1. INTRODUCTION

Go to any major city around the world – any aggregation of people, for that matter – and you will find the same problem: piles of waste, inhabiting ever-growing rubbish dumps, and how to dispose of it. The basic principle of waste disposal around the world hardly differs. Producers produce, consumers consume and the state steps in to manage the disposal of the used goods. In the developed world, this works relatively well, but in the developing world, where the state is often weak or offers few services, this can result in the waste lying around unprocessed, polluting environments, both human and natural, and causing harm to those who live within them. Even in the developed world this is becoming a more severe problem, and government are looking for new ways to minimise the cost of waste management and the amount of waste that is produced.

The current system that is in place almost everywhere in the world is broken. Producers of goods generally do not take the end of the life cycle of their products into consideration, as their main concern is the production and distribution of the goods. The free market approach will almost never make any headway in dealing with waste, not unless customers become activists, which is unlikely. The corporatist approach also fails to deal with waste disposal, as cartels are generally formed to maximise profits, not increase costs. Unfortunately, the option of privatising waste management is not feasible.

In light of this, the onus is falling on governments to deal with the problem of waste and waste management. The question, becomes, therefore, how much government coercion of industry is necessary and/or prudent? Are there ways of meeting the goals of minimising waste, increasing recycling and sustainable product design without government intervention, or is the only option a mandatory approach, with government forcing industry to comply?

In response to this growing waste crisis a number of methods have been developed. This thesis will focus on one of them, known as Extended Producer Responsibility (hereafter shortened to EPR where expedient) and its effectiveness as a solution to the problem of waste management. The main question this thesis is seeking to answer is if Extended Producer Responsibility is a viable, plausible solution to the problems of waste management and waste disposal. This thesis shall discuss the principles of this relatively unknown form of waste management before looking to two examples of it in practice: the Netherlands, with the Dutch Packaging Covenants of 1991-2005, which used an early form of extended producer responsibility; and the state of Maine, in the United States of America, which has implemented some of the most sweeping EPR legislation enacted thus far.

This thesis aims to examine Extended Producer Responsibility in terms of meeting the goal of turning the product life cycle into a true cycle, where, if possible, items are recycled and reused. The thesis will analyse the effectiveness of EPR in theory and practice, to ascertain whether or not it should be more widely implemented, focusing specifically on the above mentioned examples of the Netherlands and Maine.

After examining the case studies, and analysing both their successes and shortcomings, the thesis will then examine whether or not plastic products would make a suitable candidate for an extended producer responsibility program. No waste management programs have been able to truly deal with plastic waste. In the case study of the Dutch Packaging Covenant, it is revealed that plastic packaging is the poorest performer out of all the product categories, due to the difficulty of recycling it. As a result, plastic waste is mostly sent to conventional waste disposal facilities such as landfill, where it is estimated that it can stay for thousands of years. The urgency of finding a solution to this problem makes plastic a prime candidate for the implementation of EPR program.

With the current levels of consumption and waste prevalent worldwide, which are only growing as countries such as India and China become more wealthy, something has to change before it is too late. Extended Producer Responsibility may just be the answer to that problem, and that is what this thesis strives to ascertain.

1.1 Methodology

This thesis will be presented in the framework of an analysis of extended producer responsibility, and then two case studies will be done to examine its effectiveness in practice. The first case study will involve a well-documented example of an early form of extended producer responsibility. That is the Dutch Packaging Covenant. The second case study represents a newer experiment, which is product stewardship in Maine, which fully adopted the principle of extended producer responsibility in 2010 with its product stewardship laws, after two decades of moving in that direction.

Seeing as extended producer responsibility in its full form is rare, two of the best examples were selected for the case study. These examples were also selected because they represent different possible directions for extended producer responsibility to go, therefore allowing an evaluation of which of the two used a better model for attaining their environmental and economic goals.

One of the reasons an approach using case studies was selected was because of a shortage of existing literature about the topic, meaning that an examination of practical examples, though imperfect, became necessary. Eisenhardt (1989) states that case studies are "...particularly well suited to new research areas or research areas for which existing theory seems inadequate." Extended Producer Responsibility is a relatively new concept which has been fully put into practice

only a few times. The comparison of the case studies, is, therefore, useful in terms of seeing if EPR is successful in practice.

The methods of research included email conversations with one of the sponsors and most vocal supporters of the Product Stewardship Framework legislation, who at the time of the discussion was a Senator in Maine's Upper House. The remainder of the source material was found in books, journals, newspapers, film, as well as online sources.

An important question to answer is why this topic in particular? I became interested in extended producer responsibility when reading an article in the Economist, shortly after Maine passed its pioneering product stewardship laws. As I have often felt that not enough is being done to curb waste and encourage recycling, I was intrigued by the effects that a policy such as EPR would have on waste generally, as well as both its political and economic implications. The more I researched, the more fascinated I became, and this thesis is an extension of that original fascination.

2. EXTENDED PRODUCER RESPONSIBILITY: A BACKGROUND

2.1 What is Extended Producer Responsibility?

The main topic of this thesis is extended producer responsibility, the name of which gives some clue as to the nature of itself, but it is still a somewhat ambiguous term.

Lindhqvist (2000) defines Extended Producer Responsibility as:

> *'... 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.'*

Or, put simply: Extended Producer Responsibility internalises the cost of waste management into product prices (Fishbein, 1996). This definition of the internalisation of waste management costs into the final price of the product is key to this thesis, and will be discussed throughout the whole work.

Another key term that will be discussed, particularly with mention to Maine, is product stewardship. Most definitions state that extended producer responsibility and product stewardship are terms that can be used interchangeably, but Rubin et al (2010, p1) note that there are differences between them: "The term product stewardship generally indicates an approach in which multiple

parties bear statutory and/or fiscal responsibility for the end-of-life management of products. Extended producer responsibility is a variant of "polluters pay," in which primary or ultimate responsibility falls upon the producer of a product. Both include mechanisms for manufacturer financing of product recycling or disposal."

Our current levels of consumption and waste are unsustainable, and it is necessary to find a solution. Part of the problem is that there is no incentive for producers to create long-lasting, recyclable products; as they have no part in the disposal of the good, there is no need for them to worry about how to dispose of what they create. Extended Producer Responsibility aims to rectify that, with producers being charged (in whatever way) for the disposal of the product they made. Such systems include product taxes, producer take-back schemes and container deposit programs.

2.2 Why is Extended Producer Responsibility Necessary?

All over the world, citizens and governments alike are struggling with the problems of pollution and waste disposal. Unfortunately, one consequence of the consumer-dependent capitalist system, is dealing with the waste that is produced as a result, usually far more than is necessary. In the period between 1980 and 1997, worldwide municipal waste production increased by over 40% (OECD 2001). Technological advances have sped up such processes, as we continually upgrade our electronic goods long before they stop working.

In 1932 Bernard London wrote an article entitled: Ending the Depression Through Planned Obsolescence. He attacked society at the time hanging onto old and damaged goods, arguing that "People everywhere are today disobeying the law of obsolescence. They are using their old cars, their old tires, their old radios and their old clothing much longer than statisticians had expected on

the basis of earlier experience" (London, 1932, p2). Only by throwing away these items, he argued, would it be possible to bring the economy back to growth.

There are many factors that have resulted in our relatively throw-away society. One of the most crucial, but which is not widely discussed, is the concept of planned obsolescence. Bulow (1986) defines planned obsolescence as "...the production of goods with uneconomically short useful lives so that customers will have to make repeat purchases. However, rational customers will pay for only the present value of the future services of a product. Therefore, profit maximization seemingly implies producing any given flow of services as cheaply as possible, with production involving efficient useful lives."

Put simply, it is in the interest of the producers of goods to create products that have short lives, as it maximises their chances of making a further sale. There is a limitation with this analysis, as producers of shoddy goods will not have repeat customers, so it is in the interest of the producer to make a good that lasts just long enough for a customer to be satisfied enough to buy a new one from the same producer (Rampell 2013). This is currently a major issue in electronics, where the goods, which are high-value and contain many valuable resources, have a shelf life of only a few years. Many in the industry, for example Apple, which is a frequent target of such accusations, claim that this is not intentional planned obsolescence, but simply a matter of continuing technological development. It is true that many consumers of, for instance, mobile phones, upgrade to a newer, flashier model before their previous phone became unusable.

In the case of technological or electronic goods, one reason for recycling is to gain access to the valuable materials inside the goods. In other cases, it is because the products, when disposed of conventionally, are hazardous or cause environmental harm. In the current models most of the world employs for waste management, the costs of disposal are borne entirely by the government, usually at the municipal level, and are thus funded by taxpayers. The producer is unaffected by the

cost of the disposal, and has no motive to change to less profitable, but more environmentally-friendly materials.

Worse still, often these hazardous or environmentally-harmful products end up making their way to landfill or incinerators. From there, there is a high risk of pollution, whether from burning the harmful products, releasing the pollutants into the air, or them leaching into the soil or water through the landfill. This damage is not currently measured in economic terms, but it is extremely harmful, not only to the economy, but also to the environment and society.

Extended producer responsibility may be the answer to these problems, as it privatises, or internalises, these costs back onto the producer, burdening them with the problem and forcing them to deal with the consequences.

2.3 The Product Life Cycle

The product life cycle, without intervention, is essentially a straight line. It can be represented as follows:

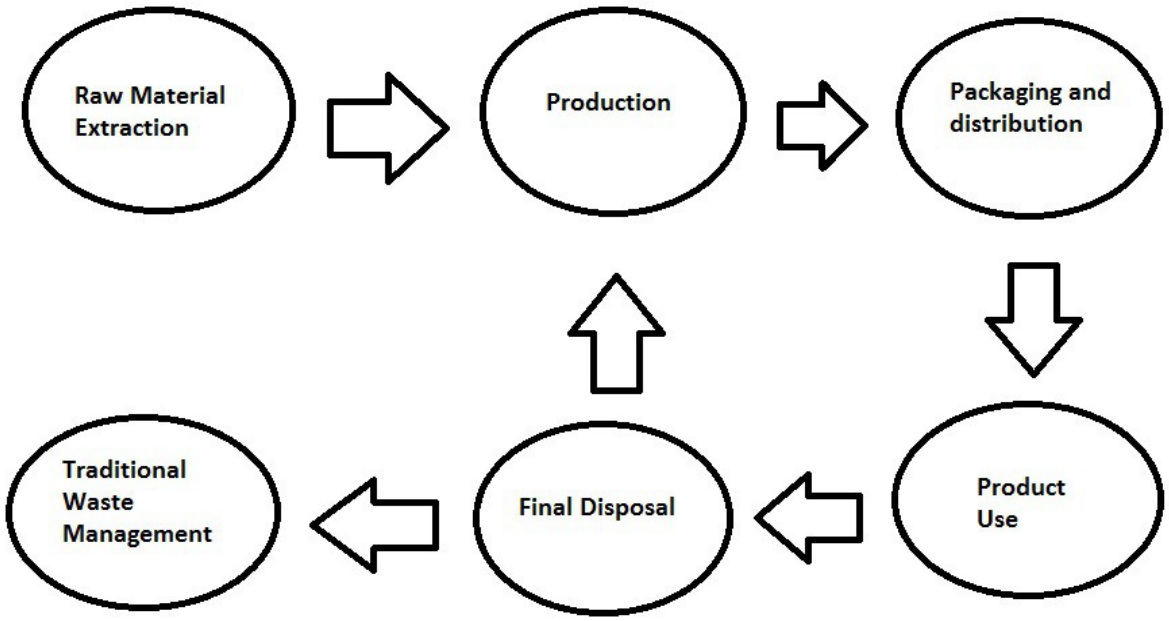
Raw material extraction => Production =>Packaging and Distribution => Use => Disposal

Each aspect of the product life cycle involves different actors. For the purpose of this thesis the most important parts of the product life cycle are the production (or manufacturing) stage, which is done by the producer, and the disposal, which is done typically by municipal governments.

The purpose of extended producer responsibility is to change the product life cycle from a straight

line to a close circular system. This can be illustrated in this way:

Diagram 1



In this simple diagram, I have tried to show the way the product life cycle can be made more circular, by the waste being returned to the producer. This is one of the key tenets of extended producer responsibility.

For the sake of clarity, I will mention that this thesis also examines packaging waste, in the case study of the Dutch Packaging Covenants, but for the purpose of that case study, the packaging industry which is being examined is in fact the producer.

3. WASTE MANAGEMENT

3.1 Introduction

It is first important to understand what is a waste stream, as this is the problem that waste management sets out to address. Davidson (2011) states that a waste stream can contain garbage, refuse, sludge, rubbish, tailings, debris, litter and other discarded materials resulting from residential, commercial, institutional and industrial activities.

The following section will examine the traditional methods of dealing with waste, to provide clarity during in-depth discussions of waste management later in the thesis, particularly with reference to extended producer responsibility.

3.2 Types of Waste Management

The following section examines the different kinds of waste management. This is necessary as a means to understanding the process that EPR both employs and seeks to avoid.

3.2.1 Treatment and Disposal

- Landfill

  As the name suggests, landfill refers to waste being disposed of on land, usually by being buried under the earth. Many facilities offering this service simply occupy holes left by quarries or mines, but modern technology and is making them more sophisticated and less environmentally harmful.

One of the biggest problems with landfill is the release of methane and other gases due to anaerobic reactions which break down waste. This release of methane and other gases is a contributor to to the emissions of greenhouse gases (Lou, Nair & Ho, 2013). It also has an unpleasant smell, contributing to NIMBY-ism (Not In My Backyard), making new landfill difficult to establish. Other problems include infestations of pests such as rodents and birds, and the spread of waste and contaminants due to wind and water.

Lou, Nair and Ho (2013) note that approximately 12.6% of the waste going to landfill in Australia is food-based, which quickly breaks down and releases methane and other gases, as well as hastening the break down of other waste stored there.

- Incineration

  Incineration is a hugely controversial method of waste disposal, largely due to its nature – it involves the burning of waste material. When this process is used successfully, the solid waste is decreased to a fraction of the original mass, making disposal somewhat easier. This solid waste is then generally sent to landfill, but this process makes the amount of waste storage possible much greater. This makes incineration a common option in areas with high population density and little available space for landfill.

  The British Department of Environment, Food and Rural Affairs (2013) defines incineration as "'processes that combust waste and recover energy." It goes on to state that in many countries the incineration of waste is relied on for the disposal of the remaining residual waste left over from other aspects of the waste management chain.

  Even though measures are put in place to prevent pollutants being released in the air, due to

filtering and emissions limits put in place to minimise the release of harmful compound such as dust, heavy metals, carbon monoxide and sulphur dioxide, this pollution still occurs, so it is desirable to keep such pollution to the barest minimum.

The biggest factor against incineration in waste management is public perception, particularly because of odour, noise, dust and environmental concerns.

3.2.2 Recycling

Recycling is a concept that is particularly relevant to extended producer responsibility, as any EPR program will involve recycling. Recycling is the process of transforming used goods or materials into new goods or materials, which can have equal, greater or lesser value of the original goods or materials.
Most recycling is carried out in facilities that sort and then process different kinds of waste. The sorting process traditionally involves human labour, but technology is being increasingly used for the job. The Economist (2007) mentions optical sorting technologies which are able to separate different types of paper and plastic.

Recycling is also an increasing part of the waste management cycle. The Economist (2007) uses the United States as an example, which increased its recycling rate from 9.6% in 1980 to 32% in 2007. Some European countries, including Austria and the Netherlands, recycle more than 60% of their municipal waste.

The biggest problem with recycling is the economic aspects of it. Recycling is expensive, time-, labour- and energy-intensive, and often is not capable of being self-sustaining without government

intervention and support. In the case of curbside recycling, which is a common way that
Even so, most kerbside recycling programmes are not financially self-sustaining. The cost of collecting, transporting and sorting materials generally exceeds the revenues generated by selling the recyclables, and is also greater than the disposal costs.

One of the main reasons that recycling can be economically and environmentally inefficient is that products are not designed specifically for the purpose of being recycled. This links back to extended producer responsibility, which aims also to affect product design.

3.2.3 Energy Recovery

- Biological Recovery

  The best example of biological recovery is something many households have at home: a compost bin or compost heap. This turns biological waste into mulch or compost which can be used for gardening or landscaping. It can be done on large scales, and these large-scale examples often involve energy recovery of escaping methane and other gases.

- Energy Recovery

  Energy Recovery is an increasingly popular form of waste management. This involves using different processes, such as incineration or the trapping of gases escaping from landfill. This field is often referred to as biomass, though biomass also harnesses energy from other sources, such as wood, sugarcane and corn.

  Energy recovery differs depending on the sources. The British Department of Environment, Food and Rural Affairs (2013) divides it into three main categories:

Incineration – the production of electricity and heat following the thermal treatment or incineration of waste.

Anaerobic digestion – using the by-product of the anaerobic breakdown of biodegradable waste to produce energy through the combustion of bio-gas.

Landfill – capturing and using the by-product of the process of biodegradable waste decomposing in landfill to produce electricity.

Biological and energy recovery are not particularly relevant to the topic of extended producer responsibility, but are an interesting and novel way of dealing with both waste management and an energy-dependant society.

3.2.4 Source Reduction and Reuse

- Resource Recovery

  Recycling can be seen to be a kind of resource recovery, but for the purposes of this thesis, I will regard resource recovery as the extraction of valuable materials from goods that are made of multiple materials, or composite goods. This is particularly relevant in electronic waste, where resources such as gold, copper and rare earths can be extracted and re-used after processing. This is, unfortunately, extremely expensive and not aided by product design. Extended Producer Responsibility can be used to encourage resource recovery, by providing incentives and impetuses for producers to both extract the resources and also make it easier to extract them with better product design.

- Waste Minimisation

  Probably the most effective method of waste management comes before production, in the design phase, when choices can be made that minimisation the amount of waste at the end

of the product's life cycle. This can be through using products that are more easily recyclable, or by using fewer materials to produce the same good.

Waste minimisation can also involve restoring and reworking goods or parts that have broken down, are no longer in ideal condition, or are simply in products that are no longer wanted. This is a form of recycling that minimises the amount of materials required to create new goods.

Waste minimisation is a key aspect of extended producer responsibility. EPR aims to influence producer decisions and processes at the earliest stages, from design to production, to minimise end-of-life waste.

3.3 The Waste Management Hierarchy

The main goal of waste managers, which in the vast majority of situations are run by the public (state) sector, is to make waste management as cheap, efficient and environmentally-friendly as possible.

The Department of Environment, Food and Rural Affairs (2011) defines the waste hierarchy as ranking "...waste management options according to what is best for the environment." This is also a core goal of extended producer responsibility. The hierarchy shows different methods of waste management ranked from most preferred to least preferred: see Diagram 2.

Diagram 2: The Waste Management Hierarchy

Source: United States Environmental Protection Agency (2013)

Extended Producer Responsibility is one way of achieving the waste hierarchy's goals, as recycling, and source reduction and reuse. Extended Producer Responsibility provides the instruments that allow this to be achieved.

4. EXTENDED PRODUCER RESPONSIBILITY IN THEORY

4.1 Introduction

Extended Producer Responsibility is not a particularly new phenomenon, it is new simply in its scope and how elaborate its schemes are becoming. The grandfather of EPR is the container deposit scheme, which is quite widespread around the world.

4.2 History of Extended Producer Responsibility

The first known container deposit scheme in modern history is said to have been enacted in Dublin in 1799 by A & R Thwaites & Co, wherein customers received two shillings for a dozen returned bottles. The well-known company Schweppes also had a policy around that time of rewarding customers for returning bottles. This was unlegislated – rather, it was a voluntary program in the companies' own interest - and may have been largely related to the high cost at that time of producing glass bottles, thus saving the company considerably, even after the return of the deposit.

The most famous examples of these systems mostly started appearing around the 1970s and 1980s, starting with the Oregon “Bottle Bill”, which was passed in 1971 and came into force in 1972. It has been amended several times, but remains in force, and provides for the return of deposits from cans, bottles and other containers of beer, water and carbonated beverages. Most of the world's container deposit systems were modeled on Oregon's pioneering system.

A more advanced scheme, which is more directly related to extended producer responsibility, was established in Germany in 1991 in response to the burgeoning problem of the disposal of packaging.

The scheme, known as the Duales Systeme Deutschland, or German Green Dot System, was put in force to make the producers and distributors of all forms of packaging responsible for the collection and disposal of packaging waste. Due to the implementation of the law, between 1991 and 1998, despite an increase in consumption, the per capita annual consumption of packaging decreased from 94.7 kilograms to 82 kilograms, which is an overall decrease of 13.4%. This was an extremely impressive achievement, as during this same period, which coincided with the reunification of East and West Germany, consumption per capita increased (OECD 2000).

At the same time, the Netherlands was developing its own similar system that was also effective at decreasing packaging waste. This was established by the Dutch Packaging Covenant of 1991, which will be further discussed in a later case study.

As was shown in the examples of A & R Thwaites & Co and Schweppes, not all systems need to be legislated for; sometimes companies can develop such programs voluntarily. This is particularly true in the case of technology companies. According to the OECD (2001), IBM has long had a voluntary take-back program in Austria, France, Switzerland, Italy, and the United Kingdom, and Xerox had a significant program for the return of cartridges from its photocopiers. Dell developed a take-back program in the 1990s, and even changed the design of its computer casings to increase the ease of recycling.

Rubin et al (2010) estimated that in 2010 there were at least 60 programs with some elements of extended producer responsibility enacted in 33 different states in the United States. Possibly the most progress was made by the state of Maine in the United States. While many other states introduced programs with elements of extended producer responsibility, Maine has pushed it the furthest, with laws targeting six different product categories and legislation to encompass them all

that was passed in 2010, the product stewardship framework. Product stewardship, as was previously mentioned in the definitions section of the introduction, is another name for extended producer responsibility. These developments will be further discussed in this thesis's second case study, which will focus on the pioneering example of Maine.

4.3 Types of Extended Producer Responsibility

4.3.1 Introduction

We once lived in a world were things were made to last. One need only look at the Great Pyramids of Giza, the Great Wall of China, or the Charles Bridge, to realise that things were once built to last. The same went for the things we use in our everyday lives. The castles of Europe are still adorned with furniture from many centuries ago, often looking just as good (perhaps after a restoration or two) as it did when it was first outfitted.

This is stark contrast with the modern world. Sometimes it seems like the products we buy are designed so poorly that it seems like they are intentionally falling apart.

While Bernard London may have coined the term, planned obsolescence is often attributed to the industrial designer Brooks Stevens. He described planned obsolescence as "...instilling in the buyer the desire to own something a little newer, a little better, a little sooner than is necessary." He did not intend it as being a reason to create low-quality products, but rather as a way of inducing people to want something new (Adamson 2003).

This sounds like a fairly innocuous idea, but in practice it has led to companies making products

more intricate, more complicated, with more parts, which are more likely to malfunction, or even products that are completely disposable. One only need look at tissues, plastic bottles and plastic cutlery to see a world where entire industries have sprung up to provide goods which are replaced after only one use, but often needlessly. This is in addition to the fact that they often are made from a product which is very difficult to biodegrade (plastic, in the case of bottles and cutlery) and thus could potentially be used for a very long time.

Many companies even create products that are almost impossible or too expensive to fix. The cost of repairing a broken printer is usually higher than the cost of replacing it. Laptops, tablets and phones are now often designed to make it difficult to replace broken parts, such as batteries or motherboards. An iPhone that survives two years is already obsolete, but most people still have a Nokia phone sitting around in a drawer that after ten or fifteen years works perfectly well. While the technology involved in making a modern smartphone is certainly much more advanced than a fifteen-year-old handset, much of the hardware consists of the same basic resources.

This is the world where extended producer responsibility is important. It is in the companies' interest to sell as much as they can. When they are not involved in the products' end-life, they also have no impetus to make the disposal of the product as easy as possible, or to make the valuable resources in the product easy to extract.

There is also a great paradox. While industrial waste is an increasing problem around the world, more and more people in the developed world are opposed to incinerators, dumps and landfill being placed in their neighbourhood. This makes it even more difficult to deal with the end of the product life-cycle, and has resulted in much waste from the developed world being exported to developing countries. Rather than being re-used or recycled, there is instead an increase in the pollution of

countries which already have burgeoning pollution and public-health crises.

Extended producer responsibility, therefore, is a means to internalising (on the part of the producer of the goods) the cost of the externality (the disposal of the good). In this way, using EPR can result in increased resource efficiency, the increased use of both recycled and recyclable materials in the production of goods, and, most importantly, both waste prevention and reduction.

Another way of describing it is as the Polluter Pays Principle (PPP). This ensures that polluters (and in this case I am classifying all producers of goods that need to be sent to landfill, be incinerated or recycled) are the ones who bear the brunt of the costs of the environmental impacts they generate. This is in contrast to them being borne by society as a whole, and especially, local governments. While the world may be highly globalised, the vast majority of waste management is dealt with at a local level, which puts great pressure on local and municipal governments (OECD 2000).

The cost of this is ultimately borne by taxpayers, but not the producer of the good. Extended producer responsibility seeks to remedy that, by making the producer involved also in the end of the products life. By forcing the producers to be responsible for at least the cost of the disposal of the goods, it gives producers cause to create longer-lasting, less environmentally-damaging, more easily-disposed-of products.

Without this pressure, it is unlikely that producers would give much thought to incorporating these ideas into product design. In the capitalist world, the ultimate goal is to make profit, and many of these changes are relatively costly for little gain to the producer, seeing as governments and taxpayers bear the cost of disposal.

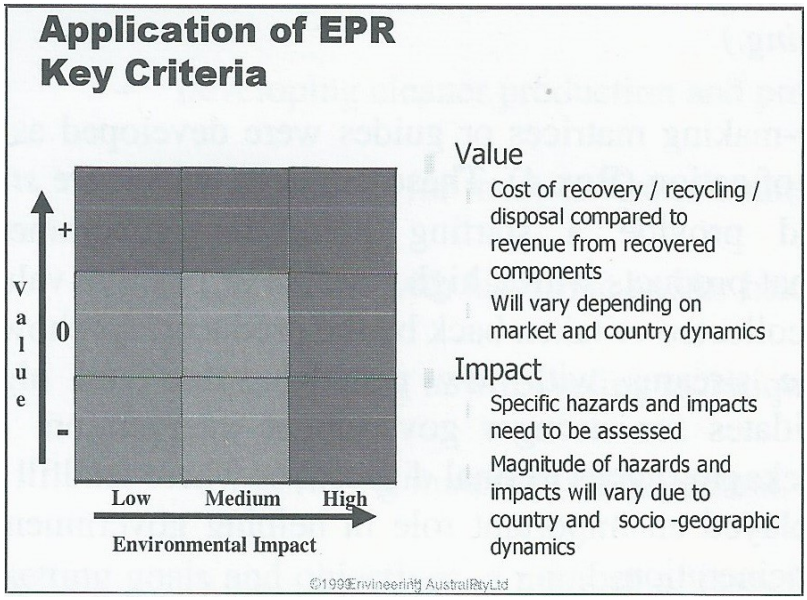
4.3.2 EPR Criteria

Extended producer responsibility can be applied to any goods, from the aforementioned example of plastic bottles, plastic cutlery and tissues, to higher level goods such as electronics or even automobiles. The disposal of all of these goods creates externalities which must be dealt with, and extended producer responsibility is one way of doing that.

Most of the world's existing schemes deal with the disposal of either packaging (usually government-enforced) or electronics waste (often voluntary). This leads to the question: what is the most effective way of putting extended producer responsibility systems in place, which balance both cost effectiveness and environmental impact.

To examine this, the reader is directed to look at Graph 1, which shows value charted against environmental impact. The ideal situation would be a positive value (low-cost or profitable) result with high environmental impact.

Graph 1

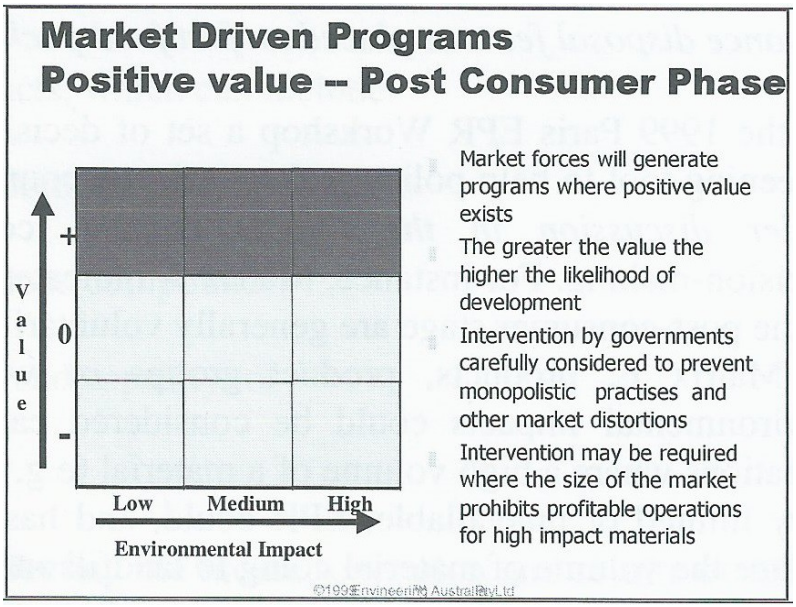


Source: Bennett (1999)

4.3.3 Market Driven Programs

Graph 2 shows a situation where the market will drive the developments needed, with consumers and producers in a symbiotic relationship resulting in the implementation of changes that have both positive value and there is the potential for high environmental impact.

Graph 2



Source: Bennett (1999)

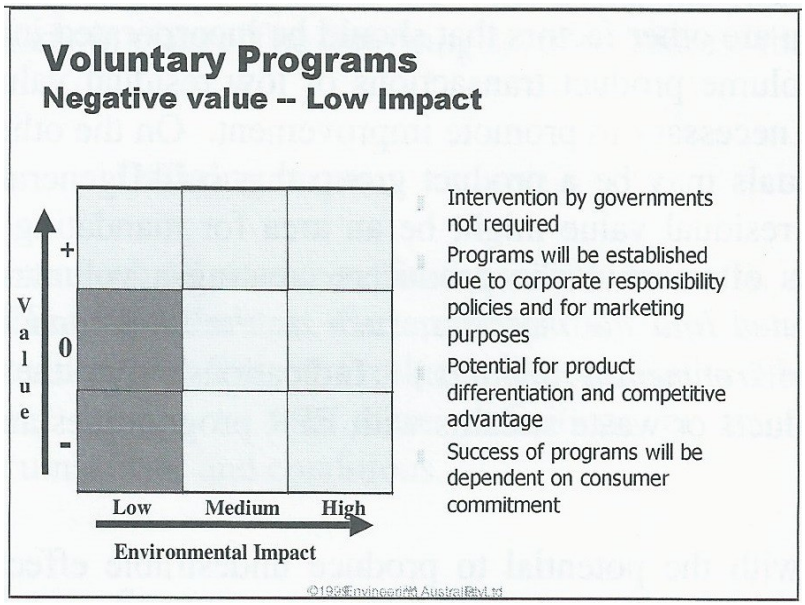
Unfortunately, there has been plenty of time for these programs to be developed, and, unfortunately, they are extremely rare. When they do exist, they are often niche products, where it is in the interest of both parties to have an environmentally-responsible option, such as in products which advertise their "green" credentials.

4.3.4 Voluntary programs

Graph 3 shows a kind of program which is already quite pervasive. That is where the company

develops such a program, often driven by corporate social responsibility (CSR), for marketing purposes and differentiation from their competitors.

Graph 3



Source: Bennett (1999)

These programs are generally merely cosmetic, and have low environmental impact. They can still be costly, though as they are voluntary, the producer usually keeps the costs to their lowest acceptable minimum. These programs are quite common, such as the voluntary take-back programs from producers of electronic goods.

The OECD (1999, p. 16) gives the following examples as methods that could fall under the category of voluntary programs.

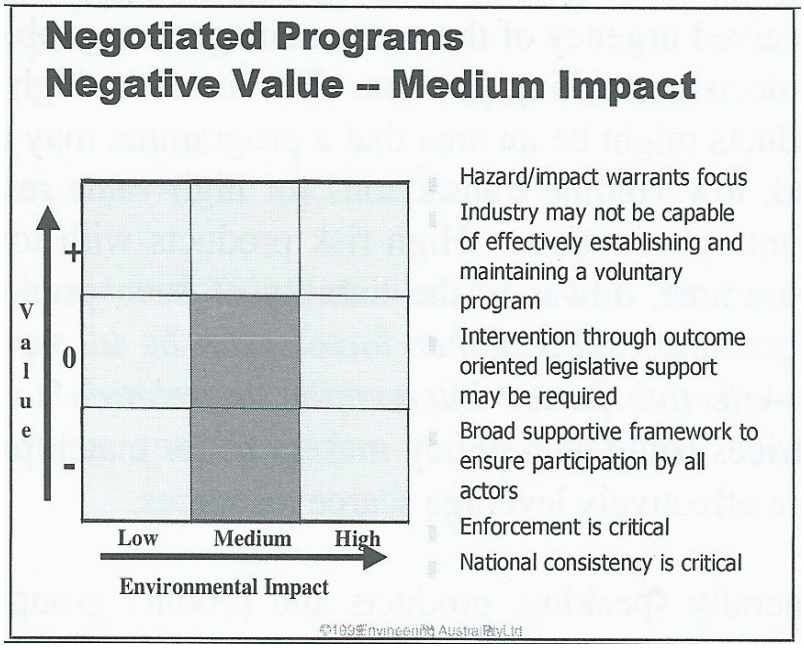
- unilateral commitments made by polluters;
- agreements that have arisen between polluters and those affected by the pollution;
- environmental agreements negotiated between public administration or authorities and industry; and

- voluntary programmes established by public authorities, which individual firms may choose to participate in.

4.3.5 Negotiated Programs

Graph 4 shows an approach which is also quite commonly used. This is a step up from the voluntary model, where it is often an industry-wide program that can be either negotiated by industry alone or with government involvement. The most common cases require the government to be involved, and an example of this is the Dutch Packaging Covenant, which will be analysed later in a case study.

Graph 4



Source: Bennett (1999)

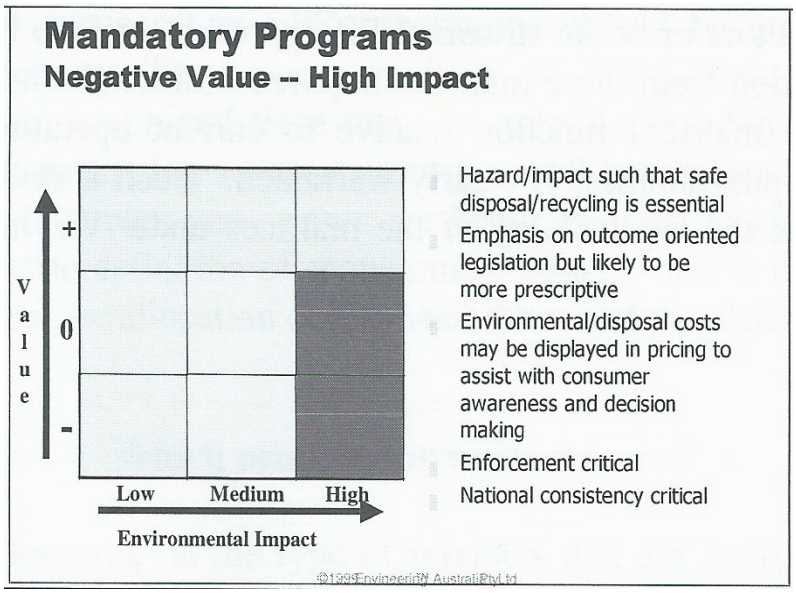
These programs can still be costly, but are effective in the sense that the costs are spread throughout the industry, thus resulting in all players being affected and not losing competitive advantage. They generally result in medium effectiveness, resulting in a reduction of resource and energy consumption, as well as operational costs. Increased credibility with the public, government and

shareholders is also a result, which fits into the trend towards corporate social responsibility.

4.3.6 Mandatory approaches

Unfortunately, many industries are reluctant to become involved in such programs because of the cost and a lack of external impetus from customers, shareholders and society at large. In view of this need, governments often choose to legislate without corporate consultation or against producers' wishes.

Graph 5



Source: Bennett (1999)

These programs can be highly effective and result in strong positive environmental results, but also have high costs to both companies and in enforcement. It is crucial that governments strictly enforce these laws and are consistent at the highest possible level, preferably national or higher.

This thesis mostly examines negotiated and mandatory approaches to extended producer responsibility, though there are examples of voluntary programs contained throughout. Unfortunately market driven programs are rare and will not be further discussed.

5. POLICY INSTRUMENTS IN EPR

5.1 Introduction

Just as there is no one way to approach extended producer responsibility, there is no singly way to implement it. There are many ways in which these policies can be developed to have similar results.

5.2 Product Take Back

The clearest way of ensuring that the product's life cycle both begins and ends at the level of the producer is through product take-back schemes. This is a perfect example of the producer's responsibility being fully extended. It is possible to say that product take back is a very pure form of extended producer responsibility.

Product take-back can be both voluntarily and mandatorily implemented, but the ultimate result is fairly similar. It can be extended to products (cars, computers), product categories (electronic goods) or even to product waste streams (packaging). After the product has been used, it is taken back to the producer and subsequently destroyed.

The German Packaging Ordinance was previously discussed in the chapter on the history of extended producer responsibility, and this is seen as a pioneering example of the take-back concept. Examples of product categories it has been extended to include: automobiles, tyres, batteries, computers, mobile phones, used oil, oil filters, paint, containers (such as beer bottle and gas cylinder schemes), refrigerants, white goods and other electronic products. It varies by country, but such programs exist throughout the European Union, in the United States, Australia, Canada, Japan,

Korea and Norway (OECD 2000).

5.3 Economic Instruments

Taxes, deposit-refund schemes, advance disposal fees and subsidies are all examples of instruments that can be used to ensure similar outcomes to the aforementioned product take-back schemes, but are considerably economically messier and more distortive than the simpler take-back programs.

To ensure the greatest amount of effectiveness, it is important that the responsibility is still shifted to the producer to the highest possible degree. In the case of taxes which would increase the cost of the purchase/production of the product, it would be important the ensure that the money raised from the tax is earmarked towards the disposal of the taxed goods in question. Likewise, in the instance of an advance disposal fee, where the consumer pays a fee at the point of purchase, which is designed to cover the costs of the disposal of the good, it is important to make that the producer has physical responsibility for said product (OECD 2000).

Unfortunately, there are examples of the system of advance disposal fees, which is commonplace in the European Union (however usually at the level of the distributor, e.g. electronics stores), being abused by the producers or distributors of the goods, who simply dumped the products that were returned to them (putting pressure once again on the municipal waste system, which these systems are designed to prevent) and pocketing the fees they had charged the customers for the disposal. This potential for abuse results in a need for carefully-crafted legislation, and strong enforcement with punitive damages for law-breakers. Ideally, it would avoid the middle men, such as the distributor, which decreases the potential for abuse of the system.

Container deposit schemes are the most famous and widespread example of this category, and have been extremely successful around the world. Unfortunately, they have largely been limited to food and beverage containers, such as cans, tins an bottles, though there is no reason they could not be equally effective in other product categories. The basic function is a small deposit is made at the point of purchase; when the used product is returned, the deposit is repaid to the consumer. The higher the deposit, the higher the rate of return. An OECD analysis of such schemes indicated an average of over 60% of all covered containers during the 1990s (OECD 2000).

5.4 Product Standards

Product standards are another way of affecting the design of the product, and often also contain take-back mechanisms. They are not a perfect example of extended producer responsibility, but they do often result in significant reductions in waste or the use of toxic, harmful, or difficult-to-dispose-of products.Through the establishment of standards that are progressive, that is, that they get progressively more advanced or difficult to meet, it encourages industries to innovate and find better ways of producing goods. This model has often been used with packaging and containers (OECD 2000).

Examples of product standards that would fit into extended producer responsibility would be establishing a minimum recycled content for the product or ensuring that the product is easily recyclable/re-usable. These systems are often put in place voluntarily across industries, but can occur with government involvement.

5.6 Leasing

Leasing directly from the producer is an example of extended producer responsibility, as at the end of the customer's contract, the product would be returned to the producer and the producer would be responsible for the end of its life cycle. This encourages the producer to create products that are easily recycled, re-purposed or disposed of (OECD 2000).

This is a system that works only with high-value goods, such as automobiles, white goods, or electronics, and is increasingly popular with consumers who wish to continually update their technology. The producer is often also responsible for servicing and maintaining the quality of the good, so it is in their interest to create goods that are long-lasting and high quality.

6. CASE STUDY: THE DUTCH PACKAGING COVENANTS

6.1 Introduction

The first case study will focus on a negotiated agreement: the Dutch Packaging Covenant. It is often put forward as the quintessential example of a negotiated agreement.

The Packaging Covenant actually comprised three separate negotiated agreements which covered the periods of 1991 to 2005. The agreements were negotiated between the Dutch government and private actors in the packaging chain as a means of decreasing the amount of packaging use and increasing the total percentage of packaging being recycled.

One of the reasons a negotiated agreement was chosen was because the package industry in Holland was greatly opposed to the establishment of a deposit-refund system, which the Environment Ministry was most in favour of, due to its impact on encouraging recycling and decreasing the problem of littering. The packaging industry, on the other hand, saw the financial cost of a deposit-refund system as being punitive and exorbitant, and were therefore keen to negotiate a system in which that was not so economically punishing (Toovey 2006).

This is often a forcing hand the government holds in negotiating any agreement; they can always make a mandatory system instead. This forces otherwise reluctant actors to come to the table.
For the purposes of this case study, only the three Covenants will be analysed, as later changes moved away from the negotiated model, which reinforces the model's shortcomings.

6.2 The First Packaging Covenant

Negotiated agreements have been a popular policy approach in the Netherlands with regards to environmental issues since 1989, when the country laid out a framework in the National Environmental Policy Plan. This led to the development of the First Packaging Covenant, wherein the association for local governments, the Dutch government and private actors in the packaging industry all agreed on the definition of producers and importers of packaging being the actors which must be responsible for meeting the Covenant's requirements. The local government remained the main actor involved in the collection and transportation of household waste to recyclers, though industry-generated packaging waste had to be dealt with by the company that generate said waste (Toovey 2006).

The OECD (1998) lists the goals of the First Packaging Covenant as follows:

- no increase in packaging across the Dutch market;
- by the year 2000 reaching the same level of packaging as was entering the Dutch market in 1986. If possible, further decreases were encouraged;
- packaging waste no longer being sent to landfill;
- an emphasis on reusable packaging; and
- a 60% rate of recycling for disposable packaging by the year 2000, with specific targets for different materials.

These goals are important, because they also provide the foundation from which the Second and Third Covenants were developed.

Worrell and Reuter (2014) argue that the main goal of the covenant was to stimulate packaging

prevention and reduction. Waite (1995, p143) noted that the total amount of packaging waste in the Netherlands in 1986 was 2 million tons. Considering the growth rate of packaging waste in 1991, if this was not dealt with, by the year 2000 that number would have reached 2.8 million tons, so a return to the 1986 levels would represent a 30% reduction, which is no mean feat.

The Covenant was quite successful. Harjula (1998, pp29-31) notes that most of the actors involved in the implementation and management of the program (specifically the government and the packaging industry) were satisfied with the results visible at the end of the first covenant, though there was still significant room for improvement.

6.3 The Second Packaging Covenant

As a result of the fact that the goals of the First Covenant were easily achieved, the actors involved agreed to move forward by developing the next phase: the Second Packaging Covenant, which was then implemented at the end of 1997 (Worrell & Reuter 2014) The new covenant built on the previous covenant, with the main aim of reducing the amount of packaging waste that was not being recycled.

The biggest criticisms of the new Covenant came from environmentalists. They objected to the fact that there were allowances made for economic growth, thus resulting in net increases in the amount of packaging being sent to market, so long as it decreased in relation to GDP. The First Covenant had no allowance for economic growth, so, this was a major letdown to the environmental movement (Toovey 2006). There was also an exception for small companies with less than four employees or less than fifty tons of packaging waste being produced annually (Worrell & Reuter 2014)

That being said, there were still increases in the targets for recycling rates for packaging, which was in any case a positive change. Packaging waste prevention and recycling of packaging waste were dealt with separately, and overall, the recycling targets were received more positively by environmentalists (Toovey 2006).

The Second Covenant did not last long; it was superseded in 2002 by the Third Covenant. By this time, it was clear that results had been somewhat hotchpotch. Some targets were not met; others were more acceptable; others still were more than overcome. This could have been an impetus to try a different approach, but rather the main actors once again agreed to continue with the negotiated agreements and thus the Third Covenant was born (Toovey 2006).

6.4 The Third Packaging Covenant

The new Covenant continued in the same vein as the previous version, with a similar structure and goals. The main new change was the addition of a seventh sub-covenant, which focused on package-waste litter. The purpose of focusing on litter from packaging waste was clear: the ideal solution for the government was still a deposit-refund system, wherein the refunded deposit would act as a positive deterrent for littering. With this in mind, a target was set with a goal of reducing the amount of packaging waste in little by 80% within three years. The government maintained that this was the level of benefit a deposit-refund system would bring (Toovey 2006).

Coercion is a common tactic used by governments to get the results they want, and are a common feature of negotiated agreements. As was just discussed, the Dutch government used to threat of a scheme the packaging industry detested to force them to comply lest they be burdened with the worst possible outcome: the implementation of a deposit-refund system. The use of coercion in negotiated agreements, shows that it does not really pertain to a voluntary system, which is why this kind of program was given its own sub-category in chapter 4 of this thesis.

New targets were set for the different kinds of packaging material. Wood packaging saw a significant increase in the recycling target, as the previous target was easily attained and may have even been set too low originally. A lack of further processing facilities meant that the original target of 80% for metal packaging could not be increased, so this rate remained stable. Paper and cardboard packaging saw a modest decrease in the target rate, but the definition of what was collectable was changed, resulting in what was effectively no change in the target rate. Glass packaging's target recycling rate was not changed. Plastic remained a major under-performer out of all of the packaging waste, due to its difficulty of processing and recycling (Toovey 2006). The difficulty of processing and recycling plastics is a major problem with all plastic recycling worldwide, and will be further discussed in chapter 9 of this thesis.

The Third Covenant was a failure from the perspective of having a measurable effect on packaging litter, and the overall target recycling rate of 70% across all types of packaging was not met. In fact, there was no sizeable change from the period of the Second Covenant. With the Third Covenant failing to meet its goals, the Environment Ministry saw that there was no option but to change tact and look for other ways to meet their targets, and the use of negotiated agreements was slowly phased out. (Toovey 2006; Worrell & Reuter 2014).

6.5 Results

Of the three, the First Packaging Covenant was the most successful in terms of delivering solid improvements and meeting targets. Both the Second and Third Covenants resulted in small victories, but the overall period after the First Covenant was more one of stagnation than anything else. Worrell and Reuter (2014) noted that the targets of the Second and Third Covenants were mostly not met.

Table 1

Targeted recycling rates under different Covenants. Recovery and Recycling Targets (%)								
Year	**Document (target year)**	**Overall Recovery (%)**	**Overall Recycling (%)**	**Metals Recycling (%)**	**Glass Recycling (%)**	**Paper and Board Recycling (%)**	**Plastics Recycling (%)**	**Wood Recycling (%)**
1991	First Covenant (2000)	-	60	75	80	60	50	-
1997	Second Covenant (2001)	65	65	80	90	85	27 to 35	15
2002	**Third Covenant (2005)**	**73**	**70**	**80**	**90**	**75**	**30**	**25**

Source: Nathan Toovey (2006*)*

Table 1 shows the changes in the targets for recovery and recycling of individual product categories and across all categories in the three different covenants. Most categories and the overall rates did improve, but modestly, and, as was previously discussed, not at what was deemed to be an appropriate level. Even despite that, several categories failed to reach their targets.

In the case of plastics recycling, which was substantially decreased from its initial target of 50% to the far less impressive 30%, the adjusted rate was still not met. Paper and cardboard was also a chronic underperformer, seeing the target rate dropping from 85% to 75% from the Second Covenant to the Third Covenant.

6.6 Conclusion

The main conclusion that comes from this case study is that while negotiated agreements are relatively economically efficient, the struggle to deliver the desired results, particularly in a sustained program over a longer period of time. In the case of the Dutch Packaging Covenantsthere were some positive outcomes, but they were limited and achieved early on. The results from the different kinds of packaging waste also indicate that negotiated agreements are most effective where the problem is easily managed. Wood and metal were both successfully managed in this way, but plastic was almost completely ignored, due to the extreme difficulty the recycling of it poses.

The true problem of negotiated agreements, and voluntary agreements as well, is that they generally do not go far enough to deliver the desired results. They are a kind of *extended producer responsibility lite*, not bad by any means, but also not really what is necessary to have lasting and meaningful effects on waste. The effects, as in the Dutch case, can be deemed at best *satisfactory.*

7. CASE STUDY: PRODUCT STEWARDSHIP IN MAINE

7.1 Introduction

The state of Maine in the USA has enacted perhaps the most extensive extended producer responsibility legislation in the world, though in Maine it is referred to as product stewardship. In the period between 1992 and 2009 it instituted six separate laws, each concerning different products, which enacted comprehensive EPR programs to deal with the recovery and disposal of, among other things, dry mercuric oxide and rechargeable batteries, mercury auto switches, electronic waste, mercury thermostats, cell phones, and mercury lamps. In 2010 it instituted the most comprehensive legislation of them all, the Product Stewardship Framework, which is the most far-reaching extended producer responsibility legislation in the United States. In 2012 it also use the framework to extend a product stewardship program for paint and other architectural coatings, which will be implemented by 2015.

The timeline of the development of Maine's product stewardship laws is as follows:

- 1991 - Dry cell mercuric oxide and rechargeable batteries
- 2001 - Mercury auto switches
- 2004 – Electronic waste
- 2005 – Mercury-added thermostats
- 2007 – Cell phones
- 2009 –Mercury-containing lamps
- 2010 – Product Stewardship Framework
- 2012 – Paint recycling (to be implemented in 2015)

This chapter will look briefly at the earlier laws that led to the developing the pioneering product stewardship framework, before looking at the product stewardship framework in depth. The paint recycling law, which has yet to be implemented, will only be mentioned in passing.

7.2 Product Stewardship Laws in Maine

The process of implementing the laws before reaching the Product Stewardship Framework was a gradual process. Six laws were implemented before the comprehensive law was enacted.

7.2.1 The First Law: Batteries

This law was brought into being in 1991 as a means to encourage the recycling of nickel-cadmium and sealed lead acid rechargeable batteries. The law set up an institution known as the Rechargeable Battery Recycling Corporation, which later changed its name to Call2Recycle. This enabled battery producers to meet their commitments which were specified by the new legislation.

The law follows a similar structure to the previously discussed Dutch Packaging Covenants, and would meet the criteria for being classified as a negotiated agreement.

The law has been extremely successful since its implementation. There has been a vast increase in collection of batteries at businesses, one of the law's original goals, not only at government and retail locations. The total number of participating actors has greatly increased. It continues to be successful, and in the period from 2008 to 2012 experienced a 33% increase in the total weight of batteries that were recycled (Maine Department of Environmental Protection, 2014).

7.2.2 The Second Law: Mercury Auto Switches

This law was implemented in 2001, and aimed to increase the amount of recycling of auto switches. This was the first of a number of laws which targeted mercury specifically, due to its both hazardous and widespread nature. Maine was the first state in the United States to require the producers of automobiles to take responsibility for preventing mercury pollution from old automobiles. Older models of cars in particular contained many parts which contained mercury, and Maine deemed auto switches to be of high priority in removing the mercury from the waste stream.

Auto makers strongly opposed the scheme, particularly because they were being made responsible for goods that had been sold many years beforehand. Because of the opposition of industry to be involved, it was difficult to implement in the beginning.

Later, a federal program was implemented by automobile manufacturers nation-wide, called the National Vehicle Mercury Switch Removal Program. With the addition of this program to Maine's already existing program, there was an uptick in the annual recycling rate, which by 2012 had reached 40% (Maine Department of Environmental Protection, 2014).

7.2.3 The Third Law: Electronic Waste

Electronic waste exponentially increased in the second half of the twentieth century, as people moved into the technological age, not only buying computers, televisions, mobile phones, etc, but also replacing them with greater and greater frequency. This has put huge strains on the waste disposal systems wordwide, and much electronic waste, despite containing extremely valuable components, such as gold, platinum and rare earths, often makes its way to landfill.

Maine's electronic waste legislation was enacted in 2004 and implemented in 2006. Rubin et al (2010) describe it as the first legislation of its kind, targeting e-waste, in the United States. The law directs its attention to covered electronic devices such as televisions, monitors, laptops, digital picture frames, tablets, e-readers, game consoles and desktop printers. This is considered to be Maine's first true EPR law, as it was extensive in both scope and spread, and strongly internalised waste costs back into the production stage.

The program has been quite successful, recording 6.57 pounds (2.98 kilograms) of electronic waste being recycled per capita in 2012, which is one of the highest rates in the United States (Maine Department of Environmental Protection, 2014). In 2010, the Economist estimated that the e-waste law had saved municipalities in the area of US$1.5-3 million annually, as a result of forcing producers to pick up the cost of the collection and disposal of electronic waste.

7.2.4 The Fourth Law: Mercury-Added Thermostats

In 2005 it was decided to extend producer responsibility to mercury-added problems, as a means of decreasing the amount of hazardous mercury products in Maine society. The law was implemented in 2007, and aimed to collect 125 pounds (56.7 kilograms) of mercury from service technicians and contractors, and 160 pounds (72.6 kilograms) of mercury from households, within two and three years respectively (Maine Department of Environmental Protection, 2014).

However, despite the wide availability of collection points throughout the state, the return rates were extremely low at the beginning of the program, not even reaching 10%.

To counter this, the law contained the means for a financial incentive of at least US$5 for each thermostat that was returned that contained mercury to be paid by the producer to the customer returning the thermostat (Maine Department of Environmental Protection, 2014; Rubin et al, 2010). This was a further way of internalising the waste disposal costs, in addition to providing an added reason for customers to return the goods.

The new program was quickly successful in reaching its goal of increasing the amount of mercury-added thermostats being recycled. By 2009 the total percentage recycled reached 25.84%, and since then this percentage has remained relatively stable (Maine Department of Environmental Protection, 2014). That also shows that this system may have reached its maximum potential, and that further deepening of the aspects of extended producer responsibility used in the program could likely result in higher gains.

7.2.5 The Fifth Law: Cell Phones

This law was an extension of both the battery and electronic waste legislation, and aimed to encourage the recycling of both broken and still-functional mobile phones. It was enacted in 2007 and implemented the following year. Unlike most of the other laws, the onus was not put on the producer of the goods, but on the telecommunications providers from which most people bought their phones (Rubin et al, 2010; Maine Department of Environmental Protection, 2014).

It is believed that the program is extremely successful, though there is little data to support this. Because of the high value of cell phones, including their potential resale value, the industry developed voluntarily and strongly (Maine Department of Environmental Protection, 2014). This is a good example of voluntary EPR systems working in practice.

7.2.6 The Sixth Law: Mercury-added Lamps

Moving on from the mercury-added thermostats, the focus then shifted to lamps containing mercury. In 2009 legislation was passed extending product stewardship to mercury-added lamps, and the law was implemented in 2011.

The law contained provisions for free containers, shipping and recycling services to collection sites, which included municipal and retail facilities. In 2012, it is estimated that 29% of household mercury-added lamps were recycled, which can be taken as a relatively successful result (Maine Department of Environmental Protection, 2014). Rubin et al (2010), however note that only around a quarter of the mercury-added lamps in Maine were recycled, with the remainder being thrown in the trash, despite it being illegal to do so.

To further increase the rate of recycling, an outreach program was performed, looking for new collection sites, as well as educational awareness raising programs, such as print and radio ads, which advertised the free recycling program and the ban on regular disposal of mercury-added goods (Maine Department of Environmental Protection, 2014).

7.3 The Product Stewardship Framework

In 2010, Maine became the first state in the United States with a comprehensive EPR law which extended across multiple product categories and industries.

The framework, which passed with a strong bipartisan majority, is essentially a blanket law which could be extended to any product or category. Until this law was passed, each time Maine had

wanted to extend its programs to another product or category, it required a new piece of legislation, as was seen in the previous examples. The new law made this unnecessary, by establishing a process for adding new products to be covered by the framework.

The law, despite being passed with a strong majority, was opposed by business and industry in Maine, and was subsequently revised by the Natural Resources Committee in the Maine Legislature. The revised version passed unanimously in the Committee, and was more widely supported by business and industry.

The framework saw the codification of product stewardship as a policy tool that could be use across industries and product categories. Melissa Iness, one of the designers of the law, set the process out as listed in Box 1.

Box 1

Step 1: Review and Prioritization.

Department of Environmental Protection (DEP) reviews existing product stewardship programs and conducts a prioritization process to identify candidate products for product stewardship programs.

Step 2: Report and Stakeholder Input.

DEP writes annual report to the Legislature on

1. the state of existing product stewardship programs,
2. any need for refinements to existing programs, and
3. at DEP's discretion, a recommendation for a potential candidate product to be considered for a product stewardship program. Stakeholders and interested parties have opportunities to provide comments to the Legislature on the report before it is reviewed by the Natural Resources Committee.

Step 3: Legislative Review and Potential Designation.

The Natural Resources Committee would review the report and have the authority to report out legislation to refine existing programs or create a new product stewardship program for a candidate product in the report.

Step 4: Implementation

If the Legislature decides to create a product stewardship program for a given product, the producers of that product would be collectively responsible for establishing and financing a collection and recycling program for that product.

Under LD 1631, the Legislature has full authority to create new product stewardship programs. DEP's authority is to conduct a prioritization process and provide recommendations in an annual report.

(Innes 2010)

As is the case in any law, it is difficult to satisfy all parties. As the law was modified, the reaction of business and industry improved, however, some important aspects were removed to placate, resulting in some disappointment from sectors that had hoped the law would be stronger. The Department of Environmental Protection lost some authority that had originally been included in the early version of the law, including the authority to designate products through rule-making, the authority to make unilateral changes in manufacturer plans, and the authority to establish management and labelling requirements. The law also shed the requirement that producers must submit to annual third-party audits.

Despite this slight disappointment in the scope of the new framework, the legislation was heralded as the dawn of a new era for extended producer responsibility.

The fact that the new legislation made it substantially easier to extended producer responsibility to new products is perhaps the most effective feature of this legislation. The criteria for adding new products to the program is as follows:

- The product or product category is found to contain toxic or hazardous materials that have a risk of causing an adverse impact to the environment or public health and safety;
- extending product stewardship to the product or category will cause a positive increase in the amount of materials being recovered for re-use or recycling;
- extending product stewardship to the product or category will result in a reduction of costs for waste management for municipal governments and taxpayers;
- there is evidence of success of similar programs related to the product or category in other states or countries; and
- existing programs already in place are not adequately meeting their targets (Rubin et al, 2010)

7.4 Effectiveness of Product Stewardship in Maine

Having been in effect for only a few years, it is difficult to judge the effectiveness of the new framework in meeting its goals. The first major test will come in 2015, when the system is to be extended to paint and other liquid architectural coverings.

Mattresses and carpets have also been identified as highly problematic components of the waste stream, and the Department of Environmental Protection is examining schemes in other states

(Connecticut, Rhode Island, and California, specifically) as to how best implement these product categories into the product stewardship framework (Maine Department of Environmental Protection, 2014).

The biggest advantage of Maine's system is that it now has a stable and predictable system for dealing with new products and product categories. Industries and businesses that have products that may be affected are consulted well in advance, and they now have a clear process to follow, learning from the missteps and successes of the earlier product stewardship programs that Maine had in place. As shown in Box 1 under "Step 4: Implementation" earlier in the Chapter, it is up to the producers of the goods in the designated product category to develop, establish, finance and maintain the collection and recycling program for their product.

This does place a financial burden on the industry in question, which is less than desirable, but is a necessary trade-off as a means of internalising the costs of waste disposal and recycling.

7.5 Conclusion

Maine's journey from the battery law to the Product Stewardship Framework was an excellent example of building a successful program step by step. With each new law they were able to come one inch closer to a working system incorporating extended producer responsibility.

The implementation of the framework was not without its negative aspects, particularly with the watering down of the legislation, but this was a necessary compromise to obtain the cooperation of industry and business, without whom the process would have been much more difficult.

8. Problems with EPR

8.1 Introduction

No system is without its negative aspects, and extended producer responsibility is no exception. The following chapter will examine three of the biggest problems with this system that I identified while undertaking research into this topic.

8.2 Developing Economies of Scale

One of the greatest problems shown in both the Dutch and Maine case studies, was the opposition from the industry that was affected by extended producer responsibility legislation. This is completely understandable, as it is in the producer's own interest to keep costs as low as possible so as to maximise profit. Unfortunately, this desire does not easily reconcile itself with society and government's want and need to decrease waste and encourage reuse and recycling of products, rather than them being sent straight to landfill or incinerators.

Problems that presented themselves in both Maine and the Netherlands, was the ability to avoid the legislation due to being part of a larger market. In Maine, which is small a state in a large federation, this has led to some producers moving at least part of their product chain out of the state to avoid having to comply with the legislation. The Netherlands, which is a part of the European Union and its common market, also suffered from the risks of this occurring, though the legislation was crafted in such a way as to describe any packaging entering the Dutch market, which was specific enough to minimise the risks. The Netherlands also had the advantage of having neighbours with similar policies, especially its largest neighbour, Germany, which had the Duales Systeme

Deutschland in place at the same time.

The need for consistency at the highest possible level is a key factor in the implementation of extended producer responsibility, so the ideal situation in both cases would be a system that covered the entire United States and European Union, respectively, to allow the programs the best chance of success. It would also allow the recycling, repurposing and waste disposal industries in these unions to develop economies of scale, which would further lower the costs of waste management, resulting in more competitive programs.

The fact that the United States has only piecemeal legislation dealing with waste management means that many companies that would otherwise do beneficial work do not operate there. The Economist (2007) quoted Michael Biddle, the boss of MBA Polymers, a plastic recycling company, as saying that his company operates minimally in the US due to the lack of consistency across states, instead doing most of its work in China and Europe.

8.3 Occupational Health And Safety

Most of the products and product categories that are and will be targeted by extended producer responsibility programs are targeted in this way because of their containing hazardous, toxic, difficult to dismantle, or in other ways risky materials. This is not a problem of EPR itself, *per se,* rather a problem of recycling and reworking dangerous and hazardous goods in general. This is still relevant, because any program using EPR will involve such processes.

Unfortunately, disposing of, recycling or repurposing such products is not only expensive, but also dangerous. This makes producers even less keen to becoming involved in the end of their product's

life cycle.

Because of the difficulty and danger in these processes, there has been a tendency in the developed world to simply export the waste to developing countries for recycling. There are many stories of shipping fleets being sent from China to the United States filled to the brim with shining, gleaming new products, and returning to China filled with garbage, as waste disposal in China is far less regulated than in the United State. Much of this is then simply dumped, rather than recycled. Of the products that are recycled, which typically head to countries such as China, India, Pakistan and the Philippines, the facilities that are involved in the recycling process generally have little to no regard for health and safety regulations, which are generally poorly enforced, resulting in very dangerous working conditions. There is also evidence of prison labour being involved in the recycling chain in the United States, which is extremely troubling, considering prison labour is exempt from otherwise stringent occupational health and safety laws in the country, and is considerably cheaper than regular labour, that would be required to receive hazard pay (Toffel, Stein & Lee, 2008).

Both these examples show that shortcuts and loopholes allow producers and waste managers to bypass otherwise well-designed systems, and these ambiguities must be closed and strictly enforced. By returning hazardous waste to the producer for disposal, it also provides an impetus for the producer to source safer materials, which would be a desirable result. This is entirely the point of these programs, and governments implementing extended producer responsibility must be vigilant in ensuring that producers are unable to use loopholes such as exporting waste or using labour that is not covered by safety laws to decrease the costs of disposal.

There is, however, criticism of this argument. The previous point in this chapter was that a piecemeal approach to waste management results in a lack of economies of scale, which are

beneficial to positive outcomes. The Economist (2007) quotes Pieter van Beukering, an economist specialising in the export of waste materials as saying that "as soon as somebody is paying for the material, you bet it will be recycled." These industries in countries such as India and China allow for the necessary economies of scale to develop, resulting in more productive, economical and environmentally-friendly outcomes. That being said, it does not really counter the argument that such countries lack proper occupational health and safety.

8.4 Politics and Partisanship

Unfortunately, in the modern polarised world, no new legislation is without its opponents or detractors. Both the United States and Europe have seen increases in partisanship in the last decade, and this makes it harder to develop balanced legislation that goes far enough to bring about desired change, but does not cause too much harm.

Maine provides an excellent example of how partisan politics can get in the way of otherwise smart economics. After the mid-term elections in 2010, politics in the United States moved drastically to the right. Many of the newly-elected representatives had been elected on a Tea Party platform, opposing everything from the Federal Reserve, the United Nations, international peacekeeping and, unsurprisingly, global warming and anything associated with the "green" agenda. This, unfortunately, included extended producer responsibility.

As was discussed in the previous chapter, Maine's implementation of the product stewardship laws was largely a resounding success. Recycling rates went up, the amount of packaging was decreased, entire new industries sprouted creating new employment opportunities.

In the wave which swept the Republican party to control the House of Representatives, not even Maine was unaffected. Democrats lost control of the Governor's mansion, the state House and the state Senate. Republican Paul LePage was elected as the new Governor, and one of his priorities was dismantling environmental regulations (Quimby 2011).

Maine voters returned the Democratic party to power in 2012, granting them control once again over the state House and Senate. During their brief stint in power, many Republicans had even joined the Democrats to oppose the dismantling of the product stewardship laws, so the laws survived the period intact.

In June 2013 both houses of the Maine government passed a law creating a new product stewardship program: a paint recycling program. It was passed with strong bipartisan and industry report, but was heavily opposed by the Governor. He had threatened to veto the bill, but ultimately let it become law without his signature. In this way the bill was accepted without his approval, which may have been a more appealing alternative than having his veto overturned or signing a law he greatly opposed (Quimby 2011).

Maine's success with the product stewardship laws is largely due to its heavy consultation with industry, allowing it to formulate laws that are both good for business and strengthening environmental protection. The fact that the laws managed to survive in a period of intense hostility shows that they have a lot of potential for further growth in the United States and around the world, though the other message from this experience is that there is a political risk that comes with partisanship, even when the laws themselves are relatively popular.

9. PLASTIC: EPR'S NEXT BATTLE?

9.1 Introduction

One area in which the author of this thesis would like to see extended producer responsibility fully implemented is with plastics. Currently, the issue of plastics is thoroughly ignored, but it is fast shaping up to being one of the great crises of our time.

Plastic takes an exorbitant amount of time to bio-degrade. Scientists currently estimate it at thousands of years, though it could be even longer. According to Alan Weissman (2007), the total production of plastic worldwide in the fifty years to 2007 was greater than 1 billion tons. Of this, he estimates that the vast majority of it still exists in some form or another on the world's surface; very little of it has bio-degraded.

One of the main reasons plastics have been able to proliferate so widely is because of their ease of creation and low costs. But the environmental cost that they cause is unmeasurable, and our descendants thousands of years from now may still be dealing with the consequences of our current society's obsession with plastics. Nobody knows how long plastics can last; Weisman (2007) puts it more bluntly when he states that “polymers are forever”.

A huge amount of the world's plastic ends up in the ocean, even when disposed of on land, and sent to, for example, a landfill. Because of the structure of plastics, which are light and easily float, they easily make their way from land, down watercourses and eventually into the ocean. As a result, large parts of the ocean are now over-run with plastic, particularly slow-moving circular streams known as gyres. The most famous of these, which has recently begun receiving a modicum of

media attention, is known as the North Pacific Subtropical Gyre, although in the media it is often referred to as the Great Pacific Garbage Patch. This is the largest and most famous example of a phenomenon which is becoming all too common throughout the world's oceans: massive tracts of ocean simply full of plastic garbage. There are seven of these massive gyres world-wide, as well as countless smaller ones (Weisman 2007).

This plastic then ends up throughout the food chain. Tiny polymers are eaten by krill, larger fragments by fish, turtles, sea birds and oceanic mammals. It is causing untold deaths of this marine life, and also likely making it into the human food chain, particularly through consumption of contaminated fish. There is evidence that exposure to such plastics causes an array of illnesses, including stomach blockages and even cancer.

9.2 Why not recycle?

Hannequart (2004) sets out the problems of recycling plastic waste in his tome *Waste Plastics Recycling: A Good Practices Guide for Local Governments.* There are a number of reasons plastics in particular are difficult to recycle, which he sets out as follows:

- *The broad variety of different types of plastics*: Plastics come in a broad variety of types, each with different appearances and characteristics, which come as a result of the different polymers used in their development. In fact, even particular varieties of plastic can have different forms, such as PVC, which can be both hard and soft; polystyrene can be opaque or transparent, and can come both expanded or unexpanded. Recycling therefore requires extremely efficient selective collection, which separates the plastics to be as homogeneous as possible.

- *Collection, Sorting and Contamination*: Because of the extremely wide and varied variety of plastic products and the types of polymers used in plastic production, it is extremely difficult to obtain homogeneous streams of plastic. The facilities required for separation are expensive to establish and run, and the work itself is tricky, because of the speed of the production lines needed and the difficulty in identifying plastic types, even when identifying marks on packaging are taken into consideration. Food residues are also a problem, as the energy and resources required to clean the plastics make the process much more expensive and less environmentally friendly. Only plastic polyethylene terephthalate (PET) or high density polyethylene (HDPE), are particularly easy to identify and separate, which is why most plastic recycling programs focus on them. Industrial and commercial plastic waste is also usually fairly homogeneous, so it is also commonly recycled.

- *Quality of the sorted fraction*: Even after the sorting and cleaning processes are completed, much of the resulting sorted plastic waste is still of low quality, and is thus rejected and sent to landfill. This is one of the worst parts of plastic recycling: a huge amount of energy and resources are expent when only a small amount of plastic waste is subsequently recycled.

- *Composite goods*: Many goods are not made of one material alone. In addition to being made of multiple kinds of plastics, they can also be composites containing plastic plus glass, wood, metal, etc. These products are exceptionally difficult to recycle, especially using current conventional techniques, and usually can only be sent to conventional waste disposal mechanism.

As was just shown, recycling plastics is a resource-intensive, energy-intensive process, which currently can only work with a fraction of the plastic in the market. For this reason, there must be a

push to stop plastic being used so widely, and the best way to do this is to internalise the extremely high costs of disposal into the production cost. The answer to that may just be through extending producer responsibility to the producers of all plastic goods and materials.

9.2 The solution

The precise nature of plastics is exactly why it is a prime target for extended producer responsibility. Truly disposing of plastic is so difficult and expensive, that putting the responsibility for doing it back on the producers, and not simply sending it to landfill, would make the cost of plastic far higher.

If the cost of plastic became much higher, more innovation would be spurred to find better products. Plastic has usurped the use of some products, such as glass, paper, cardboard, tin and other metals, in food and beverage storage, and if these products became more competitive it is likely that more producers would return to using these listed products.

Scientists are also looking to innovate plastics or plastic-like materials that more easily biodegrade. A recent discovery created a plastic-like substance from using compounds found in the shells of shrimp and krill (Shim 2014). This is a promising development, and likely we will soon see more such developments, but extending producer responsibility would hasten the process, spurn research and development, and also make subsequent development more price competitive.

Many kinds of plastic are indeed recyclable, however the nature of plastics is that the polymers themselves that make up the plastic are almost unbreakable, so even recycling does not fully solve the problem. A complete move to other products would be the best solution, and through

implementing the processes detailed in earlier chapters, this would likely be achievable.

In this way a move to a system of extended producer responsibility for all forms of plastic products is not only recommended, but may indeed be essential, or even urgent.

10. CONCLUSION

10.1 Extended Producer Responsibility: Plausible or Impossible?

Extended Producer Responsibility is a pioneering, relatively new way of dealing with the problem of waste management. By ensuring that producers are involved in the end of life cycle of the products they make, it can have real effects on recycling rates and more environmentally-friendly product design.

Unfortunately, it has yet to be tried on a truly large scale, in a large country across industries and product categories. This thesis examined the example of Maine, which has a program that is quite extensive in size and scope, but lacks the size that would make it truly effective.

However, the evidence suggests that extended producer responsibility is not only a plausible option, but it is a very practical one too. Both case studies did see strong results, though with room for improvement. And governments are taking notice of the successes that are occurring, and as a result EPR programs are spreading around the world, from the United States, to Canada, to the European Union, to Australia. So far, it has mainly been limited to the rich, developed world, but it is also a model that may have potential in poorer, developing countries.

The example of Maine, with its comprehensive Product Stewardship Framework, is something that governments all over the world should be emulating; rather than taking a piecemeal approach, one product at a time, governments should make legislation that is ambitious in size and scope, encompassing as many products and product categories as possible.

It is the opinion of the author of this thesis that Extended Producer Responsibility is an extremely plausible option for waste management, and that the costs and problems of implementing such a system are far from impossible to overcome. The benefits far outweigh the disadvantages, because no matter what, *someone* must cover the cost of waste disposal, so it is better to use this program as a coercive way of forcing producers to be more involved in their products life, from product design to destruction. This is, in the opinion of the author, the only economically viable solution to the problem, that incorporates market forces into an environmentally responsible model.

10.2 Overall Assessment

This thesis sought to enquire whether or not Extended Producer Responsibility could be put into practice to solve the waste management crisis. Neither of the two case studies presented an ideal implementation of extended producer responsibility. In both of the cases of the Dutch Packaging Covenant and Maine's Product Stewardship laws, there were problems and disappointments, as well as successes.

When considering the two case studies, it is clear that the system that has been put in place in Maine is the better of the two, but still with room for improvement. As the Product Stewardship Framework was only passed in 2010, there is also a dearth of data to fully understand its effects on waste and economics. That being said the data that is available shows that the more advanced EPR system in Maine is more successful at meeting its goals than the mixed negotiated agreements used in the Netherlands from 1991 to 2005.

A key factor of this analysis was the level of government involvement needed to get the desired results of waste minimisation, an increase in recycling and reuse of used products, and sustainable

product design. Put simply, how much government coercion is prudent? Are producers capable of solving environmental issues on their own, or is government intervention a necessity? The answer to this, as was revealed throughout the thesis, is that, as far as the aims of waste minimisation, more recycling and reuse, and environmental protection are concerned, more government involvement results in better outcomes.

Negotiated and voluntary programs are a step in the right direction, but the only true way to implement an effective extended producer responsibility program is either for a mandatory system to be established, or, in a perfect world, a completely market-driven system. Because of the shortcomings of the free market approach, and the rarity of these market-driven systems developing and delivering measurable results, this is unfortunately not an option. It is necessary, therefore, to state that more government intervention is the best way to deliver substantive, lasting results.

The central question this thesis sought to address was whether or not extended producer responsibility presents a viable option for addressing waste, waste disposal and recycling. While the case studies showed flaws in the different options, it is the author's belief that a fully-implemented extended producer responsibility program is an excellent option, as it has been demonstrated to remove the pressure from municipal governments, increase recycling rates and reduce waste, and also not be too economically costly.

Extended producer responsibility is an ideal system for dealing with problematic product categories, particularly those where the main goal is also decreasing the production of the problematic good, such as hazardous and dangerous waste or materials that do not quickly or easily biodegrade. As was discussed, this makes it an candidate for dealing with plastic waste, as it would hopefully make the cost of plastic incorporate not only its manufacture, but also its extremely high waste and

disposal costs. This is an extremely desirable outcome, as our planet is becoming mired in plastic waste, with no real end in sight. Unless, that is, real action is taken. And Extended Producer Responsibility might just be the best solution for the otherwise hopeless problem.

BIBLIOGRAPHY

Adamson, G. (2003), *Industrial Strength Design: How Brooks Stevens Shaped Your World,* MIT Press: Cambridge, Massachusetts

Bennett, M (1999) *Towards Sustainability,* OECD EPR and Waste Minimisation Workshop, Paris France, Paris: OECD, published in OECD (2001) *Extended Producer Responsibility: A Guidance Manual for Governments,* OECD Publications: Paris

Bulow, J. (1986), An Economic Theory of Planned Obsolescence, The Quarterly Journal of Economics, 101(4): 729-49

Calcott, P. and Walls, M. (2000) *Can Downstream Waste Disposal Policies Encourage Upstream "Design for Environment"?* American Economic Review, 90(2): 233-237

Department for Environment, Food and Rural Affairs (2011), *Guidance on Applying the Waste Hierarchy*, accessed at: defra.gov.uk [5 April 2014]

Department for Environment, Food and Rural Affairs (2013), *Incineration of Municipal Solid Waste*, accessed at: defra.gov.uk [5 April 2014]

Economist, The (2002), *Model makers,* accessed at: http://www.economist.com/surveys/displaystory.cfm?story_id=1098153 [30 April 2014].

Economist, The (2010) *Governments oblige manufacturers to take back used goods for disposal,* accessed at: http://www.economist.com/node/15825706 [20 April 2014]

Eisenhardt, K.M. (1989), *Building theories from case study research,* Academy of Management Review, 14(4): 532-550.

European Commission (2005), *EU Waste Policy: The Story Behind the Strategy*, accessed at: ec.europa.eu/environment/waste/pdf/story_book.pdf [13 April 2014]

European Commission (2011) Dutch Study Show Policy Effective in Reducing Packaging DG ENV News Alert Issue 240 19 May 2011

Fishbein, B. K (1996) *Germany, Garbage and the Green Dot: Challenging the Throwaway Society,* DIANE Publishing: Darby, Pennsylvania

Fishbein, B. K. (2000), *Carpet take-back: EPR American style,* Environmental Quality Management, 10(1): 25-36.

Harjula, H. (1998). *Extended Producer Responsibility Phase 2: Case Study on the Dutch Packaging Covenant*, OECD Publications: Paris

Hannequart, J.-P. (Ed.) (2004). *Good practices guide on waste plastics recycling: A guide by and for local and regional authorities*. Association for Cities and Regions for Recycling: Brussels

Hiriart, Y. and Martimort, D. (2006), *The benefits of extended liability*, RAND Journal of Economics, 37(3): 562-582

Innes, M. (2010), *Email Correspondence*, [December 2010]

Innes, M. (2011), *Email Correspondence*, [January 2010]

Innes, M. (2012), *Maine's EPR Framework Law: A unique approach to product stewardship legislation in the U.S.A,* accessed at: www.nyfederation.org/PDF2012/36%20InnesM.pdf [10 April 2014]

Presented by Maine State Representative Melissa Walsh Innes
Outreach Director for Recycling Reinvented

Kinnaman, T, and Yokoo, H. (2011), *The Environmental Consequences of Global Reuse*, The American Economic Review, 101(3): 71-76

London, B (1932), *Ending the Depression Through Planned Obsolescence,* New York. Accessed at: commons.wikimedia.org/wiki/File:London_(1932)_Ending_the_depression_through_planned_obsolescence.pdf [10 May 2014]

Lindhqvist, T. (2000). *Extended Producer Responsibility in Cleaner Production: Policy Principle to Promote Environmental Improvements of Product Systems*. IIIEE Dissertations 2000:2, Lund University: Lund, Sweden

Lou, Nair and Ho (2013), *Potential for energy generation from anaerobic digestion of food waste in Australia,* Waste Management & Research, 31:283, accessed at: http://wmr.sagepub.com/content/31/3/283

Maine Department of Environmental Protection (2012), *Implementing Product Stewardship in Maine: 2012 Report to the Joint Standing Committee on Environment and Natural Resources,* accessed at: www.maine.gov/dep [13 March 2014]

Maine Department of Environmental Protection (2013), *Implementation of Product Stewardship in Maine: Report to the Joint Standing Committee on Environment and Natural Resources 126th Legislature, First Session,* accessed at: www.maine.gov/dep [13 March 2014]

Maine Department of Environmental Protection (2014), *Implementation of Product Stewardship in Maine: Report to the Joint Standing Committee on Environment and Natural Resources, 126th Legislature, Second Session,* accessed at: www.maine.gov/dep [13 March 2014]

Mayers, C. K. (2007), *Strategic, financial, and design implications of extended producer responsibility in Europe: A producer case study*, Journal of Industrial Ecology, 11(3): 113-131.

OECD (1998), *Extended Producer Responsibility: Phase 2 – Case study on the Dutch Packaging Covenant,* OECD Publications: Paris

OECD (1999). *Voluntary Approaches for Environmental Policy: An Assessment*. OECD Publications: Paris

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

Quimby, B. (2011), *Maine Gov. LePage: Loosen rules on environment,* Portland Press Herald, accessed at: http://www.pressherald.com/news/lepage-loosen-dozens-of-rules-on-environment_2011-01-25.html [4 April 2014]

Rampell, C. (2013), *Planned Obsolescence, as Myth or Reality*, New York Times, accessed at: http://economix.blogs.nytimes.com/2013/10/31/planned-obsolescence-as-myth-or-reality

Rouw, M., and Worrell, E. (2011), *Evaluating the impacts of packaging policy in The Netherlands,* Resources, Conservation and Recycling, 55(4): 483- 492.

Rowley, J. (2002), *Using Case Studies in Research*, Management Research News, 25(1)

Rubin et al (2010) *Product Stewardship in Maine,* Margaret Chase Smith Policy Center, University of Maine, accessed at: https://mcspolicycenter.umaine.edu/2010/12/28/product-stewardship-maine-0/ [8 January 2014]

Shim, E. (2014), *Harvard Scientists May Have Just Solved One of the Biggest Environmental Issues of Our Time*, Policy Mic, accessed at http://www.policymic.com/articles/88989/harvard-scientists-may-have-just-solved-one-of-the-biggest-environmental-issues-of-our-time [7 May 2014]

Toffel, M., Stein, A., and Lee, K. (2008) *Extending Producer Responsibility: An Evaluation Framework for Product Take-Back Policies,* Harvard Business School [unpublished], accessed at: http://www.hbs.edu/faculty/Pages/download.aspx?name=09-026.pdf [15 February 2014]

Toovey, N (2006) *Negotiated Agreements: An analysis of the Third Packaging Covenant in the Netherlands,* IIIEE Theses 2006:25, Lund University: Lund, Sweden

Weisman, A. (2007) *The World Without Us,* Virgin Books LTD: London

United Nations Environment Programme. 2011. Towards a Life Cycle Sustainability Assessment: Making informed choices on products, accessed at: www.unep.org/resourceefficiency/Publications/Publication/tabid/444/language/en-US/Default.aspx?BookID=6236

United States Environmental Protection Agency (2013), *Non-Hazardous Waste Management Hierarchy,* accessed at: http://www.epa.gov/waste/nonhaz/municipal/hierarchy.htm [3 March 2014]

Waite, R (1995), *Household Waste Recycling*, Earth Scan: Milton Park

Woodard, C. (2013), *Maine leaders try and fail to dilute recycling's success,* Portland Press Herald, accessed at: http://www.pressherald.com/news/Maine-leaders-try-and-fail-to-dilute-recyclings-success.html?pagenum=full [4 April 2014]

Worrell, E. and Reuter, M. (2014), *Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists*, Elsevier: Waltham, Massachusetts

Zaman, A. (2009), *Life Cycle Environmental Assessment of Municipal Solid Waste to Energy Technologies*, Global Journal of Environmental Research, 3(3): 155-163

Zero Waste New Zealand Trust (2002) *Extended Producer Responsibility: Container Deposit Legislation Report,* accessed at: http://www.zerowaste.co.nz/assets/Reports/Beveragecontainers.pdf [17 April 2014]

Zero Waste New Zealand Trust (2001) *The End of Waste: Zero Waste by 2020,* accessed at: http://www.zerowaste.co.nz/assets/Reports/TheEndofWaste.pdf [17 April 2014]