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VARIOUS INTERNATIONAL EXPERIENCES IN WASTE MANAGEMENT - USEFUL LESSONS FOR ALGERIA

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ABSTRACT

The environmental concern is very important because the interest of a clean environment is among the most important pillars of sustainable development. Therefore, the amount of waste we produce is the result of our unsustainable lifestyle. Most of the waste produced by human can be treated by incineration, composting or landfill. However, all these methods cause air, water and soil pollution, which is harmful to human health, plants, and animals. Therefore, developed countries promote the 3R principle (waste reduction, reuse, and recycling) which have less negative effects on the environment. However, being responsible towards waste minimization is directly linked to how a society is educated to see it. As well, being responsible is something that can be taught and learned and this can be achieved if countries are learning from the others who are achieving better in waste minimization. For that, this study had a look in several experiences in different countries such as: Austria, Germany, Belgium, Netherlands, Switzerland, USA, Japan and China to profit from various international experiences in municipal solid waste management (MSWM) and learn some useful lessons for Algeria. This research used a descriptive study to show the situation of MSWM in Algeria and in other different countries and then it discussed some initiatives made by different governments to conclude some recommendations for Algeria.

Keywords: Environment, MSWM, 3R principle, Experiences, Governments' initiatives, Algeria.

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This study is one of very few studies which have investigated the management of municipal solid waste in Algeria, moreover, it discussed the useful methods used in developed countries in order to consider those methods as useful experiences that can be used in Algeria.

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1. INTRODUCTION

Pollution is resulting from what human produces waste in his daily life; nevertheless, there are different methods to manage these produced wastes. Therefore, most of the waste can be treated by incineration, composting or landfill.However, when composting is conducted under uncontrolled conditions, it generates odors and it attracts flies or other animals (Martin, 2010). Moreover, incineration produces two distinct types of ash: furnace ash, which is left in the combustion chamber after incineration, and fly ash which is recovered from gas cleaning and emission control processes (Department of the Environment Industry Profile, 1996). In addition, when solid waste is dumped into rivers or streams it can alter aquatic habitats and harm native plants and animals (USAID, 2009). As well, the migration of solid waste from disposal sites can also contaminate water resources such as rivers, streams, ponds and wetlands. This occurs directly if the water resource is near a dumpsite or indirectly if contaminated ground water moves through the water cycle (United Nations Environment Programme UNEP, 2003). Therefore, all these methods cause air, water and soil pollution, which is harmful to human health, plants, and animals.Thus, human seeks to manage waste with minimum negative effects and provide the natural resources for future generation by reducing the use of these natural resources and reuse and recycle it as most as possible through applying 3R principle (reduce, reuse, recycle). There are different kinds of waste such as: municipal solid waste (MSW), industrial waste, liquid waste, biodegradable waste and hazardous and non-hazardous waste… MSW is the general waste collected by municipalities, and it is generated mainly by households, commercial activities and street-sweeping, as well as construction and demolition debris (World Bank, 1999; Linda *et al*., 2003; Olar and Candidate, 2003; Guilberto and Shigefumi, 2010; Martin, 2010). Most MSW is produced in the daily life of local citizens, including dust, titles, paper, plastic, textiles, glass, metal, wood, and residual food (Qi *et al*., 2006; Ming, 2011). In general, MSW is composed of three groups of materials: organic waste (kitchen, garden waste, etc), non-recyclable inorganic waste (coal ash, cinder, dust, etc), and recyclable waste (paper, plastics, glass, metal, etc) (Dong *et al*., 2010). According to Tschobanoglous (1993) municipal solid waste management (MSWM) is the term applied to all of the activities associated with the management of society's waste. The basic goal of MSWM is to manage society's waste in a manner that meets public health and environmental concerns as well as the public's desire to reuse and recycle waste materials. Therefore, MSWM aims to maximize practical benefits for the environment and to generate the minimum amounts of MSW.

This study addresses specific problems such as: what problems in waste management are prevalent where? What are the most common sources of waste? How do these affect the people, environment, economy, etc? What initiatives have been done in some countries with better waste management? Which of these initiatives proved effective? What is the level of applicability or adaptability of these methods if applied in other countries? In order to answer these questions,

this study will present policy initiatives for MSWM in Algeria, and in various experiences learned from waste management in Europe, USA, Japan and China.

2. LITERATURE REVIEW

There are very few literatures about MSWM in Algeria, among them there are: Garfi *et al.* (2009) who applied general criteria for human development to the study of different waste management solutions in Saharawi refugee camps in Algeria, and they tested the feasibility of a decision-making method developed for application under particular conditions in which environmental and social aspects must be considered. Sefouhi *et al.* (2010) pointed trends and problems of MSWM in Batna city in Algeria and they showed the prospects for a sustainable development, so their studies are useful to find solutions for solving problems of MSWM. In addition, Bouanini (2012) assessed the management of MSW for well-being fulfillment in Algeria. And she found that there were poor cultures with respect to the 3R Principles in Algeria, and she concluded some useful recommendations to enrich their cultures. Moreover, Bouanini (2014) analyzed people's behavior towards reducing MSW in Bechar city in Algeria. And she found that people help for reducing the use of plastic bags, but they don't participate in reusing principal. In addition, there is a lack in knowledge and culture of recyclable products. Andpeople in their majorities were affected by both cultural and political factors to minimize waste, and the rest didn't comply with these factors. Therefore, government should make political incentives to minimize waste.

Among the studies about MSWM in Europe, it can be pointed the following studies: the Eunomia Research and Consulting (2002) talked about costs for MSW in the EU, which showed the roles and responsibilities for waste management in the EU 15 member states. And Europe The Regional Environmental Center for Central and Eastern (2002) developed new opportunities for MSWM. In addition, Wenke *et al.* (2002) participated with a paper for the seminar on household waste management entitled "capacity building on European Community's Environmental Policy". They pointed the EU waste policy and challenges for regional and local authorities including MSWM. Furthermore, Ulrich and Cees (2002) viewed MSWM in some European countries including the current situation of MSW and the general overview of MSW. Matt *et al.* (2002) discussed the biodegradable MSWM in Europe; they covered the successful composting of municipal waste, incineration, and landfill. Moreover, Council of Europe CE and Parliamentary Assembly PA (2007) talked in their report about the management of MSW. Mette *et al.* (2008) pointed in there working paper MSWM and the greenhouse gases. They discussed the MSWM in the EU 27, the composition of MSW, and the amounts of municipal waste incinerated and landfilled in the EU 27 from 1995 to 2009.

In addition, there are some studies about managing MSW in USA such as: Garrick (2004) made a historical context of MSWM in the United States. United States Environmental

Protection Agency (2013) analyzed MSWM in the United States. And Center for Sustainable Systems (2013) provided management methods for MSW and sustainable alternatives.

Furthermore, among the studies about Japan, it can be pointed the following studies: the paper of Itaru and Vivian (2007) published in the journal of environmental management is among the reviews about MSWM in Japan. They balanced the proximity principal with economic efficiency. Moreover, the UNEP (2009) "UNEP" in Japan (2009) developed integrated solid waste management which focused on the 3R principal (Reduce, Reuse, and Recycle).

Moreover, there have been a series of publications reviewed the trend of MSWM China. World Bank (2005) talked about waste management in China by providing some issues and recommendations. Moreover, Visvanathan and Trankler (2009) made a Comparative Analysis of MSWM in Asia. In addition, Guilberto and Shigefumi (2010) discussed MSWM and issues in south east and East Asian countries. They included MSW composition, laws, regulations, and standards for MSW in China. Qi *et al.* (2006) analyzed the situation of solid waste management in China. Furthermore, Dong *et al.* (2010) discussed the status, problems, and challenges of MSWM in China, and they talked about waste collection and disposal methods. Xu *et al.* (2010) made an overview of MSWM in China. They showed that since the late 1990s, the amount of MSW collected has been largely decoupled from economic growth and incineration has become an increasingly widespread treatment method for MSW. They identified and discussed four major challenges and barriers related to China's MSWM, and they proposed an integrated management framework to improve the overall eco-efficiency of MSWM. Bouanini and Dadene (2013) analyzed and evaluated the commitment to social and environmental responsibilities in Chinese companies. And they used a survey based on Chinese companies located in Nanchang city in China. Hence, they found that there was a great importance concerning the environmental responsibilities in those companies through reducing waste, reducing energy conception, reducing resources consumption and reducing pollution emissions. Bouanini (2013) assessed MSWM in China, and she found that the amount of MSW produced but not generated is increasing per annum, because reduce, reuse and recycle became increasingly implemented in China. And as more items are reduced or reused and recycled, the amount of waste that needs to go to the landfill or incinerator is reduced, so the quantity of MSW generated decreased.

Depending on the previous studies in Europe, USA, Japan and China, this study will have a closer look at the various international experiences in waste management.

3. RESEARCH METHODOLOGY

In order to understand the facts, observe patterns and formulate explanations we choose an effective review method. Therefore, this research uses data analysis explained methods, so that useful information can be highlighted to understand all what is presented. Furthermore, in order to profit from various international experiences who are achieving betterin MSWM and learn

some useful lessons for Algeria, this research will have a look at the situation of MSWM in Algeria and in other different countries such as: Austria,Germany, Belgium, Netherlands, Switzerland, USA, Japan and China. And then it will discuss some initiatives made by different governments to conclude some recommendations for Algeria.

4. RESEARCH DISCUSSION

4.1. The Situation of MSWM in Algeria

In 2009, the quantity of MSW generated in Algeria was estimated at 8.5 million tons/year. And each Algerian in urban areas generates about 0.7kg of solid waste daily (Kehila *et al*., 2010). According to the 2011 report of the National Agency for waste, the quantity of MSW reached more than 10 million tons in 2011. The report pointed out that the volume of MSW collection coverage was estimated at 85% in urban areas and 60% in rural areas. The National Agency of waste estimated that annual production of MSW will reach 12 million tons in 2015, and 17 million tons in 2025 (Nathir, 2011). And the Algerian MSW contains a high proportion of Organic, plastic, and paper/cardboard. However, glass and metal make very low proportions and 14% of MSW contains other types.Nevertheless, the most of waste generated is treated by open-dumps (50%), uncontrolled dumps (30%), landfill (15%) recycle (4%) and composting (1%) (Kehila *et al*., 2010). Therefore, in order to reduce dumps and landfill and increase recycling, Algerian governments is making some policy initiatives to improve MSWM.

4.2. Policy Initiatives for MSWM in Algeria

Since 2002, Algeria sought to create a financial action to fight pollution and minimize it, for that it issued tax act including the collection of MSWM (Razik, 2007). The amounts of this tax are as follow: (500-1000 Algerian Dinars) for residential use, (1,000-10,000 AD) for commercial use and professional, (5,000-20,000 AD) for land predisposing to establish camps, and (10,000-100,000AD) for industrial use, commercial use, and craft producing larger quantities of waste (Michel *et al*., 2003). In the same year, Algeria has developed a National Action Plan for Environment and Sustainable Development (NAPE-SD). This plan offered a vision of the future that Algeria engaged in to invest in environmentally sustainable development. In addition, improving the health and quality of life of citizens was a central objective of the NAPE-SD. As well as, the establishment of an integrated MSWM remained a priority and urgency (Ministere de l'Amenagement du Territoire et de l'Environment, 2002). As well, Algeria has launched MSWM National Program (PROGDEM). This was based on the precautionary principle, prevention; the polluter pays principle, the principle of producer recovery, and the role of information and awareness of the citizen. Algerian government has created some laws and executive decrees for MSWM appropriately.

- The law 01.19 of 12 December 2001 is the basic legislation for MSWM. It is concerning

the conduct of solid waste and it stipulates the need to develop a special strategy to re-manufacture of solid waste, through the adoption of the principle of selective screening (Hossin, 2013).

- Law No: 01-21 for tax garbage removal.
- Law No.03-10 for the protection of the environment in the context of sustainable development.
- The decree no 02-175 of May 2002 for the creation of the national waste agency.
- Executive decree No.04-410 for the general rules for the development and operation of waste treatment facilities and the admission of such waste at these facilities.
- Executive decree No.07-205 for the modalities and procedures for the preparation, publication and revision of the scheme of municipal household and similar waste management.
- Executive decree No.02-372 for packaging waste.
- The decree no 04-199 in 2004 of the modalities for the establishment, organization, operation and financing of the public system of treatment and recovery of packaging waste.
- Executive decree No. 04-210 defining the procedures for determining the technical characteristics of packaging destined to directly hold food products or items meant to be handled by children.
- Ministerial order for laying down the technical characteristics of plastic bags meant to directly hold food products (Kehila et al., 2010).

To evaluate policy initiatives made by this country, we should have a look on other initiatives made by other countries who are achieving betterin MSWM.

4.3. Experiences Learned From Waste Management in Europe

According to European Environment Agency "EEA" report, 2013, many European countries increased the share of MSW recycling, and the highest rates werein Austria, with 63 %, followed by Germany (62 %), Belgium (58 %), the Netherlands (51 %) and Switzerland (51 %). Therefore, it is very important to analyze how these countries have achieved these high percentages in MSW recycling.

4.3.1. Experiences Learned from Waste Management in Austria

The total amount of MSW generated in Austria has increased by 7% from 2001 to 2010. However, due to an increase in the separate collection of waste, the increase in residual household waste is seeing an increase by only 5% over the same period. Over the ten year period the total recycling rate accounted for 55-63% and this is the highest level in Europe (Marton, 2013a). According to the EU landfill directive, all member states have to reduce the amount of

biodegradable municipal waste landfilled by a certain percentage by 2006, 2009 and 2016. However, Austria has already met all three targets, having reduced biodegradable municipal waste landfilled to below 3% already by 2008. And all main legislation to divert biodegradable municipal waste from landfill has been adopted in Austria before the respective EU legislation came into force. In order to improve recycling and reduce landfill, Austria has made some initiatives as following:

- In 1989, the act on the remediation of contaminated sites introduced a levy on landfill waste which on the one hand finances the remediation of contaminated sites and on the other hand provides a financial incentive on treating and recycling waste instead of landfill it.
- In 1992, the separate collection of packaging and biogenic waste was introduced all over Austria.
- In 2008, about 105kg/capita of biogenic waste was collected separately.
- In 2004, the landfill ban for untreated waste came into effect.
- Increase of the landfill tax in 2004 and 2006 and it was extended in 2006 to cover incineration tax (EUR 7/T before 2012 and EUR 8/T from 2012). The fee for landfill was EUR 44 in 2001, EUR 65 in 2004, and EUR 87 in 2006. A strong correlation between increasing landfill tax rates and decreasing rates of landfill for MSW appeared in Austria. Furthermore, it has encouraged recycling and recovery of waste.
- In 2006, the Austrian waste prevention and recycling strategy was in effect. In fact, many policy initiatives were taken in the early 1990's in order to improve recycling.
- Rapid development of separate collection of paper waste (685,000 tons in 2007; 83kg/capita) and other fractions due to mandatory separate collection at households (Marton, 2013a).

Austria is playing an important role in landfill ban by introducing an increasing landfill tax, and by encouraging recycling.

4.3.2. Experiences Learned from Waste Management in Germany

The total German generation of MSW decreased from 52.1 million tons in 2001 to 46.4 million tons in 2006. The generation increased to 48.5 million tons in 2009 but then decreased from 2009 to 2010 to 47.7 million tons. In 2010, the level of recycling had increased to 62%, landfilling was almost 0% and incineration had increased to 37% (Christian, 2013). For waste generated by households, the recycling management and waste act assigned responsibility to the local public waste disposal authorities. Their responsibility covers collecting and transporting

waste, measures to promote waste prevention and recovery, and planning, constructing and operating waste disposal facilities. Municipalities have more practical tasks such as providing sites for waste collection. Germany was among the first European countries to introduce policies to limit landfilling in the 1990s. Measures included schemes for collecting, packaging waste, biowaste and waste paper separately. The most important initiatives taken by Germany in order to increase MSW recycling have been as follow:

- A long tradition for developing waste strategies on the national level, and developing waste management plans in the federal states and in the municipalities.
- Introduction of producer responsibility for packaging waste already in 1991. Germany was the first country in the EU to introduce this regulation. According to this principle, producer of a product is generally responsible for the product when it becomes waste.
- The introduction of the ban on landfilling un-pretreated MSW by defining requirements to the organic content of MSW. Germany has reported to the commission that zero tons of biodegradable municipal waste were landfilled in 2006, 2007, 2008, and 2009.
- Focus on separate collection and recycling of secondary raw materials (paper and biowaste), pretreatment of mixed household waste in mechanical-biological treatment plants and dedicated incineration with energy recovery of mixed household waste.
- The introduction of so-called recycling bin where it is estimated that seven kilograms per capita per year of high-grade material of metal and plastic other than packaging can additionally be material recycled (Christian, 2013).

Germany has a very high level of recycling of MSW and it is interesting that Germany has achieved this without using landfill tax. The requirement of pre-treatment of MSW before it can be landfilled combined with other management activities such as producer responsibility have been strong drivers in diverting MSW away from landfills and towards recycling.

4.3.3. Experiences Learned from Waste Management in Belgium

The quantity of MSW generated between 2001 and 2010 has increased by 5%. This is most probably due to an increase in migrant population. During the same period, the recycling rate has increased from 50% in 2001 to 58% in 2010. This increase seems to be due to the increase in material recycling, as well as, due to the separate waste management strategies in Belgium (Emmanuel, 2013). The most important initiatives taken in Belgium to improve MSW management between 2001 and 2010 include the following:

- Regularly updated waste management plans with a focus on closing down landfills and developing new ones with better standards. This plan also included the maximum use of the existing incineration capacity and the separate collection of municipal solid waste was initiated. Landfill and incineration costs were increased in order to promote waste separation and recycling. A second plan was in force between 1991 and 1995, specially

emphasizing the separate collection of waste with the overall objective of waste prevention, material recovery, optimization of waste management technology and pollution control. The 2003 to 2007 plan indicated tighter targets. The plan also included other key policy aspects, such as promotion of organic recycling, 13% prevention by 2007 compared to 2000, 70% selective collection and recycling. And the 4th prevention management plan 2010 emphasized more on recycling.

- Strong emphasis on waste prevention.
- Since 2010, mandatory waste separation by householders with fines up to EUR 625 for non-compliance.
- High levels of separate collection (kerbside collection, bring banks in streets and container parks).
- Landfill bans, high landfill tax, incineration ban and incineration tax. The landfill ban have been in place since 1998 and it has a significant effect on the reduction of the landfilling and it has been a driver for diverting waste from landfilling directly to recycling.
- Extended Producer Responsibility (EPR) is applied to 11 flows of waste, and more specifically fractions potentially found in the MSW. According to the 4th prevention management plan 2010, the EPR has been a significant driver for the increase in the recycling rate.
- Color coded collection bags with variable fees in the three Belgian regions.
- Systematic installation of communal container parks, and quality thresholds for separately collected waste. As well as, focus on communication campaigns for waste prevention and separation.
- Waste prevention and recycling education in schools (Emmanuel, 2013).

This improvement of the waste management performance in Belgium can be attributed to four main factors: firstly, reduction of the direct emissions of the different technologies with time, secondly, a drastic reduction of landfilling and a smaller extent incineration, thirdly, a significant increase in source separation of recycling, and finally, a low increase in overall municipal solid waste generation.

4.3.4. Experiences Learned from Waste Management in Netherlands

The amount of MSW generated has remained very stable throughout the years up to 2009, despite a break in series in 2007, at around 620 kg per capita every year. For the first time in 2010 MSW generation per capita dropped below 600 kg to the level of 595 kg per capita (Leonidas, 2013). The Netherlands is a frontrunner in recycling in Europe, having managed over the last years to divert more than half of the MSW generated in 2010 to material and organic recycling. Out of the 9.8 million tons of MSW generated in 2010, 5 million tons were recycled; 3.2 million

tons were incinerated and only 0.03 million tons ended up in the landfills (Leonidas, 2013). The total recycling of MSW in the Netherlands reached 51% of MSW generated in 2010. Since 2007, Netherlands has already fulfilled the target of 2020, where the recycling accounted for 50% of the total MSW generated. In general, MSW recycling has been evolving positively throughout the years in the Netherlands, making the Dutch waste management a fine example of a successful recycling practice. The important initiatives taken by Netherlands to improve MSWM are as follow:

- Landfill ban and landfills decree of 1994 introduced the ban of landfilling of certain waste streams. In 1995, the environmental taxes act introduced the tax on the landfill of waste. Both measures contributed drastically to the reduction of waste being landfilled since their full application by 1996.
- In 1996, there was a decision to centralize responsibility for waste management, which promoted a shift of responsibilities from the provincial authorities to the central government authorities. This led to the amendment of the environmental management act in order to reflect the change in the waste management occurring in the Netherlands which came into force on 8 May 2002. With that shift came the responsibility of waste management to the ministry of environment.
- The national waste management plan 2002-2012 came into force in 2003 and three subsequent revisions measuring the progress of its implementation followed in 2004, 2005 and 2006. Among other measures, the plan introduced stricter rules on disposal of MSW.
- On 1 January 2002, the tax on landfilling was further reinforced by a steep increase of EUR 11 per ton to put an end to the landfill.
- The decree on packaging and paper/cardboard came into effect in 2005 further boosting producer responsibility in an effort to increase recovery rates of recyclables as much as possible.
- In 2009, the second national waste management plan came into force covering the period 2009-2015 and extending its vision to 2021.the overall objectives of this plan are: to limit growth in waste generation, to reduce the environmental impact of waste (optimizing recovery and reuse) and to minimize the environmental impacts from chains.
- In 2010, another steep increase of EUR 19 per ton in the landfill tax was applied. The continuous increase of the landfill tax has mostly rendered incineration cheaper than landfilling, and it has also diverted MSW from landfilling to recycling.
- In 2011, the ministry of finance has decided to eliminate the tax on landfill as part of a simplification of the taxes. In recent years, revenues from the tax of landfill have been reduced substantially following the reduction of waste going to landfill (Leonidas, 2013).

The government of Netherlands has utilized a mix of measures in order to enhance MSW management in the direction of material and organic recovery. Several financial instruments have

been used such as the tax on landfilling, producer responsibility for a number of products and rate differentiation (pay-as-you-throw-scheme) in the collection of household waste

4.3.5. Experiences Learned from Waste Management in Switzerland

The total amount of MSW generated in Switzerland has increased by 16% from 2001 to 2011 (Marton, 2013b). Switzerland has a long tradition in diverting waste from landfill and has a long established good recycling system and performance. Most of the MSW generated in the country is either recycled or incinerated. In the ten year period the total recycling accounted for 50%, while composting and other biological treatment together accounted for 15%. The country has already had a recycling performance of 50% in 2005 which obviously already met the target set for 2020 by the EU legislation (Marton, 2013b). The responsibilities of MSWM are shared between the three levels in Switzerland: the federal state, cantons and communes. At the federal level the federal office for the environment is responsible for developing legislation and policies to ensure the recovery and environmentally sound disposal of waste, controlling the import and export of waste, and coordinating the planning of waste disposal facilities. The cantons and municipalities are also responsible for the implementation of the policy framework. The important initiatives taken in Switzerland to improve MSWM are as follow:

- In 2001, Switzerland introduced the ordinance on the amount of the early recovery tax on glass bottles for beverage. And in the same year Switzerland introduced a landfill tax, the so called VASA-tax which is a federal tax applied in all cantons. Tariffs apply on landfilling on sanitary landfills (11.17 EUR/T), residue landfills (12.65 EUR/T), inert material landfills (2.23 EUR/T) and export for underground storage (16.38 EUR/T). In 2009, the revenues were EUR 20.3million. The Swiss tax is solely spent on cleaning up contaminated sites.
- In 2004, since the installment of the MSW incinerator in the city of Thun, the total incineration capacity available in Switzerland in 3.29 million tons which is sufficient to avoid the landfilling of any combustible MSW. Moreover, in Switzerland all 30 MSW incinerators have a thermal efficiency coefficient of over 65%.
- Separate collection on MSW has been improving continuously, for example, in 2006, 880,000 tons of biodegradable waste was collected separately, 740,000 tons were recycled in compost of good quality, whereas 140,000 tons were treated in anaerobic digestion plants to produce energy and fertilizer. In 2008, 50% of the total MSW was collected separately and then recycled (Marton, 2013b).

Switzerland is expecting a change of paradigm in the future, meaning the focus of waste management policy will be switched from the control of waste treatment emissions to closing the product cycles. The later is to be achieved by improved recycling techniques and product design that will contribute to the protection of primary resources. The process will be supported by

increasing costs of raw materials and more efficient recycling technologies. Inefficient recovery and treatment of waste that is not environmentally sound will be prevented by waste legislation.

4.4. Experiences Learned from Waste Management in USA

From 2001 to 2005, the amount of MSW generated increased in USA, since 2005; there have been small decreases in total and per capita MSW. And in 2011, it reached 250 million tons, where 11.7% was incinerated with energy recovery, 34.7% was recovered for recycling and composting, and 53.6% of MSW was landfilled. During the same period, the recycling rates of MSW increased over time from over 29% in 2000, and over 34% in 2011 (USEPA, 2013). The United States is focusing on separate collection by providing curbsides and drop-off programs in order to improve recycling (Garrick, 2004). A number of new recycling bins popping up around the communities in USA, it is probably due to the increased focus on "going green" across America. In 2011, there were over 9,800 curbside recycling programs in the United States and about 3,090 yard trimmings composting programs were documented. Recycling paper and yard trimming alone diverted about 26% of MSW generated from landfills and combustion facilities (USEPA, 2013). By 2009, USA had 88 waste to energy plants that combust about 26.3 million tones of MSW and serve a population of 30 million (Psomopoulos *et al*., 2009). However, in 2011, there were 86 waste to energy facilities with capacity of 96,200 tons per day (USEPA, 2013). The important initiatives taken in USA to improve MSWM are as follow:

- Landfill disposal fees, or "tipping" fees, in the U.S. currently average USD 44 per ton (CSS, 2013).
- Emphasizing on source reduction through designing products or packaging (e.g. in 2011, an aluminium beverage can weights 0.462 ounces; down from 0.546 ounces per can in 1996, over 15% reduction), reusing existing products or packaging (e.g. over 10 million tons of wood pallets were refurbished and returned to service in 2011), lengthening the lives of products and managing nonproductive organic waste (e.g. food waste and yard trimming) through onsite composting or other alternatives to disposal. Other actions contributing to reduce organics disposal are establishing of variable fees for collection of wastes "Pay-As-You-Throw". By 2011, 22 states had legislation discouraging the disposal of yard trimming (USEPA, 2013).
- Providing curbside recyclables collection. In 2011, more than 9,800 curbside recyclables collection programs were reported in the United States and 71.2% of the U.S. population had access to these programs.
- Providing drop-off centers in locations such as grocery stores, sheltered workshops, charitable organizations, city-sponsored sites, and apartment complexes. In 2010, over 21,000 communities have drop-off centers and 83% of the U.S. population has access to drop-off collection programs.

- Providing deposit systems. Ten states have container deposit systems: California, Connecticut, Hawaii, Iowa, Maine, Massachusetts, Michigan, New York, Oregon, and Vermont. In these programs the consumer pays a deposit on beverage containers at the point of purchase, which is redeemed on return of the empty containers.
- In 2011, there were 633 material recovery facilities operating in the United States, with an estimated total daily throughout of over 98,000 tons per day (USEPA, 2013).
- In 2013, the U.S. department of agriculture and environmental protection agency launched the U.S. food recovery challenge, with the goal to divert food from landfills by donating to food charities, composting, and generating electricity with the anaerobic digestion of food scraps (CSS, 2013).

USA is playing an important role in imposing deferent fees of Landfill disposal and collection; in addition, it provides different facilities for waste collection and separation.

4.5. Experiences Learned from Waste Management in Japan

The total quantity of MSW generated in Japan was almost steady since the year 2000 until 2003. Then from 2003 to 2010, the quantity of MSW generated decreased over time. According to Masaru (2014) in 2010, the total quantity of MSW generated was 46.3 million tons that is about 0.98kg of waste capita per day. 21% of MSW generated was recycled, 10% was landfilled, and the rest was incinerated. And the number of incineration plants was 1,221 in 2010 and 306 of them recovered energy from MSW for power generation. MSW policy in Japan has shifted from proper treatment and disposal of MSW by developing MSW facilities to establishing a 3R society. And this movement was because of the increasing amount of MSW generated, difficulty in sitting of final disposal, limited capacity of remaining landfill site and frequent illegal dumping of waste. The focus on establishing 3R society in Japan led to the increase in recycling rates from 1998 to 2010. Separation of waste into several items at source is very popular; more than half municipality requests a generator for separating their waste into more than 10 kinds of items. Municipalities collect waste typically separated into combustibles, non-combustibles and recyclable items. Part of such waste is further sorted at recycling facilities. And there is an existing of "not in my backyard" attitude against waste management facilities. Apart from municipalities' separate collection of recyclables, resources retrieval groups in local communities and other voluntary measures play an important role in recycling (Masaru, 2014). The important initiatives taken in Japan to improve MSWM are as follow:

- MSWM in Japan was initiated upon the promulgation of the "Dirt Removal Law" in 1900.
- In 1954, the "public cleaning law" was introduced to secure a hygienically sound living environment. Following rapid economic growth, "waste management and public cleaning law" was enacted in 1970. This law constitutes the main framework of the present waste management legislation and it holds the key to "sustainable society" and since then the target

of MSWM has been shifted to 3R.

- Developing a legal system for recycling with extended producer responsibility (EPR) which was based on new strategy for promoting the internalization of all environmental and other external costs related to the entire life-cycle of a product. By applying the concept of EPR, recycling laws for specific products or waste type were enacted as follows:
    - Containers and packaging recycling law (1995) for PET bottles, glass bottles, and plastic or paper containers and packaging.
    - Home appliance recycling law (1998) for TV Sets, air conditioners, refrigerators, freezers and washing machines. This law provides a collection and recycling system.
    - Construction material recycling law (2000) for waste materials from designated construction and civil works.
    - Food recycling law (2000) for food waste from manufacturers, wholesalers, retailers and restaurants.
    - End of life vehicles recycling law (2002).
- Setting a national target for MSW reduction.
- Strengthening enforcement, especially by strengthening the compliance system and responsibility of the waste discharger.
- developing high-tech treatment facilities with subsidies from the central government for establishing a 3R society in 2001, and this law was approved by the Cabinet in 2003 (Masaru, 2014).

In order to establish a 3R society, the government of Japan intends, among other initiatives, so further develop laws and regulations for waste management and recycling; to promote a slower, less consumption-oriented lifestyle by enhancing environmental education and learning and providing adequate information; and to accelerate the production of environmentally friendly goods and services through the incorporation of design for the environment.

4.6. Experiences Learned from Waste Management in China

The amount of MSW increased every year in China, and it reached in 2010 about 250 million tons of MSW, where 158 million tons were generated. However, Chinese government is making some efforts to deal with this waste.

- Since 2000, residents in China are advised to place their waste in bags and deposit their garbage in the appointed garbage bins outside the residents' house for collection. And then the waste is transported by truck to a transfer station. And this system is usually carried out by a community or business entity in China (Dong *et al.*, 2010). In order to encourage the separate collection of waste at source, China provides separate waste bins for recyclable and non-recyclable waste conveniently placed in streets and parks.By the end of 2005, there were 23,512 enterprises engaged in the 3R industry in China (Liu *et al.*, 2006).

- In 2008, China's recycling rate was lower than other countries, because the secondary materials' market in China was affected by several factors such us; the value to the recycles. China's target is to realize 50% recycling of waste paper by 2030, over 38 million tons of waste paper could be diverted from disposal.
- In January 2008, the Chinese government banned shops from giving out free plastic bags, and asked consumers to use baskets and cloth bags instead in an effort to reduce pollution. "White pollution" is a reference to the color of many of the bags given out stores (Jeffrey, 2008).
- The reuse centers are also emerged in China. An example, in Nanchang (Jiangxi province in China) the government provides a big and clean center for second hand products such as refrigerators, chairs, desks, TVs etc… to encourage the reuse policy (Bouanini, 2012).

Under the environmental policies, Chinese government has identified a set of laws and regulations to find a suitable solution in order to reduce waste and to regulate the behavior of humans and economic organizations. Some examples are:

- City appearance and environmental sanitary management ordinance 1992.
- Regulations regarding municipal residential solid waste 1993.
- Law on prevention and control of environmental pollution caused by solid waste of PRC 1996.
- Comments on the promoting of industrialization of municipal waste-water treatment and MSW treatment 2002 (Bouanini, 2015).
- Moreover, the technical policy on pollution prevention which was effective from april 27th, 2006, it promoted the eco-design, and set forth the guiding principles of "3R" and "polluter pays principle" (Lin and Yang, 2012).
- National catalogue of hazardous wastes 2008.
- Catalogue of solid waste forbidden to import in China, catalogue of restricted import solid wastes that can be used as raw materials in China, catalogue of automatic-licensing import solid wastes that can be used as raw materials in China 2008.
- Imports of MSWM practices 2011…etc (Bouanini, 2015).

China presents useful and easier examples for waste reduction, reuse and recycle through emerging reuse centers and providing facilities of waste collection, as well, by setting laws for supporting recycling.

5. CONCLUSIONS AND RECOMMENDATIONS

We may influence the environment positively or negatively because we are all connected to the environment. Ultimately, waste management presents an opportunity, not only to avoid the detrimental impacts associated with waste, but also to recover resources, realize environmental, economic and social benefits and take a step on the road to a sustainable future. Despite the

increasing in MSW in Algeria, however, the government is trying to manage this waste effectively. And it provides large sums of money for the environmental sector. MSWM is an important environmental problem in Algeria, because the greater part of the generated waste is disposed of at uncontrolled dumps and open dumps.

Being responsible towards waste minimization is directly linked to how a society is educated to see it. As well, being responsible is something that can be taught and learned and this can be achieved if Algeria is learning from the others who are achieving better in waste minimization such as Austria, Germany, Belgium, the Netherlands, Switzerland, USA, Japan and China. So it should introduce landfill ban, increase landfill tax, introduce EPR and encourage separate collection through providing separate curbsides collection, bring banks in streets, container parks, drop-off centers, and deposit systems. Furthermore, government should emphasize on source reduction through designing products or packaging. Moreover, government should encourage and provide reuse centers.

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