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Advancing the Frontier of Extended Producer Responsibility: The management of waste electrical and electronic equipment in non-OECD countries

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Doctoral Dissertation

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Panate
MANOMAIVIBOOL

Doctoral Dissertation
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The International Institute for Industrial Environmental Economics
Internationella miljöinstitutet

I have envisioned this cover since I did the licentiate thesis two years ago (and drew it even before I started writing this thesis). The spread of the dandelion seeds represents the spread of policy idea like EPR. I can only hope that, when the seed finds good soil, a beautiful flower will bloom.

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and
Associate Professor Naoko Tojo

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Panate Manomaivibool

Lund, September 2011

Executive summary

Background

During the last decade, several major countries outside the Organisation for Economic Co-operation and Development (OECD) were in the process of developing policies to manage *waste electrical and electronic equipment* (WEEE). Environmental justice groups and researchers have uncovered environmental and health hazards from large-scale uncontrolled recycling and disposal of WEEE in China, India, Vietnam, Nigeria, and Ghana. The majority of WEEE is believed to come from OECD countries through the imports that breached the mechanisms of *the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal*, although there has been a growing understanding that the amount of WEEE generated within non-OECD countries will also rise sharply in the next 10-15 years. In some other countries like Thailand, Argentina, and South Africa, the policy-makers became aware of the issue from the knowledge about WEEE policies in the industrialised economies, in particular: *the Directive 2002/96/EC on waste electrical and electronic equipment* (WEEE Directive) and *the Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment* (RoHS Directive) of the European Union (EU).

Extended producer responsibility (EPR) has increasingly been discussed in the development of WEEE policy in non-OECD countries. The environmental policy principle underpins many WEEE policies in the OECD, including the WEEE Directive and the RoHS Directive. Instead of having the municipalities responsible for the waste stream, an EPR programme extends the responsibility of the producers to the end-of-life management of their products in order to promote upstream and downstream improvements in the product system. Notwithstanding the many variants of WEEE programmes in OECD countries, notable extended responsibilities are the design for end-of-life requirements, the obligations of physical take-back and recycling of used products, the financial responsibility for the handling cost, and the provisions of end-of-life information for the products.

However, it remains unclear whether and how EPR can be applied to the policy for the management of WEEE in *the context of emerging and developing economies*. EPR is a guiding principle for the selection of policy instruments and can be interpreted and implemented in a number of ways. Although non-OECD countries can learn from the experiences of early adopters, identifying and replicating successes in a different context is not an easy feat

and requires a good understanding of the policy process in which such a change can be brought about.

The Research – Objective, Question, Design, and Strategies

The objective of this thesis is to *provide practical knowledge about EPR for policy-makers, practitioners, and policy advocates who are working with WEEE issues in non-OECD countries*. Practical knowledge includes both substantive information about EPR and WEEE and information about the policy process in which EPR can be applied to the management of WEEE. Both types of knowledge are needed *to promote healthy policy development* that facilitates learning and avoids uninformed, incomplete, and inappropriate policy-making in general and policy transfer in particular.

To achieve this objective, six academic papers that constitute this thesis contribute to answering the overarching question:

How can EPR work for the management of WEEE in non-OECD countries?

In this thesis, EPR is treated analytically as *a policy paradigm* that can lead to the most profound change in waste policies by offering a product-oriented view on solid waste. Under this paradigm, an effective intervention should *aim at total life cycle environmental improvements of product systems*. This ultimate goal is translated into two sets of EPR objectives: *upstream improvements in product design and system architecture and downstream improvements in waste management*.

The environmental effectiveness of EPR programmes for complex products in industrialised economies to achieve the upstream and downstream objectives were assessed in Papers I and II. *Theory-based evaluation* was applied to the EPR programmes for end-of-life vehicles in the United Kingdom and in Sweden (Paper I) and the EPR programmes for WEEE in Northeast Asia (Paper II) to uncover the links between the intervention mechanisms and the policy outcomes in the programmes. The programme theories were reconstructed from the analysis of policy documents and actual implementation. The outcomes were measured through performance proxies and based on secondary data. This line of analysis is extended in this thesis in order to generate policy lessons from the experiences of other WEEE programmes in OECD countries.

Papers III and IV tested *the compatibility between underlining assumptions of EPR and the prevailing conditions of emerging and developing economies*. They followed *a single-case design* but the use of a common framework based on *material flow analysis* ensured the comparability of the findings. Data about the flows of EEE and WEEE in a specific country were collected from documents and topical interviews. Besides the cases of India in Paper III and of Thailand in Paper IV, this thesis also benefits from a similar study in Argentina and literature about the conditions in China in identifying opportunities and challenges of implementing EPR in non-OECD countries.

The research in Thailand continued beyond the contextual analysis to *the development of policy options that would suit the context*. It involved *a large-scale statistical survey to collect data about the preferences of households, the cost estimation of the policy proposal, and the modelling of financial consequences of policy options*, key results of which were presented in Papers IV and V. Besides the substantive contributions, the process in which the researchers learnt together with the practitioners in the search for solutions to the problem was equally important. *The action research was guided by network management strategies* that tried to further the development of ideas and the social interactions in the policy network.

After the generation of technical information about EPR and the non-OECD contexts and the action research, Paper VI took a step back to look at the policy process at large. The analysis of the policy process followed *the Advocacy Coalition Framework to understand the nature of advocacy coalitions, policy changes, and policy-oriented learning in the development of WEEE policies in non-OECD countries*. The analysis was based on topical interviews with stakeholders in India, Thailand, and Argentina and policy-related documents that helped sketching the policy development in these countries over the past decade. This analysis completed the circle that began with the longitudinal study in Paper I on the impacts of network management in the policy process on the development and the effectiveness of the EPR programmes for end-of-life vehicles in the UK and in Sweden.

Results and Discussion

Effectiveness of EPR for WEEE in industrialised economies

Upstream improvements. Evidences exist for *the effect of the restriction of hazardous substances* but beyond that they are less uniform. Early evaluation reported *evidences of design changes attributable to the coming of EPR legislation* in Sweden and in Japan. Later studies continued to report evidences of product redesigns in

Japan that has a unique system in which major domestic manufacturers involve in *the physical management of their home appliances that are sorted by brands* after being collected by retailers. However, the impacts of the downstream measures in Europe on product design faded after the WEEE Directive was transposed and implemented in Member States.

The implementation of the WEEE Directive (as well as other WEEE laws in Europe) see the producers pay fees to collective bodies; either national producer responsibility organisations or compliance schemes to manage their compliance. This leads to an interest in improving the performance of the collective systems, in particular, in *reducing the compliance costs through increasing competition. The absence of differentiated fees at the brand level* in WEEE programmes is worth noting. Most financial mechanisms do not differentiate the size of the fee based on the end-of-life costs of new products and are primarily designed to raise funds for the management of historical WEEE.

Downstream improvements. Most programmes have successfully utilised the resources from the producers to *develop collection and treatment infrastructure for WEEE*. The most important downstream lesson from the review of WEEE programmes is that *collection is a keystone activity*. While *the free take-back obligation* almost becomes a symbol of EPR in most WEEE programmes, the financial consequence to end users does not appear to be a good explanation of varying collection performance at least among industrialised economies. C*onvenience standards* that require a certain level of service coverage and c*ollection goals* play a more important role, although a single overall weight-based target tends to discriminate against the collection of small equipment.

Once used products are collected, the *transfer obligations* on the collectors and *reporting mechanisms* are vital to ensure that the collected will be treated according to *the environmental standards including recycling targets*. Although it is not perceived as a necessity in most industrialised economies, *a meticulous third-party auditing system* can be installed like in Taiwan to protect the programme from frauds. To complement *the licensing and authorisation regime*, programmes can provide *financial incentives* to encourage downstream actors who adhere to the high standards and best environmental practices. On a negative note, *product reuse has been a blind spot* in many programmes and it remains to be seen whether some new programmes in North America with give reuse bonus in form of extra weights towards the collection goals will produce desirable outcomes.

Opportunities and challenges in emerging and developing economies

At first glance EPR is an attractive strategy for several non-OECD countries that have *large manufacturing industries*. The Japanese model of physical responsibility, for example, comes to one's mind. However, the structure of the electrical and electronic industries might not lend that much support to the implementation of EPR. To begin with large part of the industries tends to be *export-driven* and would have little to do with a national EPR programme. In addition, the majority of manufacturers serve as sub-contractors or assembling units of multinational corporations and *might not have much influence over the product design and development*.

Moreover, there is *a challenge with assembled, counterfeit, no-brand, and unreported products*, the makers of which are going to be free riders in an EPR programme. Although it is possible to *include the suppliers of key components used in assembled products as responsible producers*, supplement measures such as *market surveillance* are needed to combat illegal shipments of products. On the other hand, an EPR programme can reinforce the control of imported WEEE into the country by *putting the responsibility also on the importers of used products* in order to make it less attractive to falsely declare WEEE as reusable products. To be able to catch these actors, the EPR programme must try to indentify the responsible producers at the early point in the product shipment chain.

Another key challenge of implementing EPR in non-OECD countries is *to establish and sustain environmentally sound downstream sectors*. Although some separate and sell recyclables to waste dealers, in general people in these countries *lack public infrastructure and a social norm* to sort and recycle their waste for non-commercial reasons. *Collection will be difficult and expensive* if the end users are misguided about the remaining value of their WEEE because some recyclers do not pay the compliance and environmental costs and offer them high bids for the materials. *The unfair competition from the informal recycling sector* has suppressed the development of authorised treatment facilities for WEEE from households in emerging and developing economies. In the future, resources available in an EPR programme could be employed *to change the incentive structure and encourage formalisation*. However, because money can attract scams, the programme in non-OECD countries might need to *pay more attention to the monitoring and auditing of the actual results* than in OECD countries.

Despite the challenges, there are some signs showing that *the problem of WEEE and the costs of EPR-based inventions are manageable in non-OECD countries*. *The historical stock of products* that can no longer be redesigned *is a relatively small burden* compared to the situation in OECD countries where product ownership was high before the programmes were put in place. The implementation of most financial mechanisms apart from the end-user-pays system will benefit from the difference between the amount of WEEE from this stock and the larger sale volumes. In the cases of specific equipment, such as information and communication technologies (ICT), *the high share of institutional users* who might have close relationship with the producers makes it easy to direct collection efforts. Last but not least, *the inexpensive labour* would allow elaborated manual dismantling to extract more values from WEEE and enhance depollution at little cost.

WEEE policy-making in non-OECD countries – trends, potential, limitations, and delimitations

There are two trends in the developments of WEEE policies in non-OECD countries. The first is *the harmonisation with the RoHS Directive* by restricting the use of six substances – lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether – in virtually all categories of new EEE. The policy change comes from *the awareness about the RoHS Directive* and can happen in a short time in countries with large export-oriented industries. The upstream measures can come as a separate action from the downstream measures for waste management like in the cases of China and Thailand or combined into one single package like in India and Argentina. The difference is that the latter approach takes more time for the downstream measures to be developed.

The second trend which is the focus of this research is *the popularity of a national fund model for the management of WEEE*. Lawmakers and the governmental agencies in Argentina, China, Thailand, and Vietnam have proposed, or were at one point proposing, the establishment of a state fund for the management of WEEE. The funds would be financed by the producers or the consumers most likely through the upfront fees on new products. The proposal was passed into law in China, approved by the Senate and being reviewed by the Lower Chamber of the parliament in Argentina, and pending as a draft law in Thailand. Only Vietnam switched to a model similar to the programme in South Korea and some states in America that set collection quotas for individual producers. Although the idea of state fund was not directly discussed in South Africa, the suggestion

under the (draft) national strategy which favoured a single national compliance system with mandated advanced recycling fee might lead to a similar result.

The national fund model holds some promises in the context of non-OECD countries. All the proposals with the model aim at *improving the end-of-life management of targeted items at a national scale* in a country where the municipal solid waste management system is underdeveloped. The Bill in Argentina contains *the convenience standard* requiring that there must be a WEEE collection centre for every town with more than 10,000 inhabitants. Not only does the draft law in Thailand have a convenience standard but it also proposes *a buy-back mechanism*. The government-backed trade-in scheme in China proved to be very successful in encouraging product returns with monetary incentives. It also paid *subsidies to the transporting companies and authorised treatment facilities* that handled collected WEEE. However, the scheme has cost the Chinese government a large sum of money and was perceived largely as a temporary economic measure to boost the economy. The national fund model will *provide financial means for these undertakings on a more continuous basis by linking fundraising for waste management with a driver of WEEE generation – consumption*.

The national fund model is also *a way to translate the financial responsibility of the producers*. The proposals in Argentina, China, and South Africa all make direct reference to EPR while the one in Thailand to *the polluter pays principle* (PPP). Policy-makers in these countries have learnt a great deal about EPR programmes especially through developmental agencies from Europe and Japan, but found the implementation models in these regions challenging to implement in their countries. This limited interpretation of EPR might be *fit with the context in which the producers are not keen to engage in waste management and the free-riding problem threatens the viability of the industry solutions without strong backing*. Taiwan, for example, first experimented with industry-operated recycling schemes in the early 1990s amidst the privatisation movement, but decided to discontinue the fraud-ridden schemes and nationalised the system by establishing a governmental fund in 1998.

Nevertheless, the national fund model is an awkward implementation from the EPR perspective. The system is designed to be a universal solution for all and is gravitated towards uninspired producers. Besides substance restrictions, it typically *lacks other mechanisms that have seen to be able to stimulate upstream improvements*. Keeping the management of WEEE at the arm's length of the producers does not encourage them to engage in or communicate with the downstream sectors. The producers also do not have much control

over the design of the collective system and its costs. A lack of competition and, in the cases of a governmental fund, bureaucracy can lead to inefficiency of the national system. In addition, because the fees tend to be simple and flat, they do not give design incentive for the development of new products. The fee in South Africa, for example, is proposed to be set at 10% of the retail prices. High and inappropriate fees have led to serious scepticism about the motives behind fundraising.

There were also *cognitive deficiencies in the policy process* that might compromise the potential of the policy proposals. The search for policy solutions tended to overlook the experiences of the governmental funds implemented in Taiwan, in California, or in the defunct Swedish car scrapping system. *The missed learning opportunities* mean that the proponents of the model failed to capitalise on positive evidences elsewhere to vindicate their points and might repeat otherwise avoidable mistakes. In addition, *the policy proposals often appeared incomplete with key elements missing or underdeveloped.* The ordinance in China, for example, went into effect without the details on the management of the state fund, the size of fees, and the payment procedure. The earlier versions of the draft law in Thailand did not contain any auditing mechanism to safeguard the subsidy-driven scheme from frauds.

Moreover, *the policy process was rather closed.* With an exception of the parliamentary hearings in Argentina, the interactions were largely *limited to the governmental agencies, their consultants, and their clients.* Key stakeholders notably foreign companies, NGOs, local governments, and consumers reported to be unaware of the policy development or failed to get their voice heard. *The social closedness* might result from a mixture of a non-participatory tradition, a nature of public consultation, and a limited frame of reference (e.g. that the producers mean only the manufacturers in the country), or the accessibility of the policy documents, including language issues.

To improve the development of WEEE policies in non-OECD countries, *policy-oriented learning* is vital. The generation and accumulation of technical information is a necessary condition for learning. However, without *network management* learning can still be difficult especially between the opposing parties that hold different belief systems. Network management strategies can aim at cognitive or social fixations in the policy network in order to breakthrough an impasse.

Advocates of EPR have encouraged the learning about EPR-based solutions. The globalisation of trade and the internationalisation of environmental

affairs have created two groups of stakeholders that have a fairly consistent belief in EPR and are likely to be found in many countries. *Leading manufacturers of information and communication technologies* (ICT) *most of which are multinational corporations have a corporate policy supporting individual producer responsibility* (IPR). The belief of these companies converges with that of *non-governmental organisations* (NGOs) *working on toxics in the products and environmental justice issues*. Although the NGOs tend to prefer stronger and faster interventions from the government than the manufacturers that tend to oppose the national fund model, these two groups have been seen working together at international and national levels to advocate EPR. In India, such a coalition developed and proposed an EPR-based legal framework for the management of WEEE to the government. The joint action between the industry and the civil society gives strength to their advocacy.

Although the policy-oriented learning across coalitions is inherently difficult, there have been signs of compromises on the secondary aspects of the policy. While they are not likely to change the policy core of the proposal fuelled by the general belief about uninspired producers, the proponents of the national fund model might be willing to negotiate *a specific concession with a proactive sector of the industries*. By including an opt-out option to a national fund model, the system has better leverage for system innovations. To make their case in the negotiation, the ICT manufacturers often show the effect of competition on the compliance costs. Moreover, the logics and the evidences of upstream benefits of E/IPR, although inconclusive and are unlikely to persuade the process-oriented specialists in the waste subsystem, might be sufficient to convince the legislature to extend the objectives of waste policies to the upstream improvements.

In addition to learning about alternatives, it might also be beneficial *to encourage the learning about the national fund model*. Because the economics of recycling varies greatly between different categories of WEEE, a cost-estimation or a fee-setting exercise can prompt reflection on the appropriateness of any one-size-fits-all approach. *The flat rate fee fixed proportionally to the retail prices is unfair across product categories*, for example. The learning about the fund management can be triggered by examining the financial consequence of high ratio of new sales to WEEE generation. One discussion that came out from such a reflection in Thailand was the possibility to use part of the financial cushion as *discounts for environmentally certified products to give design incentive*. Certifying criteria which need to be periodically reviewed can then serve as a subsystem-wide indicator of design

improvements of the programme – which is now the Achilles' heel in the evaluation of EPR.

Conclusions

EPR has a potential to help solving the WEEE problem in non-ECD countries. Despite challenges, this research finds that opportunities exist that make an effective EPR programme possible at manageable costs. Nevertheless, whether this potential will be realised depends largely on the exact design and the implementation of the programme. This research advises that policy-makers, practitioners and producers in non-OECD countries should learn from the experiences of OECD countries and take actions in an integrative and preventive manner.

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List of Appended Publications

Paper I: Manomaivibool, P. (2008). Network management and environmental effectiveness: the management of end-of-life vehicles in the United Kingdom and in Sweden. *Journal of Cleaner Production*, 16, 2006-2017.

Paper II: Manomaivibool, P. (2010). Extended Producer Responsibility in East Asia: approaches and lessons learnt from the management of waste electrical and electronic equipment. *East Asian Review*, 13, 41-65.

Paper III: Manomaivibool, P. (2009). Extended producer responsibility in a non-OECD context: The management of waste electrical and electronic equipment in India. *Resources, Conservation & Recycling*, 53, 136-144.

Paper IV: Manomaivibool, P., and Vassanadumrongdee, S. (2011). Extended producer responsibility in Thailand: Prospects for policies on waste electrical and electronic equipment. *Journal of Industrial Ecology*, 15, 185-205.

Paper V: Manomaivibool, P., and Vassanadumrongdee, S. (2011). Disposal of waste electrical and electronic equipment: A household survey of past behaviors and future preferences in Thailand. Submitted in February 2011 to *Resources, Conservation & Recycling*.

Paper VI: Manda, B.M.K., Maneschi, D., and Manomaivibool, P. (2011). Extended producer responsibility and waste electrical and electronic equipment in non-OECD countries: insights from the Advocacy Coalition Framework. Submitted in May 2011 to *Journal of Industrial Ecology*.

Other Publications from the Author

Lawhon, M., Manomaivibool, P., and Inagaki, H. (2010). Solving/ understanding/evaluating the e-waste challenge through trans-disciplinarity? *Futures*, 42, 1212-1221.

Manomaivibool, P., and Tojo, N. (2010). The management of used mobile phones in the United Kingdom: Is exporting for re-use a sufficient solution? In *Proceedings of Going Green CARE Innovation 2010*, 8-11 November, Vienna, Austria.

Murakami-Suzuki, R., Tojo, N., Manomaivibool, P., Terazono, A., and Murakami, S. (2010). The collection and recycling systems of used mobile phone in European countries and Japan. In *EcoBalance2010*, 9-12 November, Tokyo, Japan.

Manomaivibool, P., Lindhqvist, T., and Tojo, N. (2009). *Extended Producer Responsibility in a non-OECD Context: The management of waste electrical and electronic equipment in Thailand*. Lund: IIIEE, Lund University, (available in English and Thai).

Lindhqvist, T., Manomaivibool, P., and Tojo, N. (2008). *Extended Producer Responsibility in the Latin American Context: the management of waste electrical and electronic equipment in Argentina*. Lund: IIIEE, Lund University, (available in English and Spanish).

Manomaivibool, P., Lindhqvist, T., and Tojo, N. (2008). EPR in non-OECD context: an introduction to research projects on the management of WEEE. In *8th Asia Pacific Roundtable for Sustainable Consumption and Production*, 18-19 September 2008, Cebu, Philippines.

Manomaivibool, P., Lindhqvist, T., and Tojo, N. (2007). *Extended Producer Responsibility in a non-OECD Context: The management of waste electrical and electronic equipment in India*. Lund: IIIEE, Lund University.

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Abbreviations

ACF	Advocacy coalition framework
ARF	Advanced recycling fee
CRT	Cathode ray tube
DfE	Design for environment
EEE	Electrical and electronic equipment
ELV	End-of-life vehicle
EPR	Extended producer responsibility
EUR	Euro
ICT	Information and communication technology
IPR	Individual producer responsibility
MFA	Material flow analysis
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
PPP	Polluter pays principle
PRO	Producer responsibility organisation
R&D	Research and development
RMB	Renminbi (Chinese Yuan)
RoHS	Restrictions on the use of hazardous substances
TBE	Theory-based evaluation
THB	Thai Baht
TV	Television
WEEE	Waste electrical and electronic equipment

CHAPTER
ONE

1. Introduction

1.1 Background

Since Joseph Swan lit his house in Gateshead with incandescent light bulbs in 1880 and cities were electrified, *electrical and electronic equipment* (EEE) has gradually become a common feature of a modern life. Televisions (TV), refrigerators, washing machines, and several other home appliances were commercially available as early as the 1920s. They were enjoyed by the majority of households in industrialised countries after the economies had recovered from World War II. The economic prosperity allowed the then Four Asian Tigers of Hong Kong, Singapore, South Korea and Taiwan to follow suit in the 1970s and 1980s. The next two decades witnessed the unstoppable penetration of information and communication technologies (ICT), in particular personal computers and mobile phones, and a shift to anything digital in the information age. With economic development and electrification programmes underway, more and more households in emerging and developing economies can access to comforts and new possibilities EEE offer for the first time.

The other side of a successful story of EEE is a growing amount of used products that are discarded as *waste electrical and electronic equipment* (WEEE). The obsolescence can be either absolute or relative. Absolute obsolescence results from tears and wears that prevent the products from functioning properly. However, even when the old products still function, we sometimes make replacement decisions in order to enjoy new features or designs. In the UK, for example, it was calculated that in 2008 on average mobile phones were in use for only 18 months, far below their engineered lifespan (Manomaivibool and Tojo 2010).

WEEE first prompted concerns when it appeared among municipal solid waste in *industrialised economies*. Early concerns focused on the risk of lead contamination from display devices in landfill and the release of ozone-depleting substances from cooling appliances to the atmosphere. Later the list of substances of concern expanded to cover other heavy metals and brominated flame retardants.

While generally being an applauded strategy, reuse and recycling of WEEE were difficult endeavours for municipalities. Used home appliances were bulky and would consume a lot of storage space in waste segregation systems. The used products were also too complex to be repaired or dismantled at material recovery facilities. Moreover, electrical and electronic equipment was evolving fast during the last couple of decades. While *new product developments could have profound effects on reuse and recycling*, they were beyond the control of municipalities. The shift from cathode ray tubes (CRT) to flat-panel displays, for example, not only led to the collapse of a market for new and used CRT and recycled CRT glass, but also introduced more mercury and new elements, such as indium, to the waste stream. A shift towards energy-saving light bulbs created problems with mercury in the compact fluorescent lamps.

Recognising the challenges, the European Commission included WEEE in the Priority Waste Streams Programme in 1991. The Commission estimated that in 1998 Western Europeans generated about six million tonnes of WEEE – about 4% of the municipal solid waste – and that the amount would grow at 3-5% per year – about three times faster than average waste (MEMO/05/248). It was further believed that, without dedicated legal and physical infrastructure, some 90% of the waste was landfilled, incinerated or recycled without proper treatment (EC DG JRC and IPTS 2006). In 2003 the European Parliament and the Council finally adopted *the Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment* (RoHS Directive) and *the Directive 2002/96/EC on waste electrical and electronic equipment* (WEEE Directive).

These directives and transposed national laws in the European Union (EU) as well as legislation for WEEE in many other OECD countries followed the principle of *extended producer responsibility* (EPR). EPR suggests that shifting end-of-life responsibilities from municipalities and taxpayers to producers and consumers is not only a way to finance the waste management, but it can also create incentives for the producers to design better products and product systems. The principle gained support from the

Organisation for Economic Co-operation and Development (OECD) as an approach for waste prevention and minimisation. Between 1994 and 2006, OECD carried out work and disseminated information about EPR, including the publication of a guidance manual for governments in 2001 (OECD 2010). With a number of mandatory and voluntary take-back schemes in Europe, North America, and Northeast Asia, it is not far to say that EPR is now a dominating policy paradigm for WEEE management in developed countries.

Against this backdrop, it is not surprising that when the WEEE problem later surfaced in *emerging and developing economies*, there would be an interest in the transfer of EPR policies. However, it is not immediately clear which policy lessons are to be transferred and how EPR can benefit non-OECD countries. The details of EPR policies vary considerably among OECD countries. So do their results. A lack of sufficient understanding about policy interventions and their outcomes can lead to uninformed or incomplete policy transfers. Policy failures can also result from inappropriate transfers that are not able to produce or repeat the same successes in different contexts. Williams and colleagues (2008) even question the relevance of common measures, namely take-back legislation, restrictions on hazardous substances in new products, and trade bans, to pressing issues in developing countries such as demands for used products and informal recycling. Therefore, *there is a need to provide knowledge about EPR that is relevant to the WEEE problem under the conditions of emerging and developing economies*.

1.2 Objective

This doctoral thesis aims at *providing practical knowledge about EPR for policy-makers, practitioners, and policy advocates who are working with WEEE issues in non-OECD countries*. Practical knowledge includes both the substantive information about EPR and WEEE and the information about the policy process in which EPR can be applied to the management of WEEE. Both types of knowledge are needed *to promote healthy policy change* that facilitates learning and avoids uninformed, incomplete, and inappropriate policy-making in general and policy transfer in particular.

With this objective in mind, this thesis cannot only make policy prescriptions about WEEE management from the perfect world of EPR, but it also has to consider compromises, modifications, and enablers

necessary for the policies to work in the real world. The evidence-based policy-making requires an understanding of how the principle has been applied, advantages and disadvantages of such applications, contextual conditions of emerging and developing economies, and the preferences of stakeholders.

Part of this objective was achieved in my licentiate[1] thesis (Manomaivibool 2009). The work that preceded this doctoral thesis developed a framework for policy transfers based on theory-based evaluation in order *to structure knowledge about EPR implementation*. It classified variants of EPR programmes in Europe and Northeast Asia and policy proposals in developing countries based on key policy instruments and programme designs. By decomposing the complex interventions into generative mechanisms and contextual conditions that are responsible for policy outcomes, the framework improved the analytical tractability and transferability of policy lessons. Some conditions pertinent to non-OECD countries that might help or hamper EPR mechanisms were also identified and limitations of the framework noted in the licentiate thesis.

The purposes of the research after the licentiate were twofold. The first was *to search for policy solutions* to the WEEE problem in non-OECD countries based on the knowledge about EPR interventions and the understanding of pertinent conditions in these countries. This was pursued with policy-makers and advocacy groups in the context of reflective action research where researchers and the others learned how to solve the real-world problem together. The second purpose of the research was *to reflect on the policy process* in particular the ability and inability of the political system to promote learning and policy change.

1.3 Research Question

An overarching research question for this thesis is: *How can EPR work for the management of WEEE in non-OECD countries?* In order to answer this question, the thesis synthesises the findings from the research presented in six scholarly papers attached to the end of the thesis. The rest of this

[1] In the Sweden a licentiate degree is obtainable with 120 higher education credits of PhD work. A doctoral degree is obtainable with 240 credits. A higher education credit in Sweden is equivalent to one credit in the European Credit Transfer and Accumulation System (ECTS).

section groups these papers into four themes explaining their contributions to the synthesis and stating the underlying sub-questions.

A significant part of the first two papers attempts to make sense of EPR from the evaluation of programmes implemented in industrialised economies. ***Paper I***, published in the *Journal of Cleaner Production*, uses theory-based evaluation to explain the environmental effectiveness of the management of end-of-life vehicles in the UK and in Sweden between 1991 and 2006. ***Paper II***, published in *East Asian Review*, develops a two-step, semantic approach to evaluate WEEE programmes in Japan, South Korea, and Taiwan. A common theme that runs through the two evaluations is: *What mechanisms achieved (or failed to achieve) the goals of EPR?*

Paper III, published in *Resources, Conservation & Recycling*, turns attention to conditions in the developing world. It explores the implications of shifting end-of-life responsibilities to the producers considering the flows of EEE and WEEE in a non-OECD country. Although the paper reports only the results from the first endeavour in India in 2007, similar investigations were later conducted in Argentina (Lindhqvist et al. 2008) and Thailand (Manomaivibool et al. 2009) using the same analytical framework, which in turn, strengthened the findings from each single case study (Yin 2003). At the heart of this qualitative material flow analysis is the question: *What would be advantages and disadvantages of following the EPR approach in developing countries?*

The next two papers focus on the policy proposal of the Thai government to establish a governmental fund to administer the money raised through product fees for buying WEEE back from end users. ***Paper IV***, published in the *Journal of Industrial Ecology*, combined the qualitative material flow analysis with the quantitative analysis of the policy proposal. ***Paper V***, submitted to *Resources, Conservation & Recycling*, analyses the prospect of the product buy-back based on self-reported past disposal behaviours and future preferences of Thai households. Not only do they outline the strengths and weaknesses of the policy proposal, but the analyses also try to answer: *What mechanisms would be effective to deliver improvements in WEEE management in developing countries?*

Paper VI, submitted to a special issue on EPR in the *Journal of Industrial Ecology*, looks at the process wherein WEEE policies were formulated in three non-OECD countries – Argentina, India, and Thailand – through the theoretical lens of Advocacy Coalition Framework. This work is a counterpart of the policy network analysis in ***Paper I*** which explains the

development of EPR programmes in developed countries. Both address the question: *What were the social and cognitive forces for or against EPR and specific programme designs?*

1.4 Methodology

The papers that are appended to this thesis have already described the details of methods and materials that are directly relevant to the research and findings they present. This section, therefore, takes a broader perspective and presents methodological themes that cut across the studies.

1.4.1 Theory-based evaluation

*Theory-based evaluation (*TBE) is a practice that asks "why a programme works (or fails to work)?" In order to answer this question, the evaluators have to develop a set of propositions, called a *programme theory*, explaining how the intervention under the evaluation should produce the desirable outcomes. The programme theory is then used as a standard of comparison to check whether the logical steps did materialise. Table 1-1 maps out possible evaluation results.

Table 1-1 Typology of results in theory-based evaluation.

		Has the expected outcome been observed?	
		Yes	*No*
Has the intervention executed as planned?	*Yes*	Successful theory, correctly executed**	Failed theory, correctly executed (Theory failure)
	No	Superfluous theory* with failed execution	Unproven theory with failed execution** (Implementation failure)

* For a theory about necessary conditions

** Together confirm a theory

Source: Manomaivibool (2009)

Pawson (2002) asserts that the practice, which he terms the *realist evaluation*, can provide richer and more transferable lessons about the relationships between the context, mechanisms, and outcomes in the *intervention theory* of

an evaluand than either a numerical meta-analysis or a constructivist's narrative. Other proponents further suggest that theory-based evaluation is particularly suitable to complex interventions with long-term goals (Tojo 2004; Weiss 1997; Fitz-Gibbon and Morris 1996). By checking interim markers and activities prescribed in the *implementation theory*, the evaluation can inform the evaluators and practitioners whether the programme is on a right track according to the *theory of change* to reach its ultimate goal (Connell et al. 1995).

As mentioned in Section 1.2, theory-based evaluation was the basis of the *policy-transfer framework* in the licentiate work. I developed the framework mainly during my early works as a heuristic device to organise knowledge about EPR in theory and in practice. The principle provided a *problem theory* explaining the root cause of the waste problem and the objectives of policy interventions. Actual EPR programmes were the source of intervention theories and implementation theories. The problem theory defined a legitimate boundary of the evaluation, which I suggest should be limited to one policy paradigm because of a lack of rational common ground to gauge the merits of competing worldviews (Manomaivibool 2009).

Within this boundary, the environmental effectiveness of different programmes could be compared in two steps. The first step made predictions about programme outcomes based on the alignments of implementation theories and the EPR objectives. Insufficient alignments would predict failures from *implementation slippages*. For example, from the finding that most transpositions of the WEEE Directive to the implementation at a national level failed to uphold the concept of individual producer responsibility (Sanders et al. 2007), we would predict that they would not likely lead to design changes. The second step checked the predictive outcomes with the (proxies of) actual outcomes. When they did not agree, we had a case of *intervention-theory failures*. For example, while the reading of law texts would predict more involvements of the EEE producers in Europe than in Japan because the European laws imposed more responsibilities and targets, we actually witnessed the opposite. This indicated deficiencies in our understanding of the interventions and the theory might benefit from including contextual factors such as the market conditions in addition to mere legal responsibilities.

Although theory-based evaluation was not explicitly mentioned in later works because there had not yet been actual programmes to be evaluated in developing countries, the thinking was still influential. As a matter of the

fact, these studies could be perceived as an attempt to enrich the intervention and implementation theories of EPR with the knowledge about the contextual conditions and policy proposals in developing countries.

1.4.2 Transdisciplinarity

> *We believe that, because of [its] complexity, responding to the challenges and opportunities of e-waste requires examination from a range of disciplinary perspectives as well as a transdisciplinary attempt at synthesis* (Lawhon et al. 2010, 1213).

This research borrowed knowledge from multiple disciplines. At its core, its paradigm, EPR, belongs to the field of *Industrial Ecology*, which focuses on:

> *the role of industry in reducing environmental burdens throughout the product life cycle from the extraction of raw materials to the production of goods to the use of those goods, and to the management of the resulting wastes* (Lifset 1997, 1).

An Industrial Ecology's tool, the material flow analysis (MFA), was employed to render a structure to the investigations in different non-OECD countries. This ensured that the findings about material flows were comparable across the cases. While *engineering* knowledge was indispensable for the understanding of the transformation, transport, and storage of materials and their environmental consequences in the material flow analysis, it needed to be supplement with the knowledge from *economics, sociology* and *psychology* that explain mechanisms and drivers behind the flows in the anthroposphere. In addition, owing to the objective of this research, to be relevant to public policies, insights and knowhow about *politics* and *laws* were instrumental. One project I involved in Thailand was to produce a new draft law for the management of used products for the government. Appendix A gives a comprehensive list and short descriptions of the research projects that contribute to the synthesis presented in this thesis.

This research thus confirms the value of transdisciplnarity which has been celebrated as being appropriate for pragmatic research fields like environmental studies (Blättel-Mink and Kastenholz 2005; Hardorn et al. 2006). The exact nature of disciplinary interactions, however, varied. The literature review, for example, involved me reading and trying to integrate relevant knowledge from different disciplines into the framework. The projects commissioned by the government in Thailand, on the other hand,

saw me working in a research team consisting of economists, chemical engineers, law scholars, and project managers. The interactions could also be less formal like during the first (NVMP-)StEP E-waste Summer School in 2009 in which young researchers from various disciplines, who shared a research interest in the WEEE problem, gathered for some ten days. The encounter in the summer school was indeed so inspiring that we collectively reflected on challenges and recommendations to promote transdisciplinarity in WEEE research and education (Lawhon et al. 2010).

1.4.3 Mixed methods

Mixed methods research, also known as multimethodology, combines methods to collect and analyse quantitative and qualitative data (Creswell 2003). Like transdisciplinarity, combining the strengths of quantitative and qualitative methods to address different aspects of the problem and/or to increase the validity of the research is another celebrated strategy, especially among realists (see March and Furlong 2002, Read and Marsh 2002). However, before engaging in methodological triangulation, we need to grasp the differences between quantitative and qualitative research that can render the triangulation of incompatible world views unattainable.

Quantitative methods are occupied with discovering general laws with predictive power. They normally measure samples of repeated incidences and make generalisations about the empirical world (John 2002). Statistical techniques play a crucial role in establishing the validity of the inferences and the reliability of the measurements. Researchers in this tradition are advised to detach from the researched to minimise biases. *Qualitative methods*, on the other hand, strive for a deeper understanding of specific cases. They advise researchers to immerse themselves in the setting in order to be able to interpret the meanings behind actions and symbols (Firestone 1987). Qualitative research is less interested in computing the statistical significance of inferences than making convincing interpretations of the social world.

Recognising that the dichotomy was real, this research did not fully adopt the mixed methodology design but instead followed *multiple-phase* and *dominant/less dominant designs* (Creswell 2003). My early research in India and Thailand was qualitative and exploratory in nature. Although I also used statistics and number, their roles were to complement *direct observations* and *topical interviews* with key informants. The main purpose of this exploration was to identify salient issues that people perceived about managing WEEE

in these countries. It thus appreciated and even encouraged the subjectivity and different constructions of realities presented by stakeholders. My recollection about the use of qualitative interviews can be found in the licentiate thesis and the list of the interviews can be found in Appendix B.

After key issues were identified, quantitative research took over the enquiry. The interviews showed that at the heart of the policy discussion in Thailand were the two following questions: "how much WEEE could the proposed system collect?" and "how much would it cost in terms of future fees on new products?" These questions were better tackled with quantitative methods like *large-scale surveys* and *cost modelling*. The purpose of the quantitative research was to produce a range of estimation with required precision. This assumed that there was a truth out there which we could approximate using statistical techniques. Qualitative methods such as topical interviews, direct observations, and focus groups played supporting roles in developing a survey questionnaire, specifying technical systems and scenarios to be modelled, and giving feedbacks on the results.

The research then switches back to a qualitative mode in the analysis of policy process. My topical interviews in India and in Thailand (see Appendix B) and those that were carried out by two master students I co-supervised in India and in Argentina (Manda 2009; Maneschi 2009) formed the basis of the analysis. *Qualitative interviewing* allowed stakeholders to freely offer their interpretations of the assumptive world (Green and Houlihan 2004). The technique thus enabled us to capture the nuances of stakeholder's beliefs which, according to the Advocacy Coalition Framework, motivate the advocacy coalitions and strategies. Quantitative accounts such as the analysis of media and parliamentary attention to the WEEE issues in India supplement the qualitative analysis.

The final reading of all the results that is going to be presented in this thesis is informed by a *realist epistemology* (see Archer et al. 1998). It pays special attention to knowledge about the interactions between generative mechanisms and contextual conditions that produce policy outcomes. At the same time, there is also a strong element of subjectivity in the choice of the policy paradigm. This means that the goals of EPR will take precedence in the analysis and policy recommendations. In order to check the inter-subjectivity and the soundness of the chosen paradigm, strategies such as *member checks* and *peer reviews* (Creswell 2003) have been pursued. First, the results from the research projects in non-OECD countries were reviewed by external experts selected by the commissioning parties and then

presented to stakeholders to comments both orally and in the form of project reports (in English and in local languages if English is not an official language). Details about this process can be found in Papers III and IV. Second, I have published main findings in peer-reviewed academic journals, as listed in Section 1.3.

1.5 Scope

This research focuses on *the management of WEEE*. *WEEE* is a waste stream consisting of a wide range of obsolete EEE, its accessories, components, and consumables. Appendix C provides a non exhaustive list of EEE and product categories as appear in the WEEE Directive. However, unlike the legal framework in the EU that has a separate Directive for waste batteries, in this thesis waste dry-cell batteries can be discussed as consumables used within many EEE. The term *electronic waste* or *e-waste* in short, though sometimes used interchangeably with WEEE in the literature, will in this thesis give a narrower connotation for waste from ICT equipment and consumer electronics. *Home appliances* include all white goods such as refrigerators, air conditioners, washing machines and microwave ovens and some brown goods notably TVs but not covering ICT equipment. While the hazardousness of WEEE is debatable, waste fluorescent lamps and waste dry-cell batteries are part of *household hazardous waste*.

The exact product scope of the studies that constitute this thesis varied. The evaluation research was limited by the scope of the actual programmes in Northeast Asia, mainly home appliances and computers. The study in India was supposed to cover a wide range of WEEE but due to data availability its final discussion focused mainly on e-waste. The research in Thailand started with a broader product scope in the contextual analysis before getting narrower to the ten product types that were the target of the proposed government intervention (see Section 4.1). The analysis of the policy process in non-OECD countries covers the whole range of WEEE as it is discussing the issue of the scope of the (proposed) legislation. Moreover, in order to provide a deeper understanding about the moderating effects of WEEE on the relationship between policy interventions and outcomes, an evaluation of EPR programmes for the management of end-of-life vehicles is added to this collection.

Among various criteria for policy evaluation, *environmental effectiveness* takes precedence in this research. The policy analyses focused on the ability or

the potential of policy interventions to produce desirable outcomes under specific contexts. However this does not mean that it was pursued to the complete exclusion of other criteria. The issues of *unintended or indirect consequences*, *cost effectiveness*, *fairness and distributional effects*, and *political acceptance* were also discussed among other things, though not as thorough as the effectiveness issue.

Last but not least, it is important to remember that this work takes *a national perspective*. For example, the material flow analysis began and ended when materials entered and left a national boundary. It is not thus uncommon that upstream processes such as the extraction of raw materials or the production of products and downstream processes such as the recovery of precious metals from pretreated WEEE or the utilisation of recycled materials were cut off from the scope of the study. Nevertheless, all the research covers at least the shipments of products, consumption, disposal, and waste collection and pretreatment. Although it has some disadvantages compared to a life-cycle or a regional/global approach (see Chancerel 2010), the national approach is more relevant to the current state of WEEE policy-making in both OECD and non-OECD countries.

1.6 Structure of the Thesis

This thesis has six chapters and six appended papers. Because the papers have already been introduced in Section 1.3, this section outlines the contents of the chapters:

Chapter 1 introduces the topic of this thesis, its objective, and the research strategies to achieve the objective.

Chapter 2 discusses the role of EPR in waste policy in relations to WEEE programmes in industrialised economies.

Chapter 3 discusses the compatibility of EPR and the prevailing conditions in context of non-OECD countries.

Chapter 4 presents the action research to advance policy solutions to the WEEE problem in Thailand.

Chapter 5 discusses the reception of EPR for the management of WEEE among non-OECD countries.

Chapter 6 concludes the thesis and outlines policy recommendations and suggestions for future research.

CHAPTER
TWO

2. Extended Producer Responsibility

This chapter introduces a central concept of this thesis – extended producer responsibility (EPR). The concept is viewed analytically in this research as a policy paradigm that articulates and redefines the problem theory of solid waste and the objectives of waste policy. An effective intervention from the EPR perspective should promote both the downstream improvements in waste management and the upstream improvements in products and product systems. After a brief description of the background of the concept and its role in the policy analysis, the rest of this chapter reviews variants of WEEE programmes which exist mainly in OECD countries and evaluates their effectiveness in promoting upstream and downstream goals of EPR.

2.1 Background

A success and a setback in earlier environmental protection in industrialised countries prepared the stage for EPR (Lindhqvist 2000). On one hand, a strict process-oriented approach in these countries was successful in dealing with major point sources of pollution. Emissions from manufacturing processes were greatly reduced by the 1990s through end-of-pipe and cleaner production solutions as well as the relocation of polluting industries. On the other hand, the policy repertoire at that time was less effective in dealing with post-production emissions including solid waste.

Throughout the 1980s various attempts were made in OECD countries to move up *the waste management hierarchy* (in descending order of preference: reduce, reuse, recycling, energy recovery and safe disposal) but without prevailing success. The amount of municipal solid waste continued to rise in all OECD countries and on average the annual generation increased from 430 kg per capita in 1980 to 510 kg per capita in 1990 (OECD 2008). The promotion of refillable containers only impacted a fraction of packaging

waste. Recycling made limited headway and engaged municipalities were struggling to finance source separation programmes and to find markets for reclaimed materials. The development of large-scale incinerators was dented by a not-in-my-backyard (NIMBY) syndrome after the reports of heavy metal, dioxin and furan emissions.

Against this backdrop, EPR was proposed as *a product-oriented strategy*. The term "extended producer responsibility" or "förlängt producentansvar" in Swedish was first introduced by Lindhqvist and Lidgren (1990) in a report to the Swedish 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). The formal definition of the term in English (Lindhqvist 1992, 2) as follows:

> *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.*

Lindhqvist (2000) later re-defined EPR as *a policy principle* to connote its guiding role in the selection of the policy mix to promote total life cycle environmental improvements of product systems.

The conceptual development reflected in the actual policy change at that time in industrialised economies. On 12 June 1991, the German Parliament passed *the Ordinance on the Avoidance of Packaging Waste (BGB1. I 1991 S. 1234)*, commonly known as the German Packaging Ordinance, which had the retailers and the fillers of packaging as responsible parties for the material-based collection, sorting and recycling targets. In practice, a collective system, Duales System Deutschland (DSD), was set up to organise nation-wide separate collection for packaging waste and broker contracts with recyclers and waste management companies on behalf of the responsible parties. Packaging producers paid DSD licence fees for the use of its "Green Dot" (Der Grüne Punkt). Because the fees were calculated by type and weight of packaging materials, they influenced weight reduction and the choice of packaging materials which are key determinants of the environmental impacts of packaging (OECD 1998). After this radical policy change, Germany experienced a decoupling between GDP and the

consumption of sale packaging. Even harsh critics of the policy admitted that the Ordinance increased the recycling of packaging waste, in particular the plastic fraction, beyond what would otherwise be possible (Staudt and Schroll 1999).

Later on the EU enacted a series of product-oriented directives that were progressively incorporating elements of EPR. The change began with a reaction to the national adoptions of EPR policy and other measures for packaging waste that affected the flows of packaging waste in the community. *The Directive 94/62/EC on packaging and packaging waste* was an attempt to harmonise the patchwork of the Member States to ensure the functioning of the Internal Market. It was indifferent whether EPR-based measures would be used by the Member States to achieve the prescribed recovery and recycling targets. The tone changed in *the Directive 2000/53/EC on end-of-life vehicles* (ELV Directive) which required the Member States to take necessary measures to ensure that producers meet all, or a significant part of, the costs of free take-back. More information about the ELV Directive and examples of its transposition in Sweden and in the UK can be found in Paper I. *The Directive 2002/96/EC on waste electrical and electronic equipment* (WEEE Directive) was the first directive that referred to the "principle of producer responsibility" in its preamble. Article 8(2) of the WEEE Directive was also a pinnacle of *individual producer responsibility* (IPR) (van Rossem 2008). It demands each producer to finance the collection, treatment, recovery and environmentally sound disposal of WEEE from private households that come from his own products put on the market after 13 August 2005 – new household WEEE.

The ripple effect was also seen beyond Europe. As mentioned in Section 1.1, since 1994 OECD sponsored by the Japanese government had studied and disseminated information about EPR. The case of the German Packaging Ordinance was selected as an exemplar of mandatory EPR regimes in the Phase 2 of the OECD project (OECD 1998). OECD (2001, 9) also gave a definition of EPR – "an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle". Although this definition was narrower than Lindhqvist's, it reflected *the applications of EPR which focused mainly on the end-of-life stage* – the "weakest link" in the product responsibility chain (Kroepelien 2000). EPR programmes in Canada, Japan, and South Korea started with packaging waste before expanding to cover more complex waste streams including WEEE.

2.2 EPR in this Policy Analysis

EPR is a powerful concept that has changed the landscape of the waste policies. More and more end-of-life responsibilities have been allocated to the producers and other actors at the upstream of the product chain. The question for a policy analysis is *how should we make sense of the nature of changes that EPR has brought about?*

Some studies viewed EPR as a policy instrument, a short form of a take-back mandate or a kind of economic instrument (Gottberg et al. 2006; Sachs 2006). The analysis of a particular instrument, however, fails to appreciate a complication and the complexity of an intervention and misses the point that EPR has been implemented through a mix of policy instruments. The restriction of hazardous substances in the RoHS Directive, for example, is neither a take-back mandate nor an economic instrument, but it is an EPR-base measure that was conceived in order to influence the design of EEE for the end-of-life purposes. While the WEEE Directive and the RoHS Directive are separate pieces of legislation, the downstream and the upstream measures can co-exist in a single framework such as in the cases of the ELV Directive or the law for WEEE management in South Korea. Failing to include the RoHS in the EU EPR policy package for WEEE would create an inconsistency in comparison.

To be true to the concept and to avoid any inconsistency in drawing policy lessons from international experiences, in this policy analysis EPR is viewed as *a policy paradigm* that defines the problems and the objectives of policy interventions. Paper I introduced the term "policy paradigm" from the policy change literature. Hall (1993, 279) defined a policy paradigm as:

> *a framework of ideas and standards that specifies not only the goals of policy and the kind of instruments that can be used to attain them, but also the very nature of the problems they are meant to be addressing.*

The third order change in policy paradigms was distinguished from the other two orders of less profound policy changes: a change in policy instruments and fine tuning of policy instruments. While a paradigm shift is a sufficient condition for a rethink of policy objectives, instruments and their tuning, a mere change in policy instruments does not necessarily mean an alteration in a problem theory and policy objectives.

EPR offers a product-oriented problem theory about solid waste. From this perspective, the root cause of the solid waste problem is the design of products and product systems that does not take into account the environmental consequences at the end-of-life stage (Lindhqvist 2000). Plastic recycling, for example, is problematic not just because we lack technologies to sort and process once plastics become waste. The decision to use multiple types of polymers or to add additives to the resins and the requirements that discourage the uses of recycled plastics in products have already predetermined the problems with plastic waste. Based on this theory of design predetermination, an effective intervention has to encourage communication between the waste managers at the downstream and the designers at the upstream and foster design improvements of products in addition to establishing the end-of-life infrastructure and improving the quality of waste management as such (Tojo 2004).

As mentioned in Section 1.4.1, *the policy paradigm defined a legitimate boundary of theory-based evaluation*. It provided a common ground to evaluate the effectiveness of a complex and evolving mix of policy instruments. As stated in Paper I:

> *A programme is considered environmentally effective if it implements those policy instruments specified in an existing intervention theory and tunes them to suit its setting, or it changes the policy instruments in a way that makes it more logically relevant to the problem theory.*

A more systematic procedure was developed in Paper II where aspects of intervention programmes were linked with EPR objectives to predict and validate their effectiveness (see Section 1.4.1). Following the OECD definition that focuses on the application of EPR in the end-of-life phase, van Rossem and Lindhqvist (2005) presented a set of *upstream and downstream objectives* and key evaluation questions that are reproduced in Table 2-1. The policy analysis and policy advocacy in non-OECD countries were also guided by the twin objectives of EPR as will be seen in the following chapters.

Viewing EPR as a policy paradigm is also conducive to policy learning in general and policy transfer in particular. It forces the advocates of EPR to articulate the lessons to be transferred in relation to the problem theory. The licentiate thesis showed a worrying trend of the diffusion of EPR as of late which put the means before the ends (Manomaivibool 2009). Instead of focusing just on a particular model or a defining feature of EPR, the review

and the analysis in the following sections tries to capture variants of existing programmes and assesses their merits in terms of goal attainment under different contexts in order to provide a more informed, complete and appropriate picture of EPR for WEEE management.

Table 2-1 The upstream and downstream objectives of EPR and key evaluation questions.

Objectives	Sub-goals	Evaluation questions
Upstream	Product design	Will the individual producer benefit directly from product design improvements?
	Individual system	Will the individual producer benefit directly from system design improvements?
	Collective system	Will the producers collectively benefit for product and system design improvements?
Downstream	Collection	Does the system include measures to secure goal achievement for collection targets? Are there tangible incentives for striving towards higher collection results?
	Treatment	Does the system provide measures to ensure compliance with the treatment regulations? Does the system provide incentives to promote best environmental practice for the treatment?
	Re-use and recycling	Does the system include measures to secure goal achievement for re-use and recycling targets? Are there tangible incentives for striving towards higher re-use and recycling results?

Source: van Rossem and Lindhqvist (2005)

2.3 EPR in WEEE Programmes

Figure 2-1 shows existing mandatory programmes and some policy proposals being developed for the management of WEEE as of 2010. This section provides a historical account of the policy development and the influence of EPR in three sub-regions, Western Europe, Northeast Asia, and North America.

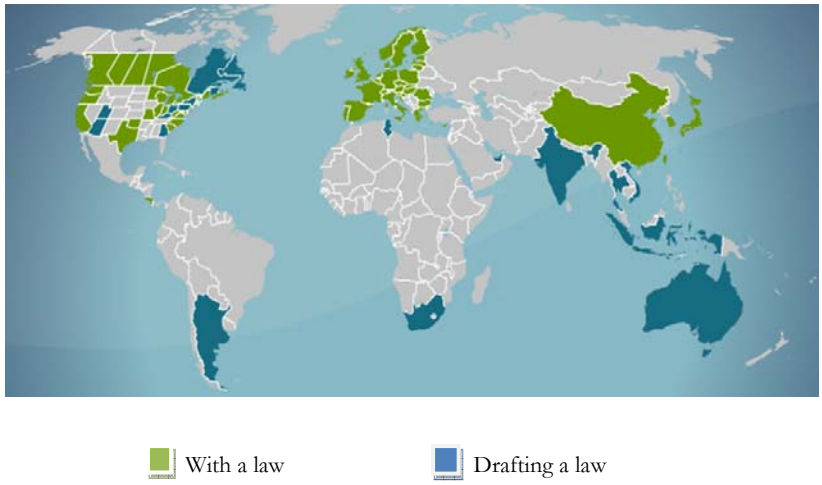


Figure 2-1 Status of WEEE laws in different territories (as of 2010)

2.3.1 Western Europe

Switzerland was arguably the first country to pass an EPR law for WEEE. Prior to the law the Stiftung Entsorgung Schweiz (S.EN.S) was established in 1991 for the recycling of specific white goods. Starting in 1994 the Swiss Association for Information, Communication and Organisation Technology (SWICO) offered to its members a Recycling Guarantee Programme. The problem of free riders, however, necessitated the passing of *the Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Appliances* (ORDEA) in 1998 to give *a legislative backing* for the voluntary schemes (Khetriwal et al. 2009). *Norway*, which is also not a member of the EU, passed *the Regulations relating to scrapped electrical and electronic equipment* (T-1224) in the same year. The Regulations were implemented through *a covenant* between the suppliers of EEE and the Ministry of Environment in Norway (Røine and Lee 2006). The industries set up El-retur as a PRO for household WEEE to ensure free take-back and environmentally sound management of WEEE in the country.

In 2003 the EU enacted *the WEEE Directive* and *the RoHS Directive*. Although by that time WEEE programmes had already been set up in a few Member States including Austria (voluntary), Belgium (voluntary), the Netherlands (mandatory) and Sweden (mandatory), the two Directives served as a framework for the transfer of EPR within the community (Manomaivibool 2009). The WEEE Directive demands among other things *a financial*

guarantee for new household WEEE to ensure the availability of financial resources for orphan products in the future, *free take-back* at least for all WEEE from households, *an annual collection rate* of no less than four kilograms per inhabitant, *minimum treatment standards* for components containing hazardous materials, and *recovery and recycling targets*. The RoHS Directive imposes *material restrictions* on the uses of six substances in new products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether.

The transposition results of the two Directives differed. Because the RoHS Directive deals directly with the standards of the products that can be put on the market in the EU, it is based on Article 95 establishing and functioning of the internal market of the Treaty establishing the Europeans Community. The WEEE Directive, on the other hand, is based on the environment procedure of Article 175 of Treaty. Although the original intention of the legal basis was to allow more stringent measures for environmental protection at a national level, in this particular case some deviations from the texts of the WEEE Directive weakened the EPR provisions. Notably IPR got lost in the transposition (Sanders et al. 2007; van Rossem 2008; van Rossem et al. 2006). The financial guarantee was largely replaced by *a pay-as-you-go mechanism* where the fees were collected from new products to finance the recycling of waste from old products. The obligation on the retailers to take back an old product free of charge when selling a new product of a similar type was also watered down. In practice, *municipalities in Europe have still played a central role in providing the collection service* either because of their statutory duty or because of the contracts with the retailers and the producers (Sanders et al. 2007).

A lack of harmonisation in the transposition of the WEEE Directive is evident in the design of compliance systems. Sanders and colleagues (2007) classified compliance approaches for household WEEE into two broad categories: single national compliance systems and competing collective systems. In *a single national compliance system*, *a national producer responsibility organisation* (PRO) normally with a backing from the associations of the targeted industries acts as the only *de facto* option of compliance. There can be more than one PRO in the country but they do not compete against one another rather representing sub-sectors in the industries. For example, in the Netherlands NVMP takes care of white and brown goods while ICT Milieu covers ICT and office equipment. Single national compliance systems are largely legacies of the national programmes developed before the WEEE Directive. They continued in *Belgium* (PRO: Recupel), *the Netherlands* (PRO:

NVMP and ICT Milieu) and in *Sweden* (PRO: El-Kretsen, until the second competing compliance scheme, Elektronikåtervinnings-föreningen, or EÅF, was formed in 2007). Austria is the only country that switched to the competitive model right after the transposition. New single compliance systems that were developed as a result of the WEEE Directive can be found mainly in small Member States: *Cyprus* (PRO: EDHHA), *Greece* (PRO: Appliances Recycling SA), *Luxembourg* (PRO: Ecotrel), and *Malta* (PRO: RofA SA).

In *competing collective systems* the market is open for multiple service providers, called *compliance schemes*, to offer compliance solutions to the producers. They exist in *Austria, Finland, Germany, Ireland, Italy, Portugal, Spain, the UK*, and *several new Member States*. This approach requires *a clearinghouse mechanism* to allocate the share and coordinate the effort of different compliance schemes. In the UK the authority played this role while in Germany the industries are obliged to set up a national clearing house. The main drivers behind competitive systems were the government's opposition to monopolistic arrangement and the producers' concern over the lack of competition in a single national compliance system (Sanders et al. 2007). The European Recycling Platform (ERP), for example, was founded by Electrolux, Sony, HP, and P&G in 2002 with a mission to ensure cost-effective implementation of the WEEE Directive (ERP 2010). ERP competes in twelve European countries including Norway where it started the operation on 1 January 2011 ending the single national system for household WEEE there.

2.3.2 Northeast Asia

In Northeast Asia, the WEEE items known as the "big four" of cathode ray tube (CRT) TVs, refrigerators, air conditioners and washing machines, and later computers and fluorescent lamps have been added to mandatory recycling programmes in Taiwan since 1998 and in South Korea since 2003. The Taiwanese and Korean programmes up until 2007 were similar in that the legal framework covered a wide range of waste products from packaging waste to end-of-life vehicles. However, their evolution as far as EPR was concerned went in opposite directions.

Taiwan first tried self-management in the so-called period of privatisation after *the Waste Disposal Act* was amended in 1987 but the industry-led regime was ridden by frauds and scandals (Fan et al. 2005; Lee et al. 1998). The 1997 amendments to the Act called for *a nationalisation of the system with strict*

third-party auditing. The 17 PROs were abolished and their remaining funds were transferred to the Resource Recycling Management Fund (RRMF) established under the Taiwan Environmental Protection Administration (TEPA) in 1998. The producers of regulated recyclable wastes have to pay the recycling, clearance and disposal fees to the state fund. The fund has a rule that at least 70% of the revenue from the fees has to be earmarked in the so-called Trust Fund and can only be used to subsidise the recycling of respective regulated packaging materials and products. The rest of the revenue can be used to cover the administration costs, including the auditing costs, and to promote the general waste management.

In *South Korea*, a system was introduced in 1992 where the producers paid "deposit" and got "refund" according to the amount of waste they recycled from the Special Account for Environment Improvement which was administered by Korea Environment & Resources Corporation (now shortened to ENVICO). The state-owned enterprise used the unclaimed funds to sponsor recycling activities. This scheme discontinued in 2003 in favour of *a producer-operated system*. *The Act on the Promotion of Saving and Recycling of Resources* promulgated in 2002 requires the producers of regulated products to meet *annual collection quota* calculated from the market share or pay *penalties for underachievement*, called "recycling dues". Major Korean manufacturers have invested in their own recycling centres while other producers become members of recycling business mutual aid associations in order to meet their statutory obligations (Jang 2010; Park 2007).

Japan was the first country in Asia to pass a WEEE recycling law. *The Specified Home Appliances Recycling Act* (SHAR Act) was enacted in 1998 and came into force in 2001. It might be the only WEEE programme that effectively *shifted the physical responsibility to collect waste from the municipalities to retailers*, although the system requires *the end user to pay* for the take-back service and for the recycling ticket at the point of disposal. This arrangement results in relatively high recycling fees per unit (Tasaki et al. 2005). Retailers send collected waste to *regional consolidation centres which perform brand sorting* and forward materials to respective producers. *Major Japanese manufacturers organise themselves into two recycling consortiums*. The Association for Electric Home Appliances (AEHA) acts as the designated legal body for small producers and for orphan products outside the consortiums.

The producers of *personal computers in Japan* organise a separate system under *the Act for the Promotion of Effective Utilization of Resources*. They use *the postal offices as a waste collection network*. Because after 31 October 2003 the price of a

new computer has already included *an advanced recycling fee* (ARF), the user can post it back to the producer without any further charge. However, for historical waste the end users still have to pay for the end-of-life services.

In recent years, new statutes were adopted in Asia in response to the EU directives. In South Korea, *the Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles*, known Korea RoHS, WEEE & ELV, was enacted in 2007. It represents a continuation of the EPR programme under the 2002 Act rather than a radical change. Coming into force in 2008, it covers all types of WEEE (and end-of-life vehicles), restricts the use of hazardous substances in new products and closes some loopholes that resulted in leakage of WEEE in the past. Retailers that decide to reuse collected products must now report the type and quantity of the reused items to the producers. The Chinese government issued *the Measures for Administration of the Pollution Control of Electronic Information Products* (China RoHS) in 2006 and *the Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products* (China WEEE) in 2009. The latter will create a governmental fund to oversee the recycling of WEEE. More details about policy-making and implementation in Northeast Asia can be found in Paper II. The Chinese case will be discussed together with policy developments in other non-OECD countries in Section 5.1.

2.3.3 North America

Waste management is under the jurisdiction of *the state/provincial and local governments* in the United States of America (USA) and Canada. At the beginning of 2010, 23 states in the USA and seven provinces in Canada had e-waste recycling programmes with several more draft laws pending. The primary targets of the programmes in North America were video displaying devices and computers, although some had expanded the scope to cover also other electronic products such as audio systems, mobile phones, and digital cameras.

EPR has gained currency in e-waste policies in North America although the legacy of the product stewardship approach[2] can still be found in the policy rhetoric especially in Canada. Except for the first programme in California

[2] Advocates of product stewardship, while conceding that the producers have a role to play in the end-of-life management, argue that the system should encompass all actors throughout the commerce chain and avoids naming the any single responsible party. For detailed discussion about EPR and shared product responsibility, see Lindhqvist (2000).

under the *Electronic Waste Recycling Act* (2003, effective in 2005) that mandates a governmental fund, product fees, and state subsidies, the other programmes are either under the statutes that prescribe *a default compliance method with possible opt-out options* or the ones that give the producers, sometimes called "stewards", *a free hand to plan and implement* their statutory duties as they see fit.

The default method normally involves a collective compliance scheme that requires an allocation mechanism. *A market-share allocation* calculates the size of the contribution from a producer based on the amount of products he currently put on the market. *A return-share allocation*, on the other hand, determines a producer's size of the contribution based on the number of his used products that come back through the collection system. The scheme might be operated by *a state contractor* (e.g. Maine, Oregon) or *a not-for-profit Industry Funding Organization* overseen by a multi-stakeholder (e.g. Alberta, Saskatchewan) or producer-only (e.g. Washington, British Columbia, Ontario) board of directors.

The free hand approach can be divided into those that allocated *a market-share collection quota* (e.g. Illinois, Indiana, Minnesota) and those that have *no binding target* (e.g. Oklahoma, Texas, Virginia). Those belonging to the former group determine annual contribution from each producer based on a market-share (common for TV) or a return-share allocation (common for computers). The quotas usually come with *performance penalties* for underachievement, but there can also be *rewards* for the over-collected e-waste. In the programme in Illinois which started in 2010 has *reuse bonus* that doubles the weight of the used products that a producer reuses and is verified by an independent third-party auditor (triples if the reused products are for donation). While the programmes with collection quotas are quite elaborated on the target-setting, the programmes with no binding target only require the manufacturers to submit *a recycling plan* and report results to the authorities.

2.4 Evaluation of WEEE Programmes

2.4.1 Upstream improvements

In general, there were *fewer evidences of product and system design improvements as a result of EPR programmes than the positive impacts on the waste management*. However, this is not surprising. Despite the upstream objectives being the

defining characteristic of EPR in theory and in policy rhetoric, the analysis of the programme theories tend to show that most programmes were designed for the targeted industries to collectively cope with the waste from yesterday and lack mechanisms to influence the property of new products or reward individual producers for their innovative systems.

All evaluations that existed to date accepted *the impacts of the RoHS Directive* (Gottberg et al. 2006; Røine and Lee 2006; Tojo 2004), although they might not include it in the EU EPR policy package (see Section 2.2). Tojo (2004) also documented some other *positive changes prior to the legislation coming into force* in the electrical and electronic and car industries in Sweden and Japan.

In order to make a design decision beyond compliance with administrative measures, the producers would have to ensure that they could obtain the benefits from the upstream improvements. Some design changes, such as modular designs for reuse and upgrade and specific designs for disassembly, require corresponding downstream changes. Among the existing WEEE programmes, *the management of home appliances in Japan is the one in which the producers have the most control over the fate of their own used products*. Evaluation after the implementation of the Specified Home Appliances Recycling Act continued to report evidences of upstream changes (DTI 2005; Ogushi and Kandlikar 2007). However, the replicability of the Japanese model in other contexts has often been discredited because of a unique feature of the Japanese market which is dominated by domestic manufacturers (DTI 2005; PCD and JETRO 2004). Herold (2007) found that the presence of company's research and development (R&D) infrastructure in the country was an important factor for a manufacturer to engage in the physical management of WEEE.

Apart from the Japanese experience, the end-of-life management in most of the other WEEE programmes is at the arm's length of the producers who rely on a collective body to broker the contracts with downstream actors. This setting is not encouraging for an individual producer to optimise his products because the chance that he will get return on his investment is slim. Moreover, some programmes discriminate against a producer who wants to develop his/her own system. For example, based on the analysis of the transposition of the WEEE Directive, van Rossem (2008) found that typically an independent system would not be able to enjoy the same benefits, such as an exemption from future guarantees and an access to subsidised public waste collection, which collective systems had. It is not surprising that evaluation in Europe did not find a strong link between the

implementation of EPR and product design beyond the reductions of restricted substances (Gottberg et al. 2006; Røine and Lee 2006).

A main strategy for the producers supporting IPR in Europe is *to encourage competition between compliance schemes* which tends to increase the cost effectiveness of the overall system and save compliance costs for the producers (Bohr 2007; Mayers 2007; van Rossem 2008). Without competition, the producers would lose their leverage, and the decision to make system improvements is in the hand of a national PRO. Although the PRO should be better at representing the interest of the producers than the governmental fund seen in Taiwan and California, it is not without the principal-agent problem – the PRO might not act in the best interest of its licensees but instead advance its own benefit. NVMP in the Netherlands and Recurpel in Belgium, for example, had accumulated a reserve of multi-hundred million Euro over the years before the authority in the respective countries forced the PROs to bring down the reserve level.

2.4.2 Downstream improvements

The impacts of the existing WEEE programmes on the collection, treatment and reutilisation of WEEE are evident. *Most programmes have improved and expanded collection and treatment infrastructure for WEEE*. Separate collection of WEEE has become a norm in these countries. The collection rates have in general continued rising over time and the recycling targets surpassed. However, the achievements are not without *controversies*. On one hand, several programmes managed to collect a fair amount of WEEE compared to the available treatment capacity in the country. On the other hand, the collection rate often looked appalling compared to the amount of WEEE expected to be generated. Rarely were collection rates higher than 50% reported. The so-called "leakage" especially to backyard recycling in developing countries caught the attention of stakeholders in the recast of existing programmes (Aoki-Suzuki et al. 2009; Cobbing 2008; GAO 2008).

Figure 2-2 depicts possible routes of *the hidden flows*. Although it is difficult to comment on the relative sizes of different paths of leakage, it can be seen that some used products that are returned by the consumers to the designated collectors, such as municipalities and retailers, can still leak out of the system. To address the loophole in the system, the new law in South Korea asks retailers to report the amount they reuse in addition to general transfer requirements. In Japan, the recycling tickets that the end users pay

for used home appliances are used also as manifests to tracking the flows of each individual item.

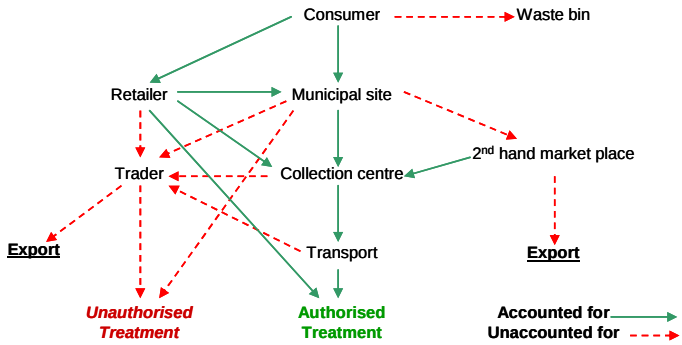


Figure 2-2 Possible leaks in return logistics of WEEE from private households

Source: Commission of the European Communities (SEC(2008)2933)

In addition, *the collection amounts varied greatly between programmes*. For example, within the EU the collection performance of the four long-running systems were: 14.4 kilograms per inhabitant in Sweden, 7.6 in Austria, 7.3 in Belgium, and 5.8 in the Netherlands in 2009 (calculated by Naoko Tojo based on Eurostat [2010]). The difference was also evident across product categories. In Japan, for example, the unit-based collection rate for the four home appliances was 44% compared to only 5% for waste computers and monitors (Oguchi et al. 2008). The single weight-based target of four kg per capita in the EU has led to a focus on the collection of large appliances to meet the target and only marginally affected the collection of small items like used mobile phones (Manomaivibool and Tojo 2010).

These differences in collection performance can be difficult to explain and counterintuitive. Paper II presents a surprising finding that the end-user-pays system in Japan managed to collect much more waste home appliances than the system in Taiwan which included collection incentive in its subsidies: 91 units in Japan versus 64 units in Taiwan per 1,000 inhabitants in 2006[3] (AEHA 2010; TEPA 2011). The perplexity increased with the fact

[3] The figure from Japan is recalculated based on the latest report from AEHA (2010). There is no change from Paper II in the case of Taiwan. Although it is possible that there were more waste available to be collected in Japan, studies using survival analysis (Lin 2008; Oguchi et al. 2008) still reported slightly higher collection rates in percent for Japan for all four product groups. It is also observable that while the collection in Japan had steadily

that the collection of waste computers in the Taiwanese programme topped that of the programme in Japan that provides free take-back by post: 74 units in Taiwan versus only six units in Japan per 1,000 inhabitants in 2009 (PC3R 2010; TEPA 2011). Possibly in the case of large home appliances the reverse logistics bundled with the shipment of new products that retailers normally offered in Japan provided sufficient convenience for households to pay for the services. On the other hand, the mail collection for used computers, even though it is free, might not be so convenient for end users who have to print mailing address and do the packaging.

A comparison of some e-waste programmes in the USA highlights *the importance of collection targets* showing poor results from the states using free-hand approach without any target (Electronics TakeBack Coalition 2010). However, the establishment of collection targets is not an area that existing WEEE programmes are good at. The four kilogram per inhabitant target in the EU has come under heavy criticism in the recast of the WEEE Directive (Farmer and Watkins 2009; United Nations University/StEP Initiative 2009). Other programmes either do not contain any target or have one that is not very ambitious. Having a low target could, however, lead to an awkward situation if the collection effort is allowed to be dialled back once the target is met (Learn 2009).

Besides collection goals, programmes can employ supplementary or alternative measures to ensure high collection. New programmes in the USA are now experimenting with supplementary financial mechanisms, including not only performance penalties but also *rewards to encourage more collection beyond the target*. Some laws (Sweden, Switzerland, Oregon and Washington) had *a convenience standard* that prescribes the minimum availability of the collection service. Others tried to break the conflict of interests by *separating physical and financial responsibility* (Japan where end-users pay for the mandated retailers' take-back service) or by putting waste collection in the hands of municipalities (Germany).

Last but not least, *although treatment standards and recycling capacity in the formal sector had increased after the implementation of WEEE programmes, the recycling was not always optimal*. Several studies (Bohr 2007; Chancerel and Rotter 2009; Huisman et al. 2008; Laner and Rechberger 2007) criticise the merits of

increased from 65 to 137 units per 1,000 inhabitants between 2001 and 2009, Taiwan experienced the peak in 2001 at about 80 units before the levels dropped and stayed with the range of 55-70 units between 2002 and 2009 (AEHA 2010; TEPA 2011).

weight-based recycling targets and the way recycling results were actually measured. Not only did such targets not prioritise materials with larger ecological rucksack, such as precious metals, but simply measuring what went in and out of intermediate treatment facilities also failed to reflect the environmental consequences of difference applications of recycled materials.

When taking into account uncollected WEEE and leakage to the informal sector, the loss of precious metals and other strategic resources could be massive (Chancerel 2010). The pollution caused by the backyard recycling in developing countries, which will be discussed in the next chapter, also makes one wonder whether it is better to deposit WEEE in a sanitary landfill in a developed country than having it recycled in the informal sector in a developing country (Kahhat and Kavazanjian 2010).

2.5 Summary

EPR is an environmental policy principle. It originated in the context of OECD countries as a strategy to lever the waste management. By putting the responsibility to management end-of-life products on the manufacturers who have the influence over the design of products, it aims to stimulate both upstream and downstream improvements in the product system.

A review of the WEEE programmes in industrialised economies shows not only variants of implementation models, but also a wide range of policy instruments that can be used in an EPR programme. Some policy lessons can be drawn based on the evaluation of their effectiveness in reaching the upstream and downstream goals of EPR.

To promote improvements in product design, administrative measures such as material restrictions can be used. Beyond complying with prescriptive measures, a system that implements brand identification can encourage the producers to handle and change the properties of their own products.

To promote improvements in individual systems, the system should not put the individual systems at a disadvantage by giving exclusive privilege to collective systems. One barrier to entry for independent plans is the requirement that the collection systems of the independent plans must have the same comprehensive coverage as the national/default program.

To promote improvements in collective systems, the pressure from competition can improve the cost-effectiveness of the systems. In a single national system, limited improvements can be levered through pressure from the board of directors and licensees, and a bidding procedure. The leverage can, however, be very low in a government-run system.

To promote high collection, several instruments can supplement one another, including system-wide collection targets, individual collection quotas, convenience standards, and financial incentives. However, the problem with leakage hints at the importance of transfer requirements, including reporting obligations, on intermediate actors in the system.

To promote environmentally sound treatment, environmental standards are needed. However, collection can be a bottleneck – the majority of leakage outside the formal treatment system can end up polluting the environment.

To promote high reuse and recycling, targets can play an important role but the way performance is measured is equally important. Reuse bonus has a potential to encourage more reuse, though it is difficult to comment before more experiences are gained from its implementation. Collection can also be a bottleneck here.

In addition, there are some supporting instruments that are vital to an EPR programmes, including legislative backing and market surveillance to minimise free riders, and monitoring and auditing mechanisms to protect the system from frauds.

CHAPTER
THREE

3. Waste Electrical and Electronic Equipment in non-OECD Countries

This chapter tests the compatibility of EPR and the context of non-OECD countries. A lack of environmentally sound management of WEEE in non-OECD countries has caused an international concern over the release of toxins to the environment and human bodies. The awareness of the problem has led to a growing interest in EPR as a potential solution. The contextual analysis pays attention the underlying assumptions and the basic mechanisms of EPR. Prevailing conditions in emerging and developing economies that can help or hamper EPR to reach the upstream and the downstream objectives are identified. The chapter also discusses possible solutions for the identified challenges as well as advantages and disadvantages of applying different EPR-based solutions in non-OECD countries.

3.1 Background

In 2002 the Basel Action Network (BAN) and the Silicon Valley Toxics Coalition (SVTC), NGOs working with environmental justice issues, released a documentary, titled *Exporting Harm – The High-Tech Trashing of Asia* (2002). The film exposed *the impacts of crude recycling of imported electronic waste on the communities and the environment* in Guiyu, China. Scientific studies later confirmed that the contamination of pollutants in this former rice paddy town far exceeded most health and environmental standards (Bi et al. 2007; Deng et al. 2006; Huo et al. 2007; Wang et al. 2005; Wong et al. 2007a; Wong et al. 2007b; Yu et al. 2006). Environmental justice groups have also uncovered large-scale backyard recycling of WEEE in several Asian and African nations (BAN 2005; Brigden et al. 2005; Toxics Link 2003).

The awareness about the impacts on human health and the environment has led to *a search for policy solutions to the mismanagement of WEEE in non-OECD countries*. The United Nations Environment Programme (UNEP) started its Solving the E-waste Problem (StEP) initiative in 2004. The Basel Convention Regional and Coordinating Centres (BCRCs) have sponsored a number of fact finding missions about WEEE in emerging and developing countries since the Sixth Meeting of Conference of the Parties (COP 6) in December 2002 recognised WEEE as one of the priority waste streams. In addition, two public-private partnerships were launched under the Basel Convention: the Mobile Phone Partnership Initiative (MPPI, launched in 2002) and the Partnership on Computing Equipment (PACE, launched in 2008). Information dissemination and capacity building were further strengthened through the work of some developmental agencies, notably, the Swiss Federal Laboratories for Materials Testing and Research (Empa). Several major non-OECD countries are preparing draft WEEE laws and regulations, as can be seen in Figure 2-1 and will be discussed in Section 5.1. There was also a call for action in the global North to stop the leakages of WEEE in their programmes that contributed to the problem in the global South.

EPR has received a lot of attention in the policy discussion. As a cornerstone of most WEEE programmes in OECD countries, it was tipped as a potential solution for the problem in non-OECD countries (Lin et al. 2002; Mungcharoen and Varabuntoonvit 2006; Nnorom and Osibanjo 2008; Pellow 2007; Toxics Link 2007; Widmer et al. 2005). MPPI's (2008) and PACE's (2009) guidance documents acknowledged the popularity of the principle but also made an observation that some of the implementation models might not always be advantageous. After analysing the EPR-based legislation in Asia, Hotta and colleagues (2009, 8) concluded that "there is no single right interpretation of the EPR principle. Indeed, the way to implement EPR needs to be carefully adapted to the situation in each country."

3.2 Contextual Analysis

The contextual analysis examines *the compatibility of EPR interventions and the prevailing conditions in a non-OECD context*. Basic assumptions of the intervention theory are tested to identify opportunities and challenges to the attainment of EPR goals. As such, it contributes to the prevention of inappropriate policy transfers.

Figure 3-1 depicts a typical scenario of a national EPR programme. The system boundary starts from the point where the producers put the products on the market. *The implementation of EPR assumes that the brand owners, the manufacturers, or the importers of the products are known and can be made responsible.* The internalisation also means consumers, who in the case of EEE can be divided into households and institutional users, are effectively the ones who sponsor the producers to carry out their extended responsibilities. While the diagram depicts buyers paying at the point of sales, it is also possible to arrange it in a way that end users are the ones who pay like in the management of used home appliances in Japan (see Section 2.3.2)

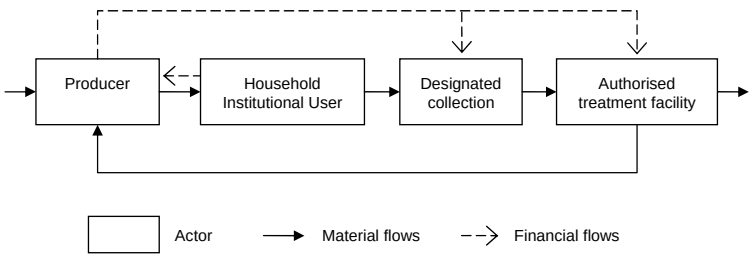


Figure 3-1 A simplified model of a typical scenario for a national EPR approach

The implementation of EPR further requires collection and treatment systems. When they finish with the product, a consumer is expected to deliver the used product to a designated collector who forwards it to an authorised treatment facility where it is reused and recycled. The resources from the producers are the mechanism that drives the flows of used products. However, in some European systems where municipalities act as designated collectors the monetary flow from the EPR programmes to the municipalities can be rather limited. In addition, although not shown in the diagram, *monitoring and reporting mechanisms are vital to the functioning of the programme.*

Based on the classification of different types of products in the system and their relation to the goals of EPR, Papers III and IV focused on the conditions in India and Thailand that could help or hamper an EPR programme to "1) provide incentives for design for environment (DfE) to identifiable producers of new products; 2) prevent the occurrence of new, orphan products and free-riders in general; 3) ensure high utilisation of product and material quality through effective collection, treatment, and re-use or recycling of all products, and 4) have an acceptable method of

distributing the costs relating to historical products." The next section reports key findings from the two papers and similar studies.

3.3 Key Considerations in a non-OECD Context

3.3.1 Production and product shipments

As far as EPR is concerned, the actors who put the products on the market can be divided into responsible producers and free riders. *Free riders are the greatest threat to EPR.* Not only do the free riders evade the onus placed on the other producers, but they also increase the problem with orphan products, the cost of which the responsible producers might have to shoulder when the free riders' products get discharged into the system.

Although every EPR programme has to cope with the problem of free riders, there are signs that the problem can be pronounced in non-OECD countries. *The popularity of assembled products* is one of the concerns. Assembled products are generally cheaper and more custom-made than branded products but the fact that they were delivered by small shops or independent technicians makes it very likely that they would become orphan products in an EPR programme.

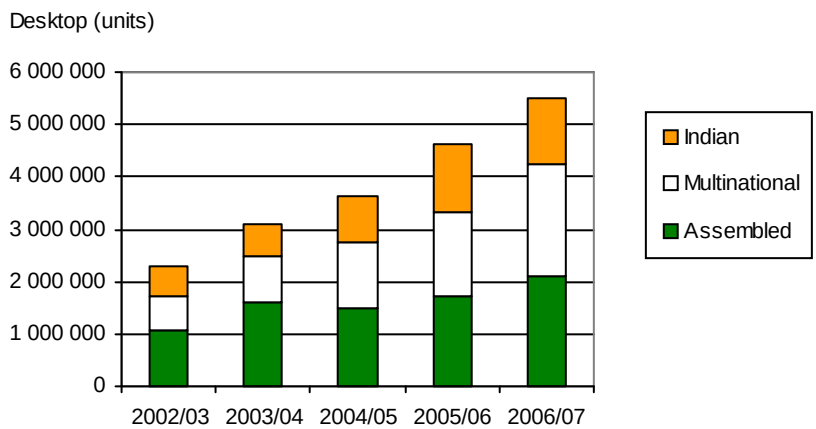


Figure 3-2 The shipment of desktop computers in India by types of producers between April 2002 and March 2007

Source: MAIT (2007)

Figure 3-2 shows the estimated market size of assembled desktop computers in India between 2002 and 2007. Although their market share fell from its peak at 53% to 38%, the shipments of assembled computers were actually doubled during the period. Assembled mobile phones, known as shānzhài phones in Chinese, became phenomenal after the Taiwanese company, MediaTek, developed an economical turnkey solution for wireless communication. It is estimated that several hundred million assembled phones were sold each year worldwide (Kwong 2011). However, the challenge presented by assembled products is manageable. An EPR programme can include the suppliers of key components of the assembled products, such as MediaTek, as responsible producers. Assemblers can be treated as distributors of the covered key components.

A real threat of free riding comes from *a poor and corrupted market surveillance* that allows a sizeable black market and counterfeit products to exist. Papers III and IV found that in the worst cases, such as specific consumer electronics in India (see also Jain 2009) and mobile phone batteries in Thailand, the majority of products were sold illegally. The actors involving in these illegal activities would by default be free riders in an EPR programme. Moreover, according to the interviews with informants in the industries, there were *trade irregularities* that distorted the official shipment statistics. Manufacturers might submit understated figures to the authority to avoid paying taxes. Importers can bundle extra accessories with the imports of main devices without paying additional duties and then repackage and sell them separately. The same techniques can be used to free ride EPR.

Unlike the case of assembled products, extending more responsibilities or expanding the scope of the programme would do little against these adversities. An end-user-pays mechanism or a return-share allotment could correct some of the trade irregularities but would be vulnerable to the problem of orphan products from scores of small, short-lived companies and assemblers. Nevertheless, although supplementary mechanisms are needed to tackle these market anomalies, implementing EPR would give one more reason and potentially additional resources to strengthen market surveillance in non-OECD countries.

On a more positive note, some non-OECD countries such as China, Malaysia, Mexico, Thailand and Vietnam have become global production hubs for EEE. *Large-scale manufacturing of EEE* leads to the development of recycling infrastructure to accommodate industrial WEEE. Paper IV showed that Thailand had many more authorised treatment facilities for

WEEE than what was reported in Paper III for India. In addition, if an EPR programme can be configured and fine tuned to give manufacturers incentive for design improvements, its effects will be less mediated through the supply chain. However, the upstream benefits might not be as large as it sounds. The electrical and electronic industries in non-OECD countries tend to be export-oriented and might not be very sensitive to the measures at home. In addition, sub-contractors or assembling units of multinational corporations might not have much influence over the product design and development.

3.3.2 Consumption

The level of consumption in the past hints at *the size of historical stock of WEEE*. Although historical waste cannot be redesigned and hence is in theory not the main target of EPR, it is in practice something the system has to cope with first. As mentioned in Section 2.4.1, in OECD countries WEEE programmes were preoccupied with raising funds to manage the waste from yesterday at the expense of the attainment of the upstream objectives.

Table 3-1 Lifespan and estimated saturation of selected products in Thailand

	Estimated Lifespan (years)	Assumed saturation (unit/inhabitant)		Estimated year of saturation[1]	
		Lower	Upper	Lower	Upper
Television	11.8	0.50	0.70	2039	>2050
Digital camera	10.8	0.40	0.65	2023	2025
Camcorder	7.6	0.07	0.10	>2050	>2050
Portable player	6.0	0.10	0.15	2024	2024
Printer	5.7	0.20	0.30	2026	2031
Mobile phone	6.3	1.00	1.30	2022	2025
Computer	7.6	0.30	0.50	2030	2035
Air conditioner	9.5	0.45	0.70	>2050	>2050
Refrigerator	11.2	0.35	0.40	>2050	>2050

[1] The year of saturation was determined when 99% of all sales are replacement sales.

Source: PCD (2010)

The market in non-OECD countries is still far from reaching the point of saturation where most sales are replacement sales. Table 3-1 shows the results of the prognosis we did as part of the WEEE inventory in Thailand that was presented in Paper IV. The prognosis gave a range of possible points of saturation based on the lifespan estimated from a large household

survey (n=1,529) and the assumed lower and upper bounds of saturation. In general, it would take Thailand between 10 to more than 40 years to reach the point of long-term equilibrium, in several cases assumed to be the level of product ownership in Japan. Although Yang and William (2009) assumed much higher lower and upper bound of the carrying capacity for computers in the USA (1.0 and 1.3 units per capita), their bounding analysis found that the equilibrium would be reach sooner in the USA between 2023 and 2033.

A programme that puts *the financial responsibility upfront* is going to do very well in a country with a low historical stock of products and a fast growing economy. Paper III shows that even with a 100% waste collection rate there would be three new computers paying for every old computer that became obsolete in India in 2006/07. A fee in a pay-as-you-go system would only be 33% of the total costs per unit. A more realistic outlook on the collection rate would predict an even lower fee.

The use of *financial guarantees* is also viable under this context. Normally the double needs to make a provision for the future and to sponsor the treatment of historical waste render the instrument unfavourable. However, with the combination of low historical stock and realistic estimation of collection performance the financial burden might not be so high. Assuming a constant collection rate of 50%, the size of guarantee plus the money needed to cover the management of historical waste that might be put on new computers in India would be 66%. This does not take into account the fact that for durable products the guarantee could be set lower than the expected cost if the future funds were allowed to grow through investment (Lindhqvist 2000; Rydén 1995). This might be an important omission as products tend to be used for an extended period in non-OECD countries.

A closer look into the pattern of product uptakes in the past also identifies *a large share of institutional users* as another advantage in non-OECD countries that should be capitalised in the start-up of a programme. WEEE from these sources is homogenous, has high value, and come in large quantity. Several leading producers have already had asset management targeting obsolete equipment from their business-to-business customers. Besides the economic driver, having a stringent requirement on the large generators of WEEE to ensure environmentally sound management of their used products could step up the pressure on the producers (Khetriwal et al. 2009). Paper IV featured a case of two lighting producers in Thailand that volunteered to take back waste fluorescent lamps for free from large establishments in order to keep a good business relationship with their clients. One of them

later expanded the programme to assist the municipalities that had source separation campaigns for household hazardous waste. Paper III showed that in India authorised treatment facilities had to rely on WEEE from producers and large institutional users who had an environmental code because they could not compete with the informal recycling sector for household WEEE.

3.3.3 End-of-life management

Backyard recycling is perhaps the most well-known aspect of the WEEE problem in non-OECD countries. Large-scale recycling activities in Guiyu and other notorious cases in the global South are believed to be fuelled by *illegal imports of WEEE* from the global North (BAN 2005, 2002; Pellow 2007). The violation of the Basel Convention by declaring WEEE as second-hand products is a thorny issue. It is difficult to determine whether the used equipment is still reusable or can be repaired without hazardous parts being disposed of in importing countries. In order to avoid tedious testing, Thailand and some countries in Africa regulate *the maximum age of EEE that can be imported into the country* as used products. In the future if EPR will be implemented in non-OECD countries and the onus on the producers is real, *the extended responsibility of the importers in the EPR programme for their second-hand products can discourage fault declarations of unusable junk*. Nevertheless, although being a significant step forward, stopping illegal imports would not be sufficient to end the menace of backyard recycling.

Increasingly backyard recycling lives on WEEE generated in the country. A new case study from Kalasin, a province deep inland in the Northeast of Thailand, reported a transformation of an agricultural village into a WEEE-processing village, albeit at a much smaller scale compared to Guiyu (Sae-tang et al. 2009). Villagers were reportedly collecting used products from neighbouring cities and tried to refurbish them. Those that could not be refurbished were cannibalised for saleable materials. Cooper wires were burnt to rid of plastic. Everything was literally done in the backyard and they did not have any licence for their operation.

The strength of the informal sector lies in its logistic prowess and the avoidance of compliance costs. The analysis in India in Paper III indicated that when these were translated into a higher bid to buy recyclables at the doorstep, the authorised treatment facilities stood little chance to tap into post-consumer WEEE. In China, early pilot projects to set up a formal recycling system failed largely because of the competition from the informal sector (Hicks et al. 2005; Streicher and Yang 2007).

While the informal recycling sector thrives, *the municipal solid waste management systems in emerging and developing economies are generally underdeveloped*. Civic amenity sites or separate kerbside collection are virtually non-existent, except in very environmentally proactive cities or communities. Although households may sort recyclables for sale, they are often sceptical about municipal source separation schemes believing that their efforts would be in vein and the dysfunctional system would eventually landfill sorted waste (Manomaivibool 2005). Similar scepticism can be shown towards voluntary free-take-back schemes that some producers offer. When consumers still value their old equipment in their mental accounting (Okada 2001) and can easily find someone in the second hand market or the informal recycling sector to pay for their priced WEEE, they need to be convinced that the free take-back is actually a good deal for them and/or the environment. Findings from a household survey in Thailand presented in Paper V indicate that only between 4-16% of the respondents prefers drop off WEEE for free when there are more convenient and/or financially attractive options.

In the future, an EPR programme should muster resources and skills from the upstream to promote environmentally sound management of used products. Activities that might not otherwise be economical such as separate collection, drop-off centres, treatment of toxins, recycling of low-value fractions, and safe disposal are subsidised or demanded through administrative instruments in the programme. Although the exact arrangement depends on negotiations and agreements among stakeholders, in principle municipalities and authorised treatment facilities should be able to gain support. I have suggested in Papers III and IV that, if *a right incentive structure* is in place, some actors in the informal sector might decide to come under the authorisation in order to enjoy the benefits in the formal sector.

A decisive factor for such transformation is going to be *the ability of the system to motivate product returns in non-OECD countries*. So far a key concern recyclers and investors have is the quantity of WEEE that can be collected through a formal programme. Although they are in general ineffective, some lessons can still be learnt from pilot projects and voluntary take-back in developing countries. Nokia in India, for example, successfully increased the amount of returned equipment from three to 15 tonnes in a year. Singhal (2010) attributed the improvement to *the information campaign* with simple messages and the efforts to make returns for recycling convenient. The mobile phone manufacturer also offered to plant one tree for every phone returned. It, however, refrained from giving direct financial incentive to consumers which was instrumental in the following case.

In China, after years of struggling to collect post-consumer WEEE, the breakthrough finally came under the *Old-for-new Appliance Implementation Measures* of 2 July 2009. Although it can be argued that the measures were designed to stimulate consumption more than being a recycling scheme (similar to car scrappage schemes in Europe during the recent economic downturn), the result in terms of returned products is unmistakeable. During the three quarters in 2009/10, almost 19 million units of used TV, refrigerators, air conditioners, washing machines and computers were traded in for new purchases in nine pilot provinces and cities – putting the recycling capacity of the formal sector to the test (Wen 2010). The scheme is, however, expensive and would not be possible without the RMB 2 billion (EUR 230 million) from the State Council (Perchards 2010). Table 3-2 shows the amount of subsidies for different products. The high subsidies also require stringent control and conditions to minimise frauds.

Table 3-2 Subsidies in the "Old for new" project in China in RMB (EUR) per unit.

	Buy back subsidy	**Transport subsidy**		**Treatment subsidy**
		< 150 km	**> 150 km**	
Television	400 (46)	20-30 (2.8)	30-40 (4.0)	15 (1.7)
Refrigerator	300 (34)	30-40 (4.0)	40-50 (5.1)	20 (2.3)
Washing machine	250 (28)	30-40 (4.0)	40-50 (5.1)	5 (0.6)
Air conditioner	350 (40)	20-40 (3.4)	30-50 (4.6)	0 (0)
Computer	400 (46)	20-25 (1.7)	30-35 (3.7)	15 (1.7)

Source: Perchards (2010)

Although the analysis indicates that the collection of WEEE in non-OECD countries might require extra cost compared to the situation in OECD countries, part of the extra cost required for collection can be offset by higher returns in reuse and recycling. *The low labour cost* in non-OECD countries would allow the level of manual dismantling that was not possible in developed countries. While Bohr (2007) assumed the labour wage at EUR 15 per hour in Western European countries and Kang and Schoenung (2006) approximately EUR 7 per hour in the USA, the value for our cost modelling in Thailand was merely EUR 1 per hour (which was already 75% higher than the minimum wage in the country at that time) (PCD 2010). Readers should also not forget the cost implication of a low historical stock discussed in Section 3.3.2.

3.4 Summary

Although the amount of WEEE generated in non-OECD countries was relatively low compared to OECD countries, the acute pollutions from uncontrolled recycling of WEEE in these countries has prompted a search for policy solutions at both national and international levels.

This chapter shows that EPR can help improve the management of WEEE in non-OECD countries in two important ways. First, by including the importers of used products as producers in a programme, EPR can discourage the practice to declare WEEE as reusable products which is now a major loophole in the control of transboundary movement of hazardous waste. Second, resources mobilised through an EPR programme can be used to divert the flow of post-consumer WEEE from the polluting recycling sector, although a more attractive solution than free take-back is needed. Once WEEE is collected, the system can benefit from inexpensive labour for dismantling and, in some countries, the treatment capacity that was installed for WEEE from the production processes of the electrical and electronic industries.

However, challenges exist to the implementation of EPR in emerging and developing economies. There are a number of actors that deliver assembled, counterfeit, and no-brand products on the market. These actors are likely to become free riders in an EPR programme. EPR mechanisms do not have an answer to counterfeit and illegal shipments in the black market and would require forces external to the programme to control free riders.

Identifying the producers including the suppliers of key components early in the product chain can be a solution to the challenge of assembled products. The use of upfront financial mechanisms such as a pay-as-you-go arrangement or financial guarantees can also benefit from the small stock of historical products in non-OECD countries. A financial guarantee is an attractive instrument that can stimulate upstream improvements and solve the problem of orphan products in the context where the burden of historical WEEE is not so high.

CHAPTER
FOUR

4. Action Research in Thailand

This chapter presents a case of the action research in which I engaged in a reflexive learning process with practitioners in order to advance the solutions proposed by the government to the WEEE problem in Thailand. It starts with a description of the early policy development in Thailand before the research started at the end of 2007. By that time, the policy proposal to have a state-run buy-back programme sponsored by mandatory fees from the producers and administered by a governmental fund had already taken root in the policy community. However, the analysis of the learning and the social interactions within the policy network shows signs of deficiencies that can compromise the effectiveness of the proposed model especially from the EPR perspective. In order to improve the policy process and consequentially its outputs, various actions were taken in the research in Thailand to encourage participation in the policy development and reflexion on the policy proposal. The influences of the action research can be seen in the new draft law that is presented at the end of this chapter.

4.1 Background

The WEEE issue first appeared on the policy radar in Thailand when the Ministry of Commerce through the diplomatic mission in Brussels informed the other authorities about the upcoming product policies in the EU. Early concern was over *the competitiveness of the export-oriented electrical and electronic industries* in Thailand (Chotichanathawewong and Thongplew 2009). The Electrical and Electronic Institute (EEI), a strategic unit under the Ministry of Industry, tasked the Thailand Environment Institute (TEI) to conduct a study which warned of direct impacts on the manufacturing industries from the RoHS Directive (TEI 2003). The National Metal and Materials Technology Center (MTEC), a research arm in the Ministry of Science and Technology, later developed a programme to help preparing the industries

with aid from the Small Projects Facility of the EU-Thailand Economic Co-operation. In early 2008, the Thai Industrial Standards Institute (TISI) adopted the same requirements as in the RoHS Directive as general product standards under *the Industrial Standard Act*, B.E. 2511 (A.D. 1968).

In addition to the aid from the EU, the Thai government received financial and technical support from Japan through the Green Aid Plan (now the Green Partnership Plan) which was co-chaired by the Ministry of Economy, Trade and Industry (METI) in Japan and the Ministry of Industry in Thailand. This should come as no surprise because many Japanese manufacturers have large-scale production in Thailand. Among the outputs of the aid was *the three-phase study on the WEEE situation in Thailand*. The Pollution Control Department (PCD) and the Japan External Trade Organization (JETRO) commissioned a consultancy, Kokusai Kogyo, to conduct the study. The first phase of the investigation reconstructed a historical inventory for the four large home appliances and computers in Thailand between 1967 and 2003. The second phase reviewed the treatment and recycling technologies for CRT and printed circuit boards. The third phase focused on the generation and the end-of-life management of waste mobile phones, spent dry-cell batteries, and waste fluorescent lamps, including limited take-back initiatives offered by manufacturers and network operators. The study (PCD and JETRO 2004) highlighted some of the prevailing conditions of WEEE management in a non-OECD context, including the low but increasing stock of products, available infrastructure for industrial WEEE, limited collection of post-consumer WEEE, and informal recycling activities (see Section 3.3).

Equipped with more knowledge about the problem, industrial and environmental authorities began to formulate WEEE policies. To limit the risk of being a dumping ground of developed countries, the Department of Industrial Works (DIW), Thailand's competent authority of the Basel Convention, issued *regulations restricting imports of used EEE* older than three years and used copiers older than five years on 26 September 2003. The Custom Department backed up the regulations by differentiating the 11-digit export-import codes for used EEE (now ending with .800). The Department of Industrial Works also floated an idea similar to the "deposit-refund system" in South Korea for the management of post-consumer waste. However, according to the interviewees who were actively involved in the early policy development, the idea did not gain support from the manufacturers in Thailand who had no interest in engaging in waste management to get refunded. Instead, they preferred a simpler method

suggested by the Pollution Control Department to pay the fees into a governmental fund and let the government do the recycling work.

The fee-and-fund idea was a product of another study that the Pollution Control Department sponsored early on. The study by the Social Research Institute, Chiang Mai University, proposed an establishment of a new governmental fund to administer a buy-back programme for household hazardous waste, including WEEE (PCD 2004). The programme would be financed by fees levied on new products. According to interviews with the researchers who carried out the study, the model was inspired by the way remaining value in saleable waste materials drove recycling in the country. It was thought that the recycling of household hazardous waste could work in a similar way if artificial value was created through buy-back. The team from Chiang Mai University also delivered a draft law that would be a stand-alone act to establish the system. *The draft Act on the Promotion of the Management of Hazardous Waste from Used Products* (henceforth the PCD draft Act) became available for the public to comment in March 2005. Two slightly amended version of the draft later appeared in June 2005 and February 2006.

To coordinate the work of different agencies, a national master plan for the management of WEEE started taking shape in the mid 2000s. The process was led by the Pollution Control Department and the Office of Industrial Economics (OIE). The draft of *the National Integrated Strategy for the Management of Waste Electrical and Electronic Equipment* (henceforth the "Thai WEEE Strategy") was presented to the National Environmental Committee for the first time on 18 July 2005. However, the approval of the document was delayed because of the volatile political situation that led to a military coup on 19 September 2006. The strategy was finally endorsed by the caretaking cabinet on 24 July 2007 and enumerated the following goals for the WEEE policies (PCD 2007, 26, translated from Thai):

> *1. To manage domestic post-consumer WEEE in a scientific and systematic manner;*
> *2. To establish an efficient and sustainable WEEE management system with cooperation from every sector of society;*
> *3. To reduce hazardous wastes from EEE at the origin and to encourage environmentally friendly design and production;*
> *4. To enhance the competitiveness and negotiation power of the country in international trades; and,*
> *5. To have nationwide efficient and effective integrated WEEE management by 2017.*

A steering sub-committee for the Strategy was erected under the National Environmental Committee with the Pollution Control Department serves as its secretary. The Thai WEEE Committee in its meeting on 30 September 2008 listed *ten priority products*: (1) CRT TVs and monitors, (2) digital cameras and camcorders, (3) portable media players, (4) mobile and cordless phones, (5) flat-panel display TVs and monitors, (6) fluorescent lamps, (7) refrigerators and freezers, (8) unit-type air conditioners, (9) personal and notebook computers, and (10) desktop printers and facsimiles. Later the two groups of TVs and monitors were combined and dry-cell batteries were added to make the new top ten.

Although the Pollution Control Department successfully established itself as a leading authority in the WEEE policy subsystem ahead of industrial authorities, its draft law project suffered a critical blow from another turf war. Its proposal to establish a new environmental fund ran up against the Ministry of Finance's attempt to *unify all proposed uses of economic instruments for environmental reasons under one framework and one fund*. The Fiscal Policy Office (FPO) with assistance from the Asian Developmental Bank (ADB) commissioned a two-phase project to develop the framework. In the second phase, the researchers from Chiang Mai University who assisted the environmental authority in writing its draft act were instrumental in the development of *the draft Act on the Economic Instruments*[4] *for Environmental Management* (henceforth the "FPO draft Act") with the financial authority.

The FPO draft Act would provide a general framework for the use of pollution taxes, service charges, product taxes and fees, performance bonds, tradable permits, and environmental subsidies (Kaosa-ard et al. 2008). Revenues from taxes and fees would be deposited in a new fund established under the treasury. The fund would be managed by a financial institution and, according to the interviews with the financial officials, could partly be earmarked for specific purposes including buying back used products and subsidising recycling. The law in itself, however, would not bring to life any of the listed economic instruments. Instead, the Ministry of Finance invited other ministries to submit a subordinate decree-level law for specific use of the instruments and co-sponsored the draft act. The Ministry of Industry was the first to submit its plan to levy pollution taxes on water and air pollutants from industrial and other large sources.

[4] Later the word "Measures" replaced "Instrument" in its title following the comment that the term "economic *instruments*" were not commonly used in Thai.

Figure 4-1 presents the two-tier legal framework under the FPO's draft Act in the case of using the product fees for the buy-back of WEEE. At about the same time I started my research in Thailand, the Pollution Control Department reluctantly took up the invitation and began to explore ways to modify its draft act into a decree under the FPO draft Act. One of the projects I later involved was precisely to develop the draft decree.

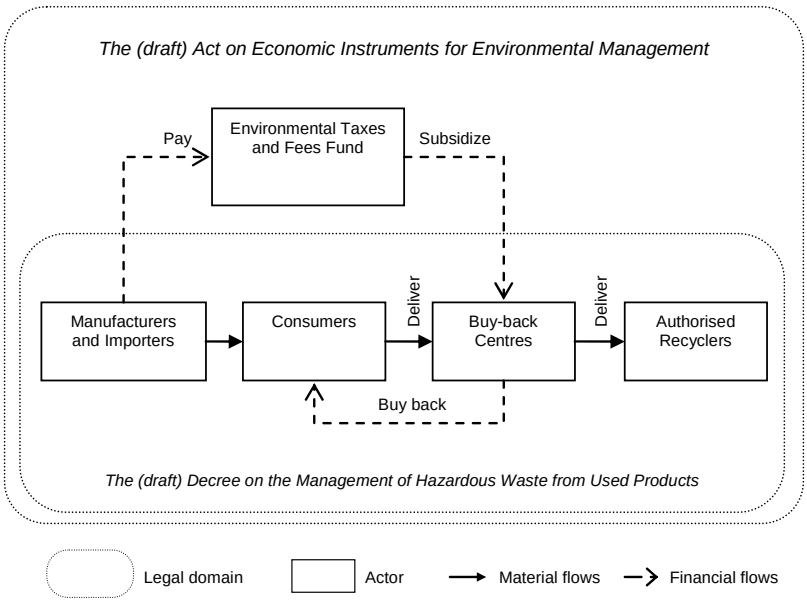


Figure 4-1 The proposed model for the management of selected WEEE items in Thailand

4.2 Action Research and Network Management

The description of the early policy development in Thailand reports a number of actors who worked on the WEEE policy. Although some of these actors played a key role and had a lot of influence on the policy, they were not likely to be able to impose the decisions in a top-down hierarchical manner. *The resource dependency between policy actors* at multi levels of the government that characterised the policy process fits well with the image of a policy network.

A policy network is a metaphor characterising the state of policy process with resource dependencies. Kickert and colleagues (1997a, 6) define policy networks as:

> *stable patterns of social relations between interdependent actors, which take shape around policy problems and/or policy programmes.*

Rhodes (1997) suggested that the image of complex, tangled webs of relations between governmental agencies in different levels and other stakeholders gives a more accurate depiction of contemporary form of governance than the traditional top-down hierarchy (known as the Whitehall model in the UK).

Paper I suggested that *network management was imperative to the success of EPR*. As mentioned in Section 2.2, EPR is a powerful concept that can reframe the problem theory and the objectives of waste policies. One of the desirable consequences of the reframing is to activate the manufacturers and have them interact with waste managers. The feedback between the upstream and the downstream should then further the ideas about the improvements of the product system.

There is no guarantee that the desirable transformation according to the EPR perspective will just happen when the idea is out there. It is not uncommon to have the producers opposing the idea that they should be responsible for the end-of-life management unless they can see new possibilities or face worse alternatives. The lobby by the targeted industries can lead to a weak legal framework or, if the lawmakers manage to pass a strong statute, the implementation by unconvinced practitioners can go awry. IPR that got lost in the transposition of the WEEE Directive was a notable example of implementation slippages. Even when the producers are ambitious, the interdependencies between the upstream and downstream can get in their way. Paper I reported a case where car producers in Sweden had to scrap their idea to commercialise their pilot project on part remanufacturing because dismantlers on whom they relied for the take-back of end-of-life vehicles saw this as a threat for their spare-part business.

Therefore, Paper I suggests that a successful implementation of EPR requires considerable effort in network management. Network management is "a form of steering aimed at promoting joint problem solving or policy development" (Kickert and Koppenjan 1997, 43). It is the key feature of what I called in Paper I the Dutch approach to policy network analysis. This approach has network management as a main independent variable and policy breakthroughs and impasses as a dependent variable. Termeer and Koppenjan (1997) identified the exclusion of important actors or ideas as the main sources of impasses. Strategies to breakthrough social and

cognitive fixations can also be divided into social and cognitive strategies, as shown in Table 4-1. Because trying to break through the fixated aspect head on can be difficult, Termeer and Koppenjan (1997, 88) suggest that "in the case of a cognitive or social fixation, it is possible to direct management efforts towards that dimension of the process which is not fixed."

Table 4-1 Strategies for network management.

Strategies aimed at Cognitive Aspects	Strategies aimed at Social Aspects
Reframing	Selective (de)activating
Changing formal policy	Changing rules and resources
Covenanting	Changing internal structure
Influencing perceptions	(De)coupling games
Bargaining	Changing incentives
Development of common language	Organizing confrontations
Prevention or introduction of ideas	Development of procedures
Furtherance of reflection	Furtherance of facilitation, brokerage, mediation and arbitration

Source: Kickert and colleagues (1997b)

In this action research, I saw my role as the one of *a policy broker*, who tries to find some reasonable compromise to reduce intense conflict (Sabatier and Jenkins-Smith 1993). Brokering strategies were deployed to break through social or cognitive fixations that would otherwise prevent policy participants to seek beneficial cooperation or perspectives. However, it would be naïve to assume that a policy broker did not have an agenda of his own. Therefore, it might be helpful to restate my objective of advancing the frontier of EPR as a policy principle promoting total life cycle environmental improvements for the effective management of WEEE in developing countries – in this case Thailand.

The main venues of this action research were three of my research projects on the management of WEEE in Thailand. The first project was commissioned by Greenpeace International. It reconstructed the policy development and stakeholder views in Thailand from documentary research and qualitative interviews conducted between December 2007 and November 2008. Besides its substantive value, this project was also my introduction to the WEEE policy circle in the country. One of my interviewees later approached me when her research centre was awarded two

successive projects from the Pollution Control Department, one to estimate the cost of the buy-back system for the ten priority products and the other to develop a new draft law to be proposed with the FPO draft Act. The work with the National Center of Excellence for Environmental and Hazardous Waste Management (EHWM), Chulalongkorn University, lasted for two years. As a government-funded project, the research team, which included also a law scholar from the Social Research Institute, Chiang Mai University, in the law-drafting project had to organise a series of focus groups and public hearings. We were also called for advices in a number of inter-ministerial meetings. These events provided opportunities for action research in addition to the substantive work in the projects. More information about the research projects can be found in Appendix A.

4.3 Advancing Policy Solutions in Thailand

4.3.1 Diagnosis of the early policy development

The social dimension. The social interactions within the Thai WEEE policy circle were largely limited to those between authorities in the central government, a rather stable group of researchers and to a lesser extent foreign aid agencies and manufacturing industries. This gives a picture of *a closed policy community*. Despite some turf wars and disagreements, different authorities could use inter-ministerial mechanisms and commissioned projects to coordinate their actions and resolve their disputes. The Thai WEEE Strategy was a notable example in this case.

In addition to the agencies and their aids, two groups of companies were active in seeking consultation with the agencies during the early years. The first was *Japanese manufacturers* under the Japan Chamber of Commerce. These manufacturers had their production of electrical appliances and electronic components in Thailand and had a good connection with the industrial authorities. The interviews with some of them revealed that they were not keen in taking the initiative and making a policy proposal. Instead, they were instructed by their headquarters in Japan to report the policy updates and ensure compliance with the government decisions. The other group consisted of *foreign investors* who made independent contacts with the authorities. They were interested in the prospect of WEEE recycling in Thailand in particular the quantity that would be available and in selling their technologies and services.

The role of other interest groups was not so evident in the early policy development. *Thai NGOs* were either occupied with global environmental issues (e.g. climate change, deforestation) and the impacts of mega projects (e.g. dams, land bridges) or busy with community-based projects. The fact that Thailand was not one of the main destinations of hi-tech dumping might explain the absence of the environmental justice movement in this area. Some NGOs passively monitored the policy development and relied on the consultations in study projects to react on the government's proposals.

My interviews uncovered that the past policy consultation missed some of the most affected parties. *ICT producers* who had large market share but did not have the production in Thailand were not solicited, although the basis for fee collection would be sales and not production. The interviews showed that all of the multinational corporations in the ICT sector interviewed were against the policy proposal to charge an upfront fee into a fund administered by the government. One interviewee enumerates the following disadvantages of the governmental fund model:

> *Firstly, unlike producer-run systems, a state-run system might not be efficient as the state monopolises and has no interest in reducing the costs of the system. Secondly, in a state-run system, it is hard for producers to manage the risk to the brands as they have no control over the fate of WEEE and cannot guarantee that their WEEE will be properly managed. Thirdly, [the company] wants to maintain the connection to consumers. […] Finally, if the fee rates are flat, there would hardly be any incentives for proper design and [it] would not [be] in line with IPR (originally in English).*

Most of these companies preferred a flexible framework in which they have more compliance choices than paying to the government. This position was derived from their global policy which favoured the principle that each producer should only be responsible and have control over their own waste which could be collected back with reasonable costs, i.e. (a conditioned version of) IPR. Some of these corporations with representatives from their global or regional headquarters were reported to arrange individual meetings with Thai authorities for the first time during 2007-2008, but felt it was difficult to influence the policy decisions and outputs.

Consumers and local governments were also not well represented in the policy process, even though their behaviours would be imperative for the success of the buy-back programme. Hitherto it was simply assumed that Thais

needed monetary incentive to return waste products to a designated system. However, the generalisability of the assumption was questionable (see Paper V). Not less controversial was the size of incentive required for the buy-back to be effective (see Paper IV). Regarding the local governments, although many stakeholders agreed that they would play an important role due to their proximity to households and the public cleansing duties under the *Public Health Act*, B.E. 2535 (A.D. 1992), the alignment of the responsibilities of different types of local governments remained unclear. The representative they had in the Thai WEEE Committee clearly could not reflect the varying views among different types of local governments in Thailand.[5]

The cognitive dimension. Cognitively the Thai WEEE policies were more *home-grown solutions* than a product of policy transfer. Unlike the policy development in some other developing countries which saw the WEEE Directive being cut and pasted, the Thai policy-makers were rather cautious about the potential of policy transfer. While they have learnt a great deal about WEEE programmes in the EU and in Japan, they observed some features of the policy interventions that would not fit well with the Thai conditions. A collective industrial solution like a producer responsibility organisation was perceived as unlikely to be developed because of a weak tradition of sectoral associations in the industries outside the Japanese group which no longer commanded a large market share in Thailand. The competitive compliance systems were described by officials who had visited Germany as being too complex. None of my interviewees believed that the end-user-pays in the Japanese home appliance recycling system would work with Thais and thought that it would just make the collection problem worse. An exception to a lack of positive lesson drawing was in the area of the restrictions on the use of certain hazardous substances in which the RoHS Directive was emulated into general product standards in Thailand.

Pragmatism guided the search for policy solutions. To distinguish imported second hand products from WEEE, for example, the Thai authorities

[5] There are three types of local governments in Thailand plus the two special autonomous cities, the Bangkok Metropolitan Administration (BMA) and the City of Pattaya. About 2,000 municipalities in the urban areas (which were further divided into three classes based on their population) are in general more equipped to provide public services. 6,746 Tumbon (sub-district) administrative organisations (TAOs) (divided into five classes) have been established in most rural areas. Despite some exceptions, they normally have limited resources. Together the 75 provincial administrative organisations (PAOs) have the total coverage over the areas outside Bangkok, but they primarily act as a coordinator of municipalities and TAOs in their respective provinces.

adopted a simple rule based on the age of used products. Admittedly the rule would reject used copiers older than five years and other used equipment products older than three years though still otherwise reusable. However, this was the criterion that was within the competence of the custom officers to check without having to summon the help of technicians. The low values for the maximum age sent a signal that the country was against hi-tech dumping.

The buy-back proposal was what seemed to work on the ground. Instead of arguing about the right of consumers to free take-back or the civic duty to return waste products, the technocrats studied the reality in Thailand and concluded that *monetary incentive was needed to motivate returns* at least in a short run. The merit of this pragmatic approach was appreciated not only in the policy circle but also among scholars. The Draft Law for the Management of Hazardous Wastes Project of the Social Research Institute, Chiang Mai University, won an award for distinguished research in jurisprudence from the National Research Council in 2007.

With pragmatism reigning supreme *EPR was interpreted instrumentally as a way to finance the proposed system*. According to an interview with one director-level official:

> *The best and most practical way is to collect money first, probably based on the market share which is also fair [to all producers putting the products on the market]. Then, the management of WEEE will be the responsibility of a central agency. That is it … EPR Thai style (translated from Thai).*

Lifset and Lindhqvist (2008), however, warned that such narrow interpretation could rob the concept off its transformative power. The policy proposal for the management of WEEE in Thailand was indifferent to product designs and the involvement of the producers in the end-of-life management, despite the third objective of the Thai WEEE Strategy (see Section 4.1).

There were also *missed opportunities for evidence-based policy-making*. I have already suggested in my licentiate thesis that a recent upsurge in the interest in the governmental fund model among non-OECD countries was rather a pre-EPR model back in fashion than an invention of a new model. Paper I shows that since 1975 the Swedish government had collected car scrapping fees to pay premiums for the disposers of end-of-life vehicles in order to curb the problem of abandoned cars in the nature and encourage

authorisation among dismantlers. More recent and direct examples in the area of WEEE management were the Taiwanese and Californian programmes. However, my interviews revealed that these examples were only little known (if at all) to the technocrat circle.

The policy proponents failed to capitalise on existing evidences elsewhere to support the merits of the chosen model. As a matter of fact, one of the main criticisms to the policy proposal in Thailand was that it was *an untested solution*. True that this had never been tried before in Thailand, but it should not be difficult to show that the Swedish Car Scrapping Fund was successful in consolidating waste collection and in promoting formalisation, pretty much the objectives of the proposal. The policy shift in Taiwan from a competitive system to a governmental monopoly in 1998 might attest the necessity of a hard-handed approach to combat rampant frauds, which was also a concern in Thailand.

In addition, they missed the opportunities to learn about *possible shortcomings and difficulties in the proposed model and possible remedies*. Paper I discusses some shortcomings in the Swedish car scrapping system including the management of the fund balance and a lack of upstream effects which, to be fair, were not envisioned in the design of the programme. The state subsidies also tended to create inertia in the system in the form of programme's clients who had little interest in improving the efficiency of the end-of-life management. However, these shortcomings were manageable. A more sophisticated programme in Taiwan demonstrated some remedies. First, the desirable amount of reserve was taken into account in the fee setting to balance the fund (Wu et al. 2009). Second, the fees were differentiated between and within some product types such as batteries to encourage the reduction of hazardous substances. Third, the fund had separate accounts for different groups of regulated products to limit cross subsidisation. Last but not least, the programme tightly audited and benchmarked the material flows and the cost of subsidised contractors to ensure the integrity and cost effectiveness of the system (Lee 2009).

This diagnosis formed the basis for the actions described in the next section and some of the policy recommendations outlined in Paper IV.

4.3.2 Actions in the research

Language was the first point of actions. Most if not all policy documents and previous public consultations were in Thai. To inform non-Thai contacts, I prepared a brief in English about the proposed policy in Thailand at that time and attached it with the interview questions. The report prepared for Greenpeace International was available in English and Thai.

Because Thai was the official language for the projects commissioned by the Pollution Control Department, we took some measures to encourage participation from non-Thai stakeholders. For the first four workshops all the presentation materials prepared by the research team were in English with the oral presentation in Thai. Participants could ask questions or give comments in both languages. Taking into account the feedback from earlier events, I also provided a short translation during the Q&A sessions to further facilitate the discussion in the fourth workshop. Because the formality required the presentation of the final results to be in Thai, simultaneous translation into English was provided by professionals. In addition, we prepared a consultative paper (Vassanadumrongdee and Manomaivibool 2009) listing key issues and options compiled from the workshops and several interviews in Thai and English. The policy brief was circulated to stakeholders for comments in November 2009. Although the several-hundred page reports were only available in Thai, their executive summary and, more importantly, *the draft subordinate law were presented in both Thai and English.*

One feature of the studies commissioned by the government was the requirement to organise a number of *consultative workshops and seminars* to report the progress of the project and get feedback from target groups. The first project with PCD, for example, had five such events. Table 4-2 reports the number of participants to these workshops and seminars by groups of stakeholders. In addition to the list of stakeholders provided by PCD, we used these opportunities to invite the companies in the ICT sector that had not been well represented in earlier consultations through the contacts in my previous project.

Table 4-2 The number of participants to the project workshops and seminars.

	Apr 09 [a]	**Jun 09** [b]	**Nov 09** [a]	**Jan 10** [a]	**Mar 10** [b]
Government	22	36	18	14	30
Local government	8	4	10	10	13
Trade association	4	4	2	0	3
E&E company	20	43	31	24	48
Recycling company	9	16	6	3	9
Bilateral aid agency	2	3	2	2	4
NGO	2	1	0	0	1
Media	1	3	1	1	2
Academia	11	40	12	9	40
Total	79	150	82	63	150

[a] A consultative workshop with a main purpose to get feedback from focus groups on preliminary results of the project.

[b] A seminar with a main purpose to disseminate information and final results; the number of academia was high because it included other interested researchers and university students other than the core researchers in the area.

Source: PCD (2010)

The participation of ICT producers was interesting in two respects. First, some, especially the persons from their regional headquarters in Singapore, were very outspoken in voicing their opposition to what they described as a "one-size-fits-all approach". Although this was nothing new, the setting of formal multi-stakeholder consultations forced the officials (and also the research team) to be more elaborated in justifying the proposal. This led to some self-reflection on the secondary aspects of the proposed model such as the fee setting, waste collection, and the fund management.

Second, through this series of events these producers developed their common position and strategy. The coordination between leading ICT producers continued after they got back to Singapore. One event that came to our knowledge was their roundtable discussion on 8 July 2009. According to the presentation they shared with us, the purposes of the discussion were twofold: to update policy developments in the region and to further develop their common position that argued for the producers to have more compliance options that suited different product groups and their levels of ambition (Canon et al. 2009).

Later on we learned that they were successful in swaying the Vietnamese government from the governmental fund model. In Thailand where they felt

that the government was firm on the model, their strategy was to ask for *an opt-out option*. In their opinion, producers that manage their own waste individually or collectively should be exempted from paying the product fees. The team from Chulalongkorn University helped coordinating with the Pollution Control Department to have the ICT coalition presenting its proposal to the Thai WEEE Committee in its meeting on 9 July 2010. The reception was, however, lukewarm. The committee members challenged the producers to put concrete actions without waiting for the legal framework to demonstrate their ability to effectively manage their waste in Thailand.

Together with the strategy to organise confrontations between opposing coalitions, actions were taken to *bring in more knowledge about the proposed programme through a new social interaction*. During the first project with Chulalongkorn University, I made a suggestion to the research team to get an expert from the governmental fund in Taiwan instead of the expert from a European PRO that PCD recommended.[6] This was because the Taiwanese experiences in the management of WEEE and waste batteries were the closest to the policy proposal in Thailand but little known at the time. The Taiwan Environmental Protection Administration agreed to send a specialist for the information sharing. Most of the information about the programme in Taiwan presented in Section 4.3.1 was learnt in that event. After the workshop, it became clear to the participants that *third-party auditing would play a decisive role in the success of the proposed programme*. The cost estimation, the results of which were presented in Paper IV, therefore paid considerable attention to auditing giving it equal status to the other three supporting functions that would be performed by different organs of the government: fee collection (the Excise Department and the Custom Department), fund management (the Ministry of Finance), and the coordination and promotion of buy-back (local governments).

Last but not least, this section would not be complete if I do not mention *the cognitive contributions of the research to the policy development in Thailand*. Without undermining the importance of the qualitative research which helped preparing the ground and identifying key issues and actors, it was the quantitative research that pushed the policy dialogue to the next level. Paper IV, for example, presents the results of the cost estimation which showed *variation across product groups in terms of costs per unit*. While the cost per unit of ICT products was on average 2% of the retail price (if only portable

[6] We also tried to invite the managing director of another producer responsibility organisation in Europe but with no success.

products, just 1%), the unit cost of home appliances was on average 9% and that of lamps and batteries, 6%. This variation advised against levying a fixed rate fee as percentage of a retail price like the value-added tax, which was one option the Ministry of Finance considered as easy to implement. The results also partly explained the positions of different sectors in the electrical and electronic industries. Besides their global corporate policy on IPR, there was a tangible benefit for ICT producers to have a separate system/account for their products that have low end-of-life cost implications.

The surveys of past disposal behaviours and future preferences of Thai households presented in Paper V further challenged the assumption of the policy proposal and indicated that *Thais were not usually actively seeking to make money from all types of products although they were aware of potential financial gains*. The majority of people reported to keep their unused small electronic devices at home. In addition, more than half of the respondents would not ask for compensation for waste fluorescent lamps and batteries that they viewed as hazardous waste. The analysis of the survey results also showed the role of convenience, captured by scenarios with a pick-up offer, information, and socio-economic factors on behaviours and preferences.

The overall estimation that the buy-back programme might be able to collect about 30% of waste arising was indeed controversial. On one hand, it was lower than what the government would have liked. On the other hand, the number was still higher than what the ICT producers believed reasonable (for them) to achieve. Nevertheless, one thing became clear – *the amount of collected waste would be significantly less than the annual shipments of new products* that would sponsor the programme. To demonstrate this quantitatively we combined a Weibull function for delayed waste generation (Tasaki et al. 2001) with a logistic function for market penetration and saturation (Yang and Williams 2009, see also Section 3.3.2) to correct the errors from an infinite growth assumption in early inventory studies (in some cases by a factor of 10 in a 15-year forecast). Based on the model, we could deduce *various scenarios of fund management*.

For example, a default scenario would be the full-unit-cost upfront fees levied on every new product with a cap at 5% of the retail price. We predicted based on the estimated collection rate that in this case *the size of unspent funds* would be around THB 4.7 billion (EUR 110 million) per year or about 64% of the revenue. Predictably this led to many questions. Was this acceptable? Should the fund balance be factored to give discount for the fees in the next years? Or could it be perceived as a charge on environmental

damages of uncollected waste? Should the money be used to increase the buy-back premiums? Should money be used to support general waste management in Thailand that had been underfunded? We did not pretend that we had the answers to these questions. What we did in PCD (2010) was to chart different options and calculated the consequence in monetary term to facilitate the policy dialogue.

4.3.3 Preliminary policy outputs

Some lessons learnt from the previous projects were utilised in the law drafting project with also consisted of more consultation with the local governments. This section outlines the main product of the project. *The draft Royal Decree prescribing rules, procedure, conditions and management of revenue generated from product fees* (henceforth the "draft Decree") was delivered to the Pollution Control Department in March 2011. The draft Decree was based on the former PCD draft Act but also included several elaborations and some significant modifications:

- *General provisions* state the purpose that the money will be raised through the product fees for the management of used products. The effective date will be one year after the decree appears in the Royal Gazette. The general provisions also clarify that the Ministry of Finance will have the power to set the fee rates while the Ministry of Natural Resources and Environment will have the power over the operational details of the buy-back programme. Some legal definitions are added and altered after the international review of WEEE laws. Because there is only one word in Thai – "ผู้ผลิต" – for manufacturers and producers, it is defined to include original equipment manufacturers and brand owners. The term "ผู้นำเข้า" is defined separately for importers according to the customs law.

- *Chapters 1-4 – Collection of Product Fees, Registration of the Product Fee Payer, Submission of Form and Payment of Product Fees, and Estimation and Appeal against Product Fees* – containing 52 sections, elaborate on the collection of product fees, the registration of producers, the submission of payment, and special provisions about reassessment of the payment and appeals. These chapters are based on close collaboration with the Excise Department that will be the nodal agency for fee collection in the future.

- *Chapter 5 – Exemption, Relaxation, Reduction and Refund of Product Fees* – is added in response to the concerns of the electrical and electronic industries in four ways. First, it clarifies that exports are exempted from paying the fees. Second, the fees are not levied on the main components that can be proved to be part of other covered products but are payable for components of assembled products of which the producers can be hard to identify. Third, it allows the minister to issue rules that reduce the fees for environmentally friendly products and for other economic or social reasons. Fourth, it allows producers to conclude a covenant with the minister to manage their used products individually or collectively and get exemptions or refunds according to the quantity or the expenses they manage.

- *Chapter 6 – Accounting and Recordkeeping Practices* – outlines the recordkeeping rules which among other things require records to be kept at least five years for the purpose of fee collection.

- *Chapter 7 – Management of Product Fees* – outlines the financial management of the fund which will be deposited in a separate account, "Product fee account", in the Environmental Taxes and Fees Fund. Although most expenses are directly related to the management of used products including the development of infrastructure, databases and the administration of the fund, it is possible to use the money for clean-up sites affected by uncollected used products or other activities related to environmental management. In addition, the fee collecting agency is allowed to retain 3% of the revenue for their work.

- *Chapter 8 – Buy-back Centres* – elaborates on the rights and responsibilities of buy-back centres. One important addition is that it demands a municipality with more than 50,000 inhabitants and every district in Bangkok to have at least one buy-back centre. Other local governments can choose to set up the facility or give a licence to interested parties to operate buy-back centres in their jurisdictions. Similar to the PCD draft Act, governmental and non-commercial centres are exempted from the licence fees. To expand the buy-back networks, another addition encourages the fund manager and local governments to work with retailers and repairers to act as an extension of the buy-back centres. These actors are allowed to buy used products at rates lower than the official rates.

- *Chapter 9 – Budget Administration and Financial Reporting* – is added according to the consultations with local governments who are concerned that under the existing financial regulations the paper work can make it impractical to make each buy-back payment. Therefore, it proposes to allow local governments to set up a local fund where the money from the product fees can be managed separately. This is similar to an existing arrangement for the money from the tobacco and alcohol taxes they get from the Thai Health Promotion Foundation. The local fund can have its own accounting and bookkeeping rules according to the standards set by the main fund under the Ministry of Finance.

- *Chapter 10 – Management of Used Products* – outlines the management of used products. However, because the transportation and the treatment have already been regulated under the factory and hazardous substance laws (under the authority of the Department of Industrial Works), this chapter mainly focuses on the requirements of the buy-back centres and reporting obligations. A buy-back centre has to buy back at the rates announced by the fund and transport the used products to authorised treatment facilities without dismantling them. Based on the review of international practices, a provision is added obliging the producers to provide the dismantling and treatment information of the products. Authorised treatment facilities have an obligation to report to the fund the quantity of used products they get from the buy-back programme, recycle, and send to other authorised treatment facilities or disposal. The inspection and supervision of these activities are outlined in *Chapter 11 – Inspection and Supervision*.

In addition to the draft Decree, the research team also proposed several amendments to the FPO draft Act and existing laws including a technical committee to review the fee rates, an exception in the city-planning law for the buy-back centres to be set near communities, a condition on the licensing of waste dealers that they must not deal with regulated waste unless they are part of the buy-back systems, and penal provisions. At the time of writing, the policy process in Thailand was put on hold after the Vejjajiva administration called for a general election in July 2011. It was understood that after the political window reopened, the policy package would be presented to a new cabinet and, if approved, to the parliament. Nevertheless, the legal framework is not likely to be enacted in 2013 as initially envisioned in the Thai WEEE Strategy.

4.4 Summary

Thailand is one of the non-OECD countries that have been working on a new policy to improve the management of WEEE. As far as EPR is concerned, the basic tenet of the policy proposal in Thailand was to take it as a way to interpret the polluter pays principle. The producers of targeted products are expected to pay mandatory fees to support an environmental protection programme of the government. The programme in this case is a national scheme to buy back regulated WEEE for environmentally sound treatment in order to reduce health and environmental hazards from the mismanagement of the hazardous waste.

The proposed model was based on an understanding about the local context and negative lessons drawn from mainstream implementation models of EPR in OECD countries. Underlining the proposal about product buy-back was an assumption that financial incentives would be needed to consolidate WEEE collection and make it available to the formal treatment sector. EPR was seen as a financial means to make this happen. The policy development was guided by pragmatism, not the principle that each producer should be responsible for the management of his/her own end-of-life products. Little consideration was given to programme arrangements to encourage the producers to get more involved in the end-of-life management such as physical responsibility and competition.

Despite its merits and potential, this chapter finds that the policy proposal was too restrictive to realise the upstream objectives of EPR. It was just a waste policy but by no means a product policy. In addition, it suffered from social and cognitive fixations that might further compromise its ability to achieve the downstream improvements it so desired.

To help advance the policy solutions, network management strategies were employed. They aimed at creating a more evidence-based and participatory policy-making. Technical information was generated to enhance learning about the proposed programme both by positive lesson drawing from the international experiences and by deeper understanding of the local context. The enhanced understanding about the proposal also helped identifying dormant actors whose resources were important to the policy but who had yet to play active role in the policy network. Actors who held opposing views were also encouraged to develop alternative solutions.

The benefits of the network management are reflected in the revision of the draft law with a new draft containing some improvements compared to its predecessors. The governmental fund model becomes not only more complete about its implementation details than before but also becomes more flexible opening to new possibilities. However, there seems to be a limit to the learning and cooperation in the policy process. Opposing groups hold strong views and compromises are hard to reach even with the steering efforts and the support of technical information. With this rather negative note, the next chapter will examine the policy process in which WEEE policy has been developed in non-OECD countries in order to understand the force behind advocacy, learning, and policy changes.

CHAPTER

FIVE

5. Extended Producer Responsibility in non-OECD countries?

EPR has increasingly become a subject of policy discussion in the management of WEEE in non-OECD countries. As a policy principle, the concept can lead to the most profound type of policy changes – a paradigm shift to a worldview that sees solid waste as a problem embedded in the product and system design. Based on this problem theory, the waste policies should try to promote upstream product and system improvements in addition to traditional downstream improvements in waste management.

Chapter 2 presented a number of implementation models to manage WEEE as seen in industrialised economies and comments on their effectiveness in reaching the upstream and downstream goals of EPR. The advantages and disadvantages of EPR-based interventions under the prevailing conditions of emerging and developing economies were further explored in Chapter 3. Chapter 4 presented the action research that tried to advance EPR-based solutions for the WEEE problem in Thailand. The knowledge gained from the programme evaluation and the contextual analysis was incorporated in the network management strategies. The preliminary policy output was, however, far from a paradigm shift. Notwithstanding the improvements in the draft law, EPR was perceived largely by the policy-makers in Thailand as a means to finance the government-operated waste management system with little considerations of the upstream objectives.

This chapter shows that Thailand is by no means an isolated case. Section 5.1 recounts the policy development in several other non-OECD countries that gravitated towards a national fund model. However, it also shows that the merit of this model has been challenged by a group of ICT manufacturers who subscribe to individual producer responsibility (IPR). To understand the policy process with opposing views and coalitions, the

insights from the Advocacy Coalition Framework are used to explain the advocacy coalitions, policy changes, and policy-oriented learning in the development of WEEE policies in non-OECD countries.

5.1 Policy Trends in non-OECD Countries

There are at least two trends in the development of WEEE policies in non-OECD countries. The first is *the harmonisation of product standards with the restriction in the RoHS Directive*. As mentioned in Section 2.3.2, *China* issued administrative measures known as China RoHS in 2006. The measures require the producers to get their products tested by an accredited laboratory in China before putting them on the Chinese market. Similar to the labelling scheme in Japan, mandatory labels are affixed on products with the concentration of the six hazardous substances exceeding the standards. Section 4.1 reports that in *Thailand* the government adopted the restrictions and the exemptions in the RoHS Directive as general standards under the existing product standard regime in 2008. According to my interviews with the authorities in Thailand, the general standards would be made mandatory in the future. Both the Bill that passed the Senate in *Argentina* in April 2011 and *the e-waste (Management and Handling) Rules* that was issued in *India* in May 2011 contained the restrictions of the six substances in new products. It is worth noting that, while China, Thailand, and India had a narrower scope of targeted products for downstream measures than the comprehensive scope of the WEEE Directive or the Bill in Argentina, the scope of their RoHS-like measures virtually covers all types of EEE.[7]

The second trend which is the focus of this thesis is *the popularity of a national fund model. Thailand* is not the only non-OECD country that might have a national fund for the management of WEEE. The *China* WEEE Ordinance has a provision that requires the producers of the regulated products to pay fees to the governmental fund. The Ordinance which has been developed by the National Development and Reform Commission (NDRC) since 2004 was enacted in 2009 and came into force on 1 January 2011. The Official Announcement on 8 September 2010 listed televisions, refrigerators, washing machines, air conditioners, and computers as the first set of regulated products. However, the Ministry of Finance in China had not

[7] Although the term "electronic information products" in the China RoHS Measures does not cover directly home appliances, it includes a number of electronic components found in these products and a range of other products and materials.

finalised the details of the funding mechanism including the size of the fees and the payment procedure even after the Ordinance became effective (Zhang 2011).

The Bill that received a victorious 54:1 vote in the Senate and is now under the review of the Lower Chamber of the parliament in *Argentina* is also proposing a state fund for the management of WEEE, despite its strong leaning on EPR or *Responsabilidad Extendida del Productor* in Spanish. On one hand, the influence of WEEE policies in Europe and North America on the Bill that was originally presented by Senator Filmus on 8 October 2008 and was later sponsored by Senator Martínez is unmistakable. The Bill has the ten product categories of the WEEE Directive plus one additional category of batteries, the crossed out wheeled bin symbol for source separation, and a collection target of one kilogram per capita. There are also convenience standards for the collection of WEEE. Similar to some e-waste programmes in the USA (see Section 2.3.3), towns with more than 10,000 inhabitants must have at least one collection centre. In addition, retail shops larger than 400 square metres that sell EEE will have to provide a reception area for WEEE. On the other hand, the Bill in Argentina is more restrictive on the compliance than the policies in Europe and North America with an exception of the e-waste recycling programme in California. The default compliance option for the producers is to pay mandatory recycling fees to a new autonomous state fund called *Fondo Nacional de Gestión de RAEE*.[8] More information about the policy development in Argentina can be found in Paper VI.

In *South Africa*, even though a state fund has not been discussed directly, a single national compliance system with a mandated advanced recycling fee that was suggested in the first draft of the *National Waste Management Strategy* might lead to a similar result. The draft was developed by the Department of Environmental Affairs (DEA) under the *National Environmental Management: Waste Act*, 2008, and appeared for public comment in March 2010. The proposal of a mandatory fee, called the "green fee", came from the e-Waste Association of South Africa (eWASA), a subsidiary body of the Information Technology Association (ITA) of South Africa. The Swiss developmental agency, Empa, was instrumental in the start-up of the eWASA as a pilot project to test the viability of a producer responsibility organisation in South Africa (Lawhon 2011). Later the eWASA has turned into a multi-stakeholder organisation with a broad base of membership. The green fee set at 10% of

[8] RAEE is WEEE in Spanish. It stands for Residuos de Aparatos Eléctricos y Electrónicos.

the retail price is proposed as a way to finance the management of e-waste on a continuous basis (Lawhon 2011).

On one hand, the national fund model is an attractive strategy for the management of WEEE in non-OECD countries. At the front end of the model, the responsibility to pay the fees can be universally applied to anyone who puts the regulated products on the market including the suppliers of key components of disassembled products and the importers of used products (see Section 3.3.1). At the back end, this can be a way to raise money to improve downstream waste management processes in these countries. The analysis in Section 3.3.3 indicates that the collection of WEEE and the formalisation of the treatment sector might require considerable resources in a non-OECD context.

On the other hand, as mentioned in Section 4.3.1, the model is an awkward implementation from an EPR perspective. It typically lacks mechanisms and conditions that can encourage upstream product and system improvements. In addition, policy proposals often appear to be incomplete, missing important working details and key supporting mechanisms. Besides concerns over the efficacy of the system, there is also scepticism about the real intention behind the fundraising. While Section 3.3.2 shows that only a small fee is needed from the new products for the management of limited stock of historical WEEE in non-OECD countries, the actual policy proposals tend to suggest a fee rate that can be even higher than in OCED countries.

Leading manufacturers of ICT, who subscribe to the idea of IPR, generally oppose the national fund model. HP, the largest supplier of computers in South Africa, for example, left eWASA, an organisation it helped starting up, because of the different views on the WEEE policy (Lawhon 2011). HP lobbied for the government to allow the producers to develop alternative industry waste management plans instead of levying the mandatory green fee. Lawhon (2011) reported that the producer and eWASA had reached a certain degree of understanding about the possibility of parallel systems although this did not reflect in the first draft of the national strategy to the frustration of the ICT giant. HP later formed an alliance with other manufacturers in a separate forum exclusively for producers.

The tension has been intense in the countries where a governmental fund was proposed by the lawmakers or by the governments. Similarly to what happened in Thailand (see Section 4.3.2), a group of mobile phone and computer manufacturers negotiated with the lawmakers in Argentina to have

their own systems. The mentioning of the possibilities to opt-out or get performance rebates from a national fund system in the later versions of the Bill in Argentina and the draft law in Thailand, albeit being somewhat vague, could give the producers some relief. A real change of heart, however, came from *Vietnam*. The new draft law that came out in December 2009 removed the provisions about the mandatory fee and the state fund that appeared in the earlier version (April 2009) and received criticisms from the ICT manufacturers. Instead of the national fund model, the Vietnamese government proposed a system similar to the EPR programmes in South Korea and in some states in the USA that assign collection quotas and have performance penalties but leave the operational details to the producers (see Sections 2.3.2 and 2.3.3).

While most actions were reactionary to the proposal on the table, the ICT manufacturers did also make an anticipatory move. In *India*, after more than a year of hiatus since the Ministry of Environment & Forests withdrew its draft Rules at the end of 2006, the Manufacturers Association of Information Technology (MAIT) tabled a project to draft a legal framework in the early 2008 with its members and leading environmental NGOs. MAIT delivered to the Indian government in August 2009 the draft *E-Waste Management Rules* which suggested *inter alia* the restrictions of the six substances and IPR (financial) for new products, a market-share allocation for the management of historical waste, and concrete informative responsibilities. The influence of the industry proposal on the drafts that the Ministry circulated in 2010 was evident, although the terms such as "IPR" and "targets" and some informative requirements were removed from the governmental drafts. The *e-waste (Management and Handling) Rules* were finally published in the Gazette of India on 14 May 2011 and will become effective on 1 May 2012 to ICT equipment, televisions, refrigerators, washing machines, and unit-type air conditioners. More information about the policy development in India before the enactment of the Rules can be found in Paper VI.

5.2 Advocacy Coalition Framework

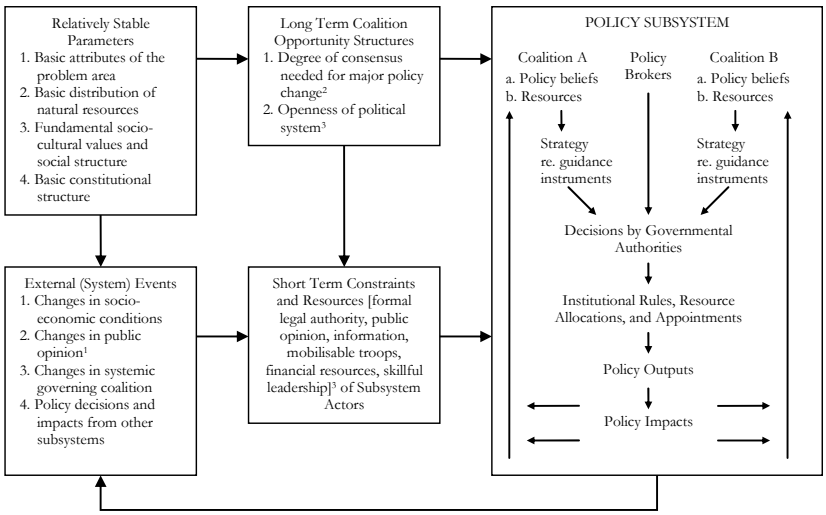
The description of the policy development in several non-OECD countries shows not only trends in policy change but also other interesting patterns of advocacy, changes, and learning in the policy process. The advocacy of the ICT manufacturers is a recurring theme in several countries as well as the resistance of the overall programme design in the policy proposals to

change. In order to understand the forces behind these patterns, Paper VI introduced a well established theory of the policy process in Political Science, the Advocacy Coalition Framework (ACF).

The ACF Sabatier was developed by Sabatier and Jenkins-Smith (1988) as an alternative approach to the stage model[9] that failed to capture the reality of public policies that deal with "wicked problems" involving goal conflicts and technical disputes among different stakeholders (Hoppe and Peterse 1993). Although the ACF was born of the American pluralist politics, the framework has become more versatile with growing empirical evidences from other countries that were periodically reviewed in the revision of the framework by the original theorists (Sabatier and Jenkins-Smith 1993, 1999; Sabatier and Weible 2007).

The ACF has three "foundation stones": a policy subsystem as its locus, an advocacy coalition as its unit of analysis, and a micro-level "model of individual" that is influenced by social psychology (Sabatier and Weible 2007). The framework assumes that, because of the scarcity of attention in the high level of politics that can only be devoted to a handful of issues at a time, most policy-making happens in relatively autonomous subsystems within the broader political and socio-economic system. It is further assumed that policy actors in the subsystems hold strong beliefs which they try to translate into actual policy. The framework distinguishes between three levels of beliefs: deep core beliefs (e.g. being liberal or conservative); policy core beliefs (e.g. the goals of waste policies); and beliefs about secondary aspects of the policy (e.g. the effectiveness of policy instruments and fine tuning). The ACF assumes that policy core beliefs are the "glue" of advocacy coalitions in which policy actors share resources and develop joint strategies to influence decisions and policy outputs in the subsystem. Figure 5-1 presents the revised diagram of the framework.

[9] The stage model was the mainstream at that time in the study of public policy. Nakamura (1987) called it the "textbook approach" to policy studies. The model assumed that issues flowed through successive stages from issue identification to problem definition to option development to implementation and finally to evaluation. The concept of policy cycle was the stage model presented in a loop format. Regardless of the presentation, however, the model did not articulate any causal explanation about the drivers that move policies from one stage to another. For criticisms of the stage model see Sabatier and Jenkins-Smith (1993) and Parsons (1995).



Note: [1] 1993 Revision; [2] 1998 Revision; [3] 2005 Revision

Figure 5-1 Diagram of the Advocacy Coalition Framework

Source: Sabatier and Weible (2007)

The ACF is interested in major policy change over a decade or more. Two critical paths to policy change are policy-oriented learning and external perturbations. Policy-oriented learning is a process in which search and adaptation to new information lead to relatively enduring alternations of beliefs about the policy (Sabatier and Jenkins-smith 1993). However, because policy core beliefs are resistant to change, the advocacy coalitions and the policy core attributes of a governmental programme tend to be stable over a long period. In the ACF, significant external perturbations, such as structural changes in the society, changes in public opinion, changes in the government, or policy outputs from other subsystems, are a necessary cause of major policy change. These hypotheses about policy change are in line with incrementalism (Lindblom 1959) and the punctuated equilibrium model of policy change (Jones and Baumgartner 2005). The basic twelve hypotheses of the ACF on advocacy coalitions, policy change, and policy-oriented learning (Sabatier 1998) will be discussed in the next three sections in relations to EPR and the policy process in non-OECD countries.

5.3 Understanding Advocacy, Changes, and Learning in the Policy Process

5.3.1 EPR and advocacy coalitions

The ACF hypothesis: On major controversies within a mature policy subsystem when policy core beliefs are in dispute, the line-up of allies and opponents tends to be stable over periods of a decade or so.

EPR has become a major controversy in the development of WEEE policy in non-OECD countries. Stakeholders have diverging views on who should be responsible for the management of WEEE. Paper VI found that the line-up of believers, sceptics, and opponents of EPR was not only stable over time but also somewhat similar across the three cases. The positions of some stakeholders will be highlighted and discussed below.

The ACF hypothesis: Actors within an advocacy coalition will show substantial consensus on issues pertaining to the policy core, although less so on secondary aspects.

Figure 5-2 reproduces from Paper VI the positions of stakeholders in India where a coalition is formed among some actors at the top right corner of the chart, including ICT manufacturers and their association, environmental NGOs, and developmental agencies. *The shared belief in EPR was a policy core belief that motivates these actors to coordinate and develop an EPR-based legal framework*. Instead of working with the rest of the industries, leading ICT manufacturers were seen working with the very NGOs that used to target them in the campaign asking for the manufacturers to show their end-of-life responsibility. This coordination was possible even though they had different opinions on the other aspects of the policies such as the scope of the programme and the speed of the legislation. According to the ACF, sharing policy core beliefs helps lowering the transaction costs in the collective actions. While I was working with Greenpeace in India, it was noticeable that the NGO needed more campaign efforts targeting major domestic manufacturers of computers to endorse IPR than in the case of the local offices of multinational corporations that had already had a global policy on IPR.

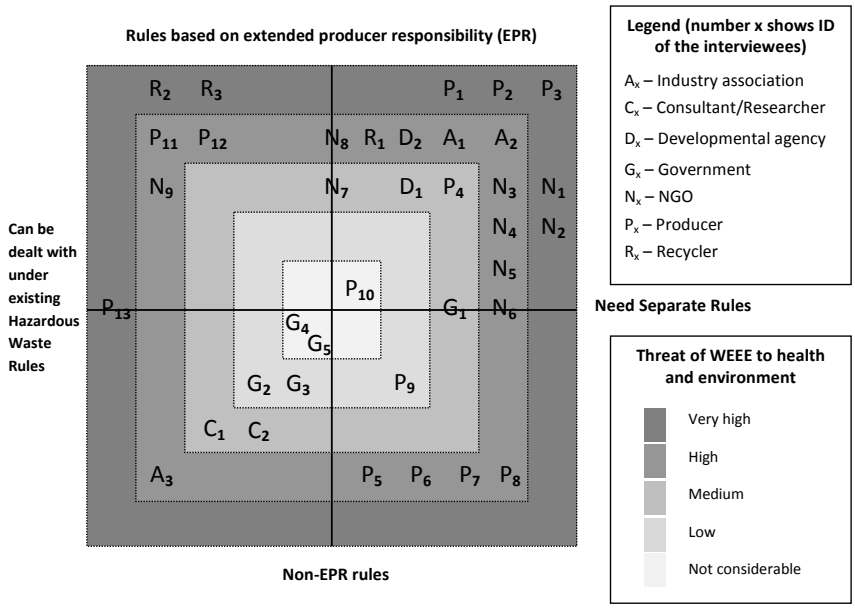


Figure 5-2 Beliefs about three aspects of waste electrical and electronic equipment (WEEE) policy in India

A lack of any real consensus other than their dislike of EPR might explain *the absence of a notable anti-EPR coalition in non-OECD countries* (see the case of an anti-legislation coalition in the UK before the ELV Directive in Paper I). Local manufacturers, importers, and distributors of EEE in these countries were not familiar with EPR and had no interest in WEEE. Large international manufacturers of home appliances, lighting equipment, and batteries, while conceding that they could play a role to improve the end-of-life management, tended to believe that it was not their responsibility to take the lead but the society should share the responsibility. Waste dealers and small local recyclers often saw EPR as a threat to their lucrative businesses. Although these actors might to some degree prefer a status quo, the unsatisfactory state of affairs in non-OECD countries especially backyard recycling was too obvious to make this a viable position. In this respect, eWaste Alliance – a group of small local refurbishing and recycling businesses in Cape Town, South Africa, that tried to develop a participatory guarantee system for responsible handling of e-waste (see Lawhon 2011) – and similar attempts to encourage self-transformation of the informal sector

in non-OECD countries are interesting. If successful, they can provide *a platform for a legitimate rivalry coalition to EPR* in the future.

> *The ACF hypothesis: Elites of purposive groups are more constrained in their expression of beliefs and policy positions than elites from material groups.*

Although the diversity in the industries seems to support the hypothesis that material groups are less constrained to choose their positions than purposive groups, the consistency in the positions of multinational corporations in different countries indicate the opposition. *Multinational corporations are subject to the expectation of the consumers and the society to uphold a single standard wherever they operate.* The pressure is particularly high on those endorsing IPR. Our interviewees from these firms in India, Thailand, and Argentina all referred to the global policy of the company. The manager of HP in South Africa was also reported to be convinced by his international office to abandon the national model developed by eWASA which he initially supported (Lawhon 2011). The fact that the ICT manufacturers and environmental NGOs have worked together in various countries and in international platforms such as MPPI and PACE (see Section 3.1) further supports the suggestion by Liftin (2000) that advocacy coalitions are increasingly operated along the "domestic-foreign frontier".

> *The ACF hypothesis: Within a coalition, administrative agencies will usually advocate more moderate positions than their interest-group allies.*

Despite the absence of an opposing coalition, advocates of EPR have to convince the governmental authorities in the policy subsystem. *Due to departmentalisation, governmental agencies often have a process-oriented focus on waste management.* Although the authorities are not necessarily hostile to EPR, they can be rather sceptical about the product-oriented approach that a patchwork of different product systems would not be able to provide an overall solution for the waste management processes such as collection and/or treatment. Design improvements are perceived as a nice co-benefit to have but not a primary goal of waste policy. In Thailand, while the officials were open to sector-specific concessions, they tended to insist in having universal measures, such as mandatory fees, a national fund, and a national buy-back scheme, as a subsystem-wide default option. This supports:

> *The ACF hypothesis: An actor (or coalition) will give up secondary aspects of his (its) belief system before acknowledging weaknesses in the policy core.*

5.3.2 Drivers, moderators, and mediators of changes

> *The ACF hypothesis: Significant perturbations external to the subsystem (e.g. changes in socio-economic conditions, public opinion, system-wide governing coalitions, or policy outputs from other subsystems) are a necessary, but not sufficient, cause of change in the policy core attributes of a governmental program.*

Because of the inertia in the policy subsystem, ACF predicts that a major policy change requires external perturbations to tip off. Section 2.1 describes the structural change in emissions in industrialised countries that culminated in a shift to product-oriented policies in the 1990s. The privatisation movement during the same period created a favourable context for the reception of EPR. The policy change then gained momentum with an increase in the adoptions of EPR policies among the members of OECD resulting in what Ikenberry (1990) called "policy bandwagonning".

The bandwagonning continued to stimulate changes in non-OECD countries. Section 4.1 shows that WEEE became a salient issue in Thailand after the adoption of the WEEE and RoHS Directives in the EU. The EU policies were also an inspiration for the policy development in Argentina. As Dolowitz and Marsh (2000) suggest, global economic pressures, communication technologies, and international organisations have made policy transfer a common feature of policy-making. Developmental agencies, such as the Swiss Federal Laboratories for Material Testing and Research (Empa), and the Japan External Trade Organization (JETRO), were instrumental in spreading the knowledge about the implementation of EPR in their motherlands to policy-makers and practitioners in non-OECD countries. The dissemination of information shaped the image of EPR in the receiving countries. In India and in South Africa it was the Swiss's model with a national producer responsibility organisation. In Thailand it was the physical responsibility of the Japanese model. However, the reception of foreign models was not always positive. While the European models were well received in India, South Africa, and Argentina, policy actors in Thailand were rather doubtful about the applicability of the Japanese model. This might explain why the policy proposal in Thailand made a reference to the polluter pays principle instead of EPR.

The other external factors described in the ACF played *a moderating role* on the impacts of policy bandwagonning on the development of WEEE policies in specific countries. *The RoHS Directive has hit hard the countries with*

exported-oriented electrical and electronic industries. It was thus no surprise that China and Thailand were quick in formulating measures to harmonise the product standards. India and Argentina, on the other hand, could afford to take more time to draft one legal framework that had the upstream restriction together with other downstream measures. A slow development of downstream measures might result from *the perceived lack of urgency*. Although emissions from backyard recycling, which are partly driven by imports of WEEE from OECD countries (see Section 3.1), are acute, the problem of post-consumer WEEE has not yet ripened in non-OECD countries (see Section 3.3.2). Paper V showed that just about half of the respondents in the household survey in Thailand had retired one of the selected equipment before 2009 and only about a third had heard of WEEE. *The political instability* in Thailand after the military coup d'état in September 2006 further delayed the change. In addition, the arguments that the producers should have control over the end-of-life management and that competition would increase efficiency might not resonate well with the public opinion in the countries with *the legacy of failed privatisation*.

In addition, *external perturbations do not determine changes but rather offer "window of opportunities"* (Kingdon 1995) *to policy actors to advance (or protect) their agenda*. Those who seek major change can try to heighten the pressures. As mentioned in Section 3.1, the environmental justice groups replicated the investigation done in Guiyu, China, to highlight the problem in other hotspots. When the problem with WEEE was little known in the society, Greenpeace Argentina was keen to have waste batteries in the same policy package in order to capture the public awareness on the hazardous waste. The same motivation might be behind the move by the Thai WEEE Committee to include batteries after the prioritisation exercise (see Section 4.1). On the other hand, Paper VI reported the attempts by some administrative agencies in India and anti-EPR trade representatives in Argentina to calm down the "hype" about WEEE by doubting the significance of the quantity or the toxicity of the waste. Sympathisers to the less formal businesses tried to show that the imports of used electronics were for reuse and beneficial to the environment as well as to the emerging and developing economies (Kahhat and Williams 2009). Sceptics could also select examples to demonstrate the problems with EPR in the existing WEEE programmes and highlight its disadvantages in non-OECD countries (see Section 4.3.1).

The ACF hypothesis: The policy core attributes of a governmental programme in a specific jurisdiction will not be significantly revised as long as the subsystem

> *advocacy coalition that instituted the programme remains in power within that jurisdiction – except when the change is imposed by a hierarchically superior jurisdiction.*

The comparison of the policy development in non-OECD countries also shows *the effect of jurisdiction on the degree of policy change* which is classified into three orders of changes (see Section 2.2). In India, WEEE was handled in the hazardous waste policy subsystem under the jurisdiction of the Ministry of Environment & Forests. The *e-waste (Management and Handling) Rules* represented a continuation of the authorisation in the hazardous waste regime. In Thailand, the Pollution Control Department (PCD) succeeded in carving out a new subsystem with a focus on the collection of WEEE from the existing hazardous waste regime which was under the control of the industrial authorities. The policy proposal from PCD could lead to a significant change in the governmental programme in terms of policy instruments. An even more profound change could be achieved through the Bill imposed by the Senate in Argentina. The Senate has a broader jurisdiction and were less constrained by departmentalisation and the traditions in the existing subsystem than the governmental agencies. The same can be said for the China WEEE Ordinance which was initiated by the country top planning agency. The Bill in Argentina and the Ordinance in China contain more upstream provisions than the Rules in India and the draft law in Thailand.

5.3.3 Learning about WEEE and EPR

> *The ACF hypothesis: Policy-oriented learning across belief systems is most likely when there is an intermediate level of informed conflict between the two coalitions. This requires that: (a) Each has the technical resources to engage in such a debate; and that (b) The conflict is between secondary aspects or one belief system and core elements of the other or, alternatively, between important secondary aspects of the two belief systems.*

Although the idea that the producers should have the responsibility and the control over the management of WEEE has not yet been widely accepted in the subsystem in non-OECD countries, *learning about secondary aspects is possible*. The pro-IPR manufacturers in the ICT sector often shared the information about the cost comparison in Europe with the lawmakers and the authorities to stress the merit of competition and benchmarking in the

system. In addition, in Thailand the results of the cost estimation for the proposed buy-back scheme (see Paper IV) made it understandable why the ICT manufacturers were against the proposal. The technical cost modelling showed that the recycling of most ICT products did not entail net operational cost. Therefore, their estimated costs were almost exclusively related to the buy-back incentive and the administration of the government-operated system. Although the calculated fees of the targeted ICT products were very small compared to home appliances, they were much higher than the fees the producers paid in existing WEEE programmes abroad (see Paper IV).

> *The ACF hypothesis: Policy-oriented learning across belief systems is most likely when there is a forum which is: (a) Prestigious enough to force professionals from different coalitions to participate; and, (b) Dominated by professional norms.*

The network management in Thailand (Section 4.3.2) also taught a lesson about *the importance of the nature of the learning forum*. Organising confrontations in a forum dominated by professional norms such as in the consultative workshops of the study project stimulated information exchanges and learning between coalitions. Confrontations in an official committee meeting even with almost the same set of people could, on the other hand, encourage the "devil shift" – the tendency to exaggerate the power and the malice of the opponents (Sabatier et al. 1987). The same can be said with parliamentary hearings in which stakeholders wear their political hats.

> *The ACF hypothesis: Problems involving natural systems are more conducive to policy-oriented learning across belief systems than those involving purely social or political systems because in the former many of the critical variables are not themselves active strategists and because controlled experimentation is more feasible.*

My research and policy experiences, including those described in Section 4.3.2, support ACF assertions that problems involving natural and engineering systems were conducive to policy-oriented learning across belief systems. By now at least two issues have been settled that non-OECD countries are going to experience *a steep increase in the amount of WEEE in the next 10-15 years*; and, that *backyard recycling is a health and environmental hazard.* Being scientific and quantitative helps establishing the "facts". Despite the dramatic footage being showed by environmental justice groups, it was still possible when I started the research in India to find their opponents who preferred status quo dismissing it as hype. Nevertheless, Section 3.1 shows

that the accumulated evidences that the NGOs amassed were sufficient to move many other stakeholders, such as the international bodies and the developmental agencies, to work on the issue. This supports:

> *The ACF hypothesis: Even when the accumulation of technical information does not change the views of the opposing coalition, it can have important impacts on policy – at least in the short run – by altering the views of policy brokers.*

While being able to stimulate learning, *technical information is far from resolving policy conflicts.* Despite the projected increase in WEEE generation, it remains a normative question whether the policy intervention should be preventive or reactionary. The technical aspect of the treatment and recycling system might not be controversial but its economic and social implications can be a subject of hot debate between utilitarianism (a course should be selected that maximise the benefits) and deontological ethics (principles and rules should be respected). Waste collection involves a complex social system with probabilistic psychological and behavioural theories and often perplexing statistics (see Section 2.4.2) which increase the difficulty of cross learning between people with different beliefs about the civic duty, the take-back responsibility, and the ownership over the resources in used products.

> *The ACF hypothesis: Problems for which accepted quantitative data and theory exist are more conducive to policy-oriented learning across belief systems than those in which data and theory generally qualitative, quite subjective, or altogether lacking.*

The demand for quantitative evidences and theories to stimulate learning between belief systems might explain the enduring controversies around EPR and upstream improvements. While the focus on influencing product and system designs is its selling point, positive evidences of upstream improvements beyond the compliance with the restriction of hazardous substances are scattered (see Section 2.4.1). So far the only seminal work that attested the impacts of EPR on design changes was Tojo (2004) but it was based on data from qualitative interviews and set at the onset of the programmes in Japan and in Sweden. Although later studies in Japan reaffirmed the findings (DTI 2005; Ogushi and Kandlikar 2007), the subsequent evaluation in some Europen countries produced contradictory results (Gottberg et al. 2006; Røine and Lee 2006). A lack of subsystem-wide performance indicators, implementation slippages, and the problem of attribution contribute to the struggle to produce robust intervention theory and technical information about whether and how EPR programmes promote upstream improvements in complex products.

5.4 Summary

There are two trends in non-OECD countries that attest to the influence of EPR on the policies for the management of WEEE. First, several major non-OECD countries have adopted or are in the process of adopting measures to restrict or discourage the use of six substances in all new EEE. Such measures have already existed in OECD countries in order to make new WEEE less toxic than historical WEEE. Second, there have been proposals from lawmakers and governmental agencies to have the producers responsible for the separate management of selected WEEE at least by paying mandatory fees to a national fund. However, the way EPR is interpreted as financial responsibility in the national fund model receives a lot of criticism from ICT manufacturers who are supporting IPR.

This chapter borrowed insights from the Advocacy Coalition Framework into the policy process. It showed that the hypotheses of the framework about advocacy coalitions, policy change, and policy-oriented learning are applicable to the making of WEEE-related policies in non-OECD countries.

The prediction that external perturbations are necessary for major change in the policy core attributes of governmental programmes led to the identification of the earlier shift in waste policies towards EPR in OECD countries as the main trigger of the policy development in non-OECD countries. This was evident in the diffusion of measures similar to the EU's RoHS Directive. Other external forces, including the broader socio-economic conditions, public opinion, and the system-wide politics, moderated the effect of policy bandwagonning. In the rare event that an initiative comes from the high level politics, such as the Senate in Argentina, bandwagonning can lead to a profound change. However, the WEEE management issues, other than the substance restrictions, were usually dealt with in the existing waste policy subsystem in non-OECD countries.

Policy actors play a mediating role in the learning about WEEE programmes in OECD countries. EPR was seen as a mainstream response to the WEEE problem in OECD countries. Developmental agencies from countries with EPR programmes played a key role in promoting lesson drawing in non-OECD countries. However, at the end of the day the policy-makers in non-OECD countries are the ones who draw the lessons based on their belief systems. In several non-OECD countries, the national fund model was their interpretation on how EPR should be implemented in their own countries. This interpretation was grounded on the belief that a single national system

would be needed to implement desired improvements in the collection and treatment of WEEE in a unified manner across the country, and that the producers were not keen on end-of-life management of their products and would prefer a simple way to discharge their responsibility.

The proposed national funds, especially those that would be administered by the governments, however, faced strong opposition from a sector in the electrical and electronic industries. Leading ICT manufacturers, most of which are multinational corporations, prefers a more flexible approach that allows them to explore options to pursue IPR. They generally believe that the responsibility should come with the control and the producer should be able to choose the option that is most advantageous in dealing with his/her products. The negotiations between the lawmakers, or the governmental agencies who proposed the national fund model, and the ICT manufacturers were a recurring theme in the policy process. The manufacturers also made anticipatory moves in a country where such a model had not yet been developed. The belief in E/IPR in some cases led them to join hands with environmental NGOs to advance EPR-based solutions.

As far as EPR is concerned, the cross learning between the specialists within the established waste regime in non-OECD countries and the pro-EPR coalitions has been difficult. The waste subsystem was, and is going to be, at least in a foreseeable future, dominated by a process-oriented view. While the waste specialists were not openly hostile to EPR, they appeared uncomfortable to fully embrace the product-oriented perspective, being sceptical whether the patchwork in various product systems driven by groups of producers would be able to provide a subsystem-wide answer to the waste problem. In addition, they might not be convinced that the upstream goals of influencing product design and system improvements should belong to waste policy. Nevertheless, the outcomes of the negotiations between the policy-makers and the ICT manufacturers in Thailand and in Argentina show that it is possible to achieve limited compromises that can make the system more flexible. The information can be supplied to the authorities to show that the properties of the products or the sector are not conform with the general assumptions of the national fund model and the specific concessions required can be made without considerable effects on the overall design of the system.

CHAPTER

SIX

6. Conclusions

6.1 Revisiting the Research Question

Against the backdrop of a growing interest in applying EPR to the management of WEEE in non-OECD countries, this research set out to answer the following research question:

How can EPR work for the management of WEEE in non-OECD countries?

Principally, it is found that an EPR programme has a potential to divert WEEE going to backyard recycling to the formal treatment sector. The implementation of such policy in industrialised countries has showed that at the minimum EPR programmes have diverted a significant amount of hazardous waste from landfills by separately collecting and forwarding WEEE to authorised treatment facilities. Because WEEE causes much more damage in uncontrolled recycling processes than in sanitary landfills, the environmental benefits from diverting it to safe and efficient treatment processes can be even greater in emerging and developing economies. In addition, the evaluation of existing WEEE programmes shows that, although less common, progressive elements of EPR programmes, such as the restriction or the mandatory declaration of hazardous substances and individualisation of physical and financial responsibility, can stimulate product redesign and innovations in the treatment and reutilisation of WEEE that make the end-of-life management easier, and more cost-effective than it otherwise would be.

The analysis of the material flows in non-OECD countries suggests two concrete means that can be considered when designing EPR programmes to limit the flow of WEEE to backyard recycling. First, the inclusion of importers of used products as responsible producers in the programme can

discourage fault declarations of WEEE and strengthen the control of transboundary movement of hazardous waste to the non-OECD country. Second, for WEEE generated in the country, the resources from an EPR programme, such as the fees from the manufacturers and the importers of EEE, that are going to be available to the formal treatment sector can reverse the incentive structure in the recycling industries and promote formalisation. The key is to use the resources to make WEEE available to the authorised treatment facilities, for example, by investing in the collection system that offers convenience to the end users and/or gives financial incentives to existing collectors to deliver WEEE to the formal treatment sector.

The most challenging obstacle to the implementation of EPR is the potential free riders in non-OECD countries. Those who put assembled, counterfeit, and unbranded products are not likely to be cooperative in an EPR programme. Supplementary measures, such as market surveillance, are required to supplement EPR mechanisms in order to minimise trade irregularities such as counterfeit products. However, for assembled products it is possible to include the suppliers of key components as responsible producers in the programme. This requires at least financial responsibility to be put at an early point in the product supply chain. In addition, a base collective compliance option that does not require high transaction costs between them should be available to component suppliers, importers of used products, and other small market players. The collective entity can also help identifying free riding activities.

Despite the challenges, this research shows that the relatively small stock of historical products in non-OECD countries is advantageous to the implementation of EPR. Because the burden from the historical stock is not as high in non-OECD countries as in OECD countries, EPR programmes can be developed in these countries with a focus on the new products the design of which can still be improved. Progressive mechanisms, such as financial guarantees that reflect the end-of-life costs of the products and send feedback to the designers, can be experimented in this context. Such a mechanism, even though prescribed in the WEEE Directive, has so far been neglected in OECD countries because the combined costs of the guarantees and the fees for the management of a large amount of historical WEEE makes it prohibitively unattractive.

However, the analysis of new policies and policy proposals in non-OECD countries, in particular the national fund model, shows that the potential

might not be materialised when EPR is interpreted narrowly as a means to raise money. It is found that, when the policy was made in the existing waste subsystem, the upstream goals of EPR were likely to disappear. The policy analysis also shows a mismatch between the proposed policy and the implementing context. The idea to link the fees with the retail prices, for example, is unfair not only because the end-of-life costs do not correlate with the prices of the products but also because it would be too late at the point of retail sales to capture many assembled products and imported reuses. Moreover, some proposals lack intervention details about downstream improvements, which in turn, breeds suspicion over the real intention behind fundraising.

Although network management strategies and research can help improving the policy process and policy outputs, there is a limit to the learning and cooperation between opposing coalitions. A complete switch to a product-oriented approach is difficult in a process-oriented community of waste specialists, unless a higher jurisdiction can be mobilised to intervene. Nevertheless, we can expect that some policy-oriented learning can lead to specific compromises that allow new possibilities, such as a possibility for the producers to opt out and implement alternative solutions. Depending on the exact details and the conditions, the opt-out option can provide the flexibility needed to encourage system innovations.

6.2 Policy Recommendations

In addition to the policy implications outlined in the previous section, some general recommendations with specific examples can be provided for policy-makers, practitioners, and producers who are working with WEEE issues in non-OECD countries and have an interest in EPR. The recommendations are grouped into three themes: learn, act, and integrate.

Learn from others – drawing lessons for evidence-based policy-making. Although EPR might be a new concept, the policy actors in non-OECD countries can still engage in evidence-based policy-making by drawing positive and negative policy lessons from the experiences of the implementation of EPR in OECD countries. One contribution of this research is to demonstrate a way to structure the policy lessons that are conducive for policy transfer.

Learning should focus on the causal relationship between the outcomes and the intervention mechanisms instead of the forms that they take in specific

contexts. For example, the free take-back is a form of an intervention that tries to encourage waste collection through an incentive-based mechanism in developed countries where end users were otherwise expected to pay for their WEEE at the point of disposal. The form might need to be changed if the same mechanism is applied in a context where end users can sell their WEEE at their door step.

Lesson drawing at the level of mechanisms also allows the search for policy options to go not only beyond the geographical boundary but also beyond the policy domain. For example, the financial officers in Thailand recalled the success of tax differentiation in the case of leaded and unleaded gasoline when discussing the potential of differentiated fees to promote environmentally friendly products.

When learning about the WEEE programmes in other places, it is important to get information not only about the core measures, but also about supporting mechanisms and implementing contexts. For example, while the subsidies are important for the improvements of WEEE treatment in Taiwan, the correct payments depend on the meticulous auditing that is possible because of the limited number of control points at authorised treatment facilities. The information about the interventions at this level of details is best obtained through the practitioners who have direct experiences in the day-to-day implementation of the programmes.

Act now – prevention is better than cure. From an EPR perspective, it is preferable to prevent the problem as compared to only react to it. Non-OECD countries are now in a privileged position to apply EPR for the management of WEEE, not only because they can learn from the OECD countries, but also because they have relatively small stocks of historical products that cannot be redesigned. However, the policy window is diminishing as the stocks continue to grow. Moreover, the costs of delayed action in the non-OECD countries can be high if the growing stocks of available materials excite the establishment or expansion of the informal recycling sector.

One of the very first actions that should be taken is to adopt the restriction of hazardous substances in all new products similar to the RoHS Directive in the EU in order to make the future WEEE less toxic and avoid being a dumping ground of non-RoHS-compliant products. The other action that is advisable is to demand financial guarantees for all new products in order to ensure the availability of the funds when they become WEEE in the future.

In the case that the government feels the need to mandate a base programme, it is important to ensure separate lines of supervision and operation. A state contractor can be an option to avoid the conflict of interests and ensure professionalism in the management. In addition, the base programme should not be too rigid in terms of compliance options. It is not likely that an optimal system can be conceived at this stage (or will ever be). Because amending the legal framework takes time, it is advisable to have clauses in the legislation that give space for the development of alternative solutions that are as effective as the base programme.

Integrate product policies. The ultimate objective of EPR – to promote total life cycle environmental improvements of product systems – requires concerted efforts from various product-related policies under a fragmented structure of governance. Because of the limit in pursuing the upstream goals of EPR solely in the waste management community, waste policy should be coupled with product-oriented measures from the other subsystems. In addition to the adoptions of RoHS-like measures in the product standard regime, Paper IV suggests the coupling between the mandatory fees proposed in the Thai WEEE policy and the national environmental labelling scheme which has received only limited interest from the producers and the consumers in the country. The suggestion is to "refund" a part of the expected surplus revenue from the fees to environmentally certified products in order to create artificial fee differentiations in favour of more environmentally friendly products.

The producers should also consider an integrated approach to EPR. Too often companies take a damage-control approach to EPR and confine it within the environmental department. However, from a broader perspective, the coming of EPR legislation in non-OECD countries is an opportunity for the producers to negotiate with the government on the issue of illegal product shipments that directly affect their core business – selling products. If the government is proposing EPR for the management of WEEE, it is self-defeating to leave a backdoor open to free riders. Because the power and the responsibility to address the market anomaly ultimately lie with the government, the producers are in this case entitled to demand a level playing field for all actors putting EEE on the market. The overlap between trade-in, which has largely been a strategy contrived by the marketing department, and the end-of-life responsibility managed by the environmental department is mentioned in Papers IV and V. Instead of paying advanced fees that are added to the price of products in order to sponsor a government's buy-back scheme, the producers should be better off implementing trade-in to achieve

the collection results while generating more sales. An even more transformative approach is suggested in Paper VI in which the manufacturers are urged to integrate product leasing (also known as product-service system, PSS), in which they retain the ownership and the responsibility over the products, with the pro-poor projects in non-OECD countries.

6.3 Contributions, Limitations, and Future Research

A large part of this research contributes to our understanding of the policy process in which EPR programmes are developed. Even though an observation had been made early on that the design and operation of EPR programmes are participant-dependent (Rydén 1995), few formal analyses existed that tried to explain the process of programme development. The same is true with the spread of EPR that has become evident since the seminal work of Lindhqvist (2000).

To understand the policy convergence and the development of EPR programmes in particular cases, this research borrows insights from complementary theories of the policy process, including the policy network analysis (Paper I), the internal determinants versus diffusion models (Paper II), and the Advocacy Coalition Framework (Paper VI). Notwithstanding the specificities of the cases, it can identify the knowledge about the adoptions of EPR programmes elsewhere as a main driver for the convergence and certain conditions of the country, such as the industry structure and the severity of the physical problem, as the critical moderators of the diffusion effect.

Because there are now many states with different types of EPR programmes, it will in the future be possible to move from a qualitative case study to a quantitative research by applying different innovation and diffusion models (Berry and Berry 2007) across a large number of political systems. Findings from the case study research can be used to specify the determinants in the models that predict the propensity of a state to adopt a certain type of EPR policy.

Alternatively, the case study research can shift the focus from a country to a change agent, such as the OECD, the EU, or a developmental agency, that facilitates diffusion of EPR in different countries. Because the agents differ

in their resources and transfer strategies, it would be interesting to compare, for example, the efficacy of voluntary policy transfer with a more coercive approach, such as enacting a directive, in terms of the degree and the speed of convergence and the effectiveness of the resultant programmes.

Another area to which this research makes a major contribution is the management of WEEE in non-OECD countries. The pioneer work that was presented in Papers III, IV, and Chapter 3 was able to discern some prevailing conditions in emerging and developing economies that could affect the implementation of EPR and discussed their implications. However, the discussion was often theoretical and based on a simple model of rational actors that might not truly reflect the complex reality.

For example, Paper V reported an empirical finding from a large-scale survey that the majority of Thai households did not sell their obsolete products to waste dealers who offered both money and convenience but rather kept them in the storage. This action is not rational in the strict sense but is understandable considering the social stigma traditionally attached to waste dealing businesses in Thailand (see Manomaivibool 2005).

Similar to the case of households and waste dealers, future research should find empirical evidences to reaffirm or rebut two implications discussed in the exploratory studies. The first is the assertion that the competition between branded and no-brand products is based on their prices and an increase in the price of branded products due to EPR-related costs would increase the share of no-brand products. However, this did not take into account other factors, such as brand loyalty, that might make the demand for branded products rather inelastic to such level of price differences.

Second, future research should investigate the interdependency between different actors and activities in the semi- and informal downstream sectors. In this research it is implicitly assumed that they are independent and it is possible to focus the interventions on the most polluting part, the backyard recycling, while leaving more benign activities, such as collection or refurbishing, semi- or informal. This might be difficult if in reality they are more dependent and involve in some sorts of vertical integration or social lock-in relationships.

There remain a lot more to be learnt about the applications of EPR. This research echoes a call in previous research for a better understanding of informative responsibility (Hayashi et al. 2009; Lindhqvist 2000).

Admittedly, the role of informative responsibilities was underdeveloped in the evaluation of EPR programmes in Papers I and II which paid most of the attention to the organisation of the programmes and the physical and financial responsibilities.

A similar limitation can be said about the role of supporting mechanisms, such as auditing, monitoring, and reporting, that were not fully integrated and only introduced as ad hoc explanations in the evaluation. However, the success of the implementation of EPR in non-OECD countries will to a large degree depend on these very mechanisms. Future research should explore how to design a control system that can generate strategic information in an effective and economical way.

An applied research is also needed to further develop the idea of financial guarantees that is advocated in this study. The relatively small burden of historical WEEE in non-OECD countries allows the EPR programme to pay attention to new products and implement such a forward-looking mechanism. However, its efficacy to stimulate upstream improvements will depend on the operational details, such as how the guarantees will be determined and how the future funds will be managed and paid back.

Last but not least, there is a need for further research that explores new possibilities for EPR to promote total life cycle environmental improvements outside waste policy. This knowledge will be instrumental to stimulate and support the integrative approach to environmental product policies mentioned at the end of the policy recommendations.

References

AEHA. (2010). *Kaden recycle Nenji Houkokusho Heisei 21 nendo ban* [Annnual report of Household appliance Recycling, Fiscal year 2009 edition]. [Online]. Available: http://www.aeha.or.jp/recycling_report/pdf/kadennenji21.pdf (Accessed 1 August 2011).

Aoki-Suzuki, C., Bengtsson, M., and Hotta, Y. (2009). Trade of second-hand electrical and electronic equipments from Japan to developing Asia: issues, policies and its implication for extended producer responsibility. In Y. Hotta, S. Hayashi, M. Bengtsson, and H. Mori (eds), *Extended Producer Responsibility Policy in East Asia: in Consideration of International Resource Circulation* (131-156). Kanagawa, Japan: Institute for Global Environmental Strategies.

Archer, M., Bhaskar, R., Collier, A., Lawson, T., and Norrie, A. (eds). (1998). *Critical Realism: Essential Readings*. New York, USA: Routledge.

BAN (Basel Action Network). (2005). *The Digital Dump: Exporting High-Tech Reuse and Abuse in Africa*. Edited by J. Puckett. Produced and distributed by Basel Action Network.

BAN and SVTC (Silicon Valley Toxics Coalition). (2002). *Exporting Harm: the High-tech Trash of Asia*. Edited by J. Puckett and T. Smith. Produced and distributed by Basel Action Network.

Berry, F.S., and Berry, W.D. (2007). Innovation and diffusion models in policy research. In P.A. Sabatier, *Theories of the Policy Process*, 2nd ed. (223-260). Cambridge, USA: Westview.

Bi, X., Thomas, G. O., Jones, K. C., Qu, W., Sheng, G., Martin, F.L., and Fu, J. (2007). Exposure of electronics dismantling workers to polybrominated diphenyl ethers, polychlorinated biphenyls, and organochlorine pesticides in South China. *Environmental Science & Technology*, 41, 5647-5653.

Blättel-Mink, B., and Kastenholz, H. (2005) Transdisciplinarity in sustainability research: Diffusion conditions of an institutional innovation. *International Journal of Sustainable Development and World Ecology*, 12, 1-12.

Bohr, P. (2007). *The Economics of Electronics Recycling: New Approaches to Extended Producer Responsibility*. PhD thesis, TU Berlin, Berlin, Germany.

Brigden, K., Labunska, I., Santillo, D., and Allsopp, M. (2005). *Recycling of Electronic Wastes in China and India: Workplace and Environmental Contamination.* [Online]. Available: www.greenpeace.org/raw/content/international/press/reports/recycling-of-electronic-waste.pdf (Accessed 1 August 2011).

Canon, Dell, Epson, Hp, Kyocera Mita, Nokia, and Ricoh. (2009). *Industry Discussion: Environment Legislation in the Region.* 8 July, Singapore.

Carisma, B. (2009). *Drivers and Barriers of E-waste Management: A Case Study of EPR*. Master's Thesis, IIIEE, Lund University, Lund, Sweden.

Chancerel, P. (2010). *Substance Flow Analysis of the Recycling of Small Waste Electrical and Electronic Equipment: An Assessment of the Recovery of Gold and Palladium*. PhD thesis, TU Berlin, Berlin, Germany.

Chancerel, P. and S. Rotter. (2009). Recycling-oriented characterization of small waste electrical and electronic equipment. *Waste Management*, 29, 2336-2352.

Chotichanathawewong, Q., and Thongplew, N. (2009). Applicability of EPR mechanisms in Thailand. In Y. Hotta, S. Hayashi, M. Bengtsson, and H. Mori (eds), *Extended Producer Responsibility Policy in East Asia: in Consideration of International Resource Circulation* (87-98). Kanagawa, Japan: Institute for Global Environmental Strategies.

Cobbing, M. (2008). Toxic Tech: Not in Our Backyard: Uncovering the Hidden Flows of e-Waste. http://www.greenpeace.org/international/Global/international/planet-2/report/2008/2/not-in-our-backyard.pdf (Accessed 1 August 2011).

Commission of the European Communities. (2008). *Commission Staff Working Paper Accompanying the Proposal for a Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE) (Recast)*. SEC(2008) 2933. [Online]. Available: http://www.ipex.eu/IPEXL-WEB/dossier/document.do?code=SEC&year=2008&number=2933&extension=FIN (Accessed 1 August 2011).

Connell, J.P., Kubisch, A.C., Scchorr, L.B., and Weiss, C.H. (1995). *New Approaches to Evaluating Community Initiatives: Concepts, Methods and Contexts*. Washington, D.C., USA: Aspen Institute.

Creswell, J.W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd ed. California, USA: Sage.

Deng, W.J., Louie, P.K.K., Liu, W.K., Bi, X.H., Fu, J.M., and Wong, M.H. (2006). Atmospheric levels and cytotoxicity of PAHs and heavy metals in TSP and PM2.5 at an electronic waste recycling site in southeast China. *Atmospheric Environment*, 40, 6945-6955.

Dolowitz, D., and Marsh, D. (2000). Learning from abroad: the role of policy transfer in contemporary policy-making. *Governance*, 13, 5-24.

DTI (Department of Trade and Industry, UK). (2005). Waste electrical and electronic equipment (WEEE): innovating novel recovery and recycling technologies in Japan. *Report of a DTI Global Watch Mission*, September. [Online]. Available: http://www.cfsd.org.uk/aede/downloads/JapaneseWEE.PDF (Accessed 1 August 2011).

EC DG JRC (European Commission, Directorate-General, Joint research Centre) and IPTS (Institute for Perspective Technological Studies). (2006). Implementation of the Waste Electrical and Electronic Equipment Directive in the EU. [Online]. Available: http://ftp.jrc.es/EURdoc/eur22231en.pdf (Accessed 1 August 2011).

Electronics TakeBack Coalition. (2010). *How much e-waste is collected in the sate-mandated recycling programs?* [Online]. Available: http://www.computertakeback.com/legislation/Collection_Volumes_by_State.pdf (Accessed 1 August 2011).

ERP (European Recycling Platform). (2010). *The European Recycling Platform.* [Online]. Available: http://erprecycling.prodigentia.net/index.php?content=12 (Accessed 1 August 2011).

Eurostat. (2010). *WEEE – Key Statistics and Data.* [Online]. Available: http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastestreams/weee (Accessed 1 August 2011).

Fan, K.-S., Lin, C.-H., and Chang, T.-C. (2005). Management and performance of Taiwan's Waste recycling Fund. *Journal of the Air & Waste Management Association*, 55, 574-582.

Farmer, A., and Watkins, E. (2009). *IMPEL Project "Practicability and Enforceability of the WEEE Directive Recast Proposal".* [Online]. Available: http://www.ieep.eu/assets/439/impel_pe_weee.pdf (Accessed 1 August 2011).

Firestone, W.A. (1987). Meaning in method: the rhetoric of quantitative and qualitative research. *Educational Research*, 16: 16-21.

Fitz-Gibbon, C.T., and Morris, L.L. (1996). Theory-based evaluation. *Evaluation Practice*, 17, 177-184.

GAO (United States Government Accountability Office). (2008). Electronic Waste: EPA Needs to Better Control Harmful U.S. Exports through Stronger Enforcement and More. [Online]. Available: http://www.gao.gov/new.items/d081044.pdf (Accessed 1 August 2011).

Gottberg, A., Morris, J., Pollard, S., Mark-Herbert, C., and Cook, M. (2006). Producer responsibility, waste minimisation and the WEEE Directive: case studies in eco-design from the European lighting sector. *Science of the Total Environment*, 359, 38-56.

Green, M., and Houlihan, B. (2004). Advocacy coalitions and elite sport policy change in Canada and the United Kingdom. *International Review for the Sociology of Sport*, 39, 387-403.

Hall, P.A. (1993). Policy paradigms, social learning, and the state: the case of economic policy-making in Britain. *Comparative Politics*, 25, 275-296.

Hadorn, G.H., Bradley, D., Christian, P., Stephan, R., and Wiesmann, U. (2006) Implications of transdisciplinarity for sustainability research, *Ecological Economics*, 60, 119-128.

Hayashi, S., Hotta, Y., and Mori, H. (2009). The emerging need for sharing environmental product information and reconsidering the producers' informative responsibility. In Y. Hotta, S. Hayashi, M. Bengtsson, and H. Mori (eds), *Extended Producer Responsibility Policy in East Asia: in Consideration of International Resource Circulation* (61-72). Kanagawa, Japan: Institute for Global Environmental Strategies.

Herold, M. (2007). *A Multinational Perspective to Managing End-of-life Electronics*. Doctoral Dissertation, Helsinki University of Technology, Helsinki, Finland.

Hicks, C., Dietmar, R., and Eugster, M. (2005). The recycling and disposal of electrical and electronic waste in China—Legislative and market responses. *Environmental Impact Assessment Review*, 25, 459-471.

Huang, Z. (2009). *Producer's Role in Managing Used Mobile Phones: China Case*. Master's Thesis, IIIEE, Lund University, Lund, Sweden.

Huisman, J., F. Magalini, R. Kuehr, C. Maurer, S. Oglivie, J. Polk, C. Delgado, E. Artim, J. Szlezak, and A. Stevels. (2008). *2008 review of directive 2002/96 on waste electrical and electronic equipment*. ENV.G.44/ETU/2006/0032. Bonn, Germany: United Nations University.

Huo, X., Peng, L., Xu, X., Zheng, L., Qiu, B., Qi, Z., Zhang, B., Han, D., and Piao, Z. (2007). Elevated blood levels of children in Guiyu, an electronic waste recycling town in China. *Environmental Health Perspectives* 115, 1113-1117.

Ikenberry, J.G. (1990). The international spread of privatization policies: inducements, learning and 'policy bandwagoning'. In E. Suleiman and J. Waterbury (eds), *The Political Economy of Public Sector Reform* (88-110). Boulder: Westview.

Jain, A. (2009). Current situation of EPR policy in India. In Y. Hotta, S. Hayashi, M. Bengtsson, and H. Mori (eds), *Extended Producer Responsibility Policy in East Asia: in Consideration of International Resource Circulation* (99-114). Kanagawa, Japan: Institute for Global Environmental Strategies.

Jang, Y.-C. (2010). Waste electrical and electronic equipment (WEEE) management in Korea: generation, collection, and recycling systems. *Journal of Material Cycles and Waste Management*, 12, 283-294.

John, P. (2002). Quantitative methods, in D. Marsh, and G. Stoker, *Theory and Methods in Political Science,* 2nd ed. (216-230). New York, USA: Palgrave Macmillan.

Jones, B.D., and Baumgartner, F.R. (2005). *The Politics of Attention*. Chicago, USA: University of Chicago Press.

Kang, H.-Y., and Schoenung, J.M. (2005). Electronic waste recycling: a review of U.S. infrastructure and technology options. *Resources, Conservation & Recycling*, 45, 368-400.

Kahhat, R.F., and Kavazanjian, E. (2010) Preliminary feasibility study on the use of mono-disposal landfills for e-waste as temporary storage for future mining. *Proceedings of the 2010 IEEE International Symposium on Sustainable Systems and Technology*, 17-19 May 2010, Virginia, USA.

Kaosa-ard, M., Laplante, B., Rayanakorn, K., and Waranyuwattana, S. (2008). *Thailand: Capacity Building for Pollution Taxation and Resource Mobilization for Environmental and Natural Resources Sectors—Phase II*. Asian Development Bank Technical Assistance Report 4667 THA. [Online]. Available: http://www.adb.org/Documents/Produced-Under-TA/38626/38626-THA-DPTA.pdf (Accessed 1 August 2011).

Khetriwal, D.S., Kraeuchi, P., and Widmer, R. (2009). Producer responsibility for e-waste management: key issues for consideration—learning from the Swiss experience. *Journal of Environmental Management*, 90, 153-165.

Khetriwal, D. S., Kraeuchi, P., and Widmer, R. (2009). Producer responsibility for e-waste management: Key issues for consideration - Learning from the Swiss experience. *Journal of Environmental Management*, 90, 153-165.

Kickert, W.J.M., Klijn, E.-H., and Koppenjan, J.F.M. (1997a). In W.J.M. Kickert, E.-H. Klijn, and J.F.M. Koppenjan (eds) *Managing Complex Networks: Strategies for the Public Sector* (1-13). London, UK: Sage.

Kickert, W.J.M., Klijn, E.-H., and Koppenjan, J.F.M. (1997b). Managing networks in the public sector: findings and reflections. In W.J.M. Kickert, E.-H. Klijn, and J.F.M. Koppenjan (eds) *Managing Complex Networks: Strategies for the Public Sector* (166-191). London, UK: Sage.

Kickert, W.J.M., and Koppenjan, J.F.M. (1997). Public management and network management: an overview. In W.J.M. Kickert, E.-H. Klijn, and J.F.M. Koppenjan (eds) *Managing Complex Networks: Strategies for the Public Sector* (35-61). London, UK: Sage.

Kingdon, J.W. (1995). *Agendas, Alternatives and Public Policies*, 2nd ed. New York, USA: Harper Collins.

Kroepelien, K. F. (2000). Extended producer responsibility – new legal structures for improved ecological self-organization in Europe? *Review of European Community & International Environmental Law*, 2, 165-177.

Kwong, R. (2010). *Media Tek breaks out into mobile phones*. Financial Times, 17 March.

Laner, D. and H. Rechberger. (2007). Treatment of cooling appliances: interrelations between environmental protection, resource conservation, and recovery rates. *Resources, Conservation and Recycling*, 52, 136-155.

Lawhon, M. (2011). *Relational Power in the Governance of South Africa's E-Waste Regime: A Sustainable Transition in Progress?* Ph.D. Dissertation, Clark University, Worcester , USA.

Lawhon, M., Manomaivibool, P., and Inagaki, H. (2010). Solving/ Understanding/ Evaluating the e-waste challenge through transdisciplinarity? *Futures*, 42, 1212-1221.

Learn, S. (2009). Oregon's electronics recycling too successful for some manufacturers. [Online], Available: http://www.oregonlive.com/environment/index.ssf/2009/05/oregons_electronics_recycling.html (Accessed 1 August 2011).

Lee, S.-C. (2009). Taiwan's recycling scheme for waste electrical and electronic equipment and dry batteries. Paper presented at *A Seminar on the Study Framework of WEEE Management in Thailand*, 29 April, Bangkok, Thaialnd.

Lee, C.-H., Chang, C.-T., and Tsai, S.-L. (1998). Development and implementation of producer responsibility recycling system. *Resources, Conservation and Recycling*, 24, 121-135.

Lifset, R. (1997). A metaphor, a field, and a journal. *Journal of Industrial Ecology*, 1: 1-3.

Lifset, R. and Lindhqvist, T. (2008). Producer responsibility at a turning point? *Journal of Industrial Ecology*, 12, 144–147.

Liftin, K.T. (2000). Advocacy coalitions along the domestic-foreign frontier: globalization and Canadian climate change policy. *Policy Studies Journal*, 28, 236-352.

Lin, C.H. (2008). A model using home appliance ownership data to evaluate recycling policy performance. *Resources, Conservation and Recycling*, 52, 1322-1328.

Lin, C.K., Yan, L., and Davis, A.N. (2002). Globalisation, extended producer responsibility and the problem of discarded computers in China: an exploratory proposal for environmental protection. *Georgetown International Environmental Law Review* 14, 525-576.

Lindblom, C.E. (1959). The science of muddling through. *Public Administration Review*, 19, 78-88.

Lindhqvist, T. (2000). *Extended Producer Responsibility in Cleaner Production: Policy Principle to Promote Environmental Improvements of Product Systems*. Ph.D. Dissertation, IIIEE, Lund University, Lund, Sweden.

Lindhqvist, T. (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, *Vanor som faror – Underlagsrapporter* [Products as Hazards – background documents] (DS 1992:82) (229-291). Stockholm, Sweden: Ministry of the Environment and Natural Resources.

Lindhqvist, T., and Lidgren, K. (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, Sweden: Ministry of the Environment.

Lindhqvist, T., Manomaivibool, P., and Tojo, N. (2008). La responsabilidad extendida del productor en el contexto latinoamericano: La gestión de residuos de aparatos eléctricos y electrónicos en Argentina [Extended producer responsibility in the Latin American context: The management of waste electrical and electronic equipment in Argentina]. IIIEE, Lund University, Lund, Sweden.

MAIT (Manufacturers' Association for Information Technology). (2007). *Industry Statistics*. [Online]. Available: http://www.mait.com/industry-statistics.php (Accessed on 1 August 2011).

Manda, B.M.K. (2008). *E-waste Management in India: Stakeholders' Perceptions and Media Attention.* Master's Thesis, IIIEE, Lund University, Lund Sweden.

Maneschi, D. (2009). *Proactive Approaches towards Producer Responsibility Regulation: The Case of Nokia in Argentina.* Master's Thesis, IIIEE, Lund University, Lund, Sweden.

Manomaivibool, P. (2009). *Making sense of extended producer responsibility: Towards a framework for policy transfer.* Licentiate Dissertation, IIIEE, Lund University, Lund, Sweden.

Manomaivibool, P. (2005). *Municipal Solid Waste Management in Bangkok: The Cases of the Promotion of Source Reduction and Source Separation in Bangkok and in Roong Aroon School.* Master's Thesis, IIIEE, Lund University, Lund, Sweden.

Manomaivibool, P., Lindhqvist, T., and Tojo, N. (2009). *Extended Producer Responsibility in a non-OECD Context: The management of waste electrical and electronic equipment in Thailand.* IIIEE, Lund University, Lund, Sweden.

Manomaivibool, P., Lindhqvist, T., and Tojo, N. (2007). *Extended Producer Responsibility in a Non-OECD Context: the Management of Waste Electrical and Electronic Equipment in India.* IIIEE, Lund University, Lund, Sweden.

Manomaivibool, P., and Tojo, N. (2010). The management of used mobile phones in the United Kingdom: Is exporting for re-use a sufficient solution? In *Proceedings of Going Green CARE Innovation 2010*, 8-11 November, Vienna, Austria.

March, D., and Furlong, P. (2002). A skin not a sweater: ontology and epistemology in Political Science. In D. Marsh, and G. Stoker (eds) *Theory and Methods in Political Science*, 2nd ed. (17-44). New York, USA: Palgrave Macmillan.

Mayers, K.C. (2007). Strategic, financial, and design implications of extended producer responsibility in Europe: a producer case study. *Journal of Industrial Ecology*, 11, 113-131.

MPPI (Mobile Phone Partnership Initiative). (2008). Guidance Document on the Environmentally Sound Management of Used and End-of-life Mobile Phones. [Online]. Available: http://www.basel.int/industry/mppi/MPPI%20Guidance%20Document.pdf (Accessed on 1 August 2011).

Mungcharoen, T. and Varabuntoonvit, V. (2006). Current status and future prospects for recycling-based economy: case study of Thailand. In *Proceedings of the 1st International Conference on Green and Sustainable Innovation*, 29 November-1 December 2006, Chiang Mai, Thailand, 86-90.

Nakamura, R. (1987). The textbook policy process and implementation research. Policy Studies Review, 7, 142-154.

Nnorom, I.C., and Osibanjo, O. (2008). Overview of electronic waste (e-waste) management practices and legislations, and their poor applications in the developing countries. *Resources, Conservation and Recycling*, 52, 843-858.

OECD (Organisation for Economic Co-operation and Development). (2008). *OECD Key Environmental Indicators*. Paris, France: OECD.

OECD. (2001). *Extended Producer Responsibility: A Guidance Manual for Governments*. Paris, France: OECD.

OCED. (1998). *Extended Producer Responsibility Phase 2: Case Study on the German Packaging Ordinance*. Paris, France: OECD.

Oguchi, M., Kameya, T., Yagi, S., and Urano, K. (2008). Product flow analysis of various consumer durables in Japan. *Resources, Conservation and Recycling*, 52, 463-480.

Ogushi, Y. and Kandlikar, M. (2007). Assessing extended producer responsibility laws in Japan. *Environmental Science & Technology,* 41, 4502-4508.

Okada, E. M. (2001). Trade-ins, mental accounting, and product replacement decisions. *Journal of Consumer Research*, 27, 433-446.

Park, J.-W. (2007). Extended producer responsibility and e-waste recycling in Korea. *Proceedings of the Fourth NIES Workshop on E-waste*, 21-22 November, Tsukuba, Japan, 211-220

Parsons, W. (1995). *Public Policy: An Introduction to the Theory and Practice of Policy Analysis*. Cheltenham, UK: Edward Elgar.

Pawson, R. (2002). Evidence-based policy: in search of a method. *Evaluation*, 8, 157-181.

PC3R (PC 3R Promotion Association). (2010). *Heisei 21 nendo no Shiyouzumi Paso con no kaishuu, recycle jisseki wa 654 sendai* [The achievement of collection and recycling of post-consumer personal computer as of fiscal year 2009]. [Online]. Available: http://www.pc3r.jp/topics/100721.html (Accessed 1 August 2011).

PCD (Pollution Control Department). (2010). *Raay-ngaan-cha-bap-som-buun-khroong-kaan-suek-saa-lak-keen wi-tii-kaan-nguen-khai-lae-at-traa-kaan-jat-kep-khaa-tham-niam-kaan-jat-kaan-saak-pha-lit-ta-phan-krueng-chay-fay-faa-lae-i-lek-thor-nik* [Final report: The study project on rules, procedures, and fees of Thailand's WEEE management.] Report prepared by National Center of Excellence for Environmental and Hazardous Waste Management, Chulalongkorn University. Bangkok, Thailand: PCD.

PCD. (2007). *Yut-tha-saat-kaan-jat-kaan-saak-pha-lit-ta-phan-khrueng-chay-fay-faa-lae-i-lek-thraor-nik-chueng-buu-ra-naa-kaan (cha-bap-thii-kha-na-rat-tha-mon-trii-mii-ma-ti-hen-chaorp mue-wan-thii 24 Ka-rak-ka-daa-khom 2550* [The National Integrated Strategy for the Management of Waste Electrical and Electronic Equipment (as approved by the Cabinet on July 24, 2007)]. [Online]. Available: www.pcd.go.th/count/hazdl.cfm?FileName=Strategies_Electronic.pdf&Bookname=ยุทธศาสตร์การจัดการซากผลิตภัณฑ์ฯ. (Accessed 1 August 2011).

PCD. (2004). *Raay-ngaan-cha-bap-som-buun-khroong-kaan-suek-saa-phue-yok-raang-kot-maay-waa-duay-kaan-jat-kaan-khorng-sia-an-ta-raay* [Final report: Project: A study for drafting a law on hazardous waste management.] Report prepared by Social Research Institute, Chiang Mai University. Bangkok, Thailand : PCD.

PCD and JETRO (Japan External Trade Organiization). (2004). *Raay-ngaan-cha-bap-som-buun Kaan-sam-ruat-kaan-thing-saak-pha-lit-ta-phan-khrueng-chay-fay-faa-lae-i-lek-thraor-nik Kaan-sam-ruat-kaan-thing-saak-thaor-ra-sap-mue-thue thaan-fay-chaay lae laort-fluu-aor-reet-sen* [Final Report: A Survey on Disposal of Waste Electrical and Electronic Equipment and A Survey on Disposal of Waste Mobile Phones, Batteries, and Fluorescence Lamps]. Report prepared by Kokusai Kogyo. Bangkok, Thailand : PCD.

Pellow, D.N. (2007). *Resisting Global Toxics: Transnational Movements for Environmental Justice*. Cambridge, USA: Massachusetts Institute of Technology.

Perchards. (2010). *Subsidy Programs Extended to Drive and Improve WEEE Management.* Retrieved on 22 July 2010, from http://www.perchards.com.

Read, M. and Marsh, D. (2002). Combining qualitative and quantitative methods. In D. Marsh, and G. Stoker (eds) *Theory and Methods in Political Science*, 2nd ed. (231-248). New York, USA: Palgrave Macmillan.

Rhodes, R.A.W. (1997). *Understanding Governance: Policy Networks, Governance, Reflexivity, and Accountability*. Berkshire, UK: McGrew-Hill.

Rydén, E. (1995). *Car Scrap – Throw It Away? Or Make It Pay?* Licentiate Dissertation, IIIEE, Lund University, Lund, Sweden.

Røine, K., and Lee, C.-Y. (2006). With a little help from EPR? Technological change and innovation in the Norwegian plastic packaging and electronics sectors. *Journal of Industrial Ecology*, 10, 217-37.

Sabatier, P.A. 1998. The advocacy coalition framework: revisions and relevance for Europe. *Journal of European Public Policy*, 5, 98-130.

Sabatier, P.A., Hunter, S., and McLaughlin, S. (1987). The devil shift: perceptions and misperceptions of opponents. *Western Political Quarterly*, 42, 229-261.

Sabatier, P.A., and Jenkins-Smith, H. (1999). The advocacy coalition framework: an assessment. In P.A. Sabatier (eds), *Theories of the Policy Process.* (117-166). Cambridge, USA: Westview.

Sabatier, P.A., and Jenkins-Smith, H. (eds) (1993). *Policy Change and Learning: An Advocacy Coalition Approach*. Boulder, USA: Westview.

Sabatier, P.A., and Jenkins-Smith, H. (1988). An advocacy coalition model of policy change and the role of policy oriented learning therein. *Policy Sciences*, 21, 129-168.

Sabatier, P.A., and Weible, C. (2007). The advocacy coalition framework: innovations and clarifications. In P.A. Sabatier (eds), *Theories of the Policy Process*, 2nd ed. (189-220). Cambridge, USA: Westview.

Sachs, N. 2006. Planning the funeral at the birth: extended producer responsibility in the European Union and the United States. *Harvard Environmental Law Review*, 30, 51-98.

Sae-tang, P., Rojanapriwong, S., Mooksuwan, W., and Prathumchart, S. (2009). *Impacts and solutions for a participatory management of waste: a case of Khok Sa-at Sub-district, Khong Chai District, Kalasin Province*, (in Thai). Bangko, Thailand: the Asia Foundation.

Sanders, K., Schiling, S., Tojo, N., van Rossem, C., Vernon, J., and George, C. (2007). *The Producer Responsibility Principle of the WEEE Directive*. DG ENV. Study Contract No. 07010401/2006/449269/MAR/G4. Hamburg, Germany: Ökopol Gmbh.

Singhal, P. (2010). Shaping consumers' behaviour for responsible recycling in India. In *Proceedings of Going Green CARE Innovation 2010*, 8-11 November, Vienna, Austria.

Staudt, E., and Schroll, M. (1999). The German packaging ordinance: the questionable effects of a fragmentary solid waste management approach. *Journal of Material Cycles and Waste Management*, 1, 17-24.

Streicher-Porte, M., and Yang, J. (2007). WEEE recycling in China: present situation and main obstacles for improvement. *Proceedings of the 2007 IEEE - International Symposium on Electronics and the Environment*, 7-10 May 2007, Orlando, USA, 40-45.

Tasaki, T., Terazono, A., and Moriguchi, Y. (2005). Effective assessment of Japanese recycling law for electrical home appliances: four years after the full enforcement of the law. *Proceedings of the 2005 IEEE International Symposium on Electronics and the Environment*, 16-19 May, New Orleans, USA.

Tasaki, T., Oguchi, M., Kameya, T., and Urano, K. (2001). A prediction method of number of waste durable goods. *Journal of the Japan Society of Waste Management Experts*, 12(2), 49-58 (in Japanese with English abstract, figures and tables).

TEPA (Taiwan Environmental Protection Administration). (2011). *Verified Volumes of Recycled Resources*. [Online]. Available: http://www.epa.gov.tw/en/statistics/c4040.pdf (Accessed on 1 August 2011).

Termeer, C.J.A.M., and Koppenjan, J.F.M. (1997). Managing perceptions in networks, in W.J.M Kickert, E.-H. Klijn, and J.F.M. Koppenjan (eds), *Managing Complex Networks: Strategies for the Public Sector* (79-97). London, UK: Sage.

Tojo, N. (2004). *Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality?* Ph.D. Dissertation, IIIEE, Lund University, Lund, Sweden.

Toxics Link. (2007). *Into the Future: Managing E-waste for Protecting Lives and Livelihoods*. New Delhi, India: Toxics Link.

Toxics Link. (2003). *Scrapping the hi-tech myth: Computer waste in India*. New Delhi, India: Toxics Link.

United Nations University/StEP Initiative. (2009). *Solving the E-Waste Problem (StEP) White Paper on the Revision of EU's WEEE Directive – COM(2008)810 Final*. [Online]. Available: http://www.step-initiative.org/pdf/white-papers/StEP_TF1_WP_WEERecast_rvsd_22March2010.pdf (Accessed on 1 August 2011).

Van Rossem, C. (2008). *Individual Producer Responsibility in the WEEE Directive: From Theory to Practice?* Ph.D. Dissertation, IIIEE, Lund University, Lund, Sweden.

Van Rossem, C., and Lindhqvist, T. (2005). *Evaluation Tool for EPR Program*s. IIIEE, Lund University, Lund, Sweden.

Van Rossem, C., Tojo, N., and Lindhqvist, T. (2006). *Lost in Transposition? A Study of the Implementation of Individual Producer Responsibility in the WEEE Directive*. [Online]. Available: http://www.greenpeace.org/international/Global/international/planet-2/report/2006/10/lost-in-transposition.pdf (Accessed on 1 August 2011).

Vassanadumrongdee, S., and Manomaivibool, P. (2009). *Policy Recommendations for the Management of Waste Electrical and Electronic in Thailand*. Unpublished document.

Wang, D., Cai, Z., Jiang, G., Leuang, A., Wong, M.H., and Wong, W.K. (2005). Determination of polybrominated diphenyl ethers in soil and sediment from an electronic waste recycling facility. *Chemosphere*, 60, 810-816.

Weiss, C.H. (1997). How can theory-based evaluation make greater headway? *Evaluation Review*, (August).

Wen, X. (2010). *New Progress on E-waste Management in China*. [Online]. Available: http://www.unep.or.jp/Ietc/spc/news-jul11/02.China.pdf (Accessed on 1 August 2011).

Widmer, R., Oswald-Krapf, H., Khetriwal, D.S., Schnellmann, M., and Böni, H. (2005). Global perspectives on e-waste. *Environmental Impact Assessment Review* 25, 436-458.

Williams, E., Kahhat, R., Allenby, B., Kavazanjian, E., Kim, J., and Xu, M. (2008). Environmental, social, and economic implications of global reuse and recycling of personal computers. *Environmental Science & Technology*, 42, 6446-6454.

Wong, M.H., Wu, S.C., Deng, W.J., Yu, X.Z., Luo, Q., Leung, A.O.W., Wong, C.S.C., Luksemburg, W.J., and Wong, A.S. (2007a). Export of toxic chemicals - a review of the case of uncontrolled electronic-waste recycling. *Environmental Pollution*, 149, 131-140.

Wong, C.S.C., Wu, S.C., Duzgoren-Aydin, N.S., Aydin, A., and Wong, M.H.. 2007b. Trace metal contamination of sediments in an e-waste processing village in China. *Environmental Pollution* 145, 434-442.

Yang, Y., and Williams, E. (2009). Logistic model-based forecast of sales and generation of obsolete computers in the U.S. *Technological Forecasting & Social Change*, 76, 1105-1114.

Yin, R.K. (2003). *Case Study Research: Design and Methods*, 3rd ed. London, UK: Sage.

Yu, X.Z., Gao, Y., Wu, S.C., Zhang, H.B., Cheung, K.C., and Wong, M.H. (2006). Distribution of polycyclic aromatic hydrocarbons in soils at Guiyu area of China, affected by recycling of electronic waste using primitive technologies, *Chemosphere*, 65, 1500-1509.

Zhang, H. (2011) *Analysis on the "China WEEE Directive": Characteristics, Breakthroughs and Challenges of the New WEEE Legislation in China.* Master's Thesis, IIIEE, Lund University, Lund, Sweden.

Appendix A – List of research projects

This appendix lists research projects that relevant to this research. It also provides a short description about the project and my main responsibilities. Projects with an asterisk mark make direct contributions to the research presented in this thesis.

Project	**Duration**	**Short description**
Commissioned projects		
Model Law on Producer Responsibility for WEEE in India*	Feb-Aug 07	The project was commissioned by Greenpeace International. The aim was to support its office in India in advocating EPR and investigating the local conditions. A report, (Manomaivibool et al. 2007), was a derivable of the project. A multi-stakeholder workshop was organised to get feedbacks on the report on 21 August.
India scenario & stakeholders EPR analysis*	Dec 07-Aug 08	The project was commissioned by Greenpeace International. This spin-off project was to assist the office in India in negotaiting with industries and the government for a WEEE legal framework including a workshop between a trade association, producers, and NGOs on 11 April 2008 and follow-up feedbacks on draft laws and the then proposed guideline.
Argentina EPR Report	Dec 07-Oct 08	The project was commissioned by Greenpeace International. The purpose was to replicate the earlier project in India in a Latin American context. I played a supportive role in the production of a report, (Lindhqvist et al. 2008). The project coincided with the development of draft legislation by a senator in Argentina.

Project	**Duration**	**Short description**
Thailand scenario & stakeholders EPR analysis*	Dec 07-Nov 08	The project was commissioned by Greenpeace International. The purpose was to replicate the earlier project in India in the Thai context. I played a pivotal role in the production of a report, (Manomaivibool et al. 2009). The project coincided with the development of draft laws in Thailand.
The Study Project on Criteria and Fees of Thailand's WEEE Management*	Feb 09-Feb 10	The project was commissioned by the Pollution Control Department. It developed a fee-setting methodology and recommended the fee rates for targeted WEEE. It is based on economic and technical analyses of a future WEEE management system including the estimation of households' willingness to accept a buy-back offer. My responsibilities included the analysis of policy options, the technical cost modelling, the development of a rapid WEEE inventory, and reporting writing. The project also features a series of five public hearings.
Drafting a subordinate law under the draft Act on Economic Instruments for Environmental Management*	Jul 10-Feb 11	The project was commissioned by the Pollution Control Department. Its main purpose was to develop a new draft subordinate law for the management of used products under the draft Act on Economic Instruments for Environmental Management. My main responsibilities were the review of international laws and report writing. The project also featured consultation with stakeholders in particular governmental agencies and local governments.
Master-thesis projects		
Network management and environmental effectiveness*	Feb-Sept 06	This was the topic for my master thesis. It evaluated the ELV programmes in the UK and in Sweden. Paper I reports key findings from this project.

Project	**Duration**	**Short description**
E-waste management in India: Stakeholders' perceptions and media attention*	Jan-June 08	This work, (Manda 2008), was inspired by the first Greenpeace project and coincided with the second project in India. The motivation was to examine opinions of various stakeholders in India and to measure the perceived salience of the issue in the society via media attention. My role as a supervisor in this project was mainly in guiding the research design and data collection and analysis based on topical knowledge about the Indian context.
Producer's role in managing used mobile phones: China case	Jan-June 09	This work, (Huang 2009), was initiated by a master student. She investigated the policies related to WEEE management and voluntary take-back schemes intiated by mobile-phone producers in China. My role as a supervisor in this project was mainly to suggest key issues for the research based on the findings of previous research.
Drivers and barriers of e-waste management: A case study of EPR	Jan-June 09	This work, (Carisma 2009), was initiated by a master student. He investigated various aspects of WEEE management in the Philippines. My role as a supervisor in this project was mainly to suggest key issues for the research based on the findings of previous research.
Proactive approaches towards producer responsibility regulation: The case of Nokia in Argentina*	June-Sept 09	This work, (Maneschi 2009), was initiated by IIIEE and sponsored by Nokia to explore producer responsibility options under the proposed legislation and local conditions in Argentina. His research built upon the previous research in the country. My role as a supervisor was to suggest key issues and how to structure of the analysis.

Appendix B – List of interviews

Date	Organisation	Category	Interviewees	Format
06/07 /06	Consortium for Automotive Recycling (CARE)	Trade association	Chairman	Semi-structured, telephone, tape-recorded
08/09 /06	Association of Swedish Automobile Manufacturers and Wholesalers	Trade association	Environment	Semi-structured, telephone, tape-recorded
16/04 /07	Toxics Link	NGO	Programme Officer	Semi-structured, face-to-face, note-taking
16/04 /07	IRG Systems South Asia P.Ltd.	Consultant	Managing director	Semi-structured, face-to-face, note-taking
16/04 /07	Department of Information Technology (DoIT), Ministry of Communication & Information Technology	Government	Economic Advisor	Semi-structured, face-to-face, note-taking
17/04 /07	Consumer Electronics & Appliances Manufacturing Association (CEAMA)	Trade association	Secretary General	Semi-structured, face-to-face, note-taking
17/04 /07	Electronic Industries Association of India (ELCINA)	Trade association	Secretary General Additional Secretary	Semi-structured, face-to-face, note-taking
17/04 /07	HCL	Producer	Executive Vice President Head, Marketing Communica-tions	Semi-structured, face-to-face, note-taking
18/04 /07	Department of Environment, Government of Delhi	Government	Senior Scientific Officer	Semi-structured, face-to-face, note-taking
21/04 /07	Ash Recyclers	Recycler	Owner Engineer Worker	Semi-structured, face-to-face, note-taking

Date	Organisation	Category	Interviewees	Format
21/04 /07	E-Parisaraa P.Ltd.	Recycler	Director Director	Semi-structured, face-to-face, note-taking
21/04 /07	Swiss Federal Laboratories for Material Testing and Research (EMPA)	Bilateral agency	India e-Waste Project Coordinator	Semi-structured, face-to-face, note-taking
01/04 /08	Thai Electrical and Electronics Institute (EEI), Ministry of Industry	Government	President Director, Information and Technical Service Department	Semi-structured, face-to-face, tape-recorded
02/04 /08	Fiscal Policy Office (FPO), Ministry of Finance	Government	Senior Economist 8	Semi-structured, face-to-face, tape-recorded
02/04 /08	Pollution Control Department (PCD), Ministry of Natural Resources and Environment	Government	Director, Hazardous Waste Management Division Environmental Official 7	Semi-structured, face-to-face, tape-recorded
03/04 /08	Department of Industrial Works (DIW), Ministry of Industry	Government	Engineer 6	Semi-structured, face-to-face, tape-recorded
04/04 /08	Federation of Thai Industries (FTI), Electrical & Electronics & Allied Industries Club	Trade association	Deputy Secretary General	Semi-structured, face-to-face, tape-recorded
	Eco Group (Thailand) Co Ltd	Consultant	Managing Director	
05/04 /08	A major lighting producer	Producer	(not disclosed)	Unstructured, telephone, note-taking
16/04 /08	A dealer of lighting equipment	Dealer	(not disclosed)	Unstructured, telephone, note-taking
17/04 /08	Social Research Institute (SRI), Chiang Mai University	Researcher	Deputy Director	Unstructured, face-to-face, tape-recorded
20/04 /08	An insurance broker	Insurer	(not disclosed)	Unstructured, telephone, note-taking

Date	Organisation	Category	Interviewees	Format
20/04 /08	Hewlett-Packard (Thailand) Ltd, Asia Pacific & Japan	Producer	Environment Director	Structured, e-mail
			Environmental Program Manager	
21/04 /08	Dell Inc.	Producer	Senior Manager, Environmental Sustainability	Unstructured, face-to-face, note-taking
22/04 /08	Nokia Pte Ltd	Producer	Environmental Manager, Market Environmental Affairs	Semi-structured, face-to-face, tape-recorded
			Legal Counsel, Asia Pacific, Customer and Market Operations	
			Customer Care Manager, Customer Care Thailand	
22/04 /08	National Center of Excellence for Environmental and Hazardous Waste Management (NCE-EHWM), Chulalongkorn University	Researcher	Researcher	Unstructured
23/04 /08	Department of Chemical Engineering, Kasetsart University	Researcher	Director, Cleaner Technology and Eco-Design Research Unit	Semi-structured, face-to-face, tape-recorded
	National Metal and Materials Technology Center (MTEC)	Government	Acting Director, Focus Center on Life Cycle Assessment & EcoProduct Development	
23/04 /08	Thai Environmental Institute (TEI)	NGO	Research fellow	Semi-structured, face-to-face, tape-recorded
25/04 /08	Faculty of Economics, Thammasart University	Researcher	Professor	Semi-structured, face-to-face, tape-recorded
28/04 /08	Japan External Trade Organization (JETRO)	Bilateral agency	Director, Energy & Environment Technology	Semi-structured, face-to-face, tape-recorded

Date	Organisation	Category	Interviewees	Format
28/04 /08	A major importer of mobile phones (not disclosed)	Importer	(not disclosed)	Unstructured, face-to-face, note-taking
	An environmental consulting company	Consultant	(not disclosed)	
	A waste management company	Waste management company	(not disclosed)	
29/04 /08	A major producer of electrical appliances	Producer	(not disclosed)	Semi-structured, face-to-face, tape-recorded
29/04 /08	Federation of Thai Industries (FTI), Environmental Management Club	Trade association (recyclers)	Honorary Chairman	Semi-structured, face-to-face, tape-recorded
30/04 /08	Department of Industrial Works (DIW), Ministry of Industry	Government	Director, International Hazardous Waste Management Division	Semi-structured, face-to-face, tape-recorded
30/04 /08	Federation of Thai Industries (FTI), Environmental Management Club	Trade association (recyclers)	Deputy Secretary General	Unstructured, telephone, note-taking
	Unicopper Trade Ltd Part	Recycler	Managing Director	
02/05 /08	Department of Primary Industries and Mines (DPIM), Ministry of Industry (MoI), Bureau of Value-Added Industries (BVAI)	Government	Director,	Semi-structured, face-to-face, tape-recorded
			Senior Metallurgist	
06/05 /08	Suankaew Foundation	Charity, donation of used products	Secretary	Semi-structured, face-to-face, tape-recorded

Date	Organisation	Category	Interviewees	Format
06/05 /08	National Electronics and Computer Technology Center (NECTEC)	Government	Director	Semi-structured, face-to-face, tape-recorded
07/05 /08	Siam Cement Trading (SCT) Co Ltd	Material trading company	Senior Business Development Manager, Recycling Business Division	Semi-structured, face-to-face, tape-recorded
			Marketing Executive	
08/05 /08	Panasonic	Producer	Deputy General Manager, Environmental Management Office	Semi-structured, face-to-face, tape-recorded
			Corporate Governance Manager, Planning Group	
21/05 /08	Dell Inc.	Producer	Senior Manager, Environmental Sustainability	Structured, e-mail

Appendix C – List of electrical and electronic equipment

Category	Examples
1. Large household appliances	Refrigerators, freezers, other large appliances used for refrigeration, conservation and storage of food, washing machines, clothes dryers, dish washing machines, electric stoves, electric hot plates, microwaves, other large appliances used for cooking and other processing of food, electric radiators, other large appliances for heating rooms, beds, seating furniture, electric fans, air conditioner appliances, other fanning, exhaust ventilation and conditioning equipment.
2. Small household appliances	Vacuum cleaners, carpet sweepers, other appliances for cleaning, appliances used for sewing, knitting, weaving and other processing for textiles, irons and other appliances for ironing, mangling and other care of clothing, toasters, fryers, grinders, coffee machines and equipment for opening or sealing containers or packages, electric knives, appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body care appliances, clocks, watches and equipment for the purpose of measuring, indicating or registering time, scales.
3. IT and telecommunications equipment	Mainframes, minicomputers, and printer units, personal computers (CPU, mouse, screen and keyboard included), laptop computers (CPU, mouse, screen and keyboard included), notebook computers, and notepad computers, printers, copying equipment, electrical and electronic typewriters, pocket and desk calculators, and other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means, user terminals and systems, facsimile, telex, telephones, pay telephones, cordless telephones, cellular telephones, answering systems, and other products or equipment of transmitting sound, images or other information by telecommunications.
4. Consumer equipment	Radio sets, television sets, videocameras, video recorders, hi-fi recorders, audio amplifiers, musical instruments, and other products or equipment for the purpose of recording or reproducing sound or images, including signals or other technologies for the distribution of sound and image than by telecommunications.

Category	Examples
5. Lighting equipment	Luminaires for fluorescent lamps with the exception of luminaires in households, straight fluorescent lamps, compact fluorescent lamps, high intensity discharge lamps, including pressure sodium lamps and metal halide lamps, low pressure sodium lamps, other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs.
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)	Drills, saws, sewing machines, equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching, folding, bending or similar processing of wood, metal and other materials, tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses, tools for welding, soldering or similar use, equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means, tools for mowing or other gardening activities.
7. Toys, leisure and sports equipment	Electric trains or car racing sets, hand-held video game consoles, video games, computers for biking, diving, running, rowing, etc., sports equipment with electric or electronic, components, coin slot machines.
8. Medical devices (with the exception of all implanted and infected products)	Radiotherapy equipment, cardiology, dialysis, pulmonary ventilators, nuclear medicine, laboratory equipment for in-vitro diagnosis, analysers, freezers, fertilization tests, other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability.
9. Monitoring and control instruments	Smoke detector, heating regulators, thermostats, measuring, weighing or adjusting appliances for household or as laboratory equipment, other monitoring and control instruments used in industrial installations.
10. Automatic dispensers	Automatic dispensers for hot drinks, automatic dispensers for hot or cold bottles or cans, automatic dispensers for solid products, automatic dispensers for money, all appliances which deliver automatically all kind of products.

Source: The WEEE Directive (Annex IB)

IIIEE Dissertations

Niina Kautto
Towards More Coherent and Sustainable Biomass Policy: Examining European biomass-to-energy planning
IIIEE Dissertations 2011:2

Panate Manomaivibool
Advancing the Frontier of Extended Producer Responsibility. The management of waste electrical and electronic equipment in non-OECD countries
IIIEE Dissertations 2011:1

Martin Kurdve
Chemical Management Services from a Product Service System Perspective. Experiences of fluid management services from Volvo Group metalworking plants
IIIEE Dissertations 2010:1

Panate Manomaivibool
Making Sense of Extended Producer Responsibility. Towards a framework for policy transfer
IIIEE Dissertations 2009:7

Tareq Emtairah
Lost in Transition: Sustainability Strategies and Social Contexts
IIIEE Dissertations 2009:6

Åke Thidell
Influences, Effects and Changes from Interventions by Eco-labelling Schemes. What a Swan can do?
IIIEE Dissertations 2009:5

Helen Nilsson
Finding a Balance. Placing Farmers' Markets in the context of sustainability in modern society
IIIEE Dissertations 2009:4

Dagmara Nawrocka
Extending the Environmental Focus to Supply Chains. ISO 14001 as an inter-organizational tool?
IIIEE Dissertations 2009:3

Beatrice Kogg
Responsibility in the Supply Chain. Interorganisational management of environmental and social aspects in the supply chain. Case studies from the textile sector
IIIEE Dissertations 2009:2

Charlotte Leire
Increasing the Environmental and Social Sustainability in Corporate Purchasing. Practices and tools
IIIEE Dissertations 2009:1

Chris van Rossem
Individual Producer Responsibility in the WEEE Directive – From Theory to Practice?
IIIEE Dissertations 2008:3

Camelia Tepelus
Destination Unknown? The Emergence of Corporate Social Responsibility for Sustainable Development of Tourism
IIIEE Dissertations 2008:2

Luis Mundaca
Markets for Energy Efficiency – Exploring the new horizons of tradable certificate schemes
IIIEE Dissertations 2008:1

Adriana Budeanu
Facilitating Transitions to Sustainable Tourism
IIIEE Dissertations 2007:4

Carl Dalhammar
An Emerging Product Approach in Environmental Law – Incorporating the life cycle perspective
IIIEE Dissertations 2007:3

Kes McCormick
Advancing Bioenergy in Europe: Exploring bioenergy systems and socio-political issues
IIIEE Dissertations 2007:2

Kaisu Sammalisto
Environmental Management Systems – a Way towards Sustainable Development in Universities
IIIEE Dissertations 2007:1

Murat Mirata
Industrial Symbiosis : A tool for more sustainable regions?
IIIEE Dissertations 2005:1

Andrius Plepys
Environmental Implications of Product Servicising. The Case of Outsourced Computing Utilities
IIIEE Dissertations 2004:3

Naoko Tojo
Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality?
IIIEE Dissertations 2004:2

Oksana Mont
Product-service systems: Panacea or myth?
IIIEE Dissertations 2004:1

Philip Peck
Interest in Material Cycle Closure? Exploring evolution of industry's responses to highgrade recycling from an industrial ecology perspective
IIIEE Dissertations 2003:2

Zinaida Fadeeva
Exploring cross-sectoral collaboration for sustainable development: A case of tourism
IIIEE Dissertations 2003:1

Peter Arnfalk
Virtual Mobility and Pollution Prevention: The emerging role of ICT based communication in organisations and its impact on travel
IIIEE Dissertations 2002:1

Mårten Karlsson
Green concurrent engineering: A model for DFE management programs
IIIEE Dissertations 2001:2

Kaisu Sammalisto
Developing TQEM in SMEs: Management Systems Approach
IIIEE Dissertations 2001:1

Carl Eneroth
e-Learning for the Environment: Improving e-learning as a tool for cleaner production education
IIIEE Dissertations 2000:8

Håkan Rodhe
Preventive Environmental Strategies in Eastern European Industry
IIIEE Dissertations 2000:7

Nicholas Jacobsson
Emerging Product Strategies: Selling Services of Remanufactured Products
IIIEE Dissertations 2000:6

Karin Jönsson
Communicating the Environmental Characteristics of Products
IIIEE Dissertations 2000:5

Pia Heidenmark
Going Organic?
IIIEE Dissertations 2000:4

Peter Kisch
Preventative Environmental Strategies in the Service Sector
IIIEE Dissertations 2000:3

Thomas Lindhqvist
Extended Producer Responsibility in Cleaner Production
IIIEE Dissertations 2000:2

Desta Mebratu
Strategy Framework for Sustainable Industrial Development in sub-Saharan Africa
IIIEE Dissertations 2000:1

Peter Arnfalk
Information technology in pollution prevention: Teleconferencing and telework used as tools in the reduction of work related travel
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Advancing the Frontier of Extended Producer Responsibility

The management of waste electrical and electronic equipment in non-OECD countries

Waste electrical and electronic equipment (WEEE) has become a salient issue in non-OECD countries. With a growing awareness about serious damages to the environment and human health from a lack of safe treatment and recycling of WEEE, there has been a search for policy responses in several of these countries. This research finds that extended producer responsibility (EPR), a policy principle that underpins WEEE programmes in many OECD countries, can help solve the WEEE problem in non-OECD countries by putting the onus on the producers to ensure environmentally sound management of their end-of-life products and make improvements in their product systems, including change in product design. Although there are challenges to the implementation of EPR in emerging and developing economies, notably the problem of free riders and the competition for materials from the polluting recycling sector, they are manageable. In addition, opportunities exist that can facilitate the development of EPR-based solutions, such as the relatively small stock of historical WEEE and manufacturers that have the commitment and experiences with the principle. What is needed to realise this potential is for the policy-makers to create a policy framework that allows and encourages product and system innovations from the producers.

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