

Analysis of Environmental Management for the Treatment of Plastic Waste in Mexico: Government Strategies

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Abstract: In Mexico, garbage represents a high pollution index according to national and international organizations; eighty percent of waste products stay in sanitary landfills, out of doors, where no tailings management exists. Plastic products represent 16% of this pollution (one and one-half kilos daily per person in a country with a population of 107 million people). These sanitary landfills are methane deposits, and consequently emit gases and toxins that cause serious health problems. The object of this is to analyze governmental programs, strategies, policies and procedures which regulate both industrial sectors and society. Society and government share a responsibility since they must implement norms which include the separation, reduction, recycling and reuse of garbage. Results demonstrate that government strategies used to treat tailings are complex and are directed more towards sanctions than to motivation. Furthermore these strategies discourage a cultural transformation toward industrial sustainability. Instead of reducing the garbage accumulation problem, they increase the difficulty.

Key words: Sustainability, solid waste, plastic industry.

1. Introduction

The importance of this study resides in its focusing on three of the most serious problems facing humanity due to the overexploitation of natural resources for commercial ends¹⁻²; the first is the increasing shortage of

these resources, the second is the overproduction of garbage due to post-consumer products which are thrown away without control or measure, and the third, refers to the strategy followed by the government, in this case Mexican, to regulate the immoderate and irresponsible use, direct or indirect of fossil fuels; also the use of natural resources in the making of manufactured goods and in the production of food and more specifically the waste related to the plastic industry [1-3].

Garbage, more concretely plastic, considered solid waste, is one of the most sustainable and precious economically for commerce, considering the amounts accumulated and the possibility of reusing it. With domestic and industrial recycling or the reduction and optimizing of resources, approximately 60% of garbage can be reduced along with the reduction of pollution resulting from methane gases and special and

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¹ Developed countries have 20% of the global population but are responsible for 85% of the world consumption of aluminum and of synthetic chemical elements; 80% of paper, iron and steel; 80% of energy used commercially; 75% of wood; 65% of meat, fertilizers and cement; half of all of the fish and grain in the world; and 40% of pure water. Five planet earths would be needed to sustain the needs of all of the countries at this rate of consumption Mesera, op.cit.

² The United Nations keeps track of this through Human Development Indicators (HDI) to classify countries starting from variables which relate different aspects of human development together. These calculations have shown that the breach is reduced when not only income but education and hope of life are taken into account.

dangerous residue deposited in outdoor landfills [4, 5].

Plastic constitutes one of the most important materials in the manufacturing industry due to its enormous versatility. It is considered the first material of new design in over 300 years, thus making this “the era of plastic”. It is thought that it can replace different metals which have been so useful to humanity, such as iron, silver, gold, lead, etc. due to its high resistance to staining, abrasion and erosion since it doesn’t rust [6].

Despite this, after analyzing the results from different studies relating to the strategies used by the Mexican government to regulate the handling of solid waste, it was noted that they have been ineffective and insufficient to promote the sustainability in the plastic industry. Since the strategies focus internally, they in turn, caused the economy to come to a stand still or deterioration, and a paralization of educational programs and investigation that promote technological innovation along with the cultural transformation process, leaving a society bent on individualistic behavior and without a social conscience [7-9].

In the following sections, the current status of garbage treatment, specifically plastic, as a consequence of government strategies, as well as the implications for the preservation of the environment, is described.

1.1 Solid Waste Management in Mexico

According to de Secretary for Social Development

(SEDESOL) and the Fourth National Communication at the United Nations Framework Convention on the Climate Change [10, 11], in four decades the residue production in cities increased nine times before the year 2000, there was no other considerable increase until the year 2004 in which an important peak presented itself and continued to rise until in 2009 it reached 38.3 million tons of solid waste, 4.1 percent more than in 2007 (see Fig. 1). If we were to place the current population per square kilometer, we could fit an average of 52 people per square. They would produce approximately 4,044 thousand tons of garbage per year, which would be very difficult for those responsible to handle [12].

The Mexican population is 106.7 million (it holds 11th place in the world and third place in America, surpassed by the United States of America and Brazil), so each person is considered to produce an average of 975 grams of garbage daily. Most of them are concentrated in the central area of the country (50.3%). The states included in this area are Distrito Federal, Hidalgo, Estado de Mexico, Morelos, Puebla and Tlaxcala. The rest of the areas generate; 23% in the north, approximately 21% in the mid west area and 18% in the southern part of the country, resulting in 356.3 kgs. of garbage per capita per year [10, 12, 13].

The most notable effect of these accumulations is the amount of methane (CH_4) produced by the garbage, directly related to the climactic change. The Mexican

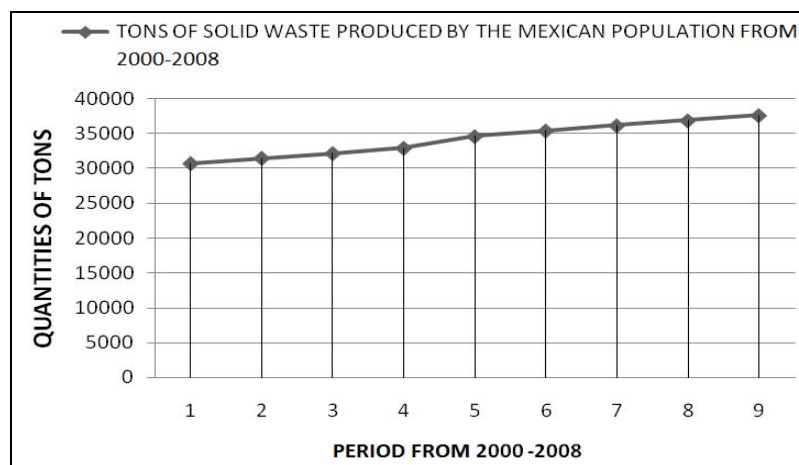


Fig. 1 Generation of urban solid waste from 2000-2008. Source: own production based on Ref. [12].

government came up with several strategies to decrease the total emissions to equivalents in carbon dioxide (CO₂) for Mexico, since they were 643,183 Giga grams (Gg) in 2002, representing a 34% increase compared to 1990.

In the methane emission race, Mexico holds the fourth place with 4%, approximately 12% of the anthropogenic world emissions, followed by the United States 17%, China 6% and Russia 5% (EPA 2005). Methane has certain properties that can aid in the fulfillment of the energy needed to produce one peso of raw internal product (RIP). This affects the tendency of the country to decrease the medium rate of growth (-0.3%) and its contaminating effect due to the anaerobic decomposition resulting from the uncontrolled management of said waste in the landfills.

The reports on urban and industrial waste management (deposition of solid waste and residual water treatment) indicated that in 1990 the emissions contributed to an equivalent of 33,353 Gg of carbon dioxide and 66,584 Gg in 2002, of which 6,803 were CH₄ emissions, representing 34% compared to 1990 produced in city residual waste sites be it either a landfill or a dump.

Most importantly is the effect these emissions have on the overall climactic change taking into account that the accumulation of the aforementioned methane gas corresponds to energy (26% oil and natural gas) and agriculture (26%, enteric fermentation); but the sanitary fields produce 24% and the handle of residual waste and water treatment, 20%. It's important to mention that the principal emissions in the CO₂eq. waste category in 2006 corresponds to CH₄ which in turn, represents 97.8% (100,022 Gg). In 2006 solid waste contributed to 54%, which means a 13.8 increase compared to 1990, and to 39.3% increase this last year; however the contribution of solid waste in landfills decreased from 40.2% in 1990 to 14.5% in 2006 [11].

The recovery of methane from the Salinas Victoria sanitary waste landfill, located in the outskirts of Monterrey City, in the state of Nuevo Leon, was

carried out in the years 2004, 2005 and 2006. The methane was used as fuel to operate the first electric plant of this kind in our country. Those methane emissions and others derived from the cities solid waste were used as fuel for the operation of the first electric plant of this kind in our country. The reports mentioned a slight increase of these emissions [14].

Another official strategy was to identify the dump sites nationwide to regulate their use, there are currently 308 in use. Even though it is "officially" unknown how many clandestine dumps there are, the calculations show that 40% of the total amount of waste is found on highways and ravines or is incinerated by the general population.

By 2009, it is reported that 58.6% of the garbage was disposed of in sanitary landfills and that 28.6% in unregulated sites which are considered open air sites and are the most contaminated. Due to this the land controlled landfills, hold just 9.3% added to the aforementioned amount of 37.9% of waste which pollute, and are not taken advantage of to produce energy [1] (see Fig. 2).

Despite the efforts of the environmental education programs (and accelerated development given to the legislation of waste management these last years), irresponsible behavior related to consumerism and a lack of interest on the part of the industrial sector, related to the separation and reduction, recycling and reusing of residue, can still be found [11].

The 3.6% of solid waste was recycled but according to the interviews with the President of the Mexican Industry of Industrial Plastic, this percentage could be a lot higher if we take into account that from 2007 to 2009 there was an increase of 9.1% of solid waste. The current conditions indicate that this number could double next year, even though the transformation industry has been affected by important barriers from having the necessary elements; such as garbage collectors who manipulate the separation and sale of waste, and it has been difficult for the Mexican government to control the situation.

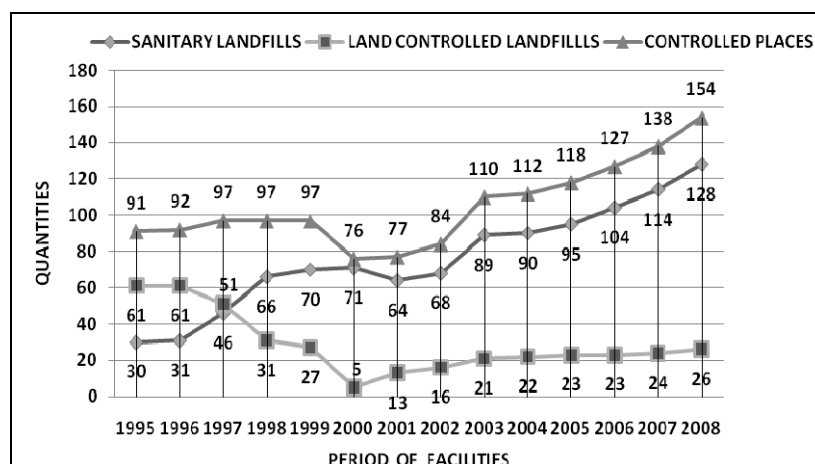


Fig. 2 Number of landfills nationwide from 1995 to 2008. Source: own production based on Ref. [1].

In 2009 the National Program for the Prevention and Management of Waste 2009-2012 (PNPGIR) was instituted [14, 15]. This program defines the national environmental policies on waste which incorporates waste management planning. The plan includes sectional programs with the formulation and instrumentation of national policies for prevention and mitigation of Greenhouse Gases (GEI in Spanish) emission and adaptation to the effects of climactic change. Nevertheless, the management of solid waste is only taken into account on projects related to reduction, resulting more in correcting than in preventing actions [11, 16].

1.2 Plastic and Government Strategies for Energy Recovery

The President of the Mexican Republic [11] informed that in 2008 the volume of organic waste represented 52.4% of the total waste collected. This can be used as compost and become a good business opportunity as well as reducing air and water contaminants. The remaining 50% is distributed as follows: 12.1% for demolition material, diapers and rubbers; 13.8% paper and cardboard; 10.9% on glass; 5.9% on plastics; 3.4% on metals and 1.5% on textiles.

In Mexico the National Association of the Plastic Industry (ANIQ y ANIPAC), the Chamber of Representatives as well as other organizations which emit reports concerning the transformation of the

plastic industry, state that plastic is the most important polymer in the market because of:

- (1) The vast amount of production and products generated (world consumption of plastic in 2004 was 210 million tons and 4.5 corresponds to national consumption of which 64% was produced in Mexico);
- (2) This production generates 150,000 jobs; with a billing for 20,000,000,000 dollars per year and 2.3% of internal raw product;
- (3) The total amount of consumers it caters to (of the 72 branches of the countries economic activities the plastic industry provides products to 59 and the main customers are the car industry, electronic and electrodomestics, pharmacological, and agricultural);
- (4) The wide variety of usage can decrease contaminant action in other areas such as lumber, electronics, car industry, etc.

These qualities allow the lowering of production costs, transportation costs, etc. and generate new developments every 4 years. An example of this is the fast and economic prototypes that replace mechanical or engineering parts. They are produced more easily and economically and may actually be an improvement on the traditional ones.

To define the position of the transformation industry in the Mexican economy it is important to take into account the following information: most of the income comes from the United States (73%), Germany (8.42%), Switzerland (4%) and France (3.66%) among

others and the manufacturers that pay this income are relatively larger than the national ones. These industries generated 34.9% of the Gross Value Added (GVA) and 33.7% of employment in the industry.

The productive chain of the plastic industry is made up of two sectors: the oil industry (producer of resins and additives) and the transformation industry which manufactures plastic products, as can be seen in Fig. 3. The last link in the oil industry is the first one of the manufacturing industry considering that resin is the raw material (48.5% is used in the manufacturing of plastic products). The manufacturers of plastic resins are found in Tampico, Tamaulipas and Coatzacoalcos, Veracruz.

There are two problems affecting the industry: In interviews with managers of leading companies in plastic and the President of IMPI, say the tax programs and financial support that the government has designed do not stimulate the process of sustainability that businesses and the plastics industry in general perform to preserve the environment; and second, a lack of competition in fuels, such as natural gas and other by-products like ethane, those for refining and electric energy. These represent the highest prices in the world and despite an apparent growth from 1995 to 2000

there is a decrease in the raw internal product to less than 2% in 2003.

Mexican Oil, (Pemex in Spanish), principal producer of raw materials and polyethylene-for the plastic transformation industry, established in the year 2000, a strategic business plan for parastatal industry so that operations could be restructured and generate higher GVA and efficient products as well as associate with the private sector to develop a better petrochemical industry. By 2003 the installed capacity grew 9.1% due to an increase in production at the ethylene plants in La Cangrejera and Morelos, reaching 10.296 tons, 4% more than in 2002.

Despite the country having large quantities of oil, exporting it as raw material has resulted in a major depletion of the product. This, along with inadequate technology for processing resin and the narrow-minded vision of the legislative and executive powers in managing international prices towards competitiveness and growth in the market, is worsening the situation due to its importance in the manufacturing of plastic products.

The manufacturing industry is made up of over 3500 business, which as we have already mentioned can make up to 50 times more its GVA once

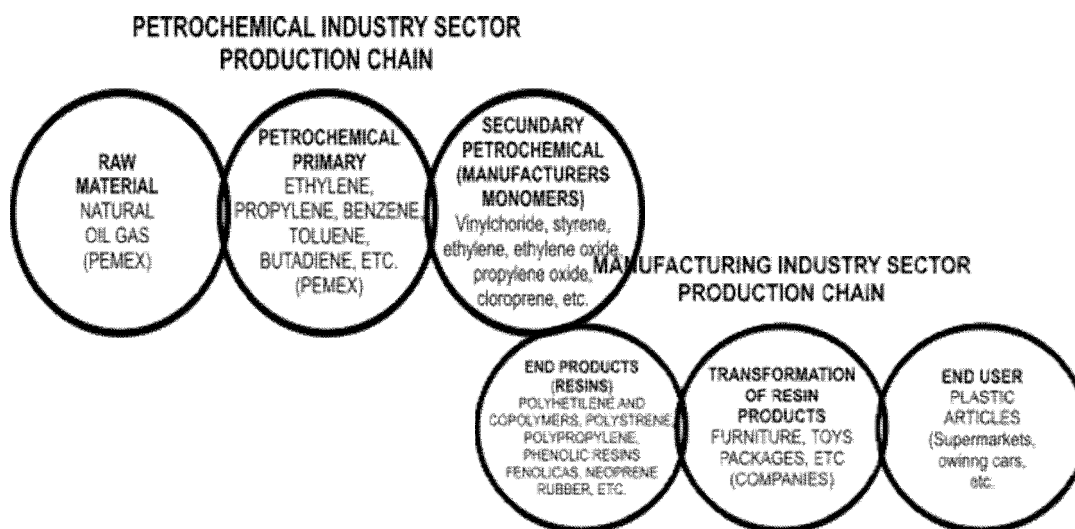


Fig. 3 Chain of the production of plastics. Source: own production based on Ref. [17].

finished.³ However, 84% corresponds to micro and small industry, this means that most of the productive activity falls on medium and large businesses, the former are mostly transnational and are expected to make 28,000,000,000 dollars to reach a commercial balance in 2014 (perfect balance).

To reach the total of transformation industries we took into account the manufacturing of plastic products, waste management and remediation services in 2004. The national production of plastic was reported to have been 4,400,000 tons, of these, containers were the most produced making up 46% of the total production (2,112,000 tons), followed by consumption (23%), construction (11%), electric and electronics (6%), furniture and car industry (4% respectively), industry (2%) and medicine and agriculture 1% each [18].

According to the information gathered by the Economic Census in 2004, the annual total production of the manufacturing industry is made up of 328,718 economic units, of which only 3,419 (1.04%) are involved in the manufacturing of plastic products which are processed with raw material in the form of: pellets, powders, plates, films, liquid, etc. These plastic products can be obtained from the recycling of containers or plastic picked up by the garbage workers or the general population and brought to large businesses such as: Avangard, which between Houston and Mexico is one of the third largest cullers in Latin America, Grupo Simplex in Monterrey with over a decade of experience, Global; Plastics in Monterrey, etc.

These numbers are important because 71% of the solid waste found in landfills is made up of containers and consumer products which could be recovered and recycled if there were an effective regulation for its separation and culling. Paradoxically, in 2008 the

production of containers went down 30% and it was necessary to import 854,166 tons (59%) of products such as: (1) adhesives and glues; (2) resins, plastic material and related materials; (3) cork, rubber and related materials; (4) synthetic filaments; (5) impregnated weaves and coatings.

Polyethylene terephthalate (PET) and high density Polyethylene (PEAD) are the most commonly used types of plastic used for recycling. The number of cullers in Mexico fluctuates between 100 and 60, between 15 and 20% of which can be said are well established. This is why recovery centers appear and disappear. It is important to point out that the recovery rate of PET residue is between 10 and 15%, of the recovered material. More than 80% is exported to countries like China, India and the United States in flake form [19].

There are very few companies in Mexico that reach the final step in recycling, which is transforming the residue into another product. Some factories use it to make short fiber, plastic strips and plates; produce textile fiber; others make thick plates and some use it to make broom fiber. This shows us that besides a demand for the ground PET flakes, there are other markets to be reached if products of greater value are made through the process of residue transformation [17]. Finally, customers are the final link in the chain and possibly the two most important issues to be addressed by recyclers is first to become self supporting in ecological terms and the other is to satisfy the consumers.

Government policies and norms on environmental conditions in Mexico determine the strategies to support and regulate the relationships among society, education and environment. However, the study reported in this document identified that although there is planning, organization and activities designed to reduce gas emissions causing the greenhouse effect, they have been ineffective due to the fact that a minimum effort has been made by the manufacturing industry to improve environmental conditions without

³ The plastic industry can be found all over the country and is represented by 3 chambers of commerce and one association. The National Chamber of the Transformation Industry (CANACINTRA), the Regional Chamber of the Transformation Industry in the State of Jalisco (CAREINTRA), Chamber of the Transformation Industry in the state of Nuevo León (CAINTRA) and the National Plastic Industry Association, A.C. (ANIPAC).

taking into account the cultural and administrative aspects necessary for the design and planning of these strategies.

In the following paragraphs you will find the results of the analysis of the government strategies in the light of the data related to environmental pollution and the possibilities that plastic is a material that allows sustainability in its own area.

1.3 Strategies of the Mexican Government to Improve the Environment

One of the aspects found in this research analysis was that the planning and organization of government strategies have to be immersed in the macro-dimensional problem of the sustainability when it interacts in society, the economy and environment. Their intersections imply questions of ethics, eco-efficiency and a healthy environment (see Fig. 4). Therefore the complexity of the situation is extreme when it has to do with integrating the three areas in one nation [20].

Most governments leave a wide range of uncertainty on the complexity of the phenomenon having to do with the opinion of those involved. They are the political leaders, businessmen (it is understood that these refer only to non governmental organizations) or to individual people which when brought together as a group, present complex and confusing relationships. As a result, they cannot work together to construct institutional planning policies and programs.

It is a fact that there are efforts to improve environmental conditions and that little by little the

participation of the three main characters involved increases. However, these efforts are still insufficient and present adverse circumstances attributed to cultural factors and the inadequate gestation of public administration. For this reason, the research done in this study has as an explanatory frame, a socio-cultural, and a psychological and administrative focus more than economical or technical [21].

The purpose of government is to adopt policies that promote the satisfaction of people's needs and at the same time minimize environmental pollution and the use of natural resources along with the regulation of prices of products and services according to their environmental cost. In other words, internalize the environmental costs basing them on principles such as "whoever pollutes pays". Companies should develop products and services considering their life cycle. The products and services should have high performance and be durable, recyclable, reusable and non toxic. Companies should also adopt policies of responsibility towards society and the environment. For example fair trade and organic products [22]. Therefore, citizens should become aware of the impact that their life style has on economics and society and modify their patterns of consumerism.

Even though the responsibility is shared and international agreements concretely define the part each one has; the reach and limitations of this are lost in the culture and interests of each town and the actions are done on a reductionist basis and locally and are therefore, less liable to create a universal culture surrounding sustainability. World wide, each country

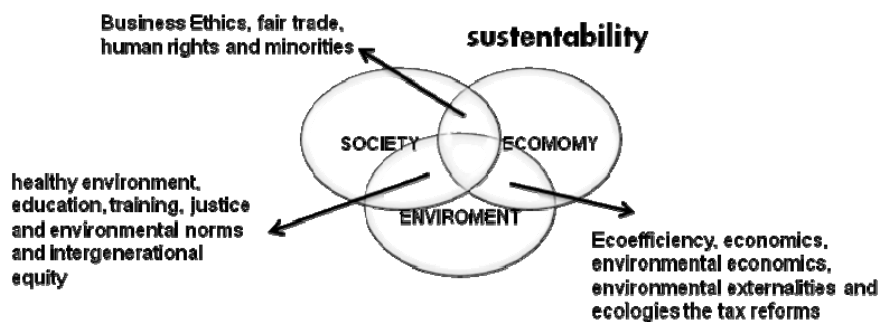


Fig. 4 Relationship between sustainability and effects when they interrelate. Source: Ref. [21].

does whatever it must to deal with emerging situations and save and justify its economic activity (Green washing), but strategies, in terms of conceptualizing future actions that will allow success in the desired effects to obtain sustainable development of all the nations, has only been a rhetorical approach in the different conferences organized internationally [11].

The concept of “strategy” is conveniently defined in this study as: the group of actions planned systematically, consistent with the purpose of sustainability, accomplished under a regulable process that ensures an optimal decision each and every moment and which is stated in a document containing the long term objectives and proposals of the company and the courses of action that follow, as well as those responsible.

Those involved have very specific functions to optimize the effects of policies in which society, the economy and the environment coincide. Here the government acts as the leader and coordinator of national actions, thus its responsibility is of the highest order because the nation falls under its tutelage and must consequently be the most reliable of all in order to achieve the goals. This is why it is of utmost importance for it to assume an incorruptible code of ethics and that the planning is strategic and foresees the contingencies and actions of the others involved (see Table 1).

Companies should organize the actions to be backed by the government in order to be competitive not only in the market but also on the environmental impact generated by their processes. Their most direct

responsibility is focused on social welfare, and they should therefore be sure that they design and make quality products that first satisfy the needs of survival and second use a minimum of or no natural resources.

Citizens are responsible for themselves and their fellow human beings; their actions must be shared and supported by the actions of the government and companies, since the satisfaction of their primary and secondary needs depends on a regulated economy. The culture is created starting from accumulated information obtained from their school. An ignorant community pollutes more.

The government’s functions were taken into account for the effects of this study and government strategies were analyzed in direct relation to their effectiveness in the behavior of society and industries. The creation of strategies to decrease the effect of environmental pollution by the Mexican government as well as part of the programs to face the climatic changes, are stated in the National Development Plan (PND 2007-2012), created by the executive power and constitutes the basis for planning of the Federal government for six years.

Each function implies the search for a goal and strategy that will achieve the relationship between society and economy; economy-environment and environment-society and the supposition underlying this study is that the final goal of sustainability will be achieved in integral terms. In the following paragraphs you will find the results of the analysis which show partiality of the government’s strategies, their economic tendency and emergent attention.

Table 1 Functions of those involved in sustainability. Source: own production.

Actor	Functions		
	Intersection SOC-ECON	Intersection ECON-AMB	Intersection SOC-AMB
Government	The norms are created to make sure that they are expedited following a code of ethics in legislation in the policies and in public administration. This will create an equity in the distribution of wealth and support the growth of emergent countries.	To establish and to provide administrative, financial and fiscal stimuli across organisms that determine the ecoefficiency of the social and managerial actions to encourage the managerial and social sustainability in the country.	To design and to implement rational programs of environmental education and of research and development, under which the culture of the social responsibility is outlined in the different social and managerial areas to obtain innovations and scientific knowledge under the optics of the sustainability.

2. Methodology

The present paper was carried out under the following characteristics.

2.1 Level of the Investigation

A socio-ecological study is being planned in order to broach the macro-dimension of the problems in the plastic industry and its impact on the sustainable development of the country.

2.2 Focus of the Investigation

The research is a documentary analysis to identify the interpretation of the process of sustainability which the Mexican government gives it and how it translates in its strategies in the text and actions. Likewise, we conducted interviews with the President of IMPI, six executives of companies in the plastics industry and two experts in public administration.

2.3 Procedure

(1) Documentary research was done to analyze the content of the reports and research published in the bibliography, hemerography and ciberography that allows the establishment of frontier knowledge related to the plastic manufacturing industry, the concept of sustainable development and the models used to determine the efficiency of the strategies used.

(2) Focal interviews were done with experts in the field from the following organizations: Universidad Nacional Autonoma de Mexico, the Mexican Institute of Industrial Plastic and the Instituto Politecnico Nacional, to determine the strategies followed by businessmen to promote reaching sustainability.

3. Results and Discussion

3.1 Referring to the Strategies to Promote a Socio-Economy Relationship for the Managing of Sr Plastics

The Inter-secretarial Commission for Climatic Change (CICC) has coordinated the activities of the units of the Federal Public Administration, related to

the formulation and instrumentation of national policies to prevent and mitigate the GEI emissions and to adapt to the effects of climate change. This policy allows the government to establish 17 goals and 39 specific strategies. Goals 2 and 7 respectively, are meant to face the climatic change problem. However, referring to solid waste, none deals directly with its treatment or regulation. In fact, it is specifically intended to adapt and mitigate the changes more than prevent or transform the conditions and behavior of those involved. The organisms in charge of enforcing the norms and regulating environmental behavior (SEDESOL and SEMARNAT and the local governments) have created strategies to reduce or eliminate GEI emissions in sanitary landfills between 2007 and 2009 that have the characteristics of a corrective rather than preventive management.

The strategies needed to reach the goal of reduction to 18.7 million tons of CO₂ eq. by the year 2020 are reduced to give assessment and industrial training and educational environmental programs can only be found in elementary schools. The educational programs at the basic levels have given positive results. In meddle and higher education there is no obligation to include the themes in the curriculum, however, the schools feel the need to include them and they are done entirely without orientation.

No strategies for domestic treatment have been established, such as the culling of the landfills and leaving the garbage collectors uncontrolled. Nor have actions been implemented which relate directly to the industrial sector and society such as the use of the cleaning trucks, recycling and collecting. Even when legislation proscribes fines for these situations, the ecological agenda focuses more on fining than on promoting positive behavior on the industrial sector and excludes the normalization of citizens' actions.

In the plastic industry entrepreneurs' point of view, their actions are limited by legislation which is confusing and related to corruption. In a survey directed at CEOs of all branches, the results reveal that

the one of their most important concerns is to meet the norms in sustainable material and the next to last is to minimize risk of sustainability, which is of course incongruent with the goals set to reach sustainable behavior. As to the regulation of domestic activities in society, they are simply unknown and aren't even applicable. The actions to prevent irresponsible consumption are immersed in anarchy and the actions of environmental education are not connected and no societal impact exists.

3.2 Referring to the Strategies for Promoting an Economy-Environment Relationship for the Management of Sr Plastics

Mexico has been a member of the Directive Committee and participates actively in the Methane to Markets (M2M) Partnership since 2005, coordinated by the Environmental Protection Agency of the United States. However, since the crisis in 2008 the strategies to impulse the economic regional growth have been very precarious. The development of local capacities for the implementation of productive projects based on the recovery and use of CH₄ as a source of energy are completely insufficient and not considered worthy to be taken into account, even though 14.4% of un-renewable energy would be recovered.

Employers in the plastics industry feel unprotected and excluded from government policies because the actions needed to strengthen technical capacities and allow the development of attractive economical projects on the part of the government; are focused on energy projects. Their own needs were never heard and never favored. Large companies in the plastic industry are mainly transnational and their processes involve sustainable actions framed by the norms of the countries involved.

Most of the Mexican companies are micro and small enterprises, without any formal structure and much less having sustainable perspectives. The government established strategies to stimulate them economically, but few have the opportunity to obtain this financing

because they do not meet the established conditions. Fiscal, administrative and financial stimuli, which companies with sustainable activities can obtain and which fit directly into the recycling and collecting of plastic waste and create a sustainable culture, are set up in such a way that they discourage more than encourage the activities.

Society has a vague idea of the danger of pollution, because the information on the damaging effects of the same are incomplete, obtained from imprecise advertising and individual citizens have no clear idea of what is expected of them and how they can participate in sharing the responsibility.

3.3 Referring to the Strategies to Promote an Environment-Society Relationship for the Management of Sr Plastics

Educational programs have a major influence in the undertaking of the established strategies in the environment-society relationship because they are practically the only used as strategies to instill the necessary values to limit the fall to extreme poverty. Economically, the Mexican government sets 5.3% of raw internal product to education, below the 8% established by UNO in the General Law of education. This low finding rate has affected economic, social and cultural development in Mexico since schools have cut down their human resources, scientific programs and training.

The environmental programs were created by SEMARNAT, through the Education and Training Center for Sustainable Development (CECADESU), and the Secretary of Public Education (SEP), under the principles of the Agreement to implement the Decade of Education for Sustainable Development (DEDS 2005-2014), promoted by the United Nations Organization for Education, Science and Culture (UNESCO). The operation of these programs is directly related at elementary education and on other levels, to training public servants or businessmen. These programs are provided as external services

according to an established offer by said organisms.

In the formal education system, the programs for the elementary level have been successful in collecting containers and recyclable plastics. This is primarily because alliances have been created through foundations and private institutes in conjunction with elementary schools as a practical part along with the theoretical contents included in their curricula on environmental aspects. Small children are good promoters of the sustainability at home because they absorb universal values for the conservation of the environment naturally. In the subsequent levels only people directly related to SEMARNAT know of the existence of the adaptation programs and mitigation of the contaminating effects of gases, but there is no strategic planning that takes into account a defined vision of environmental culture in social, educational and economic terms in the country.

It is paradoxical that a great deal of importance is given to education and investigation as motors of development; however, in the logistics of the operation, the articulation among the institutions of higher education that would unify the undertaking is excluded.

4. Conclusions

Environmental management of plastic waste in Mexico has been ineffective because government strategies work differently for companies and society. These regulations have been created to coordinate and regulate the generation of waste, as well as its transference, separation and recycling, all of which work separately for businesses and society, and therefore imply a waste of resources and low impact on sustainability.

Environmental strategies are focused on reducing pollution and avoiding the change in climate, the investment and stimuli are unassertive and insufficient because requirements are difficult to meet.

The plastic recycling industry is an alternative for solving environmental, social and economical problems in the country, because the increase of solid

waste is certain as a result of the growing population. However if we can improve the conditions of the landfills, we will obtain many benefits such as provide energy for a large population, generate jobs and educate people.

The lack of innovation and technologic and scientific investigation which allows the modernization of the plastic recycling industry and the generation of associated knowledge is more of a social political problem than one of infrastructure and resources. Therefore, it is important to design a national project committed to developing local programs according to the needs of the counties, which integrates joint actions between the government, business and society under its own cultural logic and in the interest of meeting the goals of sustainability.

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