmental Policy Concept of the Closed Substance Cycle and Waste Management Act. In *Recycle '95 – Environmental Technologies*, 15-19 May 1995, Davos, Switzerland.

86 Danish Environmental Protection Agency. (1991). *Miljøstyrelsens redegørelse vedr. tilbagetagningspligt og producentansvar for emballageaffald* [Report of the Environmental Protection Agency on Take-back Duty and Producer Responsibility for Packaging Waste]. J.nr. M 3048-0048. 13 December 1991. Copenhagen: Miljøstyrelsen, Affalds og genanvendelseskontoret, p. 49.

87 Danish Ministry of Finance, Ministry of Environment, Ministry of Taxes, & Ministry of Economics. (1992). *Budgetanalyse om markedsorientering af affalds- og genanvendelseindsatsen* [Budgetary Analysis Concerning the Market Orientation of the Waste and Recycling Efforts]. Copenhagen: Finansministeriet, Miljøministeriet, Skatteministeriet & Økonomiministeriet, p. 26.

The Danish EPA stressed the disadvantage of the local authorities retaining the co-ordinating role, as well as the overall responsibility for waste management, whilst making selected producer groups responsible for the handling of specified waste products. A way to avoid this conflict would be to divide the physical responsibility from the economic responsibility and make the producers responsible only for the latter.[88] It was pointed out that it would be irrelevant, from an isolated environmental point of view, to transfer the economic responsibility for the waste management to the producer if there were no environmental benefits as compared with other financing models.[89] The report was, in general, reluctant to implement EPR and criticised existing and proposed systems. The Danish EPA also concluded that the report from the Swedish Packaging Commission neglected the uneven economic burden on manufacturers of various packaging materials arising from its proposal.[90]

The Action Plan for Waste and Recycling issued by the Danish Ministry of Environment in June 1992 had a more positive view of EPR, and put EPR in the framework of an increased market orientation of waste-related management of selected product groups. Voluntary agreements were seen as the basis for establishing EPR systems. The voluntary approach would allow maximal flexibility and market adaptation of collection and recycling systems.[91] An inter-ministerial report from August 1992 stated that despite the general approach of voluntary action, it might be necessary to have public involvement in the form of mandatory take-back legislation or a common system for collecting the fees. The latter would be combined with a system to channel the money back to the private sector.[92]

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88 Danish Environmental Protection Agency. (1991). *Miljøstyrelsens redegørelse vedr. tilbagetagningspligt og producentansvar for emballageaffald* [Report of the Environmental Protection Agency on Take-back Duty and Producer Responsibility for Packaging Waste]. J.nr. M 3048-0048. 13 December 1991. Copenhagen: Miljøstyrelsen, Affalds og genanvendelseskontoret, p. 32.

89 Ibid., p. 49.

90 Ibid., p. 40.

91 Danish Ministry of Environment. (1992). *Handlingsplan for affald og genanvendelse 1993-97* [Action Plan for Waste and Recycling 1993-97]. Copenhagen: Miljøministeriet, pp. 23-24.

92 Danish Ministry of Finance, Ministry of Environment, Ministry of Taxes, & Ministry of Economics. (1992). *Budgetanalyse om markedsorientering af affalds- og genanvendelseindsatsen* [Budgetary Analysis Concerning the Market Orientation of the Waste and Recycling

In France, a discussion had started in the end of the 1980s about the risk of the landfills becoming overloaded. Following the announcement of the packaging ordinance in Germany in 1990, the French minister of the environment, Brice Lalonde, decided in February 1991 to ask Antoine Riboud, chairman of the BSN group, to draft a plan on how the French manufacturers could contribute to the solution of packaging waste. On 30 June 1991, Antoine Riboud presented his plan, which would become the basis for the French approach to this issue.

The main idea of the report can be summarised as a sharing of responsibilities between manufacturers and local authorities. The local authorities would continue to be responsible for the collection of packaging waste, while the manufacturers would take care of the recycling of separated materials and provide financing through fees on the packaging. The aggregated size of the fees was to be calculated as corresponding to the share of the packaging in the total waste stream and the total waste management costs. A second study, led by Jean-Louis Beffa, the Saint-Gobain chairman, proposed the target that would later be confirmed by the minister to a valorisation of 75% of the packaging waste by 2002. The French term valorisation corresponds to energy recovery, as well as material recycling. In April 1992, the minister published the decree 92-377, which is the legal basis for the French system, and later in the year a company called Eco-Emballages was set up to receive the contributions from the distributors of packaged goods and from the importers.[93]

The Dutch approach to product-oriented policies was a mixture of voluntary action by all stakeholders and a more or less explicit threat of government intervention. Geelen (1995), representing the Ministry of the Environment,[94] stated that the Dutch Government would implement the policies primarily by self-regulation. In order to reach results, the Government would invite manufacturers and importers of selected product groups

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Efforts]. Copenhagen: Finansministeriet, Miljøministeriet, Skatteministeriet & Økonomiministeriet, p. 26.

93 Eco-Emballages. (1996). *Eco-Emballages: The French solution*. Paris: Victoires-Editions, pp. 3-4.

94 The full name of the ministry is translated to English as the Ministry of Housing, Physical (sometimes translated Spatial) Planning and the Environment, but in this dissertation, as is also practised by representatives of the Ministry, the abbreviated name Ministry of the Environment will be used in parallel to the full name.

to enter into voluntary schemes, which might be backed by supporting legislation to counteract possible free rider activities. Referring to the Policy Paper on Products and the Environment issued by the Ministry of the Environment in 1994,[95] he warned that "in case this voluntary approach fails to meet the objectives of the Policy Paper, the government will resort more direct means of intervention".[96]

Clement (1997), also representing the Dutch Ministry of the Environment, stressed the fact that there were well-defined goals in the Dutch policy that make it possible for industry to choose its own means. However, he found that the voluntary approach should be supported with "a clear framework with carrots, but also with sticks", else the policy will fail.[97]

The negotiated agreements, the covenants, have been seen as characteristic of the Dutch product policy approach, the Packaging Covenant from 6 June 1991 being the typical example.[98]

During the 1990s, the European Union (EU) worked with identified priority waste streams and the products related to them. After the adoption of national policies on packaging waste in Germany, the Netherlands, and several other countries, the EU Commission decided to negotiate a new directive addressing the packaging waste.

The Directive on Packaging and Packaging Waste was decided in 1994 and it provided a framework for the countries in the EU. The directive demanded specified minimum levels of recycling and recovery, and it also included maximum levels that a country may impose in its national

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95 Dutch Ministry of Housing, Spatial Planning and the Environment. (1994). *Policy document on Products and the environment.* The Hague: Ministry of Housing, Spatial Planning and the Environment.

96 Geelen, Paul. (1995). Country Report: Product Oriented Environmental Policy in the Netherlands. In E. Rydén, & J. Strahl, *Green Goods.* (147-151). Ecocycle Commission Report 1995:5. Stockholm: Ecocycle Commission, p. 147.

97 Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C, p. 6.

98 Dutch Ministry of Housing, Physical Planning and Environment. (1991). *Packaging Covenant.* The Hague: Ministry of Housing, Physical Planning and Environment.

legislation. These maximum levels can only be exceeded under specified conditions and following the consent of the EU Commission.[99]

For other selected products, and specifically for end-of-life vehicles and waste electrical and electronic equipment, the EU Commission initiated working groups that would find consensus solutions for these products. A number of reports have been issued and final recommendations given from the working groups. However, the European Parliament only passed the directive for end-of-life vehicles in spring 2000, and the interpretation of the decision is still being argued. Consequently, neither the end-of-life vehicle directive nor the waste electrical and electronic equipment directive has been adopted finally yet.

3.5 Key Issues Concerning EPR Systems

3.5.1 Reasons for EPR

In the first studies that the author specifically devoted to the EPR concept, the motivation for the EPR approach was connected to the need for promoting environmentally conscious product development and to signal the end-of-life related costs to the consumer at the time of buying the product.[100]

Lifset (1993) pointed to four motivations underlying EPR:

> *(1) to bring about specific results, especially to achieve high levels of reuse, recycling and related forms of recovery…*
>
> *(2) to alter behavior, particularly to influence materials use and product design decisions by producers;*
>
> *(3) to tap expertise of producers for activities that relate to their capabilities as designers, manufacturers, marketers and distributors; and*

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[99] European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. OJ L 365 31.12.94 p. 10-23.

[100] Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products] (7-44). Stockholm: Ministry of the Environment. (Ds 1991:9), p. 33.

> *(4) to obtain financial resources to allow more ambitious environmental and, especially, waste management goals to be achieved than could be accomplished through public, taxed-based sources.*[101]

Vogel, in a report in 1994, discussed the rationale for the EPR introduction with the Austrian Packaging Ordinance [102] and the Ordinance of Goals for Packaging Waste [103]. By referring to the law of demand and supply, he argued that when the manufacturer had to pay for the recovery, he would try to minimise the costs of recovery and for that purpose investigate the possibilities of substituting virgin materials with secondary materials. He further stressed the negative aspect of the accumulated effect of the licence fees for all packaging used by a company and the incentive for change created by this.[104]

McCarthy (1993) illustrated the root of the problem when he discussed the merits of various systems for collecting recyclables. In comparing deposit-refund systems for beverage containers that incorporated take-back by manufacturers, distributors, and retailers with kerbside collection systems organised without any assigned responsibilities for these actors, he noted the argument of many concerned industries that the latter programmes do not directly affect product prices and consumption. But he continued:

> *At the same time, manufacturers are free to introduce new packages without concern for their impact on waste management. Not having to recycle the material, some use packages that interfere with the quality of what is collected. In recent years, waste management officials have complained about such packages as glass beer bottles with ceramic tops (ceramics are incompatible with the recycling of glass containers) and soft drink and water*

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[101] Lifset, Reid. (1993). Take it Back: Extended Producer Responsibility as a Form of Incentive-based Environmental Policy. *The Journal of Resource Management and Technology, 21,* p. 166.

[102] Verordnung über die Vermeidung und Verwertung von Verpackungsabfällen und bestimmten Warenresten (VerpackVO) [Ordinance on the Avoidance and Recovery of Packaging Waste and Specified Product Residues]. BGBI. 645/1992.

[103] Verordnung über die Festsetzung von Zielen zur Vermeidung und Verwertung von Abfällen von Getränkeverpackungen und sonstigen Verpackungen (ZielVO Verpackabfälle) [Ordinance on the Target Setting for Avoidance and Recovery of Waste from Beverage Packaging and other Packaging]. BGBI. 646/1992.

[104] Vogel, Gerhard. (1994). *Abfallvermeidung und Abfallverringerung in folge der VerpackVO* [Waste Avoidance and Waste Minimisation as a Result of the Packaging Ordinance]. Vienna: Wirtschaftsuniversität Wien, Institut für Technologie und Warenwirtschaftschaftslehre, p. 7 & p. 2.

> *bottles that use PVC plastic. PVC is incompatible with the more common PET in recycling processes, and is difficult to identify and separate.* [105]

The Ecocycle Commission expressed the need for EPR to ensure that the marketed products make the least possible impact on the environment and use as few resources as possible in the manufacturing and upstream phases, during usage and disposal. It was explicitly stated that producer responsibility extending to end-of-life products must provide drivers for product improvement. Objectives in terms of collection, reuse, recycling and final treatment of discarded product should be achieved.[106]

Greenpeace International spoke about the idea of EPR "to encourage producers to prevent pollution and reduce resource and energy use in each stage of the product life-cycle through changes in product design and process technology". It was further stated that the quintessence of EPR was that producers would incorporate a broader range of environmental considerations into the product design.[107]

A recent example of the problems concerning products that have not been designed for recycling is the work-environment problem connected to the dismantling of plastics that contain brominated flame retardants from electronic and electrical equipment. The managing director of the trade organisation for Swedish recyclers, Annika Helker-Lundström, was quoted as having said that in practice this meant that the recycling companies were left to deal with all the problems.[108]

Wijnen (1997) explained the rationale of the Dutch adoption of EPR as a general acceptance of the responsibility from the producers, the internalisation of disposal costs in product prices and improvement of

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[105] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 19.

[106] Ecocycle Commission. (1996). *Producentansvar för elektriska och elektroniska produkter* [Producer Responsibility for Electrical and Electronic Equipment]. Kretsloppsdelegationens rapport 1996:12. Stockholm: Kretsloppsdelegationen, Miljödepartementet, p. 25.

[107] Kruszewska, Iza, & Thorpe, Beverly. (1995). *Strategies to Promote Clean Production: 4. Extended Producer Responsibility.* Amsterdam: Greenpeace International, p. 3.

[108] *MiljöRapporten.* (1999). Stockholm: Ekonomi-Teknik Förlag AB. No. 14, p. 14.

products.[109] Tanaka (1999) supported the same argument stating that EPR internalises environmental and other external costs in the entire life cycle of the product and will thereby lead to Design for Environment.[110]

Jobin, representative of the Federation of Swedish Industries, saw the essence of producer responsibility in the fact that it "can, if it is based on competition, be made a flexible, dynamic self-policing system with built in incentives to rationalisation and efficiency".[111] He argued for the transfer of the responsibility for waste management from the local administrations to industry in light of the change from being only a local problem to the need for national and international solutions.

3.5.2 What is EPR?

In the first formal definition the author determined EPR as strategy to achieve a decreased total environmental impact from the entire life cycle of the product.[112]

Davis (1994) introduced EPR as an "emerging principle for a new generation of pollution prevention policies that focus on product systems instead of production facilities". He continued by defining EPR as:

> *Extended Producer Responsibility is the concept that manufacturers and importers of products bear a degree of responsibility for the environmental impacts of their products throughout the products' life-cycles, including upstream impacts inherent in the selection of materials for the products, impacts from manufacturers' production process itself, and downstream impacts from the use and disposal of the products. Producers accept their responsibility when they design their products to minimize the life-cycle environmental*

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[109] Wijnen, Henk. (1997). Product-oriented Environmental Policy as a Policy Objective for an EPR Programme. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada, p. 1.

[110] Tanaka, Masaru. (1999). Waste Minimisation, Recycling and Waste Management in the 21st Century. In *OECD Workshop on Extended Producer Responsibility and Waste Minimization Policy in Support of Environmental Sustainability,* 4-7 May 1999, Paris, p. 4.

[111] Jobin, Bengt. (1997). Extended Producer Responsibility: Who is the producer?. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada, p. 1.

[112] Lindhqvist, Thomas. (1992). Mot ett förlängt producentansvar - analys av erfarenheter samt förslag [Towards an Extended Producer Responsibility - analysis of experiences and proposals]. In Ministry of the Environment and Natural Resources, *Varor som faror - Underlagsrapporter* [Products as Hazards - background documents] (229-291). Stockholm: Ministry of the Environment and Natural Resources. (Ds 1992:82), p. 238.

> *impacts and when they accept legal, physical or economic responsibility for the environmental impacts that cannot be eliminated by design.*[113]

Reijnders (1993) gave a very limited definition of the "principle of producer responsibility for post-consumer waste". He used the concept for extention of "current responsibility for waste originating during production to waste originating from used products". He compared this principle with the concept of integrated chain management. The latter had been more discussed in the Netherlands, and Reijnders viewed it as a more comprehensive approach. It is interesting to note Reijnders' appreciation of both concepts as new additions to the policy debate:

> *Most of the foundations of current environmental policy and law were laid down in the 1970s, although occasionally new ideas on implementation give rise to major changes. One example is the emergence of two proposed key aspects of environmental law and policy, both of which aim to expand producer responsibility for reducing environmental impact. These are the concept of integrated chain management and the principle of producer responsibility for post-consumer waste.*[114]

The authors of a 1996 report for the Rathenau Institute assigned the introduction of the producer responsibility concept in the Netherlands in 1990 to the Minister of Housing, Spatial Planning and Environment. A number of quotations from the government document were used to support the argument that it was in the context of waste management and recycling that EPR had been introduced. A direct connection between EPR and the closing of material loops was traced from this. The authors saw the presumed link to sustainable development as being less explicit.[115] It was,

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[113] Davis, Gary. (1994). Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention. In C. A. Wilt, & G. A. Davis, *Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention*, 14-15 November 1994, Washington, D.C. (1-14). Knoxville, TN: Center for Clean Products and Clean Technologies, The University of Tennessee, p. 1.

[114] Reijnders, Lucas. (1993). Expanding Producer Responsibility for Reducing Environmental Impact. *Tijdschrift voor Milieu Aansprakelijkheid* [Environmental Liability Law Review], *7,* p. 69.

[115] Vermeulen, W.J.V., Weterings, R.A.P.M., Stevels, A.L.N., & Brezet, J.C. (1996). *Van afvalzorg naar milieu-innovatie van produkten: een visie op producentenverantwoordelijkheid* [From Waste Management to Environmental Innovation of Products: A vision of producer responsibility]. The Hague: Rathenau Instituut, p. 8.

however, noted that alternative definitions of producer responsibility existed outside the Netherlands.[116]

In the USA, the President's Council on Sustainable Development (PSCD) published its policy recommendations concerning EPR in 1996. The concept had now been redefined to Extended Product Responsibility.

> *Extended product responsibility is an emerging practice that considers the entire life of a product, from design to disposal, to identify opportunities for resource conservation and pollution prevention. Under extended product responsibility accountability for the environmental impacts of products and waste streams is shared among manufacturers, suppliers, users (both public and private), and disposers of products.*
>
> …
>
> *A goal of extended product responsibility is to identify those actors with the greatest ability to reduce the environmental impact of specific products. In some cases, this may be the producer of raw materials, in other cases, the end user.* [117]

The report from PCSD stressed that it considered voluntary assumption of responsibility to be ideal; however, if sufficient progress was not reached within four years after a programme launch, then national legislation assigning responsibility should be drafted.[118]

Industry representatives have on a number of occasions emphasised the approach to EPR that was expressed in the PSCD report. The U.S. Council for International Business talked about Shared Product Responsibility (SPR), encompasses a responsibility and role for all parties along the chain of commerce. The system should "place responsibility on the actors and activities that control the critical decisions at each stage of the life of a product".[119] The Business and Industry Advisory Committee (BIAC) to the OECD also supported the concept of Shared Product Responsibility, which

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[116] The Dutch word 'producentenverantwoordelijkheid' ('producer responsibility') was used by the authors of the report in opposition to the English term 'extended producer responsibility'. The latter was given a broader scope, extending over the life cycle of the product. (Ibid., p. 8)

[117] President's Council on Sustainable Development. (1996). *Eco-Efficiency Task Force Report.* Washington, D.C.: President's Council on Sustainable Development, p. 17.

[118] Ibid., p. 17.

[119] U.S. Council for International Business. (1997). Shared Product Responsibility. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada.

they equalised with Extended Product Responsibility. The concept was expressed as:

> *A voluntary system that ensures responsibilities for the environmental effects throughout a product's life cycle by all those involved in the life cycle. The greatest opportunity for extended product responsibility rests with those throughout the commerce chain – designers, suppliers, manufacturers, distributors, users, and disposers – that are in a position to practice resource conservation and pollution prevention at lower cost.*[120]

It is interesting to note that, presumably, many of the industry representatives have decided to start by defining EPR as a system for voluntary and shared responsibility, rather than elaborating what should be the purpose of the implementation of such a system.

The Swedish Ecocycle Commission used in connection with their report on electrical and electronic equipment a definition that emphasised the life cycle of the product:

> *Producer responsibility means that the producer assumes responsibility for ensuring that the product manufactured or supplied by him is as adapted to ecocycles as possible. This means that the product makes the least possible impact on the environment and consumes a minimum of resources in the manufacturing and upstream stages, and in the use and scrapping.*[121]

An OECD project on EPR was begun in 1994. The project was carried out with the aid of funding provided by the Government of Japan. The work focused particularly on programmes to address the final disposal of products after their sale to and use by consumers. The OECD Phase One EPR report from 1996 defined EPR as:

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[120] Business and Industry Advisory Committee (BIAC). (1997). Shared Product Responsibility. BIAC discussion paper. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada.

[121] Ecocycle Commission. (1996). *Producentansvar för elektriska och elektroniska produkter* [Producer Responsibility for Electrical and Electronic Equipment]. Kretsloppsdelegationens rapport 1996:12. Stockholm: Kretsloppsdelegationen, Miljödepartementet, p. 23. The published translation of the text has been adjusted by the author to be closer to the Swedish text. The published translation uses 'producer liability' and 'producer responsibility' interchangeably in the referenced section for the Swedish 'producentansvar'. Here 'producer responsibility' is preferred.

> *EPR is defined, for purposes of the OECD project, as the extension of the responsibilities of producers to the post-consumer stage of products' life cycles.*[122]

The OECD continued its efforts to explore the EPR approach. Phase Two consisted of in-depth case studies on existing EPR systems, examination of possible trade implications, economic analysis of EPR options, as well as the development of an framework report for implementing EPR programmes with a particular focus on the policy and legal considerations for sharing responsibility.[123] The OECD Phase Two Framework Report from 1998 defined EPR as:

> *Extended Producer Responsibility is the concept that manufacturers and importers of products should bear a significant degree of responsibility for the environmental impacts of their products throughout the product life-cycle, including upstream impacts inherent in the selection of materials for the products, impacts from manufacturers' production process itself, and downstream impacts from the use and disposal of the products. Producers accept their responsibility when they design their products to minimise life-cycle environmental impacts, and when they accept legal, physical or socio-economic responsibility for environmental impacts that cannot be eliminated by design.*[124]

As also noted in the report, this definition was closely built upon the definition by Davis (1994). The OECD efforts concerning EPR continue and a final report from Phase Three is expected in mid-2000.

Shiota (1999), representing the Japanese Ministry of Health and Welfare, expressed himself in a more cautious way by defining EPR as "the concept that producers assume certain responsibilities in connection with the disposal of their products discarded by customers".[125]

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122 OECD. (1996). *Extended Producer Responsibility in the OECD Area. Phase 1 Report. Legal and Administrative Approaches in Member Countries and Policy Options for EPR Programmes.* OECD Environment Monographs No. 114. Paris: OECD (OCDE/GD(96)48), p. 15.

123 OECD. (1998). *Extended and Shared Producer Responsibility. Phase 2. Framework Report.* Paris: OECD (ENV/EPOC/PPC(97)20/REV2), p. 2

124 Ibid., p. 8.

125 Shiota, Yukio. (1999). EPR and Waste Minimization Policy: Japan's perspective. In *OECD Workshop on Extended Producer Responsibility and Waste Minimization Policy in Support of Environmental Sustainability,* 4-7 May 1999, Paris, p. 3.

3.5.3 Who is the Producer?

In the 1990 study the author was quite directly addressing the manufacturer (tillverkaren) as the producer.[126] In the discussions that have followed in the 1990s, the question has come into the centre of interest in many of the policy discussions and in connection with the elaboration of specific systems.

In comparing EPR (producer responsibility) and integrated chain management, Reijnders pointed to the more pragmatic approach of the former, as "it names the responsible party". For integrated chain management he made the opposite conclusion and stated that this concept would not provide a firm basis for policy as long as this question was not answered.[127]

Clement (1998), representing the Dutch Ministry of Environment, was quite clear about the need for defining a definite producer: "there has to be one party that has final responsibility to arrange things". Referring to packaging, he explained that the packer/filler had been selected by almost all countries because this actor had the most influence on the process, and therefore was "held responsible for taking the initiative for change".[128]

PSCD expressed the need for a shared responsibility and that linking product responsibility solely to the producer would neglect involving all actors in the quest for sustainable development. Instead, industry representatives argued that all actors along the product chain should accept "an appropriate degree of responsibility for the life-cycle environmental impact of the whole product system".[129] Effective measures to achieve

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[126] Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the Cradle to the Grave - six studies of the environmental impact of products] (7-44). Stockholm: Ministry of the Environment. (Ds 1991:9), p. 33.

[127] Reijnders, Lucas. (1993). Expanding Producer Responsibility for Reducing Environmental Impact. *Tijdschrift voor Milieu Aansprakelijkheid* [Environmental Liability Law Review], *7,* p. 70.

[128] Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 3.

[129] Brewer, Chip. (1997). Extended Product Responsibility: The Shared Roles in Waste Reduction, Pollution Prevention and Resource Conservation. In *OECD International*

substantial improvements demand co-operative approaches, and a need and an opportunity for partnerships throughout the product chain are created.[130]

The Association of German Automotive Industry also argued that the responsibilities must be shared. These responsibilities would be defined in a better and more effective manner through voluntary agreements than by government regulations. The automobile manufacturers and their suppliers were prepared to assume responsibility for primarily the design, development and construction of their products. However, the vehicle owner was to be responsible for the use phase and for handing in the end-of-life vehicles, and, when necessary, pay the costs for dismantling "as he influences the value of the vehicle and can obtain the best price when trading it in".[131]

Jobin (1997) wanted responsibilities to be assigned jointly to all those belonging to the chain from raw materials extraction to trade. The allocation among these actors would then be sorted inside this group.[132]

In an OECD case study on the German Packaging Ordinance, it was stated that "the philosophy of giving the private sector a 'free hand' to make product changes and manage wastes" was claimed to be "the most effective and flexible means of regulation". It was, however, warned that the free market may also select the least actor with least abilities to pass on primary responsibilities.[133]

Workshop on Extended Producer Responsibility: Who is the producer?, 2-4 December 1997, Ottawa, Canada.

130 Galeano, Sergio F. (1997). Sharing Responsibility for the Product along Its Life Cycle - A New Paradigm. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada.

131 Wöhrl, Stefan. (1997). Statement of VDA (Association of the German Automotive Industry). In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada.

132 Jobin, Bengt. (1997). Extended Producer Responsibility: Who is the producer?. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada, p. 2.

133 OECD. (1998). *Extended Producer Responsibility. Phase 2. Case Study on the German Packaging Ordinance.* Paris: OECD (ENV/EPOC/PPC(97)21/REV2), p. 18.

3.5.4 Producer Responsibility Organisations

It has often been convenient to organise the EPR systems around an organisation that is responsible for the every-day work necessary for the system to function. The deposit-refund system for aluminium cans introduced in Sweden in 1984 includes a company, Returpack, which receives the advanced disposal fees. Returpack administers the flow of money in the system and supervises the practicalities of the collection, as well.

A similar organisation, Duales System Deutschland, was formed in Germany when the packaging ordinance was introduced in 1991. Several other systems have, subsequently, built their systems around such a Producer Responsibility Organisation (PRO).

3.5.5 Defining the Responsibility of the Retailers

One of the problems connected with take-back requirements mandating retailers to accept discarded products is the possible uneven division of labour for the various types of retailers. It has been claimed that there is an obvious risk that consumers will buy many products during a weekly shopping tour to supermarkets situated at a distance from their homes, while it will be more likely that they will return the end-of-life products to retail outlets in the vicinity of their homes, which may be mostly smaller shops. This action pattern would pose an uneven burden on the various types of retailers. The burden of taking back a certain number of products would not directly be covered by the profits from the sale of a much smaller number of products. The ideal situation would be a more balanced relationship, meaning that each retailer receives a share of returned products corresponding to what has been sold by his shop.

There are various ways of dealing with this problem. The Swedish deposit-refund system for aluminium cans and PET bottles have solved the problem by compensating the retailers for each aluminium can and each PET bottle belonging to the system that they accept.[134] Other deposit-refund systems have lacked a similar instrument and have also met criticism by involved retailers.

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[134] Vanthournout, Helga. (1998). *Beverage Container Recycling Systems in Germany, Sweden, and Switzerland.* IIIEE Thesis, Lund: IIIEE, Lund University, pp. 41, 48.

The Ecocycle Commission addressed the same problem concerning the return of electrical and electronic equipment (EEE). In this context the Commission proposed a number of rules to be included in the ordinance on EEE:[135]

- *The sale rule*
  The retailers must accept a returned product in conjunction with the sale of a product of the same type, disregarding the brand. That is, when selling a dishwasher, the retailer must be ready to accept a dishwasher of any make.
- *The representative rule*
  The retailers must accept a returned product of a type and make that he is selling. That is, if the retailer is selling Electrolux dishwashers, then he must also accept discarded Electrolux dishwashers.
- *The local authority rule*
  The local authorities must accept end-of-life products if there is no retailer obliged to accept the product according to the representative rule or if the local retailers have fulfilled their share of mandated take-back. The latter refers to the fact that the total obligation according to the sale rule and the representative rule was proposed to be limited in relation to the shop's sale of the products in question. The local authority, according to the proposal, would also always be obliged to accept discarded EEE from private consumers.

The Ecocycle Commission proposal additionally mandated the retailers to inform the consumers about their take-back obligations, so they would be aware of this method of handing in end-of-life EEE.

The pending final proposal for an ordinance on EEE in Sweden has lost the section concerning the representative rule and is only proposing to mandate the retailers to accept used EEE products according to the sale rule.[136] On

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[135] Ecocycle Commission. (1996). *Producentansvar för elektriska och elektroniska produkter* [Producer Responsibility for Electrical and Electronic Equipment]. Kretsloppsdelegationens rapport 1996:12. Stockholm: Kretsloppsdelegationen, Miljödepartementet, pp. 77-82.

[136] Swedish Environmental Protection Agency [Naturvårdsverket]. (1999). *Elektriska och elektroniska produkter* [Electrical and electronic products]. [Online]. Available: http: //www.environ.se/index.php3?main=/dokument/teknik/elektro/eledok/elektro.htm [1 April 2000].

the other hand, the Norwegian regulation on scrapped electrical and electronic products [137], put in force in March 1998, has a wider scope:

> *The Distributor of EE Products shall be obliged to accept as returns EE Waste, which is consumer waste free of charge at his place of business. The Distributor shall only be obliged to accept EE Waste, which is production waste free of charge against new purchases of an equivalent quantity of new products. The reception obligation shall be restricted to such EE Products as the Distributor sells, plus EE Products he has previously sold within the same product range. The reception obligation shall not be restricted to brand or manufacture.*[138]

3.5.6 Sanctions

When a government imposes a specified responsibility on an actor, it should also know what to do in case the requirements are not fulfilled. In other words, there should be a "threat", which could be implemented in case of non-compliance.

The German Packaging Ordinance of 1991 could be said to include such a sanction. The Ordinance forces the retailers to accept discarded packaging, unless a system fulfilling specified demands is organised. It is obvious that the retailers do not want to organise a packaging collection in the shops, and, hence, the requirements of the Ordinance function as a "threat" in case the collection organised through the DSD does not work. The sanction in the German Packaging Ordinance is mainly a collective sanction. If one material fails to reach the preset recycling levels, then Government could force an implementation of collection in shops for that specific material.[139]

Clement (1998) explained the problem by first stating that industry could be given much freedom of choice to choose the way to reach the goals set by

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[137] Forskrift om kasserte elektriske og elektoniske producer [Ordinance on Scrapped Electrical and Electronic Products]. Fastsatt av Miljøverndepartementet 16. mars 1998 med hjemmel i lov av 13. mars 1981 nr. 6 om vern mot forurensininger og om avfall (forurensningsloven) § 33, jf. kgl.res. av 8. juli 1983 og 11. juni 1993 nr. 785, og lov av 11. juni 1976 nr. 79 om kontroll med produkter og forbrukertjenester (produktkontrolloven) § 4, jf. kgl.res. av 7. September 1990 nr. 730. Endret 11 juni 1999 nr. 696.

[138] Norwegian Royal Ministry of the Environment. (1998). *Regulations. Scrapped Electrical and Electronic Products*. Oslo: Det kongelige miljøverndepartement, p. 4.

[139] Verordnung über die Vermeidung und Verwertung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 27. August 1998 (BGBI. I 1998 S. 2379) [Ordinance on the Avoidance and Recycling of Packaging Waste (Packaging Ordinance)], § 6 (4).

society, but at the same time there needed to be a certain pressure from government: "Putting responsibility on an economic actor without any guarantee that the goals will be reached is meaningless."[140]

The Danish EPA stressed the need for combining the implementation of take-back and EPR with a credible sanction in the form of, for instance, deposit-refund or fees in case the targets were not reached.[141]

3.5.7 Free Riders

The discussion about sanctions in the preceding section is closely related to the problem with free riders. Free riders of various types have been observed in many of the EPR systems. The German packaging collection under the Dual System has had an estimated cost of DEM 400 million annually because of free riding.[142] The free riding in this system has been of various types. Wastes for which the licenses have not been paid enter the system, households mix packaging waste which is licensed with waste which is not licensed.

Clement (1998) stated that free riding must be made impossible by making it clear that the attainment of the targets was a responsibility of all individual actors. He also saw it as a precondition to getting industry to co-operate.[143]

3.5.8 Limiting the Application of an EPR System

The Swedish Packaging Commission, formed in 1990, proposed a geographically limited producer responsibility. The motives were based on

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[140] Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 3.

[141] Danish Environmental Protection Agency. (1991). *Miljøstyrelsens redegørelse vedr. tilbage-tagningspligt og producentansvar for emballageaffald* [Report of the Environmental Protection Agency on Take-back Duty and Producer Responsibility for Packaging Waste]. J.nr. M 3048-0048. 13 December 1991. Copenhagen: Miljøstyrelsen, Affalds og genanvendelseskontoret, p. 55.

[142] OECD. (1998). *Extended Producer Responsibility. Phase 2. Case Study on the German Packaging Ordinance.* Paris: OECD (ENV/EPOC/PPC(97)21/REV2), p. 36.

[143] Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 3.

the assumption that the environmental advantages of packaging collection in cities and other densely populated areas would not be present to the same extent in sparsely inhabited areas, mainly because of transportation distances. It was also noted that economic considerations would support the same conclusions.[144]

This way of limiting the responsibility because of economic problems in implementing the system points to a crucial dilemma in the design of the EPR system. These systems must be financed at reasonable costs; but at the same time the cost argument should drive change towards better-adapted products. If overall environmental improvement can be achieved by recycling and one material is readily recyclable, while recycling of the other material leads to expensive transports, then, presumably, a shift of materials should be considered. However, if the legislator has decided that the latter material, because of the higher costs, must not be recycled to the same extent, then the driver for change has been removed.

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[144] Swedish Ministry of the Environment. (1991). *Miljön och förpackningarna* [The Environment and Packaging]. SOU 1991:76. Slutbetänkande av förpackningsutredningen. Stockholm: Miljödepartementet, p. 256.

CHAPTER
FOUR

4. Overview of EPR Systems

4.1 What is Included in the Overview

Chapter 4 gives short background descriptions to some of the EPR systems that are used for the analyses in the later chapters. The main emphasis is on the Swedish systems. The selection of EPR implementations from various countries is used for exemplifying specific issues and not to provide any complete overview of existing systems.

The selection of systems in this chapter is not restricted to suit any special definition of EPR. Instead, the systems are examples of various end-of-life management systems containing elements of value for the continued discussion about the EPR concept.

4.2 Sweden

4.2.1 Background

In the Ecocycle Bill[145], which was approved by the Swedish Parliament in May 1993, EPR was addressed for the first time in a government proposal to the Parliament. The Bill, which was not a law but included proposals for changes in existing laws, defined a producer as a person who manufactures, imports or sells a product.

The fact that packaging was chosen to be the first product group, together with newsprint and tyres, was, according to the former chairman of the Ecocycle Commission, Mr. Lennart Daléus, partly explained by the fact that other product groups, for instance electrical equipment, needed more time

[145] Regeringens proposition (1992/93:180) om riktlinjer för en kretslopps anpassad samhällsutveckling (Kretsloppspropositionen) [Government Bill Laying down Guidelines for Ecocycle-Oriented Development (Ecocycle Bill)]. Stockholm (Prop. 1992/93:180).

for preparation. He also pointed to the fact that the Swedish Government attributed a symbolic value to packaging.[146]

4.2.2 Packaging

Special laws[147] require manufacturers and importers of aluminium cans and PET bottles used for beer or soft drinks to establish or join deposit-refund systems. Returpack AB is the PRO responsible for the organisation of the deposit-refund systems for aluminium cans and non-refillable PET-bottles.

The systems for refillable glass bottles and PET-bottles for beer and soft drinks are organised and managed by the breweries and retailers without the involvement of any specific PRO. In both cases, the systems involve a refundable deposit as an incentive to the consumers to return empty bottles to the retailers. In the case of the PET-bottles, the deposit-refund is a requirement of the Act on Certain Beverage Packaging.[148]

EPR for packaging was introduced for glass and corrugated cardboard packaging through an ordinance in November 1993.[149] This ordinance was replaced in August 1994 by an ordinance covering all types of packaging.[150] The latter was revised in view of the EU Directive on Packaging and Packaging Waste[151] and was replaced by a new ordinance in April 1997.[152]

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146 *MiljöRapporten.* (2000). Stockholm: Ekonomi-Teknik Förlag AB. No. 2, p. 14.

147 Lag (1982:349) om återvinning av dryckesförpackningar av aluminium [Act on Recycling of Aluminium Beverage Packaging]. SFS 1982:349, and Lag (1991:336) om vissa dryckesförpackningar [Act on Certain Beverage Packaging]. SFS 1991:336.

148 Lag (1991:336) om vissa dryckesförpackningar [Act on Certain Beverage Packaging]. SFS 1991:336.

149 Förordning (1993:1154) om producentansvar för glasförpackningar och förpackningar av wellpapp [Ordinance on Producer Responsibility for Glass Packaging and Cardboard packaging]. SFS 1993:1154.

150 Förordning (1994:1235) om producentansvar för förpackningar [Ordinance on Producer Responsibility for Packaging]. SFS 1994:1235.

151 European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. OJ L 365 31.12.94 p. 10-23.

152 Förordning (1997:185) om producentansvar för förpackningar [Ordinance on Producer Responsibility for Packaging]. SFS 1997:185.

The ordinance defines a producer as one who professionally manufactures, imports or sells packaging or a product enclosed in such a packaging.[153] The ordinance requires certain recycling levels as seen from Table 4-1.

Table 4-1. Recycling requirements in the Swedish Ordinance on Producer Responsibility for Packaging

Type of packaging	1987	30 June 2001
Aluminium (non-beverage)	50%	70%
Paper and carton	30%	40% (70%**)
Corrugated cardboard	65%	65%
Plastic (not consumer ready beverage PET)	30%	30% (70%**)
Steel	50%	70%
Refillable glass bottles for beer and soft drinks	95%*	
Refillable glass bottles for wine and liquor	90%*	
Other glass packaging	70%	70%
Beverage cans of aluminium	90%	90%
PET bottles	90%	90%
Wooden		15% (70%**)
Other materials (for each material type)		15% (30%**)

* reuse requirement, for bottles filled in Sweden only; ** total recovery requirement

The Ordinance also requires the producers to organise a suitable collection system that facilitates the separation of packaging waste. The producer is furthermore obliged to inform households and others about separation, collection and management of discarded packaging. The collection of waste packaging is organised through the establishment of a number of separate producer responsibility organisations (in Swedish called "materialbolag") for the various materials.

Sweden had an extensive system for refilling of glass bottles for wine and liquors, which was supported by a deposit-refund system. The system was dismantled in January 1999. This development could be explained, at least partly, by the breaking-up of the monopoly of importing alcoholic beverages as a result of Sweden joining the European Union.

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[153] Förordning (1997:185) om producentansvar för förpackningar [Ordinance on Producer Responsibility for Packaging]. SFS 1997:185. 3 § 3.

4.2.3 Waste Paper

The Ministry of Environment and Natural Resources proposed in 1992 to introduce EPR for waste paper.[154] In 1994, the Ordinance on Producer Responsibility for Waste Paper was enacted. The ordinance addresses newsprint, journals, telephone books, junk mail, and similar paper products. The requirement is for 75% recycling of these types of products no later than in 2000.[155] The collection is co-ordinated by a producer responsibility organisation, Pressretur,[156] and the actual collection takes place mainly by containers placed in the streets. The number of containers has grown since the introduction of the ordinance, but the recycling level was high already in 1992, as can be seen from Table 4-2. The required level has been exceeded since several years.

Table 4-2. Recycling of Waste Paper in Sweden 1992-99

Year	1992	1996	1998	1999*
Recycling rate	63%	73%	78%	80%

* Prognosis
Source: Pressretur (personal communication, December 1999)

Fine paper is not covered by the ordinance and in 1996 the Swedish EPA presented a study aiming at promoting the collection.[157] The discussion with industry led to a voluntary commitment to collect and recycle at least 50% of the fine paper no later than in 2000. A long-term target of 75% was also

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154 Swedish Ministry of the Environment and Natural Resources. (1992). *Producentansvar för avfall. Förslag till ett lagstadgat producentansvar och dess tillämpning på returpapper samt förslag till återlämningspremier för nickel-kadmiumbatterier* [Producer responsibility for waste. Proposal for a legislated producer responsibility and its implementation for waste paper, and proposal for return premium for nickel-cadmium batteries]. Stockholm: Miljö- och naturresursdepartementet. (Ds 1992:59).

155 Förordning (1994:1205) om producentansvar för returpapper [Ordinance on Producer Responsibility for Waste Paper]. SFS 1994:1205, § 1 and § 3.

156 Pressretur is owned by three major paper manufacturers: STORA (33%), SCA (33%), and Modo-Holmen (33%) (Swedish Environmental Protection Agency. (1996). *På väg mot producentansvar? En tillsynskampanj om producentansvar i praktiken* [Towards Producer Responsibility? An enforcement review of producer responsibility in practice]. Rapport 4519. Stockholm: Naturvårdsverket, p. Appendix B:2).

157 Swedish Environmental Protection Agency. (1996). *Kontorspapper. Materialflöden i samhället. Redovisning till regeringen* [Office paper. Material flows in society. Report to the Government]. Rapport 4678. Stockholm: Naturvårdsverket.

agreed upon. The EPA has followed the results of the collection and has estimated that the targeted level will be met.[158]

4.2.4 Tyres

The Ordinance on Producer Responsibility for Tyres came into force on 1 October 1994.[159] To administer the collection, a special producer responsibility organisation, Svensk Däckåtervinning AB (SDAB), was formed. Already in the end of 1995 it was estimated that the company covered 99% of the market for tyres, excluding the tyres on new cars.[160] The automotive industry was reluctant to enter into the system as they feared that the various end-of-life requirements for a vehicle would be regulated by a number of separate systems: tyres, batteries, electronics, etc. The targets were set as a percentage avoidance of landfilling; 60% in 1996, and 80% in 1998. In order to finance the system, an advanced disposal fee of SEK 7.00 per tyre was charged from importers and manufacturers.

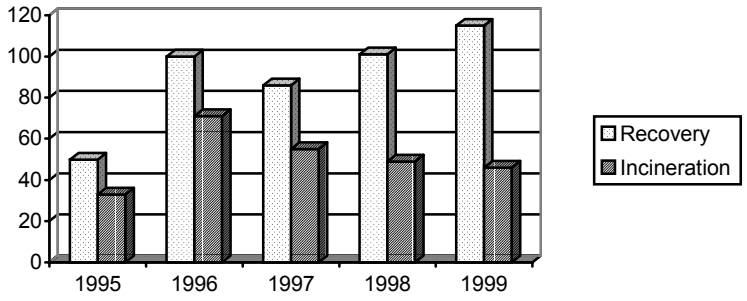

Figure 4-1. Recovery and incineration of tyres in Sweden 1995-1999[161]

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[158] Swedish Environmental Protection Agency. (1999). *Producenters ansvar för varors miljöpåverkan – underlag till en miljöanpassad produktpolitik* [Producers' Responsibility for the Environmental Impact of Products – materials for an environmentally adapted product policy]. Rapport 5043. Stockholm: Naturvårdsverket, Appendix 1, pp. 25-26.

[159] Förordning (1994:1236) om producentansvar för däck [Ordinance on Producer Responsibility for Tyres]. SFS 1994:1236.

[160] Swedish Environmental Protection Agency. (1996). *Producentansvar – det första steget* [Producer Responsibility – the first step]. Rapport 4518. Stockholm: Naturvårdsverket, p. 34.

[161] Data from SDAB, December 1999 (personal communication).

According to SDAD, the estimated average collection rate has been 95-100%. Figure 4-1 shows the recovery levels for the years 1995-1999 (the latter year is a forecasted figure). The recovery levels have fluctuated, depending on the market for discarded tyres and not because of varying collection results. Incineration, which is included in the recovery percentage, has been reduced since 1996 from approximately 70% of the recovery to 40% in 1999. Incineration is taking place in power plants and cement kilns. The 60% that was not incinerated in 1999 is being used for various purposes, including rethreading, for sports arenas, and protection during blasting operations.[162]

4.2.5 Cars

The Swedish Parliament introduced in 1975 a deposit-refund system for cars. The system was created to combat problems with cars being abandoned in nature and car scrappers not taking necessary precautions when dealing with engine fluids, etc. The system proved successful for promoting the last car owners to return their cars. However, the system lacked incentives for increased recycling and product improvement. With the introduction of the EPR approach, it became obvious to the automotive industry that the Swedish Government would study the feasibility of replacing the old car scrapping system with an EPR system.

The Association of Swedish Automobile Manufacturers and Wholesalers (BIL) formed a recycling group consisting of participants from member companies, as well as the author and his colleague Erik Rydén. In September 1994, the group presented its "Framework for a future system for environmentally sound management of end-of-life vehicles in Sweden".[163, 164, 165] The ideas and proposal will be further elaborated in Section 8.1.

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[162] Swedish Environmental Protection Agency. (1999). *Producenters ansvar för varors miljöpåverkan – underlag till en miljöanpassad produktpolitik* [Producers' Responsibility for the Environmental Impact of Products – materials for an environmentally adapted product policy]. Rapport 5043. Stockholm: Naturvårdsverket, p. 15.

[163] The Framework is included as an attachment in: Rydén, Erik. (1995). *Car Scrap: Throw It Away or Make It Pay*. IIIEE Dissertations 1995:2. Lund: IIIEE, Lund University, pp. B-2 - B-18.

[164] Kvist, Karin, & Rydén, Erik. (1995). *Miljöanpassat bilåtervinningssystem* [Environmentally adapted car recycling system]. Rapport FoU 121. Malmö: Stiftelsen REFORSK.

In 1995, the Ecocycle Commission presented its proposal.[166] In 1996, after a massive critique of this proposal, the Government presented a bill to Parliament that included part of the proposals from BIL, and part of the proposal from the Ecocycle Commission.[167] In 1997, the Ordinance on Producer Responsibility for Cars was enacted. The ordinance requires producers, that is, manufacturers and importers, to accept end-of-life vehicles free-of-charge if they have been registered for the first time after 31 December 1997. At least 85% of the vehicles should be reused or recycled from 2002, and 95% from 2015.[168]

4.2.6 Electronic and Electric Equipment

The Swedish Government is in the final stages of preparig an ordinance on electrical and electronic equipment. The ordinance will require the producer to accept one old piece of equipment free-of-charge when a customer buys a new piece of equipment of the same type. Owners of old equipment will also be able to hand in their equipment to collection centres organised by the local authorities. The proposed system has been widely criticised as it does not include any incentives for product development. Further, it will not be very easy to communicate to consumers.[169] The proposal from the

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165 Kvist, Karin, Jansson, Ulf, Lindhqvist, Thomas, & Rydén, Erik. (1993). A Future Vehicle Recycling System: Recycling – Coordination and Planning are Necessities – Seen Against Experiences from the Swedish Car Scrapping System. In *First Annual World Car 2001 Conference*, 22 June 1993, College for Engineering, Center for Environmental Research and Technology, University of California.

166 Ecocycle Commission. (1995). *Förslag till producentansvar för uttjänta bilar i Sverige* [Proposal for Producer Responsibility for Used Cars in Sweden]. Kretsloppsdelegationens rapport 1995:9. Stockholm: Kretsloppsdelegationen, Miljödepartementet.

167 Regeringens proposition 1995/96:174. *Producentansvar för uttjänta bilar, m.m.* [Producer Responsibility for used cars, etc.]. Stockholm (Prop. 1995/96:174).

168 Förordning (1997:788) om producentansvar för bilar [Ordinance on Producer Responsibility for Cars]. SFS 1997:788, § 2, § 7.

169 Swedish Environmental Protection Agency. (1999). *Producenters ansvar för varors miljöpåverkan – underlag till en miljöanpassad produktpolitik* [Producers' Responsibility for the Environmental Impact of Products – materials for an environmentally adapted product policy]. Rapport 5043. Stockholm: Naturvårdsverket, pp. 21-23.

Ecocycle Commission included more comprehensive responsibilities for the manufacturers (see also Section 3.5.5).[170]

4.2.7 Batteries

There have been several attempts in Sweden to organise an efficient collection of batteries in Sweden. The collection of starter batteries (lead-acid) for cars and other vehicles is working today with a reasonable return rate. The system is built on an advanced disposal fee to finance the work of the scrap dealers, transports and, to the extent necessary, the recycling of the batteries. The advanced disposal fee, SEK 30 (USD 3.50), is paid by manufacturers and importers.

The collection of button cell batteries has been successful, presumably because most of these batteries are exchanged in specialised shops. For all other types of batteries the collection so far has not been successful. A true EPR system has not been installed. Instead, collections organised by local authorities were tried in the later part of the 1980s. This was replaced by a voluntary commitment by producers and retailers to collect nickel cadmium batteries. When the latter collection failed, the physical responsibility was once again given to the local authorities. For more than ten years, the manufacturers and importers have funded the collection and recycling activities by fees paid to the Swedish EPA.

4.2.8 Furniture, textiles, and construction materials

The Ecocycle Commission has looked into the usefulness of introducing EPR for a number of additional products, including furniture,[171] textiles,[172]

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[170] Ecocycle Commission. (1996). *Producentansvar för elektriska och elektroniska produkter* [Producer Responsibility for Electrical and Electronic Equipment]. Kretsloppsdelegationens rapport 1996:12. Stockholm: Kretsloppsdelegationen, Miljödepartementet.

[171] Ecocycle Commission. (1997). *Producentansvar för möbler* [Producer responsibility for furniture]. Kretsloppsdelegationens rapport 1997:15. Stockholm: Kretsloppsdelegationen, Miljödepartementet.

[172] Swedish Environmental Protection Agency. (1996). *Textil och miljö. Redovisning till Kretsloppsdelegationen* [Textiles and Environment. Report to the Ecocycle Commission]. Rapport 4668. Stockholm: Naturvårdsverket.

and construction materials.[173] For all of these product groups various voluntary initiatives have been started.

4.3 Federal Republic of Germany

The German EPR implementation is today based on the Closed-Loop Economy and Waste Law from 1994. The third part of the Law (§§ 22-26) is devoted to EPR (Produktverantwortung).[174] The revised Packaging Ordinance from 1998 is based on this law. Table 4-3 includes the requirements of the first Packaging Ordinance (1991), as well as the revised Ordinance. The requirements in the first ordinance were expressed as collection and sorting targets. In Table 4-3 these requirements have been multiplied to calculate the desired recycling levels.

Table 4-3. German Packaging Ordinances – Recycling Requirements

	Ordinance 1991**			Revised Ordinance***	
	Collection 1996	Sorting 1996	Recycling* 1996	Recycling 1996****	Recycling 1999
Glass	80%	90%	72%	70%	75%
Paper, cardboard	80%	80%	64%	50%	60%
Plastics	80%	80%	64%	50%	60%
Tinplate	80%	90%	72%	70%	70%
Aluminium	80%	90%	72%	50%	60%
Beverage cans	80%	80%	64%	50%	60%

* Recycling targets are implicit from the ordinance. **** In reality, a retroactive requirement.
Sources: ** Packaging Ordinance (1991)[175] *** Packaging Ordinance (1998)[176]

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[173] Ecocycle Commission. (1996). *Producentansvar i byggsektorn* [Producer Responsibility in the Construction Sector]. Kretsloppsdelegationens rapport 1996:11. Stockholm: Kretsloppsdelegationen, Miljödepartementet.

[174] Gesetz zur Förderung der Kreislaufwirtschaft und Sicherung der umweltverträglichen Beseitigung von Abfällen (Kreislaufwirtschafts- und Abfallgesetz – KrW-/AbfG) vom 27. September 1994 (BGBl. I 1994 S. 2705, BGBl. I 1996 S. 1354) [Law for Promotion of a Closed-Loop Economy and to Secure Environmentally Sound Disposal of Wastes (Closed-Loop Economy and Waste Law)].

[175] Verordnung über die Vermeidung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 12. Juni 1991 (BGBl. I 1991 S. 1234) [Ordinance on the Avoidance of Packaging Waste (Packaging Ordinance)].

The revised version explicitly demands material recycling. The Ordinance gives an allowance for energy recovery only for plastics: 60% of the required quota must undergo material recycling, but the remaining 40% can be recovered as energy.

The method of calculating the results of the packaging collection was changed following the revised Packaging Ordinance. This means that the results for 1997 and 1998 are not immediately comparable.[177] From the point of view of evaluating the total impact of the packaging collection, the recycling and collection results for 1997 are of more interest and they will consequently be used in Chapter 5. A recalculation of the results for 1997, using the model for 1998, showed that the results are comparable in all important aspects. The more significant, notable differences can be explained, for the most part, by new definitions, for instance, by new criteria for determining the quantity of composites.[178]

In the very beginning of the 1990s, the German Government prepared a number of other ordinances. A draft of an ordinance for end-of-life vehicles was proposed originally in 1990, and was circulated by the Federal Environment Ministry in August 1992.[179] This draft, as well as a draft published later, demanded the hand-in of old cars free-of-charge for the last owner and specified recycling quotas for a number of materials: steel (ca 100%), non-ferrous metals (90%), plastics (80%, elastomers: 50%), tyres (80%), glass (60%), and other fractions (50%).[180] However, the ordinance was, instead, replaced with a voluntary commitment, including a promise to reduce the waste for disposal at landfill to a maximum of 15% by 2002 and

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[176] Verordnung über die Vermeidung und Verwertung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 27. August 1998 (BGBI. I 1998 S. 2379) [Ordinance on the Avoidance and Recycling of Packaging Waste (Packaging Ordinance)].

[177] Duales System Deutschland AG. (1999). *Mass Flow Verification 1998*. Cologne: Duales System Deutschland AG.

[178] Duales System Deutschland AG. (1999). *German citizens set an ecological example: Collection and recycling are still the trend.* Press Information. 3 May 1999. Cologne: Duales System Deutschland AG.

[179] Fishbein, Bette K. (1994). *Germany, Garbage, and the Green Dot. Challenging the Throwaway Society*. New York: INFORM, p. 135.

[180] Entwurf: Verordnung über die Entsorgung von Altautos "Vom ...". Referat WA II 4, WA 4 – 30 114-1/6. Stand: 27. Januar 1994 [Draft: Ordinance on the Management of End-of-Life Vehicles], § 6. All figures are the reuse and recycling requirements for 2000.

to a maximum of 5% by 2015. The agreement does not guarantee free-of-charge hand-in for the last owner.[181]

The ordinance on electrical and electronic equipment, first presented in draft form in 1991, has still not been enacted. The construction industry has committed on a voluntary basis to reduce the amount of construction waste landfilled to maximum 50% by 2005.[182] A voluntary commitment concerning graphic papers (newspapers, magazines, etc.) aimed for a 70% recycling by the year 2000. Already in 1996, a recycling level of 72% was reached.[183]

In April 1998, an ordinance on used batteries came into force. The retailers must take back batteries free of charge, and they must inform the customers about this opportunity to hand in old batteries. The manufacturers must, in turn, accept batteries from retailers and municipal waste collections, also free of charge.[184]

4.4 The Netherlands

The basis for the product policy in the Netherlands has been the attempt to find collaborative solutions. In June 1991 a covenant – a voluntary agreement – was reached concerning packaging. It seems quite clear that industry had no choice of totally escaping responsibility for the packaging waste. Instead, the voluntary agreement left industry with more freedom in selecting the implementation of the system.

The main goals of the Packaging Covenant were to remove landfilling of packaging waste by 2000, to limit the total amount of packaging to the 1986 level, and to achieve a recycling level of 60%. When the European Union Packaging and Packaging Waste directive had been published in 1994, the Dutch Government had to implement it into the national legislation. The

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181 Jaeckel, Ulf. (1998). EPR in Germany – Key Elements. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 5.

182 Ibid., pp. 4-5.

183 Jaeckel, Ulf. (1997). EPR in Germany. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada, p. 6.

184 Jaeckel, Ulf. (1998). EPR in Germany – Key Elements. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 3.

challenge for the Government was to retain the targets of the 1991 Covenant, and actually to motivate that the already achieved results should be maintained, as they were higher than the stipulated maximum levels in the directive. The result became the packaging regulation of August 1997. This regulation allocated an individual responsibility for each packer/filler to prevent and recycle. However, he could be relieved from these individual obligations if he became a partner in a covenant with the Government. The Covenant agreed upon in December 1994 was as ambitious as the 1991 Covenant. The overall recycling rate had to reach 65% by 2001.[185]

End-of-life vehicles have also received attention in the Netherlands. A plan for how to solve the problems with car wrecks was elaborated by a group with participants from all interested parties in the car chain. This work led to the formation of Auto Recycling Netherlands (ARN), with the goal of encouraging recycling and upgrading the treatment of cars in the scrap yards. ARN provides subsidies for dismantling specific materials, such as rubber, glass, liquids, and various plastic components, from the scrap cars. The hand-in of the end-of-life vehicles is free of charge for the last owner if the dismantler wants to be a member of the ARN organised system. The costs of the system are paid by a fee, which is imposed on all cars entering the Dutch market. The fee was NLG 250 (USD 110) for the period 1995-1998, but was reduced to NLG 150 (USD 66) for the period 1998-2000. The system aimed for a recycling level of 86%, which has been achieved for several years.[186]

The Dutch Government aimed at reaching a voluntary agreement covering a large share of the electrical and electronic equipment (white and brown goods)[187]. However, the discussions did not lead to any acceptable results and in 1998 the Government issued a decree covering these products.[188]

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185 Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 4.

186 Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 4.

187 The total amount was estimated at approximately 125 000 tonnes annually. Of this amount 85 000 tonnes were white goods (refrigerators, washing machines, dishwashers, etc.), 30 000 tonnes of brown goods (TVs, computers, audio equipment, etc.) and 10 000 tonnes of small domestic appliances (vacuum cleaners, coffee machines, etc.). (Ibid., p. 5).

188 Decree of April 21, 1998, No. 238, to establish rules for taking back and processing white and brown goods after use (Disposal of White and Brown Goods Decree). (Unofficial

Producers and importers have to take back appliances collected by local authorities and retailers and must do this free of charge. The producers and importers must organise and fund the processing of the collected equipment, and landfilling and incineration are not allowed. The retailers must accept free of charge old equipment when they sell a new product of similar type.

4.5 Austria

In this dissertation the only Austrian EPR system that will be addressed is the packaging collection. This collection is based on ordinances issued in 1992. The Ordinance on the Target Setting for Avoidance and Recovery of Waste from Beverage Packaging and other Packaging demands the combined reuse and recycling quotas illustrated in Table 4-4.

Table 4-4. Combined reuse and recycling goals for beverage packaging in Austria 1993

	1993	1994	1997	2000
Mineral, table, soda water	90%	92%	94%	96%
Beer	90%	91%	92%	94%
Alcohol-free soft drinks	80%	80%	82%	83%
Fruit juices, etc.	40%	45%	60%	80%
Milk, liquid milk products	25%	40%	60%	80%
Wine	60%	65%	70%	80%
Sparkling wine, liquors	60%	65%	70%	80%

Source: ZielVO Verpackabfälle (1992).[189]

A comprehensive collection system has also been organised for all types of packaging. The results and experiences from the Austrian system will be discussed in Chapters 5 and 6.

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translation). [Online]. Available: http://www.minvrom.nl/minvrom/pagina.html?id=1402 [8 June 1999].

[189] Verordnung über die Festsetzung von Zielen zur Vermeidung und Verwertung von Abfällen von Getränkeverpackungen und sonstigen Verpackungen (ZielVO Verpack-abfälle) [Ordinance on the Target Setting for Avoidance and Recovery of Waste from Beverage Packaging and other Packaging]. BGBI. 646/1992, § 2.

4.6 Other countries

4.6.1 Norway

Norway has experiences from several EPR-like systems. The only system that will be mentioned in this dissertation is the Ordinance on Scrapped Electrical and Electronic Products, issued in 1998.[190]

4.6.2 Japan

Japan has introduced two systems of interest in EPR discussions. In 1997 the Law for Recycling Containers and Packaging (Packaging Recycling Law) was enforced for steel and aluminium cans, and glass and PET bottles. Other packaging has become a target for recycling from 2000.[191] The Specified Home Appliance Recycling Law was enacted in June 1998. It covers four large electrical home appliances: large TV sets, air conditioners, refrigerators and washing machines. Retailers are obliged to take back appliances that they have sold originally. When selling a new appliance, they must also accept to take back an appliance of the same type, regardless of where it has been sold. The manufacturers and importers are obliged to take back products that the manufacturer/importer has manufactured/imported and, to recycle those products according to requirements set by the Government. However, they must not do this free of charge, but are allowed to charge for this service, provided the cost is announced in advance.[192]

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[190] Forskrift om kasserte elektriske og elektoniske producer [Ordinance on Scrapped Electrical and Electronic Products]. Fastsatt av Miljøverndepartementet 16. mars 1998 med hjemmel i lov av 13. mars 1981 nr. 6 om vern mot forurensininger og om avfall (forurensningsloven) § 33, jf. kgl.res. av 8. juli 1983 og 11. juni 1993 nr. 785, og lov av 11. juni 1976 nr. 79 om kontroll med produkter og forbrukertjenester (produktkontrolloven) § 4, jf. kgl.res. av 7. September 1990 nr. 730. Endret 11 juni 1999 nr. 696. (Translation in Norwegian Royal Ministry of the Environment. (1998). *Regulations. Scrapped Electrical and Electronic Products.* Oslo: Det kongelige miljøverndepartement.)

[191] Kitaba, Takashi. (1998). From Pre-Production Stage to Post-Consumption Stage – Japan's Approach for the EPR Program. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., pp. 4-5.

[192] Tojo, Naoko. (1999). *Analysis of EPR Policies and Legislation through Comparative Study of Selected EPR Programs for EEE – Based on the In-depth Study of a Japanese EPR Regulation.* IIIEE Thesis. Lund: IIIEE, Lund University, pp. 29-32.

4.6.3 France

In 1992, France introduced a packaging collection system, including fees paid by the manufacturers. The system was briefly introduced in Section 3.4 and will not be discussed further here.

4.6.4 United Kingdom

In 1997, the British Government introduced an EPR regulation for packaging waste.[193] The regulation contained an elaborated system of sharing the responsibilities between all involved actors by assigning specified percentages of responsibility to each group of actors. The reporting requirements are quite extensive and they have been criticised as being overly burdensome for industry.[194] The requirements for recycling and recovery correspond to the minimum requirements of the EU Packaging and Packaging Waste Ordinance.[195]

4.6.5 More countries

There are a number of further countries that have implemented EPR legislation, or EPR-like legislation. Several more have introduced similar systems based on voluntary agreements. Among such countries are several of EU member countries, for instance, Belgium, Denmark, Finland, Ireland, Italy, Portugal, and Spain. Switzerland has several well-functioning take-back and recycling systems. Canada has shown considerable interest in EPR issues, both on the federal and provincial levels.

The interest is, however, not limited to OECD countries. EPR has been discussed in various ways in developing countries, as well as in countries in transition.

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193 The Producer Responsibility Obligations (Packaging Waste) Regulations 1997. Statutory Instrument 1997 No. 648.

194 Bell, Victor. (1998). How Manufacturers Are Responding to Extended Producer Responsibility Programs and How These Programs Can Be Made More Effective. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C.

195 European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. OJ L 365 31.12.94 p. 10-23.

CHAPTER

FIVE

5. Collection and Recycling as EPR Goals

5.1 Factors Influencing Collection Results

The EPR systems have been organised in different ways, and in order to understand the factors influencing the collection results, it will be necessary to review experiences from a number of system implementations. There are also valuable experiences to be taken into consideration from various recycling systems that have been started without explicitly making reference to EPR.

The review will be a discussion of three main types of systems:

- Deposit-refund systems; that is, systems where the consumer's deposit will be refunded when handing in the used product. Here, the review will include all systems where the consumer receives a financial compensation when returning a discarded product, whether or not this compensation corresponds to a specified deposit paid when purchasing the product. The so-called buy-back systems will also be included.
- Kerbside collection systems; that is, systems where the discarded products are collected close to the individual homes in a fashion similar to the way the ordinary household waste is collected.
- Bring systems; that is, systems where the consumer is expected to bring the discarded products to a container or something similar, which is placed at a shorter or longer distance from the home of the individual. These systems include drop-off centres and recycling stations, among other things.

The main interest will be to understand how factors such as legal requirements, convenience, awareness and financial incentives influence the collection results.

It is assumed that in many cases it is not very difficult to institute a separate collection of waste products and to reach a collection level of 20-50%.

There are numerous examples of collection schemes initiated in the 1980s for various types of packaging, and for other products that have reached these levels. The challenge seen is to achieve collection results well over 50%, and rather in the order of 80% or more.

5.2 Experiences from Deposit-Refund Systems

Deposit-refund systems can be divided into natural and artificial systems. Natural systems occurred because of the real value of the refillable container and the consequent desire of breweries and other fillers to recoup the container. The refund had to be high enough to motivate consumers to return the container instead of keeping it for their own purposes or throwing it away. With the changes in manufacturing technology, transport prices, salary levels, etc., the economic rationale of refillable bottles gradually disappeared, and one-way packaging rapidly expanded its market share.

Triggered by the debate on energy and material wastefulness, combined with littering problems, individuals and society started to discuss the re-introduction of refillable containers and, along with them, deposit-refund systems. It was now in many cases not a question regarding a system where the fillers wanted the bottles because of their value, but rather that the bottles should be returned in order to fulfil societal objectives of reducing littering and combating wastefulness. Consequently, the deposit-refund system became an artificial system, imposed on the market by societal concerns.

Deposit-refund systems are in many instances seen as the best solution when very high collection rates are desired. The general notion seems to be that the existing deposit-refund systems are, overall, very successful in achieving high collection results. Many of the traditional deposit-refund systems for beer and soft drinks in refillable glass bottles are claimed, where they still exist, to lead to an almost 100% return rate. This is the case for the 33-centilitre glass bottles in Sweden[196] and Denmark. In these cases, as well as in other comparable countries (see Table 5-1 and Table 5-2), the refund sums are most often fairly modest, that is, in the order of USD 0.03-0.15.

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[196] The reuse is estimated to be 96-98% in 1996 (Swedish Environmental Protection Agency. (1997). *Har producenterna nått målen?* [Have the producers reached the goals?]. Rapport 4748. Stockholm: Naturvårdsverket, p. 24). Similar figures are reported for 1992, 1994 and 1995 (ibid., Appendix 2, p. 9).

Table 5-1. Return rates of selected deposit-refund systems for beverage containers

		Deposit Size		Return
Country/State	Container Type	Local Currency	USD	Rate
Germany	PET	DM 0.50	0.28	96%
Netherlands	Glass	NLG 0.25-0.50	0.13-0.27	97-98%
	PET	NLG 0.10-1.00	0.05-0.53	50-90%
Norway	Glass	NOK 1.00-2.00	0.17-0.34	98%
S. Australia	Aluminium	AUD 0.05-0.10	0.03-0.07	85%
	Glass (beer-375ml)	AUD 0.05	0.03	82%
	Glass (beer-750ml)	AUD 0.05	0.03	93%
	Glass (other)	AUD 0.20	0.13	95%
UK	Glass (soft drinks)	GBP 0.05-0.12	0.08-0.20	90%

Source: Environmental Resources Limited (1991)[197] – deposit sizes in USD recalculated from GBP with the exchange rate used in the same report: GBP 1.00 = USD 1.67.

Table 5-2. Return rate of containers in Dutch deposit-refund systems

	Beverage or	Deposit Size		Return
Country/State	Container Type	Local Currency	USD	Rate
Netherlands	Beer (35-100 cl)	NLG 0.15-0.50	0.10-0.27	99%
	Soft drinks (1-1.5 l)	NLG 0.50-1.00	0.27-0.53	95-98%
	PET	NLG 1.00	0.53	90-100%

Source: Oosterhuis & van Scheppingen (1993)[198].

A number of deposit-refund systems for beverage containers have been introduced in Canada, and in 1999 all ten provinces had collection of beer containers with deposit-refund, while eight provinces were also using deposit-refund for soft drink containers. The organisation of the systems is somewhat different. Some provinces have special return depots, or redemption centres, where the containers are to be handed in, while others rely on a traditional approach with return through the retailers.[199] Another

[197] Environmental Resources Limited. (1991). *Deposit/Refund Systems for Beverage Containers and Batteries.* London: HMSO, p. 9.

[198] Oosterhuis, Frans H., & van Scheppingen, Yvette T.M. (1993). *Inventory of Product Policy Instruments. Case study: Netherlands.* Schriftenreihe des IÖW 72-NL/94. Berlin: Institut für ökologische Wirtschaftsforschung GmbH, p. 63.

[199] Container Recycling Institute. (1999). *Beverage Container Reuse and Recycling in Canada.* [Online]. Available: http://www.container-recycling.org/page66.htm [2 December 1999].

recently devised container deposit-refund system has been reported from Israel. The Israeli Parliament, the Knesset, approved on 19 April 1999 a law requiring deposits on beverage containers.[200]

During the period 1971 to 1983 nine states in the USA enacted some form of beverage container deposit-refund law, popularly referred to as "bottle bills".[201] There is also one local system in the USA, namely in Columbia, Missouri, where a deposit-refund system for beer, malt, carbonated/mineral waters, and soft drinks was implemented in 1982.[202]

In California a number of proposals for deposit-refund legislation were introduced in the period from 1971 to 1982, but they were all rejected after vigorous and expensive lobbying. In 1986 an attempt was made by Californians Against Waste to revive the discussion about a bottle bill. In order to avoid another expensive battle, the various stakeholders sought a co-operative solution. The result, the California Beverage Container Recycling and Litter Reduction Act (AB 2020), became law on 29 September 1986. The law demanded recycling centres to be established inside a 0.8 km radius around a retailer with annual sales above USD 2 million. The centres were obliged to accept all types of containers subject to the law, that is, containers for beer, wine and distilled spirit coolers, carbonated mineral and soda waters and similar carbonated soft drinks, and to pay the determined refund value, together with the applicable scrap value.[203]

The ten states, including California, with deposit-refund systems for beverage containers serve approximately 30% of the US population. The systems generally cover containers for beers, soft drinks and mineral water, but some variation between states can be seen. Basic information about these systems can be found in Table 5-3, and the return results in Table 5-4.

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[200] Container Recycling Institute. (1999). *Israeli Knesset Adopts Beverage Container Deposit Legislation.* [Online]. Available: http://www.container-recycling.org/israel.html [2 December 1999].

[201] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 4.

[202] Container Recycling Institute. (1998). [Online]. Available: http://www.container-recycling.org/page43.htm [6 March 2000].

[203] Robinson, David L. (1996). *Beverage Container Deposit Return Systems: The cases of Sweden and California.* IIIEE Thesis, Lund: IIIEE, Lund University, pp. 10-12, 15.

Table 5-3. Deposit-refund laws for beverage containers in the USA

State	Date implemented	Refund size	Beverages included
California*	Sept 1987	5 cents for containers with a capacity > 24 oz., 2.5 cents for all others	Beer, soft drinks, wine coolers, carbonated waters
Columbia, Missouri	1982	5 cents	Beer, malt, carbonated/mineral waters, soft drinks
Connecticut	Jan 1980	5 cents	Beer, soft drinks, carbonated waters
Delaware	June 1982	5 cents	Beer, soft drinks, carbonated waters (except naturally sparkling water)
Iowa	July 1979	5 cents	Beer, soft drinks, wine, liquor, mineral and soda water
Maine	Jan 1978	15 cents for wine and spirits, 5 cents for all others	All beverages except milk and dairy-derived products
Massachusetts	Jan 1983	5 cents	Beer, soft drinks, soda and mineral water
Michigan	Dec 1978	10 cents, except 5 cents for refillable containers	Beer, soft drinks, carbonated water, wine coolers, and mixed spirit drinks
New York	July 1983	5 cents	Beer, soft drinks, mineral and soda water, wine coolers
Oregon	Oct 1972	5 cents, except 2 cents for certified refillable containers	Beer, soft drinks, mineral and soda waters
Vermont	July 1973	15 cents for liquor, 5 cents for all others	Beer, soft drinks, mineral and soda waters, wine coolers, liquor

Sources: McCarthy (1993)[204] and Container Recycling Institute (1998)[205]
* The system in California is not a true deposit-refund system, but a buy-back system as it does not involve any specified deposit.

[204] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 4.

[205] Container Recycling Institute. (1998). [Online]. Available: http://www.container-recycling.org/page43.htm [6 March 2000].

Table 5-4. Return rates in US states with deposit-refund legislation

State	Year*	Return rate*	Return rate***	Return rate****
California	1991	79% Overall - 82% Aluminium - 81% Glass - 62% Plastic	69%	76% Overall - 80% Aluminium - 67% Glass - 58% Plastic
Columbia, Missouri				85%
Connecticut				88% Cans 70-90% Plastic
Iowa	1990**	95% Aluminium 85% Glass		74% Cans (soda) 80% PET (soda) 100% Glass (refill.) 85-95% Beer 56% Wine/liquor
Maine	1991**	92% Beer/soft drinks 80% Liquor 80% Wine 75% Fruit juice		96% Overall - 96% Beer/soft dr. - 97% Non-carbon. - 87% Spirits - 83% Wine
Massachusetts	1990	85%		81%
Michigan	1988**	92%	93%	98%
New York	1990**	72% Overall - 80% Beer - 63% Soft drinks	79% Beer 66% Soft drinks	76%
Oregon	1990**	93%	93%	90%
Vermont	1988**	85%		97% Beer 90% Soft drinks 72% Liquor

* Source: McCarthy (1993)[206] ** Year reported.

*** Source: Environmental Resources Limited (1991) – year reported not specified[207]

**** Source: Container Recycling Institute (June 1998) – year reported not specified[208]

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[206] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 21.

[207] Environmental Resources Limited. (1991). *Deposit/Refund Systems for Beverage Containers and Batteries*. London: HMSO, p. 9.

[208] Container Recycling Institute. (1998). [Online]. Available: http://www.container-recycling.org/page43.htm [6 March 2000].

Table 5-5. Beer and Soda Container Sales and Recycling Rates in USA in 1995

	USA Total	10 Deposit-Refund States	40 Non-Deposit-Refund States
Population	265.2 million	77.6 million	187.6 million
Container sales (tonnes)	7.36 million	2.1 million	5.2 million
Recycled (tonnes)	2.9 million	1.6 million	1.3 million
Recycling rate (%)	40.2%	76.3%	25.5%

Source: Container Recycling Institute (1998)[209]

The return rates in the states with deposit-refund systems confirm the general perception that these systems overall lead to high and very high collection results. Table 5-5 shows a comparison between the 10 states with a deposit-refund and 40 states without any such system. The effect of the introduction of a financial incentive of a modest size is really very striking. It seems quite obvious that consumers are responding quite well even to small financial incentives.

Environmental Resources Limited has made an attempt to correlate the data on deposit size and return rate from a number of deposit-refund systems in Europe, USA, and Australia.[210] They conclude that return rates appear to be sensitive to the level of refund up to a return rate of approximately 90% from a refund of approximately USD 0.07.[211] However, the interpretation of Figure 2.2b [212] in their report is not straightforward. All data points for refunds above USD 0.07 are indeed connected to return rates above 90%. The remaining data points do not permit any clear conclusions, except the fact that all but three of them are above 80%. They also admit that the results for the collection of refillable glass bottles for wine and spirit do not correlate with the above conclusion, but would imply a higher threshold. They speculate that the reason may be connected to an older age group that

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[209] Container Recycling Institute. (1998). [Online]. Available: http://www.container-recycling.org/page23.htm [6 March 2000].

[210] In all, they are using 16 data points. Besides some Swedish figures, all of these data points are included in Table 5-1 and Table 5-4. The Swedish figures are included in Figure 5-1 and Figure 5-4.

[211] Environmental Resources Limited. (1991). *Deposit/Refund Systems for Beverage Containers and Batteries*. London: HMSO, p. 10.

[212] Ibid., p. 12.

is consuming wines and spirits in comparison with soft drinks, or to the relative size of the refund compared with the purchase price of the beverage. Consumer convenience is also referred to as a possible determinant.[213]

The data on return rates for deposit-refund systems are, in several cases, only estimates. This is especially true for the systems that are a continuation of natural deposit-refund systems. These are often administrated without any government involvement and without any particular legal requirements concerning return rates. The best data available are from the Swedish systems for aluminium cans and refillable glass bottles for wine and liquors. These systems will be examined in more detail in order to explore the factors impacting on the collection results.

The deposit-refund system for aluminium cans was introduced in Sweden in 1983. The introduction was the result of a fierce discussion about the littering problems connected with beverage cans and the high energy consumption for manufacturing aluminium cans. After attempts to convince the critics that a bring system would be sufficient, the businesses concerned decided to establish a system under their own control. This system is still in place and running without any fundamental changes since 1983. The system is supported by a special law, which forces all manufacturers, fillers, and importers to join a deposit-refund system.[214]

The consumers pay a deposit to the retailers and are refunded when returning the empty can. All retailers accept empty cans and in almost all cases they have installed reverse vending machines where the cans are inserted. In order to co-ordinate the system and especially the money flows, the domestic can manufacturer, breweries and retailers have started a company, Returpack AB, owned by themselves. Originally, the Swedish Government agreed on a 75% return level to be reached by 1987. When this result was not reached, the involved businesses decided, after considerable hesitation, to increase the size of the deposit from SEK 0.25 (USD 0.04) to SEK 0.50 (USD 0.08). Figure 5-1 shows the return rate (%) and the size of the refund (öre = SEK 0.01) for the period 1983-1998.

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213 Ibid., p. 12, see also Figure 2.2c on page 14.

214 Lag (1982:349) om återvinning av dryckesförpackningar av aluminium [Act on Recycling of Aluminium Beverage Packaging]. SFS 1982:349.

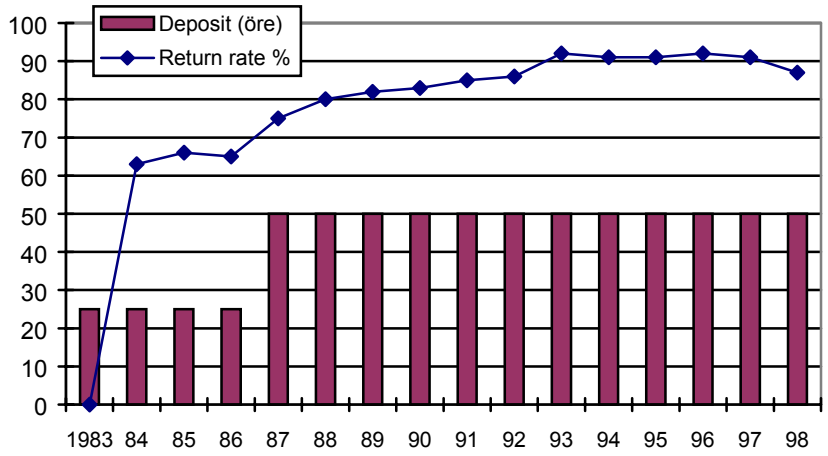

Figure 5-1. Deposit size and return rates for aluminium cans for beer and soft drinks in Sweden 1983-1998[215]

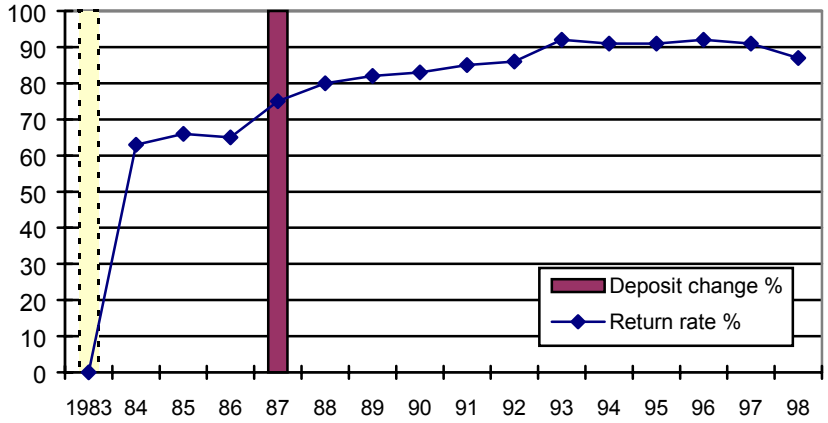

Figure 5-2. Relative increases (%) of the deposit size and return rates for aluminium cans for beer and soft drinks in Sweden 1983-1998

Figure 5-2 was constructed to accentuate the change in return rate with respect to the increase in the refund size in 1987. It should be noted that the refund was raised in the middle of the year and the change in the return rate was more immediate than that seen from the graph, where the figure for

[215] Data on return rate from Returpack AB. (1999). http://www.returpack.se [2 January 2000].

1987 is the average for that year. It is tempting to ascribe the approximate 15% change in the return rate to the doubled refund that the consumer receives. The less significant increases in the return rate in the period 1988-93 could be the result of intensive information campaigns and increased awareness.

Figure 5-3 illustrates the return rates for a deposit-refund system with a longer history, the Swedish system for refillable glass bottles for wine and liquor.

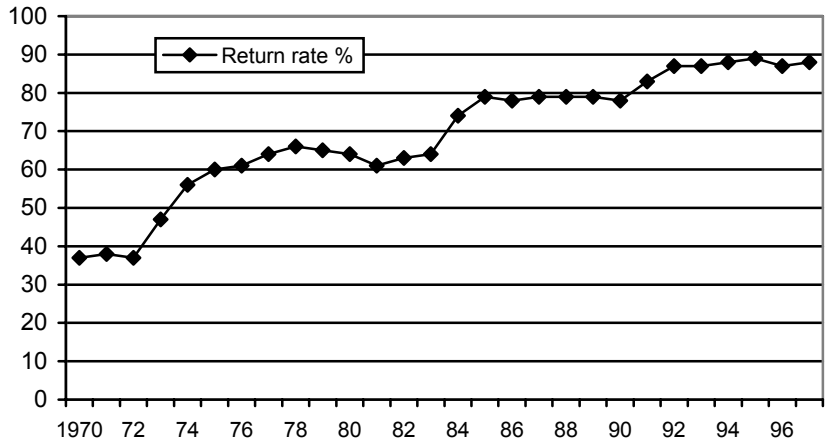

Figure 5-3. Return rates for refillable bottles for wine and liquor with deposit-refund in Sweden 1970-1997[216]

Wine and liquor in Sweden is only sold in state-owned shops, all operated by the same company. Before Sweden joined the European Union (EU) in 1995, the import of these beverages for this company was organised by another monopoly company. A considerable portion of the wine, as well as some liquor, was bottled in refillable standard bottles in Sweden. In 1990 approximately 80% of the bottles sold were refillable and were included in

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[216] Data for 1970-1989 from Lindhqvist, Thomas. (1991). Some Swedish Experiences of Using Environmental Instruments in the Packaging Sector. In M. Backman, & T. Lindhqvist, *Packaging and the Environment – Policies, strategies and instruments* (96-101). Lund: Department of Industrial Environmental Economics, Lund University, p. 97.
Data for 1988-1997 from Systembolaget. (1998). *Svenska folkets bolag: Systembolaget – Händelser och verksamhet 1997* [The Company of the Swedish People: Systembolaget – Events and activities 1997]. Stockholm: Systembolaget, p. 40.

the deposit system.[217] The same figure, 80%, is reported for 1992. However, after Sweden joined the EU, the import restrictions were not accepted and a number of companies started to import to the shops, which were obliged to also accept products from these new companies. Almost immediately, a decrease in the share of refillable bottles was seen and in 1996 less than 35% of the sales were in refillable bottles. It is claimed that changes in alcohol taxation and consumer desires for more attractive bottles have contributed to this change. The reuse of the refillable bottles fell to 69% the same year.[218] The system was discontinued and today there is no deposit-refund system in place. The data for the period 1970-1989 are more complete and in Figure 5-4 the return rate and the size of refund for these years are shown.

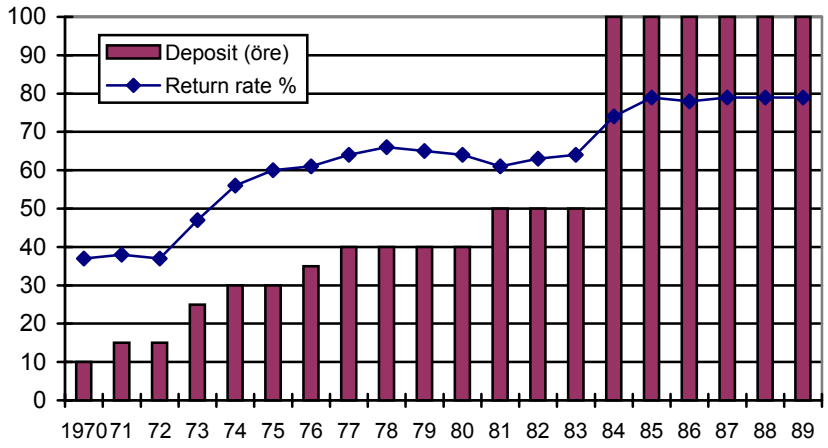

Figure 5-4. Deposit size and return rates for refillable bottles for wine and liquor with deposit-refund in Sweden 1970-1989

It should be noted that the size of the refund changed several times during this period. The relative changes of the refund size are shown together with the return rates in Figure 5-5.

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[217] Swedish Ministry of the Environment. (1991). *Miljön och förpackningarna* [The Environment and Packaging]. SOU 1991:76. Slutbetänkande av förpackningsutredningen. Stockholm: Miljödepartementet, p. 157.

[218] Swedish Environmental Protection Agency. (1997). *Har producenterna nått målen?* [Have the producers reached the goals?]. Rapport 4748. Stockholm: Naturvårdsverket, p. 24.

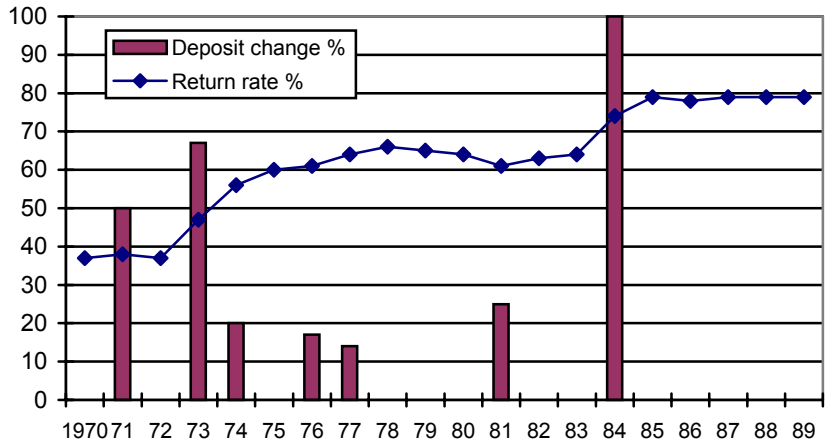

Figure 5-5. Relative increases (%) of the deposit size and return rates for refillable bottles for wine and liquor with deposit-refund in Sweden 1970-1989

It can be seen that not all increases in refund size are followed by any significant increase in the return rate. The significant increases in 1973 and 1984, both in the order of 15-20%, are, however, connected to the most significant relative increases of the refund, 67% and 100% respectively.

The survey of various deposit-refund systems strengthens the accepted idea that such systems in most cases lead to a high return rate. However, it is more difficult to define precisely the relationship between the size of the refund and the return rates. The data for the Swedish systems for aluminium cans and refillable glass bottles for wine and liquor indicate that the consumer is sensitive to changes in the refund size. However, the relative size of the change seems to influence whether an increase in the return rate occurs or not. The size of the refund in absolute terms, and especially the increases of the refund, can hardly explain such a significant consumer reaction. It is tempting to see an important element of psychology in the response of the consumers. The available data, and the complex interrelations with other factors, however, make a precise conclusion impossible.

The differences in return rates for the deposit-refund systems for refillable 33 cl glass bottles for beer and carbonated soft drinks (96-98%), as compared with aluminium cans (ca 90% at maximum) and bottles for wine and liquor (80-90% at maximum), can be explained by several factors:

- 33 cl bottles were mostly sold in crates of 20 bottles and not only the bottles but also the crate were connected to a deposit-refund. In fact the refund for the crate was approximately the same as for 20 bottles.
- The deposit-refund for 33 cl bottles has a long history and the handling in the household could be seen as being a typical Swedish custom, while the aluminium can system in particular was a relatively new invention.
- 33 cl bottles and aluminium cans could be returned to all shops selling beverages in these types of containers. The wine and liquor bottles could only be returned to very limited number of shops selling alcoholic beverages.
- The wine bottles included in the deposit-refund system were in many cases indistinguishable from bottles that were not refundable. A text in the glass could help to determine whether a bottle was refillable or not, but it demanded knowledge of this and extra effort. The same is true for a special marking on the label, which was introduced in the late 1980s. This was also not very prominent.
- The resistance to disposing glass in the ordinary dustbin was most likely higher than for aluminium and other materials that do not break.
- It is well established that a significant proportion of those not returning aluminium cans were younger single men. The 33 cl bottles were to a lesser extent bought by this group.

In short, the return rate is not only dependent on the size of the refund, but also on the level of convenience or inconvenience connected with the return and disposal of the container, and the level of awareness or information about the system.

There is much uncertainty about what refund levels would be necessary to achieve a specified return rate for a product that is presently not part of a deposit-refund system. This has been seen clearly in the discussions about deposit-refund systems for products such as batteries.

In 1992 there were ten states in the USA with a legislated deposit-like system for lead-acid accumulators for cars. These laws require that consumers return a used battery when buying a new one, or pay a deposit of USD 5-10. The consumer has the possibility to receive a deposit refund if returning a spent battery within a specified period of time, generally 30 days. The laws further require wholesalers to accept returned batteries from

retailers and recycle the batteries.[219] A voluntary deposit-refund system for these batteries had been operating in New Zealand in 1991 for some 30 years and it reported a return rate of 95%, with a deposit size of NZD 5.00 (USD 2.45).[220]

A common misunderstanding is connected with the financing of the collection and recycling systems. A deposit-refund system may generate revenues from several sources:

- unclaimed deposits,
- interest on capital if there is a time lag between the moment when the organisation receives the deposit and the moment when the refund is reclaimed, and
- revenues from selling the returned items.

It is, however, not necessary that all costs should be covered by these revenues. The size of the refund should mainly be adjusted to secure the desired return rate. If additional revenues are necessary, these can be collected, for instance, in the form of administrative surcharges added to the deposit. The deposit-refund systems for aluminium cans in Sweden, as well as several other deposit-refund systems, have practised this for many years.

Swedish experiences, as well as German, Austrian, and those from many other countries, do not show any problem combining a deposit-refund system with other types of packaging collection schemes. The same observation was made in the USA, where, in 1991, 43% of the population in the ten states with mandatory deposit-refund systems was served by kerbside collection. The corresponding figure for the other states was only 22%.[221]

It can be added that the quality of the collected material is generally much higher when a deposit-refund system is used, as compared to other forms of

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[219] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 3.

[220] Environmental Resources Limited. (1991). *Deposit/Refund Systems for Beverage Containers and Batteries*. London: HMSO, p. 15.

[221] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 20.

collection. The risk of having to downgrade the material is, consequently, less, and the prices of the recycled material will be higher.

5.3 Kerbside Collection Systems

5.3.1 Kerbside Collection

The most illustrative example of a large-scale kerbside collection system is the German packaging collection. It is also a countrywide collection and it will be used here to illustrate the potential of achieving high collection rates in these systems.

5.3.2 German Experiences

The German Packaging Ordinance [222] from 1991 is the most well known implementation of EPR. The ordinance led to the establishment of the so-called Dual System (DSD – Duales System Deutschland AG) and a country-wide co-ordinated collection of packaging waste. Decided upon in 1991 and implemented the following year, the Dual System collection is today providing some results that could be used for better understanding the potentials and problems of collection systems.

In this section the interest will be on some key figures on collection and recycling efficiency. The German Packaging Ordinance of 1991 places specific demands on the Dual System. These demands are expressed as certain collection and sorting percentages, referring to the consumption of packaging by private households and small businesses in Germany.[223] Recalculated to recycling percentages, the demands of the Packaging Ordinance originally corresponded to 72% recycling for packaging made of glass, tinplate, or aluminium, and to 64% for packaging made of paper/carton, plastics, or composites. At the time of the introduction of the Packaging Ordinance, these figures were considered to be very high for several of the materials. In the revised Packaging Ordinance these levels are

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[222] Verordnung über die Vermeidung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 12. Juni 1991 (BGBl. I 1991 S. 1234) [Ordinance on the Avoidance of Packaging Waste (Packaging Ordinance)].

[223] The Dual System is in fact only concerned with what is called sales packaging and, over the last years, with secondary packaging. This will, however, not weaken the conclusions, as these types of packaging are the most difficult to approach in a recycling system.

expressed as recycling levels. They have also been slightly revised and are now fixed on levels in the range of 60-70%.

However, as can be seen from Figure 5-6, all of these goals were passed with a good margin in 1997. The recycling levels for packaging made of glass and paper or carton are in the range of 90%, while the levels for aluminium and tinplate packaging are well above 80%. Also the recycling of composites, that is, mainly containers for liquids made of carton coated with plastics and sometimes with a thin aluminium layer, has reached a level just below 80%. Only for packaging made of plastics is the level around 70%, which is also, in this case, well above the legal requirements.

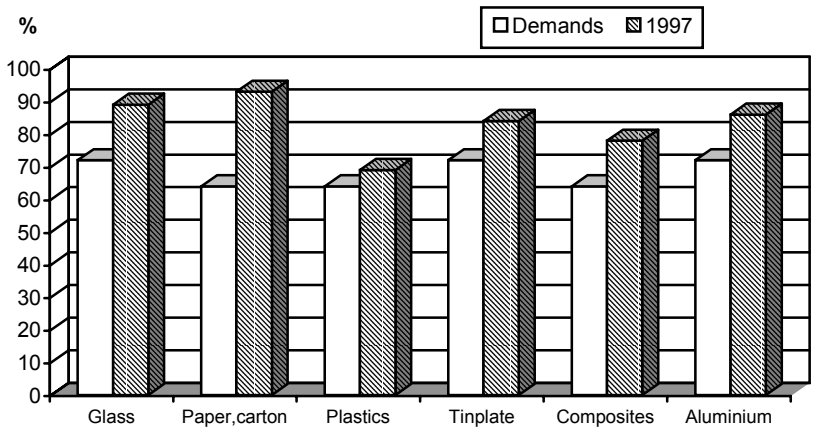

Figure 5-6. Result of the DSD 1997 - Recycling of sale packaging in Germany 1997 compared to the demands of the Packaging Ordinance (% recycled material)[224]

The collection levels are for all materials, and are, with the exception of glass, higher than the recycling levels as can be seen from Table 5-6. The collection is organised so that glass and paper/carton are collected in the bring systems that were established in the 1980s. These systems have been further expanded and the level of proximity for the households, and hence the convenience for them, has been considerably enhanced. The other materials, for which new systems have largely had to be established after the introduction of the DSD, are all collected kerbside in the so-called yellow bins.

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[224] Figures for the recycling results for 1997 are taken from the homepage of DSD: http://www.gruener-punkt.de/d/content/medien/grafik/ms97_anf.htm. [24 June 1998].

Table 5-6. Result of sale packaging collection in Germany 1996

Material	Collection	Sorting	Recycling
Glass	85%	100%	85%
Paper, cardboard and cartons	94%	98%	92%
Plastics	80%	88%	68%
Tin plate	82%	99%	81%
Composites	84%	96%	79%
Aluminium	95%	88%	81%

Source: OECD (1998)[225]

Especially dramatic is the development of plastic waste recycling, as can be seen in Figure 5-7. From a very low level in the beginning of the 1990s, the collection and recycling activities were significantly developed and today more than half a million tonnes of plastic packaging waste are treated.

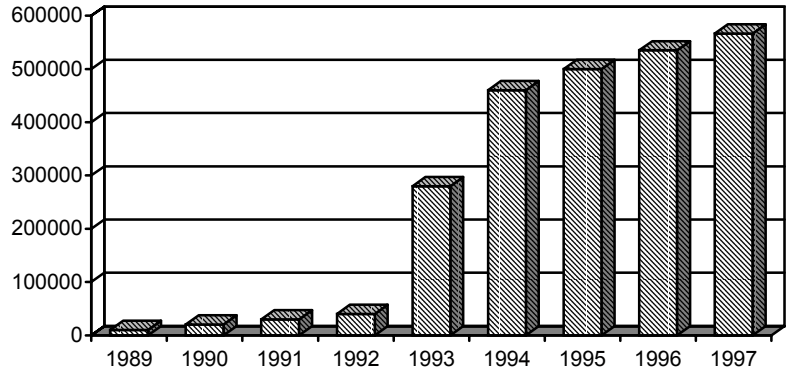

Figure 5-7. The development of recycling of plastic wastes from packaging in Germany 1989-97 (tonnes of recycled material)[226]

[225] OECD. (1998). *Extended Producer Responsibility. Phase 2. Case Study on the German Packaging Ordinance*. Paris: OECD (ENV/EPOC/PPC(97)21/REV2), p. 27.

[226] Duales System Deutschland AG. (1998). *Entwicklung der Verwertungsmengen für Kunststoff-verpackungen* [Development of the Recycling Amounts of Plastic Packaging]. [Online]. Available: http://www.gruener-punkt.de/d/content/medien/grafik/krecy.htm [1 April 2000].

5.4 Bring Systems

The packaging waste collection as organised in Sweden is an example of a system that mainly relies on the consumers to bring the discarded products to containers, which are distributed in various parts of the cities. The collection results are fairly mixed. The collection of waste glass packaging has steadily developed since it was initiated in the early 1980s, and in 1998 it reached a level of 84% (Figure 5-8). Similar high collection results have been achieved for packaging of corrugated board (85%), and steel (71%).[227]

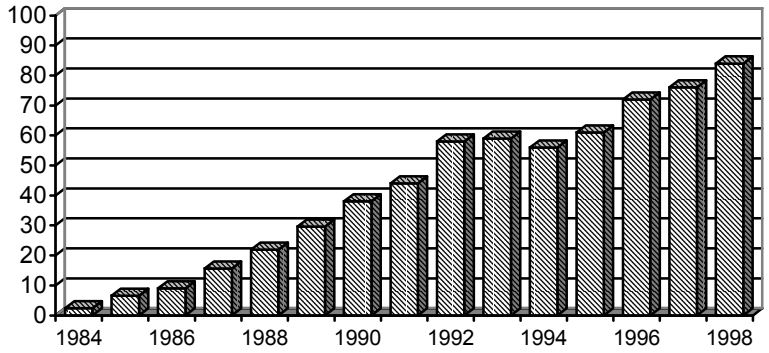

Figure 5-8. Sweden – Glass Recycling 1984-1998 (% recycled)[228]

However, the collection rates for plastics (31%), paper/carton (37%), and aluminium packaging (27%; excluding beverage cans) are considerably lower.[229]

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[227] Förpackningsinsamlingen. (1999). Förpackningsinsamlingen i siffror [Packaging collection in figures]. *Förpackningsinsamlingen informerar*. Juni 1999, p. 6.

[228] Sources: Svensk GlasÅtervinning AB. (1999). *Diverse information framtagen vid frågor om vår produktion* [Various information collected in connection to questions about our production]. Photocopies supplied by the glass recycling company. Hammar, Sweden: Svensk GlasÅtervinning AB.
Svenska Kommunförbundet – Kalmar länsavdelning. (1989). *Glasåtervinning i kommunerna – med utgångspunkt från erfarenheter i Emmaboda, Nybro och Oskarshamn* [Glass Recycling in the Municipalities – based on experiences from Emmaboda, Nybro and Oskarshamn]. REFORSK FoU 37. Malmö: Stiftelsen REFORSK, p. 10.
The collection figures for 1984-1989 have been compared to an estimated total annual consumption of 140 000 tonnes of glass, in accordance with estimates in the latter reference.

[229] Förpackningsinsamlingen. (1999). Förpackningsinsamlingen i siffror [Packaging collection in figures]. *Förpackningsinsamlingen informerar*. Juni 1999, p. 6.

The kerbside collection in Germany of glass and paper/cardboard has reached even higher collection results than in Sweden, as can be seen from Table 5-6. This difference could be explained by greater convenience in Germany, that is, the collection points are on average closer to the households, or maybe because of a greater attention and awareness of the recycling system. There is, however, no tangible information supporting the latter explanation.

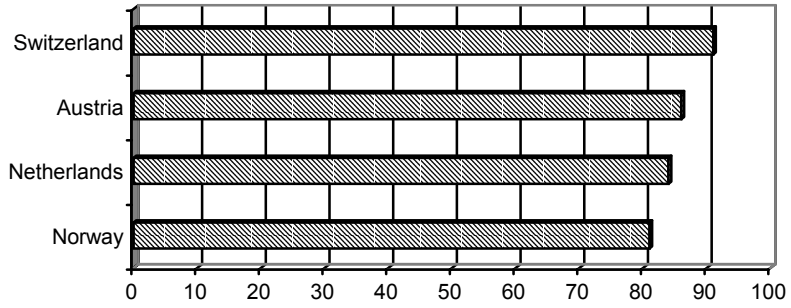

Figure 5-9. Glass Recycling (%) in Selected European Countries in 1998[230]

Figure 5-9 shows glass recycling in 1998 in some of the countries in Europe where the collection results have been the highest. In all four countries the collection is organised as a bring system. In the leading country, Switzerland, the recycling result for 1999 was reported as even higher: 92.6%.[231]

The packaging collection in the Netherlands is organised by the local municipalities and there is no special fee placed on the packaging. The collection results (see Table 5-7) are not as high as in Germany packaging

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[230] Bei Glas in Europa auf Platz zwei [For Glass in Place Two in Europe]. (1999). *Waste Magazin*, no. 4, p. 22.

[231] Vetro-Recycling AG. (2000). *Leichter Anstieg der Altglassammelmenge* [Small Increase in Amount of Collected Waste Glass]. [Online]. Available: http://www.vetrorecycling.ch/de/index.htm [1 April 2000]

collection. Clement (1998) pointed out that the costs are low relative to the German costs.[232]

Table 5-7. Packaging in the Netherlands (1986-2001)

	1986	1991	1995	1997	2001
Market volume (ktonnes)	2350	3200	2650	2745	
Recycling (%)	26%	38%	51%	55%	> 65%
Landfill/incineration (ktonnes)	1800	2080	1300	1220	< 940

Source: Clement (1998)[233]

Information can be seen as a major factor influencing the collection results. Several of the collection schemes have been complemented with extensive information campaigns, not the least for household battery collections. Sweden has experienced country-wide battery collections with high levels of promotional activities since the mid-1980s. The results of these collection efforts have still been largely disappointing. Besides high collection quotas for button cells, none of the other types of batteries have come close to the desired levels.

In the period November 1987 – May 1988, the author took part in organising a comprehensive battery collection test on the Danish island of Bornholm. The primary objective of this collection was not to study the return percentage, but to explore the administrative and organisational problems connected to a deposit-refund system for batteries. However, even if the local retailers initially were positive to the trial collection, including the deposit-refund, the central organisations of the general convenience goods trade decided not to participate in a deposit-refund trial. In order to still be able to study the problems connected to a collection system with high return rates, an extensive information campaign was prepared.

The information campaign included lottery tickets, a green magazine with information about the battery collection placed prominently, slots on the

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[232] Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 4.

[233] Ibid., p. 4.

collection in local radio and TV, repeated articles in the local newspapers, and posters on all buses during the initial week of the collection. For almost four months all milk cartons sold on the island carried information on the collection, and all households (more than 21 000) received a brochure describing the collection scheme. Some shops printed information about the collection in their advertisements in the daily press, and sales leaflets, posters and stickers were distributed to all shops, schools, libraries and public sector utilities. All shops got extra stickers to hand out to children. Finally, the majority of the shops selling batteries had a receptacle box with additional information on it.[234] Not surprising, 92% of the surveyed persons stated four months after the start that they were aware of the collection. A total of 87% expressed that they felt it was right to collect batteries.[235] Disregarding the massive information campaign, the results of the collection were disappointing. It was estimated that approximately 20-30% return rate was achieved for the ordinary round cells, including both zinc carbon batteries and alkaline manganese batteries. The collection rate for nickel cadmium batteries was difficult to estimate accurately, but was considerably lower than 10%.[236]

The results of the Bornholm collection corresponded well to experiences from other collections that were going on at that time. Experts in the area from various European countries concluded that these results were in the same order as the best achieved.[237] There was only one exception, a small Swedish municipality, Östhammar. In April/May 1985, a decision had been made to introduce a local buy-back scheme. For each battery returned, the consumer would receive SEK 0.25 (USD 0.03). In 1987 and 1988, it was estimated that the approximate return rate for alkaline manganese batteries was 100% and for zinc carbon batteries 50%.[238]

It is difficult not to recognise the importance of information and awareness. The increasing return rates for bring systems, illustrated by the glass recycling schemes, are a clear evidence of the need for creating awareness

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234 Lindhqvist, Thomas, & Christiansen, Kim. (1990). *Collection and Sorting of Used Batteries*. Sjöbo, Sweden: TEM, pp. 17-21.

235 Ibid., p. 25.

236 Ibid., p. 29.

237 Ibid., p. 39.

238 Ibid., pp. 41-42.

among the households. However, as was seen from the battery collection activities, and as was clearly illustrated by the collection on Bornholm, information is not necessarily enough to reach high return rates.

5.5 Factors Deciding the Collection Results

The earlier sections of this chapter have proven that very high collection results can be obtained in all of the three types of collection systems described. The factors that have been dealt with can be expressed as:

- Financial incentives; that is, refunds or redemptions that are given to the person that is handing the waste product to the designated collection points.
- Level of convenience or inconvenience; that is, how much of an effort must be taken to dispose of the waste product at the designated collection system. It could also be a question of the degree of inconvenience.
- Level of information and awareness; that is, how well known the system is and how important the public finds it to comply with the intended system. Another side of this factor is whether the system is understandable for the ordinary person or not.

It is possible, at least in principle, to make a specific hand-in mandatory by law. It is illegal in Sweden, for instance, to not dispose of a battery defined as hazardous in a separate collection. In reality, very few Swedes are aware of this, and it is also largely impossible for the authorities to enforce this part of the law.

5.6 Factors Deciding the Recycling Levels

The organised collection of the discarded products is a necessary prerequisite for recycling. However, if the recycled materials are to be used, then a market must also exist, or at least be created. The market could be supply or demand driven. A policy instrument that could lead to a demand driven situation is the recycling content legislation. This instrument is used more frequently in the USA than in Europe, and in the American context a

number of states have implemented since considerable time such legislation for, especially, newsprint.[239]

Essentially, the problem of securing a market for recycled materials is an economic problem. If any negative prices on recycled materials are accepted, then a market will eventually emerge. However, negative prices on a recycled material would most likely signal high inefficiency in the use of this material, and a subsequent high environmental impact. In all normal cases, the costs connected to recycling are related to collection, dismantling and/or sorting, and a sorted clean material can be expected to meet a real market demand.

5.7 Collection and Recycling

The factors to achieve high collection and recycling results are the same, with or without an EPR system. The collection results can mainly be influenced by:

- economic incentives (refunds);
- disincentives (not being deregistered as a car owner and consequently having to pay annual taxes);
- convenience (short distances to collection points);
- inconvenience (difficult to understand collection system);
- information (awareness-raising activities).

Negative prices, or in general high costs for collection and recycling, could be expected to be forceful drivers for innovation. This innovation could take several directions. It could be a search for ways to improve the recyclability of the products in question, or a product system improvement in order to facilitate the collection and sorting of the products. It could also be an active search for a better market for the recycled materials, including the development of new products based on these materials.

If collection and recycling are the most important goals and the possibility for overall product system improvement is considered to be negligible, then

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[239] Lifset, Reid. (1992). Extended Producer Responsibility: Rationales and Practices in North America. In T. Lindhqvist, *Extended Producer Responsibility as a Strategy to Promote Cleaner Products* (33-49). Lund: Department of Industrial Environmental Economics, Lund University, pp. 40-41.

the real reason for applying an EPR approach will be lost in the view of the author. However, it might still be attractive for a policy-maker to apply the EPR approach and make the manufacturer or other distributor responsible for the economic costs connected to collection and recycling. In these cases, the role of the EPR system is rather to supply financing outside the tax and municipal charge systems. This can be most attractive for the authorities responsible for waste collection, as the possibilities of raising taxes to meet new demands in the management of waste are politically limited. It is possible that this type of consideration influences the emerging interest for EPR outside the OECD countries. Such an interest has been recorded, for instance, in Poland[240] and in China.[241]

[240] Kielkiewicz-Young, Aleksandra. (1999). *Packaging and Packaging Waste Policy in Poland. Case study of containers for beer and soft drinks*. IIIEE Thesis. Lund: IIIEE, Lund University.

[241] Shuk-wai Freda, Fung. (1999). *Handling the Municipal Solid Waste in China. Case study of policies for 'White Pollution' in Beijing*. IIIEE Thesis. Lund: IIIEE, Lund University.

CHAPTER

SIX

6. Design for Environment as an EPR Goal

6.1 Identification of Product Improvements

As was seen in Chapter 3, the EPR concept was formulated to promote product and product change in order to reach overall life cycle improvement. The logic of extending the responsibility of the actor who can change the properties of the product seems evident and a rational producer could be expected to optimise the product and product system given the new circumstances and requirements. The DfE experiences, as illustrated in Section 2.3, prove that there are opportunities for win-win solutions for a wide range of products, that is, solutions that combine environmental improvements with economic profitability.

A key question is how such improvements could be registered and measured. It is quite obvious that a lot of product and product system development leading to environmental improvements is taking place all the time. Numerous examples have been published and the marketing activities of many companies are also a good indicator of the many improvements taking place every year. Whether or not they have been promoted by EPR systems is a crucial question to be asked.

It will never be possible to isolate the influence of the introduction of an EPR system from all other developments in society. Theoretically, it could be argued that given enough examples of EPR implementations, it would be possible to isolate the effects of the EPR system from other influences. However, EPR systems are imposed on nations and regions with different traditions, economies, and geographical and demographical conditions, among other things. The EPR implementations, as such, are also of very different nature, as has been illustrated in earlier chapters. An additional factor complicating the evaluations of the DfE promoting capacities of the EPR approach is the fact that only a few product groups have been affected

by EPR systems for a period long enough to allow for product and product system improvement to be seen. The time lag for product development activities is quite substantial in many industries. The more comprehensive product changes and the development of totally new product systems need considerable time to mature and to penetrate the market.

A major problem when assessing the impact of the EPR systems is the fact that companies react not only to the final implementation of EPR legislation, but also to anticipated requirements. Impacts on product design are also not limited to the country where an EPR system has been implemented. Manufacturers in the USA have, for instance, been reported to respond to EPR legislation in Europe.[242]

It should, consequently, not be expected that a completely rigorous evaluation of the actual influence of the existing EPR systems could be made. This dissertation attempts to use a combination of recorded experiences of observers and researchers, statements by companies, results from surveys to manufacturing companies, and some data on the development of the total packaging consumption in Germany after the introduction of the Packaging Ordinance in 1991.

6.2 Packaging and Product Improvement

It was earlier stressed that extended producer responsibility was to achieve changes in the design of products and services. In the case of packaging, such changes would be seen in the individual design of various packaging, in the design of systems, and also in an aggregate figure such as the total amount of packaging used in the country.

Changes in the design of packaging have taken place during the 1990s. Illustrative examples have been published by several organisations, among them the DSD. These examples are not limited to Germany; similar developments have taken place in other countries. To formally accredit such changes to the German development is not always possible. Cost-saving

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[242] Dillon, Patricia S. (1994). Electronics Recycling Legislation in Europe and Its Implications for U.S. Public Policy. In C. A. Wilt, & G. A. Davis, *Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention*, 14-15 November 1994, Washington, D.C. (61-73). Knoxville, TN: Center for Clean Products and Clean Technologies, The University of Tennessee, p. 71.

arguments could have led to the same measures in some of the cases.[243] However, if you speak to representatives of the packaging industry and industry using packaging, most of them will recognise the triggering effect of the German Packaging Ordinance. The development of policies and legislation concerning packaging in other countries, such as the Netherlands, has reinforced the understanding of having to change within industry.

After having performed a study on the effect of the one-year experience of the Austrian Packaging Ordinance, Vogel made some conclusions in 1994 about the effectiveness of the regulation. He argued that there were no reasons to expect a minimisation or avoidance of packaging before the Packaging Ordinance was introduced. Neither the economic situation nor the objectives of the packaging companies, isolated from the introduction of the legislation, could have explained the development he observed. He saw no reason not to attribute the changes in the packaging market to the introduction of the economic instruments by the Packaging Ordinance, and he especially pointed out the extension of the producer responsibility for take-back and recycling.[244]

Clement (1998), representing the Dutch Ministry of the Environment, stated very clearly that an effect of the Dutch Packaging covenant of 1991 was a drastic improvement of the overall environmental impact of packaging and a lot of innovations.[245]

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243 Serret, Ysé. (1998). Stimulating a Dynamics of Structural Change through Environmental Public Policy - Insights from the French Packaging Waste Policy. In K. Jönsson, & T. Lindhqvist, *Extended Producer Responsibility as a Policy Instrument – what is the Knowledge in the Scientific Community?* (42-63). AFR-Report 212. Stockholm: Swedish Environmental Protection Agency, p. 47.

244 Vogel, Gerhard. (1994). *Abfallvermeidung und Abfallverringerung in folge der VerpackVO* [Waste Avoidance and Waste Minimisation as a Result of the Packaging Ordinance]. Vienna: Wirtschaftsuniversität Wien, Institut für Technologie und Warenwirtschaftschaftslehre, p. 133.

245 Clement, Kees. (1998). Extended Producer Responsibility: Conditions for a successful policy. Some experiences in the Netherlands. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 4.

6.3 Total Packaging Consumption

Another measurement of the effects of the Packaging Ordinance is the amount of packaging used. When measured by weight, a decline has been seen in Germany since 1991 when the Packaging Ordinance was introduced, as is illustrated in Figure 6-1 and Figure 6-2 below. The average yearly reduction of close to 3% in the consumption in private households and small businesses should be compared to a normal increase of 2-4% per year during the 1980s.

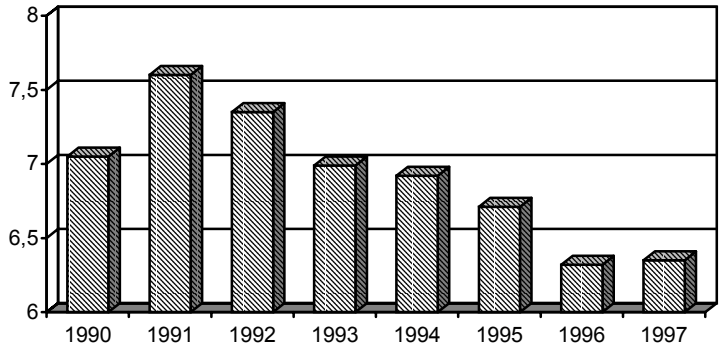

Figure 6-1. Packaging consumption in private households and small businesses in Germany 1990-1997 (Mtonnes)[246]

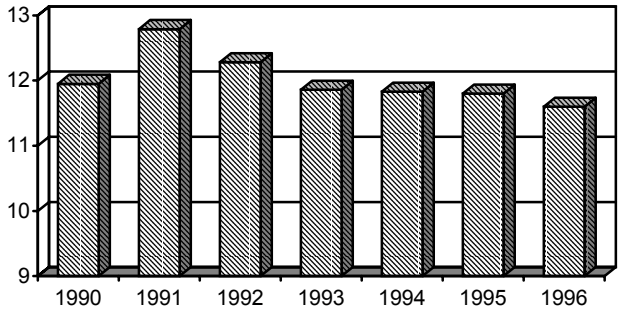

Figure 6-2. Total packaging consumption in Germany 1990-1996 (Mtonnes)[247]

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[246] Lindhqvist, Thomas. (1998). What is Extended Producer Responsibility. In K. Jönsson, & T. Lindhqvist, *Extended Producer Responsibility as a Policy Instrument – what is the Knowledge in the Scientific Community?* (3-10). AFR-Report 212. Stockholm: Swedish Environmental Protection Agency, p. 9.

It is quite evident that the decrease in the packaging consumption in private households and small businesses has been very significant and that a former trend was broken in 1991. It is clear that the Packaging Ordinance was the main impetus for this change. The effects of the German development can also be seen in other countries, reinforced by local regulations and expected future requirements.

Jim Salzman (1997), referring to personal and general experiences, pointed to the fact that the EPR schemes for packaging in Germany and other European countries had lead to the systematic search for product innovation in order to minimise the fees paid to the producer responsibility organisations.[248] He concludes that:

> *As markets evolve and new institutional links develop, companies are taking seriously what happens to their products when they become waste. That simply would not have happened ten or, in many cases, even five years ago.*[249]

A comparison in Austria shows that there does not have to be a link between economic growth and the amount of packaging used. The Austrian GDP in real values grew in the period 1994-1996 by more than 5%, while the packaging use was approximately constant.[250]

Bell (1988) made some conclusions concerning the need for a clear responsibility to be given to the manufacturer:

> *It is the product manufacturer that makes packaging design decisions. Diluting packaging fees among additional sectors reduces the economical justification to modify packaging.*[251]

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247 Ibid., p. 9.

248 Salzman, Jim. (1997). Sustainable Consumption and the Law. *Environmental Law, 27*, p. 1273.

249 Ibid., p. 1292.

250 Altstoff Recycling Austria AG (ARA). (1997). *Verpackungsoptimierung – Untersuchung über neue Lösungen bei der Verpackungsgestaltung* [Optimisation of Packaging – Study of new solutions in the packaging design]. Vienna: Altstoff Recycling Austria AG, p. 16.

251 Bell, Victor. (1998). How Manufacturers Are Responding to Extended Producer Responsibility Programs and How These Programs Can Be Made More Effective. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 7.

6.4 Packaging Industry Surveys

Already in 1992, the DSD carried out studies of the changes in packaging design.[252] In August and September of that year, all the 8 689 licensees were sent a questionnaire with this purpose. This was answered by 1 062 (12.2%), representing approximately 20% of the amount of packaging on the German market; 83% of the respondents claimed to have environmentally optimised some of their packaging; 17% had even optimised more than 50% of their packaging range.[253] The motives for this optimisation are shown in Figure 6-3.

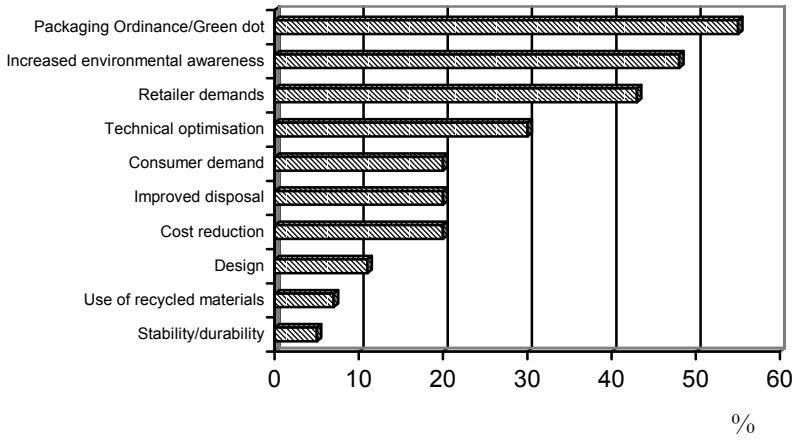

Figure 6-3. Main motives for packaging optimisation stated by German companies [254]

In the middle of April 1997, Altstoff Recycling Austria AG (ARA) sent out a questionnaire to 3000 member companies, approximately 30% of the membership, to explore if packaging from these companies had been optimised, and to find out in what way this optimisation had been achieved

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252 The study was carried out in co-operation with Universität Dortmund (Fachgebiet Logistik), and Institut für empirische Psychologie (Cologne).

253 Duales System Deutschland GmbH. (1992). *Der ökologische Wandel bei Verpackungen* [The Environmental Change of Packaging]. Bonn: Duales System Deutschland GmbH, pp. 7-9.

254 Ibid., p. 16. Translation from German by the author.

and quantify the results. The companies returned 265 questionnaires (9%), which is considered to be a more than average return rate. It could be noted that the data from these companies cover approximately 63 000 tonnes of packaging (1996), that is, approximately 10% of all ARA licenses.[255]

Approximately 70% of the responding companies had taken measures to optimise their packaging. The remaining 30% of the companies had, according to their answers, no direct influence on the design of the packaging because such decisions were taken in central offices, often outside of the country.[256] Despite a yearly increase in the financial turnover of approximately 3%, that is, approximately 9% since the Packaging Ordinance came into force, the packaging use had been slightly reduced over this three-year period.[257] The reasons stated by the companies for the measures taken to optimise their packaging are depicted in Figure 6-4.

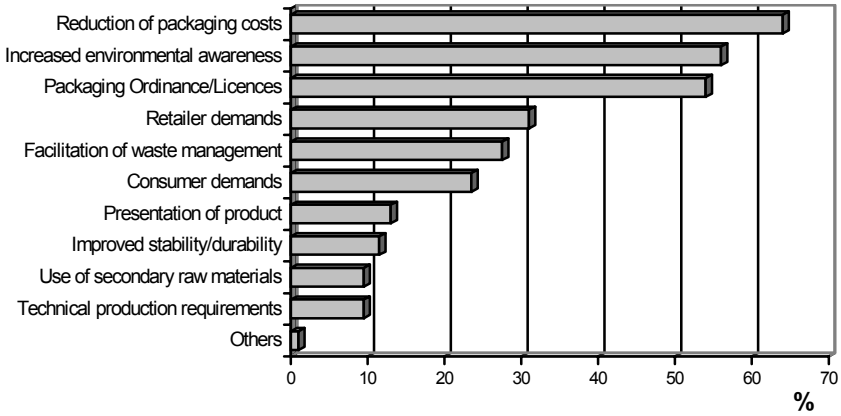

Figure 6-4. Motives for measures to optimise packaging stated by Austrian companies[258]

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[255] Altstoff Recycling Austria AG (ARA). (1997). *Verpackungsoptimierung – Untersuchung über neue Lösungen bei der Verpackungsgestaltung* [Optimisation of Packaging – Study of new solutions in the packaging design]. Vienna: Altstoff Recycling Austria AG, pp. 6-7.

[256] Ibid., p. 11.

[257] Ibid., p. 16.

[258] Ibid., p. 11. Translation from German by the author.

It can be noted that the economic argument may be directly expressed in two of three most often mentioned motives. It should be noted that the companies refer to more than one reason for these activities.

The questionnaire also explored what type of measures the companies employed. Twenty-five percent responded that they had been able to refrain from the use of packaging for at least one of their products. This concerns mainly secondary packaging, but also the delivery of products by tank wagon or tank lorry. The weight and material reductions seem to have been particularly important for wooden, plastic, aluminium and paper packaging. Reductions are also recorded for glass, ferrous metal and composites.[259]

The following measures for the substitution of packaging materials are the most recorded in the responding companies:[260]

- Substitution of shrimp plastics by plastic or metal stripes (53% of the recorded cases)
- Change from plastics to paper (21%)
- Composites replaced by plastics (15%)
- Substitution of plastics by glass (8%)
- Substitution of composites by paper (8%)

Many Austrian companies also refer to optimisation through exploitation of reusable packaging, as well as increased use of secondary raw materials in the production of packaging. Every second company expects further optimisation, and in this context they especially mention reductions of packaging costs, reduced material use, increased use of easily recyclable materials, more frequent use of reusable packaging, refraining from packaging, and simplification of material combinations.[261]

6.5 Other Examples of Product Change

Dillon (1997) studied three American manufacturers of electronic products. Concerning the computer manufacturer Compaq, she pointed to the take-

[259] Ibid., pp. 12-13.

[260] Ibid., p. 14.

[261] Ibid., pp. 14-15.

back legislation under discussion in Europe as a driver for design that created an "integral part of the competitiveness equation".[262] The desire to stay ahead of legislation was claimed to be a main trigger for Hewlett-Packard's product stewardship programme, and a similar explanation was also given for the telephone manufacturer Nortel.[263]

Wijnen (1997), representing the Dutch Ministry of the Environment, pointed to the fact that many producers started to think already in the design phase on the possibilities to reduce waste or to dismantle, reuse and recycle their products, and came to the general conclusions that the existing EPR schemes had substantially contributed to prevention, reuse and recycling.[264]

Den Hond (1998) pointed to activities in the car industry following the EPR discussions in European countries, and mentioned pilot projects with multiple objectives, including developing knowledge of design for disassembly and design for recycling, and increasing the efficiency of current vehicle designs and assembly procedures.[265]

The Ecocycle Commission (1998) reported a large number of cases where complex products had been adapted to better correspond to expected EPR requirements.[266]

Three out of five Japanese companies manufacturing products covered by the new legislation for electrical and electronic equipment responded in interviews performed during the summer of 1999 by designating the EPR legislation as one of the strongest incentives for their companies to be

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262 Dillon, Patricia S. (1997). Improving the Life Cycle of Electronic Products: Case studies from the US electronics industry. *The Journal of Sustainable Product Design,* Issue 2, p. 20.

263 Ibid., pp. 22, 27.

264 Wijnen, Henk. (1997). Product-oriented Environmental Policy as a Policy Objective for an EPR Programme. In *OECD International Workshop on Extended Producer Responsibility: Who is the producer?*, 2-4 December 1997, Ottawa, Canada, p. 1.

265 Den Hond, Frank. (1998). The 'Similarity' and 'Heterogeneity' Theses in Studying Innovation: Evidence from the End-of-Life Vehicle Case. *Technology Analysis & Strategic Management, 10,* p. 532.

266 Ecocycle Commission. (1998). *Företag i kretslopp – en lägesredovising av företagens kretsloppsanpassning* [Enterprises in Ecocycles: A status report on the adaption to ecocycles of enterprises]. Kretsloppsdelegationens rapport 1998:23. Stockholm: Kretsloppsdelegationen, Miljödepartementet, pp. 76-103.

engaged in DfE activities. Japanese companies manufacturing IT equipment not covered by the new legislation were less inclined to see an incentive in a presumed future expansion of the law. Instead, they referred to other circumstances such as take-back connected to leasing, general recycling promotion policies, European legislation, and foreign market demands.[267]

Bugge (1996) summarised a meeting in Oslo and stressed the great potential for making seemingly non-profitable systems profitable through steady improvements in product design and organisation that he had heard illustrated by the presentation of the Senior Vice President of Electrolux, Mr. Per Grunewald.[268]

It should, however, be mentioned that there are also those who question the possibilities to promote the necessary restructuring of the handling of materials and the creation of markets for recovered materials by introducing EPR legislation. Hjern & Plogner (1999) questioned the chances of closing many material loops, based on their experiences from analysing the furniture and packaging industry, among others, and further asked whether the state ought to be involved at all.[269]

6.6 Deposit-Refund Systems and Refillable Containers

The question of whether deposit-refund systems for beverage containers promote refillable containers or not is an issue that has been debated. US data seem to imply that a mandatory refund does not necessarily increase or even stabilise the market shares for refillable bottles. As can be seen from Table 6-1, refillable bottles rapidly decreased their market shares during the period 1947-1990.

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[267] Tojo, Naoko. (1999). *Analysis of EPR Policies and Legislation through Comparative Study of Selected EPR Programs for EEE – Based on the In-depth Study of a Japanese EPR Regulation*. IIIEE Thesis. Lund: IIIEE, Lund University, pp. 42-43.

[268] Bugge, Hans C. (1996). Summary. In *Green Goods 3: The Third International Conference on Product Oriented Environmental Policy,* 15-16 February 1996, Oslo, p. 5.

[269] Hjern, Benny, & Plogner Ann-Charlotte. (1999). *Vems styrmedel är producentansvaret?* [Whose policy instrument is the producer responsibility?]. AFR-Report 247. Stockholm: Swedish Environmental Protection Agency.

Table 6-1. Market share (%) of refillable bottles in the USA 1947-1990

	1947	1959	1967	1978	1990
Soft drinks	100%	96%	65%	38%	7%
Beer	86%	53%	35%	11%	5%

Source: McCarthy (1993) [270]

The expectation that the introduction of a beverage container deposit would increase the demand for refillable bottles seems to be confirmed by the experiences of the first US states enacting deposit-refund legislation, as shown in Table 6-2. However, according to McCarthy, the market shares have declined in the long run in most deposit states, as well as in all of the USA. Even so, he states that the market shares in the states with deposit-refund seem to be "somewhat higher" than elsewhere.[271]

Table 6-2. Market shares of refillable bottles for soft drinks and beer before and soon after the enactment of deposit-refund laws in four US states

	Maine		Michigan		Oregon		Vermont	
	Before	After	Before	After	Before	After	Before	After
Soft drinks	0%	64%	22%	66%	53%	91%	73%	85%
Beer	4%	8%	16%	32%	36%	95%	7%	23%

Figures are presented as percentage of the total market. 'Before' and 'soon after' were not defined in the source used by McCarthy, but he assumes that they represent the year immediately prior to implementation of the law and the year immediately after.
Source: McCarthy (1993) [272]

The forced introduction of a deposit-refund system is a sanction that was attached to the German Packaging Ordinance. The Ordinance requires a share on the market of refillable containers corresponding to at least 72% of the sales for beer, mineral water, carbonated soft drinks, fruit juices, and wines. The corresponding figure for milk containers is 20%, but also milk

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[270] McCarthy, Jim. (1993). *Bottle Bills and Curbside Recycling: Are They Compatible?*. CRS Report for Congress. 93-114 ENR. Washington, D.C.: Congressional Research Service, The Library of Congress, p. 9.

[271] Ibid., pp. 9-10.

[272] Ibid., p. 10.

pouches are included in this figure.[273] The method of calculating the figure has been changed to avoid the introduction of deposit-refund systems. In the revised Packaging Ordinance, for instance, the requirement is a total figure for the entire Federal Republic, while there were individual requirements for each Province in the first Packaging Ordinance. However, figures below 72% have now been reported for 1997 and 1998: 71.4% and 70.1% respectively. A prognosis of a 68% market share has been mentioned for 1999.[274] This means that the German Government should impose countrywide requirements for deposit-refund of at least DEM 0.50 (USD 0.24) for containers of a volume of up to 1.5 litres and DEM 1.00 (USD 0.49) for larger containers.[275]

The dilemma for the Government is that criticism exists today from two sides. The industry and retailers have constantly opposed deposit-refund systems; but also the pro-refillable NGOs are reluctant, as they fear that a deposit-refund system would favour the wider spreading of one-way packaging. The Swedish experience proves that compulsory deposit-refund systems do not necessarily favour refillable bottles, but could as well work efficiently with non-refillable containers, in the Swedish case: plastic bottles and aluminium cans. These NGOs would favour high environmental fees on non-refillable containers.

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[273] Verordnung über die Vermeidung und Verwertung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 27. August 1998 (BGBI. I 1998 S. 2379) [Ordinance on the Avoidance and Recycling of Packaging Waste (Packaging Ordinance)], § 9 (2).

[274] Environmental Data Services. (2000, March 2). German drinks packaging debate heats up. *ENDS Environment Daily* [Online]. Available e-mail: mailer@ends.co.uk [2000, March 2].

[275] Verordnung über die Vermeidung und Verwertung von Verpackungsabfällen (Verpackungsverordnung – VerpackV) vom 27. August 1998 (BGBI. I 1998 S. 2379) [Ordinance on the Avoidance and Recycling of Packaging Waste (Packaging Ordinance)], § 8 (1).

CHAPTER

SEVEN

7. Analysis

7.1 The Actors in an EPR System

The product system consists of a number of actors with different roles. A simplified linear model, as shown in Figure 7-1, can start with producers of raw materials, followed by a varying number of manufacturers of components, the manufacturer of the final product in question, and then a distribution network with a varying number of steps and individual organisations. The product then enters the use phase, which might involve one or several consecutive users (consumers), before the product is worn out and not readily reparable. Finally, it enters the end-of-life stage, with alternative routes leading in one or several steps to reuse, recycling, recovery or final disposal.

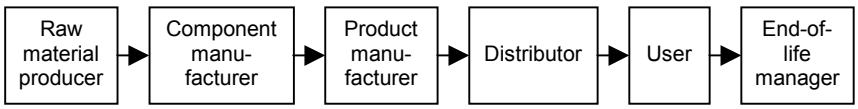

Figure 7-1. A simplified linear model of the product system actors

The alternative product systems, which include the reuse of a product or product components and recycling within the product system, are shown in Figure 7-2.

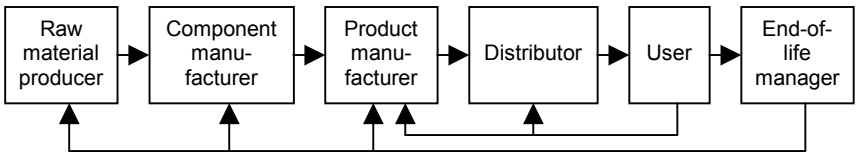

Figure 7-2. A model of the actors in the product system with reuse, and recycling

If the product is examined in a life cycle perspective, then the product system can be described as a loop. The loop will be more or less closed depending on whether the product is being reused or recycled to the same product system. When the material is being recycled and used for a product belonging to another product system, then the first loop will lead into a loop belonging to another system.

The systems described above are simplified and in all real systems there will also be a number of additional actors. In the manufacturing stages, there will be a huge number of service organisations providing the production facilities with all the necessary services in order to make production possible. In the same way, there will be numerous actors providing services to the other actors in the distribution system and to the users, for instance, in the form of repairs.

The way the product system works is also influenced by legislation and the way the local, regional, and national authorities enforce the regulations. Particular product systems can also be of vital interest for various types of professional associations, consumer groups, and environmental organisations, etc.

In order to analyse the implications for EPR systems, it will be beneficial to determine the specific roles of the relevant key actors. The experiences from existing and proposed EPR systems have led the author to identify four groups of key actors in the implementation of these systems. It is important to point out that the results of this analysis will not be the same if the study is focused on the negotiation phase of an EPR system. The latter case will be discussed in Section 8.5.

The four key actors are illustrated in Figure 7-3, and consist of the following groups:

- Producers – these are all the actors from raw material extraction, component manufacturing, assembly of the final product, and distribution. The latter stage includes actors such as wholesalers, importers, dealers, and retailers.
- Users – these are private and professional consumers.
- Waste managers – these are the actors collecting the discarded products, the ones that are sorting, dismantling, and treating the collected products, and finally the various actors involved in recycling activities. The latter group includes material processors such as waste

paper plants, oil re-refining plants and metal re-melting plants, as well as those involved in the remanufacturing and refurbishment of products.

- Authorities – various levels of the government that are involved in the supervision and sometimes in the management of the EPR systems. The latter case has been illustrated, for instance, by the government managed funds, which have been established in several countries, including the car-scrapping fund and the battery fund in Sweden.

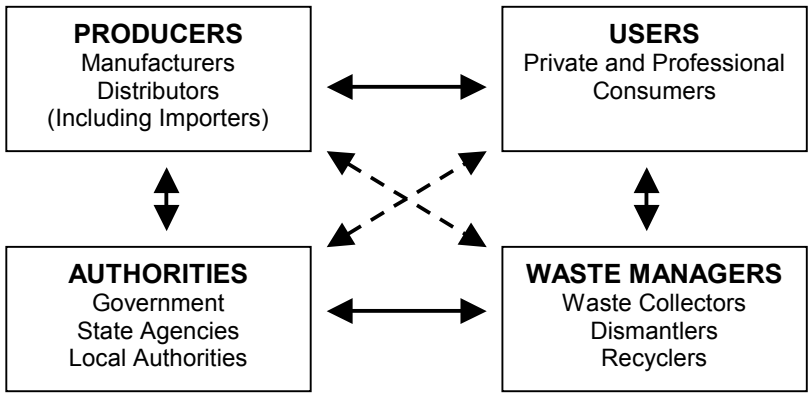

Figure 7-3. The four groups of key actors in an EPR system.

All these actors have their particular roles and particular possibilities of influencing various parts of the product's system. The users make the purchasing decisions and in that sense decide what products are to be manufactured. However, the possibilities for the users to transfer their preferences are not always present in real life. The consumers are restricted to choosing or not among the various products offered on the market. The opportunities to initiate totally new products or redesign the existing products are, for especially the private consumer, in most cases very limited.

It is instead the manufacturer or, in certain cases, the distributors who are the ones to mainly initiate the design changes in existing products and the development of new products and product systems, based on their perceptions of existing and future consumer preferences.

The waste managers should not be seen as one homogeneous group. They are for the most part not at all involved in product development. The links between most waste managers and the manufacturers of the discarded products are very often non-existent. The obvious exemptions are for the

cases where the recyclers are also processors of virgin materials. For instance, many paper and metal manufacturers work with secondary materials, as well as primary ones. There are also some cases where product manufacturers combine recycling activities with their ordinary business, such as some of the manufacturers of nickel-cadmium batteries. Another exemption are manufacturers involved in the remanufacturing of their own products. However, disregarding the mentioned exemptions, waste managers have very little contact in general with the producer group.

Authorities provide, among other tasks, the legal framework in which the other actors have to work. As seen from Chapter 5, the authorities are only to a limited extent able to regulate, and especially enforce, detailed requirements on the private consumers in areas that concern sorting and separate collection. The same restrictions are true concerning buying patterns. For producers, the authorities have the potential to implement quite severe limitations on their activities. In reality, this is not typical and the specific regulations concerning manufacturing are relatively few and of a general character. The waste managers, on the other hand, are to a much larger extent steered by governmental decisions, and considerable portions of the waste management activities are in many countries performed by local authorities with their own staff.

The analysis of the various actor groups and their roles demonstrates that there are few real feedback loops today from waste managers to the producer group, especially to the manufacturers of the final products, and from them to the distributors. Also in the case of authorities and users, especially private consumers, there is scarce communication for environmental improvement based on experiences with the present products. These feedback loops, therefore, are the key to product and product system improvement. The successful EPR scheme must secure – that is, in most cases create – such feedback loops where they do not already exist.

7.2 Various Types of Products

Products are of very different sizes, complexities, durability, prices, etc. Most product groups that have been included in EPR implementations are mentioned in Chapter 4. Some fundamental differences between various product groups have proved to be of special importance with respect to the way the EPR system will function.

The preceding chapters have shown that much of the experiences with EPR schemes are connected to packaging. Packaging is in most cases a short-lived product with a relatively low complexity with respect to the number of materials employed and the way the materials are joined.

Cars and electronics are products of a very different type. The way they are constructed – for instance, the number of materials and components – and the length of the life cycle are examples of how they differ from packaging. They are also examples of products with an international market. For many of them the number of manufacturers is very limited worldwide and the number of manufacturing facilities is also limited. This means that these products are often not manufactured in the country where they are used, but are imported from other countries.

The concept of durable products covers products such as cars and electronics. However, it also includes a number of products with very different qualities, such as simple types of construction materials, screw drivers and other tools made of only one or two materials, garden furniture, etc. The latter types of products have a long life span, but are in many cases, because of the mono-material construction, readily and easily recyclable if separated into the corresponding material fraction.

There was a need for a new terminology and the author, together with Erik Rydén, developed the concept of *complex products* in the early 1990s. The concept of complex products may be used for a broad spectrum of products. Characteristic of complex products is that they consist of several different components and materials. Another characteristic is their relatively long life prior to disposal.

Among the different groups of complex products, the following have attained almost global special interest with regard to their environmental end-of-life management: electrical and electronic equipment (TV sets, radios, refrigerators, washing machines, calculators, etc.), machinery and vehicles (lawn-mowers, cars, power aggregates, aeroplanes, etc.), and building materials. Spare parts and accessories to these products may also be included in the concept.

This list may of course be supplemented with many smaller groups of products, which may not fit directly into the main groups mentioned above, but still could be considered as complex products. Examples are batteries,

and many types of furniture, kitchen utensils, clothes, sporting equipment, tools, and stationery.

The characteristics of complex products differ in many ways from products that are traditionally recycled. One of the main characteristics of complex products is that their inherent complexity may discourage recycling. Complex products are built of various materials that may be combined in ways that make them technically difficult and expensive to separate during recycling. The use of new materials with unknown environmental qualities and the long life of the products prior to disposal make any predictions of the costs for the handling and treatment of complex products more difficult.

An important distinction, in the context of EPR, between different types of products is the market in which they are used. A product that is used only by professional users is more easily controlled by legislative restrictions, both concerning usage and end-of-life disposal, than a product that is used mainly by private consumers. An illustration of this are the experiences from the battery collections in Sweden, where it is a well-known fact that the companies and organisations were much more successful in collecting batteries than private households.

It is also apparent from the battery collection that the way the product is used and replaced when worn out strongly influences the need for incentives to secure a high collection result. The collection results for button cells are generally very high, even when the problems connected to establishing the correct sale figures are acknowledged. The reason may be due to the fact that many button cells are used by professionals. However, it may also be due to the difficulty for the private person to know how to replace the battery in a watch, for instance, or to know which specific button cell is needed for the particular piece of equipment. This means that a large portion of the button cells are replaced in shops selling clocks, cameras, electronics, and similar goods. Hence, in this case, the problem is simplified and can be solved by encouraging the shops to put the batteries in a separate box and then organise a collection system covering the relatively limited number of shops in question. The extra economic incentive for the shops to sort out the silver oxide batteries has added to the total result of this collection. Thus, in the collection of button cell batteries we recognise the factors encouraging high collection results as discussed in Chapter 5.

7.3 Historical Products vs. New Products

A special problem for EPR systems that has attracted considerable attention during the last years is the issue of so-called *historical products*. An historical product is a product that was sold before the EPR system was implemented. The principal question that has been discussed concerns the legality and the appropriateness of instigating new responsibilities, with subsequent economic consequences, that cover such products. This would be a form of retroactive legislation, which, depending on the country, may be in conflict with the fundamental rights declared in the constitutions.

The legal discussion will not be referred to here in any detail, as the main emphasis of this dissertation is on the change of products and product systems; that is, how to influence the environmental impacts in the future. As the name also indicates, the problems related to historical products are due to an inheritance from the past. However, the issue deserves some comment, as any EPR system must in one way or another address the problem. It will also be seen in the following chapter that there might be strong reasons to address the historical and new products with a common approach in its most essential aspects.

It is worth mentioning that the date from which to label a product historical is not necessarily the date when the full EPR system was implemented. It might as well be argued that as soon as the legal responsibilities have been clearly decided, the various actors, particularly the ones given the economic and physical responsibilities, can incorporate these requirements into their planning and deal with them in the same way as with any other specifications for new products.

During the last decade, companies from all over the world have provided information about the way they have prepared their products for take-back and recycling. It could, indeed, be argued that this shows that the manufacturers, at least of the products discussed for EPR implementation, have had a considerable time to prepare themselves for the new requirements. The counterarguments are the uncertainty of the real future requirements and the way the EPR schemes are to be organised. The weight of these arguments is dependent on how the responsibilities are allocated and on how, for instance, issues such as free riders are dealt with in the particular scheme.

A particular problem related to historical products are the so-called *orphaned products*. An orphaned product is a product whose producer, as defined by

the producer responsibilities, has ceased to exist as a legal entity. The likeliness of this situation occurring depends significantly on what product is discussed, the length of the life span of the product, and the type of manufacturers, etc. The concerns are especially significant when small importers, which in many cases are companies with a less certain future and smaller financial assets to cover unexpected costs, are the ones that should bear the producer responsibilities. A successful system must incorporate solutions for how to deal with these orphaned products.

The debate over historical products must be seen in the perspective of the size of the economic consequences which increased demands on collection, proper treatment, and recycling may have for many product groups. For products with a long life span, the total number of historical products may be many times higher than the number of products that are sold each year. For example, the number of cars on the EU market today is 160 million, which is approximately eleven times higher than the number of cars that are sold each year. The German car industry has estimated that the proposed EU Directive on end-of-life vehicles would cost them approximately EUR 10.2 billion (USD 9.8 billion) – only to pay for the costs of the historical vehicles that would be covered by the directive. It was estimated that the German manufacturers would be responsible for 40% of the cars. This figure has been contested as being exaggerated, but even a fourth of this, which is the figure calculated by the German Government, is a considerable amount of money and gives an indication of the problem. [276]

A concern that has been raised in this context is that the size of the economic responsibility for an individual manufacturer could make the company legally insolvent. This problem is of particular concern for importers without large assets in production facilities and equipment that would balance the deficit on the balance sheet. When this is the case, a solution to the issue must be incorporated in the EPR system, for instance in the form of a legal exception decided by the appropriate organs.

The discussion around historical products illustrates not only the principal and practical problems connected with the design of an EPR system, but also the more fundamental problem of a society that has not designed the necessary responses to production and consumption activities. Whether

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[276] Environmental Data Services. (1999, July 29). Car firms "inflated" costs of ELV directive. *ENDS Environment Daily* [Online]. Available e-mail: mailer@ends.co.uk [1999, July 29].

expressed in economic terms or as a technical challenge, the sheer size of the problems society is now facing in taking care of the products consumed is, of course, a reflection of a production system and a society that did not demand these solutions to be identified and addressed before new products were introduced on the market. The problems, if they were at all recognised and understood, were left to future generations to solve.

7.4 Who Is the Producer?

Early in the development of the EPR concept, the question of who the producer is was raised. As was seen in Section 3.5, the concept of shared responsibility was put forward by many industrial representatives as an alternative approach. Also, the extended product responsibility approach, originally presented by the US President's Council for Sustainable Development, is emerging from attempts to answer this question. Much of this discussion is, unfortunately, based more on ethical arguments or on discussions about semantics than on what the results of various approaches mean to society and what the chances are of encouraging measures leading to environmental improvements.

One argument put forward is that all actors must share the responsibility, because all actors contribute to the environmental impacts of the product. The manufacturer should be responsible for the manufacturing stage and its impacts, and to produce products with good environmental qualities, and the distributor should be responsible for an efficient and environmentally adapted distribution of the products. The consumer will have the responsibility for using the product in the best way and for disposing of the product in the proper way at its end-of-life; and finally it is the task of the waste managers to treat the discarded products correctly and to take advantage of the qualities of these products through reuse, recycling, and recovery.

It is easy to sympathise with this type of argument and agree that all actors have a responsibility for acting in the appropriate way. It will always be a reasonable request to demand that each actor follow the rules set out by society, and it would be unreasonable to make one actor responsible for all types of activities related to a product system.

As was discussed earlier in this dissertation, there is, however, the need for a change in the products and the product systems themselves. Not all actors in the product life cycle will be directly involved in the development of

these new products and product systems. In all normal systems, it is the manufacturers who carry out the product development and the design of products. The competence and resources for this work lie, consequently, also with the manufacturers.

It has also been shown that the feedback from users and waste managers is not functioning today in a way leading to the necessary changes. The successful EPR system must incorporate built-in feedback loops from all the relevant actors in the life cycle in order for this information to form the basis for the new, improved products and product systems.

When designing EPR systems, it is sometimes impossible to address the product manufacturer. Such a case is when a product is manufactured abroad and imported by a legal entity other than the manufacturer. The standard solution in these cases has been to equate an importer with a manufacturer. This is routinely the case in the various Swedish ordinances on producer responsibility. This must be seen as a necessary compromise based on the restrictions to legislate over national borders. There are cases when the links between an importer and a manufacturer are quite close, but there are also cases when the contacts are very limited. In the latter case the feedback loops must be established through the introduction of the EPR system, or the approach must rely on the possibility of the importer to change his product mix and his choice of brands in order to better optimise his situation in the new context.

The German Packaging Ordinance is an example of a legislator choosing to address primarily an actor in the producer group that is not the manufacturer. The ordinance requires the retailers to take back sale packaging from the consumers. However, the outcome of the discussion preceding the publication of the final ordinance led to the establishment of the DSD and the collection system as it is described in Section 4.3. This solution has been accepted in the ordinance, providing it achieves the specified goals. If these goals are not reached, then the retailers will be responsible for the take-back in their shops. This is an example of how an actor who is seen as being influential in the product system in question can be used to target the actor who is in control of the product design.

The choice of directly addressing an actor in the product group, such as the retailer instead of the manufacturer, is connected to the practical possibilities of reaching all the relevant actors and enforcing the EPR system. In Germany, the group of retailers is dominated by a very limited

number of retailer chains. The preceding actors in the producer group, whether they are the manufacturers of the products, which are packed, or the manufacturers of the packaging itself, are very numerous. The retailer group is thus easier to reach and control.

It can, in general, be assumed that the information flow between the actors in the producer group is much more developed, compared to the information flow with the actors outside the producer group. It will therefore be more straightforward to incorporate feedback loops between these actors. The actors in the producer group are also normally connected by a standard business relationship, which creates various forms of inter-dependencies between these actors. The problem with feedback loops between these actors is not trivial and has been exemplified in the many studies and projects that have been conducted in such areas as integrated product chain management.

However, for each particular product group these issues must be investigated thoroughly before the appropriate producer can be designated particular responsibilities in the EPR system. The leading principle is to find actors that are able to effectively influence the change towards improved products and product systems. The question about producer identity is, thus, a practical question about designing a controllable system with the desired feedback loops, and not a semantic or moral question.

Mr. Henrik Troberg, Electrolux Environmental Affairs, pronounced the arguments in favour of a manufacturer-oriented EPR system in an interview for the newsletter Miljörapporten in early 1999. He comments on EPR for electronic and electric equipment as it is discussed on the EU level and in the EU member countries and classifies these systems as being based on a shared responsibility. He is quoted as saying "the waste management is transferred from a public collective to an industrial collective", and he continues, "We want to see a more market driven system, and a system that is open for alternative and more visionary ideas". Troberg further expresses that Electrolux wants EPR to be an area for competition between manufacturers, and that such an allocation of responsibility rewards intelligent and resource-saving solutions and, hence, promotes product development towards environmentally improved design. The collective systems do not have the same driver.[277]

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[277] *MiljöRapporten.* (1999). Stockholm: Ekonomi-Teknik Förlag AB. No. 1, p. 14.

It is also unreasonable to expect manufacturers to economically sub-optimise their production. They are today only economically rewarded for their environmental efforts if these are required by enforced legislation, or if the consumers prefer the environmentally superior products. The extended producer responsibility approach is a way to internalise part of the environmentally related costs in the price of the product and thus is in correspondence with the polluter pays principle. It is true that the EPR systems will only internalise those costs that are priced. However, even if external costs, such as the impacts of emissions from landfills or from transportation for waste management, are priced by society through environmental charges, it does not necessarily mean that the consumer will pay when buying the product. The EPR approach is the way to ensure that these costs are included in the price of the products and that the consumers are given the appropriate price signals.

7.5 Setting the Goals of an EPR System

Chapter 5 has shown that the factors that ensure high collection results are convenience (including the possibility of avoiding inconvenience), financial incentives (refunds, risk of having to continue to pay taxes, etc.), and information (awareness). These are then, obviously, the factors to be addressed by the policy instruments chosen for the implementation of the EPR system when certain collection goals are to be obtained. The EPR system can, additionally, if properly designed, provide financing for the collection system and create incentives for developing an efficient system to reach the set goals.

It was further shown in Chapter 5 that the attainment of specified recycling goals is essentially an economic issue. The EPR system can in the same way secure financing for this.

However, this does not answer the question about what collection or recycling targets should be set or if, indeed, any such targets should be set at all. This is, essentially, a political decision that should be based on social values and available information about all the consequences of the different alternatives. The possibilities of obtaining relevant information are briefly discussed in Section 7.6 below.

We will not discuss cases when collection and/or recycling are the only environmental goals that are being sought. The emphasis of the dissertation is on those cases where the main objective is to achieve environmental

improvements of the products and product systems through design and product development.

Collection and recycling targets are in this context secondary goals that are justifiable if they give the proper incentives for changes of the products and product systems. Some such desirable changes may, in fact, be to increase collection and recycling of discarded products. However, these secondary goals should be the result of a life cycle approach to the environmental impacts of the services provided by the product systems.

It would be ideal to have an assessment tool that would supply the decision makers with information about the optimal systems. However, all available assessment tools are subject to principal and practical limitations, as is discussed for life cycle assessments and cost benefit analyses in Section 7.6 below.

An important limitation of the assessment tools is connected to the possibility of dealing with changes that are not known today. If incentives are given for promoting change in the form of product and product system improvement, but the responses to these incentives are not known, then it is impossible to formulate probable scenarios that could serve as the basis for estimating the environmental and other consequences of this change. The more radical the desired and expected changes are, the more difficult it will be to predict how the final outcomes will be conceptualised.

Product systems can be changed in many incremental steps, or, at least in some instances, by fundamental system changes. When the process takes place in incremental steps, it is important to realise that it is not necessary that each step in itself lead to an immediate improvement of the total system. The really important outcome is the sum of all the incremental steps and whether they together add up to the optimal level of product system improvement under the given conditions.

A way of identifying such changes is to use a back-casting approach, that is, to define the desired qualities of a future product system, and, based on this scenario, study and find the necessary measures in order to actualise this scenario. These scenarios may be built on the fundamental features of a future system, such as the need for factor 10 or factor 20 improvements of a product system. From a product end-of-life management perspective, questions concerning the long-term sustainability of a waste treatment system based on landfilling or waste incineration could be raised.

In the view of the author, the important goal for an EPR system is the ability to create incentives for the continuous improvement of product systems. A truly sustainable society will not be reached in any foreseeable future, and the changes that are needed are substantial.

7.6 Evaluating the EPR System

7.6.1 Life Cycle Assessments and Cost-Benefit Analyses

The difficulty, and even inappropriateness, of using assessment tools for determining the goals of an EPR system has been discussed in Section 7.5. In this section some of the practical problems connected to the more commonly applied assessment tools will be elaborated. Life cycle assessment (LCA) and cost benefit analyses (CBA) are such assessment tools that have been used to evaluate proposed and implemented EPR systems.

Life cycle assessment (LCA) has a history dating back to the energy-related analysis of product systems from the 1960s. The assessment tool was further developed to incorporate other environmentally relevant factors: emissions to air and water, generation of wastes, etc. These assessments were called product life assessments, life cycle analyses, eco-balances, environmental profiles, etc. Companies, governments, and NGOs performed them for various purposes, including lobbying for or against one-way packaging, refillable containers and recycling systems.

The LCAs have been gradually more formalised in the 1990s, leading to ISO standardisation of the methodology. Many organisations have been engaged in the discussions about LCAs in the 1990s and a large number of companies have used LCAs to systematically study the environmental implications of their products.

According to the ISO 14040 standard, LCA is divided into four steps:

- Goal and scope definition
- Inventory analysis
- Impact assessment
- Interpretation

All steps of the LCA are connected to specific problems. Three major problems will be highlighted here:

- *Definition of relevant system boundaries*
  The system studied in the life cycle assessment is not immediately defined. It is interacting with a number of activities that are related to the system, but is not necessarily an integral part of it. To decide how far back in the raw materials acquisition the system should extend, and what parts of the systems for auxiliary tools and infrastructure are to be included, is a difficult task. System boundaries also include a temporal and geographical dimension, and both of these aspects set limitations on the applicability of the chosen system.
- *Data quality problems in the inventory analysis*
  The data used in the LCAs are often inaccurate because of fundamental measurement problems, as well as the cost of performing special measurements for all the particular processes in a product system. Many types of emissions and discharges are very seldom monitored; and, when they are measured, they are not measured in a way covering natural variations.
- *Problems in comparing environmental impacts of different types*
  There is no basis in natural science for how to compare environmental impacts of different types – for instance, how global warming effects could be compared to eco-toxicity. The LCA models have also been forced to utilise a number of assumptions about various impact categories that are not necessarily very accurate models of reality. Dose-response functions are, for instance, generally supposed to be linear without any threshold levels. In reality, however, most of the relations are far from being linear. Synergetic effects, as well as varying local sensitivity to different emissions, are also not included in the normal LCA approaches.

These limitations inherent in the LCA methodology restrict the applicability and relevance of the assessment tool. It could be noted that the same limitations are present when discussing cost benefit analyses. Both these tools are also subject to the problem of dealing with changes that have not occurred yet, as was discussed in the preceding section. The assessments that have been performed are consequently often static and do not take into account dynamic factors. This is, of course, a detrimental approach if the very essence of the system to be evaluated is the ability to promote change of product systems. If these changes can be foreseen and scenarios can be developed, then it is possible to include a dynamic element in the

evaluations. However, the innovative approaches are generally not foreseeable to any substantial extent. It is even difficult to evaluate many innovative solutions in the first period of the application as the system has not had time to optimise itself and the infrastructure has not adapted to the new circumstances.

It must be observed that the attractiveness of the cleaner production approach is based on the opportunities for win-win solutions. An evaluation tool must, if it is to be at all relevant in the cleaner production context, allow for win-win opportunities to be explored. That is, it must be recognised that information is lacking about improvement possibilities in society, and that by using the appropriate approaches, these opportunities will be more efficiently explored. The EPR approach further assumes that if society adopts the right policy instruments, then manufacturers would be more likely to recognise such win-win opportunities.

7.6.2 A Short Note on the Cost Calculations

A particular issue related to the application of cost benefit analyses has been noted in a number of studies concerning the implementation of the packaging recycling systems in Sweden and Norway. Two of the recent studies have in common that they explicitly attempt to evaluate in monetary terms the time spent by households on cleaning, sorting, and delivering the waste packaging to the recycling system.[278] By using a cost of SEK 60 per hour, and an estimated average of 30 minutes extra work in each household per week, the Swedish study comes to the conclusion that the costs of such a recycling system far exceed the benefits.[279] The totally dominating cost in these calculations refers to the time spent by the households. The studies have been criticised in many aspects by various persons.[280] The criticism

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[278] Radetzki, Marian. (1999). *Återvinning utan vinning – en ESO-rapport om sopor* [Recycling – Not Worth the Effort – An ESO report on Municipal Waste]. Ds 1999:6. Stockholm: ESO, Finansdepartementet.
Bruvoll, Annegrete. (1998). *The Costs of Alternative Policies for Paper and Plastic Waste.* Oslo: Statistics Norway.

[279] Radetzki, Marian. (1999). *Återvinning utan vinning – en ESO-rapport om sopor* [Recycling – Not Worth the Effort – An ESO report on Municipal Waste]. Ds 1999:6. Stockholm: ESO, Finansdepartementet.

[280] Andersson, Karin, & Ekvall, Tomas. (1999). *Utvärdering av återvinning för Göteborgsområdet* [Evaluation of Recycling for the Gothenburg Area]. Gothenburg, Sweden: CIT Ekologik.
Bruzelius, Jan. (1999). *Har vi råd med återvinningen?* [Can We Afford the Recycling?]. [Online]. Available: http://www.ilreturpapper.se/aktuellt/index.html [3 December 1999].

includes the selection of data, the choice of monetary values for various environmental impacts, etc. That is, the critics have pinpointed several of the inherent weaknesses of the evaluation tool. It is of special interest in this dissertation to note that these studies do not recognise any product or product system improvements, besides the increased levels of recycling of the packaging materials.

The value attributed to the time spent by a household has also been the focus of discussion. It can be questioned what value for time spent in this way would be appropriate. The value should reflect the way the individuals perceive their efforts. There are no theoretical limits to this value and it is permissible to assume a negative value if the individual judges the effort to be connected with enough satisfaction that he is prepared to conduct it, even when connected with an expense. Cases when individuals are not expecting any monetary compensation are well known and include, for instance, charities of various types. If it could be assumed that people do indeed view their participation in the recycling activities as something giving them positive value, then the total outcome of the calculation would be changed.

This issue will not be further developed in the dissertation; but it may be noted that if the approach is the one described in the following section, then this will raise additional doubts about the values used in the above-mentioned studies.

7.6.3 Evaluations Expressed in Consumer Polls

The appreciation of an EPR system as expressed in consumer polls could be regarded as an alternative to other evaluation tools. Two consumer polls will be discussed below. They have been performed in Sweden and Austria, and both are related to the EPR systems for packaging in the two countries.

Sifo Research & Consulting AB, commissioned by Svensk Kartong-återvinning, explored the views of a randomly selected group of 1000 Swedes from the age of 15 years and upwards in the period 22-25 February 1999. The survey was conducted by telephone interviews. Of the respondents, 69% said they sort packaging and hand it in for recycling. This initial question was followed by several questions concerning problems related to the collection points. These problems have been fairly extensively reported in the media and it is tempting to believe that such questions would provoke the respondent to think about the negative aspects of the

packaging collection.[281] Still, an overwhelming majority (81%) of the respondents who sort packaging answered that they perceive the packaging collection system to function 'very well' ('mycket bra') or 'rather well' ('ganska bra'). This figure was roughly the same for all groups of respondents. The distribution between 'very well' and 'rather well', as well as between 'very badly' ('mycket dåligt') and 'rather badly' ('ganska dåligt'),[282] was, however, somewhat different between men and women and between private business owners and employees.[283]

The consumers in Austria claim to have a very positive view of the Packaging Ordinance and the separate packaging collection. In March 1999 the market research institute IMAS, commissioned by ARGEV, asked a representative group of consumers about their experiences in the collection of plastic and metal packaging. Of the respondents, 90% claimed that waste separation was a 'very good' ('sehr gut') or 'good' ('gut') idea, and 75% found the Packaging Ordinance to be 'very good' or 'good'.[284]

It could also be noted that 96% of the respondents said they actually separated packaging, 61% of them also had the view that this did not lead to any additional time spent on waste management, and 70% viewed the

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[281] Questions asked are: 'How would you describe the maintainance of the recycling centre you use?' ('Hur skulle du beskriva skötseln vid din återvinningsstation?'), 'How often is there litter at your recycling centre?' ('Hur vanligt är det att det förekommer skräp på din återvinningsstation?'), 'What do you believe to be the most common reason for littering at your recycling centre?' ('Vilket tror du är det vanligaste skälet till nedskräpning på din återvinningsstation?'), 'How far is it to the place where you can deposit bulky waste?' ('Hur långt är det till den plats där du kan lämna grovsopor?'), 'What type of refuse is most often found at your recycling centre?' ('Vilken typ av skräp är vanligast förekommande på din återvinningsstation?'), 'How often are the containers for packaging overfilled?' ('Hur vanligt är det att behållarna för förpackningar är överfulla?'), and 'How would you describe the way your recycling centre looks?' ('Hur skulle du beskriva utseendet på din återvinningsstation?'). Translation by the author.

[282] Total figure for 'very badly' is 3% and for 'rather badly', 12%.

[283] Sifo Research & Consulting AB. (1999). *Förpackningsinsamlingen. Frågor till allmänheten om förpackningsåtervinning och återvinningsstationer Februari 1999* [The packaging collection. Questions to the public about recycling of packaging and recycling centres]. Dokument-nummer 3295010. 1999-0308. Stockholm: Sifo Research & Consulting, p. 1-10.

[284] Altstoff Recycling Austria AG (ARA). (1999). *ARA System – Der Report '98* [ARA System – Report '98]. Vienna: Altstoff Recycling Austria AG, p. 48.

collection as an 'evident necessity' ('selbstverständliche Notwendigkeit'). Only 4% saw the costs as 'not justified' ('nicht gerechtfertigt').[285]

It should be noted that these studies are not exceptional in any way. The positive responses from the citizens shown in these surveys are typical for similar studies carried out, for instance, in Sweden and Germany. Despite the considerable costs connected to the collection requirements in the German packaging collection, a very clear majority of the Germans have expressed themselves in favour of packaging collections and in particular are satisfied with the way the Dual System is working.

It could be argued that if the questions concerning an EPR system (demanding product-related fees paid by the consumers) are formulated in a relevant way, then the consumer poll would be the means to estimate the willingness to pay the higher price and, consequently, the product fees. This requires, however, that it can be assumed that the persons answering the survey are well informed about the systems, what the systems are achieving in environmental improvements, what problems they are related to, and what they cost. As the systems and their costs have been extensively debated in the press in these countries, it would seem that the level of knowledge about the relevant issues should be high.

7.6.4 Some Important Factors for Evaluations

Many of the fundamental issues determining the efficiency of the EPR system are ingrained in the design of the system. In this section the attention will be drawn to two areas that have proven to be of special concern in the functioning of the existing schemes – namely, to avoid the creation of excessive administrative procedures and to safeguard competition between various actors in the system.

It is obvious that a complicated administrative system will demand excessive resources. Mr. Victor A. Bell, an international packaging consultant, pointed to serious problems for companies to comply with the different reporting requirements in various countries. Referring to the UK packaging legislation,[286] he claimed that the number of reporting entities had increased ten

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[285] Ibid., p. 49.

[286] The Producer Responsibility Obligations (Packaging Waste) Regulations 1997. Statutory Instrument 1997 No. 648.

fold because of the shared responsibility programme. He drew the conclusion that "the fees paid by each sector become so diluted that the economic justification to modify the packaging (by the product manufacturer) diminished".[287]

The Ecocycle Commission proposed in 1995 a new EPR legislation for end-of-life vehicles. The proposal included provisions for new legislation covering the management of end-of-life vehicles. Among the proposals were very comprehensive demands on reporting the dismantling and recycling of the various parts of the vehicle.[288] The Association of Swedish Automobile Manufacturers and Wholesalers evaluated that the requirements related to the reporting would necessitate a separation and weighing of all dismantled components in order to be able to identify to what vehicle the component originally belonged. The costs were estimated to be on a prohibitive level for some scrappers who were expected to not continue their work.[289] Subsequently, these reporting requirements were deleted from the Government Bill[290] and, consequently, from the Ordinance on Producer Responsibility for Cars.[291]

The waste management and recycling fields have always been connected with the problem of monopolies. Through legislation, the governments risk augmenting such a tendency. The producer responsibility organisation (PRO) could in itself lead to a monopoly, as it might be very difficult for alternative organisations to establish themselves. The operation of the PRO must also be such that it operates in a non-discriminatory manner with

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[287] Bell, Victor. (1998). How Manufacturers Are Responding to Extended Producer Responsibility Programs and How These Programs Can Be Made More Effective. In *OECD Workshop on Extended and Shared Responsibility for Products*, 1-3 December 1998, Washington, D.C., p. 4

[288] Ecocycle Commission. (1995). *Förslag till producentansvar för uttjänta bilar i Sverige* [Proposal for Producer Responsibility for Used Cars in Sweden]. Kretsloppsdelegationens rapport 1995:9. Stockholm: Kretsloppsdelegationen, Miljödepartementet, pp. 107, 113.

[289] Association of Swedish Automobile Manufacturers and Wholesalers. (1995). *Remissyttrande angående Kretsloppsdelegationens Förslag till producentansvar för uttjänta bilar i Sverige* [Statement Concerning the Ecocycle Commission Proposal for Producer Responsibility for Used Cars in Sweden]. 9 October 1995. Stockholm: Bilindustriföreningen, p. B:16.

[290] Regeringens proposition 1995/96:174. *Producentansvar för uttjänta bilar, m.m.* [Producer Responsibility for used cars, etc.]. Stockholm (Prop. 1995/96:174).

[291] Förordning (1997:788) om producentansvar för bilar [Ordinance on Producer Responsibility for Cars]. SFS 1997:788.

various types of companies. The large contracts that might arise through large-scale collection may make it more difficult for smaller and medium sized waste management companies to take part in the bidding for contracts. OECD concluded, however, that anti-competition concerns did not appear to be different for these organisations than they were for other trade associations that routinely engage in contracting for their memberships.[292]

The PRO also has an important role in deciding about recycling contracts. According to OECD, waste management firms, including recyclers, are generally excluded from decision-making bodies in order to avoid price-fixing during the negotiation of recycling contracts.[293]

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[292] OECD. (1998). *Extended and Shared Producer Responsibility. Phase 2. Framework Report.* Paris: OECD (ENV/EPOC/PPC(97)20/REV2), p. 39.

[293] OECD. (1996). *Extended Producer Responsibility in the OECD Area. Phase 1 Report. Legal and Administrative Approaches in Member Countries and Policy Options for EPR Programmes.* OECD Environment Monographs No. 114. Paris: OECD (OCDE/GD(96)48), p. 32.

CHAPTER
EIGHT

8. Models for EPR Implementation

8.1 The BIL Model

During the work with the Swedish Association of Automobile Manufacturers and Wholesalers (BIL), Erik Rydén and the author concentrated on developing a special implementation model of an EPR system for end-of-life vehicles. In 1995 Erik Rydén presented the model in his Licentiate Dissertation.[294]

The model was an attempt to create an industry-initiated response to anticipated discussions on EPR. However, at the time when the work started, the Government had not formulated any EPR policy for cars, and the details of the expected policy could only be guesses. The model tried to combine the need of society to trust that the solutions were concerned with environmental results and long-term stability with the manufacturers wish for an economically efficient system. During the discussions, it also became clear that an important aspect of the system, as seen from the side of the representatives of the manufacturers, was its ability to reward the environmentally related improvement efforts undertaken by various individual manufacturers. The last characteristic coincides with the most important overall goal of the EPR systems as discussed in preceding chapters, that is, to promote product change.

The key to creating a system that rewards real product improvements had to be a compromise with regard to the ability to judge what a real improvement is, which is evident from the discussion in Section 7.6. The solution was to equate these improvements with the economic results for fulfilling the national goals of end-of-life treatment, including any set levels

[294] Rydén, Erik. (1995). Car Scrap: Throw It Away or Make It Pay. IIIEE Dissertations 1995:2. Lund: IIIEE, Lund University.

of recycling and recovery.[295] Hence, the manufacturer should pay the real cost.

The first complication that arose was connected to the risk of having orphaned products. The first obvious solution was to wait until the used car had been scrapped and then settle the bill. However, if the manufacturer, or the importer representing the manufacturer, disappeared from the market in question, then there would not be any way of forcing him to pay the costs. Hence, the money, or at least a guarantee for the money, had to be secured in advance, and, logically, when the car was introduced onto the market.

Cars in Sweden have an average expected lifetime of well more than 15 years.[296] There is no way of deciding with any certainty what the costs of the end-of-life management will be. Estimations can be made, but they risk being very inaccurate and it becomes difficult to justify any differentiation between different makes based on these estimates.

The solution was to create a system with advanced payments, which would be corrected retroactively, that is, when the results of the end-of-life management were available. The advance payments had to be collected in a common fund to secure their accessibility when the car was discarded. The advanced payments of each individual manufacturer were to be kept on record, as well as the costs related to the cars of his make. This would allow any surpluses to be returned to the manufacturer "when the bill was settled".

The problem would not be solved if a particular manufacturer paid too small an advanced fee to the fund. Having a series of special solutions solved this problem:

- If the manufacturer still existed, then he would be obliged to cover the extra costs.

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[295] No national goals were set at that time, and the goal-setting was, obviously, an issue upon which the manufacturers had many views and demands. However, for the discussion in this section, it could be assumed that the goal-setting was a process that would not be influenced by the design of the particular EPR system.

[296] Bilindustriföreningen. (2000). *Frågor och svar om bil och trafik. Statistik* [Questions and answers about cars and traffic. Statistics]. [Online]. Available: http://www.bilbranschen.com/bilen/bil_trafik/ [4 April 2000].

- For the case where the manufacturer had disappeared – the orphaned product problem – two solutions were discussed. The first was an insurance to which all fund members contributed. The second was joint responsibility of the entire fund, or of all the manufacturers belonging to the fund.

The problem was not supposed to be very severe in the proposed model as it was expected that the manufacturers would be inclined to have a conservative approach to how high the advanced fee should be. The risk of having to cover additional costs for orphaned products, for which too small a fee had been paid, would lead to an inclination to prefer to start by paying fees that were too high, according to the manufacturer representatives.

The various outcomes for the individual cars joining the fund are depicted in Figure 8-1. The figure shows the growth of the fund share because of the investment of the capital during the lifetime of the vehicle.

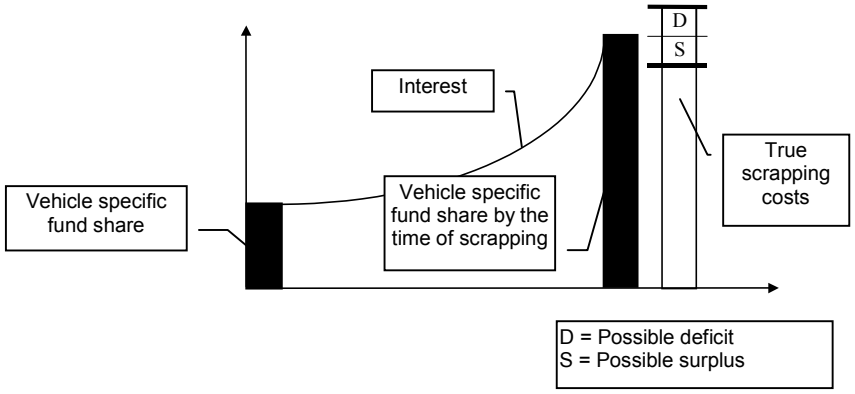

Figure 8-1. The financial development of the fund share of an individual vehicle over its life cycle.[297]

If the fund is organised in a way in which the capital is giving reasonable dividends, then the cost of binding the capital for the period in question will

[297] Source: Rydén, Erik. (1995). *Car Scrap: Throw It Away or Make It Pay*. IIIEE Dissertations 1995:2. Lund: IIIEE, Lund University, p. 90.

not have to be very high. Considering the long period during which the money can be invested and assuming reasonable growth of capital above the general cost increases, the size of the advanced payment will also be substantially lower than the cost of the future end-of-life management.

The historical products, that is, the cars that were sold before the planned introduction of the new EPR system, will in the Swedish case have been part of the car scrapping system which was put in place by law in 1975. It was natural to seek a combination of the two systems; the proposed solution was a common fund but with separate fund shares for new and old cars. While the fund shares for new cars would be individual manufacturer shares, the shares for the old cars would be one common share for all manufacturers. The financing of the old cars was to be achieved through the continuation of the existing car scrapping system, that is, new cars introduced on the market would pay for the old cars during a phase-in period. This period would, in principle, cover the time span until all old cars had been scrapped. However, the period could be shortened if the fund share for old cars showed a surplus.

8.2 EPR in a Life Cycle Perspective

Much of the attention in the discussion and the implementation of EPR systems has been devoted to the end-of-life qualities of products. Even if total life cycle improvements have been sought, it has often been by allocation of responsibility for the end-of-life management that these improvements were to be promoted and initiated. The policy instruments used have typically demanded specific take-back, recycling, and reuse levels.

However, there is no fundamental reason for limiting an EPR approach to requiring specific end-of-life qualities. On the contrary, there are already today a large number of examples when product qualities reaching outside the manufacturing facility are demanded from the manufacturer and must become part of the design specifications:

- Selection of raw materials that are causing less environmental impact in their extraction; for instance, using more renewable raw materials, selecting wood from environmentally certified, sustainable forestry activities, selecting organically grown agricultural products, and avoiding raw materials that are causing special environmental damage during extraction;

- Using energy sources that are environmentally preferable in all the various stages of the life cycle;
- Non-use of toxics; for instance, heavy metals such as mercury, cadmium, or lead, in the manufacturing of various products, as well as for the functioning of the products;
- Design of cars that are more fuel-efficient;
- Design of low-emission cars;
- Design of more energy-efficient household appliances.

All examples above have been chosen from existing practices. This is in no sense an exhaustive list, but represents only a few examples of manufacturers assuming responsibility for environmental properties of products that go beyond the direct impact of the manufacturing. The different types of improvements of the environmental product qualities mentioned above can be the result of voluntary action, as well as binding legislation. They can result from real or perceived market demands, and also be part of a long-term corporate strategy of positioning a company as being especially environmentally aware, aiming to contribute to sustainable development.

Davis (1994) argued for having this broader approach to EPR and also gives several examples of how an EPR approach could influence the environmental properties in various phases of the life cycle of a number of products. [298]

It is in the context of this dissertation especially interesting to explore to what extent an EPR approach can add to or enhance the existing policy work in order to promote preventive solutions to environmental problems. It is obvious from the examples given above that many of the existing policy instruments have been applied in line with an EPR approach. The key component is to identify areas of the total environmental impact that are under the control of the manufacturer, or that indeed demand action to be taken in the design stage in order to allow for efficient improvements.

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[298] Davis, Gary. (1994). Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention. In C. A. Wilt, & G. A. Davis, *Extended Producer Responsibility: A New Principle for a New Generation of Pollution Prevention*, 14-15 November 1994, Washington, D.C. (1-14). Knoxville, TN: Center for Clean Products and Clean Technologies, The University of Tennessee.

The informative responsibility of the producer as illustrated in Figure 3-1 could play a decisive role in this context. A combination of environmental awareness and relevant information about the products would direct consumer-purchasing habits towards products with improved environmental properties. There are several alternatives for how to promote awareness, and there are various ways, as well, of providing information about the products. It would be outside the scope of this dissertation to discuss in more detail the experiences from work in these areas. The author would, however, like to stress the importance of further exploring how informative instruments such as environmental product declarations could be developed to promote the design of more environmentally adapted product systems. This instrument should then be seen not only as a voluntary instrument, but also as a potentially mandatory requirement for specified product groups.

8.3 An Idealised EPR Model

The idealised model of an EPR implementation should secure that clear incentives are created for environmental improvement of the product system. In order to make these improvements possible, efficient feedback loops are necessary in the product system. These feedback loops must work on several levels:

- They must provide an economic signal that more adapted products will be more successful on the market. In the ideal case, this calls for a situation when all relevant costs are expressed in the price of the product. In order to achieve this, all costs, whether externalities or not, must be priced, and the costs must be allocated to the product in question.
- Information exchange between the various actors in the product life cycle must be secured in order to transfer experiences and knowledge that will guide the improvement process. This information must reach those actors that can change the properties of the product or product system. The actor that ultimately governs the product system design phase must receive sufficient and accurate information about the performance of the product.

The factors emphasised here are based on a market economy situation where individuals that are free to optimise according to their preferences make the consumption choices. Societal goals are expressed in the pricing of products and perfect information is available to all actors, especially manufacturers deciding on the need of developing new products.

However, there are few reasons to believe that all relevant costs will be internalised in the prices of products. An internalisation of the costs involves a number of practical problems emerging from lack of knowledge about the short- and long-term impacts of various activities, from difficulties in monitoring the activities, and problems in enforcing comprehensive systems. There are also obvious problems in gaining the necessary societal and political acceptance for the implementation of such a system. It is further well-accepted knowledge that the answer to the question of what the true costs for society are will depend on when it is asked. The values of the people today will not necessarily, and even not likely, be the same as those of future generations. The task of finding morally and ethically acceptable policies for today is ultimately not a scientific question, but the answers must be sought after in a democratic process involving the citizens and their representatives.

Complete information is also not available in the real world. Consumers, will not be able to base their purchasing decisions on perfect information, and producers will not be able to rely on perfect information for their design decisions.

The goals and targets decided upon by society should, however, be addressed in an efficient way. The role of EPR is to give direction for how the mix of policy instruments in this field could be configurated to be efficient. Analysis of experiences of EPR implementation shows that a clear allocation of physical and economic responsibilities to the influential actors in the producer group (see Section 7.1) will be the key to creating the incentives for product system improvement.

8.4 Adjusting the EPR Model to Real Life

In the development of efficient and feasible EPR models, it has been important to secure an internalisation into the consumer prices of expenses that are mainly determined and influenced by the design of the product. The end-of-life treatment and related expenses have been of particular interest in the studies for this dissertation. The development of EPR started by recognising that the end-of-life management failed to reflect upon the design of new products and product systems; and it has throughout the development of EPR been an essential task to find implementation models that would provide relevant incentives to the individual manufacturers for improvements of existing and future product systems in this respect. To

allocate the full physical and economic responsibilities for the end-of-life management is the ultimate way of securing such a link.

The need for physical responsibility is connected with the difficulty of quantifying, in advance, the economic responsibility with a calculation model. The time lag between the introduction of a product on the market and when it is discarded varies between various types of products. For products with a long life span it will be necessary for society to secure that a payment has been made in advance to cover the end-of-life costs. For products with a short usage phase the necessity for advanced payments will depend on the structure of the manufacturing companies, and on whether the manufacturing is domestic or the products are imported. However, also in the latter case, the general approach should be an advanced payment.

If the advanced payment cannot be determined with an accuracy that allows for a differentiation of the product fees reflecting the real costs of taking care of the product in the prescribed fashion, then a system built on retro-active adjustments will be preferable. In reality, this is the situation for most complex products with a life span stretching over several years.

A necessary simplification of the ideal model concerns what costs can be included in the economic responsibility. It would be preferable to have all relevant costs expressed, but it falls outside of the EPR approach, as such, to secure a pricing of externalities. The strength of the EPR system is that it is able to cover all appropriately priced end-of-life costs.

The model with advanced payments and retroactive compensation for excessive payments as presented in Section 8.1 seems to be the only model presented that solves the problem of differentiating the payments for complex products. For simpler products such as packaging, a rough cost estimate can be based on type of material and weight. This method of differentiating the fees is used in several countries. However, the same simplified approach is not applicable for many complex products, which cannot be defined in the sense of a dominating material and for which the weight is only one factor influencing end-of-life costs.

The experiences from trying to introduce the BIL model proved to the author that it is difficult to get acceptance from the government for a system where the main control is in the hands of the manufacturers. The proposal from the Ecocycle Commission aspired to regulate in all detail how the various actors would be allowed to handle the end-of-life vehicle

and components dismantled from it. The possibilities of securing access to cheap spare parts for old cars seemed more important than to devise a well functioning market based system guaranteeing environmental qualities and high recycling levels.[299]

It has been suggested that an insurance system would effectively address the problems related to deciding, in advance, the size of the future costs for end-of-life management.[300] A system of recycling insurances has also been organised by one of the major Swedish insurance companies. Likewise, a system with mandatory eco-cycle insurances has also been suggested by the Ecocycle Commission. However, the insurance solution is connected to a number of problems that have not been solved.[301]

The most prominent problems facing an insurance system have been to explain why an insurance company would be more capable of estimating the future costs than other actors and how an efficient information flow, a feedback loop, would be established to the original manufacturer to help implement product improvements. There are also a number of other issues related to the insurance solution that deserve further development. It should be stated that these problems are not of equal difficulty, and indeed, to a large extent can be solved if the insurance solution is a totally voluntary initiative, as has been the case in Sweden so far.

There is one type of insurance solution that the author believes will have a better potential than existing approaches, that is, a form of a mutual insurance company owned by the manufacturing companies. In reality the insurance company would be what has been depicted as a producer responsibility organisation. The possible added value of involving an insurance company would be to take advantage of the experiences of these

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299 There is in this particular case a level of irony in the fact that many of the cheap spare parts are sold outside the controlled economy and are not providing VAT payments to the state.

300 Ecocycle Commission. (1997). *Producentansvar för varor. Förslag och idé* [Producer responsibility for Goods: Proposal and idea]. Kretsloppsdelegationens rapport 1997:19. Stockholm: Kretsloppsdelegationen, Miljödepartementet, p. 47.

301 Rydén, Erik. (1998) Extended Producer Responsibility - an emerging field for new economic actors. In K. Jönsson, & T. Lindhqvist, *Extended Producer Responsibility as a Policy Instrument – what is the Knowledge in the Scientific Community?* (24-28). AFR-Report 212. Stockholm: Swedish Environmental Protection Agency.

companies in managing capital and administrating the records. It could be argued that there are other financial organisations having similar skills.

EPR as approached in this dissertation is a policy principle for promoting product and product system change. The so-called historical products have already been sold and the design of these particular products is set. There is, consequently, less rationale for including historical products into the EPR system. However, the author views it as important to create common infrastructures to improve the end-of-life management from both the technical and economical point of view and also to initiate feedback loops for information about product improvement opportunities.

Experiences from EPR systems in several countries have proven that these systems influence the design of fairly simple products such as packaging, without necessarily providing an elaborated individual basis for allocating responsibilities. However, it seems that the most significant improvements are more likely to be achieved if complex products are addressed by the EPR approach. The design opportunities concerning not only the product per se, but also the whole product system, seem more challenging for such products. The possibilities to substantially change the way the function of the product is provided are also perceivably better. Such changes will be addressed in Section 8.6.

8.5 Negotiating an Agreement about an EPR Model

An important issue concerning EPR systems is the development of the specific implementation for a specified product group. It has generally been argued that initial negotiations or discussions should involve all stake-holders, and especially all actors in the life cycle of the product, as illustrated in Figure 7-3. The EU Commission launched special working groups for several product groups, including end-of-life vehicles and electrical and electronic equipment, based on this approach. The approach was modelled on the Dutch experiences of negotiating the so-called covenants.

However, as Erik Rydén also discusses in his dissertation, there are reasons to question this approach if the objective of the EPR system is supposed to be a change in the products and the product systems. By analysing the experiences from developing EPR systems for end-of-life vehicles in the European Union, the Netherlands, and Sweden, he draws the conclusion

that the character of the system "may be predetermined already when putting together the working group".[302]

By involving all the actors in the elaboration of a new system, there is a risk of maintaining the structure of the existing product system. There is a risk in particular that all present actors are guaranteed a role in the future system. It should, however, be recognised that all actors do not have the same goals. This is well illustrated by analysing the roles of the actors in the waste management group. The owner of a waste incinerator has hardly any incentive to direct good fuel in the form of easily combustible waste products to other treatment such as recycling. The dismantler does not appreciate attempts by manufacturers to establish their own remanufacturing or recycling units. Radical changes of the product systems, as is discussed in Section 8.6 below, potentially threaten the raison d'être for some actors and it would be astonishing if these actors would actively promote such a development.

8.6 Towards Providing Services and Not Products

During the last decades, the GNP of the industrialised countries has changed in the sense that the role of the manufacturing industry for the total GNP has been reduced and the proportion of the GNP that is connected to services has grown most substantially. This has been the basis for the statements about a shift to a service society that have been heard now for a long period of time. From an environmental perspective, it is not immediately obvious that this development is of any particular advantage. The GNP changes express the relative importance of manufacturing activities as compared to those services that are recorded in the accounting. The total volume of industrial manufacturing activities, as well as the total throughput of materials, may still be increasing. Indeed, part of the shift is only a reflection of the fact that actors on the market now provide services that were earlier performed in the households. An obvious example is the care of children and elderly that was earlier to a larger extent a responsibility of the families, that is, outside of the national accounting.

In the environmental context, special interest is connected to the possibility of providing the desired functions, represented by the purchased products,

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[302] Rydén, Erik. (1995). *Car Scrap: Throw It Away or Make It Pay*. IIIEE Dissertations 1995:2. Lund: IIIEE, Lund University, p. 78.

in a dematerialised way, or rather, in a less material intensive way. The prospects of an environmentally driven development in a service-oriented direction have been discussed for a quite substantial period of time and a number of studies have been devoted to the theoretical concept of a product-service system, also referred to as servicisation.[303]

The idea of ultimate product-service systems, when an almost total dematerialisation would be obtained, is not the most interesting to discuss in the context of this dissertation. Rather, it is to examine the systems based on an assumption that manufacturers may try to extend their control on the products and materials in the products, with the purpose of optimising the economic and environmental outcome.

Examples of systems incorporating this type of idea have been discussed on a number of occasions. Leasing has been put forward as an example of a situation where it would be in the interest of the owner of the product to optimise the product system in a life cycle perspective. The reason is that the retained ownership would automatically allocate the appropriate responsibilities for impacts in usage and, in particular, end-of-life management to the lessor. Environmental benefits that could be anticipated include:

- The product is designed for durability;
- The product is designed for reparability;
- The product is designed for remanufacturing;
- The product is designed for reuse of components;
- The product is designed for recycling;
- The product is designed for recovery or easy waste disposal.

However, as was pointed out by the author in the early studies of EPR systems, in most cases of leasing the responsibilities for the product are terminated before the product reaches the end-of-life stage because the lessor sells the product on the second-hand market.[304] A more comprehensive analysis of the same issue is found in Lifset (1998).[305]

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[303] A comprehensive overview of the product-service system concept, including an overview of published case studies, is found in Mont, Oksana. (2000). *Product-Service Systems*. AFR-report 288. Stockholm: Swedish Environmental Protection Agency.

[304] Lindhqvist, Thomas, & Lidgren, Karl. (1990). Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, *Från*

The standard example put forward of a leasing system leading to environmental improvement is the Xerox leasing of copying machines. This system has been described in a number of publications. The first comprehensive study of the environmental impacts of the system by Kerr (1999) also confirmed the environmental improvements obtained by the system.[306] It was further shown that the more comprehensive optimisation of the system, seen in the form of new modular models, had meant an additional improvement of the environmental performance of the product system.[307]

A leasing system with environmental profile, or in general a take-back system for remanufacturing, refurbishment, or component reuse, could also be viewed as a new business concept, incorporating new possibilities of creating customer relationships. This means that there are more potential benefits for an innovative manufacturer than just an optimisation of the use of the product and material qualities. Technical innovation, including, for instance, regular automatic diagnostics at a distance with the help of in-built sensor systems, can help to further enhance the overall performance of the product system.

Implementation of an EPR system with clear individual economic and physical responsibilities allocated to the manufacturers of products will be an incentive for change towards product-service systems. By making the manufacturer responsible for end-of-life management of the products, the rationale for retaining the ownership of the product will become more apparent.

Product redesign has proven to be able to achieve substantial environmental improvements of the products and product systems. Improvements in the order of 30-50% are mentioned as typical levels of improvements for the

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vaggan till graven - sex studier av varors miljöpåverkan [From the Cradle to the Grave - six studies of the environmental impact of products] (7-44). Stockholm: Ministry of the Environment. (Ds 1991:9), p. 23.

305 Lifset, Reid. (1998). Extended Producer Responsibility and Leasing: Some Preliminary Thoughts. In K. Jönsson, & T. Lindhqvist, *Extended Producer Responsibility as a Policy Instrument – what is the Knowledge in the Scientific Community?* (34-41). AFR-Report 212. Stockholm: Swedish Environmental Protection Agency.

306 Kerr, Wendy. (1999). *Remanufacturing and Eco-Efficiency: A case study of photocopier remanufacturing at Fuji Xerox Australia.* IIIEE Thesis. Lund: IIIEE, Lund University.

307 Ibid., p. 60.

focused environmental concerns.[308] However, if more substantial improvements are to be obtained, then more profound changes in line with product-service systems seem to be an attractive alternative to more radical adjustments of consumption levels. The industrial interest in exploring new product-service systems could be substantially promoted by a clearer allocation of the physical and economic responsibilities to industrial manufacturers.

[308] Ryan, Chris. (1997). Moving Beyond the Low-Hanging Fruit in DfE. *Journal of Industrial Ecology, 1*, no. 3, p. 4.

CHAPTER

NINE

9. Conclusions

9.1 EPR as Policy Principle for Product System Improvement

The EPR principle is consistent with the polluter pays principle and, moreover, a necessary condition for reflecting the essential life cycle costs in the price of the product. Without an EPR approach, it is not guaranteed that even those environmental costs that have been priced will be reflected in the final price of the product and, hence, signal the buyer that these qualities exist. With the exception of a few EPR systems, costs connected to waste collection, recycling, or final disposal, for instance, are not reflected in the price of the products. Consequently, these costs run the risk of being overseen by the consumer when he is making the buying decision. Indeed, they are beyond the control of the consumer today and will not be influenced by his actions. Equally important, the manufacturer of the product may oversee such costs when designing the product.

It is still difficult today to evaluate the experiences with EPR. Few schemes have been in place for a longer period of time and the information available is often not comprehensive enough for thorough quantitative evaluations. The existing experiences from the German Packaging Ordinance and other EPR-like systems all indicate that EPR systems can influence all three of the environmental objectives that have been discussed in this dissertation: well organised collection with high collection results, increased recycling, and promotion of DfE activities leading to overall life cycle environmental improvements of products and product systems.

EPR should be seen as a principle for preventive environmental policy-making. The main emphasis of EPR is to stimulate product and product system improvements. In order to reach this objective, various policy instruments must be used. It is by linking the economic responsibility to the individual manufacturers that the feedback loops for product improvement

are constructed. Only allocating responsibilities will not necessarily be enough to secure the relevant feedback systems, and more research is needed to understand how best to organise the feedback loops.

To combine the economic responsibility with the physical responsibility is a way to secure a correct and reasonable inclusion of the costs for the handling of the product, and it is also a way to give control of the organisation of the system to the actors that are responsible for covering the costs. This is the most direct means of building incentives for cost optimisation and improvements into the product systems.

In many cases, the future costs are not known and it is difficult to estimate them with an accuracy that will allow for a fully relevant differentiation of fees in collectively organised collection and recycling systems. This is especially a problem for complex products with long life spans. To secure financing for end-of-life management through some kind of advanced payment is in most cases necessary in order to avoid free riders, as well as problems related to bankruptcies.

The model presented in this dissertation of advanced payments and possibilities for retroactive compensation for excessive payments is a way to solve the dilemma of not knowing in advance the level of future costs.

EPR is an important concept if viewed as a principle for environmental product policies and not just as an alternative name for take-back policies. This does not exclude take-back policies from being a most interesting policy instrument to be used in order to implement an EPR scheme. A distinguishing and crucial element in such policies should be the feedback to product and product system development.

The revised definition of EPR presents the concept as a policy principle:

> Extended Producer Responsibility (EPR) is a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product.

A policy principle is the basis for selecting the mix of policy instruments that are to be used in the particular case.

> Extended Producer Responsibility (EPR) is implemented through administrative, economic and informative policy instruments.

It would be inappropriate not to have a life cycle perspective on all policies being implemented. It is, however, difficult to approach sustainability in small incremental steps if each step must be proven to be optimal in itself and not part of a more substantial change. Therefore, it is important that both the EPR principle and the implementation of policy instruments are viewed in a strategic attempt to reach sustainable solutions. The present evaluation tools are not equipped for determining the goals and targets of such policies.

It is sometimes easier to reach the original manufacturer through other influential actors in the product group. The German Packaging Ordinance, which is primarily directed towards retailers, is a good illustration of how such an approach may influence the manufacturers very efficiently.

EPR is a vehicle for innovation in the design of products and product systems. An EPR implementation, allocating full physical and economic responsibilities to manufacturers, will encourage a shift towards providing the functions of the products in a more efficient way. This could be the necessary push for a shift towards product-service systems. It will definitely enhance the interest for re-manufacturing activities in the industry that is manufacturing and providing complex products. An EPR system with full responsibilities allocated to the original manufacturers will make the business opportunities connected to such re-manufacturing and product-service approaches more visual and comprehensible for the industrial entrepreneurs.

Finally, one should not fail to mention that EPR provides a financing solution for a government wanting to improve the waste management and recycling standards in its country. Contrary to the traditional ways of financing such activities, EPR provides a means of not raising taxes and municipal charges. This fact is attractive, and relevant, to developing countries and economies in transition, as well as to OECD member countries. Here is an explanation for the growing interest in these types of countries.

9.2 Concluding Remarks

The understanding of the need of a concept such as EPR was implicit in some of the discussions during the 1970s and 1980s. However, the concept needed a name, a definition, and to be transferred to a policy principle. The take-back instrument, as well as deposit-refund systems, recycling require-

ments, and many other policy instruments were well known, but they needed a firmer policy framework in order to be seen by governments as being widely applicable components in the emerging product policies.

The main contribution of the research for this dissertation lies in its formulation and definition of EPR as a policy strategy, and eventually as a policy principle.[309] The model of different types of responsibilities has been of importance in clarifying the content of policy proposals. To suggest extended producer responsibility for a product group without explicitly defining the economic and physical responsibilities has no meaning whatsoever.

Before a policy is implemented, the goals to be achieved must be known. The identification of the three main goals in this context: collection targets, recycling targets, and promotion of DfE are crucial for sorting out the real objectives of a policy intervention.

The promotion of product system improvement is an inherent strength of an appropriately designed EPR implementation. The BIL model, presented by Erik Rydén and the author in the work with the Swedish Association for Automotive Manufacturers and Wholesalers (BIL), with advanced fees and retroactive refunding for successful efforts in product adaptation, is the clear answer to the dilemma of not being able to foresee future costs with necessary accuracy.

The need for product system change has led to insights concerning the process of defining the particular EPR system in co-operation with the societal actors and the stakeholders in the product life cycle. Contrary to the often preferred strategy of elaborating such policies in a forum including all stakeholders, the author and Erik Rydén came to the conclusion that this approach was not beneficial. It would inhibit the possibilities of designing new product systems involving new actors, at the same time possibly excluding present actors from the future business. In other words, a dynamic market-based policy cannot rely on pre-set static definitions about the role of all stakeholders.

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[309] Gary Davis was the person first proposing to the author that the EPR definition be changed in order to define EPR as a principle and not as a strategy. The author fully recognises the more appropriate terminology proposed by Gary.

The author pointed out early in the work with EPR the importance of the informative responsibility. This area has not been developed to the same extent as other aspects of EPR and deserves more concerted future attention.

9.3 Further Research

There are many aspects of EPR that could not be dealt with in any reasonable detail in this dissertation. Further, as most systems have only been implemented in the 1990s, new experiences are now accumulating and they can form the basis for future research. For example, up to this point it has not been possible to study in any detail how the automotive or the electronics industry react to EPR systems. In general, there is a need for more studies of particular product groups, and more thorough studies and evaluations of individual systems. In order to make the evaluations useful for policy-makers, the evaluation tools must be adjusted to incorporate product and product system improvements. Such case studies will enhance the possibilities of further developing practical financing mechanisms that provide clear incentives for product and product system improvement.

EPR is meant to lead to product improvement, and consequently there must be an efficient response from the individual companies. There is a need to better understand how companies are reacting to various implementation solutions. What factors are decisive and how are these policy signals transmitted inside the companies? How can the companies organise themselves? Is the EPR a threat or an opportunity for a company? How can the company use EPR for more integrated life cycle management solutions? Product-service systems have attracted considerable interest, but so far it has been mainly a question of building theoretical concepts or studying a limited number of cases that have evolved by themselves. Is it possible to design new product-service systems and what are the approaches for these?

Informative responsibilities have only been marginally discussed in this dissertation. The author is convinced that this will be a crucial area in the future. So far, most of the interest has been devoted to voluntary information disclosure through eco-labels, environmental reports, or environmental product declarations (or other types of more comprehensive environmental report cards). The information about how environmental product declarations work in practice, as well as how they could be part of a mandatory

policy framework, would be of great importance in order for governments to form comprehensive product policies.

To model EPR in a way that would address products in general has been discussed by the Swedish Ecocycle Commission, as well as by other actors, but there is too little knowledge today to devise such successful policies.

Integrated product policy (IPP) has been met with much interest from various stakeholders in the countries of the European Union. The concept lacks, however, a firm definition and a common understanding.

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Abbreviations

ARA	Altstoff Recycling Austria AG
AUD	Australian Dollars
BIL	Association of Swedish Automobile Manufacturers and Wholesalers (Bilindustriföreningen)
CBA	Cost-benefit analysis
CP	Cleaner production
DEM	German Marks
DSD	Duales System Deutschland AG
EEE	Electrical and electronic equipment
EPA	Environmental Protection Agency
EPD	Environmental product declaration
EPR	Extended producer responsibility
	The abbreviation EPR is in some cases in the US context used for the concept Extended Product Responsibility (see Section 3.5.2)
EU	European Union
EUR	Euro
GBP	United Kingdom Pounds
Ktonnes	kilotonnes = thousand tonnes
LCA	Life cycle assessment
Mtonnes	megatonnes = million tonnes
NLG	Dutch Guilders
NOK	Norwegian Kroner
NZD	New Zealand Dollars
OECD	Organisation for Economic Co-operation and Development
PCSD	President's Council on Sustainable Development (USA)
PRO	Producer Responsibility Organisation
SEK	Swedish Kronor
SPR	Shared product responsibility
UN ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNEP IE	United Nations Environment Programme Industry and Environment Office (Paris)
USD	U.S. Dollars

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Thomas
LINDHQVIST

Extended Producer Responsibility in Cleaner Production

Policy Principle to Promote Environmental Improvements of Product Systems

The focus of the environmental policy-making has shifted noticeably during the last decade. From having played a fairly insignificant role in the 1980s and earlier, product-related environmental problems have attracted an ever-increasing interest from policy-makers, especially in industrialised countries in North-Western Europe. Considerable attention has been devoted to the concept of extended producer responsibility (EPR) and today this concept is spread to most OECD countries and also outside this group of countries.

This dissertation shows how the concept was developed, presents a model for various types of responsibilities and defines the EPR concept as a policy principle for environmental improvements of products and product systems. Experiences from existing EPR systems are studied and complemented with an analysis of proposed system implementations. The results are combined with a model for how an EPR system can be developed in order to give the incentives for change to the relevant actors. Conclusions concerning how the details of EPR systems should be organised are presented, as well as a discussion about the advantages and disadvantages with involving various actors in the policy development process and the role of these actors in the implementation of the system.

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