Integrated product policy: a case study of batteries

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Abstract: The increasing complexity of product chains is an argument for analysing actors and policy instruments throughout the lifecycle of products. Actors are persons or corporations deciding upon the fate of the product. The policy instruments refer to well-known measures like information, economic or administrative measures. The theoretical part of the study discuss governance and the role of policy instruments influencing actors' decisions and behaviour during the lifecycle of a product. The empirical part of the study analyses the use of policy instruments addressed to actors involved in the lifecycle of batteries and to what extent policy instruments affect actors' behaviour.

Keywords: policy instruments; integrated product policy; production; consumption; lifecycle; pollution; post modernity; battery; mercury; cadmium.

Reference to this paper should be made as follows: Lindén, A-L. and Carlsson-Kanyama, A. (2006) 'Integrated product policy: a case study of batteries', *Int. J. Environment and Sustainable Development*, Vol. 5, No. 2, pp.163–180.

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1 Introduction

A common way to solve problems is to address an actor with policy instruments solving one problem at a time. That also counts for environmental policy. Solutions are proposed and decided by the Government when problems are discovered. This kind of policy making represents a command and control system (Jacob and Volkery, 2003). The strategy represents a remedial perspective rather than a prevention perspective. Governance in such a perspective has to include reporting from the addressed actors or inspection of routines by authorities to be efficient in solving environmental problems. However, actors have different assumptions and methods of following laws, rules or recommendations. The differences in capabilities can, for example, be difficulties to keep to the timetable or to develop strategies and measures within the organisation to fulfil a defined goal. During the 1990s such empirical problems led to the development of voluntary agreements as policy instruments in environmental policy in Sweden (Helby et al., 1999; Lindén and Carlsson-Kanyama, 2002; Lindén, 2004a). Experiences of using voluntary agreements as policy instrument in energy policy were used in Germany and The Netherlands already during the last years of the1980s (Jacob and Volkery, 2003). Levels of goal fulfilment and strategies could be negotiated by the addressed actors and an authority. This is still an example of governance in a command and control system although it includes delegation of responsibility to authorities and local actors. An example is the Recycling Act (1993), where responsibility for organising waste management was handed over to local authorities, which in their strategies used a number of organisational models to fulfil the goals set by the national Recycling Act. However, the policy instruments used are intended to solve *one* problem, the reuse of waste, and do not represent an integrated view of the product over its lifecycle.

The EU declaration about Integrated Product Policy presents a holistic perspective on products and their environmental consequences, taking into consideration the lifecycle of the product from the designers' table to the recycling process (EUC, 2001). A number of actors are involved in different phases of the lifecycle of a product. During the *design* phase, the composition of the product is decided, such as material use, function and design (Lindén and Carlsson-Kanyama, 2005). During the *production* process, methods and materials to produce the product in an efficient way to guarantee quality norms are developed. During the *distribution* phase the products are marketed, and sent to shops for offer and sale. The customer uses the product during the *consumption* phase and decides how to handle the product when it is worn out. During the last phase, *waste management*, the product is recycled or sent to destruction. The main actors in these phases are the designer, the producer, the conveyor and the retailer, the consumer and the waste manager. In all phases actors are addressed by policy instruments regulating the design and handling of the product from the cradle to the grave.

A product's lifecycle can seldom be traced to one location only, or even to one country. In modern societies most products are global at least when it comes to phases like design, distribution and consumption. National policy is consequently not sufficient in order to prevent environmental problems, neither present problems nor future ones. The European Union thus becomes important in its role to harmonise integrated product policies at least between European member states.

The intention of this paper is to develop theoretical perspectives on Integrated Product Policy. The empirical example used in this study is the Swedish environmental policy and its efficiency in solving environmental problems stemming from batteries.

2 A theoretical framework

Inefficient production processes have for a long time been looked upon as the main cause for environmental problems in industrialised societies. The main solution of these problems ought to be replacing old and dirty technology with clean technology (Murphy, 2001). However, research focusing on the implementation of clean technology has shown that the role of leadership is at least as important as technological innovation in the modernisation processes. The combination of technology and leadership has been found to be important for environmental improvements and to yield an economic profit as well (Gouldson and Murphy, 1998). Theories about ecological modernisation have been developed and advanced, from a background of empirical studies in chemical industries in The Netherlands. Processes of ecological modernisation are to a great extent driven by integrating environmental goals into organisations (Mol, 1995). However, ecological modernisation is not a process parallel to the development of technology and leadership. Technological development and ecological thinking have to be integrated to be able to reorganise management and to handle an ecological crisis. Modernisation of production in industrial societies cannot proceed in isolation from society as a whole. Modernisation processes in general, create a need and at the same time assumptions for organisational changes in industrial societies. There seem to be a reflexive relation between industrial and societal processes. Although consumption was not integrated in the early development of theories of ecological modernisation, it soon became evident that technological change led to incentives for changes of other phases in the lifecycle of a product to be able to avoid environmental impacts.

Production processes provide important incentives not only for ecological modernisation but also for changing patterns of consumption in society. Individual preferences for improving individual wellbeing is important, but at the same time, the supply of modern products and the role of producers can not be neglected as a pressure group (Spaargaren, 1997). Besides theories about the role of expressing social status, consumer behaviour is involved in social processes where ethical and environmental values are involved in choosing among products in a purchase situation.

The role of policy making is to observe, highlight and influence such processes from ideological aspects, e.g., by environmental protection, saving fauna and flora etc. A change of focus in policy making, from production to environmental consequences, of products widen the arena for policy making from design of products and production processes to include consumption and waste management as well (Table 1). A system perspective in environmental policy makes it possible to formulate an integrated policy for product design, production, distribution, consumption and waste management, not only for solving observed environmental problems, but also to establish environmentally benign solutions preventing environmental impacts in the future (Berkhout and Smith, 1999). The problem can be put into focus by changing from a process perspective to a product/consumer perspective. In addition, the definition of measures as well as policy strategies also has to be changed.

Table 1 Environmental policy from process and product/consumer perspectives

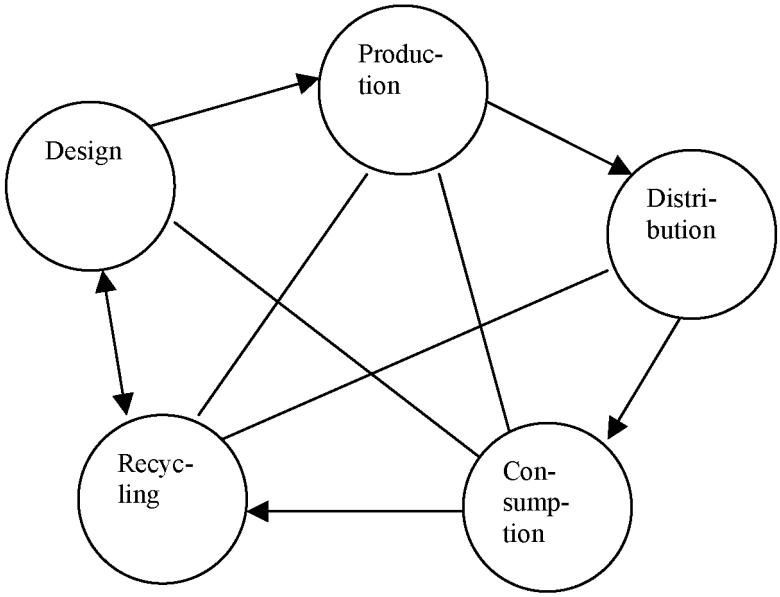
	Process perspective	*Product/consumer perspective*
Problem/focus	Producers	Production processes
	Producing units	Lifecycle perspective
	Enterprise	Consumers – lifestyles
		Markets, demand/supply
Measures	Narrowly defined measures	Complex measures
	Well-known measures	Addressing several actors
	End-of-pipe and middle-of-pipe solutions	Front-of-pipe solutions
		Develop environmental benign products
Policy	Authority driven control	Market-based measures
	Command and control	Voluntary agreements
	Formal measures	Informal measures
	Negotiating environment and economy	Synergies between environment and economy
		Partnership and cooperation
		Sharing responsibility
		Public participation
		Consumer perspectives behind policy measures

Source: Andrén and Arderup (2004)

Although a command and control system is replaced by an integrated and negotiated strategy with a number of actors in several phases of the product lifecycle, the policy instruments used represent wellknown administrative, economic or informative measures (Glasbergen, 1998, 2000). However, they are more often used in a package, including new instruments, and are supposed to support each other to be efficient for fulfilment of a policy goal over the product cycle (Jordan et al., 2003; Lindén, 2004b; Lindén and Carlsson-Kanyama, 2005).

Five phases can be identified during the lifecycle of a product as already mentioned. The phases represent a logical order from the cradle to the grave in a product chain. They represent some sort of timetable in the development and usage of a product. However, when it comes to policy measures relevant during the phases, the policy instruments often form a network, where instruments used in one phase establish restrictions for other phases (Figure 1). The intention expressed in the Recycling Act is, for example, to reuse material from wornout products as much as possible. Consequently, what is done in waste management has an impact on what can be done in the design phase, e.g., using recycled material for a new product. When recycled material is used, it may affect production costs in cases where recycled material or components are cheaper than using new material. This situation may as well lead to a lower price of the product for consumers. The straight relations in a policy chain affecting each phase also create crossrelations and a more or less complex network. The more severe environmental impacts from a product are that increased restrictions, in phases, by policy instruments addressing actors, are to be expected.

Figure 1 Network relations within the lifecycle of a product



Source: Lindén and Carlsson-Kanyama (2005)

Policy in chain processes, compared to networks differs, in several respects. In a product chain, environmental problems are located in a defined phase and instruments are implemented by addressing and controlling identified actors. The policy strategy is developed step by step through all phases. There is a risk of forgetting or even neglecting side effects on activities in other phases of instruments used in one phase. A step by step implementation process represents a process oriented policy strategy as shown in Table 1. A network oriented implementation process on the other hand focuses on products consumed and its environmental impacts, i.e., has a product/consumer perspective (Meuleman et al., 2003). The problem of getting rid of, as well as preventing, environmental impacts is a question of the systems affected and not only the series of identified and defined problems in a product chain. The network relations have to be taken into consideration already when designing the policy strategy and policy instruments. Compared to the process perspective, policymaking in a product/consumer perspective is extended over time and addresses large numbers of actors nationally, who in their turn may be dependent on material produced abroad.

3 The research problem

Environmental problems stemming from mercury were observed already in the 1960s when fishermen in Japan got ill by eating fish contaminated by mercury. This event was a starting point for implementing restrictions for the use of mercury in products. The ambition today, according to the EU, is to decrease the use of mercury, lead and cadmium according to the directives ELV (EU, 1991; EU, 2002 ELV-directive) and RoHS (EU, 2002 RoHS-directive). Within the EU Sweden is active in implementing the process (Kemikalieinspektionen, 2004).

From the 1960s until today, there have been intense debates about the human and environmental consequences of mercury, lead and cadmium leaking from industries and sewage treatment plants into farming land, lakes and rivers. In Sweden about 50 metric tons of mercury originated from industrial processes in the late 1960s. Ten years later they had decreased to 10 metric tons (Swedish Environmental Agency, 1983). The use of cadmium in products has been restricted since the 1970s and the emissions have decreased. However, there is still an increase of cadmium in farming land (Kemikalieinspektionen, 2004). One main source causing these environmental problems is batteries. During almost 50 years, a number of policy instruments have been implemented to solve the problems and get rid of the severe consequences for human beings and animals. Policy instruments have so far mainly addressed actors in the design, production and recycling phases in the lifecycle of batteries. Batteries, as a product, are chosen for this analysis because policy making and the instruments used have quite a long history and involve many addressed actors in at least three phases of the product's lifecycle. Policy making and the effects of some policy measures used, have to some extent been evaluated.

In analysing the research problem in this study, theories about integrated product policy and consumer/product perspectives have been used to evaluate the fulfilment of environmentally defined goals in Swedish environmental policy, reducing contamination from mercury, lead and cadmium from batteries. Besides describing the policy instruments used, the study intends to answer the following questions:

- what ways are policy instruments used, performed and linked to each other for goal fulfilment?
- what ways are actors in different phases addressed by policy instruments during the lifecycle of batteries?
- what ways have policy instruments been accepted and implemented by actors? what are the obstacles and advantages?
- how have network relations between actors in different phases been affected and what are the results?
- what way have process oriented policy instruments been effective in goal fulfilment and in preventing mercury, lead and cadmium problems in the future?

4 Methods

In this study, a number of empirical materials have been used to be able to analyse our problem in depth.

- administrative material with governmental origin: proposals, investigations and laws
- administrative material from authorities, e.g., directives, handling strategies, protocols, communication documents addressing the government, ministries, authorities, and actors affected by the policy instruments
- interviews with key persons representing producer unions, producers, as well as officials in ministries, authorities and organisations
- documents and evaluations.

5 Environmental policy and batteries

Batteries can be categorised by the intended users, by whether or not they can be dismounted, by whether or not they are possible to recharge, by the type of electrolyte used in their construction (alkaline or acid), by whether or not they contain heavy metals and by whether or not they contain any liquid (wet or dry). 'Household' batteries are those batteries that are primarily used to power small, portable devices such as flashlights, radios, laptop computers, toys, and cellular phones. In this study we focus on household batteries which contained or contain any of the heavy metals mercury or cadmium. Table 2 shows some common types of household batteries and categorises them according to their ability to recharge and according to whether they contain heavy metals. The use of rechargeable batteries in households has increased tremendously during the past decades in Sweden and in the rest of the EU as a result of the increasing use of mobile phones and power driven home tools. In Sweden, where this case study was performed, most batteries have since long, been imported.

Table 2 Battery types

Chemical composition	*Rechargeable?*	*Heavy metals?*
Nickel-Cadmium-batteries	Yes	Yes, cadmium, 15%
Nickel-Metal Hydride	Yes	No
Lithium and Lithium Ion	Yes and No, the button cell type cannot be recharged	No
Alkaline batteries	Not usually, but there is one type that can be recharged	Only the button cell type contains mercury today
Zink-Carbon cells	No	Not today, but they used to contain small amounts of mercury
Zink-Air cells	No	The button cell type contains up to 1% mercury
Silver-Oxide cells	No	The button cell type contains up to 1% mercury
Mercury-Oxide cells	No	Comes only as a button cell with up to 35% mercury

Source: Lindén and Carlsson-Kanyama (2005)

6 The battery situation in Sweden today and 20 years ago

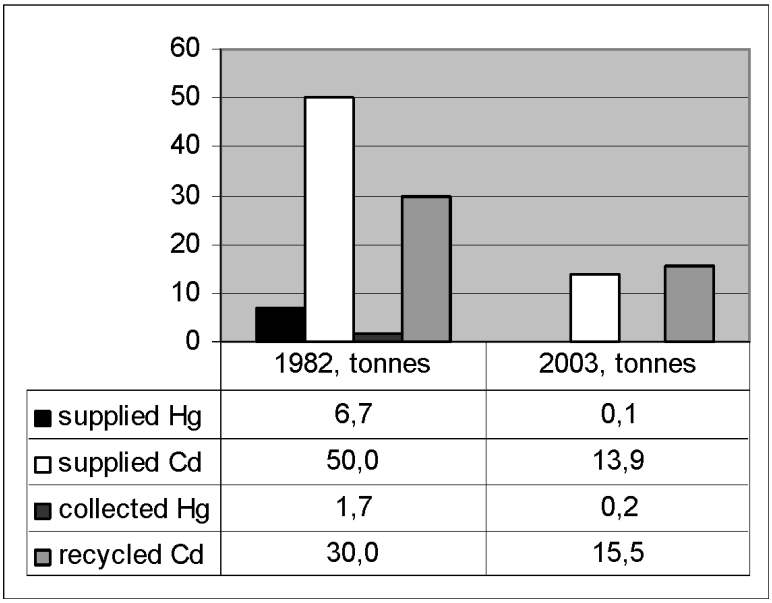
Two decades ago, the risks of mercury were well known by society. Cadmium was also recognised as a major pollutant. Policy instruments were applied to lower the risks of contamination, but they were not focusing on batteries. In 1982, the widely used alkaline batteries contained up to 1% mercury and they were not collected separately from other waste to any considerable extent. Mercury was added during the production process in order to eliminate gas production. The political focus during those days was to eliminate the use of harmful materials in products, by policy instruments addressing producers during the phases of design and production of products. The use of alkaline batteries had increased by a factor of 3.7 compared to 1976, and the producers initiated a substitution

process after being pressurised to do so by the national authorities in Sweden. The outcome was uncertain. However, most of the 2.9 tonnes of mercury supplied from the alkaline batteries ended up in municipal waste dumps, since only 25% of municipalities had started battery collection schemes (Halldin and Wulff, 1983; Statens Naturvårdsverk, 1983). Batteries are used over a long time and most batteries in use ended up in waste from households in municipal refuse dumps. The use of button cells with 35% mercury became very common as they were used in a number of appliances such as hearing aids, watches and toys. The total amount of mercury supplied by such batteries was 3.2 tonnes during 1982. A substitution process had started with mercury oxide button cells being substituted by zinc-air cells in hearing aids and at the same time, producer initiatives for collecting used batteries was underway (Halldin and Wulff, 1983). Retailers, distributing and selling batteries, played an important role in collecting batteries for delivery to waste management organisations. Distribution and waste management phases became important in national policy in addition to substitution processes during the design and production phases. During the same year the possibilities of substituting nickel-cadmium batteries were considered to be small (Naturvårdsverket, 1983), while the supply of cadmium from such consumer batteries was 20 tonnes and usually ended up in municipal waste. The sales of nickel-cadmium batteries had doubled since 1976. This fact increased the focus on collecting and recycling batteries.

More than 20 years later, the alkaline batteries and the zinc-carbon cells contain no added mercury at all. The European battery industry were able to eliminate mercury as an added component since the beginning of the 1990s (www.nema.org) and in connection with this development, several countries, including Sweden, prohibited sales of alkaline and zinc-carbon cells with added mercury. Also sales of mercury-oxide batteries is prohibited in a number of countries while sales of nickel-cadmium batteries has not been regulated other than by stipulating that such batteries should be recycled and that they should be easy to dismount by the consumer (Lindén and Carlsson-Kanyama, 2005). As a result of this development, the supply of mercury to the Swedish society is less than 100 kg per year today. Most of that supply comes from button cells with less than 1% mercury. Collection schemes existed for two decades, and in 2003, 300 kg of mercury was collected from used batteries, which is more than was being supplied. Concerning rechargeable batteries, the cadmium supply is about 14 tonnes per year today and the amount recycled is 15 tonnes per year. In applications, such as mobile phones, nickel-cadmium batteries have been substituted for batteries without heavy metals, while the use of cadmium rich batteries persists in certain power driven tools. Pertinent battery challenges today are that there is a stock of about 3.5 million products with nickel-cadmium batteries in the Swedish households and that the suppliers of certain applications of power driven hand tools have not yet presented alternatives to rechargeable batteries with heavy metals.

In summary, the flows of battery related mercury and cadmium have changed substantially during past decades (see Figure 2). The supply of cadmium is but a third of what it was 20 years ago and the supply of mercury is insignificant today.

Figure 2 Supplied, collected and recycled mercury and cadmium from batteries in Sweden in 1982 and 2003 (authors' calculations)



	1982, tonnes	2003, tonnes
supplied Hg	6,7	0,1
supplied Cd	50,0	13,9
collected Hg	1,7	0,2
recycled Cd	30,0	15,5

7 Policy instruments used in the battery product chain

The policy instruments used had two purposes, one was to *control* the flow of heavy metals in order to minimise the exposure of toxic metals to humans and nature. The other purpose was to *prevent* such flows by encouraging substitution. In order to *control* the flows, numbers of regulatory instruments were used, such as demands on labelling of products, making it compulsory for municipalities and retailers to receive used batteries from consumers and then send them for recycling and legislation concerning fees being collected from the importers of environmentally damaging batteries. The latter measure was carried out according to the 'polluter pays' principle and the funds thus collected were used to finance recycling and large scale information campaigns directed at the general public about the importance of recycling. The large stakeholders in this process were, and still are, the Swedish Environmental Protection Agency, The Ministry of Environment, the Swedish Battery Association representing importers of nonrechargeable consumer batteries and several other branch organisations, the Swedish Federation of Trade, RVF – The Swedish Association of Waste Management and a now dissolved foundation for recycling nickel-cadmium batteries, called SIMBA.

In order to *control* the flow of heavy metals, there have been threats of sales prohibition, and legislation regulating the amount of heavy metals allowed in batteries as well as a general appeal to importers to substitute whenever possible. The most important stakeholders in this process have been the Swedish Environmental Protection Agency, the municipalities of the three largest cities of Sweden, the companies importing batteries to Sweden as well as their branch organisations (Lindén and Carlsson-Kanyama, 2005). Table 3 gives an overview of the policy instruments applied, the senders and the goals.

Table 3 Overview of different types of policy instruments used in the battery chain

Goal of the policy instruments	*Type of policy instrument*	*Sender*
Control by recycling and collection schemes	Legislation about labelling and recycling	The government and the Swedish Environmental Protection Agency
	Legislation about import fees and supervision of that fees are being paid	The government and the Swedish Environmental Protection Agency
	Information campaigns directed to the general public	Authorities at national and local level, branch organisations
	Voluntary agreements	Swedish Trade Association
	Prohibition to import certain types of batteries	The government and the Swedish Environmental Protection Agency
Prevention by substitution	Information campaigns directed at the general public	National authorities and local authorities, branch organisations
	Legislation about substitution and supervision	The government, the Swedish Environmental Protection Agency and some municipalities

Swedish national policy follows a vertical implementation strategy, addressing actors in phases of the product chain one at a time, following the theoretical patterns discussed in an earlier section. The actors addressed are producers during the design and production phase, importers and retailers during the distribution phase and municipal waste management organisations for recycling. Consumers are so far indirectly addressed by the activities of importers and retailers supervising and collecting batteries. However, a combination of policy instruments is used. Legislation and economic instruments in combination are used addressing producers, importers and retailers. The Swedish Environmental Protection Agency is responsible for control. Later in the policy process for battery information, campaigns are used to inform branch organisations on a local level about how to handle and collect consumers' wornout batteries.

8 Results

8.1 Sales prohibition or threats about it

Threats to prohibit sales of batteries containing mercury have, without doubt, been a very efficient policy instrument for encouraging the substitution of primary cells without mercury. The measures taken by Swedish national authorities in the 1980s had an echo not only in Sweden but in Europe as a whole. This was due to the fact that many Swedish municipalities started to burn household waste in order to recover energy in late the 1970s. When analysing the exhaust fumes from the burners, it was found that they contained unacceptable amounts of mercury. The reason for this contamination was found to be batteries thrown in the household waste and at the time there was no large scale effort to recycle or recover used batteries. The mercury problem with batteries was new and a result of new patterns of production and consumption developing during the

late 1970s. During this era, power driven products became more common and alkaline batteries with 1% mercury added were launched by the suppliers as they performed much better in terms of capacity than the common zinc-carbon cells. Representatives of the municipalities started collection schemes, but at the same time they approached the government demanding action against the suppliers of the mercury laden products (Lindén and Carlsson-Kanyama, 2005). One representative remembers that "*it was wrong that customers and companies were allowed to buy any crappy product and then the municipalities should take care*" (interview, 2004). The issue of cleaning the exhaust fumes was discussed but ruled of because out the high costs.

The Swedish Ministry of Environment called the importers for a meeting to discuss substitution, but were met with little understanding from the suppliers at first. All primary cells on the consumer market were imported at that time and the importers had little knowledge about environmental issues and production processes and depended on what the suppliers in Europe told them. A member of the Swedish Battery Association remembers that

> "We asked the producers to come here, mostly from UK and they came and said that mercury is not a problem, it is harmless, all people have mercury in their mouths and then I went to the Ministry and told them that mercury is not dangerous at all."

The same representative of the Swedish Battery Association remembers that the representatives of the Ministry threw him out '*feet first*' on hearing about this attitude. After this first confrontation, the Swedish Battery Association contacted the Ministry again, asking what levels of mercury would be tolerated and the answer they got was zero. This firm statement from the authorities was crucial and served as a guideline for the substantive product development that took place in the European battery industry until end 1980s, when the first mercury free primary cells were put on the market. During the same era, the realistic potential for a sales ban of primary cells with mercury increased. "*I thought that they (the authorities) could think about some kind of sale prohibition and that was the fear, that alkaline batteries should be forbidden*" says a representative of the Swedish Battery Association, when thinking about those times. During the same period several investigations showed how mercury flows had increased in Swedish society. The toxicological evidence of the mercury problem increased, as did the demands for action among the general public (Lindén and Carlsson-Kanyama, 2005). In the elections in 1988, environmental issues were high on the agenda. When the mercury free alkaline batteries were launched at the end of the 1980s, the Swedish authorities were surprised to find that the importers had kept the pace of product development secret in order to have room for flexibility if the process should face problems. The subsequent ban on sales of alkaline batteries had no large effect on the market, as it was already being supplied with such products. At the European level, the European battery industry has promoted a similar legal development as the one in Sweden, but has experienced the process being slow and backward.

Regarding batteries containing cadmium, demands for substitution came about ten years later compared to batteries containing mercury. It was the Swedish Municipal Authority that was more instrumental than the national organisations in the dialogue with importers and retailers. During the 1990s, when nickel-metal hydride batteries entered the market, these authorities threatened to use the existing legislation to enforce a substitution among retailers. During that time the sales of mobile phones was increasing

rapidly. They were supplied with nickel-cadmium batteries as a standard. The municipal authorities in Stockholm were confronted with battery producers, this time from Japan, who argued that cadmium is not a problem. "*They brought a whole delegation who said that cadmium is not a problem, it is just a matter of dealing with it in the right manner*" said one representative of the Stockholm Municipal Authority (Lindén and Carlsson-Kanyama, 2005). But off the record, Japanese developers confirmed that substitution was already well under way and a few years later all new mobile phones were supplied with nickel-metal hydride batteries. This development was enhanced by the fact that large producers of mobile phones were very interested in alternative batteries, for environmental reasons, but also because the nickel-cadmium batteries were too heavy to be compatible with the small and light weight mobile phones that was the future market. Large phone producers such as Motorola and Ericsson put pressure on battery suppliers and the producers responded positively when they realised that the demand was high. At the beginning of this development the Swedish attitude was regarded with suspicion. A representative of a branch organisation remembers that

> "many countries looked at us in an odd way and said what are you doing, don't you have more important issues to dwell upon … but afterwards they have also followed the same path."

The efforts to find substitutes was so successful that the suppliers themselves approached the Swedish government in the mid 1990s demanding either a total ban on the sale of nickel-cadmium batteries, with allowance for some exceptions, or a substantially higher import fee. By then, however, the attitude of the Swedish government was less progressive and the proposal from the suppliers was disregarded. Today the EU intends to revise its *Directive 91/157/EEC* on batteries and accumulators. One of the proposals is to prohibit the sales of nickel-cadmium batteries. Authorities and the suppliers have different opinions about such a development. Swedish authorities and some of the suppliers are positive, while the European Battery Association (European Portable Battery Association) is against a sales ban and argues that "*the restriction of heavy metal is not scientifically justified*" (Dallenbach, 2004). For some of the suppliers, a ban will be beneficial depending on investments made "*... a ban on sales, well some companies will say à la bonheur that is not so bad, we have other batteries while other companies may resist a lot*" says a representative of a branch organisation. Companies promoting a change are those with large investments in the old technology.

In summary, threats of sales ban had a large impact on substitution. On the other hand substitution has been further encouraged by the use of import fees for batteries with heavy metals.

8.2 Use of fees

Environmental fees paid by importers of batteries with heavy metals have been used since 1987 in Sweden and they have successively been raised, see Table 4. The fees are collected and funds are administrated by the Swedish Environmental Protection Agency.

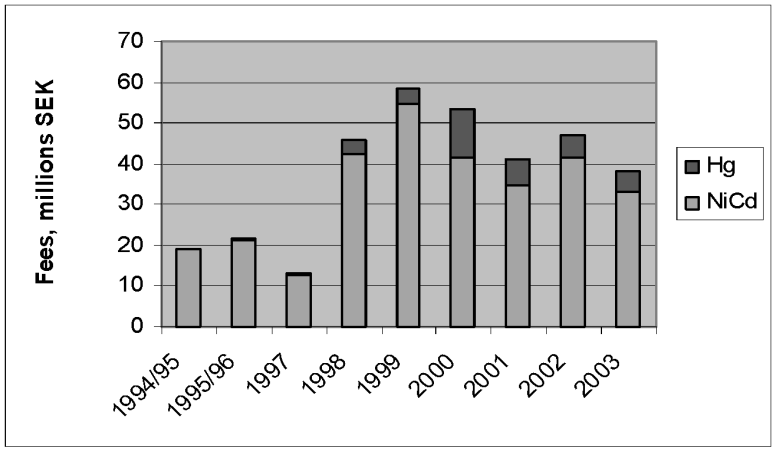
Table 4 Fees for importing batteries containing heavy metals from 1998 to today

	SEK per kg			
Year	*Alkaline batteries*	*Button cells*	*Nickel-cadmium batteries*	*Legislation*
1987–1990	23	23	13	SFS (1986:1236)
1990–1997	23	23	46	SFS (1989:974)
1997–1999	1000	1500	300	SFS (1997:645)
1999-	500	500	300	SFS (1997:645)

Source: Lindén and Carlsson-Kanyama (2005)

Today the available funds for consumer batteries is 350 million SEK, and are supposed to cover costs for collection, recycling of cadmium, final disposal of the mercury as well as information campaigns about the importance of recycling. Most of the funds have been collected from the imports of nickel-cadmium batteries as can be seen in Figure 3.

Figure 3 Fees collected from nickel cadmium batteries and batteries with mercury from 1994 to 2003 (the calculations are based on information from the Swedish Environmental Protection Agency)



The supervision of fees actually being paid by the importers has been the weakest point in the Swedish implementation of policy instruments in the battery chain. The importance of efficient supervision increases as the fees are raised (Lindén and Carlsson-Kanyama, 2005). However, for the past decade the main concern about fees concerns nickel-cadmium batteries. Supervision of fees being paid for batteries containing mercury has been a smaller problem since fewer batteries contain mercury, due to substitution, as explained above.

One example of interventions from business into the matter of fee collection is that the Swedish Battery Association wrote to the Environmental Protection Agency in 1991 saying that

> "it is of outmost importance that the Swedish Environmental Protection Agency creates routines to make revisions of companies. We have so far seen several examples of companies we suspect are not paying fees according to the law."

The association named companies who they suspected were not paying the fees, and expected the Environmental Protection Agency to follow up on this issue. At the Agency, only one person worked with fee collection for more than a decade and she estimates that 75% of the fees were collected.

Supervision activities have further declined during the past years. The reason is that when the Swedish environmental legislation was reformed in 1999 into a comprehensive Environmental Code, by omission it did not include a proper legal foundation for supervision. This was discovered by the Swedish Environmental Protection Agency in 2002, who addressed the Ministry of Environment, demanding that the legislation should be complemented (Naturvårdsverket, 2002). Up to now the Ministry has not responded, causing frustration among the staff of the Swedish Environmental Protection Agency (Lindén and Carlsson-Kanyama, 2005).

The reason why the Ministry has not responded to the demands from the authority in charge of supervision is not known. The consequences for suppliers and retailers are substantial. In a letter from 2003 the Delivery Association of Electric Hand Tools writes that "*during a meeting with members it was discussed why Swedish Authorities do not have an interest in the battery law being upheld in Sweden*" and the members concluded that "*authorities do not take measures against companies breaking the law even after repeated reminders*". The Association writes that

> "less serious suppliers import nickel-cadmium batteries, but declare them as nickel-metal hydride batteries at the customs in order to avoid paying the fees."

The Association give examples of companies that break the law but notice that the Agency has not pursued them. One such example is a supermarket selling tools where a drilling machine with a rechargeable battery was sold at 239 SEK, while the fee for the battery exclusively, amount 350 SEK. The same Association estimates that the fees for rechargeable batteries in hand tools, where the use of nickel-cadmium batteries is still common, are paid by 50% of the suppliers only.

Nevertheless, fees are considered a very important policy instrument for substitution by several suppliers. They believe that the policy adopted by Swedish authorities have led to a supply that differs from other countries in the EU, where fewer products than in Sweden are supplied with rechargeable batteries without cadmium. The suppliers interviewed, think that the use of nickel-cadmium batteries will not disappear completely in the foreseeable future without increased fees or a ban on the sales of nickel-cadmium batteries. "*With current fees and without a ban, nickel-cadmium batteries will persist*". An important step in the right direction would be a more efficient supervision of fee collection or consumers demanding environmentally friendly batteries, according to the suppliers. Without powerful policy instruments that are applied in an efficient manner, product development will not take place in the near future. Concerning substitutes they are not worried, "*it can be arranged, it just hasn't been a matter of priority*".

8.3 Information campaigns about recycling and their success

An important feature of the Swedish experience of applying policy instruments in the battery product chain is the large investment in information campaigns directed at the general public about the importance of collecting batteries instead of throwing them in the household waste. The campaigns have been going on for about 18 years. Consumers are informed about the danger of batteries leaking mercury and cadmium on nature and

humans. At the same time they are informed about where to dispose their wornout batteries for recycling. By tradition batteries have been taken care of by retailers, e.g., pharmacies. Batteries can also be disposed in other places, e.g., groceries, petrol stations, as well as in a special barrel at municipal recycling stations. Although most people understand the problems with leaking batteries and are positive to recycling them, the information about how to do it and where, is organised in a very different way from recycling other fractions of waste from households. Instead of one organisation managing batteries there seem to be several from the consumers' point of view. This situation may create a lot of confusion about where to dispose the batteries and reliance on the aim to recycle them, compared to the situation for other fractions of waste (Lindén and Carlsson-Kanyama, 2003). One organisation taking care of all kinds of garbage probably makes the recycling intention more reliable and makes it easier for the consumer to behave in the right way.

The Battery Campaign with a budget of four million SEK started in 1987 and went on until 1993. The goal was that 75% of all batteries sold should be collected. Means to reach that goal were: collaboration with the municipalities, advertisements on TV and distribution of printed material. Popular actors were involved in TV advertising. The lessons learned, according to the campaign leader, was that "*big things that could be observed to make a difference were better, than doing many small things*".

The collection target for alkaline batteries during that time never exceeded 30%. For nickel-cadmium batteries it varied between 35% and 45%. For button cells was it higher and reached, at most 96%, partly because many button cells were sold at places such as pharmacies (for use in hearing aids), where collection had a long standing tradition. The staff in these places had technical training and a personal encounter with the customers, enabling them to collect most used button cells. In an evaluation of the Battery Campaign during 1990, it was found that the public seemed to be well aware of the fact that spent batteries should be collected separately. 1000 households were interviewed by phone and 93% had noted the battery information campaigns. 81% of those considered the campaign very important (Batterijakten, 1990, nr 1-90). Still, collection targets were far from reached.

From 1993 to 1996, information campaigns mostly communicated the importance of recycling nickel-cadmium batteries (SIMBA, 1994a, 1994b). They were administered by a consortium, called SIMBA, run by the Swedish Trade Association, who in 1992 made an agreement with the government to collect 90% of the spent nickel-cadmium batteries by the year 1995. This agreement came about after the government planned to introduce a refund on nickel-cadmium batteries that should be administered by those who sold them, which was something that the Trade Association strongly disliked. Large information campaigns, using national media, were carried out with funds originating from the battery fees. In 1994 the collection rate was 31% and very far from the target of 60%. By 1996 it was clear that the 90% target was never to be reached. In fact it never exceeded 35% and by the time the SIMBA consortium came to an end 16 millions SEK had been spent on information campaigns. A major problem encountered by SIMBA was how to measure collection targets. At the time they were measured by the amount collected during one year divided by the amount sold the previous year. Products with rechargeable batteries last many years and the sales figures constantly increased. The measuring method portrayed the campaigns as unfairly unsuccessful according to SIMBA.

The government assumed responsibility for the recurring battery information campaigns in 1998 after SIMBA failed to meet their collection targets. Again, large information campaigns were launched and attitudes among the population were measured. Again, results showed that many had seen the campaigns, 49% in 2002, although the result fell far below that of 1990, which was above 90% (Effekt, 2002). During 2004, the share of responders mentioning that batteries should not be thrown in the garbage was 55%; still 22% threw their batteries in the garbage. Thirty seven percent could not mention any product with built in batteries. Gender differences were apparent; women collected their batteries to a larger extent than men, while men said they had more knowledge about products with built in batteries.

In summary, a large proportion of Swedes think that it is important to collect batteries and the attitude seems to be stable over time (Nordisk Mediaanalys, 2004). When looking at collection targets achieved, they never reached the 90% target, despite the fact that approximately 63 million SEK were spent on information and in spite of the fact that many citizens have seen and understood the message. Even when using a more accurate measuring method, the results are unsatisfying. The amount of batteries in the household waste has been compared with the sold amounts in some locations with a resulting collection rate of just over 50% (UMEVA, 2004). The amount of batteries collected is far from the results of all other fractions of household waste, like paper, cupboard, glass, aluminium cans, and plastic materials. Since batteries are easy to carry, last for long, and as a result are thrown away quite seldom compared to others waste fractions, the most probable reason for this situation is the many actors collecting batteries, which affects the credibility of the measure as such. However, collecting and recycling batteries is the single policy instrument in the integrated product chain for batteries addressing consumers directly.

9 Conclusions

The Integrated Product Policy, IPP, focuses on products' lifecycles and on a close cooperation between concerned stakeholders in order to find ecologically valuable solutions in the production and consumption chain. In order to implement that policy there is a need to combine different types of policy instruments and direct them to different kinds of stakeholders throughout all phases of the product chain, in order to maximise impacts. This approach is radically different from the process oriented product policy used earlier.

It is, however, not possible to start from the beginning when developing IPP. Policy instruments have been used in the product chain during the past 30 years, and analysing the experiences from applying them are important for devising strategies for the successful implementation of IPP. In this study, we analyse how stakeholders in different parts of the battery product chain have acted and reacted to various policy instruments applied by Swedish authorities in order to limit exposure of mercury and cadmium to humans and nature during the past 20 years. A wide range of policy instruments have been applied in Sweden, ranging from prohibitions, to fees, information and voluntary agreements. Stakeholder's experiences were documented by interviews and analysis of documents.

Results show that prohibitions or threats of prohibiting the sale of certain batteries have had a large impact on product development, most pronounced for batteries containing mercury. For batteries containing cadmium, fees imposed by authorities and paid by the importers, have been very important for product development and a more environmentally benign supply. One problem is that the resources for checking up compliance with regulations have been too limited. The legislation is partly deficient when it comes to compliance. This has created substantial frustration among the suppliers and retailers and has made competition unfair. The substitution of batteries with cadmium for others that are less harmful to the environment has also been delayed. The recurring campaigns for collecting used batteries have led to a high degree of awareness among the general public, but in spite of substantial efforts, about half of the batteries may still be discarded.

In the future, stakeholders in the supply chain want a better dialogue with the authorities. Suppliers emphasise that batteries containing cadmium will not be substituted unless powerful policy instruments are applied. It is emphasised that when authorities act forcefully it is fruitful even if disagreement results. It is possible to learn form the battery experience in the upcoming work of applying IPP.

The limited impact of information campaigns on behaviour is highlighted, as well as the need for a high quality dialogue between authorities and suppliers. The limited impacts result from regulations and bans that are not followed up properly. Legislation that is not formulated in dialogue with branch organisations seems to be less efficient in the long run. But when legislative policy instruments as well as economic ones are applied efficiently, they are relevant instruments for a successful IPP in the product chain.

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