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SUPPORTING RECYCLING AND SECONDARY RAW MATERIAL RECOVERY STRATEGIES IN METROPOLITAN AREAS IN AFRICA – DEVELOPING AN E-WASTE IMPLEMENTATION TOOLKIT

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KEY FINDINGS:

Electronic waste is one of the fastest growing waste streams globally. It is a waste stream that affects not only developed countries, but also developing countries. However, the recovery of end-of-life products in developing countries remains low, with the result that these products are typically disposed of at poorly operated dump sites. Where dismantling and recycling does take place, this is often done using very basic treatment techniques, which have the potential to cause significant environmental and human health impacts. The African cities participating in this EWIT Horizon 2020 project exhibit an active informal or semi-informal sector, which is already retrieving value from e-waste. However, this value is not fully maximized due to the way in which the supply chain is organized. The value is not fairly distributed along the value chain, due to a high number of intermediaries, with the result that the value is retained at the 'highest' rungs, which are furthest from the primary source of e-waste generation and collection, and by those less involved in the risks associated with its recovery and dismantling. Furthermore, developing countries face poor traceability of e-waste flows, with no to limited identification of actors involved in the value chain. Volumes recovered remain small, and highly unstable, due to the artisanal nature of the system, resulting in a small number of local buyers, which means that hardly any value remains within the local economy. Closing the loop on e-waste in African metropolitan areas requires developing this value chain, through more robust collection systems, implementation of appropriate technology, increasing awareness, adoption and enforcement of legislation and financing systems, and improved access to local and international markets. Where limited or no local markets exist, or where economies of scale cannot be realised for a particular e-waste fraction to support the investment in local technologies, smaller, mobile technologies and regional treatment hubs supported by controlled transboundary movement and shared solutions at a transnational level, must be considered. In addition, repair and refurbishment can play a valuable role in the value chain and must be strengthened, thereby supporting local apprenticeship and the development of local artisanal skills. Synergies with local industry, in particular the mining and primary material processing sectors, should be sought wherever possible to retain end-of-life products for as long as possible in the local value, before exporting into international markets.

INTRODUCTION

This policy brief presents a summary of the key findings of the Horizon 2020 project, entitled “Developing an e-waste implementation toolkit to support the recycling and the secondary raw material recovery strategies in metropolitan areas in Africa.” The short-term objectives of the EWIT project, are to develop a comprehensive mapping of e-waste management baseline data and capacity of African metropolitan areas; collect and analyse the most relevant experiences, best practices, processes and legal tools representing the e-waste value chain; and develop a dynamic and easy to use information and service portal that will provide practical support for the design and development of e-waste collection and recycling systems in Africa. Through these actions, it is hoped that African cities

will be able to – increase e-waste recycling opportunities to generate greater local economic value and new jobs; reduce the environmental and human health impacts associated with poor e-waste management; improve the effectiveness and working conditions of informal and formal actors in the e-waste value chain; strengthen partnerships with European governments and industries to support technology transfer, minimise illegal transboundary movements, and strengthen markets; drive improvements in the collection, recycling and recovery of materials from e-waste; and develop the conditions, actions and business case necessary to implement effective e-waste recycling systems in metropolitan areas. Thereby generating strong and measurable economic benefits through the recovery of critical raw materials for Europe and Africa.

THE WEEE VALUE CHAIN

The e-waste value chain starts with collection, continues with good recycling and should be connected, according to a “circular economy” to selected end-user industries that benefit from the availability of secondary raw materials. The benefits may be considerable if the value chain is placed within the local economy, and the social and economic value is retained within the local value chain for as long as possible before resources are exported into global markets.

However, in most African countries, the e-waste value chain is a foggy chain consisting of many intermediaries who

drain much of the value (Figure 1). The current e-waste value chain in Africa is characterised as having –

- low value for e-waste pickers and collectors
- low value of e-waste fractions due to a captive, local market
- value in only a few fractions, resulting in cherry-picking of high value materials such as metals
- difficulty in tracing e-waste leading to uncertain qualities and unstable (low) volumes
- with very few local buyers, resulting in little of the value remaining in the country



Figure 1 – ‘Status quo’ of the e-waste value chain in African metropolitan areas



Figure 2 – ‘Desired state’ of the e-waste value chain in generating greater local value for African metropolitan areas

Electronic waste is recognised as one of the fastest growing waste streams, not only in developed but also amongst developing countries. The generation of e-waste in Africa is estimated at approximately 2kg/inhabitant/year (UNU-IAS, 2014), resulting in a total disposed quantity of approximately 2 million tons per annum. Given the expected rapid growth in the market volumes of electrical and electronic products in Africa, the generation of e-waste is expected to double by 2020, reaching 4 million tons (*Idem*). While many African countries are setting up local initiatives to address the challenge of increasing flows of end-of-life electrical and electronic products, the separate collection of e-waste in Africa is estimated to be less than 10%, meaning that only 200,000 tons per annum of e-waste are properly managed across the continent. While Europe has set the target of 85% recovery of e-waste by 2019 (EC,

2012), increasing the collection and recovery of e-waste in Africa from 10% to 30% by 2020, could unlock an additional estimated one million tons of end-of-life electronic products available for recycling, and releasing a potential economic value of almost €300 million into local and international economies (assuming an average market value of WEEE of €300 per ton).

Strengthening this weakly defined e-waste value chain in African countries, therefore requires targeted action in collection, technology, finance and legislation, and “closing the loop”. In this way, developing countries have the opportunity to (Figure 2) –

- distribute the value more evenly across a clear local e-waste value chain

- strengthen the roles of collectors, dismantlers, repairers and recyclers, while reducing the number of intermediaries
- improve the tracking of e-waste along the value chain, thereby ensuring a higher quality of recovered material and greater guarantee of volumes
- create higher value for all roll-players along the value chain
- increase the value for existing fractions, and unlock value for new fractions of the recovered e-waste, through increased access to local and international buyers

The key findings emerging from the Horizon 2020 EWIT project, based on insights gained in the African countries of Cote d'Ivoire, Kenya, South Africa and Zambia, are briefly discussed below, as they relate to the four focus areas of the project – closing the loop; collection; technology; and finance and legislation.

CLOSING THE LOOP

The circular economy is defined by the United Nations Environment Programme (UNEP, 2006) as “*An economy which balances economic development with environmental and resources protection. It puts emphasis on the most efficient use and recycling of resources, and environmental protection. A circular economy features low consumption of energy, low emission of pollutants and high efficiency.*”

The focus of closing the loop on e-waste management in Africa, should therefore be on implementable improvements for the e-waste value chain that will drive end-of-life electrical and electronic equipment into a collection stream that supports reuse, parts harvesting, and eventually resource extraction.

However, African countries face many common challenges with regards to closing the loop for e-waste, including collection, technology, legislation and enforcement, awareness, financing models, and access to markets.

Collection: Collection volumes for e-waste in African countries are typically low, making it difficult to realise the economies of scale necessary to justify dedicated infrastructural investment for dismantling and treatment technology. The challenges around the low volumes are further compounded by the fact that often, the e-waste is contaminated due to poor pre-sorting or separation, generating lower value material, but also posing greater environmental and human health risks; collection mechanisms are inefficient; road infrastructure is poor; collection in peri-urban and rural areas is un(der)serviced due to higher logistics costs; and export costs to global markets are high.

Steps which countries may consider putting in place to strengthen e-waste collection, include –

- establishing a framework for e-waste collection
- raising general awareness of e-waste issues
- involvement of all stakeholders in the design and implementation of collection systems
- creating favourable conditions for investments and supporting the transfer of technical expertise
- creating licensing and certification systems by means of an international standard for collection and recycling
- developing collection and recycling initiatives, including Extended Producer Responsibility (EPR) and Corporate Social Responsibility (CSR)
- stimulating competition in the collection and recycling system to drive cost effectiveness, and
- enforcing legislation and strengthen monitoring and compliance mechanisms

Technology: Although technologies exist internationally to support e-waste resource extraction, these technologies are cost prohibitive and require specialised technical skills to operate and maintain. However, this provides an opportunity to innovate by developing small-scale, low-cost, appropriate treatment technologies. Until economies of scale are achieved in the volumes of recovered e-waste, and local investment in technology becomes an option, countries can consider –

- allowing controlled export of, e.g. hazardous fractions
- implementing small scale, mobile treatment technologies, e.g. mobile HydroWEEE plant for printed circuit boards, or mobile fridge treatment plants
- supporting regional specialisation, e.g. a country specialises in treating specific materials, followed by a controlled, regional exchange of material from one country to another, so as to collectively achieve economies of scale
- looking for synergies within the national mineral processing sector, e.g. precious metals

Closing the loop in the e-waste value chain is highly dependent on the product, component and fraction, however, the following are considered appropriate for consideration in African metropolitan areas –

- non-ferrous metals
- ferrous metals
- printed circuit boards
- hi-tech plastics
- brominated flame-retardant plastics
- CRT and flat panel monitors
- portable batteries
- rare-earth elements
- printer and toner cartridges
- refrigerator foam
- fluorescent tubes

Legislation and enforcement: The lack of legislation on waste management, and specifically e-waste management in many African countries, and the weak enforcement of existing legislation, makes it extremely difficult to support the collection and proper treatment of end-of-life products. Without a regulatory framework and financing model, it is difficult to enforce any environmental protection measures, including the control of illegal dumping, and to honour international agreements. These challenges are further compounded by limitations in product legislation, often resulting in the introduction of products with low performance life, or containing difficult to dispose of hazardous material.

Regulatory and financing instruments that can be put in place to immediately support a local e-waste value chain, include –

- encouraging green procurement policies
- incentivising repair and remanufacturing through tax breaks
- encouraging producer take-back programmes, and
- setting targets for not only recycling, but also reuse

Awareness: It is acknowledged that there is currently limited awareness of closed loop solutions by governments and civil society across Africa, and limited local capacity across the value chain to appropriately manage end-of-life electrical and electronic products, resulting in poor waste disposal practices and material resources not being introduced back into the secondary materials market.

Financing models: Putting the necessary systems in place to improve the recovery of e-waste within a city comes at a cost, however, this cost increase is typically offset by an increase in the final resource (economic) value; less “value leakage” along the value chain; and reduced environmental and social costs associated with poor waste management.

Financing is necessary to support the collection and proper treatment of e-waste, and to introduce some basic material recycling that can promote further resource extraction, thereby keeping secondary raw materials within the local economy. Financing models are particularly important for negative (low) value products, so as to avoid “cherry picking” of high value materials, thereby creating a more comprehensive solution to end-of-life products.

Access to market: The availability of local markets for end-of-life products are particularly challenging in African countries, mostly due to the limited volumes. This is often compounded by restrictions placed onto the export of materials.

Access to markets may be strengthened through –

- establishment of networks of stakeholders along the value chain, including buyers
- establishment of hubs (regional solutions), that pool material locally and regionally to provide sufficient

volumes to operate at scale, while recognising issues of (controlled) transboundary movement

- improved access to information along the value chain, e.g. price information, knowledge of buyers, quality of material sought, trends, regulations, etc.
- alignment of policy and legislation with economic incentives, in order to improve business (and investment) confidence
- certification and best available technology, to improve the quantity, quality and type of material made available and increase profitability
- setting and enforcing of standards, to ensure a level playing field of all actors in the e-waste value chain
- a good understanding of the market and future trends, and the ability to absorb shocks in the market as a result of global price fluctuations in primary and secondary resources, which small recyclers are particularly at risk of
- access to credits and loans, to support local business investment

Considering the above challenges, further guidance provided to policy- and decision-makers in strengthening local e-waste value chains, and closing the loop from end-of-life electrical and electronic products to valuable resource recovery, include –

- guidance on the collection and treatment of hazardous fractions of e-waste, and
- access to secondary markets, and consideration of transboundary movement

The specific aspects of “closing the loop”, i.e. collection, technology, and finance and legislation are briefly discussed below.

COLLECTION

“e-waste collection is still dominated by the informal sector in African metropolitan areas, who bring expertise in this field, but against a poor awareness of the impacts of poor e-waste management.”

The focus of improved e-waste collection must be on establishing and sustaining simple, effective e-waste collection systems in African cities, in order to increase the volumes of end-of-life electrical and electronic equipment recovered for reuse or recycling. This requires not only understanding the collection infrastructure requirements, but also, importantly the role of communication, incentives, existing cultures and behaviour, and the importance of awareness.

Common challenges with respect to e-waste collection in African metropolitan areas, include –

- limited collection infrastructure
 - limited e-waste collection facilities
 - lack of separate waste collection
 - lack of e-waste take-back schemes

- lack of basic infrastructure in rural areas
- lack of logistic links to treatment facilities
- security issues related to e-waste collection
- land issues related to suitable collection sites
- lack of formal service providers
 - lack of formal e-waste collection providers
 - lack of quality / professional refurbishment services
- large, active informal sector
 - non-organised informal sector
 - poor working conditions
 - competition within the informal sector
 - competition with the formal sector
- lack of data on EEE and WEEE

Each of these collection challenges is discussed in greater detail in the EWIT “Collection Operating Guideline” report.

TECHNOLOGY

The main challenges facing African countries with respect to the adoption of e-waste technologies, include –

- establishing continuous and reliable collection systems, and
- ensuring the appropriateness of any technology given the limited quantity of end-of-life products available for recycling (both as a result of lower consumption patterns, but also low recovery rates from the waste stream).

The focus should therefore be on which technology platform(s) can be put in place to support refurbishment, dismantling and perhaps pre-processing as a precursor to recycling (Figure 3), in support of improved human health and environmental protection, saving critical resources, and creating jobs in the region.

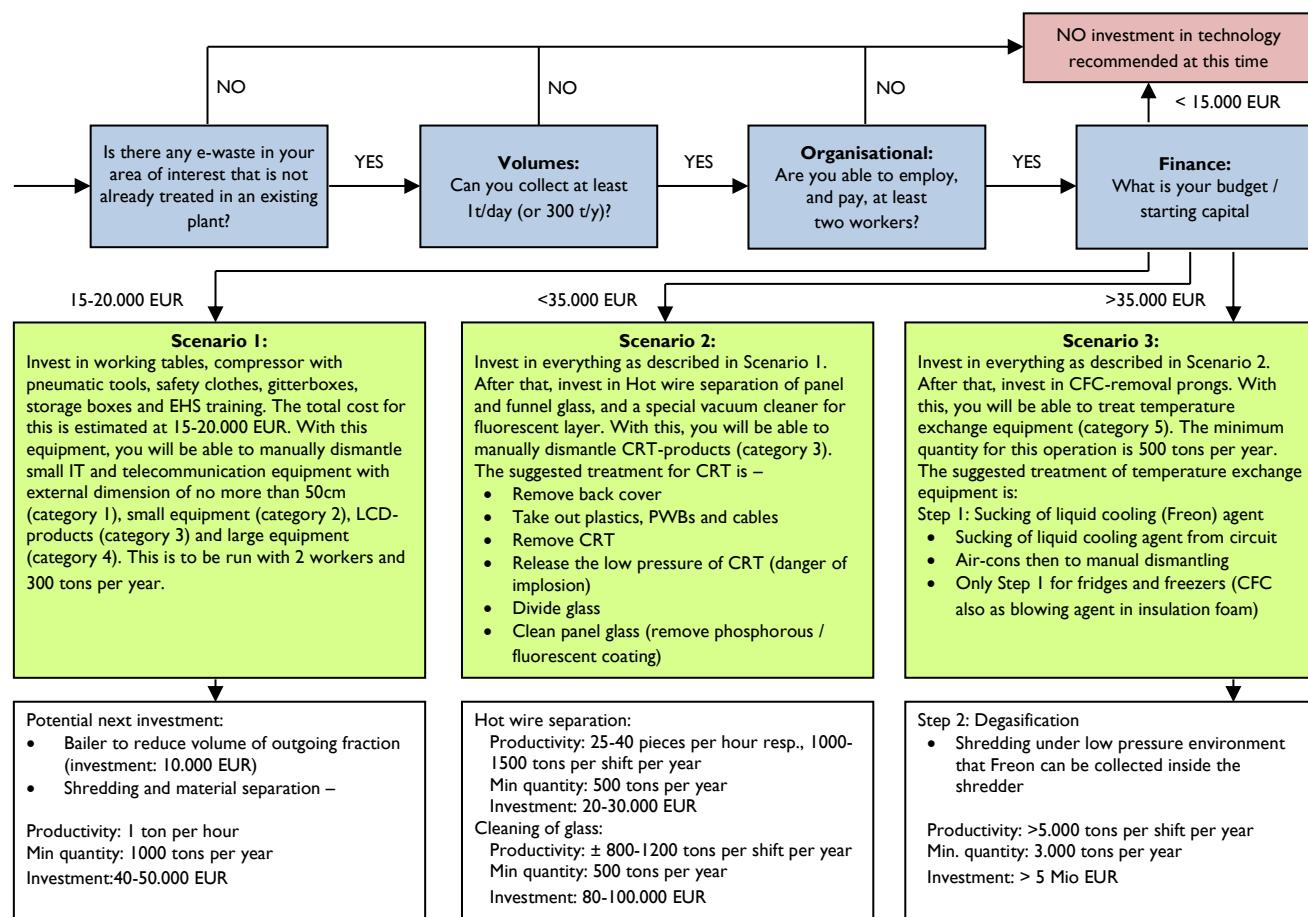


Figure 3 – E-waste toolkit – Technology Decision Tree

By keeping treatment facilities small and growing them slowly, a lot can be achieved through simple, manual dismantling of end-of-life products, of which much of this basic dismantling equipment can be produced by local craftsmen. More sophisticated technologies are available, but they need certain minimum volumes to make the necessary investments viable. In the interim, until the required volumes are collected to justify investing in these sophisticated technologies, mobile treatment plants can be

utilised, or waste can be treated in regional specialised hubs, if the necessary transboundary movement of waste can be facilitated (regional secondary resources economies). The advantage of mobile treatment technologies, is that the investment costs can be shared between several users, thereby supporting local recycling for lower quantities of collected e-waste.

Synergies with other parts of industry, such as the mining and primary material processing sectors, should be sought wherever possible. This should be particularly relevant for African countries, since the continent has a strong mining and mineral resources footprint.

The main focus for policy-makers should be on the establishment of appropriate collection systems to achieve the necessary volumes of e-waste.

The technology challenges are discussed in greater detail in the EWIT “Technology Operating Guideline” report.

FINANCE AND LEGISLATION

e-waste recycling in African metropolitan areas face a variety of issues, which follow the overall pattern of the socio-economic development of the particular country. Generally, environmental issues get moderate attention from policy-makers, and recycling and reuse are driven by market forces and foreign donor help, resulting in limited recovery and recycling, and cherry-picking of the highest value materials.

While African countries experience different levels of legal complexity and realization, they share certain similarities.

- Missing or incomplete legislation
 - on substances in electrical and electronic products
 - on hazardous waste treatment at municipal level
 - on e-waste
 - on e-waste financing
- Enforcement
 - missing mechanisms in law enforcement – national, municipal level and in the e-waste regulations
- Informal sector
 - engagement of informal sector actors in product reuse and e-waste recycling
 - do not follow health and safety standards
- Operational models
 - e-waste recycling operational models not in place, or
 - opportunities to improve exists

The implementation of an effective e-waste management system requires legislative and financial support. This is especially relevant for those substances of concern, which make it necessary to establish a sustainable financing system to enable long-term investment of the private sector in technologies.

As a minimum, legislation is necessary to ensure that hazardous components of end-of-life electrical and

electronic equipment are safely managed; workplace health and safety standards are implemented; certification for e-waste collection, dismantling, treatment is introduced; data reporting is supported; and the environment is protected during the treatment and recovery of resources. As the regulatory environment of the country matures, so the voluntary e-waste collection programs and financing models, can be transformed into more structured, voluntary product stewardship programmes, driven through corporate social responsibility, and finally into legislated extended producer responsibility (EPR) programmes, supported by mandatory financing from producers and importers of electrical and electronic equipment. In this way, countries are able to upgrade the informal e-waste collection and trading sector and create links with e-waste recycling (and future EPR) systems, thereby strengthening the local e-waste value chain through appropriate legislation and financing systems.

These finance and legislation challenges are discussed in greater detail in the EWIT “Finance and Legislation Operating Guideline” report.

CONCLUSIONS

Because of the differences in socio-economic, legislative and environmental conditions in different African cities and countries, there cannot be a “one solution fits all situations” or a “cut and paste” approach to closing the loop on e-waste. Each of the specialist reports have explored the challenges facing African metropolitan areas with respect to collection, technology, finance and legislation, and closing the loop, and have made recommendations for policy- and decision-makers to consider when designing appropriate e-waste management systems. The Operating Guidelines provide practical steps to consider in developing the local e-waste value chain, in an effort to improve the working conditions of all actors; increase the value of resources recovered; and support local economic development, job creation through resource recovery.

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