EXTENDED PRODUCER RESPONSABILITY MODEL: AN ANALYSIS ON THE BRAZILIAN CASE BASED ON SYSTEM DYNAMICS APPROACH

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Abstract

Ever growing costs incurred by solid waste management have forced many developed countries to implement new environmental policies with the purpose of sharing with manufacturers and marketers the costs involved in handling and treating post-consumer waste. The concept Extended Producer Responsibility that emerged in Europe in the 1990s, quickly gained momentum across the continent and a few years later influenced new regulations all around the world. Brazil is one of the most recent countries to adopt the concept through the National Solid Waste Policy that was passed in 2010. This regulatory framework supports the principle of shared responsibility with which manufacturers, distributors and retailers are now responsible for its own post-consumer waste. This research aims at discussing the limitations and perspectives of the reverse logistics model implemented in Brazil. Results indicate that increasing use of multilayer materials, lack of tributary incentives for consumption of recyclable material and high costs of transportation pose a series of challenges to fulfill the legislation targets.

Keywords: Extended producer responsibility; design for environment, packaging

Introduction

The evolution of materials engineering has allowed a significant improvement in fundamental properties of packaging materials which are basically to protect food and several other products, facilitating transport and storage as well as allowing direct communication

with consumers. Over the past decades, all of these attributes have been extensively researched in order to improve the performance of packaging. As a result packaging generally became lighter while keeping the original properties of products for a longer period, however this was only possible by changing the packaging structures which basically consists in using multiple materials or the use of more complex materials. Furthermore, there is a direct link between the economic growth rate of a country and its consumption and disposal of packaging. This relationship may be expressed by comparing the GDP (Gross Domestic Product) to the overall consumption of packaging (Rouw; Worrell, 2011). A growing GDP tends to increase the consumption of packaging, which results in a greater amount of disposed packaging waste.

In Western Europe, packaging corresponds to approximately 40% of total municipal solid waste according to Rouw and Worrell (2011) while in the US it accounts for about 44% (MacKerron, 2012). Social and environmental impact as well as growing costs involved in managing increasing volumes of post-consumer packaging have forced many European countries to develop and implement new environmental policies with the purpose of sharing with manufacturers and marketers the costs involved in handling and treating post-consumer waste.

The concept called Extended Producer Responsibility that emerged in Europe in the 1990s, quickly gained momentum across the continent and a few years later influenced new legislations all around the world. Brazil is one of the most recent countries to adopt the concept through the National Solid Waste Policy (NSWP) that was passed in 2010. This regulatory framework supports the principle of shared responsibility with which manufacturers, distributors and retailers are now responsible for their own post-consumer waste.

Some of the requirements established by NSWP are the expansion of recyclables collection systems, increase in the volume of sorted material by the cooperatives and consequently reduction of waste sent to landfills, extinction of dumps and an effective implementation of reverse logistics systems by manufacturers, traders and importers (NETO, 2011; GARDEN, YOSHIDA, SON, 2012; FERNANDES, 2014; BRAZIL, 2012). Within this scope, several challenges can be identified for the successful implementation of this policy in Brazil. Technological gaps within Brazilian economy, transportation problems, conflicts between producers and retailers related to costs responsibility and no tax incentive for recycling products undermine the legislation objectives. (DEMAJOROVIC; MIGLIANO, 2013).

This research aims at discussing the limitations and perspectives of the implementation of the reverse logistics model defined by the sectorial agreement submitted to the Ministry of Environment of Brazil by the coalition of companies belonging to the group of General Packaging, aimed at the fulfillment of the law 12.305/2010 that establishes NSWP. The study sought to further investigate the impact of NSWP on laminated or multi-layer flexible plastic packaging that are currently not being recycled. To accomplish this goal this research uses a qualitative and exploratory method to collect data from an extensive international literature review and also interviews with professional experts from the sectors directly impacted by new legislation, later presenting a dynamic model based on the System Dynamics methodology showing how the various stakeholders relate and how potential incentives would affect the overall model.

Extended Producer Responsibility in developed countries

The Extended Producer Responsibility (EPR) concept was first presented as a strategy for the development of environmental policies by Professor and environmental specialist Thomas Lindhqvist, a native of Sweden, in a report prepared by him in 1990 to the Ministry of the Environment of his country (LINDHQVIST, 2001). His definition was based on the observation of several recycling programs and waste management systems operating in Sweden and other countries, such as Austria, Germany, Holland and Switzerland, while those were preparing to implement new environmental policies to improve the management of post-consumer waste in their countries.

The concept of EPR emerged as a key transforming principle in order to guide our society to more sustainable consumption and production behaviors (TOJO, 2004). Tojo argues that the concept of EPR brought a number of trends, including the prioritization of prevention measures rather than containment, strengthening systemic view of the entire life cycle of products and also the replacement of command-and-control measures by an approach focused on setting targets to reduce environmental impact.

The concept defines that the responsibility for the management of post-consumer waste, previously held by consumers and public administration, now partially or fully includes manufacturers of these products. This approach makes sense to Thorpe, Kruszewska and McPherson (2004) because it puts the party with greater capacity and influence the design of products from conception to disposal, while providing incentives to implement changes to the products in order to reduce their cost of disposal. Only manufacturers can decide which materials will be used in their products and how these affect the recyclability after use.

There are records of written policies in the 1970s and 1980s that have expressed the need for inclusion of manufacturers in the solution development process for post-consumer waste (LINDHQVIST, 2001). However, it was in the early 1990s that many countries have begun to incorporate the concept of EPR in developing their environmental policies. Currently these programs based on EPR are already in operation for several groups of products such as packaging, batteries, paper, tires, paint, automobiles and electronics. This product range continues to expand and in some countries now also includes furniture and office supplies. These programs have been implemented in different ways, including binding legislation or regulation, negotiated agreements between government and the private sector or through voluntary initiatives undertaken by the manufacturers themselves even before specific legislation has been created for their sectors (TOJO; LINDHQVIST; DAVIS, 2001).

The OECD (Organisation for Economic Co-operation and Development) has served since 1994 as the main body of research and mapping information regarding EPR. The concept is defined by the entity as an approach to the creation of environmental policies in which the liability of a manufacturer for the production of a good, is extended to the post-consumer stage of the life cycle of this product (OECD, 2005). In practice, this approach consists both in partially or fully transferring to manufacturers the responsibility for treating and disposing of post-consumer waste as well as driving policy oriented to create incentives for the development of more sustainable products (Atasu; Wassenhove; SARVAY, 2009).

As the responsibility is transferred to manufacturers, they are encouraged to change the characteristics of their products in order to minimize the environmental impact caused at the end of their product life cycle. On the other hand, they are also required to take physical and economic responsibility for the remaining impact even after the changes in the product have been implemented (TOFFEL; STEIN; LEE, 2008).

This transfer of responsibility brings as a result the transfer of the costs related to treatment and final disposal of post-consumer waste. By incorporating these environmental costs, one of the alternatives faced by manufacturers is to transfer these costs back to consumers. This creates a new market dynamics in which products tend to reflect their environmental costs and consumers have the chance to take this criterion into account when buying. The cost of waste management which is traditionally paid by taxpayers, will now go be transferred to those who actually consume these products. This prevents taxpayers who opt for the more conscious consumption patterns, i.e., reducing the acquisition of products such as electronics, from have to bear the costs of waste management generated by those less aware (THORPE; Kruszewska; MCPHERSON, 2004).

As for legislators, EPR gives them an important approach to rely on when developing environmental policies for the treatment of post-consumer waste. A major focus of this approach is the reuse of these materials, which are no longer disposed of in landfills or incinerated, increasing the efficiency of use of resources extracted for processing of raw materials. Moreover, it influences the process of product development through the selection of more sustainable materials and ease of recycling. The big change from past pollution control policies is in the focus given to products instead of the previous focus that was given to the impact generated by the plants during the production process. This new approach requires manufacturers to not only control their manufacturing processes but also to better choose their source of raw materials, product design, the type of packaging and even marketing and distribution strategies. (FISHBEIN; EHRENFELD; YOUNG , 2000).

By these definitions it is clear that the concept of EPR addresses two main issues, taken as its two main objectives: (i) pass to manufacturers the cost and responsibility for solid waste management related to their product - Downstream as shown Thorpe, Kruszewska and McPherson (2004) in the figure below and (ii) encourage innovation in product design and processes so that more sustainable and thus reduce or optimize the generation of waste (Upstream according to the same authors). Figure below illustrates how the concept of EPR covers both issues that will be explored in detail in the following sub-section:

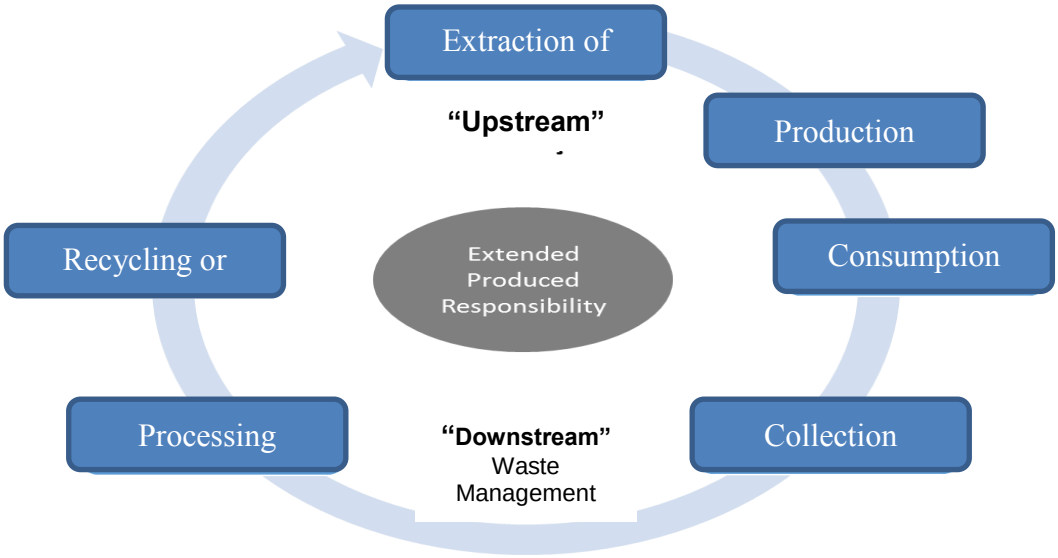


Figure 1 – EPR approach on a product's life cycle
Source: Author, adapted from Thorpe, Kruszewska e McPherson, 2004, p.12

One of the key assumptions of the EPR concept is that any manufacturer who places packaging on the market shall be responsible for its management and recovery after discarding, through the development of a reverse logistics system. The options for the implementation of this responsibility include the creation of a delivery system, which requires formal approval of local authorities by joining a collective program of reverse logistics managed by multiple companies or the transfer of this responsibility to another entity responsible for managing all this process (Cruz et al., 2013).

Kalimo et al. (2012) also analyze the differences between collective and individual accountability. When the responsibility is divided among several manufacturers in the same sector (collective), they do not necessarily take care of all waste generated by all manufacturers belonging to this collective agreement. Having a single accountability system makes each manufacturer responsible for the cost of treatment of the waste generated specifically by him. The latter model prevents a manufacturer from placing non-recyclable packaging on the market while fulfilling their responsibility through financial support to a collective system of collection and recycling of already commonly recyclable packaging. It also avoids a commonly neglected condition by most collective agreements, which is the division of costs due to volume produced by each manufacturer (or market share) and not necessarily by the cost involved in the treatment of each type of waste.

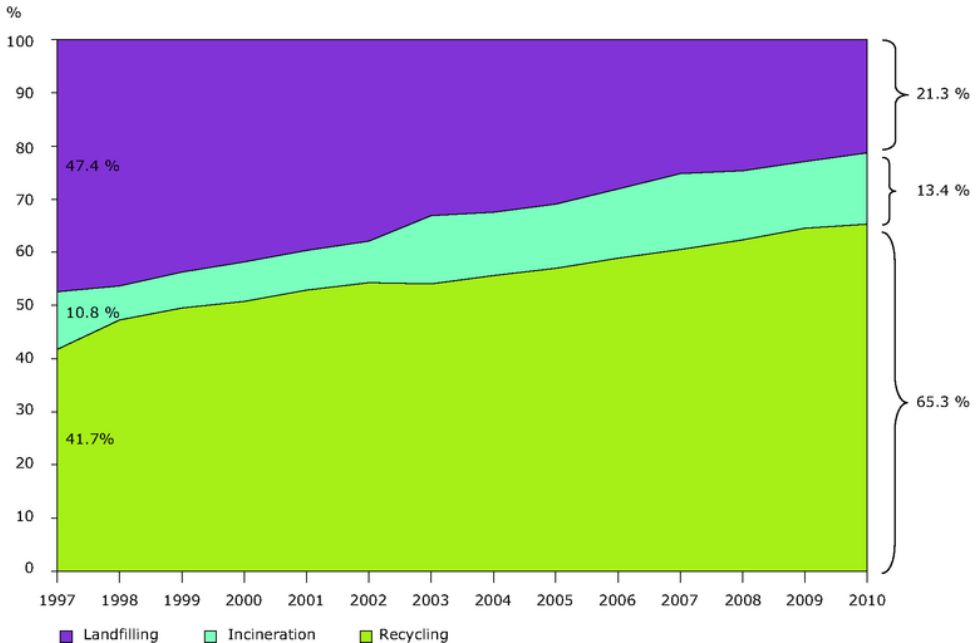
Brouillat and Oltra (2012) concluded through a simulation model that considers the interactions between businesses, consumers and recyclers, that recycling fees only produce significant effect if they are individualized and charged in proportion to the recyclability of the waste generated by each producer. Only then they are encouraged to invest in R & D to develop more recyclable

products. The same phenomenon does not happen in programs with collective goals. If a manufacturer belonging to a collective agreement decides to innovate and as a result manages to reduce the cost of treatment of waste generated by its products, the benefit of innovation will be divided among all players belonging to the collective agreement. Thus, only a small fraction of the benefit will be effectively transferred to the innovative manufacturer, thus discouraging investment in this process (OECD, 2005).

Lambert (2012) on the other hand opposes the perception that only individual responsibility fosters ecodesign by analyzing six case studies of electronics companies in Europe that developed various ecodesign initiatives even under the umbrella of a collective agreement. One of the analyzed examples is HP, an American multinational, global leader in sales of information technology equipment. To comply with existing legislation in the consumer electronics sector, it joined Sony, Electrolux and Braun in a collective agreement. While opting for a collective agreement rather than an individual solution, in 2012 alone the company recovered 120,000 tons of electronic products. As part of this recycled material, the company has produced 800 million printer cartridges, although we do not know the percentage that this amount represents relative to the total produced by the company.

Another weakness around making manufacturers financially accountable is that they may find ways to delegate this cost to third parties. In this case, the most obvious way is to pass on the cost of treatment of waste to consumers through increases in product prices. The risk arising from this practice is that by delegating this cost, manufacturers come again to a comfort zone and stop seeking more sustainable design for their products (KALIMO et al., 2012). In addition, consumers who are not responsible for the treatment of post-consumer waste, end up taking on costs that were previously paid by the government and that should now theoretically be paid by manufacturers.

While it is not clear what accountability model can contribute more to the effectiveness of EPR, the different countries where various initiatives have been implement seem to show some level of progress as well as continuing challenges for this legislation to effectively fulfill its purpose. The results obtained by the various programs operating in Europe are very significant as shown in the chart below, which focus the evolution of the distribution of packaging waste treatment solutions collected in the 15 countries that made up the European Union by 2004 (EU-15). Between 1997 and 2010, the average packaging waste recycling rate in these countries jumped from 41.7% to 65.3%:



Figure– EU-15 packaging waste treatment solution distribution evolution
Source: EEA, 2013b

Furthermore, although there is enough reference in the literature on the importance of the EPR in the development of new products, Atasu and Wassenhove (2012) believe that only a few studies focused on the real impact of the EPR concept in the design of more sustainable products, also known as Design for Environment (DfE), which is one of the most interesting research problems around EPR, a reflection that had also been commented by Gottberg et al. (2005) and Rouw and Worrell (2011). One of the conclusions found so far is that DfE efforts will only go into effect in case public policies are created, including incentive mechanisms for manufacturers to invest in these practices (calcott; WALLS, 2005).

In general, in Europe the main challenges may be related to factors that somehow prevented the optimal deployment of the various models in the continent, either because they have not encouraged eco-design in the expected level or because they allowed that not all manufacturers are directly responsible for their own waste. As for the developing countries, the discussion of the effectiveness of EPR models is much more limited, especially because most initiatives are very recent and still in implementation stage. Brazil's recent experience in approving a National Solid Waste Policy in 2010 is a good example.

The Brazilian Initiative on Extended Producer Responsibility.

After 20 years of complex negotiations among government, producers and society representatives, the NSWP was sanctioned by the National Government. This regulation represents a major change in the traditional relationship between Municipalities, States, the business sector and civil society regarding the management of municipal solid waste in Brazil. Also, based on the principle of shared responsibility, a significant advance in the division of responsibilities of the treatment of municipal solid waste was established.

For Seo and Fingerman (2011), the concept of shared responsibility presented in the NSWP share the same principles of the model of EPR, defined by Rossem, Tojo and Lindhqvist (2006). A strategy for preventive environmental protection based on incentive mechanisms for manufacturers to continuously seek improvements in their products and processes. NSWP

accounts for producers of all the environmental impacts throughout the life cycle of the product, thereby making them responsible for the costs involved in collecting and assuring the sound destination of end-use products.

The law enforces manufacturers, importers, distributors and marketers of the products covered by the law to take all the necessary measures to ensure the implementation and operationalization of the reverse logistics, independent of the public service urban cleaning. (GRANDSON, 2011). That includes established procedures for purchasing products or used packaging, implementation and expansion of collection areas for recyclable material in partnership with waste pickers associations. In order to achieve these goals legislation demands a sectorial agreement defined as "contract signed between the government and manufacturers, importers, distributors or retailers, with a view to implement shared responsibility for the product life cycle" (Brazil, 2010a); It is expected that the target of improving solid waste management in the country will be achieved with the sectorial agreements, since they are the result of dialog among all the players involved in the reverse chain.

The Corporate Commitment to Recycling, consisted of 22 professional associations that represent packaging manufacturers, users, distributors and traders, presented a proposal for a Sectoral Agreement for the implementation of the reverse logistics system for non-hazardous packaging products to the Ministry of environment – MMA in December, 2012. The project is divided into two phases, the first being geared toward raising the recovery rate of recyclable solid waste by 20%, and the consequent reduction by 22% of the total packaging which are forwarded to landfills or dumps (ABIPLAST, 2012). The expectation is that by 2015 at least 90% of the population of the cities where the Soccer World Cup took place would be included in Municipal recyclable collection programs. Currently, these cities are responsible for approximately 23% of the total weight of the solid waste produced in the country.

Another goal envisaged by the sectorial agreement is the reduction by 2015 of 45% of garbage disposed improperly in the country. The proposal also includes the waste pickers associations as partners of manufactures in several activities, such as: collecting, sorting and marketing the recyclable material. To enable the participation of waste pickers organizations, financial resources will be available to purchase equipment and to provide workers with training.

The recognition of waste pickers organizations as fundamental players in the recycling chain is considered one of the major social innovations of the Brazilian Law (Migliano et al, 2014). Ribeiro et al. (2009) pointed out that in Brazil most of the recycled waste is returned thanks to waste pickers, who with great social vulnerability is an essential source of profitability for the local recycling chain. In Brazil, around 1 million waste pickers daily supply the recycling reverse chain. Importantly, the new legislation claims that they should be included into RL processes through associations and not as self-employed individual.

The idea is that, through partnerships with large companies in the RL chain, waste pickers are able to get higher profitability and more dignified working conditions (Demajorovic et al., 2012; Souza, Paula, & Souza-Pinto, 2012). But building such partnerships still faces a series of challenges. The lack of professionalized management processes and business legal structure, often prevent these associations from issuing an invoice for their services and are thus disqualified as suppliers to the recycling industry. Also, little priority is given to management

training among cooperative members, who value practical knowledge. Lastly, corporations or recycled companies know very little about cooperatives reality, generating misunderstanding and conflicts (Mota, 2012; Demajorovic et al., 2012)**.** The law also accounts for consumers to return the end of life products, including packaging. In turn, traders and distributors must return the products and packaging for manufacturers and importers.

Although the legislation represents a major breakthrough for the improvement of solid waste management in the Brazilian context, the specificity of plastic packaging presents a series of challenges to fulfill legislation targets. Considering the logistical aspect, the post-consumer plastic packaging made of rigid materials and flexible, toys and household items, feature a low-weight-volume, increasing significantly transportation cost (Leite, 2009). According to the author, this logistical aspect is the main constraint factor to increasing levels of recycling material. High costs of transportation plus the many recycled materials collection sites throughout the city

Other difficulties inherent of the market for recycled plastic is the lack of guarantee of continuous supplying of materials for the recycling process, the low cost of Virgin resins and high contamination of waste. Another barrier for spreading plastics recycling is the lack of communication about the positives aspects related to use of recyclable plastic in the manufacture of new products.

Another problem pointed out by Forlin and Faria (2002) is the market trend of increasing use of multilayer materials. Study of Coltro and Duarte (2013) revealed that of 509 flexible packaging marketed in Brazil for packaged foods and non-food products, 39% corresponded to multilayer structure. According to the authors, the smaller the amount of materials used in the same package, less complex will be the recycling process and consequently the greater the marketing value of these materials.

Many of the flexible plastic packaging has multilayer structures or blades considered contaminated, as the packaging used for powdered juice and coffee that blend more than one type of plastic with an aluminum film. This increased material complexity will eventually reduce the commercial value of flexible plastic packaging and consequently the disposition of scavengers in sorting and selling this kind of material, undermining the success of reverse logistics model of flexible plastic in Brazil.

Fiscal aspect it is also an important issue concerning the economic viability of recycling of packaging. Recycled raw material does not receive any kind of tax incentive which ends up overly burdening the recycling process and reducing their competitiveness in the face of virgin raw materials (CNI, 2014). To Sobrinho (2006) tax collection should occur only on finished products produced from recycled raw material, but not over the sale of materials that have been produced using recovery of raw materials previously used in the manufacturing industry and consequently taxed already.

From the discussion above it is possible to formulate a dynamic hypothesis, described by means of the theoretical model presented below with the aim of highlighting the causal relationships between different variables and actors who make up the packaging reverse logistics chain in Brazil.

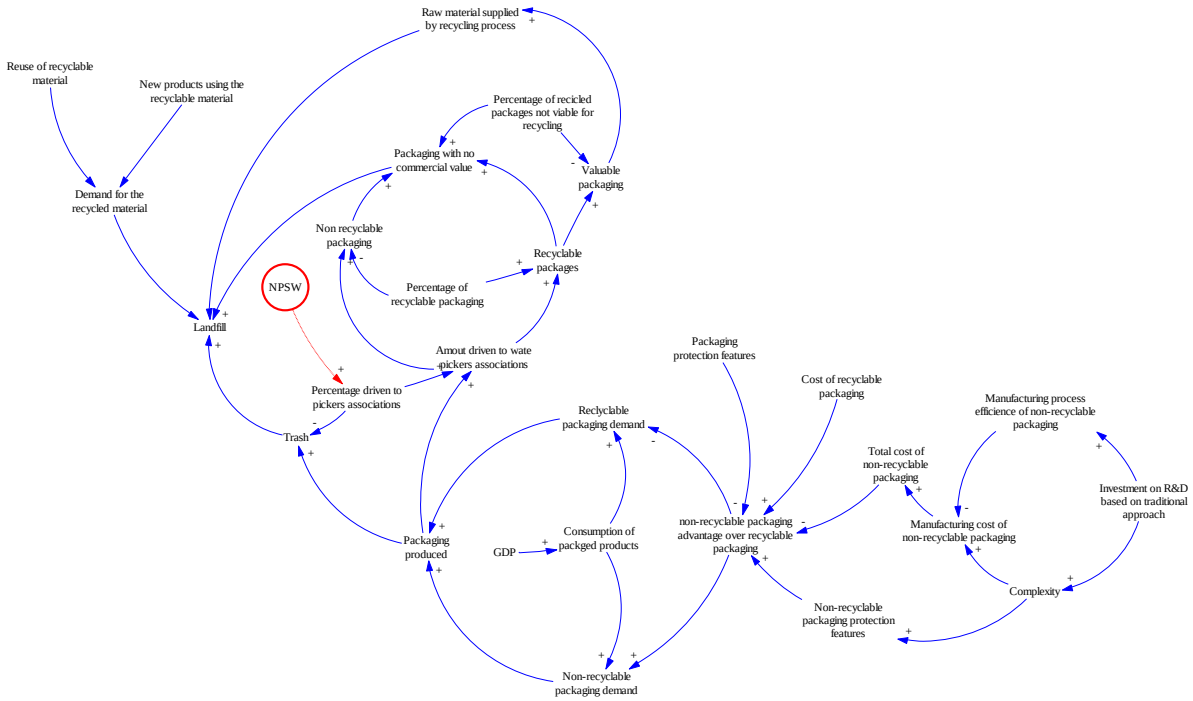


Figure 3 – The impact of NPSW

In this model we have the consolidation of several relations presented along the literature review and the basic structure of the proposal of the Sectorial Agreement submitted to the Ministry of environment by the coalition of companies belonging to the packaging associations. The interpretation follows a logical sequence whose early use of packaged products suffers the direct influence of GDP (ROUW; WORRELL, 2011). End of use packaging will eventually be discharged in trash and then dump in a landfill. A percentage of this packaging will reach the municipal waste collection system and then will be forwarded to the cooperatives of recyclable material collectors where they will be sorted by type of material. Once sorted, a fraction of these packages is then marketed generating revenues for waste pickers associations. Non valuable material generated in this process will be forwarded to landfill.

Although the literature review have made possible the construction of this model that represents the reverse logistics system of packaging proposed by the sectorial agreement, he has some limitations. The first of these is the impossibility of identified the impact caused by NSWP on the fraction of not recyclable plastic laminated. The model shows any residue not marketed by cooperatives as tailings, which consists of materials that do not have a recycling solution in the in the market due the lack of technology or due the high recycling costs. In addition to this important limitation in this model, impact from economic incentives on scavenges associations performance and on fostering Eco-design initiatives are not represented. In order to fill this gap and refine this model in order to understand the possibilities for reuse of packaging that are not marketed yet, we conducted a field research through interviews with specialists and people directly linked to the implementation of the NSWP.

Methodology

For this work, we opted for a qualitative exploratory research. This research aims to explain why some specific phenomena occur, determining the cause of the events under influencing it (APPOLINÁRIO, 2012). In order to understand the various cause and effect ties arising from the implementation of NPSW, we opted for the adoption of a method of modeling for construction of a causal loop diagram (GHAFFARZADEGAN; LYNEISB; RICHARDSON, 2011).

For gathering information about the effects of the NPSW we interviewed 10 professionals responsible for the guidelines of sustainability in large companies and cooperatives of recycled materials, legislators and environmental taxation specialists focused on NPSW. The objective of the interviews was to search for an understanding of the main obstacles to the implementation of the packaging reverse logistics and to raise possible impacts brought by NPSW to the process of innovation of products and packaging in bracketed companies under the Thematic Working Group of packaging in General.

The interviews were recorded and subsequently transcribed and from this material were built the causal maps that represent the vision of these professionals about the impacts of NPSW.

Results and Discussion

Based on the interviews conducted, it is possible to propose an updated model presented in figure 4. Comparing to the preliminary theoretical model, structured from the literature review, this new one introduces new variables and new causal relationships. The model also features the polarity of the causal relationships (STERMANN, 2000), a concept explained in the methodology chapter of this work and that describes the way in which the dependent variable changes when you change the independent variable.

The interpretation of this model also starts on the premise that the consumption of packaging is impacted by the variation of the GDP. Increased consumption of packaging have the effect of raising the use of all types of packaging, including the three divisions used in this work: laminated plastic packaging, recyclable plastic packaging and other packaging. A new variable related to the extraction of natural resources was included in the new model due the increase in packaging consumption.

Also the new model presents a new variable. Packaging that are not directly commercialized, cease to be classified only as tailings and receive another classification called "Unmarketable Packaging" just to identify that there is a chance to reutilization of these packages before they are discarded as tailings and forwarded to landfills. But due the lack of technology to recycle these complexes packaging identified as "Unmarketable Packaging" ended up discharged in Landfills giving rise to another new variable of this model entitled "Municipal Cost with Landfill".

Another variable included in the new model is the use of recyclables material in new products. This process depends directly on the availability of recycled materials which in turn is influenced by the existence of fiscal and tributary incentives. Eco-design incentive is another variable that interferes directly in the expansion of using recyclable materials. It is expected that with these incentives manufacturers will invest in research and development in order to offer for the market

more recyclable packaging. Finally, the extraction of natural resources that it was influenced directly by increased consumption of packaged products, now also has an inversely proportional relationship of the use of recycled materials in new products, since this recycling reduces the need for extraction of new natural resources.
In Figure 4 it is represented the impact of investments on Eco-design and fiscal incentives.

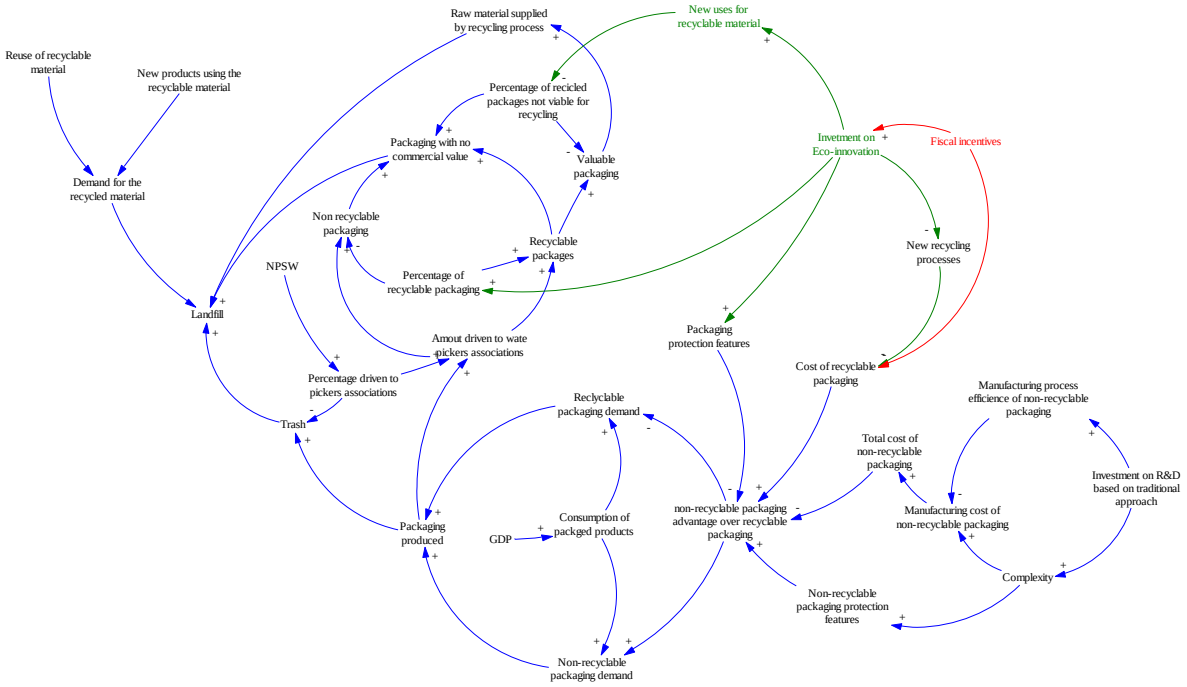


Figure 4 – Public policies for Eco-design and fiscal incentive

As shown in the figure 4, NPSW is not, based on interviewees opinion, a powerful instrument to change investment on R&D based on the traditional approach. So it is expected that more complexes packaging, with its multilayer material difficult to recycle, will reach the market. Despite, the new investments made by producers in expanding packaging collection, a significant volume of packaging processed by waste pickers will be transfer to landfills, reducing the rate of recycling efficiency. Therefore, fiscal incentive must be integrated in the NSWP in order to foster producers to invest in eco-innovation and reverse the actual non-recyclable packing advantages in the market and reduce the amount of "unmarketing packaging" processed by waste pickers organizations.

Interviews show also that, although fiscal incentives may increase the legislation performance, there are still other challenges to induce manufacturers to increase investement in eco-innovation. NPSW do not link producer to its own end-of-use packaging. Collection are performed by suppliers that will take the recycling material to the waste pickers organization to be sorted and marketed. As packaging manufactures will share the expenses of this activity, the individual cost it is too low to induce investment in eco-innovation. Therefore interviewees were invited to reflect on a scenario where producers would have the full responsibility for the collection and destination of its own end-of-use packaging.

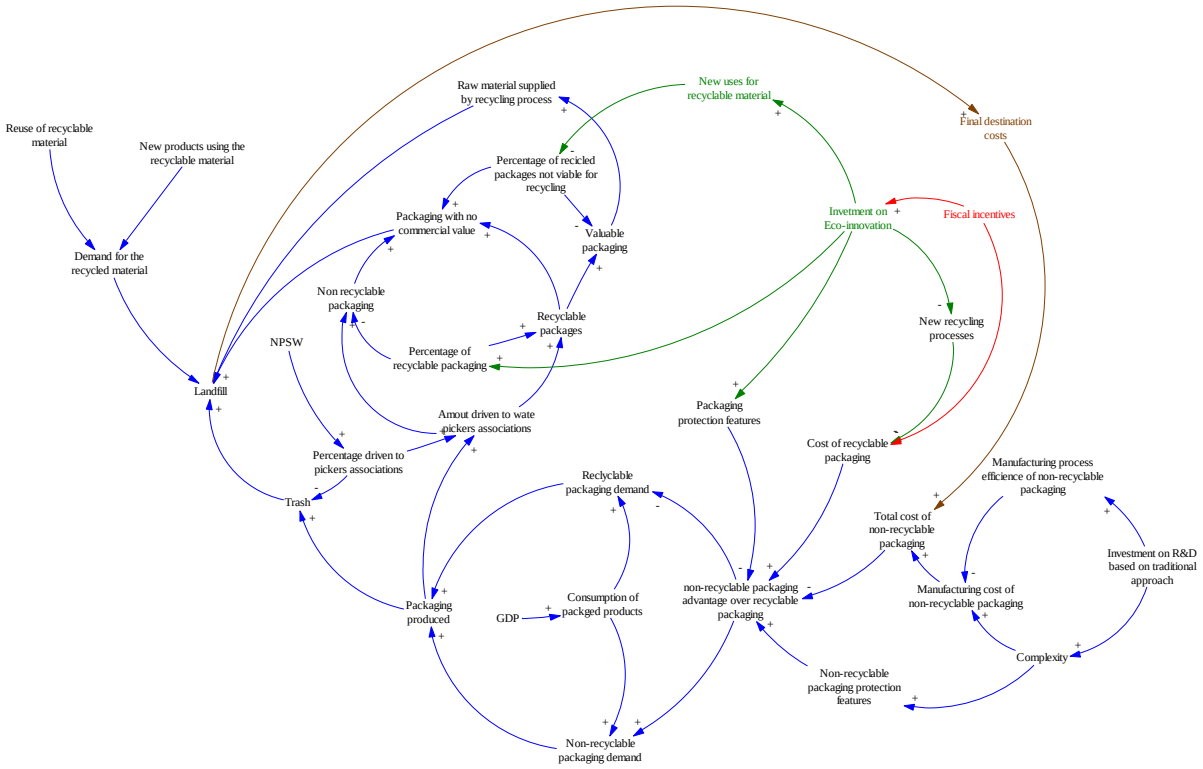


Figure 5 – Producer responsible for all costs related to collection and destination of its own end- of-use packaging.

In this scenario, landfilling cost will raise significantly for producers that keep generating "unmarketing packging", reducing even more the non-recyclable packaging advantage in the market. Eco-innovation will open new possibilities for recyclable material reducing the percentage of non-recyclable not viable material in the market.

Conclusion

The Brazilian Solid Waste Policy represents an important milestone for the management of the waste generated in Brazil and will affect different sectors in different intensities. Its main weakness is the lack of emphasis on the Individual Producer Responsibility that is an important concept of Extended Producer Responsibility, which is the basis for the vast majority of international public policies aimed at waste management.

Incentives to Eco-innovation, which is lacking in the policy, figure as an effective solution to promote the development of more recyclable packaging and also increase the use of recycled materials in the manufacture of other products. Despite overcoming some challenges like including waste pickers associations in the reverse logistics systems, there are no elements that show effective contribution of the NSWP for the process of developing more sustainable products and packaging effectively.

The segment studied in this research, the flexible plastic packaging and laminated, is included among those who must submit proposals for models of reverse logistics, including duty already completed through the Sectorial Agreement proposal. However, the actions discussed and adopted for this particular segment are very linked to economic aspects related to the division of costs among all producers. These limitations indicate that this policy will not contribute to the flexible plastic and laminated packaging to be reused and marketed, neither will create incentive mechanisms for research and development of more recyclable packaging in order to reduce the amount of waste sent to landfills. The next step for this research is to development of stock and flow simulation model to analyse the impact of these new policies would have on the reverse logistics of packaging

References

ATASU, A.; WASSENHOVE, L.; SARVARY, M. 2009.Efficient take-back legislation. *Production and Operations Management*, v.18, n. 3, p. 243-258,

BRASIL. Política Nacional de Resíduos Sólidos 2012. Lei n 12305 de 02 de agosto de 2010. 2010. Available in <http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm>. Access in: 24 nov.

BROUILLAT, E.; OLTRA, V. 2012. Extended producer responsibility instruments and innovation in Ecodesign: an exploration through a simulation model. *Ecological Economics*. Aalborg, Denmark, v. 83, p. 236-245.

CALCOTT, P.; WALLS, M. 2005. Waste, recycling and "Design for Environment": roles for markets and policy instruments. Resource and Energy Economics, Washington DC, USA, n.27, p.287-305.

CRUZ, N. et al. 2013 Packaging waste recycling in Europe: Is the industry paying for it? *Waste Management Journal*. Lisboa, v.34, n.2, p. 298-308.

DEMAJOROVIC, J.; MIGLIANO, J. Política Nacional de Resíduos Sólidos e suas implicações na cadeia da logística reversa de microcomputadores no Brasil. *Gestão & Regionalidade*, São Paulo, v.29, n.87, p.64-80, 2013.

EEA, European Environment Agency. 2013 Generation of packaging waste and GDP in the EU-15,. Available in: <http://www.eea.europa.eu/data-and-maps/figures/generation-of-packaging-waste-and-gdp-in-the-eu-15-7>. Access em: 12 jan 2014

FERNANDES, E. 2014. Desafios e oportunidades para a implantação da logística reversa de microcomputadores e aparelhos celulares no Estado de São Paulo, 2014. Dissertação (Mestrado em Administração) – Centro Universitário da FEI, São Paulo

FISHBEIN, B.; EHRENFELD, J.; YOUNG, J. 2000. Extended Producer Responsibility: A Materials Policy for the 21st Century, Germany. Available in: http://www.sustainablecitiesinstitute.org/view/page.basic/report/feature.report/Report_%20Mat_Pol_21st_Cent.. Access em: 13 mai 2014.

GOTTBERG, A. et al. 2005. Producer responsibility, waste minimisation and the WEEE Directive: case studies in eco-design from the European lighting sector. Science of the Total Environment, United Kingdom and Sweden, v.359, n.1/3, p.38–56.

JARDIM, A.; YOSHIDA, C.; MACHADO FILHO, J.V. 2012 Política nacional, gestão e gerenciamento de resíduos sólidos. Barueri, SP: Manole.

KALIMO, H. et al. 2012Greening the economy through design incentives: allocating extended producer responsibility. *European Energy and Environmental Law Review*, Sweden, v.21, n.6. p. 274-305.
LAMBERT, J. 2012. The influence of extended producer responsibility on ecodesign practices: insights from six producer case studies in the european ICT sector. Dissertação de Mestrado, University of Utrecht and the University of Leipzig.
LINDHQVIST, T. Extended producer responsibility in cleaner production. Policy principle to promote environmental improvements of product systems. Dissertação de Mestrado, The International Institute for Industrial Environmental Economics, Lund, 2001
MACKERRON, C. 2012. Unfinished Business: the case for extended producer responsibility for post-consumer packaging. As You Sow Report.
OECD. Extended Producer Responsibility: a guidance manual for governments. Paris: OECD, 2001. Available in: <http://books.google.com.br/books?id=-Zpjyhcu7TMC&pg =PA105&hl=pt-BR&source=gbs_toc_r&cad=4#v=onepage&q&f=true>. Access in: 11 Jan 2014.
PEREIRA NETO, Tiago José Pereira.A Política Nacional de Resíduos Sólidos: Os Reflexos nas Cooperativas de Catadores e a Logística Reversa. 2011.
ROUW, M.; WORRELL, E. 2011Evaluating the impacts of packaging policy in The Netherlands. *Resources, Conservation and Recycling*, v.55, n.12, p.483-492.
TOFFEL, M.; STEIN, A.; LEE, K. 2008. Extending producer responsibility: an evaluation framework for product take-back policies. Harvard Business School Working Paper, Boston, v.9, p.1-26.
TOJO, N.; LINDHQVIST, T.; DAVIS, G. 2001. EPR Programme implementation: institutional and structural factors. OECD Seminar on Extended Producer Responsibility, EPR: Programme Implementation and Assessment. France.
TOJO, N. 2004. Extended Producer Responsibility as a Driver for Design Change - Utopia or Reality?, Lund University, Sweden, 2004
THORPE, B.; KRUSZEWSKA, I.; MCPHERSON, A. 2004. Extended produced responsibility: a waste management strategy that cuts waste, creates a cleaner environment and saves taxpayers money. Clean Production Action.