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La e-waste en México: otro problema para el medio ambiente del país

The e-waste in Mexico, another problem for environment in the country

E-waste no México: outro problema para o meio ambiente do país

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Resumen

En México, la basura electrónica o *e-waste* (por sus siglas en inglés) no se considera un problema serio para el medio ambiente, los animales y los seres humanos, a pesar de que varios estudios han demostrado que el país ocupa el tercer lugar en el continente como generador de ese tipo de desechos sólidos. En tal sentido, en este trabajo se presenta información relevante acerca de la contaminación tóxica, así como de los componentes y los elementos que tienen los equipos electrónicos obsoletos, los cuales necesitan urgentemente ser normados con políticas y leyes concretas debido a los daños que pueden generar al entrar en contacto con el medio ambiente y los seres vivos.

Palabras claves: basura electrónica, *e-waste*, medio ambiente, reciclaje de electrónicos.

Abstract

In Mexico, meaning of electronic waste, or e-waste by its acronym in English, is not considered an environment´s transcendental problem for animals or humans neither, although several studies rank our country in third place in the America continent as a generator of electronic waste, the programs that exist to recycle this kind of pollutant are few or nonexistent. This article presents relevant information about toxic contamination, its components and internal elements that have obsolete electronic equipment, which urgently need to be identify or considered as a raw problem with specific policies and laws, due to the different damages that can touch a single obsolete electronic component off when coming into contact with the environment and living beings.

Keywords: electronic waste, e-waste, environment, electronic recycling.

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Resumo

No México, o lixo eletrônico ou lixo eletrônico (por sua sigla em inglês) não é considerado um problema sério para o meio ambiente, animais e seres humanos, embora vários estudos tenham mostrado que o país ocupa o terceiro lugar. no continente como gerador desse tipo de resíduo sólido. Neste sentido, este trabalho apresenta informações relevantes sobre a poluição tóxica, bem como os componentes e elementos que possuem equipamentos eletrônicos obsoletos, que precisam urgentemente ser regulados com políticas e leis específicas devido aos danos que podem gerar quando em contato com o meio ambiente e os seres vivos.

Palavras-chave: lixo eletrônico, lixo eletrônico, meio ambiente, reciclagem eletrônica.

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Introduction

One of the environmental problems caused by new technologies has to do with the huge amount of electronic devices of any kind (computers, televisions, blenders, etc.) that are discarded daily because they reach the end of their useful life cycle or because users want to replace them with more current ones. This has led to a phenomenon known as electronic waste or e-waste, which has grown exponentially due to the lack of ecological awareness, lack of laws or policies promoted by federal, state and municipal governments, as well as the decrease in the costs to acquire these new technologies.

In the specific case of our country, this problem is reflected in documents such as the 13th study on the habits of Internet users in Mexico (Internet Association, 2017) and in the National Survey on availability and use of Internet technologies. information in homes - produced by the National Institute of Geography and Information Statistics (INEGI) in collaboration with the Ministry of Communications and Transportation (SCT) and the

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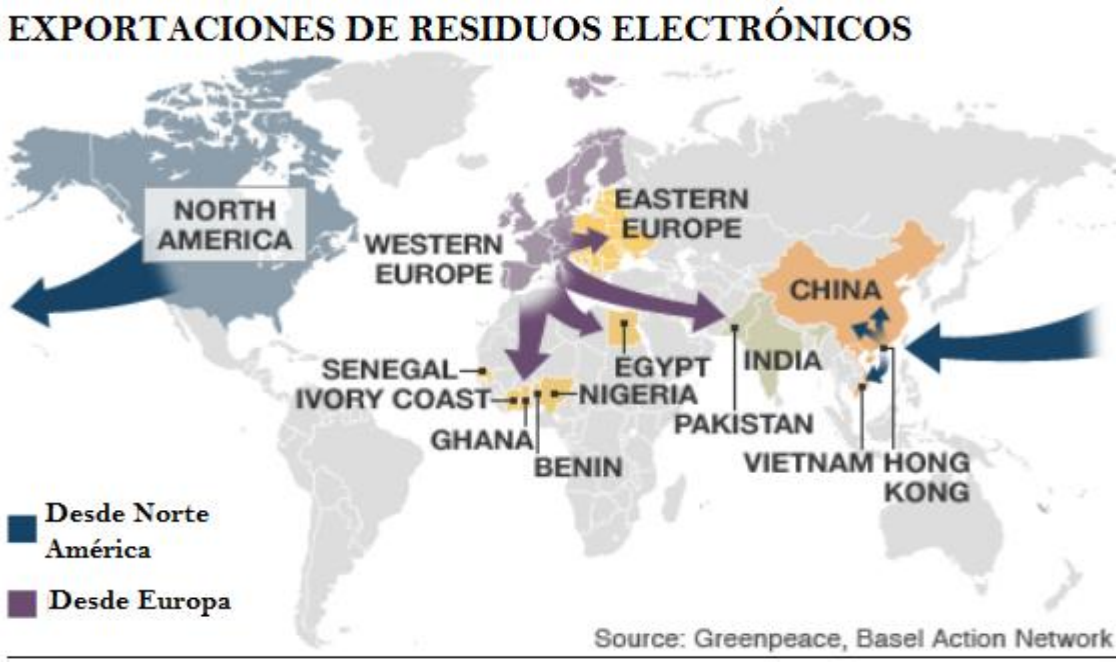
Federal Institute of Telecommunications (IFT) -, which indicates that in Mexico there are 70 million of Internet users (that is, 63% of the national population), 81 million cell phone users, 45.6 million computers and 93.1 million television sets (INEGI, 2015).

These figures obviously have a negative impact on the environment, as evidenced in the study The Global E-Waste Monitor 2014 (Baldé, Wang, Kuehr and Huisman, 2015), in the Americas, Mexico ranks third as a generator of electronic waste with 958 kilotons, that is, each Mexican produces almost 9 kilos of waste of this kind per year.

Worldwide, this is a problem that developed countries began to see in the 80s of the last century. However, they did not promote policies or laws to lessen the impact of this phenomenon, but sought agreements to send those components to African or Asian countries (eg, Ghana, Senegal, Egypt, Pakistan, Vietnam or India) to be boned and sold (Anwesha and Kunal, 2013; Tokumaru, Ozaki, Onwona-Agyeman, Ofosu-Anim and Watanabe, 2017).

Figure 1, prepared by the environmental group Greenpeace (2015), presents the routes of transfers to these countries, which does not solve the problem, but moves it to other latitudes, since the export of electronic waste actually deteriorates the quality of life of the inhabitants of those nations due to the environmental and health damages they cause.

Figura 1. Exportaciones de residuos electrónicos de países desarrollados



Fuente: Greenpeace (2015)

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Logically, the problem of electronic waste is presented not by the devices themselves, but by the different components that constitute them (eg, lead, arsenic, mercury, etc.), which, not being recycled from correct form, they spread in the environment and produce different types of affectations.

This export is maintained because in the countries that receive electronic waste there is a trade around the most valuable components of these devices (eg, gold, silver, plastic, aluminum, etc.), which They are resold or reused to assemble other equipment. In other words, thanks to these components, a formal and even informal economy is maintained that serves to create jobs.

However, the problem arises because to extract many of these elements people use inappropriate methods and work in places not equipped for that purpose. This can be seen in the work of Abhishek, Xianlai and Jinhui (2016), who present a comparison between the recycling of developed and non-developed countries. In this study, the authors show that the people of the last nations tend to present different affectations due to the fact that they work in improvised workshops or backyards. Table 1 shows some of the diseases that may cause inappropriate handling of this type of components

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Tabla 1. Sustancias tóxicas en los equipos electrónicos y sus posibles enfermedades

Nombre del componente	Posibles enfermedades
Aluminio	Daño al sistema nervioso central, demencia, pérdida de la memoria, apatía, temblores severos.
Arsénico	Irritación del estómago e intestinos, disminución en la producción de glóbulos rojos y blancos, cambios en la piel e irritación de los pulmones.
Azufre	Efectos neurológicos y cambios comportamentales, alteración de la circulación sanguínea, daños cardiacos, efectos en los ojos y en la vista, fallos reproductores, daños al sistema inmunitario, desórdenes estomacales y gastrointestinales, afectaciones en las funciones del hígado y los riñones, defectos auditivos, alteraciones del metabolismo hormonal, efectos dermatológicos, asfixia y embolia pulmonar.
Bromo	Diarreas, dolor de estómago y vómitos severos, fractura de huesos, fallos en la reproducción y posibilidad incluso de infertilidad, daño al sistema nervioso central y al sistema inmune, desórdenes psicológicos, posible daño en el ADN y cáncer.
Cobalto	Vómitos y náuseas, problemas en la visión, corazón y tiroides.
Cobre	Irritación de la nariz, la boca y los ojos; dolor de cabeza y de estómago, mareos, vómitos y diarreas. Grandes dosis de cobre puede causar afectaciones al hígado y los riñones e incluso la muerte.
Estaño	El estaño puede provocar efectos agudos, así como efectos a largo plazo. Los efectos agudos son irritaciones de ojos y piel, dolores de cabeza y de estómago, vómitos y mareos, sudoración severa, falta de aliento y problemas para orinar. Los efectos a largo plazo son depresiones, daños hepáticos, disfunción del sistema inmunitario,

	daños cromosómicos, escasez de glóbulos rojos y daños cerebrales. Incluso puede provocar ira, trastornos del sueño, olvidos y dolores de cabeza.
Germanio	Irritación de los ojos, la piel y el tracto respiratorio. La sustancia puede lesionar las células sanguíneas. La exposición puede resultar en la muerte.
Litio	Muchas reacciones del litio pueden causar fuego o explosiones, lo cual libera vapores irritantes y tóxicos. La inhalación del litio puede producir sensación de quemadura, tos, respiración trabajosa, dolor de garganta.
Mercurio	Daño al sistema nervioso, a las funciones del cerebro, al ADN y a los cromosomas. Reacciones alérgicas, irritación de la piel, cansancio y dolor de cabeza. En la reproducción puede afectar el esperma, así como abortos.
Níquel	Elevadas probabilidades de desarrollar cáncer de pulmón, nariz, laringe y próstata. Embolia de pulmón, fallos respiratorios, defectos de nacimiento, asma y bronquitis crónica, así como distintas reacciones alérgicas.
Plomo	Perturbación de la biosíntesis de hemoglobina y anemia, incremento de la presión sanguínea, daño a los riñones, abortos y abortos sutiles, perturbación del sistema nervioso, daño al cerebro, disminución de la fertilidad del hombre a través del daño en el esperma, disminución de las habilidades de aprendizaje de los niños, perturbación en el comportamiento de los niños (agresiones, comportamientos impulsivos e hipersensibilidad).
Selenio	Acumulación de líquido en los pulmones, mal aliento, bronquitis, neumonía, asma bronquítica, náuseas, escalofríos, fiebre, dolor de cabeza y de garganta, falta de aliento, conjuntivitis, vómitos, dolores abdominales, diarrea y agrandamiento del hígado.

Fuente: Elaboración propia

Now, it is true that a significant part of this problem is due to the lack of culture of recycling by users. However, it should also be noted that the greatest responsibility for this phenomenon falls on both companies and governments, which must regulate not only the production of this type of device, but also the process of recycling it. For this reason, the following is a broad overview of the Mexican legal framework around this problem.

Programs and policies in Mexico

The Mexican legal framework for the regulation of waste has its norm in the General Law of Ecological Equilibrium and Protection of the Environment. Published on January 28, 1988 in the Official Gazette of the Federation, with 7 chapters and 204 articles, it is the most important environmental law in the country, together with the General Law for the Prevention and Integral Management of Wastes, which It was published on October 8, 2003 in the Official Gazette of the Federation. This classifies waste into solid, urban, hazardous and special handling.

The waste of special handling is defined in the aforementioned law as those "coming from the computer industries, manufacturers of electronic products or motor vehicles and others that, after their useful life, due to their characteristics, require specific management" (Law General for the Prevention and Integral Management of Wastes, 2003, page 15). This means that they are a special type of waste that requires a particular treatment plan, which is defined by the Ministry of Communications and Transportation (2015) as follows:

> [It is] the instrument whose objective is to minimize generation and maximize the valuation of urban solid waste, special handling waste and specific hazardous waste, under criteria of environmental, technological, economic and social efficiency, based on the Basic Diagnosis for Management Integral de Residuos, designed under the principles of shared responsibility and comprehensive management, which considers the set of actions, procedures and viable means and involves producers, importers, exporters, distributors, merchants, consumers, users of by-products and large generators of waste, as appropriate, as well as to the three levels of government (p. 10).

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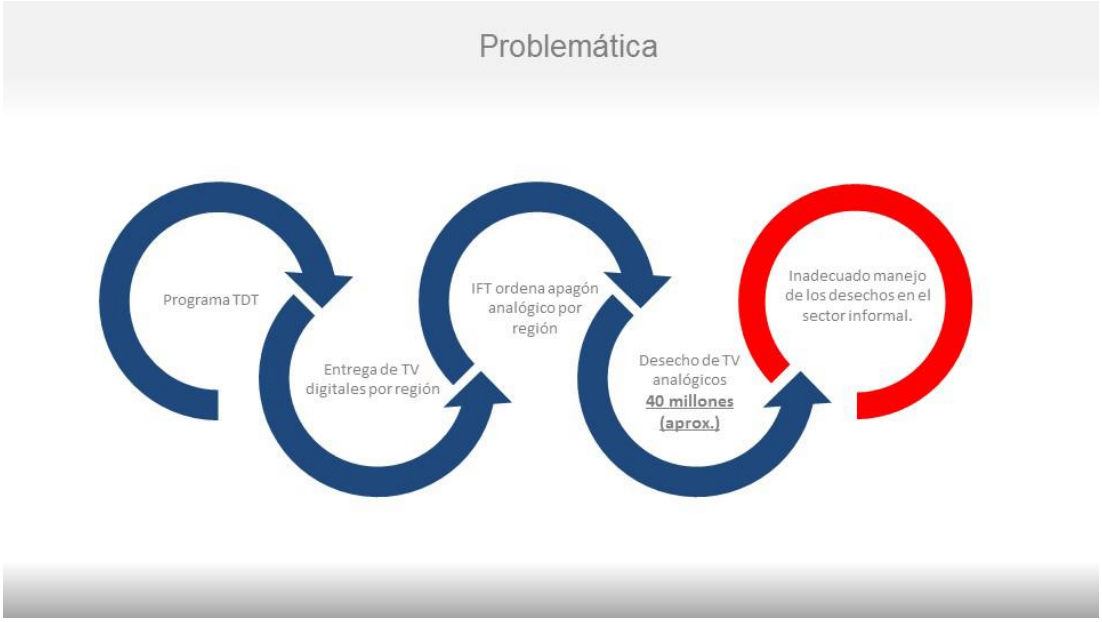
This program arises from the constitutional reform in telecommunications, which aims to end analogue television broadcasts before December 31, 2015. One of the actions of this program is to promote the delivery to the population of 10 million digital televisions to change the current analog. According to calculations of this program, approximately 40 million of these devices would be disposed of, which would be obsolete. Figure 2 shows the plan developed based on the problems of the program.

Figura 2. Problemática del Programa Nacional para la Gestión Integral de los Televisores Desechados por la Transición a la Televisión Digital



Fuente: Documento Programa Nacional para la Gestión Integral de los Televisores Desechados por la Transición a la Televisión Digital (2015)

There is also a standard prepared by the Ministry of the Navy and Natural Resources (Semarnat), which receives the name NOM-161-SEMARNAT-2011, published in the Official Gazette of the Federation on February 1, 2013 (Semarnat, 2011). This establishes the criteria for classifying the residues of special handling and specifies which ones need this plan. In addition, it determines the elements and procedures for the formulation of

management plans, etc. Likewise, the norm NOM-083-SEMARNAT-2003 can be found for non-hazardous waste, that is, those used for landfills (Semarnat, 2003).

On the other hand, on May 20, 2013, the National Development Plan 2013-2018 was published in the Official Gazette of the Federation. In this document you can find objective 4.4 of the National Goal IV Mexico Prospero, which seeks to "promote and guide an inclusive and facilitating green growth that preserves our natural heritage while generating wealth, competitiveness and employment". In fact, strategy 4.4.3 is established, which consists in "strengthening the national policy of climate change and care for the environment to move towards a competitive, sustainable, resilient and low carbon economy" (National Development Plan 2013-2018 , 2013, p.135). This provides 11 lines of action, which seek to achieve a comprehensive management of solid waste of special and hazardous management, including the use of materials to minimize the impact on the population and the environment. In this regard, Semarnat is the federal government unit responsible for promoting the protection, restoration and conservation of natural resources. Comprised of three sub-secretariats, several deconcentrated and decentralized bodies, it also has the responsibility of creating environmental policies, for which it works on four priority aspects:

- The conservation and sustainable use of ecosystems and their biodiversity.
- The prevention and control of pollution.
- The management of water resources.
- The fight against climate change.

Also, the National Institute of Ecology and Climate Change (Ineec) is a decentralized public body of the Federal Public Administration, sectorized in the Semarnat, which complies with Article 15 of the General Law on Climate Change (LGCC). Its mission is to generate and integrate technical-scientific knowledge, as well as increase the qualified human capital for the formulation, conduct and evaluation of public policies that lead to the protection of the environment, preservation and ecological restoration, green growth, as well as mitigation and adaptation to the country's climate change.

At the international level, Mexico also participates in other agreements, such as the Basel Convention, supported by the United Nations Environment Program (UNEP) (2005), which

focuses on the control of transboundary movements of toxic waste. . It is made up of 176 countries that have ratified it, of which Mexico is a founding member since March 22, 1989, and ratified on February 22, 1991. The objective is to protect human health and the environment against possible harmful effects for generation, transboundary movement and hazardous waste management.

In this regard, on May 23, 2001, Mexico signed the Stockholm Convention, supported by the United Nations (UN) (2009), which was ratified by our country on February 10, 2003 (Mexico it was the first Latin American country to ratify it), and it entered into force on May 17, 2004. 120 countries participate in this agreement and it was supported by UNEP. Its objective is to protect human health and the environment against persistent organic pollutants (POPs), as well as to promote the use of best practices and technologies to replace current POPs and prevent the development of new ones through national policies and plans. the participants of the agreement.

Likewise, Mexico is a party to the Rotterdam Convention (FAO, 2008), which entered into force on February 24, 2004, and has approximately 100 signatory countries. This arises due to the work carried out in the 80s by the UNEP and the United Nations Organization for Agriculture and Food (FAO) in order to serve as a bridge to exchange information on chemical products and identify their commercialization. In this way, we try to protect the population and the environment from the dangers generated by the trade in pesticides and highly dangerous chemical products, as well as counteract the illegal importation of toxic substances and chemical products between different countries.

Finally, and in academic-institutional level, we can mention the computer recycling campaign promoted by the Autonomous University of Carmen (Pérez, Verduzco, Cocón and López, 2011). This project of the Faculty of Information Sciences began in 2007 to allow companies and society in general to eliminate obsolete equipment located in Ciudad del Carmen. The result of this initiative is the collection to date of 120 tons of computational and electronic equipment that has been sent to recycling companies with the corresponding permits. In fact, thanks to the participation of the Colectivo Isla Verde civil association, a work structure has been created to address this problem.

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Conclusions

To attend to the problem of electronic waste, the participation and awareness of different actors is necessary. In the first place, technological companies must assume their responsibility in this situation, since the profits they generate each year with the sale of their products do not correspond to the initiatives undertaken to promote a culture of recycling.

On the other hand, it also requires the intervention of the governments (federal, state and municipal), because currently, in the specific Mexican case, public policies are still scarce. In fact, there are no programs in the country focused on offering information to the population about the recovery process of the equipment. Therefore, it is necessary to work on specific rules to deal with electronic waste, so that international agreements can materialize in concrete practices. For this, it should be taken into account that this year (2018) Mexico can generate 1150 kilotons of electronic waste, that is, about 9.4 kilograms per person per year.

Finally, consumers should also be aware of the innumerable problems that electronic waste can cause in the environment and the health of their peers. It must be thought, therefore, that the damage caused by electronic devices must be addressed from an environmental education that promotes habits of conservation and proper recycling of discarded products. Otherwise, and due to the rapid advance of technology and the massive production of this type of resources, it is likely that this problem may be uncontrollable.

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