SOLID WASTE MANAGEMENT AND REGULATION

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Abstract

Solid waste generation reduction is increasingly taking importance because of the high cost of disposal and the high health and environment harms. Canada is unfortunately among the highest OECD countries generators of solid waste. To find a way for Canada to reduce Solid Waste generation, the paper compares policies between Japan, Canada, and other OECD countries. The research found that the creation of financial incentives to households and businesses is one of the ways to reduce their solid waste generation. In order to achieve this goal, Canada should implement rigorous policies on different industries, as well as a full stewardship policy, by which the whole cost of solid waste collection and disposal is charged to polluters. Solid waste management policies that are applied under a national framework will be more effective than policies under a provincial framework.

Acknowledgment

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Glossary

Landfill	This is the oldest form of waste treatment and the least desirable option because of the many potential adverse impacts it can have. Wastes are disposed in dumpsites at designated land owned by the government or private owners, and in some cases dumped illegally in empty spaces (Goldberg et al. 1999).
Product Service System	Coming from the cleaner production approach, the precautionary integrating idea of environmental protection which tries to prevent wastes at the source and not at the end of the pipe was developed. The target was the optimization of material-, resource-, and energy-efficiency. Since the beginning, the emphasis was put on the whole life cycle of a product (McKerlie et al. 2006).
Resources Productivity	An index which comprehensively indicates how much industries and people's lives effectively use materials (Takiguchi & Takemoto. 2008).
3R	Reduce, Reuse and Recycle (Takiguchi & Takemoto. 2008).
Sound Material Recyclable-Material Society.	A society in which natural resources will be conserved and the environmental load will be reduced to the greatest extent possible, by preventing or reducing the generation of wastes from products (Yoshida et al. 2007).

Contents

1. Introduction

Canada is considered among the largest solid waste generating countries in the OECD. The establishment of effective solid waste management systems represents a serious challenge to the federal and provincial governments. According to Corbitt (1999), every activity of human beings and animals generates waste in amounts that vary by source, season, geographical site, and time. In 2008, Canadians generated 1,031 kg of waste per capita; 777 kg of this amount of waste is sent to landfills or incinerators, and 254 kg is processed (Statistics Canada, 2012a). There are different methods of Solid Waste management. The most effective methods are the reduction of solid waste at source and recycling.

Solid waste generation has been gradually increasing since 1990. According to the Conference Board of Canada, in 2009, Canada generated significantly more waste per capita than Japan (377 kg per capita) and the UK (580 kg per capita in 2008) (UN, 2009). In 2008, the annual per capita solid waste generated in the U.S. was 720 kg (lower than Canada). Canada generated approximately 34 million tonnes of waste handled by solid waste disposal systems; 26 million tonnes of that waste were disposed in landfills and/or incinerators while the other 8 million tonnes were recycled or processed through material recovery facilities or centralized composting facilities. Non-residential sources cause most of the solid waste generated. Approximately 21 million tonnes of waste generated in Canada in 2008 were generated by non-residential sources, and the other 13 million tonnes were generated by residential sources (Statistics Canada, 2012a).

According to Dyson & Chang (2005), population growth and income are positively correlated with solid waste generation. The increase in solid waste management creates the necessity to have landfills, incinerators, and recycling sites. The goal of an efficient solid waste management system is to curtail the current and future negative effects of solid waste. Solid waste management is based on the collection, discharge, and disposal systems.

To control solid waste generation, we must focus on the effective orientation of people and the environmental waste recycling awareness. Effective orientation of people and environmental waste recycling have been said to have a positive correlation with the health of people. Goldberg et al. (1999), while studying the impact of landfill location with respect to residential closeness to the waste disposal sites on health, found that there is a strong positive correlation between closeness to the landfill and the high occurrence of different cancers diagnosed in Montreal.

Psychological and social reactions by residents are stronger among those who live close to landfill sites than those close to incinerators. All the social, economic, and health problems caused by solid waste management systems in Canada put local and federal authorities under pressure to find effective solutions. An effective modern solid waste management system can not only solve the effects of the disposal sites, but it also helps to save time and resources for the authorities.

New wireless and sensors systems helped the Swedish authorities to enhance their waste pick-up time. Hence, they could save time and money by implementing sensors inside the waste containers (Johnsson, 2006). Technological systems, solid waste generation reduction at the source, and the creation of more recycling and composting facilities are different solutions for solving this problem. However, to be able to implement the best solutions combination we should understand why Canada does not do well in solid waste management. Why does Canada generate more waste per capita than other industrialized countries? What are the best solutions that Canada can use to reduce solid waste generation and to enhance solid waste disposal operations and practices?

To answer these questions, this paper will use a cross-country comparison to understand the reasons behind the differences between Japan, Canada, and other OECD countries, in the amount of per capita solid waste generated. The comparison between the countries is divided into three different sections. The first section presents statistics and solid waste generation facts in the three countries. The differences in solid waste generation among the three countries are due to different aspects like education and culture, but in this paper the focus is on the policy and regulation, as well as the technology and systems adopted by each country.

The second section focuses on the cross-country policy differences comparison. To determine which policies are more appropriate for Canada, this section presents the differences in policies between Japan, Canada, and other OECD countries. The paper will study the changes in regulations and policies between 2000 and 2010 to explore the effectiveness of the three countries' policies in reducing solid waste generation.

The conclusion discusses the results presented in the previous sections. Mainly, this section examines the differences in policies and systems used and their effectiveness in reducing solid waste generated in Japan, Canada, and other OECD countries between 2000 and 2010. It also presents the lessons learned from the comparison between the three countries and what Canada should do to reduce its solid waste generation.

2. Background

With the rising environmental issues and mass consumerism culture, the need for new solid waste management systems, technologies, and strategies is clearly required (Pires et al., 2011). Solid waste disposal is mostly done in the landfills and incineration facilities (Hjelmar, 1996). Landfills and incinerators cause serious health problems and dangerous sicknesses to people living in the surroundings of the disposal facilities because of the residues like the bottom and fly ash leachate (Goldberg et al., 1999). Solid waste disposal landfill in Montreal has caused different types of health complications to people living close to the disposal site (Goldberg et al., 1999). Many academic articles have tried to study the effects of solid waste disposal and the different strategies to enhance the situation and reduce the environmental, economic, and health harms.

Solid Waste Management Technology Stream

The path to better solid waste management should imperatively consider technological solutions. Technology is a cornerstone in any adopted strategy to solve solid waste disposal problems. The southern countries of the European Union have been struggling in dealing with solid waste compared to the northern countries, because of the systems and techniques used in both parts of the continent (Pires et al., 2011). Technology can be a beneficial economic and

environmental tool to improve the energetic valorization of organic material. Municipalities with limited income find difficulties in implementing these technologies and systems because they are very expensive. However, the payback time of these technologies is quite reasonable. Using the anaerobic integrated system to allow the extraction of energy from solid waste is an interesting option for environmental recycling and energy generation at the same time. The generation of biogas, for instance, has a 3.7 years payback time with electricity at $0.1 CDN. The second option is to add manure from the farms in the surroundings; this option increases the biogas production by 37% but increases the payback time to 6.8 years (Morin et al., 2010).

However, the technology systems can be at different stages of solid waste management. Dynamic scheduling and routing in solid waste containers have enabled the Swedish authorities to reduce the time and money spent on collection. Sensors and wireless communications equipment were installed in 3300 recycling containers in Sweden. The sensors and wireless communications equipment were installed to indicate when the container is full and the amount of waste inside the container. The wireless devices enabled the waste collection employees to save time by going only when the container needs to be picked up or emptied. So, the sensors and routers helped the waste management department to save transportation and workforce time and money (Johnsson, 2006). The implementation of more integrated solid waste management systems is very important to live up to the international standards of solid waste management. At the same time, the implementation of new models and tools is effective to enable the rationalization of technological choices and the establishment of system analysis models synergistically to benefit from the development of solid waste management (Pires et al., 2011).

Differences in the management systems and tools affect the effectiveness of solid waste management. According to Dyson & Chang (2005), minor differences were found between Dalian region (China) and Waterloo region (Canada) waste management strategies' social and economic context. However, major differences were found in the management systems and tools. The adoption of different strategies is necessary for the success of any new solid waste management strategy. These strategies include waste planning, development of waste diversion programs, waste treatment industries, customizing these programs by design of new programs and development of the local government role, systems, models, and tools upon the local economic, social, and managerial system context (Dyson & Chang, 2005). Separation at the source is considered as one

of the best systems. Waste incineration, separation at source, and recycling, as well as anaerobic digestion of organic waste, have the greatest benefits for reducing greenhouse gas (GHG) emissions (Chen et al., 2010; Mohareb et al., 2008).

One of the most urgent issues related to solid waste management is the control of solid residues. There are different types of solid waste residues, such as the bottom and fly ash and their leachate. The leachate of these residues causes serious health issues, such as the occurrence of different types of cancer in the areas near landfills and incinerators (Goldberg et al., 1999). The best practice to reduce the bottom and fly ash is by adopting a controlled contaminant release strategy, which means stopping the leachate from leaking into the surroundings of the incineration center. Monofil and separate management and disposal of solid waste incineration are recommended to solve the leachate problem more than other strategies (Hjelmar, 1996).

Solid Waste Generation Reduction at the Source

Many authors such as Arimura et al. (2008) argue that there are different ways to reduce the cost and danger of solid waste rather than using expensive technological systems. One of the effective approaches is the reduction of solid waste at the source. The voluntary approach as an environmental policy instrument is one of these effective strategies. The implementation of the ISO 14001 and the performance report is very effective in controlling the emission of solid waste by business and commercial facilities (Arimura et al., 2008). The economic development and level of income are directly correlated with solid waste management and reduction of solid waste generation at the source. According to Mazzanti et al., (2008), there is a direct negative correlation between income and municipal waste generation between the southern and the northern provinces in Italy, as well as a turning point where the provincial and municipal generation becomes unlinked with income. High economic growth and municipal income allow the local authorities to adopt effective technologies and policies to reduce solid waste generation from the source.

Privatization as a Solution to the Solid Waste Management (SWM) Stream

The difference in the collection and management of solid waste between the public sector and the private sector is an important field of research. The privatization of undesirable activities in

the public sector is one of the proposed solutions to the solid waste problem. According to data collected by McDavid (1985) from 126 municipalities in Canada from different regions between 1981 and 1982, the contracted private companies helped the municipality save money and time to collect the residential solid waste. Privatization enables the municipalities to reduce the cost of solid waste collection. It allows them to reduce the cost of an unexpected increase in solid waste management and to focus their efforts on other important fields in the public sector (McDavid, 1985; Bel & Miralles, 2003).

Psychological, Social and Physical Impacts of the Solid Waste Sites Stream

Solid waste disposal sites don't only have economic and health costs, they have also other implications. People who live in the surrounding areas of the disposal sites are also psychologically, socially, and physically affected by the presence of the disposal sites. Residents in the surroundings of landfills and incinerators in BC and Ontario, for instance, reacted to the presence of the landfill because of their awareness of the danger and the serious health implications of the disposal sites. The concerns and actions taken by residents against the incinerators and the landfills are strong and increasing (Elliott et al., 2004). The implementation of solid waste disposal represents a serious social concern and is refused by a majority of people, although they may disagree on the level of harm it may cause (Rahardyan et al., 2004). This psychological concern is justified by the hazardous impact on the health of people in the areas surrounding the disposal sites, such as the impact of the distance of the residence from the solid waste landfill (Goldberg et al., 1999).

3. Japan

3.1 The Japanese Economy

In 2012, the Japanese economy was the third largest economy in the world in terms of GDP ($5,959,718M), which grew by 1.9% compared to fiscal year 2011 (World Bank, 2013). The Japanese economy is based on three major sectors: Agriculture 1.1%, Industry 26.1%, and Services 72.8% (CIA Factbook, 2013). Japan is ranked number 1 in solid waste management among all OECD countries (Conference Board of Canada, 2009). In the past, waste management was the responsibility of municipal authorities. Lately, however, national government, municipal

governments, prefectural governments, administrative bodies, and the public sector have been responsible for waste management. Their responsibilities include recycling, reusing, and reducing the quantity of waste discharged. As a result, the Japanese government makes an exemplary waste management model.

The Japanese government aims to build a Sound Material-Cycle Society, so it focuses its attention on waste management by reviewing the Waste Management and Public Cleansing Law. As a result, the Government enacted the Fundamental Law for a Sound Material-Cycle Society, Law for the Promotion of Effective Utilization of Resources, the Construction Materials Recycling Act, Law for the Promotion of the Utilization of Recyclable Food Resources, and the Law concerning the Promotion of Procurement of Eco-Friendly Goods and Services Research (Ministry of Environment of Japan, 2010). This paper focuses on Waste Management and Public Cleansing Law (Waste Management Law), Fundamental Law for a Sound Material-Cycle Society and Law for the Promotion of the Utilization of Recyclable Food Resources (Food Recycling Law) because these industries are the main sources of solid waste. The other Laws are also briefly presented.

3.2 Japanese Solid Waste Management Laws

Japan has geographic difficulties to create more disposal sites, so, Japan decided to put in place a set of regulations in order to reduce solid waste generated at the source. Figure 1 shows the regulations and their structure within the Japanese solid waste legal context. The fundamental environmental law was the origin of the set of environmental law in Japan. Fundamental Law for establishing a sound material is the considered as a legitimate successor of the Fundamental Environmental law. As shown in the figure 1, the law has two branches, Waste management and Public law, and the Law for Promotion of effective Utilization of Resources. These branches are, themselves, divided into different laws. Detailed explanation about every law is presented in the coming section.

Figure 1: Legislative framework to establish a Sound Material-Cycle Society

Source: Takiguchi & Takemoto. (2008).

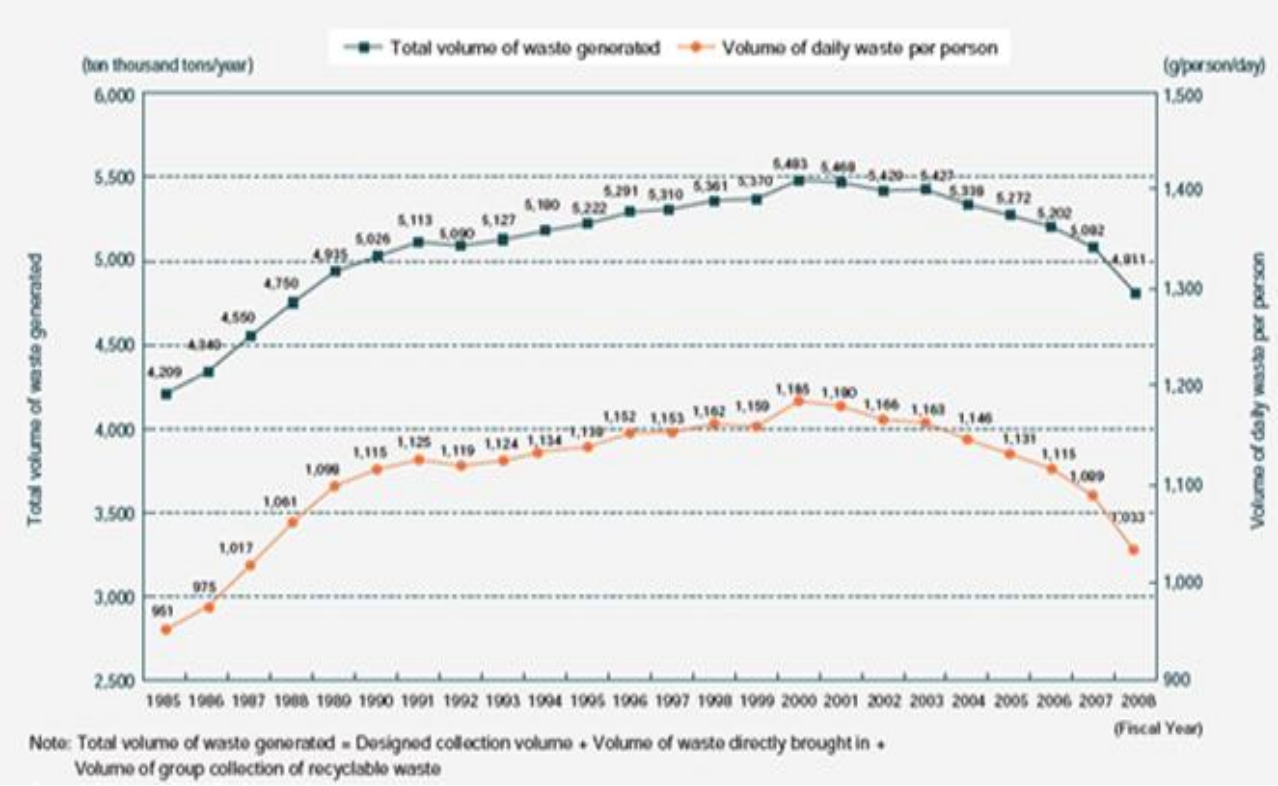
Waste Management and Public Cleansing Law (Waste Management Law)

This law's target is to reduce municipal and industrial solid waste by 50% in 2010 compared to 1997. According to this law, solid waste generation should be controlled as much as possible. It also states that the increase of recycling, reuse, and reduction of actual waste should be adopted to prevent the improper waste treatment and increase the productivity of natural resources to reduce the environmental load. It emphasizes that all wastes should be properly treated even after recycling (Tanaka, 1999).

Japan's strategy is based on the reduction of solid waste from the sources. In the early 1990s, Japan launched its 3R strategy (Recycle, Reuse, and Reduction) in order to reduce solid waste and increase natural resources productivity. This strategy was later supported by the waste generator responsibility and the Extended Producer Responsibility (EPR) concepts to push individuals and businesses to adopt the 3R. This law is considered as the foundation of

environmental law in Japan. According to the Ministry of Environment (2010), daily per capita garbage decreased to 1,089 grams in 2007 (8.1% decrease between 2000 and 2007). Moreover, daily per capita household garbage decreased by 10.4% between 2000 and 2007 to reach 586 grams in 2007. The government's objective is to increase the recycling utilization rate by 15% by the end of 2015. This rate increased by 80% from 1990, 40% to 50% increase between 1990 and 2000 and 13.5% in 2007. These results show the effectiveness of the 3R strategy in reducing the use of disposal sites in Japan. Figure 2 presents the changes to total waste generation and daily waste per person in Japan between 1985 and 2008 (Ministry of Environment of Japan, 2010). Figure 2 shows that, between 1985 and 2000, both total volume of waste generated, and volume of daily waste per person grew from 4209 to 5493 and 951 to 1185 respectively. These amounts decreased starting from 2000. Information about total volume of waste generated, and volume of daily waste per person are depicted in figure 2.

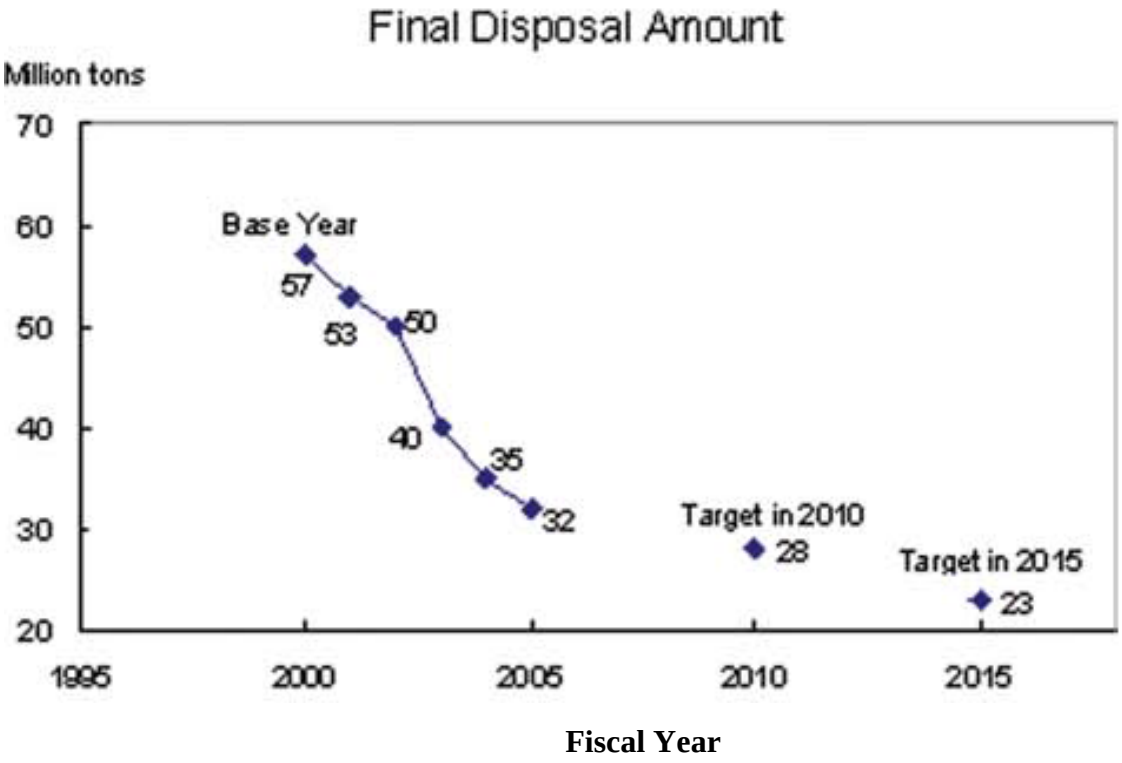
Figure 2: Changes to Total Waste Generation and Daily Waste per Person Between 1995 and 2008



Source: Ministry of Environment of Japan (2010).

Furthermore, the Waste Management and Public Cleansing Law, 3R, and Producer Extended Responsibility concepts enabled Japan to reduce waste generated by business activities to 15.09 million tons in 2007; it decreased by 16.1% between 2000 and 2007. Moreover, the final disposal volume of industrial wastes decreased by 77% between 2000 and 2007, to 20.57 million tons in 2007. In terms of numbers, the total amount of solid waste generated in 2007 was 590 million tons. Municipal wastes were 70 million tons; garbage wastes accounted for 50 million tons, and night soil accounted for 20 million tons. Industrial wastes accounted for 420 million tons, while other wastes accounted for 100 million tons. In 2008, the amount of wastes generated was 48.11 million tons, a decrease of 5.3% compared to 2007. Daily per person waste was 1,033 grams, a decrease of 5.1% compared to 2007. In 2007, Business-related activities wastes accounted for 34.10 million tons. Figure 3 depicts the change in Final disposal volume in Japan between 2000 and 2005 and the predictions until 2015.It shows that final disposal amount decreased from 57 million tons in 2000, to 32 million tons in 2005. It is estimated to get to 23 million tons in 2015 (Takiguchi & Takemoto. 2008).

Figure 3: Changes in Final Disposal Volume of General Waste (according to waste items)



Source: Takiguchi & Takemoto (2008)

Fundamental Law for a Sound Material-Cycle Society

The Fundamental Law for Establishing a Sound Material-Cycle Society is considered as the Sound Material-Recycling Society law foundation. It was promulgated in July 2000 and enforced in January 2001. Its first objective was to reduce solid waste generation in Japan by revising the increasing mass-production, mass-consumption and mass-disposal culture in the Japanese society. This law focuses on waste, recyclable resources, and non-recyclable products. This law's target is to improve natural resources productivity. The productivity of natural resources was 210 thousand yen per ton in 1990. The government's target is to increase resource productivity (Yoshida et al., 2007).

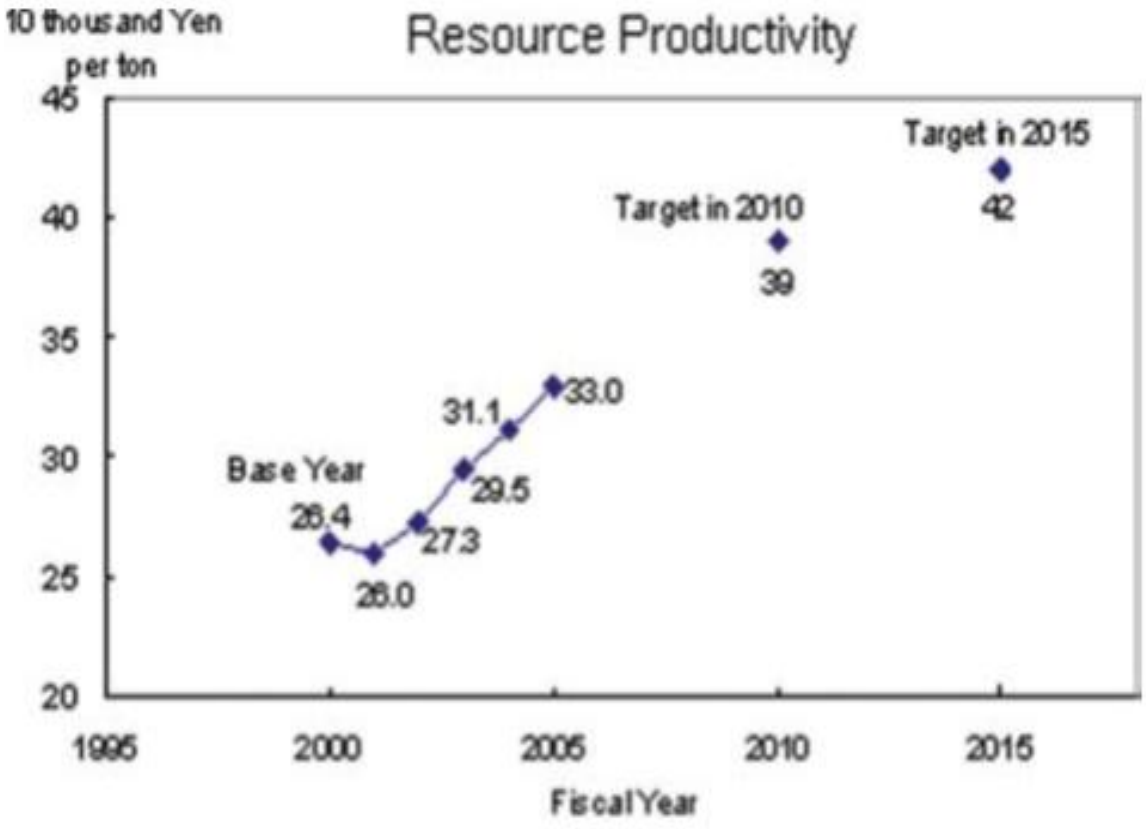
Furthermore, The Sound Material-Cycle Society's Fundamental Law articles promote the Responsibility of Waste Generator and the Extended Producer responsibility concepts. Waste generators should assume their responsibility for recycling their own waste and treating it properly. So, waste generators are responsible for the environmental damages caused by the load of solid

waste generated, and a solution to the problem is to implement the concept of Polluter-Pays (Moriguchi, 2007).

Moreover, the Extended Producer Responsibility forces producers to bear responsibility and pay for the use of their products. This idea pushes producers to come up with products that are easy to be reused or recycled. The Fundamental Plan to establish a Sound Material-Cycle Society starts by calling all environment and business actors, including citizens, businesses, Non-profit Organizations, Non-Government Organizations, universities, local authorities, and the government to cooperate to create a sound material-cycle society (Yoshida et al., 2007).

The increase of the productivity of natural resources is one of the best strategies adopted in the reduction of solid waste generated as it saves more natural, financial, and environmental resources and efforts. In 2000, resources productivity increased by 60% to 260 thousand yen per ton. In 2007, resource productivity was 360 thousand yen per ton. Resources productivity is expected to increase to 420 thousand yen per ton by 2015 (100% increase between 1990 and 2015). So, the first aim of the policy is to reduce solid waste generation at the source because of the limited number of disposal facilities in Japan. On the other side, the policy saves municipal financial and human resources because it reduces the amount of waste generated and collected. More importantly, Japan was able to save more natural resources by recycling and reusing them. Figure 4 shows the increase of resources productivity per ton between 1990 and 2007. The value extracted from 1 ton of natural resources went up from 264 thousand yen in 2000 ti 330 thousand yen in 2005. Japan's target is to increase the productivity of natural resources to 420 thousand yen in 2015 (Takiguchi & Takemoto. 2008).

Figure 4: Natural resources productivity



Source: Takiguchi & Takemoto (2008)

Law for the Promotion of the Utilization of Recyclable Food Resources

Food waste is one of the main sources of municipal and Industrial solid waste. In May 2001, the Food Recycling Law was enforced to facilitate and encourage food and food-related businesses including food manufacturers, distributors, restaurants, and catering services to promote food resources recycling. The Food Recycling Law forces food manufacturers to reduce their unsold or uneaten food, and recycle the remaining as raw materials for animal feed and fertilizers. Results show that objectives have been achieved in the food manufacturing sector. However, recycling results in downstream businesses are still low (Ogushi & Kandlikar, 2007).

The government introduced this law to increase food recycling, reuse, and reduction. In 2007, the recycling rate was 54% in the food industry (81% in food manufacturing, 62% in food wholesaling industry, 35% in food retailing, and 22% in food service industries). These policies

have been successful because they addressed the issue from the source, and have been able to save the country's natural and financial resources. On the other side, the policy of polluter-pays engaged individuals and households into strict recycling behavior (Ministry of Environment of Japan, 2010).

Johkasou Law (Household Wastewater Treatment Facility Law)

The Johkasou Law enforced in October 1985 targets the proper use of sewage and miscellaneous water with household water. The law aims to increase water conservation and to improve public health and water quality. It imposes strict regulations on manufacturing, management, installation and maintenance of water treatment facilities. It also states that examination of households should be carried out to ensure the proper use and management of household wastewater treatment facility (Gaulke, 2006).

Moreover, wastewater is another issue that the Japanese government wants to decrease. The Johkasou Law was enacted and enforced in 1985. At the end of 2008, the ratio of households that carried water quality examination based on article 7 of the Johkasou law was 89.9%, an increase of 2% over the previous year. Furthermore, the ratio of households that carried wastewater treatment facilities examination based on article 11 of the Johkasou law was 27.2%, an increase of 1.5% over 2007 (Ministry of Environment of Japan, 2010).

Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services

According to this law, the government and other authorities must adopt an eco-friendly procurement system. In 2009, the basic principles of the green purchasing principles were applied as criteria and measures of judgment of what should be procured. These principles are constantly revised based on new knowledge. The number of green purchase complying items became 256 in 19 fields (Sugiyama & Takeuchi, 2008).

Law for the Recycling of End-of-Life Vehicles

The Law on Recycling of End-of-Life Vehicles (ELV Recycling Law) was introduced and enforced in 2002. This law forces car manufacturers to remove airbags, automobile shredder

residue, and chlorofluorocarbons from End-of-Life Vehicles before recycling them in order to treat remaining materials in a better way (Sakai et al., 2007).

Law for the Promotion of Use of Agriculture, Forestry and Fisheries Resources as Raw Materials of Biofuel (Agriculture, Forestry and Fisheries Resources Biofuel Law)

This law was enforced in 2008. It aims to increase the productivity of natural resources by engaging farmers, foresters, fishers, and biofuel manufacturers in cooperation in the process of production of raw materials such as ethanol and wood pellets to biofuel production to research and development activities (Matsumoto et al., 2009).

Law on Special Measures concerning Removal of Environmental Problems Caused by Specified Industrial Wastes (Law on Special Measures against Specified Industrial Wastes)

This law was enacted and temporarily enforced in 2003. It aims to put standards on industrial waste generated from improper treatment and illegal dumping, and industrial waste that has been left for a long time. It targets the reduction of waste. It also urges prefectures to remove industrial waste by contributing to the removal budget (Ministry of Environment of Japan, 2010).

Law for the Promotion of Sorted Collection and Recycling of Containers and Packaging (Containers and Packaging Recycling Law)

The amount of municipal solid waste generated increased during the 1990s in Japan and threatened to fill the remaining solid waste disposal sites. This law was enacted in 1997 to reduce the amount of containers and packages that represented 60% of municipal solid waste generated. This law aimed to reduce glass containers, PET[1] bottles, and paper containers. However, since 2000 the government extended this list to include other plastic containers and packages than PET bottles, and paper packages and containers other than paper cartons for drinks (Suwa & Usui, 2007).

[1] PET (Polyethylene Terephthalate, a recyclable plastic.)

The Construction Materials Recycling Act

This law was enforced in May 2002. It aims to reduce concrete mass, asphalt, and waste lumber disposal construction sites. In 2008, the volumes of recycled concrete mass and asphalt mass were 97.3% and 98.4%, respectively, of their total generated waste. The amount of recycled lumber disposed at construction sites is 80.3%. The amount of waste reduction at construction sites reached 89.4%. In April 2008, this law was reviewed to deal with the construction sector's rising issues (Ministry of Environment of Japan, 2010). So, solid waste generated from construction represented 16% from total sold waste generated in the whole country (0.75 million tons of solid waste) (Tam, 2009).

Law Concerning Special Measures for Promotion of Coplanar Polychlorinated Biphenyl (PCB) Wastes (PCB Special Measures Law)

The Kanemi rice oil disease that occurred in 1968 made the toxicity of Coplanar Polychlorinated Biphenyl clear. As a result, the Law Concerning the Evaluation of Chemical Substances and Regulation of Their Manufacture was enacted and enforced in 1973. The imports, use, and production of PCB were banned. PCB waste has accumulated ever since because of the lack of cooperation between households and public authorities. The Stockholm convention states that the use of PCBs must be completely abolished by 2025 and its waste properly treated until 2028. As a result, PCB Special Measures Law was enacted and enforced in 2001. The aim of this law is to make the national government take measures to build PCB waste treatment systems, facilities and funds (Yoshida et al., 2009).

Law for the Promotion of Effective Utilization of Resources

The Effective Utilization of Resources Law was enforced in April 2001. It divided businesses into different categories. The first category of business includes companies from steel, paper, and pulp manufacturing where the by-products and their recycling must be controlled to save resources. The second category consists of businesses already using recycled parts, such as paper manufacturing and glass container manufacturing businesses. Other categories include companies where the use of raw materials should be rationalized and promoted, such as automobiles and electric home appliances businesses. Also, other businesses must have labels on

their products to promote sorted collection, such as plastic containers, plastic packages, as well as paper-made packages (Ogushi & Kandlikar, 2007).

Law for the Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Law)

The Home Appliance Recycling Law was enacted and enforced in 2001. According to this law, special collection sites were designated for the four main home appliances (household air-conditioners, televisions, refrigerators and freezers, washing machines, and clothes dryers). 379 designated collection sites have been created to make it easy for manufacturers of these appliances to collect waste and reuse it in the manufacturing process. Fluorocarbons, iron, aluminum, copper, glass, and other metals used in printed-circuit board manufacturing are collected from appliances in the sites (Terazono et al., 2004; Aizawa et al., 2008).

4. Most Efficient Municipal Solid Waste Management Policies

Many policies were adopted by different nations to solve solid waste management problems. Contrarily to Japan, the U.S. adopted different strategies and policies. The American federal government enforced the Resource Conservation and Recovery Act (RCRA) of 1976. This policy focuses on the use of advanced technologies in the construction and operation of solid waste landfills. This law came to put an end to previous municipal solid waste independent management. Prior to this Act, every municipality had its own landfill which was at the edge of town or beside rivers. Nowadays, landfills in the U.S. are constructed with strict standards. With a width of several inches, bases are built and protected by various grades of plastic lining to protect the environment from leachate seeping. Leachate is controlled and treated using underground plumbing systems. Also, the local groundwater sources are permanently monitored (Kinnaman & Fullerton, 1999). On the other side, strict standards are applied to garbage and landfill operations. Within a few hours of its disposal, garbage should be dumped with soil to prevent bad odors, pets, and health hazards from disseminating. The landfills are used to generate electricity by capturing and burning methane. Landfill access roads are watered several times every day to prevent stone caused by heavy trucks from rising. These regulations were effective since they reduced disposal external

costs (health hazards, environment, and resources pollution), but they increased the cost of internal disposal from $9 per ton to $20 per ton (Beede & Bloom, 1995).

Other policies are focusing on waste management system change. In the late 1990s Sweden introduced Extended Producer Responsibility for packages and tires entering landfills and incinerators. In 2000, Swedish authorities imposed a tax on all landfilled waste. In 2002, combustible products were entirely banned from landfilling and organic products were banned in 2005. These policies were introduced to promote incineration. Incineration has higher economic cost but has multiple benefits. The first benefit of incineration is the reduction of emissions and environmental costs. The second benefit is the possibility of energy generation using anaerobic technology (Erikson et al., 2005).

Policies concentrating on the improvement of solid waste management systems and focusing on making disposal sites more environmentally friendly are not necessarily the best policies. These policies reduce the cost to the environment caused by solid waste disposal at landfills and incinerators. However, the cost of waste disposal significantly increases. Also, the implementation of disposal sites causes both physical and social reaction. These policies are criticized because they are not effective. The creation of new disposal sites is difficult and they are rejected socially. The creation of regional landfills and incinerators to replace municipal local dumps changed the solid waste disposal industry. This shift was not considered enough because many countries have quit this disposal site type in favor of incinerators. Although incinerators are assumed to cause less harm to the environment and the surrounding areas, many experts question this fact. Furthermore, the incineration process is very costly. It was a good solution in small countries like Japan because of land scarcity. With that in mind, different states in the U.S. have enforced new policies to reduce solid waste from the source rather than bearing the high disposal cost. Municipalities with roughly 4000 inhabitants started pricing garbage by bag to give financial incentives to households to increase recycling practices (Kinnaman & Fullerton, 1999).

Also, natural resource productivity per ton has been affected by another Federal Government initiative to subsidize virgin material extraction. This policy influences the household solid waste collection and disposal market. A set of taxes enforced by the federal government

encourages the use of virgin products in production rather than recycled ones. For instance, revenues and profits earned by the timber industry are taxed at a capital gains rate, not at the corporate income tax rate. Also, freight rates on recycled products are higher than freight rates charged on virgin products. These forms of favorable taxes encourage companies to use virgin products rather than recycled ones. They end up encouraging companies and consumers to use virgin products and increase municipal solid waste. As a result, these policies participate in the increase of consumption and solid waste generation. In the absence of real policies to reduce the sources extraction and solid waste generation, any other policies will fail. Policies previously implemented in landfills and incineration sites to make them environmentally friendly have increased the cost of solid waste disposal. This tax system works as an incentive to increase the consumption and solid waste, which increases the cost of the disposal more than expected (Bruvoll, 1998).

In 1991, Germany enforced the Law Waste Management, which concretizes the concept of the Extended Producer Responsibility. This law obliges producers to pay for their own product recycling, even after these products are sold to retailers and final consumers. The law's objective was to increase the recycling rate to 80%. As a response to this law, more than 400 packaging firms and waste-hauling firms conglomerated to form the Duales System of Deutschland (DSD). The objective of this association is to minimize the administrative cost related to minimum recycling standards. Within a short time, the DSD became a national program managing solid waste instead of it being managed by municipal authorities (Michaelis, 1995).

The UK adopted a model close to the U.S. model. The UK implemented credits for recycling and imposed taxes on solid waste disposal in landfills. The UK's waste management policies are trying to comply with the international (EU) recommendations. Policies are ranging from incentives policies (carrot) to heavy taxes (stick). The UK government enforced the White Paper 'Making Waste Work' strategy. This project aims to move the solid waste management responsibility from disposal to recovery, re-use, and finally reduction. It is inspired from the Japanese 3R strategy. This means that the UK's new strategy focuses on the reduction of solid waste generation at the source (Read, 1999).

After many years of its enforcement, the German Packaging Ordinance continues to show effective results far better than expected by the most enthusiastic of its supporters. The best outcome of the Duales System is that it has created a stable, well-established, effective cohesion and cooperation between different industries within the economic system. The Duales System core concept is to create a price incentive and push towards the restructuring of the economic system and the reduction of packaging material consumption. However, the Duales System is rationally bounded because it does not completely solve the problem of market failures and price distortions.

A policy combining Extended Producer Responsibility and consumer responsibility is recommended by solid waste specialists. According to Kinnaman & Fullerton (2000), introducing a weight based disposal system is the solution to reduce waste at the source. The introduction of a $1 per bag fee is estimated to reduce solid waste generated by 44% (412 pounds). Firms that are interested to buy recyclable materials are moved by capital incentives. However, most companies' capital stock is appropriate for the use of virgin materials, and the re-equipment process is very expensive and time consuming for companies. Nestor suggested that the most effective strategy is to support these companies financially via subsidies, which will encourage them to use recyclable rather than virgin products (Nestor, 1992).

For instance, subsidies intending to stimulate growth in the timber industry work as counter effects to policies implemented to increase the supply of old newspapers (ONP). These subsidies make policies to reduce consumption and increase the recycling rate within the American society very ineffective. Furthermore, this fiscal bias, intending to maintain or increase the growth rate in the extraction industry to keep the prices relatively low, is having negative effects on the recycling rate in the US. The removal of these subsidies on virgin materials will automatically increase the cost of production and will force producers to adopt more cost efficient raw materials by using recycled raw materials instead of virgin materials.

Environment protection policies can be a source of efficiencies. According to Bruvoll (1998), imposing taxation on virgin materials can promote market efficiency. The relative price between virgin materials and other production factor inputs creates market inefficiencies. Taxes on virgin materials give incentives to producers and firms to use recycled materials rather than

extracting minerals and resources, because the cost will be lower (Bruvoll, 1998). Recycling is one of the best practices to reduce solid waste generation. The implementation of price incentives to increase recycling at home is the best solution, rather than implementing reduction at the source policies. “Reduction at the source” policies are not appropriate or suitable at home. This means that policy makers should take into consideration implementing policies that encourage people to increase their recycling at home, rather than trying to concentrate reduction at the source (Lober, 1996). A practical way to increase recycling at home and reduce solid waste generation is by giving financial incentives to both producers and end users. A practical approach to achieve the optimal solid waste level is by introducing a mixed policy combining a tax on producers for their disposal goods and a subsidy for households and end users for their recycled material (Dinan, 1993).

Solid Waste Reductions at the Source policies have been proven to be powerful approaches to a better and efficient management of waste. As a matter of fact, over the last two decades, all success stories were tackling the problem from the sources. As an example, the lead reduction from the atmosphere was successful because lead was removed from gasoline, rather than enforcing policies to control its emission. As previously noted, policies intending to control the emission of solid waste will never be successful because there is always a way to manipulate these policies. The eradication of the problem from its source is the most effective. The reduction at the source is not only environmentally friendly; it is also a financially friendly policy.

5. Canadian Solid Waste Policy (Ontario, Quebec, and British Columbia)

Unlike the U.S., Canada makes fewer efforts in reducing solid waste generation and improving natural resource management. One of the problems with Canadian solid waste policy is that it is based on the provincial perspectives rather than a national framework. Lately, however, North American policy makers (US and Canada) realized that local governments and authorities do not have the required resources to manage all kinds of disposed solid waste. Therefore, the Federal governments decided to step in and impose programmes and legislation to extend producers’ responsibility that includes product take-back and recycling. Table 1 shows the amount of diversion waste by source generated in Canada and in the provinces between 2002 and 2008.

Table 1: Diversion of Waste, by Source, Canada, Provinces and Territories, 2002 and 2008

	Residential sources [1]		Non-residential sources [2]		Total diversion	
	2002	2008	2002	2008	2002	2008
	tonnes					
Canada	**2,789,669**	**4,360,505**	**3,851,879**	**4,112,752**	**6,641,546**	**8,473,257**
Newfoundland and Labrador	25,993	x	4,393	x	30,386	x
Prince Edward Island	x	x	x	x	x	x
Nova Scotia	122,707	149,961	69,299	139,989	192,006	289,950
New Brunswick	57,192	62,076	73,536	205,391	130,728	267,467
Quebec [3]	595,000	1,046,000	1,148,376	1,417,600	1,743,376	2,463,600
Ontario	1,029,042	1,878,899	1,236,927	932,001	2,265,968	2,810,900
Manitoba	79,923	74,168	135,892	96,209	215,815	170,377
Saskatchewan	39,345	78,381	76,951	71,238	116,296	149,619
Alberta	320,536	391,709	369,981	336,827	690,517	728,536
British Columbia	496,751	614,204	721,724	890,908	1,218,475	1,505,112
Yukon, Northwest Territories and Nunavut	x	x	x	x	x	x

1. Residential non-hazardous recyclable materials include solid materials produced by residences that are picked up by the municipality using its own staff or through contracting firms or that are self-hauled to depots, transfer stations and disposal facilities.
2. Non-residential sources include solid non-hazardous recyclable material from the Industrial, Commercial, and Institutional (IC and I) sector as well as the Construction, Renovation and Demolition sector (CRD). Materials are those generated by all IC and I and CRD sources in a municipality, and are excluded from the residential waste stream.
3. Waste diversion data are derived from a survey administered by RECYC-QUÉBEC.

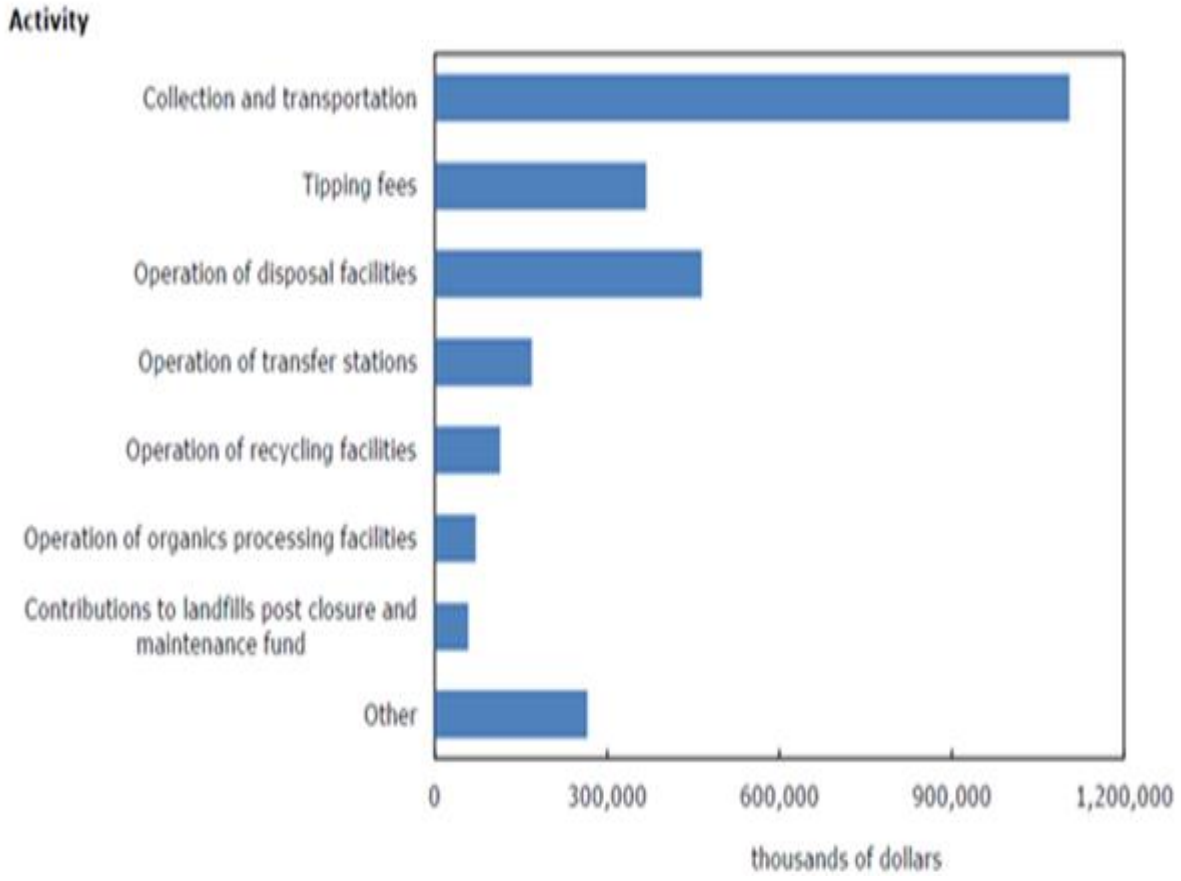
Note(s): This information covers only those companies and local waste management organizations that reported non-hazardous recyclable material preparation activities and refers only to that material entering the waste stream and does not cover any waste that may be managed on-site by a company or household. Additionally, these data do not include those materials transported by the generator directly to secondary processors, such as, pulp and paper mills while bypassing entirely any firm or local government involved in waste management activities.

Source: Statistics Canada (2012b)

The Canadian ecologic footprint analysts state that the world consumption from resources should be reduced by 50% for its sustainability, Consumption rates are not the same between countries. These inequitable consumption rates mean that nations like Canada need to reduce their waste by 90% to meet the world target. To meet this target, dematerialization through Product Service System and product redesign is required to increase natural resource efficiency. The OECD urges Canada to implement the Polluter Pays and User Pays principles increasingly until the cost is fully charged to users and producers. Bot concepts are included in the Extended Producer

Responsibility (McKerlie et al., 2006). Figure 5 depicts the expenditures on solid waste management in Canada. Collection and transportation cost only was $1.2 billion in 2008.

Figure 5: Current Expenditures by Local Government on Waste management by Activity, 2008



Source: Statistics Canada (2012b)

Canadian and U.S. environmental approaches have always been different. The Canadian approach focuses on end-of-life waste management while the greatest US concern is on reducing toxins from products. The US and Canada adopted the notorious Japanese Extended Producer Responsibility and the German Producer Stewardship policies. Canadian and US Extended Producer Responsibility programmes are different because they are in some cases extended to

products that are rarely included in the EPR products list in other countries, such as domestic pesticides, pharmaceuticals, fuels, flammable liquids, and paints (Lifset, 1993).

The increase of natural resource productivity is one of the key requirements to reduce solid waste generation. Taxes on virgin products have been implemented worldwide. In 1992, the Canadian federal government discussed suggestions to use taxes on virgin products to increase recycling, and taxes on certain commodities to give financial incentives to producers to increase the use of recyclable products instead of virgin products. However, the implementation of these taxes requires a national policy framework instead of a provincial environment policy framework (Nicol and Thompson, 2007).

In 1994, Canadian institutions at both the federal and provincial levels formed roundtables on the environment and the economy issues. The National Task Force on Packaging was established in 1989 as one of the Canadian environment and economy roundtables. This roundtable was chaired by Environment Canada with the participation of different stakeholders, including representatives from other levels of the government, industries that use packaging in their reduction process, and environmental movements. The work of this roundtable resulted in Canada's National Packaging Protocol (NaPP). This protocol was adopted by the Canadian council of Ministers of Environment (CCME) in 1990 (Sawell et al., 1996). Table 2 exhibits disposal waste by source, between 2002 and 2008, in Canada, provinces and territories. The total disposal of waste increased overtime.

Table 2: Disposal of Waste, by Source, Canada, Provinces and Territories, 2002 and 2008

	Residential sources [1]		Non-residential sources [2]		Total waste disposal	
	2002	2008	2002	2008	2002	2008
	tonnes					
Canada	**8,446,766**	**8,536,891**	**15,634,606**	**17,334,419**	**24,081,371**	**25,871,310**
Newfoundland and Labrador	216,218	216,992	160,376	193,598	376,594	410,590
Prince Edward Island	x	x	x	x	x	x
Nova Scotia	169,649	148,060	219,546	206,171	389,194	354,231
New Brunswick	203,506	233,703	210,100	245,758	413,606	479,461
Quebec [3]	1,875,235	2,052,182	3,971,225	4,105,970	5,846,459	6,158,152
Ontario	3,438,408	3,231,399	6,207,225	6,400,160	9,645,633	9,631,559
Manitoba	412,612	400,297	483,944	565,902	896,556	966,199
Saskatchewan	278,692	289,760	516,432	613,182	795,124	902,943
Alberta	866,398	958,539	2,023,896	3,070,895	2,890,294	4,029,435
British Columbia	929,101	960,472	1,758,781	1,851,097	2,687,882	2,811,568
Yukon, Northwest Territories and Nunavut	x	x	x	x	x	x

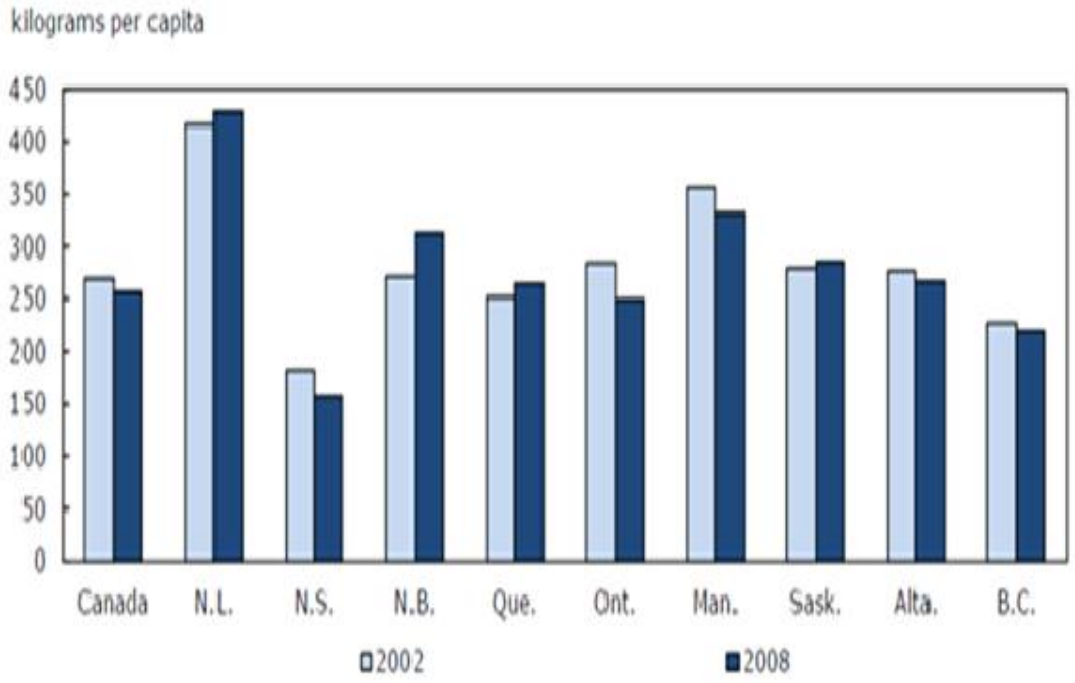
1. Residential non-hazardous waste disposal includes solid waste produced by residences that is picked up by the municipality using its own staff or through contracting firms or that is self-hauled to depots, transfer stations and disposal facilities.
2. Non-residential non-hazardous waste disposal includes solid waste produced by the Industrial, Commercial, and Institutional (IC and I) sector and the Construction, Renovation and Demolition (CRD) sector. IC and I waste materials are generated by manufacturing, primary and secondary industries; commercial operations, such as, shopping centres, restaurants, offices, and others; and institutional facilities, such as, schools, hospitals, government facilities, seniors homes, universities, and others. CRD waste generally includes materials, such as, wood, drywall, certain metals, cardboard, doors, windows, wiring, and others, but excludes asphalt, concrete, bricks and clean sand or gravel and materials from clearing previously undeveloped land.
3. Waste disposal data for 2002 were derived from a survey administered by RECYC-QUÉBEC.

Note(s): Total amount of non-hazardous waste disposal in public and private waste disposal facilities includes waste that is exported out of the source province or out of the country for disposal. This does not include waste disposal in hazardous waste disposal facilities or waste managed by the waste generator on site.

Source: Statistics Canada (2012b)

After Canada launched its Extended Producer Responsibility (EPR), all the Canadian provinces adopted product-focused Extended Producer Responsibility policies. Provincial authorities launched multi-stakeholder consultation processes. Canada uses 'Product stewardship' and 'industry product stewardship' in interaction with 'extended producer responsibility'. Today, all Canadian provinces have their own EPR programs. The country has its own nationwide and provincial EPR programs. By 2004, more than 30 EPR programs were supported by legislative acts (enacted at provincial levels). Different initiatives have been launched, such as the model programme for used oil and oil-related products (Canadian Petroleum Products Institute), and Electronics Product Stewardship Canada to address e-waste in Canada (Information Technology Association of Canada"; "McKerlie et al., 2006). Figure 6 shows that, overall, residential solid waste in Canada slightly decreased between 2002 and 2008.

Figure 6: Per Capita Disposal of Residential Solid Waste, Canada and Provinces, 2002 and 2008



Note(s): Quebec - The waste disposal data prior to 2006 were derived from a survey administered by RECYC-QUÉBEC. Residential non-hazardous waste disposal includes solid waste produced by all residences and includes waste that is picked up by the municipality (either using its own staff or through contracting firms), and waste from residential sources that is self-hauled to depots, transfer stations and disposal facilities.

Source: Statistics Canada (2012b)

In 1993, the province of Ontario enacted its Waste Management Act. This Act requires industrial, commercial, and institutional solid waste generators to separate their corrugated cardboard, fine paper, newsprint, aluminum, glass, and ferrous metal. For instance, construction firms are forced to separate their drywall, ferrous materials, concrete, and brick (McRobert, 1993). Ontario mandatory municipal solid waste separation takes two forms: a ban imposed on the disposal of specific solid waste components to enter the municipal waste disposal facilities, and mandatory separation of solid waste at the source. This regulation was enacted to comply with different North American and European municipalities banning yard waste disposal, corrugated

cardboard, construction, and demolition materials in the municipally owned disposal facilities (Macdonald & Vopni, 1992).

In June 2002, inspired by the product stewardship program, Ontario passed the Waste Diversion Act (WDA). The WDA implies that the net cost of the recycling retail packaging materials is assumed equally by the municipalities of Ontario, the brand owners, importers, and/or franchisors. A set of specific materials was given a price based on which the weighted waste cost will be calculated. This policy exemplifies the Green Dot system because the differentiated cost should give an incentive to fillers and waste generators to lower their use. Therefore, the cost incentive to reduce the waste generation has been reduced by half because it was shared between the municipalities and the industry stewards. This program has many faults. The program is managed by the Waste Diversion Ontario (WDO), which is a model that does not reward the producers' initiatives. The program is based on inconsistent standards and unequal treatment because the industry stewards whose gross margin is less than $2 million are exempted from the product stewardship fee and the reporting obligation. However, the small producers can voluntarily register in the program. Also, since the WDA does not impose a cost ceiling, the industry stewards are concerned about the absence of the incentive for local municipal governments to run an efficient and cost-effective solid waste collection and recycling system (Ferrara and Missios, 2005).

Except the British Columbia Full Product Stewardship, the Extended Producer Responsibility is often mixed with the product stewardship. The EPR states that all the solid waste generators from the product designer, producers and users are responsible for minimizing the impact of the product on the environment. The EPR does not specify the responsibility of any party to pay or assume the responsibility of waste generation prevention. Canada's first adoption of the packaging stewardship was in 1996. The Canadian Council for Ministers of the Environment (CCME) endorsed the packaging stewardship set of principles. This includes the shared responsibility between the government, producers, and consumers with regards to the impact of the packaging waste on the environment, making the packaging stewardship a viable strategy for Canada, and meeting this objective in the most efficient and cost effective manner. These

principles do not clearly specify the responsibilities of the government, producers, and consumers, but it shares the responsibilities between them (McKerlie et al., 2006).

The Waste Diversion Act in Ontario inspired its neighboring province. In November 2004, Quebec announced plans to install a WDA equivalent system for its residential multi-material recycling system. Quebec's legislation includes packaging, printed media, containers, and printed materials. The legislation states that a maximum of 50% of the net cost is charged to the industry stewards. The eligible cost is negotiated between the municipality and Eco-Enterprises Quebec (the equivalent of Stewardship Ontario). However, the industry stewardship is much more expensive in Quebec than in Ontario because of the lack of aluminum in the curbside bins. This lowers the overall revenues collected by the municipal recycling programs. Since 1984, a mandatory deposit and mandatory deposit return system has been in place for beer and soft drinks containers. Retailers are in charge of collecting back their containers and issuing refunds (Hickle, 2010).

In response to the Canadian Council of Environment Ministers 50% waste reduction target, British Columbia enacted its full product stewardship policy. Unlike Ontario's Waste Diversion Act, the full product stewardship puts the cost and responsibility of the products on the producers and users. The government of British Columbia chose to enact legislation asking the regional districts to prepare solid waste management plans to meet the target. The plans should specify the method to use to achieve the diversion target either by recycling or composting, and how they would responsibly manage residuals such as the use of incinerators or the improvement of landfills management. The regional districts plan committed to cover all the solid waste generated within their territories. The Provincial government committed itself with provincial supporting initiatives to help regional districts' plans in order to achieve the objectives of the policy and the plans, and meet the target, especially the waste diversion target (Nicol and Thompson, 2007).

6. Comparison of Canadian and Japanese Solid waste Management Policies

At the beginning of the solid waste management policies in Japan, municipalities and local authorities were in charge of solid waste management. However, the government has decided to step in and control solid waste management through strict regulations that are applied to all

businesses and households. The Japanese government decided that the National government, municipal governments, prefectural governments, administrative bodies, and the public sector are all responsible for waste management. On the other side, Canada lacks a national framework of solid waste management laws. All provinces follow the directive of the Canadian Council of Environment Ministers to reduce packaging and solid waste generation. Following these directives, each province enacted its own policy, such as the Waste Diversion Act in Ontario and the Full Product Stewardship in British Columbia. This way of managing solid waste creates differences between provinces. The Waste Diversion Act in Ontario puts the expenses of solid waste collection and disposal on the government, producers, and users, while the Full Product Stewardship in British Columbia puts all the expenses on producers and users (Nicol and Thompson, 2007).

Japan has succeeded in controlling its solid waste generation by practicing rigorous measures on producers and users by adopting the Polluter Pays principle. British Columbia adopted this policy and has succeeded in reducing waste generation compared with the other provinces. According to Table 1, residential solid waste increased from 595,000 tonnes to 1,046,000; 1,029,042 to 1,878,899; and 496,751 to 614,204 in Quebec, Ontario and British Columbia respectively. The increase in percentage terms in residential solid waste generated between 2002 and 2008 in Quebec and Ontario is much bigger than the increase in British Columbia. Also, the increase in the non-residential waste generated in Quebec (1,148,376 to 1,743,376) was higher than British Columbia (721,724 to 890,908) between 2002 and 2008 (Statistics Canada, 2012).

Non-residential solid waste generated in Ontario decreased between 2002 and 2008 from 1,236,927 to 932,001. Although, the situation looks better in Ontario than in British Columbia, the truth is that GDP at market prices in British Columbia grew by 21.42% between 2002 and 2008 while it only grew by 11% in Ontario during the same period (Statistics Canada, 2012). British Columbia sticks to the Japanese and German policy model in terms of Producer Extended Responsibility (Nicol and Thompson, 2007).

There is a key difference between Japan and Canada in terms of environmental laws. The law in Japan is strict and deals with different issues. In Canada, however, the law is originally from the directive of the Canadian Council of Environment Ministers in 1996. Every province developed

its own policy that has been in place for a long time and has not been changed since. Canada must update its policy and enact different policies to deal with different issues and different kinds of waste. Furthermore, countries like the USA have enacted new laws and regulations to regulate the use and standards of disposal sites (Kinnaman & Fullterton, 1999). Canada, however, does not have regulations in this field because many people are suffering from the physical, health and psychological effects of disposal sites (Rahardyan et al, 2004; Elliott et al, 2004; Goldberg et al, 1999).

Japan has enacted a special law and footprint to increase the productivity of its natural resources. In 2000 and 2008, resources productivity increased by 60% to 260 thousand yen per ton compared with 1990. In 2007, resources productivity was 360 thousand yen per ton. Resources productivity is expected to increase to 420 thousand yen per ton by 2015 (100% increase between 1990 and 2015). However, the Canadian policy does not have a clear law whose objective is to increase the productivity of natural resources. The lack of such a law that sets standards and rules to reduce, reuse, and recycle the natural resources is troublesome. Also, a remarkable difference between the Japanese policy and the Canadian policy is the proper treatment after recycling policy; the Japanese policy divides the goods into recyclable and non-recyclable and enforces the proper and special treatment of both. The Japanese 3R policy emphasizes the proper treatment and disposal of the solid waste generated after recycling while the Canadian policy is silent on this issue (Ogushi & Kandlikar, 2007).

The absence of diversification in the Canadian policy makes it vague and very elastic. The set of provincial environmental laws implicitly envisages the reduction of solid waste at the source. The fact of bearing the cost jointly between users, producers, and government does not provide the financial incentive to reduce the solid waste. On the other side, Japan is clear on this issue: the government has put the entire cost of solid waste disposal on users and producers. This has been enacted in different regulations in Japan (Law for the Promotion of Effective Utilization of Resources, the Waste Management and Public Cleansing Law, Fundamental Law for a Sound Material-Cycle Society, Law for the Promotion of the Utilization of Recyclable Food Resources, and the Law for the Promotion of Sorted Collection and Recycling of Containers and Packaging) (Lifset, 1993; Takiguchi & Takemoto. 2008).

The Japanese solid waste policy has put the pressure on different industries to increase the recycling practices within these industries to reduce their solid waste. This emphasis is through the enactment of different laws for different strategies, such as the Law for the Promotion of the Utilization of Recyclable Food Resources, The Construction Materials Recycling Act, the Law concerning the Promotion of Procurement of Eco-Friendly Goods and Services, Law for the Recycling of End-of-Life Vehicles, and the Law for the Promotion of Use of Agriculture, Forestry and Fisheries Resources as Raw Materials of Biofuel. These different policies have restructured the solid waste generation process in industries that are considered very polluting. Also, there is a specific law in Japan that forces the government to regulate its purchases and to only purchase recyclable products (Law concerning the Promotion of Procurement of Eco-Friendly Goods and Services) (Takiguchi & Takemoto. 2008).

On the other side, Canada has not done much in this way. Ontario and Quebec do not put the entire cost on the polluters (producers and users), but they charge the government a part of the cost too. These policies do not give any financial incentive to the producers and users to reduce their solid waste. Also, the Canadian policy is very generic. It is set for all industries together. Canada needs a more detailed arsenal of laws to reduce its solid waste generation. The laws should be enacted for different industries, especially the most polluting ones. There is no specific law in Canada that forces the federal or provincial governments and all public institutions to purchase recyclable products or to increase recycling within public institutions in Canada (Lifset, 1993; Nicol and Thompson, 2007; Hickle, 2010; McKerlie et al., 2006).

7. Comparison between Canadian, U.S., and German Solid Waste Management Policies

In 1991, Germany implemented its Law of Waste management that is based on the producer stewardship that is a form of the Extended Producer Responsibility. The launching of the Duales System of Deutschland created many advantages for companies which are members of the collection and recycling group. Inspired by this system, municipalities with 4000 inhabitants or more started charging residents based on the weight of the bags. The German and the US Extended Producer Responsibility puts the full cost of products' disposal on producers and users (Kinnaman

& Fullterton, 1999; Michaelis, 1995). On the other hand, some Canadian provinces like Ontario and Quebec split the expenses of solid waste disposal between the government, producers and users (McKerlie et al., 2006; Hickle, 2010; Ferrara and Missios, 2005). British Columbia, however, puts the whole amount to producers and users. This is another example to show that Canada needs a national framework in its solid waste management policies. The federal government should take over the legislation of the environment and solid waste management policies (Nicol and Thompson, 2007).

Despite the efforts that have been made since 1996 after the directive of the Canadian Council of Environment Ministers in order to reduce the amount of solid waste generated in Canada, it is still necessary to find a remarkable turn towards a unified, effective, and sustainable approach to managing solid waste. The examination of solid waste management policies evolution in the U.S., Germany and Canada shows that Canada is lagging behind in finding a federal consistent and effective policy. The unification of policies across Canada will enable the federal government to assess the performance of the applied policies and gather information in order to enhance its policies and strategies to reduce solid waste generated by residential and non-residential users. Also, the national framework of solid waste management policies will enable the enactment of different policies regulating solid waste generation within different industries.

8. Conclusion

The reduction of solid waste is very important on all sides. The increase of natural resources productivity is required to preserve scarce resources. Also, the creation of disposal sites is not the best way to deal with solid waste because of the environmental issues linked to these sites and the increasing social reaction against the implementation of landfills and incinerators. Reduction at the source is the best way to decrease the amount of solid waste generated in Canada and save the cost of collection and disposal. The creation of a clear federal policy to which all the provinces commit and which they respect is a necessity more than ever before. The only way all provinces can achieve the objective of reducing solid waste generation is to implement the same policy and the same tools.

The difference between the outcome of the Full Product Stewardship in British Columbia and the outcome of the Diversion Act in Ontario and Quebec is the proof that Canada needs to implement the same policy in all the provinces. Before Canada tries to catch up to the other countries in terms of solid waste, the federal government must work on bringing, its provinces to the same level of performance. Also, the customization of the environment law is very important. The federal government must enact different policies to reduce the solid waste generation in some industries, such as the food and construction industries.

To summarize, the situation of solid waste and environmental harm reduction, the way it is presented in the solid waste management law, requires a substantial revision and reorientation towards a federal framework projecting solid waste generation reduction. The solid waste generation level in Canada cannot be addressed as a residential or non-residential problem. Policies should be enacted and enforced to regulate both sides of solid waste generation (residential and non-residential). Successful policies projecting to reduce solid waste elsewhere in the world were holistic and unified through the whole country. It has been traditional that countries - particularly industrialized countries - imitate each other in their solid waste management policies. If Canada is to adopt a policy, the country needs to be inspired by different countries. The Japanese model is among the best, but it cannot be used as is because of the strictness of the Japanese culture as well as extreme Japanese conditions (lack of land for waste disposal, etc.). The German Stewardship and the Duales System of Deutschland are very adaptable to the Canadian system.

Canada should implement a diversified system. First, the country should focus on the implementation of the producer full stewardship and the creation of an organization whose role is similar to the Duales System of Deutschland. This should be accompanied by sets of laws focusing on different industries to customize the system based on the needs and the amount of solid waste of every industry. However, all these efforts will not have a strong effect if they are not applied within a federal framework and respected by all the provinces.

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