

CURRENT TRENDS IN WEEE MANAGEMENT IN ROMANIA

Mihaela PĂCEȘILĂ

Bucharest University of Economic Studies, Bucharest, Romania

mihaela.pacesila@man.ase.ro

Carmen Nadia CIOCOIU

Bucharest University of Economic Studies, Bucharest, Romania

nadia.ciocoiu@man.ase.ro

Sofia Elena COLESCA

Bucharest University of Economic Studies, Bucharest, Romania

sofia.colesca@man.ase.ro

Ștefan Gabriel BURCEA

Bucharest University of Economic Studies, Bucharest, Romania

stefan.burcea@gmail.com

Abstract

This paper provides an overview of waste electrical and electronic equipment (WEEE, e-waste) collection and recycling system in Romania. Although progresses have been registered in the field, Romania is facing serious problems regarding WEEE management which affect the achievement of targets set by the European Union. In this context, the paper aims to highlight the underlying causes of the inefficient management of WEEE for subsequent identification of the necessary measures by the experts and practitioners in the field.

Keywords: WEEE management, Romania

1. INTRODUCTION

The last decades are characterized by a rapid increase in consumption of electrical and electronic equipment (EEE) (Bhutta et al., 2011; Pipaș et al., 2013; Needhidasan et al., 2014; Ciocoiu et al., 2015a). These products have become indispensable in today's modern society and are successfully used in the medical sector, education, communication, security, etc. The consequence of this development is the increasing amount of electronic waste (Ciocoiu et al., 2013), especially as certain equipment become obsolete too fast. Moreover, the rapid rate of innovation in electronics determines people to buy new types of products in order to replace the old ones with others more efficient (Colesca and Popescu, 2013).

The e-waste collection is influenced by many factors, such as consumer behaviour, contextual factors (laws and regulation, monetary incentives, community expectations), the strategies adopted for e-waste management, the pace of adopting e-waste regulations (Colesca, Ciocoiu and Popescu, 2014).

Because of its composition, waste electrical and electronic equipment (WEEE) is one of the most complicated types of waste, making it difficult to recycle (Kourmousis et al., 2011). This waste contains materials that can be recovered (Cui and Zhang, 2008; Rudareanu, 2014), and toxic substances that can harm the environment and endanger human health (Kidee et al., 2013). Therefore, it should be managed properly, especially as it represents one of the problems of pollution worldwide (Popescu et al., 2014).

In these conditions, its recycling becomes vital, especially as the process has an economic motivation thanks to the materials that could be recovered. However, there are huge differences between the different types of products and their composition may vary from one product to another. Moreover, the economic value of such waste depends both on the value of recovered materials and on the costs of technology and equipment used (Pipaș et al., 2013). Waste recycling and recovery is a major problem worldwide. Even in industrialized countries not all electronic waste is recycled and recovered, some of them being disposed of to landfill or, depending on their type, incinerated (Crowe et al., 2003).

On the other hand, the proper management of WEEE contributes to the progress in implementing environmental policies and diminishing the danger generated by the uncontrolled waste disposal, but also promotes saving scarce natural resources and raw materials.

For Romania, although the adaptation to EU regulations in the field was made continuously, there are still many issues to be improved, especially regarding the e-waste collection.

2. RECENT EVOLUTIONS REGARDING THE LEGAL FRAMEWORK

The Romanian legislation is continuously adapted to the European regulations, focusing on the alignment of national policies in the field of WEEE collection and recycling. One of the recent changes is the adoption of the Government Emergency Ordinance no. 5/2015 on WEEE. This ordinance opens a new page in the implementation of the *acquis communautaire* in the environment field in our country and introduces new targets for electronic waste, calculated by using a formula. The normative act transposes the Directive 2012/19/EC and replaces the previous provisions made by Government Decision no. 1037/2010 on WEEE.

The directive 2012/19/EC extends the producer's responsibility for his product till the post-consumption stage. The collective organizations are seen as part of the recycling chain serving to close the costs on the circuit, from the collection to treatment and finally to recycling.

Since January 2016, the transposition of the directive into Romanian legislation has replaced the annual targets for WEEE collecting and recycling. Therefore, the target of 4 kg per capita has been replaced with a rate of 40% of the average weight of products put on the market by Romanian producers in the three preceding years (see Table 1). This rate will increase gradually to 65% in 2020 (Ciocoiu et al., 2015b; Popescu, 2015). Thus, like other countries in Central and Eastern Europe, Romania will enjoy a transition period: a collection rate of 40-45% between 2016-2019, a collection rate of 65% applicable in the EU since 2019 (which can be postponed by each Member State till 2021).

TABLE 1 - PLANNING THE EVOLUTION OF WEEE COLLECTION TARGETS AT NATIONAL LEVEL BASED ON THE REQUIREMENTS OF THE NEW DIRECTIVE ON WEEE

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The initial target set by the WEEE Directive	Minimum 4 kg per capita or the average quantity expressed in kg per capita annually collected in the three preceding years (whichever value is higher)				Minimum 45% of the amount put on the market (the annual average of the three preceding years)			65% of the amount put on the market (the annual average of the three preceding years) or 85% of the amount of WEEE generated		
The target for Romania	Minimum 4 kg per capita or the average quantity expressed in kg per capita annually collected in the three preceding years (whichever value is higher)				Minimum 40% of the amount put on the market (the annual average of the three preceding years)				65% of the amount put on the market (the annual average of the three preceding years) or 85% of the amount of WEEE generated	

Source: Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

According to the ordinance mentioned above, WEEE from households will be collected by public authorities, distributors (system 1 to 1 or 1 to 0 for distributors holding spaces of at least 400 square meters) and through schemes organized by collective organizations. The economic operators can perform the recycling either individually, setting up recycling points, either by joining a collective organization.

On the other hand, both producers and distributors are obliged to provide certain information to buyers when selling EEE. The information refers to the following aspects: obligation of collecting WEEE and not eliminating them with the unsorted municipal waste, recycling and other forms of WEEE treatment, negative effects on the environment and human health because of hazardous substances in their

composition. If they will not provide the information to customers and the equipment will not contains the specific symbol, the fines will range between 40,000 and 50,000 lei.

Comparative to other products, such as cars, the electronics cannot be tracked during their use (Pipaș et al., 2013). For a better management of WEEE, the ordinance states that the producers (including those who use online stores) will have to enroll in the National Register of Producers developed by the National Agency for Environmental Protection in order to introduce EEE on the Romanian market. After registration, they will receive a registration number which will be communicated to all the commercial networks dealing with the sale of EEE. The National Register provides links to other national registries of Member States in order to facilitate the registration throughout the EU. Those who will introduce EEE on the market without being enrolled in the registry will receive fines between 40,000 and 50,000 lei and their activity will be temporarily suspended.

According to the normative act recently adopted, the municipalities are obliged to set up collection points (at least one in 50,000 people) as well as mobile collection points and to collect regularly (at least once per quarter) using designated operators. Moreover, individuals and legal entities holding WEEE, including those resulting from EEE imported for own use, are obliged to deliver them to the collection systems. Therefore, while hoping that they could change the habit of keeping refrigerators and televisions broken, the citizens are now required by law to eliminate the old EEE. Furthermore, the ordinance establishes a penalty for individuals owning WEEE. They can receive a fine ranging between 500 and 1,000 lei.

This provision is welcome in Romania where a lot of small electronic devices (mobile phones, laptops and electronic entertainment) are kept at home after the end of life because their residual value is low or for other reasons.

The new WEEE ordinance introduces a new classification of EEE. The 10 categories of products will be classified in 6 categories since August 15, 2018:

1. Heat transfer equipment, including refrigerators, freezers, air conditioners, heat pumps, etc.
2. Screens and equipment with an area of more than 100 cm²
3. Lamps
4. Large equipment, including washing machines, cookers, electric stoves, dishwashers, etc.
5. Small equipment such as vacuum cleaners, microwave ovens, VCRs, radios, hair care appliances, etc.

6. Small computers and telecommunications equipment (mobile phones, personal computers, etc.).

In general, the ordinance brings benefits to the population, disposing of WEEE becoming more accessible due to the obligations imposed on distributors (which must take them for free), producers, collectors and recyclers (larger amounts collected and recycled) as well as on authorities (targets' improvement).

3. PRACTICAL ASPECTS OF WEEE COLLECTION IN ROMANIA

Dynamics of technological progress, improvement of living standards and access to loans for consumer have increased the sales of electrical and electronic products in Romania and thus the amount of WEEE (Ciocoiu et al., 2010; Stegaroiu, 2014). Globalization has brought a lot of international brands of EEE on the Romanian market (Ciocoiu et al., 2011a) leading to an increased volume of purchased equipment.

The total amount of EEE in Romanian households is around 25/30 kg/capita, and their average rate of use is higher than in other European countries (Podariu and Filip, 2013; Colesca et al., 2014). Moreover, it is expected that the amount of WEEE generated by households in Romania will increase during 2010-2020 (Huisman et al., 2008; Popescu et al., 2014).

In Romania the WEEE collection system is in its infancy (Ciocoiu et al., 2011a). According to the statistical data from Eurostat, Romania ranked last in the European Union on WEEE collected per capita in 2010 (Banacu et al., 2014). The following factors contribute to this situation:

- lack of adequate infrastructure for WEEE collection (as regards the number of collection centers at national level and the containers for separate collection, etc.).

However, progresses have been recorded in the area. Currently there are over 2,000 collection points in commercial networks in Romania, with adequate infrastructure for weekly or monthly collection. In addition, Environ Association has launched the first interactive map of recycling which specifies all the collection points and necessary information, including their work program. It is an intelligent system using the latest technology which automatically detects the location of the online visitor and guides him to the nearest collection point (Environ, 2016).

On the other hand, almost half of the Romanian population lives in rural areas and is often poorly equipped with electronic products. That is why their renewal is very low. In this context it is very difficult to organize WEEE collection systems in these areas (Ionescu, 2011). Moreover, the old products reach into rural

areas because they are still functional, and this form of reuse cannot be quantified, although it could contribute to achieving the targets set for Romania (Environ, 2016).

- low level knowledge of population regarding the WEEE collection. Some Romanians wishing to recycle their old equipment do not know the procedures and which are the collection centers (Colesca and Popescu, 2013; Stegaroiu, 2014). That is why over a third of households owns broken equipment (Todea, 2012), some of them even intending to repair it (Popescu, 2014).

More recently, according to a study developed by Ecotic and GBD Research (2016), 33.9% of respondents mentions lack of facilities for separate collection (collection points) as the biggest barrier to WEEE collection. The next response is represented by the lack of information regarding the location of points to properly drop off waste (24.2% of respondents). Overall the study showed a positive change in behavior, attitude and information about WEEE collection and recycling in the last two years.

- low interest of citizens for improving WEEE management. The environmental legislation regarding their responsibilities and obligations is not well known (Regions4recycling, 2014). People recognize that WEEE collection is important, but they are not interested in doing something in this field. Moreover, they are willing to behave ecologically as regards electronic equipment only to the extent that this does not require great effort on their part (Stegaroiu, 2014). However, the situation changes when people receive fines from environmental authorities.
- ignorance of WEEE negative effects on the environment by citizens. WEEE reaching to inadequate collective and treatment systems could have toxic effects on the environment and human health because of the pollutants contained. Moreover, all pieces of equipment that are not part of the authorized flow are lost opportunities for the recycling industry.
- tendency of half of the population to use electronic products older than 3 years (Todea, 2012), sometimes even until they break (especially refrigerators and washing machines). Modern equipment such as mobile phones, computers and TV sets are exempted due to the desire of having efficient products.

The European average of usage for large household appliances is 8-10 years, while in Romania is 13-17 years (Ciocoiu et al., 2010; Colesca et al., 2014). In some rural areas, the household appliances are still used over the lifespan recommended by the producer (even decades) until they become nonfunctional. This behavior occurs because of the Romanian "tradition" and the scarce financial resources which do not allow the purchase of new equipment (eg, low minimum wage, high percentage of people with a monthly income below 200 euros, etc) even if it is more efficient (Toretta et al., 2013).

- differences between urban and rural areas as regards the population behavior on WEEE. In cities people understand messages about WEEE and are prepared to contribute to improving the WEEE management by changing their behavior. In rural areas, people are less interested in the environmental impact of WEEE (Ciocoiu et al., 2011b). In this context, information campaigns and public awareness represent the most important activities of collective organization (Ecotic, RoRec, Recolamp, Environ) in the field of WEEE (Regions4recycling, 2014).
- presence in the WEEE collection field of the informal individual collectors who purchase materials from households and sell them at a very good price (Ciocoiu et al., 2011a). The informal collectors go from one household to another to collect WEEE. The same people collect WEEE disposed of in rubbish bins. Another problem is that most of the informal collectors are not registered and do not report the waste collected, which is a major obstacle to meeting the rate imposed by the European Directive (Colesca et al., 2014).

The results from studies highlight that WEEE topic continues to be sensitive for the Romanian citizen. Although campaigns such as "The Big Get Rid of Waste", "Your house is not a museum – Recycle!", "Throw it in the street!", etc., have been widely publicized (Ciocoiu et al., 2011a), the results of WEEE collection are unsatisfactory, away from the established target (Ionescu, 2011).

According to Ciocoiu et al. (2010) and Stegaroiu (2014), WEEE collection is achieved through three channels nationwide:

- a collection day established in advance in order to collect WEEE from households and improve citizens' knowledge on WEEE management.
- the "buy-back" system also called "one-to-one" or vouchers. The electronic product returned must be similar to the product purchased. To increase sales, some retailers offer a discount if the customer buys a new equipment from the same product line as the old one. According to studies (Regions4recycling, 2014; Green Report, 2011), Romanians are not interested to deliver the old product without bonus although they have purchased a new one.
- the municipal collection centers: the consumers can discard the old product, giving it to municipal collection centers without paying anything.

In Romania the authorized stores do not sell enough electronic equipment and therefore the population does not generate a sufficient amount of WEEE (Environ, 2016). Therefore, as regards the European directives implementation, the main problem is the failure in achieving the target (kilograms of WEEE

collected per capita). Despite authorities' efforts and involvement of operators responsible for collecting, the annual target was not reached until now.

A study made by Ecotic (2015) regarding WEEE collection in Romania mentions the following:

- According to Eurostat, Romania collected and treated 23,000 tonnes of WEEE in 2012, which is equivalent to 1.2 kg per capita. This value is below the initial target of 4kg per capita and well below the targets in the future.
- The amount of WEEE generated by households in 2015 reaches 7.3 kg per capita; therefore, the collection target would be 6.2 kg per capita.
- The municipal collection points and traders collect about 1.5 kg per capita (20% of WEEE generated). Taking into account that 0.7 kg per capita (10% of WEEE generated) reaches to the scrap collection centers and assuming that they apply minimum standards, only 30% of WEEE generated is recovered and treated currently in Romania (excluding the amount that reach to informal street collectors).
- The negative habits represent 2.0 kg per capita (equivalent to 27% of WEEE generated) followed in the rankings by uncertainty (1.4 kg per capita, equivalent to 19%).
- 21% of all WEEE generated (1.6 kg per capita) have been sold or reused. This situation has a negative effect on achieving the collection target.

All these aspects represent critical factors limiting the WEEE collection. Therefore, the Romanian system of WEEE collection needs improvement in order to meet the requirements of European directives. Such a system should be easy to use by consumers and allow them to dispose of WEEE with minimal effort.

4. OVERVIEW OF WEEE RECYCLING MARKET IN ROMANIA

WEEE recycling is particularly important given the dangerous substances in its composition. It should be seen from several perspectives (Hîncu et al., 2012): reuse of components, reduction of economic costs and minimal damage to the environment. Moreover, European regulations require recycling of electronic products that are plugged in or battery-powered in order to recover metals like gold and silver and avoid pollution with toxins such as lead or mercury.

According to Ciocoiu et al. (2015), WEEE recycling in Romania refers to treatment activities, in other words, recovery or disposal activities as well as product preparation before performing these operations.

Furthermore, the authors mentioned above highlight that there are not recyclers in Romania in the strict sense of the word.

Even if there are barriers regarding WEEE recycling, in Romania the WEEE treatment market have an adequate structure to ensure the achieving of recycling targets. According National Agency for Environment Protection (NAEP) in 2014 in Romania there are 78 companies authorized for e-waste treatment.

Since the end of 2015, Romania has two WEEELABEX certified companies, SC Rematholding SRL and SC GreenWEEE International SA, becoming the first country in Central and Eastern Europe which has two companies certified for proper treatment of e-waste.

In 2016, in the European Union there are more than 120 companies WEEELABEX certified for the treatment of WEEE, located in 10 EU countries, most of them in the Netherlands, France and Italy (WEEELABEX, 2016).

GreenWEEE International is one of the leading operators in the recycling field in Romania. This is the largest integrated factory of WEEE treatment in Romania and South-Eastern Europe, with a recycling capacity of 50,000 tonnes/year. The company provides collection, treatment and recycling services for all 10 categories of WEEE mentioned in WEEE Ordinance no. 5/2015, including portable batteries and accumulators (Asociația Planeta Verde, 2014).

In recent years some NGOs, collective organizations and companies have started the IT equipment reconditioning. These equipment are sold to customers with limited material possibilities, donated to associations working for the community and sustainable development.

Although there has been progress in terms of WEEE recycling, currently, according to the Eurostat statistics and to a study developed by the United Nations and Interpol, Romania ranks among the last countries in Europe as regards electronic waste recycling, along with Spain and Cyprus (Ionescu, 2015).

This position in the ranking is based on the following aspects:

- lack of information and education of the population regarding the importance of WEEE recycling both in terms of materials recovery and environmental protection (Târțiu, 2011).
- small share of the total EEE collected which are properly recycled by operators from Romania. The other amount gets into countries such as Poland, Hungary, Slovakia or Germany or remains in the Romanian recyclers' deposits because of their inability of recycling (Green Report, 2009).

For some of the 78 licensed operators to treat waste electrical and electronic equipment the main activity is scrap metal collection.

- illegal trade in electronic waste which brings great harm to the environment and recycling companies. Although there is no evidence that electronics and appliances out of use are delivered illegally in African and Asian countries and there are no accusations addressed to Romanian authorities regarding the improper monitoring of WEEE route, the low rate of collecting and recycling in our country raises some questions.
- reduction of prices of recyclable fractions amid the decrease of oil value greatly affecting the local recycling industry, which increases the charges of treatment because of WEEE lacking. This problem along with a national legislative incomplete framework will lead to delay in achieving the recycling target for 2020 (Environ, 2016).
- reluctance of Romanian population about WEEE recycling, especially when the sale as second-hand products can bring a lot of money. Moreover, the Romanian scrap dealers collect electronic equipment that can be later resold in order to get profit or for survival. According to President Ecotic statement in 2009, these appliances are illegally sold in the third world, the amount reaching 10,000 tonnes per year (Lates and Moica, 2015).
- existence of an informal recycling sector (Nicolescu and Jula, 2015) which focuses on the recovery of valuable materials as well as component reuse for second-hand equipment (Ciocoiu et al., 2011a). The amount of WEEE recycled is not reported to the authorities, and the recycling is illegal and hidden, and it is not in accordance with the standards set by the European directives (Ciocoiu and Târțiu, 2012; Popescu et al., 2014).

Overall, Romania is better positioned in terms of treatment and recycling than the WEEE collection, but remain certain measures to apply in order to increase the performance and compliance of the recycling system.

5. CONCLUSIONS

The paper gives a brief overview of WEEE management in Romania, speaking about the performance in the field which continue to be low, far from meeting the requirements of the EU directive.

Obtaining high performance in collection and recycling requires the involvement of all actors in the field: central authorities responsible for implementing the legislation, local authorities responsible for the creation of municipal collection centers, sanitation operators, collective organizations, recycling companies, civil society. Moreover, citizens should understand their role in WEEE management system and respect their obligations as EEE owner, without any expectation of financial reward.

For Romania there are three main lines of action regarding WEEE: continuous development of the collection – recycling – recovery infrastructure of waste; education of the citizens in Romania regarding the necessity of collecting and recycling of WEEE; improvement of legal and institutional initiatives for the correct and efficient regulation of this domain.

ACKNOWLEDGEMENTS

This work was supported by MEN – UEFISCDI, Joint Applied Research Projects programme, project number PN-II-PT-PCCA-2013-4-1400, contract 320/2014.

REFERENCES

- Asociația Planeta Verde. (2014). *GreenWEEEInternational.S.A. - companie membră GREENGROUP*. Retrieved September 14, 2016, from <http://www.green-planet.ro/greenweee-4/>
- Banacu C.S., Irimescu E.C., Dobrea R.C. (2014). *Eco-efficient recycling of electrical and electronic waste: analysis of the Romanian companies*. Bucharest, Romania: Proceedings of the International Management Conference "Management challenges for sustainable development".
- Bhutta M.K.S., Omar A., Yang X. (2011). *Electronic Waste: A Growing Concern in Today's Environment*. Retrieved September 8, 2016 from <https://www.hindawi.com/journals/ecri/2011/474230/>
- Ciocoiu C.N., Burcea S., Târțiu V. (2010). The WEEE management system in Romania. Dimension, strenghts and weakness. *Theoretical and Empirical Researches in Urban Management*. 6(15), pp. 5-22.
- Ciocoiu C.N., Hîncu D.L., Dobrea R.C., Colesca S.E. (2011a). Performane of WEEE management system in Romania. *Recent Researches in Urban Sustainability and Green Development*. Retrieved September 5, 2016 from <http://www.wseas.us/e-library/conferences/2011/Prague/USCUDAR/USCUDAR-28.pdf>
- Ciocoiu C.N., Dobrea C., Târțiu V. (2011b). The role of consumer behavior in e-waste management system in Romani. *Review of International Comparative Management*, 1, pp. 208-214.
- Ciocoiu C.N. and Târțiu V. (2012). The role of informal sector within WEEE management systems: a Romania perspective. *Theoretical and Empirical Researches in Urban Management*. 7(1), pp. 27-38.
- Ciocoiu C.N., Iamandi I.E., Munteanu S.M. (2015a). Proposal of Decision Criteria Based on Product Characteristics for WEEE Recycling in Romania: A Managerial Approach. *Academic Journal of Interdisciplinary Studies*, 4(3S1), pp. 672-678.

- Ciocoiu C.N., Cicea C., Tofana V. (2015b). Analysis on volumes and consumer disposal behavior for waste electrical and electronic equipment in Romania. *Managerial Challenges of the Contemporary Society*. 8 (2), pp. 141-146.
- Ciocoiu N., Hîncu D., Dobrea C., Târțiu V., Burcea S. (2013). Driving forces of WEEE management. A PEST analysis of Romania. *Environmental Engineering and Management Journal*. 12(3), pp. 1535-1548.
- Colesca S.E. and Popescu M.L. (2013). *Managing waste electrical and electronic equipment in Romania: comparative analysis with other countries in Europe*. Bucharest, Romania: Proceedings of the International Management Conference "New Management for the New Economy".
- Colesca S.E., Ciocoiu C.N., Popescu M.L. (2014). Determinants of WEEE Recycling Behavior in Romania: A Fuzzy Approach. *International Journal of Environmental Research*. 8(2), pp. 353-366.
- Crowe M., Elser A., Gopfert B., Mertins L., Meyer T., Schmid J., Spillner A., Strobel R. (2003). *Waste from electrical and electronic equipment (WEEE) – quantities, dangerous substances and treatment methods*. Retrieved September 9, 2016 from <http://www.resol.com.br/textos/Waste%20from%20electrical%20and%20electronic%20equipment%20part%201.pdf>
- Cui J. and Zhang L. (2008). Metallurgical recovery of metals from electronic waste: A review. *Journal of Hazardous Materials*. 158, pp. 228-256.
- Daedalus Milward Brown. (2010). *Echipamente electronice*. Retrieved September 9, 2016 from <http://www.ecotic.ro/wp-content/uploads/2015/07/e0a3345a2491822f066fc5bf63d5e50ce5a72473.pdf>
- Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).
- Ecotic. (2015). *Cuantificarea Deseurilor de Echipamente Electrice si Electronice generate in Romania* (engl. *Quantify Waste of Electric and Electronic Equipment in Romania*) Retrieved August 28, 2016 from <http://www.ecotic.ro/wp-content/uploads/2015/11/Studiu-DEEE-Generate-2015.pdf> WEEE-Generated-study-2015.pdf
- Ecotic and GBD Research (2016). *Evaluarea atitudinii populatiei din Romania cu privire la deseurile de echipamente electrice si electronice (DEEE) si DBA*, Retrieved September 2015 from <http://www.ecotic.ro/wp-content/uploads/2015/07/Comunicat-Studiu.pdf>
- Environ. (2016). *Gestionarea DEEE între presiunea pentru atingerea țintelor, lipsa deșeurilor și asigurarea trasabilității*. Retrieved September 2, 2016 from <http://environ.ro/index.php/ro/pagina-media/528-interviu-andrei-orban-gestionarea-deseurilor-de-echipamente-electrice-si-electronice-intre-presiunea-pentru-atingerea-tintelor-lipsa-deseurilor-si-asigurarea-trasabilitatii>
- Green report. (2009). *Adevărul: Unde se duc deșeurile electrice și electronice*. Retrieved September 12, 2016 from <http://www.green-report.ro/adevarul-unde-se-duc-deseurile-electrice-si-electronice/>
- Green Report. (2011). *DEEE-urile. Când colectarea nu ține pasul cu reciclarea*. Retrieved September 9, 2016 from <http://www.green-report.ro/deee-urile-cand-colectarea-nu-tine-pasul-cu-reciclarea/>
- Hîncu (Borisov) D., Ciocoiu C.N., Dobrea R.C., Șerban E. (2012). A statistical Outlook on E-waste on Romania. *Revista Română de Statistică*, Supliment Trim II, pp. 185-196.

- Huisman J., Magalini F., Huehr R., Maurer C., Ogilvie S., Poll J., Delgado C., Artim E., Szlezak J., Stevels A. (2008). *2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment (WEEE). Final Report*. Retrieved September 9, 2016 from http://ec.europa.eu/environment/waste/weee/pdf/final_rep_unu.pdf
- Ionescu S. (2011). *Waste as a global problem*. Retrieved August 29, from http://www.internationallawreview.eu/fisiere/pdf/02-Silvian-Ionescu-Waste-as-a-global-problem_2.pdf
- Ionescu G. (2015). *Doar o treime din deșeurile electronice din UE sunt reciclate; în România, procentul este de sub 20%*. Retrieved September 9, 2016 from <http://www.agerpres.ro/mediu/2015/08/30/doar-o-treime-din-deseurile-electronice-din-ue-sunt-reciclate-in-romania-procentul-este-de-sub-20-studiu--12-15-28>
- Kidee P., Naidu R., Wong M.H. (2013). Electronic waste management approaches: an overview. *Waste Management*, 33, pp. 1237-1250.
- Kourmousis F., Moustakas K., Papadopoulos A, Inglezakis V., Avramikos I., Loizidou M. (2011). Management of waste from electrical and electronic equipment in Cyprus – a case study. *Environmental Engineering and Management Journal*. 10(5), pp. 703-709.
- Lates D and Moica S. (2015). Comparative Analysis of WEEE Recovery Strategies and the WEEE Treatment Status in China and Romania. *Procedia Technology*. 22, pp. 840-847.
- NAEP (2014). Lista operatorilor economici autorizati sa trateze DEEE la 30.09.2014, Retrieved September 7, 2016 from <http://www.anpm.ro/deseuri-de-echipamente-electrice-si-electronice>
- Needhidasan S., Samuel M., Chidambaram R. (2014). *Journal of Environmental Health Science & Engineering*. 12(36), pp 1-9.
- Nicolescu M.L. and Jula M.N. (2015). *Analysis of household behaviour to the collection of waste electrical and electronic equipment in Romania*. Retrieved September 7, 2016 from http://www.nos.iem.ro/bitstream/handle/123456789/720/geo_2015_vol3_no2_art_003.pdf?sequence=1&isAllowed=y
- Pipaș N.I., Pică E.M., Rîți-Mihoc E., Bejan M. (2013). *Gestionarea și reciclarea deșeurilor electronice*. Retrieved August 6, 2016 from <http://stiintasiinginerie.ro/wp-content/uploads/2013/12/30-GESTIONAREA-%C5%9EI-RECICLAREA-DE% C5% 9EEURILOR-ELECTRONICE.pdf>
- Podariu M. and Filip G. (2013). *E-waste management in Romania*. Retrieved September 9, 2016 from <http://www.wseas.us/e-library/conferences/2013/Chania/AEBDb/AEBDb-39.pdf>
- Popescu I. (2014). *Study: Romanians know they can recycle electronic waste, but very few do it*. Retrieved September 9, 2016 from <http://www.romania-insider.com/study-romanians-know-they-can-recycle-electronic-waste-but-very-few-do-it/>
- Popescu M.L., Colesca S.E., Ciocoiu C.N. (2014). *Waste electrical and electronic equipment management in two EU developing countries: Romania and Bulgaria*. Retrieved August 31, 2016 from https://msed.vse.cz/msed_2014/article/339-Popescu-Maria-Loredana-paper.pdf
- Popescu M.L. (2015). Waste electrical and electronic equipment management in Romania. Harmonizing national environmental law with the UE legislation. *Procedia - Social and Behavioral Sciences*, 188, pp. 264 – 269.
- Regions4recycling. (2014). *WEEE Recycling. Ilfov County*. Retrieved August 5, 2016 from http://www.regions4recycling.eu/upload/public/Good-Practices/GP_Ilfov_WEEE.pdf

- Romanian Ordinance. (2015). *The Governmental Emergency Ordinance no. 5/2015 regarding Waste Electrical and Electronic Equipment, published in the Official Gazette of Romania no. 253/16.04.2015.* Retrieved September 2015 from http://www.anpm.ro/documents/12220/2043942/OUG+5_2015+privind+de+C5%9Feurile+de+echipamente+electrice+%C5%9Fi+electronice.pdf
- Rudareanu C. (2014). New challenges for the WEEE management system in Romania as a result of the recast of the WEEE directive. *Contemporary readings in law and social justice*, 6(1), pp. 518-526.
- Stegarioiu C. (2014). Policies for green computing and e-waste – The Romanian case. *Annals of the Constantin Brâncusi University of Târgu Jiu, Economy Series*. 6, pp. 230-235.
- Târțiu V. (2011). Selective collection of municipal waste in Romania: characteristics and challenges. *Management Research and Practice*, 3(3), pp. 53-62.
- Todea V. (2012). Obligații și evoluție în domeniul DEEE. Retrieved August 31, 2016, from <http://stiintasiinginerie.ro/wp-content/uploads/2013/12/67-OBLIGA%C5%A2II-%C5%9EIEVOLU%C5%A2IE-%C3%8EN-DOMENIUL-DEEE.pdf>
- Toretta V., Ragazzi M., Istrate I.A., Rada E.C. (2013). Management of waste electrical and electronic equipment in two countries: a comparison. *Waste Management*, 33, pp. 117-122.
- WEEELABEX (2016). List of attested WEEELABEX Treatment Operators, Retrieved October 2016 from http://www.weelabex.org/conformity-verification/operators/#weelabex_operator_list