

## MOUNTING E-WASTE OF EUROPE: POLICIES, MANAGEMENT PRACTICES, AND BUSINESS SOLUTIONS

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### Abstract:

*EU is among the communities recognized for their high environmental profile. This could be surprising for an informal recycler from Nigeria and Ghana who regularly receives out of use computers from EU member states and lights up open fires to recover materials. Departing from this paradox the paper attempted to build up a framework for the analysis of e-waste management options. E-waste is the fastest growing waste stream in Europe, although waste generation in general is an important environmental concern. There are huge differences among member states, although the hierarchies could vary a lot. The European waste policy framework is quite well developed with a strong branch for WEEE. Nevertheless, most of WEEE is dumped in third world countries. The initiative of several companies to build up a European Recycling Platform is an important step to improve effectiveness in e-waste management. The widespread use of the shipment business solution is however evidence that it is still not cost effective. The analysis of the typology and spatial patterns of waste generation, the current waste policy framework, the main waste management practices employed in case of WEEE, and the business solutions resulted in a number of observations. Among these, we stress the urgent need for improved data collection procedures, reporting guidelines and development of simple and effective control tools.*

**Key words:** e-waste, European policy, take-back system, clearing-house system, ERP, export

**JEL Classification:** Q53

### 1. INTRODUCTION

Waste generation is one of the most visible and concerning environmental effect of the development. Its path exceeded the capacity of technical and managerial solutions for processing toward neutralization. This is also true for the European Union (EU), although it is recognized for its leadership in environmental matters.

Waste of electric and electronic equipment (WEEE) or e-waste is one of the major challenges in this field because of it is among the highest growing waste type. The total of WEEE will grow annually with an estimated 2.5 to 2.7%, reaching 12.3 million tones per year in 2020 (Sawhney et al., 2008). Total waste generation is growing with an annual rate lower than one percent, while the annual rate of municipal waste is 2% (EEA, 2008).

The Basel Convention bans the trans-boundary shipment of hazardous waste and its transfer to developing economies. Nevertheless, there is no restriction for computers or other electronic devices that are functional to be exported and surveys conducted by EU institutions and NGOs revealed that these are in fact e-waste shipments escaping legal restrains for waste management. In other terms, there are a number of factors that transform trans-boundary e-waste shipment in a business solution under the one of the "greenest" administration of the world.

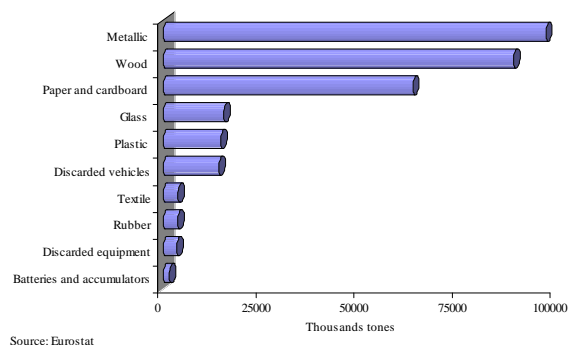
These factors are the subject of our analysis which aims to identify and describe them by over posing data and information coming from the latest reports on waste and especially e-waste policies, management practices, and business solutions. In order to perform this we will start by framing e-waste's pattern in the European waste generation picture. Further the European policies that inflict on waste will be "dismantled" and widespread management practices described. The underpinning economic reasons that encourage trans-boundary shipment of e-waste among EU Member States and to the developing world (non-OECD countries) will be given a special focus. Finally we will conclude by outlining several strengths and drawbacks of current policy framework.

## 2. WASTE GENERATION AND THE E-WASTE OUTLOOK

Waste is the cause for the most common environmental problems: air pollution, stream contamination, land occupation inflicting on human health. Meanwhile waste is a channel for resource loss by blocking down valuable materials that are less and less available worldwide.

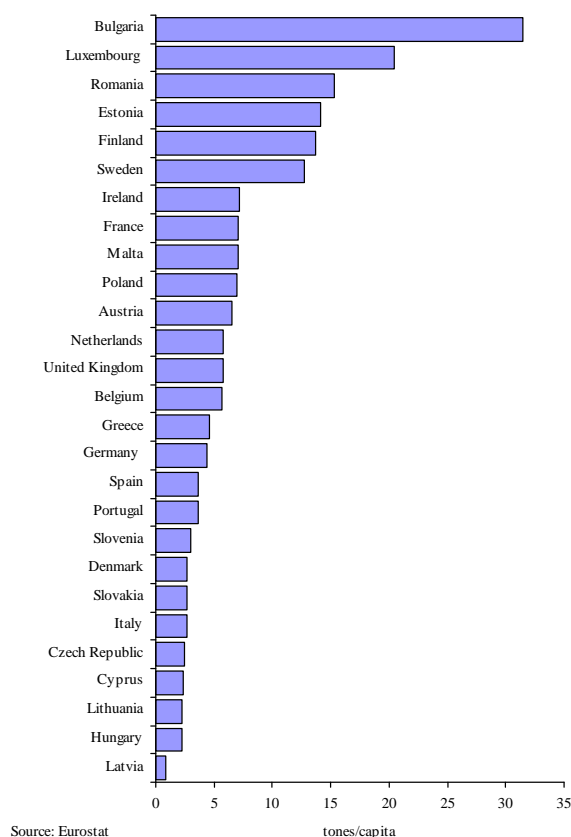
The European economy is a highly resource intensive one, which uptakes large amounts of raw materials, energy, and land in order to perform properly. According to the European Environmental Agency (EEA), around one third of the materials used are turned into waste and emissions. Each citizen produces four tones of waste per year, out of which 520 kg is household waste entering municipal waste management systems.

As long as waste types are considered, construction and demolition is on the lead, along with manufacturing activities. Municipal waste is also of concern since almost half of it (45%) is still land filled (EEA, 2010). Between three and four percent lies the proportion of hazardous waste which presents special risk for human and environmental health. In statistical records the share of recyclable waste and discarded equipment is about 10%. This fraction is dominated by metallic wastes, closely followed by wood wastes and paper and cardboard wastes (fig.nr.1).



**Figure no. 1. Structure of recyclable waste including discarded equipment in EU-27**

E-waste falls in the discarded equipment category. Although is not very important in the current structure of wastes the estimated annual growth rate (2.5 to 5%) is large enough to give more and more weight to this issue in the policy debate.

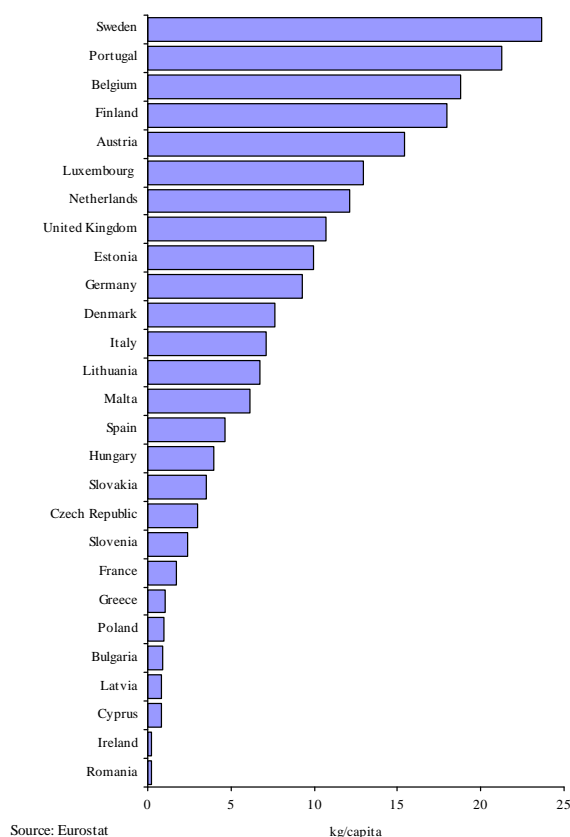


**Figure no. 2. Waste generation per capita in EU-27**

Across Member States there are differences in waste generation patterns. The largest amounts of waste are generated in France, Germany, and the United Kingdom and account for 39% of the total waste generated in EU. Nevertheless, the per capita amount situates these countries in a “milder” position (fig.nr.2) testifying for their efforts towards eco-efficiency.

It is interesting to notice that Romania is among the leading countries in terms of waste generation. Per capita waste generation puts in the third position among EU-27.

There is no specific classification in Eurostat statistics for WEEE, but considering the existing definitions this category could be assimilated with the discarded equipment excluding discarded vehicles and batteries and accumulators waste. On average each EU-27 citizen generates annually 7.5 kg of discarded equipment. The range of value is comprised between 0.2 kg/capita/year in Romania and 23.6 kg/capita/year in Sweden.



**Figure no. 3. Discarded equipment wastes generation per capita in EU-27**

Leading positions are occupied also by Finland, Belgium, and Austria (fig.nr.3). It is surprising to find Portugal in the second position. One possible explanation could be the changes in recording data. This factor is reported by several authors (Ioan and Radulescu, 2008; Sawhney et al., 2008; Nordbrand, 2009; Fischer and Davidsen, 2010) as sources of bias in the analysis of waste, and especially e-waste management.

These figures are much higher than the total amount of discarded equipment considered previously (3.4 million tones), but they were produced using independent surveys which could take in account patterns that escape from official statistics. Nevertheless, the estimates for the per capita generation of e-waste fall on similar figures as those of statistics. Thus Nordbrand (2009) gives 24.0 kg/capita/year as maximum level of e-waste generation, which is very close to the 23.6 kg/capita/year derived from Eurostat data in case of Sweden, but almost three times the average value.

Reports on e-waste management estimate the amount generated in the EU to be of about 8.3-9.1 million tones (Nordbrand, 2009), representing around four percent of the municipal waste (ECT/RWM, 2006).

The e-waste issue climbed on the environmental policy agenda because of several reasons. Firstly, the amount of e-waste is expected to increase further. The annual growth rate falls somewhere between 2.5 and 5.0 percent leading to 12.3 million tones e-waste to be generated in 2020. These figures make WEEE the fastest growing waste stream in EU.



**Figure no. 4. E-waste roadmap in EU-27**

Source: European Commission – DG Environment

Secondly, the concern is amplified by the lack of treatment capacities in EU countries. The European Commission signals that only 33% of e-waste is treated properly, while 54% is leakage toward third world countries and 13% is land filled (fig.nr.4). This could be also interpreted as missing the business opportunity for EU waste industry and related employment and increased threat for environmental health.

Thirdly, through e-waste materials with high market value are lost and should be recovered from the countries that assume the risks of unsafe processing for lead, copper, aluminum, iron, and gold.

### 3. EU POLICIES

In EU's vision waste management should be regarded as part of a broader picture: material use. Fact is, the fourth assessment report prepared by the EEA where is no chapter dedicated to waste. This issue is treated as a matter of sustainable production and consumption. Departing from this vision, the EU attempted to develop a strategy in order to arrive at fair, non-discriminatory access to international supplies, to create a frame for the sustainable extraction of its own supplies and to arrive at a more efficient use of materials and extensive recycling in the EU.

The European waste policy is outlined in the European Waste Framework Directive and further detailed by types of waste and materials. The policy is largely based on the *waste management hierarchy* and the principle of *extended producer responsibility*.

The EU also developed thematic strategies on *prevention and recycling of waste* and on *sustainable use of natural resources*. Work is going on the development of Integrated Product Policy which attempts to minimize the environmental impact of products during their entire lifecycle. There are five basic principles to underpin this policy:

- reflection on the lifecycle;
- cooperation with the market;
- the involvement of all stakeholders;
- permanent improvement; and
- diverse range of policy tools.

The main policy measure concerning e-waste in EU is the WEEE Directive (Directive 2002/96/EC). This is completed by the RoHS Directive (Directive 2002/95/EC) on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The WEEE directive already passed through a revision phase that changed the targets and enforcement conditions. The underlying objectives of the WEEE Directive are the following:

- divert WEEE from landfills to environmentally sound re-use, recycling and other forms of recovery;
- preserve resources - materials and energy;
- producer responsibility;

- harmonize national measures on the management of WEEE – common minimum standards of treatment.
- provide for a free producer take-back scheme for consumers of end-of-life equipment;
- improve product design with a view to both preventing WEEE and to increasing its recoverability, reusability and/or recyclability;
- provide for the establishment of collection facilities and separate collection systems of WEEE from private households;
- provide for the establishment and financing of systems for the recovery and treatment.

For the implementation, each Member State developed compliance schemes as it is presented in table no.1.

**Table no. 1. Compliance schemes for the implementation of the WEEE Directive**

Member State	Compliance Schemes
Austria	UFH-Emweltforum Haushalt, ERA, ERP
Belgium	Recupel
Cyprus	Chamber of Commerce
Czech Republic	Envidom, REMA, RETELA
Denmark	EPA El Retr
Estonia	EES Ringlus
Finland	SERTY, Elker Oy, SELT, FLIP ry, ICT
France	Eco-systemes, ERP, Syndicat do l'eclairage
Germany	EcologyNet Europe, ERP, ProReturn
Greece	Recycling of Appliances S.A.
Hungary	ELECTROCORD, ElektroWaste, Okhomat
Ireland	WEEE Ireland, ERP
Italy	ANIE, ecoR'it
Latvia	LZE, CECED
Lithuania	INFOBALT, CECED, LT
Luxembourg	ECOTREL
Malta	NA
Netherlands	NVMP, ICT, Sticking Lightrec
Poland	CECED, KIGEiT
Portugal	Amb3E
Slovakia	Ekolamp, Envidom, SEWA
Slovenia	European Lamp Federation Take Back
Spain	Ecofimatica, Ecolect, Ecotic, Sig Lamparas, Tragamovil
Sweden	El Kretsen
UK	Valpa, REPIC

Source: Savage, M. (eds.) (2006), *Implementation of the Waste Electric and Electronic Equipment Directive in the EU 25*, Technical Report Series, Ref: EUR 22231 EN.

The enforcement was made with several delays caused by historical amounts of e-waste, overlapping with areas of EU legislation (hazardous waste regulations, trans-frontier shipment regulations, health and safety related marking).

In addition to the delay in implementation, the initial form of the directive was unable to cover issues like e-waste leakage toward third world countries, and was criticized for increasing administrative burden on producers and lack of clarity.

The revision aims to enforce changed collection target, better enforcement, and changed recycling/reuse target. Thus, for collection it is provisioned that 65% percent of the marketed electric and electronic equipments in the two preceding years. For the better enforcement it is

envisaged the export and treatment, and the minimum monitoring requirements. All reuse targets increase with five percent.

The RoHS Directive seeks to reduce the environmental impacts of WEEE throughout all stages of the equipment's lifecycle, particularly at the end-of life stage, by encouraging the end-of-life management of the product, eco-design, life cycle thinking and extended producer responsibility.

#### 4. MANAGEMENT PRACTICES

Across EU there are three main types of e-waste management systems: take-back systems (collective –model), Clearinghouse-model and European Recycling Platform (ERP).

*Take-back systems.* Such systems consist in a dominant national system which is responsible for collection, recycling and financing of all (or the vast majority) of WEEE within national boundaries. This is the general approach in the countries with established WEEE systems in Europe. Underlying principle is that the stakeholders in the electronics' chain of commerce should manage the end-of-life system, and that stakeholders' responsibilities should be proportionate to their ability to implement and affect the system.

The adoption of take-back systems is motivated by certain advantages. According to Savage (2006), these are mainly as follows:

- Provide a predictable source of funds, pays for all returned products, adhere to principles of environmentally sound management, provide convenient collection opportunities, and do not place an extra financial burden on local governments;
- Uses every means possible to minimize costs employing competitive contracting for services, working with existing businesses and organizations, stimulating product design improvements to lower recycling costs, encouraging an extensive collection network to improve economies of scale etc;

The system's drawbacks are that its design and implementation generate higher costs than the other options and it does not encourage the reduction of e-waste amount (violating the hierarchy principle of waste management).

*The clearing-house model.* The clearing house model is again a national framework in which multiple partners (producers, recyclers, and waste organizations) can provide services. The government ensures that there is a register of producers and defines the allocation mechanisms, and reporting and monitoring systems.

Although the system has an important potential for cost savings, lack of experience and data to make a good analyses and comparisons with existing collective schemes make it less attractive. In addition, in case of smaller markets the benefits of market mechanisms are not big enough.

*The European Recycling Platform.* This is an initiative undertaken by Hewlett Packard, Sony, Electrolux and Braun to develop Pan –European compliance structures. The ERP does not need to transport WEEE outside of the country of origin, but needs to develop pan-European agreements with networks of providers with operations in all ERP countries. Supporters of such an initiative regard it as an important opportunity to develop much-needed alternatives to the national schemes, to create competition, which in turn, will stimulate efficiency and cost reductions. The high complexity of the system and differences in national legislation are the main barriers that prevent this system to become a powerful competitor of national systems.

#### 5. BUSINESS SOLUTIONS

Despite increasing legal restraints EU continues to leak large amounts of e-waste. Although it is highly difficult to monitor what Greenpeace called the "hidden flow" there is an official recognition of the fact that many electric and electronic equipment is shipped within and outside

EU in order to be reused, but it ends up in unsafe landfills and open fire recycling sites with highly polluting potential.

This reality proves the fact that there is a vision difference between government and businesses about how waste should be managed. Some aspects are true for all types of waste, but the issue becomes sharp and very visible when the flow of computers invaded third world countries (Ghana, Nigeria, and Egypt) and China. Thus while for government the solution is the establishment of national collective and recycling system that improve the possibilities to enclose material loops, from a business perspective it is more profitable to export waste.

This is not surprising at all considering the lack of safety standards in waste importer countries. What is surprising is the fact environmentally progressive communities agree to accept the governance of economic reasons. Fact is there are many possibilities to interpret legislation referring to e-waste, but in the framework of proactive environmental behavior it is expected that EU is a less permeable for e-waste leakage.

The export of e-waste is difficult to be tracked down since the commodity to be traded is not waste, but computers, TV-sets, monitoring devices, printers etc. that are still functional and could help less developed communities to catch up with the modern world. This is the most common philosophy to justify the export of e-waste to the third world.

The export statistics were browsed by several organizations in order to find the evidence of waste export. The main technique applied is to compare the quantity and the value of exported goods. Thus it was demonstrated that TV-sets were exported at a very low price compared to their market value. The average value of color television sets exported from EU to Africa is ranging between 28 and 64 euro. The market value of this commodity is 339 euro. This results in an indication that the export consists of used products. According to legal provisions these products should be functional. Nevertheless, there is not realistic to assume that a very detailed control will be performed at any custom. A testimony of a Swedish environmental crime expert is relevant in this respect:

“In order to know exactly what is in these shipments, you would have to physically inspect them. In the early days we looked at everything, we opened every box to see if the content agreed with the declaration, but this is not feasible anymore. The trade flows are so much bigger and processing has to be done quickly”

*Martin Johansson, specialist in environmental crimes at the Swedish Customs*

The size of this business solution is difficult to be estimated. Most of the authors cite trade statistics as the main data source, but ETC/RWM stresses that the information to be derived from such sources reflects only part of the problem.

Nordbrand (2009) reports that the “hidden flow” accounts for the larger part of the e-waste stream (60-75%). Other figures tell a worrying story about the dynamic of exports. It is estimated that e-waste export tripled from 1997 to 2005. ETC/RWM suggests that most registered exports take place between member states, while exports to countries outside the union are less than 10% and relatively stable. According to the statistics, main recipient countries are countries in Asia and South Eastern Europe (Albania, Bulgaria, Bosnia-Herzegovina, Croatia, the Republic of Macedonia, Romania, Turkey, Serbia and Montenegro). There is little knowledge about what is happening in these countries – proper treatment or re-export.

## 6. CONCLUSIONS

Waste generation is among the most inconvenient follow ups of the modern lifestyle. The paper highlighted several aspects of e-waste generation and management in an European framework pursuing to find strengths and weaknesses potentially useful in the ongoing public policy debate.



EU generates almost three billion tones of waste each year. The management of this huge amount is framed by a quite well developed policy with specific directives, thematic strategies, and a wider contextual vision on the entire material flow.

E-waste or WEEE is a relative recently concerning category because it is the fastest growing waste stream. Although the category is addressed by specific directives, one major problem is the leakage of 54% e-waste toward third world countries. Fact is the current legal framework in EU makes e-waste export a very attractive business solution, despite increase in environmental awareness and proactive environmental behavior.

Improving the policy measures to fight with illegal exports depends on a wide range of factors. Nevertheless, considering the facts revealed in the paper's sections, we conclude that one major area for research and policy making is to increase clarity of definitions in such a manner that custom controls to be simple and effective.

## REFERENCES

1. Bran, F. (2002), *Componenta economica a deciziilor de dezvoltare economica*, Bucharest, ASE Publishing.
2. EEA (2009), *Waste without borders in the EU?*, Report nr.1
3. EEA (2008), *Fourth assessment*, Chapter 6: Sustainable production and consumption.
4. Fischer, C., Heddal, N., Carlsen, R., Doujak, K., Legg, D., Oliva, J., Sparvath, S.L., Viisimaa, M., Weissenbach, T., Werge, M. (2008), *Transboundary shipments of waste in the EU. Developments 1995-2005 and possible drivers*, European Topic Centre on Resource and Waste Management (ETC/RWM).
5. Fischer, C., Davidsen, C. (2010), *Europe as a Recycling Society. The European Recycling Map*, European Topic Centre on Sustainable Consumption and Production.
6. Ioan, I., R dulescu, C.V. (2008), *Managerial dimension of using LCA*, Quality – access to success, nr.94.
7. Ioan, I., R dulescu, C.V. (2008), *Assisting environmental compliance*, Quality – access to success, nr. 9, pp.46-50.
8. Nordbrand, S. (2009), *Out of Control: E-waste trade flows from the EU to developing countries*, SwedWatch.
9. Rojanschi, V., Bran, F. (2002), *Politici si strategii de mediu*, Bucharest, Economica Publishing
10. Sawhney, P., Henzler, M., Melnitzky, S., Lung, A. (2008), *Best practices for E-waste Management in Developed Countries*, Adelphi Research.