The "Green e-Waste Channel" as an environmentally friendly and socially responsible concept to manage e-waste in emerging economies

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Abstract

As a result of the Swiss Knowledge Partnership in e-Waste Recycling, the concept of a "Green e-Waste Channel" was introduced in several cities in China, India and South Africa, aiming an environmentally friendly and socially responsible management of e-waste. The concept embraces the whole infrastructure associated with an e-waste management system. It starts when the consumer decides to dispose off his equipment, thus at the collection of discarded equipment, and ends with the final disposal of residues. A detailed case study was performed in the Gauteng province in South Africa with focus on IT equipment. The case study demonstrated that the Green e-Waste Channel is a suitable general concept for developing countries, when taking into account the specific context and needs of a current local situation.

Keywords: e-waste, recovery, recycling, refurbishing, Gauteng, South Africa, SWOT analysis, emerging economies

1 Introduction

Awareness is growing regarding risks associated with waste electrical and electronic equipment (e-waste) in developing countries. As emerging economies such as South Africa are producing more and more of their own e-waste, sustainable recycling systems are not in place (Widmer et al. 2005). As a result of the Swiss Knowledge Partnership in e-Waste Recycling (http://www.ewasteguide.info) the concept of a "Green e-Waste Channel" was introduced in several cities in China, India and South Africa, aiming an environmental friendly and social responsible management of e-waste.

2 General concept of the Green e-Waste Channel

The concept of the "Green e-Waste Channel" embraces the whole infrastructure associated with an e-waste management system. It starts when the consumer decides to dispose off his equipment, thus at the collection of discarded equipment, and ends with the final disposal of residues. In between lies a whole chain of recycling activities, which include the recovery of functions via refurbishment and re-use, the recovery of material via pre-processing and refining and the recovery of energy via thermal processes (Figure 1).
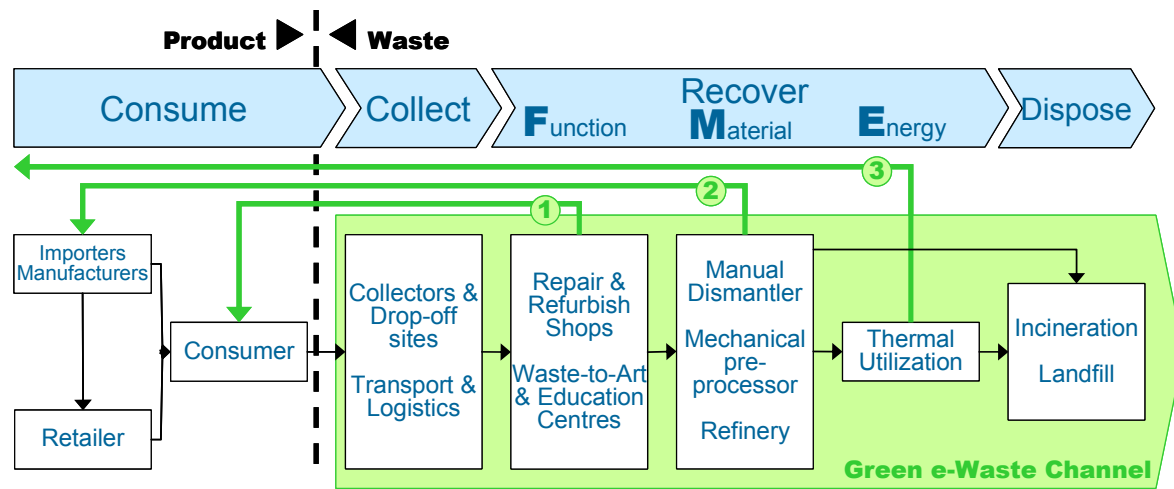
Figure 1: General concept of the Green e-Waste Channel.

The framework of the channel is given by interventions and control mechanisms regarding:

- policy & legislation (e.g. via take-back obligation, disposal obligation, auditing & standards, licenses & permits)
- business & finance (e.g. via extended producer responsibility, recycling fee, recycling funds, contracting policies)
- technology & skills (e.g. via research & development, technology transfer, skills development, education & awareness creation)

The Green e-Waste Channel aims to maximize the overall value by:

- stimulating small and big businesses
- creating jobs, if possible locally, and improving job quality
- improving skills
- creating awareness
- increasing the life-span of products
- facilitate access to technology
- reducing emissions to the environment
- increasing the re-use of raw material
- reducing the volume of residues for final disposal

3   Case study South Africa

A detailed case study was performed in the Gauteng province in South Africa where a Green e-Waste Channel was launched in October 2006 and currently is being further developed (Bondolfi 2007). The current situation was assessed through stakeholder interviews, questionnaires for consumers and the examination of available local data. Problems and undesirable operations of the current situation were identified and consequently translated into objectives that should be achieved through the concept of the Green e-Waste Channel. These objectives aim to satisfy the three main aspects of sustainable development: be environmentally friendly, economically sustainable and socially responsible. The study focused on computers and associated IT equipment only.

3.1 Current situation

Waste legislation in South Africa is well established and basic municipal waste management systems are in place in urban and some rural areas. However, there is no specific legislation for the management of e-waste, although some statutes can be read as having a bearing on e-waste (Dittke 2007, Finlay 2005, Widmer et al. 2005). A schematic overview of the current e-waste recycling situation with the identified undesirable operations is given in Figure 2.
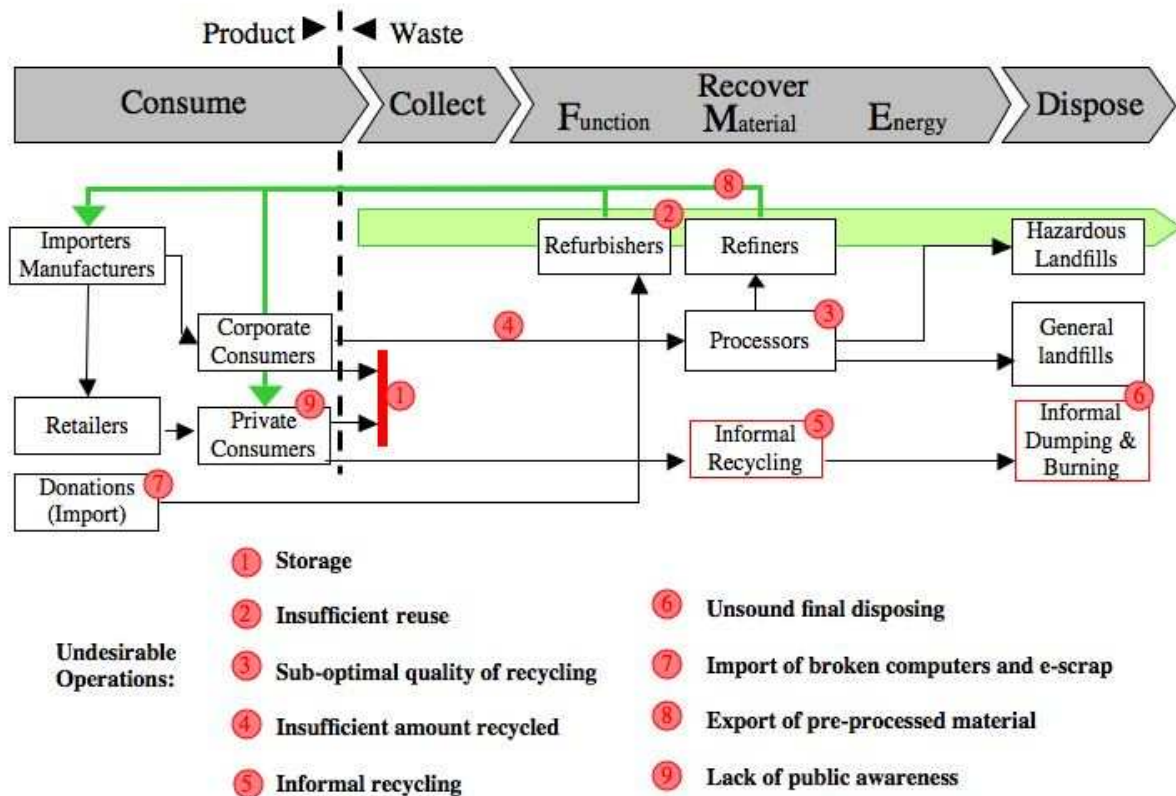

Figure 2: Schematic overview of the current e-waste recycling situation in South Africa.

Storage: Recycling in South Africa is limited by the lack of sufficient collection and take-back system, the market being currently corned by present recyclers. There are different reasons why end-of-life equipment mainly stays in storage, such as contradictory write-off restrictions for the municipalities. However the main reason is the lack of a proper take-back system. Therefore only a fraction of the e-waste (estimated 10%) currently finds its way to recyclers. Thus main objective should be an efficient collection and take-back system.

Reuse: In contrast with many home appliances, life cycle energy use of a computer is dominated by production (81%) as opposed to operation (19%) (Williams 2004). Extension of usable lifespan by refurbishment and reuse is thus a promising approach regarding energy use and other environmental burdens associated with manufacturing. In addition reuse reveals many social advantages, such as the creation of skilled and low health risk jobs and better access to IT equipment for low income classes. Therefore the inclusion of refurbishment and the encouragement of reuse should be considered in the design of a Green e-Waste Channel.

Formal recycling: A few major players tightly control the recycling industry. Their operations do not require any license (except precious metal recovery) and there are no standards or minimum requirements to be followed. Thus often only minimal environmental and health & safety standards are followed. Following economic imperatives, the recyclers in South Africa are recovering only those materials that can be sold at a profit in a "cherry picking mentality". Hazardous non-profitable components such as lead containing CRTs, batteries, flame retardant plastics and others are presently disposed off at landfill sites all over South Africa. Although formal South African recycling companies operate on a quite high technological level, the enforcement of standards should be a middle term objective.

Informal recycling: Little informal e-waste recycling is taking place, probably due to the strict regulations that have historically controlled the trade in gold and other precious metals. Thus health and environmental risks from such operations are limited for the time being to unsound processes, such as open burning of wires and breaking of CRT screens to extract the copper, the rest of the monitor being dumped. There are rumours about electrochemical processes being installed in recycling facilities; while this is known as a problematic process, it is not clear to what extent this activity is illegal. However, as awareness is rising about threats associated with e-waste, e-waste also will bee seen as a valuable waste fraction by the public and the country might risk seeing more and more informal activities. Therefore an important objective for a future system is to avoid the development of an informal recycling sector.

3.2 Aimed long term situation: the Green e-waste Channel

Based on the general concept of the Green e-Waste Channel and the situation analysis in the Gauteng province in South Africa, a model was proposed to reflect the aimed long-term situation (Figure 3). This includes:

a) Link existing business efforts

b) Establish the missing infrastructural elements

- take-back opportunities at existing drop-off sites and buy-back centres
- take-back opportunities at retailers
- transport and logistics system

c) Promote value-adding elements

- repairers and refurbishers
- waste-to-art & education centres

d) Defining a suitable framework with intervention and control mechanisms

- managing process through a system operator
- legal enforcement through the government
- facilitative process through academic (e.g. research) and non-governmental organizations (e.g. eWASA[1], awareness rising, etc.)

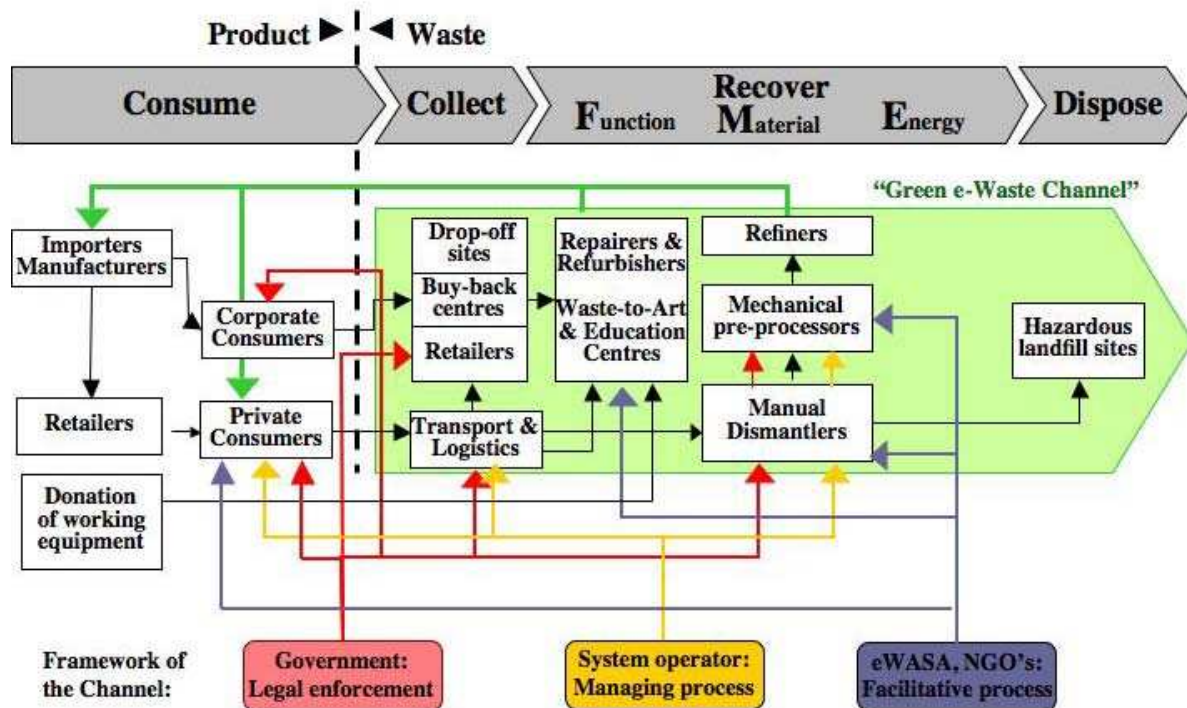[1] e-Waste Association of South Africa (http://www.e-waste.org.za)

Figure 3. The South African Green e-Waste Channel: aimed long term situation.

3.3 SWOT Analysis of the aimed long-term situation

Possible positive and negative impacts on of the proposed model of the Green e-Waste Channel were assessed with a SWOT[1] analysis. Strengths and weaknesses are associated with impacts from internal factors. Opportunities and threats are associated with impacts from external factors. The below is a summary of the most important impacts. A more detailed analysis can be seen in Bondolfi 2007.

Strengths:

- Processors and refurbishers already exist and are willing to expand.

- A take-back system can be incorporated into an existing and well-organized collection system (e.g. drop-off sites / garden sites) in most municipalities.

- Bearing in mind South Africa's history and it's current political and economical upraise, initiatives with skills and job creation potential are supported and awarded by politicians, the industry, and the society.

Weaknesses:

- Double edge sword with awareness rising: some stakeholders might pay more attention to the valuable part of e-waste, with environmental and social aspects coming after.

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[1] strength, weakness, opportunity, threat – see Srivastava et al. 2005

- The big security issue might threaten an efficient take-back and collection system (stealing of equipment at the collection site, robbing of intermediates where cash money changes hands, etc.).

- Already well-established recyclers don't necessarily see the need to be part of a system and might try to avoid a more stringed control system as proposed by a Green e-Waste Channel.

Opportunities:

- Problems as seen in other developing countries, such as import of used computers or informal recycling activities currently are limited in South Africa. However there is growing evidence of such malpractices. Thus the time is right to start with a green e-waste channel, avoiding a future negative development.

- Due to South Africa's demographical structure there is a high demand for low budget IT equipment, thus making the second-hand, refurbish and reuse market attractive.

- South Africa is a gold mining country and thus refining infrastructure for precious metal recovery and its trade is in place. Existing refineries are currently investigating in the feasibility to invest in their facilities for e-waste processing.

Threats:

- Due to the fast economical growth in South Africa, there is a danger that a Green e-Waste Channel is building up on conditions which might change dramatically in the future (e.g. labour costs, consumer behaviour).

- Producers might not be interested in encouraging reuse. Reasons may include the fear of brand damage due to poor functioning second-hand equipment and less sales of new equipment.

- A more efficient recycling system will stimulate the recycling industry. While competition might have a positive effect on costs it might also open doors for illegal activities, such as "laundering" of stolen gold from mines and import/export of hazardous waste.

4   Conclusion

A Green e-Waste Channel reveals many opportunities with advantages for all stakeholders: a) sufficient material can be provided to processors and refurbishers, b) safe jobs can be created, c) a convenient solution can be provided for the consumers, d) a solution for end-of-life equipment can be offered for the producers, and e) the channel helps respecting national and international regulations. In addition the current situation in South Africa is favourable for a successful introduction of a Green e-Waste Channel. The e-waste situation is relatively advanced with some experienced recyclers in the market. In contrast to other emerging economies South Africa still sees limited waste import and informal recycling, but growing evidence of such malpractices. And in general there is a move towards more sustainable waste management.

The general concept of the Green e-Waste Channel seems suitable as a starting point to be adapted to other emerging economies. By taking into account the different context and needs, the current situation of a country can then be translated into specific objectives for the implementation of a Green e-Waste Channel.

References

Bondolfi, A. (2007). The Green e-Waste Channel: model for a reuse and recycling system of electronic waste in South Africa. Master thesis, University of Lausanne and Empa St.Gallen, Switzerland, 126p. (www.ewaste.ch/Bondolfi_2007_UNIL-Empa)

Dittke, M. (2007). A review of South African environmental and general legislation governing e-waste. Cape Town, South Africa, report written on behalf of the e-Waste Association of South Africa: 42p. (www.ewaste.ch/Dittke_2007_eWASA)

Finlay, A. (2005). E-Waste challenges in developing countries: South Africa case study, APC "Issue papers". Serie 2005, November. 1-22. (www.ewaste.ch/Finlay_2005_APC)

Srivastava PK, Kulshreshtha K, Mohanty CS, Pushpangadan P, and Singh A. (2005). Stakeholder based SWOT analysis for successful municipal solid waste management in Lucknow, India. Waste Management. 25. 531-537.

Widmer R., Lombard R., (2005): e-Waste assessment in South Africa – a case study of the Gauteng province. Swiss Knowledge Partnerships in e-Waste Recycling, Swiss States Secretary of Economic Affairs (seco) and Swiss Institute of Material Sciences and Technology (EMPA). St.Gallen, Switzerland. (www.ewaste.ch/Widmer_2005_Empa)

Widmer, R., Oswald-Krapf H., Sinha-Khetriwal D., Schnellmann M., and Boni H. (2005). "Global perspectives on e-waste." Environmental Impact Assessment Review 25(5): 436-458.

Williams, E. (2004). "Energy Intensity of Computer Manufacturing: Hybrid Assessment Combining Process and Economic Input-Output Methods." Environmental Science & Technology 38(22): 6166-6174.