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Analysis of Existing E-Waste Practices in MENA Countries

January 2014

SWEEPNET

الوكالة الوطنية للتصرف في النفايات
ANGed

The Regional Solid Waste Exchange of Information and Expertise Network in Mashreq and Maghreb Countries

ANALYSIS OF EXISTING E-WASTE PRACTICES IN MENA COUNTRIES

Regional Study

The Regional Solid Waste Exchange of Information and Expertise Network in Mashreq and Maghreb Countries (SWEEP-Net)

January 2014

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LIST OF ABBREVIATIONS

AFDC	Association of Forests, Development and Conservation
ANGed	Agence Nationale de Gestion des Déchets
AUB	American University of Beirut
BCRC	Basel Convention Regional Centre
CDM	Clean Development Mechanism
CEDARE	Center for Environment and Development for the Arab Region and Europe
CFC	Chlorofluorocarbon
CGEM	Confédération Générale des Entreprises du Maroc
CMPP	Centre Marocain de Production Propre
CNEDS	Centre National d'Elimination des Déchets Spéciaux
CRT	Cathode Ray Tube
CULTNAT	Center for Documentation of Cultural & Natural Heritage
DEEE/D3E	Déchets d'Equipements Electriques et Electroniques
DNA	Deoxyribonucleic Acid
EEE	Electrical and Electronic Equipment
EERC	Egyptian Electronic Recycling Company
EMPA	Swiss Federal Laboratories for Materials Science and Technology
ENCPC	Egypt National Cleaner Production Center
EPA	US Environmental Protection Agency
EPR	Extended Producer Responsibility
EU	European Union
GeSI	Global e-Sustainability Initiative
GIZ	Gesellschaft für Internationale Zusammenarbeit (former GTZ)
GSM	Global System for Mobile Communications
GTZ	Gesellschaft für Technische Zusammenarbeit (now GIZ)
HP	Hewlett Packard
ICT	Information and Communications Technology
ICTD	Information and Communication Technologies for Development Unit

ITI	Information Technology Institute
ITIDA	Information Technology Industry Development Agency
ILO	International Labour Organization
ITU	International Telecommunication Union
KFW	Kreditanstalt für Wiederaufbau
KOICA	Korean International Cooperation Agency
MCIT	Egyptian Ministry of Communications and Information Technology
MEHSIP-PPIF	Mediterranean Hot Spot Investment Programme, Project Preparation and Implementation Facility
MENA	Middle East North-Africa
MPS	Mobile Phone Subscribers
MSEA	Egyptian Ministry of State for Environmental Affairs
NGO	Non-Governmental Organization
NTRA	National Telecommunication Regulatory Authority
PACE	Partnership for Action on Computing Equipment
PCB	Polychlorinated biphenyls
PCBS	Palestinian Central Bureau of Statistics
POP	Persistent Organic Pollutants
PPP	Public Private Partnership
RoHS	Restriction of Hazardous Substances
SECO	Swiss State Secretariat for Economic Affairs
SPREP	Secretariat of the Pacific Regional Environment Programme
StEP	Solving the e-waste problem
STRM	Société Tunisienne Recyclage de Metaux
SWEEP-Net	Regional Network for Integrated Solid Waste Management
TDF	Technology Development Fund
TE	Telecom Egypt
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP-DTIE	UNEP - Division of Technology, Industry and Economics
UNESCO	United Nations Educational, Scientific and Cultural Organization
WEEE	Waste Electrical and Electronic Equipment

1. INTRODUCTION

Context

The volume of electrical and electronic waste (e-waste) being generated is growing rapidly in developed countries and in developing countries, due to exponential growth in electrical and electronic equipment production and consumption worldwide. The latest estimates indicate that in 2012 more than 45 million tons of e-waste was generated globally. E-waste is today the fastest growing waste stream (about 4 % a year).

However, increasing quantities of e-waste and its mismanagement represent a major concern across the world due to the presence of hazardous substances such as lead, mercury, PCB, asbestos and CFC's. Uncontrolled dumping and inappropriate recycling processes generate negative impacts on the environment and pose risks to human health.

On the other hand, e-waste contains valuable materials such as gold, silver, copper, platinum, palladium, iron, aluminum, indium, gallium and rare earth metals that may be recovered thus contributing to sustainable resource management.

(Sources: Basel Convention, 2012; Lundgren, 2012)

GIZ/SWEEP-Net

The project "Regional Network for Integrated Solid Waste Management (SWEEP-Net)" promotes the development and implementation of integrated solid waste management in the Mashreq and Maghreb region through:

- Stimulating and facilitating exchange and sharing of information, experiences, and knowledge using an intelligent mix of communication means.
- Allowing its members to share information and knowledge and support each other's work through its information and communication systems and tools.
- Providing advocacy and policy support for sustainable and integrated solid waste management
- Facilitating and promoting the successful application of policies, planning tools, financing mechanisms, and technologies that are environmental sound, social acceptable economical viable.

The project started in September 2009 and continues for a second phase until August 2015. Ten countries from the Mashreq and Maghreb region (Algeria, Egypt, Jordan, Lebanon, Mauritania, Morocco, Palestinian

Territory, Syria, Tunisia and Yemen) have joined the network since the beginning. Stakeholders of the network are experts from the public sector (national and communal), private sector companies, civil society groups and organisations, academia, as well as regional and international organisations.

Study Objective

E-waste depicts a high valuable resource and, hence, business opportunity for the local market if properly handled. The study was intended to

- Collect relevant data from the ten member countries on the market for electronic devices as well as on the generation of electronic waste
- List, describe and analyse national policies and regulatory framework on e-waste handling and recycling (including existing or planned eco-taxing systems)
- List, describe and analyse local private and informal sector involvement in existing e-waste collection and recycling activities
- List, describe and analyse existing national or international programmes to promote e-waste recycling

The study presents the state of the existing e-waste handling and recycling activities as well as potentials in the MENA region with focus on the situation in the ten SWEEP-Net member countries.

Methodology

The study has been carried out in a desk-based approach using data and information found on the Internet and provided by national authorities, multi-and bi-lateral projects as well as regional and international organisations.

Additional information has been collected during a field visit to Egypt.

The study includes a comparative compilation of data in form of a regional benchmarking. Best practices (if existing) have been briefly described.

Important methodological remarks:

For the purpose of this study, e-waste is referred to as waste from ICT-devices.

Information and Data regarding e-waste generation and treatment in the MENA-Region are very scarce. E-waste assessments have been carried out in Egypt and Morocco only. Specific e-waste related studies in the MENA-Region have been carried out by Hossan Allam from the CEDARE in Egypt. No other regional studies have been found.

2. FACTS AND FIGURES ABOUT E-WASTE

2.1. Definition of e-waste

E-waste is an informal term used to describe almost all types of c (EEE) that has entered or could enter the waste stream. It is used for almost any household or business item with circuitry or electrical components with power or battery supply that has reached its end-of-life. A standard definition of e-waste does not yet exist.

The EU Directive on waste electrical and electronic equipment (WEEE) applies to the following categories of electrical and electronic equipment:

- large and small household appliances;
- IT and telecommunications equipment;
- consumer equipment;
- lighting equipment;
- electrical and electronic tools (with the exception of large-scale stationary industrial tools);
- toys, leisure and sports equipment;
- medical devices (with the exception of implanted and infected products);
- monitoring and control instruments;
- automatic dispensers.

In Northern America the term e-waste is limited to Information and Communication Technology (ICT) products and televisions. In Japan e-waste refers to four product categories including TVs, air conditioners, refrigerators, and washing machines.

For the purpose of this study, e-waste is referred to as waste from ICT-devices including computers, laptop computers, printers, calculators, telephones, hand-held digital apparatuses, cell phones, TV's and all its accessories.

(Sources: SBA, 2009)

2.2. Increasing quantities

The volume of electrical and electronic waste (e-waste) being generated is growing rapidly in developed and in developing countries. The total amount of global e-waste generated in 2005 was estimated to be 40 million tons. The latest estimates indicate that in 2012 more than 45 million tons of e-waste was generated globally. The amount of e-waste generated in the EU was estimated between 8.3 and 9.1 million tons in 2005 and is expected to reach about 12.3 million tons in 2020. E-waste is today the fastest growing waste stream (about 4 % a year). The US Environmental Protection Agency (EPA) has even estimated a 5 to 10 % increase in the generation of e-waste each year globally.

The increase of e-waste is due to exponential growth in electrical and electronic equipment production and consumption worldwide. Lower prices for many electrical goods have increased global demand for many electrical and electronic products. A generally high product obsolescence rate together with a decrease in prices and the growth in internet use are further driving factors for increasing e-waste generation.

(Sources: Basel Convention, 2012, Lundgren, 2012; SBA, 2009)

2.3. Composition of e-waste

Composition of e-waste is highly diverse and depends on product lines and categories. In general, e-waste contains more than 1000 different substances, which can be classified into "hazardous" and "non-hazardous" categories. Electronic products consist of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50 % of e-waste followed by plastics (21 %), non ferrous metals (13 %) and other constituents. Electronic products often contain several persistent, bio-accumulative and toxic substances including heavy metals such as lead, nickel, chromium and mercury, and persistent organic pollutants (POPs) such as poly-chlorinated biphenyls (PCBs) and brominated flame retardants.

(Sources: Basel Convention, 2012, Lundgren, 2012; UNEP DTIE, 2007; Allam and Inauen, 2009)

2.4. Risks to human health and the environment

The presence of heavy metals, POPs, flame retardants and other potentially hazardous substances in e-waste represents a major risk to human health and the environment. There are three main groups of substances that may be released during recycling and material recovery, and which are of concern:

1. original constituents of equipment, such as lead and mercury;
2. substances that may be added during some recovery processes, such as cyanide;
3. substances that may be formed by recycling processes, such as dioxins.

Toxic substances can be found within the following types of emissions or outputs:

- leachates from dumping activities
- particulate matter (coarse and fine particles) from dismantling activities
- fly and bottom ashes from burning activities
- fumes from mercury amalgamate "cooking", desoldering and other burning activities
- wastewater from dismantling and shredding facilities
- effluents from cyanide leaching and other leaching activities.

Such substances may pose significant risks to human health and the environment when improperly disposed of or recycled and therefore require specific attention as to their environmentally sound waste management.

The International Labour Organization states that "human health risks from e-waste include breathing difficulties, respiratory irritation, coughing, choking, pneumonitis, tremors, neuropsychiatric problems, convulsions, coma and even death. E-waste workers are also exposed to other hazards leading to physical injuries and chronic ailments such as asthma, skin diseases, eye irritations and stomach disease. Particulate matter collected from e-waste recycling areas can lead to inflammatory response, oxidative stress and DNA damage".

(Sources: Basel Convention, 2012, Lundgren, 2012; UNEP DTIE, 2007; Allam and Inauen, 2009)

2.5. Valuable e-waste

It is widely unknown that e-waste not only contains hazardous substances but also highly valuable materials such as gold, silver, copper, platinum, palladium, iron, aluminium, indium, gallium and rare earth metals that may be recovered. The extraction of these metals from the Earth comes along with a significant environmental impact. E-waste recycling thus contributes to sustainable resource management.

The potentials in the e-waste recycling market are considerable. For instance,

- in recycling only one ton of electronic scrap from computers, more gold can be recovered than from 17 tons of gold ore, and up to 40 times more concentrated copper than that is found in copper ore.
- one ton of mobile phones (approximately 6,000 handsets) contain about 3.5 kg of silver, 340 g of gold, 140 g of palladium and 130 kg of copper, with a combined market value of about USD 15 000.

Considering these figures it becomes clear that the recycling of e-waste and recovery of valuable metals is a major potential growth market in the future.

The use of valuable materials from recycled e-waste as a replacement for raw materials can therefore significantly increase the efficiency of use of natural resources. When appropriate technologies and methods are applied the use of material from recycled e-waste can lead to lower energy consumption and reduced greenhouse gas emissions.

The value of e-waste not only consists in its valuable materials but also in the reuse of the electronic devices themselves. Direct reuse or reuse after repair or refurbishment of electronic devices extends the lifetime of the equipment, which reduces the environmental footprint of the resource intensive production processes of the equipment. Reuse also provides access to such equipment for groups in society that otherwise would not have access to it due to reduced costs of second-hand equipment.

(Sources: Basel Convention, 2012, ILO/UNDP, 2011)

2.6. E-waste management

Capacities to manage e-waste and its hazardous substances in an environmentally sound manner and without risks for human health are lacking in most developing and emerging countries. ILO highlights "as an example, the informal recovery industry in Asia supplies manufacturers with some recycled raw

materials. There is clear evidence however that the practice exploits women and child labourers who cook circuit boards, burn cables, and submerge equipment in toxic acids to extract precious metals such as gold (Schmidt, 2006) and subjects them and their communities to damaged health and a degraded environment. Moreover, the techniques used by the informal sector are not only damaging human health and the environment; often they also perform poorly as to their efficiency in recovering valuable resources, squandering precious resources such as critical metals for future use. Even management of non-hazardous wastes can cause significant harm to human health and the environment if not undertaken in an environmentally sound manner."

According to the International Labour Organization, an environmentally sound e-waste recycling chain contains the following steps:

- demanufacturing into subassemblies and components – this involves the manual disassembly of a device or component to recover value.
- depollution – the removal and separation of certain materials to allow them to be handled separately to minimize impacts, including batteries, fluorescent lamps and cathode ray tubes (CRTs)
- materials separation – manually separating and preparing material for further processing
- mechanical processing of similar materials – this involves processing compatible plastic resins, metals or glass from CRTs to generate market-grade commodities
- mechanical processing of mixed materials – this involves processing whole units followed by a series of separation technologies
- metal refining/smelting – after being sorted into components or into shredded streams, metals are sent to refiners or smelters. At this stage, thermal and chemical management processes are used to extract metals.

(Sources: Basel Convention, 2012, Lundgren, 2012)

2.7. Legal and illegal trade of e-waste

Global e-waste generation of approximately 40 million tons a year goes along with transboundary trade activities that may be legal or illegal. A main obstacle to making precise estimations on e-waste flows is that secondary and waste products are mostly invisible to national statistics on production, sales and trade in goods. Furthermore, diverging definitions of e-waste create disparities in the quantification of e-waste generation as well as in the clear identification of e-waste flows.

Despite a lack of statistical data on e-waste flows, "there is a consensus that the purpose of shipments is gradually shifting away from final disposal towards recovery and recycling operations. Recycling rates are currently believed to be growing at an average rate of 18 per cent per year", states ILO, and confirms that "in general, e-waste flows to disadvantaged and historically marginalized areas."

As it has been demonstrated in a study commissioned by the US Environmental Protection Agency (EPA), exporting e-waste to Asia is 10 times cheaper than processing it in the United States. The incentives for legal or illegal e-waste movement are hence enormous.

However, trade of e-waste is not only increasing between the developed and developing countries but also among the developing countries themselves. The intra-regional trade accounts actually for most of the e-waste trade.

According to ILO "e-waste recycling operations have been identified in several locations in China and India. Less-investigated locations are in the Philippines, Nigeria (in the city of Lagos), Pakistan (Karachi) and Ghana (Accra) In general, small-scale exports go to West Africa while the larger and sometimes more structurally organized transports go to South- East Asia. It is estimated that China receives the highest proportion of all e-waste – about 70 per cent and rising. However, there are no confirmed figures available on how substantial these transboundary e-waste streams are. In addition, due to the recent tightening of regulations in Asia, it is estimated that more e-waste will flow into West African countries in the future."

Figure 2 shows the main known and suspected sources and destinations of the global e-waste trade.



Fig. 2. Known and suspected routes of e-waste dumping

(Sources: Basel Convention, 2012, Lundgren, 2012)

2.8. E-waste related initiatives

Increasing concerns about environmental and health risks related to e-waste have led public and private decision-makers worldwide to create initiatives for assessing e-waste generation and flows and for promoting sound e-waste management practices. The most relevant initiatives include (non exhaustive):

Basel Convention

The Nairobi Declaration on the Environmentally Sound Management of Electrical and Electronic Waste and decision IX/6 adopted by the ninth meeting of the Conference of the Parties gave a mandate to the Secretariat to implement a work plan for the environmentally sound management of e-waste.

The work plan included activities in the following work areas:

- Programmes of activities for the environmentally sound management of e-waste in Africa, in Asia Pacific and in South America;
- Partnership for Action on Computing Equipment (PACE);
- Mobile Phone Partnership Initiative activities on awareness-raising;
- Preparation of technical guidelines on transboundary movements of e-waste, in particular regarding the distinction between waste and non waste.

GeSI (Global e-Sustainability Initiative)

The Global e-Sustainability Initiative (GeSI) is a global partnership of Information and Communication Technology (ICT) companies that promotes technologies for a sustainable development.

StEP (Solving the e-waste problem)

StEP is an initiative of various UN organizations with the overall aim to solve the e-waste problem. Prominent members from industry, governments, international organizations, NGOs and the science sector actively participate in the initiative.

The Initiative is based on five principles:

1. StEP's work is founded on scientific assessments and incorporates a comprehensive view of the social, environmental and economic aspects of e-waste.
2. StEP conducts research on the entire life cycle of electrical and electronic equipment and their corresponding global supply, process and material flows.
3. StEP's research and pilot-projects are meant to contribute to the solution of e-waste problems.
4. StEP condemns all illegal activities related to e-waste including illegal shipments and re-use / recycling practices that are harmful to the environment and human health.
5. StEP seeks to foster safe and eco- and energy-efficient re-use and recycling practices around the globe in a socially responsible manner.

UNESCO

UNESCO has published guidelines regarding Computer equipment recycling.

A guide to help Pacific reporters produce news items on electronic and electrical waste (e-waste) has been produced by the Secretariat of the Pacific Regional Environment Programme (SPREP) with the UNESCO support.

CEDARE (Center for Environment and Development for the Arab Region and Europe)

The aim of the Information and Communication Technologies for Development Unit (ICTD) of CEDARE is to accelerate CEDARE member countries to adopt knowledge and information societies for enhancing their capacities sustaining development. ICTD unit is dedicated to cooperating with key partners in delivering projects in the following areas:

- Deliver Arabic e-learning programme for environment and development issues
- Cooperate with national, regional and international organizations in establishing thematic information systems and networks
- Promote best practices for e-environment
- Enhance national e-waste programmes
- Establish Regional electronic CDM carbon sinks stock exchange programme
- Enhance the information dissemination mechanisms about protected areas in CEDARE member countries
- Establish thematic knowledge hubs for environment and development

Best of Two Worlds

The "best-of-two-worlds" approach is based on the idea that recyclers in developing countries and emerging economies can cooperate with technologically advanced refineries in industrialized countries to facilitate efficient recovery of valuable metals, such as gold and palladium, from e-waste.

(Sources: Basel Convention, 2012; initiative websites)

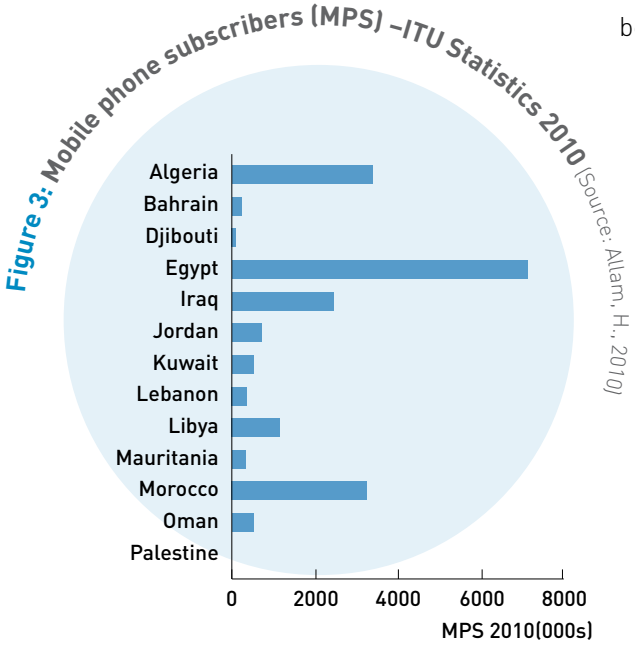
3. E-WASTE IN THE MENA REGION

In spite of increasing concern about e-waste, very few comparative studies are available with respect to the MENA-Region. The most valuable work regarding this issue has been realised by Hossam Allam from CEDARE (Center for Environment and Development for the Arab Region and Europe). There are two major studies focusing on e-waste in the Arab countries:

1. Allam, H. and Inauen, S. (2009): E-Waste Management Practices in the Arab Region. Centre for Environment and Development for the Arab Region (CEDARE), Cairo, Egypt.
2. Allam, H. (2010): Study on E-Waste Management in the Arab Region, focused on ICT equipment. Centre for Environment and Development for the Arab Region (CEDARE), Cairo, Egypt. (not published)

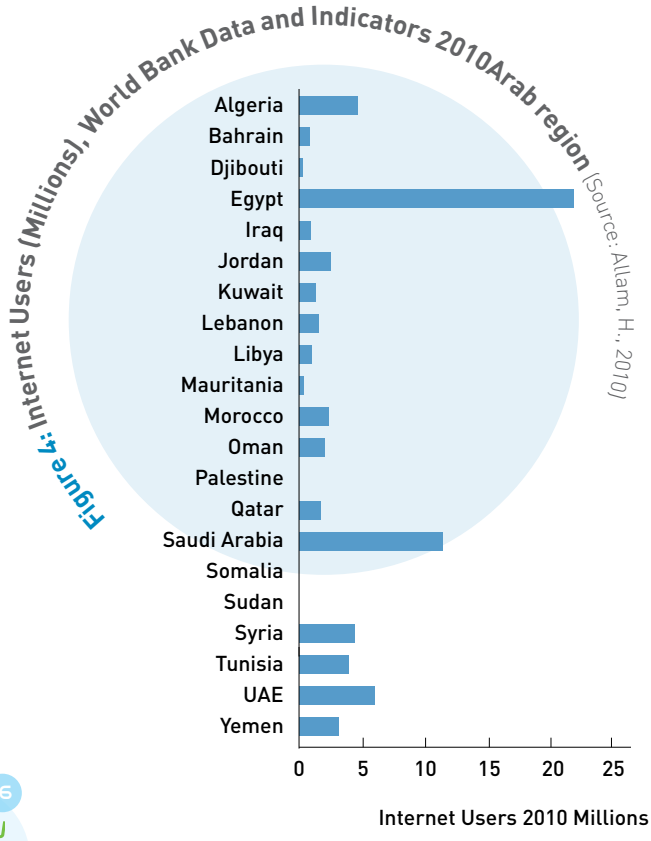
As both studies include figures and facts about the e-waste situation in the ten SWEEP-Net member countries, some study results have been used in this chapter.

The objective of this research was to identify the current status of e-waste management practices in the Arab Countries. 300 questionnaires were sent out to NGOs, governmental organizations, and ICT companies. The received answers indicate that there is no formal e-waste sector. Five international organizations, four companies and four NGOs are active in 9 Arab countries. The projects are mostly assessment studies and basic data collections leading to the assumption that the implementation of E-waste projects is in its initial phase (Allam and Inauen).



A comparison of mobile phone subscribers (MPS) in the Arab region for the year 2010 is given in figure 3.

Figure 4 shows an overview regarding the total number of Internet users in the Arab region.



According to CEDARE, "the prevalence of ICT in the Arab region is below that of international averages, particularly with regard to the use of personal computers and internet access. Thus, grow rates of internet users rang from 200 to 1100 percent. Between 2002 and 2005, internet subscriber rate rose with factor four in the Arab region. However, subscription density varies among the sub regions and countries, ranging from 3'500 internet subscribers in Djibouti to 1.800 million in Saudi Arabia (ITU Statistics, URL). Telephone line and cellular subscriptions were highest in the United Arab Emirates at 94 subscribers for every 100 population, followed by Bahrain and Kuwait, at 84 and 72 respectively".

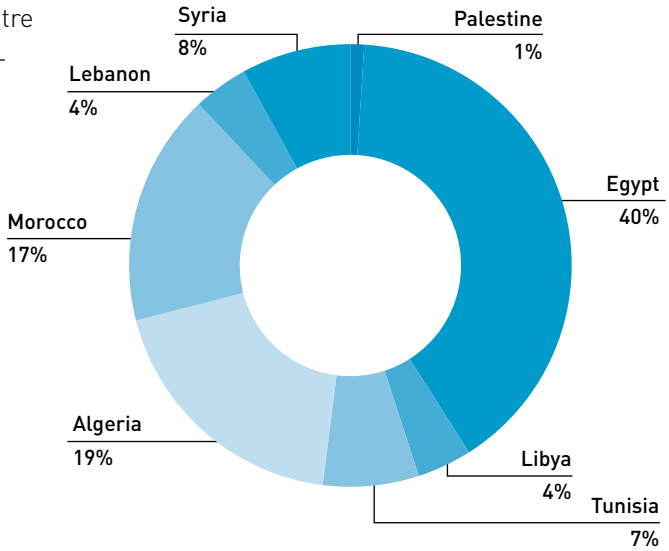
The study states that "few projects located and the content of them indicate that e-waste management in the Arab region is in its starting phase. There is a need for more basic data collection, inventories and assessment studies in all areas of the Arab region." Figure 5 demonstrates the e-waste activities identified by Hossam Allam for the Arab region.

Figure 5 : E-waste activities identifies in the Arab region (Source: Allam, H. (2010)



Figure 6: ME-waste generation in eight SWEEP-Net member countries for 2009

In November 2010, the Basel Convention Regional Centre Egypt (BCRC-Egypt) organized the "E-Waste Management Forum: Green Business Opportunities" in Marrakech (Morocco). The regional event aimed at exchanging experiences on e-waste management and evaluating its potentials for business opportunities. In its presentation, Prof. Moustafa Kamel gave an overview regarding the generation of e-waste in the SWEEP-Net member countries (excepting Mauritania and Yemen) in the year 2009 (figure 6). He showed that Egypt alone stands for 40 % of the e-waste generated, followed by Algeria (19 %) and Morocco (17 %).



((Source: Kamel M. H. (2010))

4. E-WASTE IN SWEEP-NET MEMBER COUNTRIES

The following chapters describe the results of the desk study on e-waste in the ten SWEEP-Net member countries. It can be stated that in general, information is simply not available or very hard to find. Until now, a scientific e-waste assessment has been conducted in Morocco only. A similar approach is under way in Egypt. Hence, without precise numbers and figures, an efficient management system for e-waste can hardly be developed. Tunisia started setting up an e-waste management system in cooperation with KOICA, the Korean International Cooperation Agency.

4.1. Algeria

4.1.1. Generation of e-waste

E-waste related data in algeria are barely available. No e-waste assessment has been conducted yet and reliable information is hard to find. Only one study has been carried out giving just approximate results. Companies do not communicate waste generation
A specific e-waste related inventory or assessment is not available in algeria. Moreover, data from different ministries or the office for statistics are incoherent which leads to difficulties in even approximate evaluation of e-waste quantities.

(Source : cheriet, 2011)

4.1.2. E-waste management

In algeria, e-waste is collected together with household waste and bulky refuse. There is no selective collection system for e-waste and companies specialised in e-waste collection do not exist.
Most e-waste related management activities in Algeria are handled by the informal sector whose activities include collection from dumping sites or directly from e-waste producers such as companies. Refurbishing activity in Algeria is strong but also mainly limited to the informal sector. There is an e-waste recycling branch focusing on dismantling and recovery of metals but it is also restricted to the informal sector. Thus, the informal sector carries out most e-waste related activities in Algeria where the lack of environmental standards is a major concern.

(Source : Cheriet, 2011)

4.1.3. National policies and regulatory framework on e-waste

A specific e-waste management plan for Algeria is lacking. Although a specific regulation regarding e-waste is currently being elaborated, e-waste is in general still covered by legislation on hazardous waste. The Algerian categorization of hazardous wastes contains a specific category (16.2) related to electric and electronic waste (see annex 1).

(Source : Cheriet, 2011)

4.1.4. Initiatives and stakeholders with regards to e-waste

Private sector activities

Eco-recyclage:
Eco-recyclage, an algeria based battery recycling company, commenced activities this month at a new facility in aïn ouassara, 200 kilometres south of algiers. The company, in which french recylex sa holds a 33.33% Stake, received its license to operate and has launched its production.
It is recylex's first international development outside its countries of origin (france, germany and belgium). The eco-recyclage factory designed by recylex engineers is a processing centre for used car batteries. In a full year the site will have an annual processing capacity of 20,000 tonnes of used batteries. For the record, recylex currently processes about 130,000 tonnes of used batteries a year in europe. Recylex's presence in algeria through eco recyclage reflects recylex's ambition to export its unique expertise in used battery processing with priority being given to emerging markets that have not yet been consolidated. Suresnes based recylex specializes in recycling lead and plastic from automobile and industrial batteries, recycling zinc from steel mill dust, and producing zinc oxides and special metals for the electronics industry. It operates in france, germany and belgium.

(Source: recycling international, 2010)

Valmed algérie:
Valmed algérie has been created in 2012 by a group of hazardous waste experts. The company is specialized in hazardous waste management operating in the whole algerian territory. Valmed offers elimination and valorisation services of different hazardous waste categories including e-waste.

Informal sector

Informal sector activities are widespread but no further information is available

4.2. Egypt

4.2.1. Market for electronic devices

Mobile phones

Since the introduction of GSM services in 1996, the mobile communications market has grown rapidly in Egypt, starting with 194 000 subscribers at the end of 1998, rising to 5.8 million customers at the end of 2003 and reaching 8.5 million customers in 2005. In 2007, the number increased to about 25.6 million subscribers and current reports indicate more than 37.6 million subscribers. In 2012, the total number of mobile phone subscribers is estimated at about 45 million.
Thus, Egypt has become the third largest mobile market in Africa after South Africa and Morocco.

(Sources: www.arabdev.org; LC, 2011)

Personal computers and CRT monitors

Egypt is an importer of computers and computer parts, mainly from Hewlett-Packard, IBM, Dell and Acer. According to BCRC, import of used personal computers and CRT monitors increased dramatically since 2001 (number increased approximately 6-8 times in five years).

During 2007, the Minister of Trade and Industry has issued a decree prohibiting importing personal computers that are older than 5 years (it was 10 years before). In 2010, another decree was issued that reduced it to 3 years. In 2013, import of used computers has been banned totally.

(Source: BCRC, 2009; www.arabdev.org):

Internet

Internet is playing an increasing role in the everyday lives of Egyptians. According to the latest studies, the number of internet users grew from 9.7 million in June 2008 to 13.5 million in June 2009 which represents an increase of 39.2 %.

(Sources: www.arabdev.org; LC, 2011)

4.2.2. Generation of e-waste

In egypt, no records regarding e-waste generation rates are available. According to bcrc egypt, the estimated number of end of life mobile handsets reached about 9 million at the end of 2008. The number of mobile phone subscribers increased more than 20 times in 8 years and the use of computers grew in a similar pattern.

The lack of precise numbers regarding e-waste volumes impedes the development of clear policies on ict-related e-waste and how to manage the problem in a sustainable way. Thus, in the context of the egyptian green ict strategy (2012-2014), it has been proposed to conduct a technical report on the assessment of e-waste management in egypt (greater cairo). The main aim behind the assessment is to provide the necessary data, which would allow to implement a proper e-waste management system, and to identify opportunities to create and improve employment in egypt. The assessment should provide precise insights on how e-waste is currently managed by:

- Analysing the egyptian policy and legal framework
- Analysing how stakeholders are currently involved
- Assessing current and future mass flows
- Identifying social, environmental and economic impacts

These elements will provide the basis for identifying the priority intervention measures in order to implement a proper e-waste management system. The results of the assessment should allow estimating the potentials for establishing an e-waste recycling industry and should allow drafting an action plan for implementing a pilot e-waste management project and to scale it up at national level to a proper e-waste management system in egypt.

Mcit prepared a tender for the assessment of e-waste management in egypt. As the proposals did not match with the budget, a new tender has been launched in december 2012. It is expected that the study will finally procure reliable data on e-waste generation in egypt.

(Sources: mcit, 2011; bcrc, 2009; www.Arabdev.Org)

4.2.3. E-waste management

Collection and treatment

Currently, a formal e-waste management system does not exist in egypt. Electronic waste in egypt is generally either burned or thrown into landfills in slums such as manshiet nasser, mokattam or dewei'a. Over time, harmful emissions start to affect the people who are living near these landfills. In the absence of serious national programs for e-waste management and with decreasing sale price of new technologies especially mobile phones and personal computers parts it is anticipated that the amount of e-waste going to landfills will increase in a few years.

According to leila hassanin from arab'dev, e-waste is at present being handled by informal solid waste collectors and recyclers. Often components are burned down to extract copper or other precious metals that can be sold, creating a health and environmental hazard. Some components are being reused to upgrade ict equipment. Hassanin also points out that obsolete items going to the dump aren't the only problem related to e-waste however. In fact, some items that could be re-used never get to their beneficiaries because of disclosure issues. Many companies can't release computers they don't use anymore for reuse because of privacy concerns.

(Source: lc, 2011)

Awareness rising

Mcit, in cooperation with mobinil, held two workshops in 2011 in sohag and assiut to raise awareness regarding e-waste.

Also, a team from the egypt ict trust fund visited 26 associations in various governorates to identify the most suitable candidates for inclusion in an e-waste management program. Associations in alexandria, assiut, daqahliya, qena and sharqiya were nominated and contacted, and the fund has begun working with them.

(Source: mcit, 2011)

4.2.4. National policies and regulatory framework on e-waste

Unlike other countries such as india, e-waste, specifically from the ict-sector, is not lumped in with hazardous waste in egypt, because hazardous waste is targeted specifically towards industries that produce and manufacture commodities, such as refrigerators. As computers and mobile phones are not produced in egypt but only assembled from imported parts, resulting ICT e-waste can not fall under the category of hazardous waste. According to Leila Hassanin from Arab'Dev, "it could actually be beneficial for it to be included within hazardous waste as is done for other e-waste categories like fridges and TV sets, because at least then it would "exist" and could be treated as an issue, and some policy could be developed around it". As it stands, ICT e-waste exists in a no man's land, and so nothing is being done about it."

In fact, e-waste is rather considered consumer waste. The government is more focusing on setting rules for production rather than on the management of e-waste. As such, it goes to the scrap handlers, or informal recyclers.

(Source: LC, 2011)

During 2007, the Minister of Trade and Industry has issued a decree prohibiting importing computers that are older than 5 years (it was 10 years before). In 2010, another decree was issued that reduced it to 3 years. In 2013, importing used computers to Egypt has been banned totally.

In November 2011, MCIT, the Ministry of State for Environmental Affairs and the Ministry of Industry and Foreign Trade formed a ministerial workgroup to examine legislation covering e-waste management. The group meets every month. Additionally, the three ministries are working together to review legislation covering the environment, trade and communications, with reference to the European Union's Waste Electrical and Electronic Equipment (WEEE) Directive. Based on this review, a report will be compiled including recommendations on the legislation required to support good e-waste management in Egypt.

In December 2011, MCIT participated in a workshop titled "Aswan without e-Waste." The workshop included a presentation on MCIT's achievements in managing e-waste and the ministry's future plans in this field.

An inter-ministerial committee with members from the private sector and national and regional organizations is formed and is currently discussing a roadmap for e-waste management in Egypt.

(Source: MCIT, 2011; Fieldvisit)

4.2.5. Initiatives and stakeholders with regards to e-waste

Egyptian Green ICT Strategy

In February 2010, MCIT adopted the Egyptian Green ICT Strategy in close cooperation with MSEA and the Green ICT stakeholders' committee was established. The committee includes members from public and private sectors, ngos, regional and international agencies. The Green ICT program is dealing with icts from a cradle to cradle perspective, with a special focus on developing a sustainable management of e-waste program.

Strategic Objectives:

- Raise community awareness about Green ICT challenges and opportunities.
- Set fundamentals and national policies for Green ICT.
- Adopt a multi-stakeholder approach to address various green ICT challenges.
- Reduce the adverse environmental effects resulting from the expansion in the use of ICT.
- Support the use of communication and information technology as an effective tool to reduce GHG emissions resulting from other sectors.

E-waste sustainable Management Program:

1. Conducting E-waste assessment report that covers the big Cairo governorate.
2. Implementing a program for raising the community awareness about E-waste threats and opportunities.
3. Supporting the participation of IT companies and institutions to start the implementation of pilot projects for e-Waste Management .
4. Participating in proposing legislation and laws to support the rational management of electronic waste .

(Source: SWEEP-Net Country report Egypt, 2012)

Cooperation with Switzerland

In 2011, MCIT, in collaboration with the Center for Environment and Development for the Arab Region and Europe (CEDARE), proposed means of cooperation in the field of e-waste management to the Swiss State Secretariat for Economic Affairs (SECO) and the Swiss Federal Laboratories for Materials Science and Technology (EMPA). The proposal included collaboration in the following projects:

- Preparation of a report assessing e-waste in Egypt
- Development of a fund for e-waste recycling
- Development of an incubation program for young people in the e-waste field
- Setting of legislation for organizing and putting into force good management of e-waste in Egypt
- Development of an e-waste take-back system
- Preparation of an awareness-raising and training program for those working in the field of e-waste recycling, with emphasis on the unofficial sector and civil society institutions.

The launch of the programme on 'Sustainable Recycling Industries' has been organized as a side-event to the SWEEP-Net 3rd Regional Forum on Integrated Solid Waste Management in the MENA region, on 15th May 2013 in Cairo.

(Sources: MCIT, 2011)

E-Waste Forum

A research project and e-waste forum initiated by Egypt Cleaner Production Center and the regional organizations CEDARE and BCRC-Egypt was established.

(Sources: MCIT, 2011; BCRC, 2009)

ITU Symposium on "ICT, the Environment & Climate Change"

In November 2011, MCIT in cooperation with MSEA, hosted and co-organized the fifth ITU Symposium on "ICT, the Environment & Climate Change" in coordination with ITU. The symposium tackled green ICT from its direct, indirect and systemic sides, as well as issues related to mitigation, adoption and e-waste management. The conference produced The Cairo Road Map. The document is a guideline for developing countries on "icts and Environmental Sustainability".

(Source: SWEEP-Net Country Report Egypt, 2012)

World Bank programs

In line with a memorandum of understanding between Egypt and the World Bank on green ICT, efforts continued in 2011 on the following three programs:

1. Setting an executive framework for Egypt's Green ICT Strategy

Following the visit of a World Bank delegation to Egypt in October 2010, a report was produced, and a survey on Egypt's Green ICT Strategy for 2012-15 was published and distributed to strategic partners and stakeholders. On 15 November 2011, a high-level consultative session was held in the presence of the minister of communications and information technology and representatives of various ministries, government authorities and private sector companies to discuss the framework of the Green ICT Strategy for 2012-15. Also in 2011, a green ICT community knowledge-sharing portal was built, and a survey was posted on the Egypt ICT Trust Fund website to study the management of electronic waste.

2. Designing a pilot project for managing e-waste in Sheikh Zayed City.
A report was issued on the framework for e-waste management in Egypt and the challenges involved.

3. Organizing a community awareness-raising campaign on the correct management of e-waste.
On 16 November 2011, a workshop was held on ICT procurement and environmental sustainability, attended by 55 trainees from various ministries, government entities, the private sector and international organizations.
An instructional handbook, "Guidelines for Green Procurement," was published.

(Sources: MCIT, 2011; BCRC, 2009)

Cooperation with Finland

In October 2011, the minister of communications and information technology received the Finnish ambassador to Egypt along with a delegation headed by the chairman of the Finland Trade Center (Finpro). The group discussed cooperation between Egypt and Finland in various fields of ICT, including green technology, e-waste management, e-health, e-learning, the establishment of technology parks, and support for small and medium enterprises operating in the field of ICT. The group established a work team comprising experts from both countries to shape a framework for cooperation, with the first meeting scheduled to take place during the first quarter of 2012.

(Source: SWEEP-Net Country Report Egypt, 2012)

Hazardous waste management facility in Alexandria

The Mediterranean Hot Spot Investment Programme, Project Preparation and Implementation Facility (MEHSIP-PPIF), is considering launching a feasibility study for the extension of the Nasreya hazardous waste management facility in Alexandria. The estimated value of the project is 25 million Euros. The return on investment of the proposed project is: providing solutions for 40 % of Egypt's industry; creating favorable conditions for the continuing expansion of business and employment opportunities in Alexandria Governorate; improving corporate social responsibilities for industrial facilities in the area; and providing cost effective means for managing hazardous waste including e-waste.

(Source: SWEEP-Net Country Report Egypt, 2012)

Mobinil

Egypt's mobile phone operator Mobinil is very active regarding sustainability issues including e-waste. According to Sherif Eissa, Mobinil's health and environment director, "greater efforts are now being made to educate the public about the hazards of the inappropriate disposal of electronic waste. Mobinil, he adds, has been working with a recycling factory in 6 October city in this regard, and this factory, opening in March 2012, will be the first to carry out such specialised recycling in Egypt. Eissa said that the export of used electronic devices to developing countries could be harmful, and that the media should inform the public of the need to hand over any electronic refuse to collection centres in preparation for recycling."

A Mobinil awareness expert, said that "the company was also cooperating with the Ministry of State for Environmental Affairs and the Assiut Environmental Protection Society to educate people about the safe disposal of batteries and electronic gadgets. Awareness programmes have been conducted in 65 schools in Alexandria, and Mobinil was working with the Ruh Al-Shabab Society to set up a recycling school in Manshiet Nasr."

Mobinil and the Egyptian Society for Complementary and Modern Medicine (ESCMM) are also organising seminars in Ismailia and establishing collection points for electronic waste. ESCMM said that four collection centres for electronic waste were now operating in the Al-Salam, 24 October and Gamaa Qadima sections of Ismailia.

In June 2012, Horus and the Local community Development group, both active NGO in Giza governorate, held - with the support of Mobinil - an event about safe disposal of hazardous and electronic waste and the impact of mobile networks on health and the environment. The session addressed how a hazard like e-waste can turn into an opportunity for employment and income if handled in the right way.

(Source: SWEEP-Net Country Report Egypt, 2012; Al-Ahram, 2011)

Other private sector initiatives

Egyptian Electronic Recycling Company (EERC)
In 2010, MCIT supported compume Company, one of the large retailers of ICT goods in Egypt, in establishing the first Egyptian Electronic Recycling Company (EERC). The core business of the company is refurbishing old ICT products, and Total Recycling of e-waste.

Spear Ink
Spear Ink is a pioneer in inkjet and toner environmental friendly refilling and remanufacturing.

Recyclobekia
Recyclobekia is an Egyptian electronic waste collection company (founded April 2011) that offers green recycling and data destruction with refurbishment as a middle process. With Recycling Army as a slogan, Recyclobekia aims to build up the recycling army that saves the earth from pollution and conserves its natural resources. Recyclobekia either purchases the waste or collects it for free, depending on the partner arrangement. The e-waste that can be refurbished is sold to local Egyptian retailers who restore and sell the product to local customers. The remaining waste is bundled and sold to a recycling plant abroad. "For our first shipment, we sold over 2.5 tons of e-waste to a recycling factory in China," Recyclobekia states.

(Source: www.recyclobekia.com)

Ecycle:
Ecycle is a young Egyptian company specialized in recycling and refurbishing of e-waste.
Some collection programs for end of life mobile phone batteries were initiated by local mobile operators but not publicly propagated.

Other essential stakeholders for further action in e-waste management

The following institutions may also represent essential stakeholders for further action in e-waste management:

ICT sector stakeholders:
- The National Telecommunication Regulatory Authority (NTRA)
- Telecom Egypt (TE)
- The Information Technology Industry Development Agency (ITIDA)
- Egypt Post
- The Information Technology Institute (ITI)

- The Nile University
- The Technology Development Fund (TDF)
- The ICT Trust Fund
- The Center for Documentation of Cultural & Natural Heritage (CULTNAT)

(Sources: www.arabdev.org; LC, 2011)

NGO:
Spirit of Youth – Egypt
Egyptian Association for Scientific and Technical Experts

Other:
Egypt National Cleaner Production Center (ENCPC)

The Smart Village - An innovative IT park
"The Smart Village" is a 450-acre IT park –-launched in September 2003 –, providing state-of-the-art infrastructure 28km outside Cairo. The Smart Village, is owned by a private consortium under the sponsorship of MCIT which holds a 20% shareholding. Major shareholders are Raya Holding, Orascom Group, egynet, Arab Contractors, Suez Canal Insurance and Banque Misr. Investors are permitted a 10 year tax exemption. The IT-park has attracted international companies such as Alcatel, the Cairo and Alexandria Stock Exchange, Microsoft and Vodafone. Its facilities include a back-up bourse for the Cairo and Alexandria stock exchanges, Xeed -Telecom Egypt's call center, a conference center and a hotel. To boost ICT small and medium enterprises, a venture capital company, the Technology Development Fund, was established as in mid-2004. The fund is financed by EFG-Hermes and managed by ideadevelopers with a capital of over $1 million. The Smart Village is expected to create over 30 000 technology jobs. The number of companies working in the ICT field reached 1152, employing 33,413 professionals.

(Source: www.arabdev.org)

4.3. Jordan

4.3.1. Generation of electronic waste

There are no e-waste related data available in jordan. No e-waste assessment has been conducted yet and reliable information is hard to find. A specific e-waste related inventory or assessment is not available in jordan. Even approximate evaluations of e-waste quantities do not exist.

4.3.2. National policies and regulatory framework on e-waste

In 2010, the jordan ministry of environment formed a committee with representatives from different stakeholders to work on the e-waste problem. An agreement has been signed between the ministry of environment and the basel convention regional centre for training and technology transfer for arab states in cairo (bcrc-egypt) to conduct an assessment of electronic waste (e-waste) in jordan. A specially-tailored questionnaire was designed and distributed to various institutions, agencies and commercial entities to obtain information on the quantities of the electronic equipment that find their way into the waste stream. To date, the questionnaires are under evaluation and analysis at the ministry

(Source: SWEEP-Net Country report Jordan, 2012)

4.3.3. Initiatives and stakeholders with regards to e-waste

with the aim of raising awareness in the MENA region regarding e-waste issues, the Lebanese NGO Beeatoona launched its Ecycle-me project, targeting computer retail shops and students in particular. According to Beeatoona, the same project is also being implemented in Jordan.
For further information on Beeatoona please refer to the Lebanon chapter.

(Source: Beeatoona.org)

In November 2011, Nokia supported mobile phone operator Zain during a collection event in Jordan's City mall, and recycled nearly 2000 devices. Mobile phone users could give back their old devices and receive discounts for purchase of new devices.

(Source: Shantouf, 2012)

4.4. Lebanon

4.4.1. Generation of e-waste

In lebanon, no e-waste related data are available. No e-waste assessment has been conducted yet and reliable information is therefore difficult to find. Not even an approximate evaluation of e-waste quantities generated in lebanon does exist.

4.4.2. E-waste management

In lebanon, most electronic waste generally enters the municipal solid waste stream without any sorting and ends up in dumpsites or landfills, thus cross-contaminating organic waste and affecting compost quality, or polluting soils and water. "Considering that the recycling of electronic waste and recovery of valuable metals is a major potential growth market internationally, the current haphazard disposal methods applied for e-waste in Lebanon also represent considerable economic losses" states ILO.

(Source: ILO/UNDP, 2011)

According to Nadine Haddad, director of Beeatoona, a Lebanese NGO working in environmental protection "The amount of e-waste that is being generated every day is growing. When electronics and plastics wastes are simply thrown into a pile and set aflame — a familiar practice in Lebanon — carcinogens and neurotoxins are released into the air." Unlike more developed nations, Lebanon has no way to recycle the electronics.

According to an inquiry carried out by beeatoona, 65 % of the Lebanese e-waste are stored, while 35 % are mixed up with household garbage. Another result from the study is that 65% of the Lebanese are not aware of the danger from hazardous e-waste disposal.

In order to prevent e-waste from entering the solid waste stream and ending up in landfills, Beeatoona has started initiatives for collecting and storing e-waste in a warehouse. When sufficient quantities of e-waste will have been gathered, the NGO plans to ship it to Europe for recycling.

The NGO also set up a website of its "E-cycle project" giving consumers in Lebanon and Jordan the opportunity to find locations of e-waste collection points, and a list of accepted waste items.

(Source: LAU, 2010)

4.4.3. National policies and regulatory framework on e-waste

Lebanon witnesses a lack of process and disposal facilities and there is no legislation to manage e-wastes.

(Source: www.Ecycle-me.Org)

4.4.4. International and local activities with regard to e-waste

A very active key player regarding e-waste issues in lebanon is the lebanese ngo beeatoona. Funded by usaid, transparency and accountability Grants (TAG) amongst others, Beeatoona launched its Ecycle-me project, targeting computer retail shops and students in particular.
The project aims at raising the level of awareness on this matter among workers of the public administrations and institutions. Moreover, the project particularly hopes to draft a decree to establish an E-waste management system for the public sector in order to properly dispose of all E-waste generated by the ministries and the governmental agencies. This should be attained through creating an inter-ministerial committee to promote and monitor this newly developed management system.

Beeatoona has launched several events and awareness rising campaigns:

Regional workshop in Lebanon on the proper management of E-waste
During the 3-day workshop, participants and experts from various Arab countries, such as Jordan, Kuwait, Egypt, Bahrain, Oman and Tunisia exchanged their information and experiences regarding the e-waste issue.

The workshop was concluded by the announcement of the establishment of the Arab Forum for the Proper Management of e-waste. The forum's secretariat will be located at Beeatoona- Lebanon.

The participants also came up with a list of recommendations that will be addressed to the Board of the Arab Ministries, for further advocacy and included the following:

- Enacting and amending legislations to conform with the needs of e-waste management
- Preparing national action plans that tackle the e-waste issue
- Applying and disseminating internationally approved guidelines for the sound management of e-waste, and adjusting them to suit the participating countries.
- Building the capacities of relevant institutions (Government, private sector, civil society, and media) on e-waste hazards and proper management
- Raising the level of awareness and knowledge among producers, importers and wholesalers of electrical and electronic devices, establishing a mechanism to communicate with them through Chambers of Commerce
- Strengthening the partnership between the public and the private sector and the civil society organizations for e-waste management
- Creating coordination mechanisms between the institutions of the civil society
- Introducing E-waste awareness in schools, technical institutes and universities' curriculum

E-waste and battery recycling for a better environment

A program, which targeted 450 private and public schools in Lebanon and Jordan and Tunisia, as well as training and recruiting more than 60 computer retail shops in Lebanon, known as official E-Cyclers, whose role is collecting E-waste from consumers.

E-waste awareness and collection day, at American University of Beirut (AUB)

Through this collaboration, Beeatoona and AUB aimed at spreading awareness on the E-waste issue, and providing AUB students and AUB's surrounding societies with a practical solution to dispose of their E-waste: AUB will be acting as an official E-waste collection point.

E-Waste Best Management in Public Institutions and Ministries

E-waste occupies approximately 22 000 cubic meters of storage in public institutions. In addition, according to an assessment that was recently made by the NGO, the approximate turnover rate of electronic devices in most of the ministries is 4 years. This leads to concluding that thousands of electronic devices are expected to add up to the current huge pile of E-waste

(Sources: www.ecycle-me.org, LAU, 2010, www.beeatoona.org)

Nokia's "Take Back Program"

In June 2010, Nokia launched a "Take Back Program" in partnership with the Lebanese Association of Forests, Development and Conservation (AFDC) to increase awareness of environmental friendly solutions such as mobile and accessories recycling in Lebanon. Mobile phone users are encouraged to deliver their devices to Nokia Care Center where 80% of the phone can be recycled and precious materials can be reused in kitchen kettles or musical instruments. Non-recyclable plastics in the phone are burnt to recover energy for the recycling process.

Moreover, Nokia and AFDC are hosting sessions in companies and universities to raise awareness on the importance of recycling. Energy efficient chargers are given away to all users who deliver their phones back for recycling.

(Sources: starscene.dailystar.com.lb, Shantouf, 2012)

Microsoft initiative

As example for the involvement of the Lebanese private sector in the e-waste issue, the partnership between Microsoft Lebanon and Beeatoona may be given. The initiative focuses on encouraging the reuse of computers before recycling them, by providing licensed software that is compatible with refurbished computers.

The initiative is part of Microsoft's environmental initiative in the Middle East and North Africa.

4.5. Mauritania

There are no e-waste related data available in mauritania. No studies could be found.

4.6. Morocco

Morocco is the only SWEEP-Net member country, which has conducted an in-depth e-waste assessment. Subsequently, the data situation regarding e-waste is much better in Morocco than in other countries of the MENA-region.

In 2007, Morocco launched an extensive e-waste project under the leadership of the Moroccan Cleaner Production Centre (Centre Marocain de Production Propre - CMPP) aiming at conducting a global diagnosis of the country's e-waste status. Boujemi details that "a national strategy committee was set up which included concerned stakeholders that are directly linked to e-waste to assess the current situation. The task of the committee was to define the necessary elements for drafting a road map to allow the implementation of a proper e-waste management system. By 2008, Morocco was the only Arab country that had concluded an e-waste assessment study to define the current e-waste management situation."

Based on an assessment methodology developed by the Swiss research institution for material sciences and technology development Empa, the study offers an analysis of the local context, a stakeholder analysis, a mass flow analysis as well as an evaluation of social, economic and environmental impacts resulting from the current e-waste management practices.

(Sources: boujemi, 2010; laissaoui and rochat, 2008)

4.6.1. Market for electronic devices

In morocco, the last two decades have been marked by a significant increase in the use of information and communications technologies (icts). In 2009, mobile phone subscribers reached 25.3 Million and internet users 13 million. Consequently, the sale of ict devices like mobiles and computers has grown substantially to accommodate the spike in demand in the local market.

(Sources: boujemi, 2010; laissaoui and rochat, 2008)

4.6.2. Generation of e-waste

According to the e-waste assessment, in morocco "the stock of televisions, computers and mobile phones is estimated at 222 000 tonnes in 2007. Mass wise, computers have the largest share with 68 % of the total, followed by computers with 30 %, while mobile phones only account for 2 % of the stock. On the other hand, mobile phones constitute 81 % of the stock in term of numbers. This difference is explained by the very low average weight of phones (0.1 Kg) compared to televisions (30 kg) and computers (25 kg)."
The e-waste flow resulting from the use of electronic devices amounts to 30 300 tonnes/year. Mass wise, televisions and computers account for 95 %, with respectively 15 200 tonnes/year and 13 500 tonnes/year. Mobile phone waste generates 1 700 tonnes/year.

The study concludes that "households hold the largest share of all equipments, with 81 % of the sock, while companies possess 18 % and government agencies 1 %. This unbalanced distribution of eee is mainly explained by the high penetration rate of televisions. The related e-waste flow generated yearly is also dominated by households, who generate 73 % of the flow, followed by companies and government with respectively 26 % and 1 %."

(Sources: boujemi, 2010; laissaoui and rochat, 2008)

4.6.3. E-waste management

In general, 90 % of the waste in morocco is collected and recycled by the informal sector. However, the informal sector is not specifically interested in e-waste due to the lack of interested buyers. Some waste collecting companies sell e-waste directly to recyclers without processing, while "others dismantle it first by removing plastic from desktop computers and printers. The metal parts are sold as scrap and the electrical cables are burned in the open air to recover the copper" states boujemi.

In morocco, the formal e-waste management is in its early stages of development. According to giswatch "several initiatives have been recently launched by associations or non-profit organisations, which voluntarily collect computer equipment from companies, repair it and distribute it to other associations and organisations, and rural schools."

However, the interest in e-waste among stakeholders in morocco is growing. According to a study carried out by empa and co-financed by hp and giz, several companies or ngos are currently dismantling e-waste, even though the treated volumes are small. "Apart from metal refining options (e.G. Fe, cu), no national sound solutions for downstream processing are available for most fractions generated during dismantling. However, for some special fractions national refining options are evolving, e.G. For crt monitors. For other fractions, such as precious metals containing printed wiring boards, treatment options abroad still seems to be advantageous, as currently the global players can guarantee better environmentally compliance and maximized recovery of valuable materials and thus also better business performance" concludes the study.

Boujemi has found out that "many computer agents offer their customers the option of trading in their used computers after two to five years of use. Computer repairers are also indirect stakeholders in e-waste management since some of them entrust their scrap waste to industrial pollution control companies. However, only a few retailers give their e-waste to processing companies due to the high cost and limited money offered for their waste."

(Sources: blaser and schluep, 2011; boujemi, 2010; laissaoui and rochat, 2008)

E-waste - a lost value for the moroccan metallurgical industry?

One of the e-waste assessment's major results is that "90 % of collection activities for metal scrap in general are assumed by the informal sector. A large share of these collected metals are exported to foreign smelters, while the local metallurgical industry needs to import costly raw material." Laissaoui and rochat estimate that "this costs 286 million us$ to morocco, which corresponds to the value that would be added by the 274'000 tons of metals exported every year if they were processed locally."

According to the study "the largest Moroccan metal processing units comprise SONASID, Tube et profil, Maghreb Steel, or Comptoirs métallurgiques. Several small and medium smelting units exist, especially in Casablanca, Rabat and Kenitra. The informal sector is not very active in this industry, regarding the technical know-how and the investments that are required. The recovery of precious and special metals, such as those found in printed circuit boards, doesn't exist in Morocco, excepted for the metallurgical complex of Guemassa, specialised in some metals like copper, lead, zinc and cobalt."

(Source: Laissaoui and Rochat, 2008)

Economic feasibility of e-waste recycling

The economic feasibility of e-waste recycling has also been in the focus of a study carried out by EMPA in 2011. The authors conclude that "although the model results suggest that, currently, e-waste recycling businesses in Morocco can be run by relying on the intrinsic value of the treated material only, changing conditions can pose relevant risks to the business. It is therefore concluded that sustainable recycling businesses can only grow in Morocco in combination with a comprehensive framework, which ensures:

1. that business sustainability is also guaranteed under unfavorable economic conditions, i.e. an additional flexible income stream enabled through a financing scheme needs to be established for situations where the intrinsic value of the treated material is not sufficient for a break-even;
2. that recycling businesses can grow in a level playing field; i.e. that legislation, as well as monitoring and control mechanisms favor high standard operations;
3. that market incentive are set such as high collection and recycling rates are encouraged.

At the absence of a financing scheme, a level playing field and the right market incentive it is likely that recyclers will not be interested in investing into sound operations and that cherry picking activities with low environmental and social performance as well as low collection and material recovery rates will prevail the situation in Morocco."

(Sources: blaser and schluep, 2011)

4.6.4. National policies and regulatory framework on e-waste

A specific e-waste related legislation does not exist in morocco. However, law 28-003 is related to waste management and disposal and can be used to develop the necessary legal mechanisms for the better governance of e-waste. "Since e-waste has a dangerous impact on the environment and public health in general, and particularly in uncontrolled dumps, law 28-00 is relevant as it prohibits the mixing of hazardous waste with other types of waste. Moreover, it establishes rules for the organisation of existing dumps and calls for their replacement with sanitary landfills, defining three different landfill categories. This categorisation defines the type of waste the landfills are authorised to receive" states the giswatch country report for morocco.

(Source: boujemi, 2010)

4.6.5. Initiatives and stakeholders with regard to e-waste

Governmental projects

In partnership with public and private stakeholders, the moroccan government has elaborated a national strategy called e-morocco. This strategy aims at promoting the use of new information and communication technologies for a better positioning of morocco in the international market. E-morocco aims however also to improve the market structure and develop a practical regulatory framework through institutional programmes and action plans. In this context, the government in particular has given special attention to the issue of electronic waste (e-waste) and has delegated this task to the state secretary for the ministry of energy, mines, water and environment.

Bi-lateral projects

There are several bilateral cooperation projects focusing directly or indirectly the e-waste issue.
Switzerland is cooperating actively with the moroccan cleaner production centre and the swiss institute empa has carried out the e-waste assessment fir morocco.

The german international cooperation (giz) cooperates with the moroccan ministry of energy, mines, water and environment in environmental policy, waste management including e-waste and industrial pollution. In cooperation with the german bank of reconstruction (kfw), morocco is currently setting up a hazardous waste treatment plant (cneds).

Managem urban mining project

The moroccan mining company managem has identified many similarities between the recycling industry and the mining activity, in particular regarding the separation of metals. Electronic items contain precious metals, a resource which has not yet been exploited. In 2010, managem has therefore decided to set up an "urban mining" project which includes the environmental, industrial and social dimension.
In order to organise the collection, regrouping and treatment of e-waste, the group first entered in a partnership with al-jisr, a ngo aiming at improving the performance of the moroccan education system. In this context, a partnership agreement between managem, als-jisr, the foundation drosos, the ministry of national education and the ministry of employment and professional education made it possible to set up a "green ship" workshop for the training of out-of-school young people in e-waste dismantling.
Electronic chips are directly valorized in the managem unity of guemassa, while other compounds, such as plastics, steel, etc. Are being sent to the corresponding recycling branches.

Project objectives:

- Valorize waste from ict and transform an environmental constraint into a product of highly added value.
- Contribute to environmental protection
- Improve integration of out-of-school young people
- Provide rural schools with recycled computers

Social, environmental and economic benefits:

- Every year, 65 young are trained and obtain a diploma as technicians in computer maintenance. They benefit from coaching regarding their professional integration and creation of their micro-enterprises.
- 7 000 Computers refurbished and delivered to rural public schools
- 100 000 Computers per year are dismantled and recycled avoiding in total 2 000 tons of e-waste.

(Source: www.Managemgroup.Com)

PPP measures

A public-private partnership focusing on e-waste and including the Moroccan Ministry of Energy, Mines, Water and Environment, the German GIZ and the company Hewlett Packard has been set up. According to recent information, the project is currently put on hold.

Sustainability initiatives

In Morocco, both the government and the private sector have elaborated ambitious strategies for the development of the ITC sector. According to Laissaoui and Rochat both parties are involved in environmental protection initiatives, even if "the question of sustainable management of WEEE hasn't been explicitly raised: the Environmentally Sustainable Industrial Development for the government, and the Social Responsibility Charter of the CGEM for the private sector. In order to translate these commitments into action, the existing conventions and strategies (progress contract, e-gov, etc.) need to be amended, taking WEEE management into account for the following initiatives."

(Source: Laissaoui and Rochat, 2008)

National Centre of Hazardous Waste Treatment (CNEDS)

A detailed feasibility study for launching a National Centre of Hazardous Waste Treatment (CNEDS) is currently taking place within the framework of cooperation between the Kingdom of Morocco and the Land of North Rhine-Westphalia in Germany. This centre will provide the necessary solutions to dispose of e-waste components that cannot be reused.

(Source: Boujemi, 2010)

Art from e-waste

It may be worth mentioning that some cultural initiatives are taking place using electronic waste in order to create works of art. In May 2008, the headquarters of the General Confederation of Moroccan Enterprises (CGEM) hosted an exhibition by the artist Mohammed Tayert entitled Traces and Totems, with 56 paintings and statues, ten of which were made using e-waste.

(Source: Boujemi, 2010)

4.7. Palestinian Territory

4.7.1. Market for electronic devices

The giswatch country report on palestinian territory details that "despite a lack of policy coherence, and a freezing of international aid, icts have been rapidly adopted by palestinians. The palestinian central bureau of statistics (pcbs) reports a significant increase in internet penetration rates, access to ict infrastructure and mobile telephony between 2000 and 2006.
Yet access to online information is far from ideal. Internet penetration rates in the opt remain relatively low. Although a third of all palestinian households owned a computer in 2006, only 15.9% Of the households had access to the internet. The low rates are explained by pcbs as being due to high internet costs, a lack of connectivity in rural areas, and a low level of reliance on the internet as a source of credible information."

4.7.2. Generation of e-waste

In the palestinian territory, no e-waste related data are available. No e-waste assessment has been conducted yet and reliable information is therefore difficult to find. Not even an approximate evaluation of e-waste quantities generated in the palestinian territory does exist.

Moreover, access to information in the palestinian territory is being compromised by the israeli occupation, ongoing violence and political instability.

A survey about e-waste management in the arab states revealed that there are no e-waste activities in the palestinian territory.

(Sources: ben-david and bahour, 2009; allam and inauen, 2009)

4.7.3. E-waste management

Although no data regarding e-waste and the corresponding management practices are available, there is nevertheless one case study about the town of idhna. The study states that:

"The economic potential lost from idhna's once fertile land has been replaced by e- waste collection and disposal. E-waste flows into idhna on trucks loaded with old appliances including refrigerators, computer monitors, and cell phones. Idhna has essentially turned into an electronic graveyard receiving 200-500 tons of e-waste every day. Idhna is not unique; the same methods of disposal have spilled over into the adjacent communities of al kum and beit maqdum.

In order to process the vast quantities of e-waste, palestinians have established 55 workshops that are scattered within the town of idhna. Each workshop employs between 12-38 people (over 1000 in total), many of which are under the age of 16. Workers process the e-waste to extract valuable materials such as nickel, copper and lead which is then sold and re-used. This process involves dismantling and/or burning components of electronic items in order to separate the useful materials. Furthermore 38 small-scale workshops are established next to households in idhna and 18 women also operate workshops inside their homes. In addition to workshops inside idhna town, there are also burning sites on sporadic areas of land surrounding idhna. Palestinians, who are not connected to established workshops in the village, dispose of e-waste in an open field owned by other palestinians. E-waste is burnt, minerals are extracted, and the remaining non-valuable waste is left to contaminate the land. These incidents have grown in number due to the increasing expense of owning a workshop and the ability to obtain larger profit margins from simply burning the waste. Burning sites are a quicker and cheaper way to process e-waste but are extremely detrimental to the environment."

4.8. Syria

4.8.1. Market for electronic devices

According to the international telecommunication union (itu), the number of mobile phone subscribers in syria exceeded 7 million by the end of 2009. The itu's statistics also put the number of internet users in the country at 3 565 000.

Due to the civil war there are currently no recent studies on e-waste available for syria.

(Source: tawileh, 2010)

4.8.2. Generation of e-waste

In syria, no e-waste related data are available. No e-waste assessment has been conducted yet and reliable information is impossible to find. Not even an approximate evaluation of e-waste quantities generated in Syria does exist. Moreover, access to information in Syria is being compromised since the beginning of the civil war in 2011.

The GISWatch country report on Syria specifies that "careful examination of the e-waste problem in Syria offers some interesting insight. Apparently, the vast majority of Syrians do not dispose of their old or obsolete electronic gadgets by throwing them away. A sizable market for second-hand devices and spare parts operates in the country, and most devices find their way into one form of reuse or another. This may be

attributed to the high cost of electronic devices compared to the average income, which also has another effect in increasing the life span of electronic devices."

(Source: tawileh, 2010)

4.8.3. E-waste management

In general, syrians have not yet engaged in recycling as an important part of waste management. The giswatch country report on syria states that "despite the fact that non-organic waste per capita in the country is much lower than its levels in developed nations, accelerating economic growth and household consumption indicate that waste management will soon become a critical issue. This is particularly relevant to e-waste. The decreasing prices of electronic equipment resulting in their greater affordability, combined with growing penetration of technology, has meant that increasing quantities of equipment are being imported into the country."

(Source: tawileh, 2010)

4.8.4. National policies and regulatory framework on e-waste

A survey about e-waste management in the arab states revealed that there are no e-waste activities in syria. The giswatch country report on syria however points out that "the basel convention regional centre for the arab states (bcrc) and the syrian government have engaged in a pilot project to identify and quantify hazardous waste inventories in the country. While this project does not focus primarily on e-waste, it intends to study the issue as part of the larger hazardous waste problem."

(Sources: tawileh, 2010; allam and Inauen, 2009)

4.9. Tunisia

4.9.1. Generation of electronic waste

According to information from giz, a preliminary e-waste assessment for tunisia has been conducted in 2008 by anged. Anged estimates that in the year 2010 about 50 000 tons of e-waste have been generated in tunisia (including tvs, air conditioners, refrigerators, and washing machines).

(Source: anged)

4.9.2. E-waste management

The study on e-waste management in the arab region, conducted by cedare, points out that the tunisian national agency for waste management anged is running a recycling facility with a capacity of 1000 tons/year.

Within the framework of a cooperation project with the korean international cooperation agency koica an e-waste recycling plant is built aiming at a total capacity of 24 000 tons per year (including tvs, air conditioners, refrigerators, and washing machines).

(Sources: anged; allam, 2010)

Several private companies also propose e-waste management services (see chapter 4.9.4.)

4.9.3. National policies and regulatory framework on e-waste handling and recycling

The sweep-net country report for tunisia (2010) states that a specific fee for e-waste is currently under study. Furthermore, tunisian authorities are working on introducing a tax stamp on purchase. This information could not be confirmed, but according to bilateral interviews with giz in tunisia, both regulatory initiatives are still in preparation.

In tunisia, the strategic framework for sustainable waste management prongidd is valid for the period 2007-2016 and comprises five key goals:

1. The reduction of waste production at the source,
2. The promotion of waste treatment and its valorization,
3. The improvement of the institutional, regulatory and financial waste framework,
4. The improvement of the technical and organizational aspects,
5. The development of communication and awareness about the control of waste production.

The framework also sets strategic objectives regarding e-waste for the horizon of 2016:

Key goal	implementation principle	level to reach
Promotion of waste treatment	reinforcing recycling at the level of the sectors to reach for 3e waste	70%

(Source: sweep-net country report tunisia, 2010)

According to anged, tunisia is currently setting up an e-waste management system based on epr principles. Producers (manufacturers, importers or distributors) of electronic devices are responsible for managing the e-waste resulting of their activities.

Furthermore, a 5% eco-tax on electric and electronic devices is being prepared in order to finance the e-waste management system.



Following the political and institutional changes after the revolution and due to the current transition period, political considerations regarding e-waste may also have changed.

4.9.4. Initiatives and stakeholders with regard to e-waste

Governmental projects

According to bilateral interviews with giz in tunisia, the tunisian national agency for waste management anged has started initiatives regarding e-waste inventories and the development of a regulatory framework.



A tunisian-korean project carried out by the tunisian ministry of environment and the korean international cooperation agency koica focuses on setting up environmentally friendly solutions for the management of tunisian e-waste. An e-waste recycling plant is built with a capacity of 24 000 tons per year.

(Source: anged)

Private sector activities

Several private companies are active in tunisia and propose e-waste related services:

The private initiative collectun d3e recyclage proposes e-waste management services. The company operates in e-waste collection, transport, recycling and exportation.

(Source : collectun d3e recyclage)



Elec recyclage tunisie proposes collection, transport and exportation of e-waste.

The "société tunisienne recyclage de metaux (strm)" and the "société el mouraskil" offer services from collection to conditioning, transport, dismantling and recycling.

(Source: anged)

Ppp measures

A ppp project on e-waste including a preliminary inventory on e-waste generation is currently being prepared by giz in tunisia. At the present time, no more detailed information could be gathered.

(Source: bilateral interview with giz in tunisia.

4.10. Yemen

4.10.1. Generation of e-waste

For yemen, no e-waste assessment has been conducted yet and reliable information is therefore not available. In 2004, the gtz (now giz) conducted a study titled "basic data collection on e-waste recycling in yemen", but the original document could not be made available.

4.10.2. E-waste management

According to the study conducted by the gtz, e-waste recycling does not take place in yemen and the people are not aware of the precious metal in computer hardware. Processes such as reuse, reassembling and repair of components are more rentable than using the precious metals as secondary raw materials.

Obsolete electrical and electronic devices are repaired until they get totally broken. The life span of computer is between 8-10 years. The al-ahmar company is the authorized reseller of hp and is only company in yemen which collects outdated computers from big buyers of new computers.

(Source: arora, 2008)

4.10.3. National policies and regulatory framework on e-waste

There are currently neither policies nor technical guidelines addressing the management of the waste stream in the country.

(Source: unep global partnership on waste management)

5. REGIONAL BENCHMARKING REGARDING E-WASTE IN SWEEP-NET MEMBER COUNTRIES

The following table resumes the study results as a comparative compilation of data in form of a regional benchmarking. The benchmarking is based on a model used by SWEEP-Net.

Criteria	Mauritania	Morocco	Algeria	Tunisia	Egypt	Lebanon	Syria	Jordan	Palestinian Territory	Yemen
General Data availability										
E-waste assessment										
Formal E-waste collection										
Formal and environmentally sound recycling										
Formal E-waste Refurbishing										
Policies and framework										
Local initiatives										
International cooperation activities										

The results have been evaluated in accordance to three levels:

Evaluation
Not available /Not existing
In Preparation / Preliminary activities
Available / Existing

The study on e-waste management in the Arab region, conducted in 2010 by CEDARE, has also developed a regional benchmarking regarding e-waste. As some of CEDARE's conclusions slightly differ from the results of the present study, the CEDARE benchmarking is detailed in the following table in order to provide as much information as possible.

	Legal Framework	Inventory	Collection	Recycling & Reusing Technology
Level 1 – LOW	No legal framework, strategy, or norms	There is no inventory	There is no collection	There is no recycling/ reusing mechanism
	Iraq, Kuwait, Lebanon*, Syria, Yemen	**Egypt, Iraq, Jordan, Lebanon*, Kuwait**	**Egypt, Iraq, Jordan, Lebanon*, Yemen**	**Iraq, Kuwait, Syria, UAE*, Yemen**
Level 2	There is only plan to develop legal framework	There is the inventory for municipal solid waste, but no designated inventory for E-waste.	E-waste is locally collected by local recyclers, scavengers, etc. without any legal framework. Only recyclable E-waste is well collected	Only recyclable and reusable E-waste is recycled and reused by local stakeholders
	Bahrain, Egypt, Syria	**Bahrain, Syria, UAE*, Yemen**	**Kuwait, Syria, UAE***	**Jordan**
Level 3	A legal framework is being prepared and will be issued/enforced in very near future	E-waste inventory is being prepared	E-waste is well collected by local collection mechanism. Pilot separation and collection systems have been setup	There is a plan to set up E-waste facility
	Jordan, Tunisia*, UAE*		**Tunisia***	**Bahrain, Egypt**
Level 4	Enforcement, but the legal framework is not well conducted	E-waste inventory is conducted, but lack of information and data	Collection system for E-waste is operational and includes environmentally sound disposal	There is E-waste Recycling facility, but not achieve to full operation for all E-waste in the country
		Morocco*, Tunisia	**Bahrain**	
Level 5 – HIGH	Full enforcement and model legal framework for other countries	E-waste inventory is fully conducted and available on website	Collection systems are fully operational. Our collection is recognized as a model system by other countries	E-waste recycling facility is fully operated for all E-waste in the country and the model as the stat oft the-art recycling facility
				Tunisia*

(Source: Allam, 2010)

6. CONCLUSIONS AND RECOMMENDATIONS

E-waste is of growing concern in many of the SWEEP-Net member countries and e-waste related initiatives have been launched by authorities, private sector or NGO. Nevertheless, risks for human health and the environment from inappropriate e-waste management are not yet well known and awareness is still low.
Based on the study results and discussions with various stakeholders, the following activities are recommended:

Carry out awareness campaigns

Though several initiatives exist in some SWEEP-Net member countries, awareness on e-waste risks is in general still very low or even not existing.

There is a strong need for awareness rising in all SWEEP-Net member countries, including for public institutions, private sector and population.

Carry out e-waste assessments

The tremendous lack of e-waste related data in nearly all SWEEP-Net member countries points out the strong need for carrying out e-waste assessments. International donor organizations may contribute financially or technically to the assessments, which could be based on the methodology used in Morocco.

Set up pilot projects

The study confirms the conclusions of many experts that there is a need for e-waste management pilot projects allowing the elaboration of e-waste management practices, the development of new technologies and demonstrating the benefits of a sustainable e-waste management system. Furthermore, pilot projects can demonstrate a successful business model incorporating different stakeholders.

Develop legal framework

Regulatory and legal framework, which incorporates responsibilities to importers, manufacturers, and owners, needs to be developed and implemented. The WEEE and RoHS Directives of the EU may be used as orientation and adapted to the specific needs of the SWEEP-Net member countries.

Organize Multi-stakeholder dialogs

Environmentally sound management of e-waste needs the participation of various stakeholders from the public sector, private sector and civil society. Multi-Stakeholder dialogues give the opportunity to exchange different points of views and develop integrated e-waste management concepts.

Develop e-waste business models

There is a strong need to develop a business model for a sustainable e-waste management system which includes collection, transportation, recycling, and exporting or disposal system. Thereby, the private sector plays a key role and has to be incorporated in developing an e-waste management system. Existing activities from the informal sector must also be taken into account.

The resulting business models will have to be economically viable, environmentally sound and socially inclusive.

Promote "Extended Producer Responsibility (EPR)"

Extended producer responsibility (EPR) is a policy that requires manufacturers to accept responsibility for all stages in a product's lifecycle, including "end-of-life" management. By this, EPR encourages manufacturers to reduce the volume of toxic substances contained in components and to redesign electronic products so they can be easily disassembled for reuse or recycling.

Study the setting up of regional treatment platforms

Developing an integrated e-waste management system includes recycling activities that may be expensive if carried out in every member country at national level. Setting up regional platforms for e-waste treatment or recycling may be a solution. For instance, Egypt and Morocco could play this role, under condition that requirement of Basel Convention are fulfilled.

Organize regional conferences on e-waste

Regional conferences on e-waste give SWEEP-Net member states the opportunity to exchange experiences about policies and management options for e-waste. Private companies may use regional conferences as a platform for promoting services.

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- www.step-initiative.org/
- www.environmental-expert.com/waste-recycling/electronic-waste-recycling/products/keyword-electronic-waste-scrap-29954/location-algeria

8. ANNEXES

Annex 1: Categorization of e-waste in the Algerian legislation

Code du déchet	Désignation des déchets	Classe du déchet	Critère de dangerosité
16.2	**Déchets provenant d'équipements électriques ou électroniques**		
16. 2 .1	Transformateurs et accumulateurs contenant des PCB	SD	Irritante toxique cancérogène dangereuse pour l'environnement
16. 2 .2	Equipements mis au rebut contenant des PCB ou contaminés par de telles substances autres que ceux visés à la rubrique	SD	Irritante toxique cancérogène dangereuse pour l'environnement
16. 2 .3	Equipements mis au rebut contenant des chlorofluorocarbones, des HCFC ou des HFC	SD	Dangereuse pour l'environnement
16. 2 .4	Equipements mis au rebut contenant de l'amiante libre	SD	Toxique cancérogène
16. 2 .5	Equipements mis au rebut contenant des composants dangereux (1) autres que ceux visés aux rubriques 16.2.1 à 16.2.4 (1) Par composants dangereux provenant d'équipements électriques et électroniques, on entend notamment des piles et accumulateurs visés à la section 16.6 et considérés comme dangereux, des aiguilles de mercure, du verre provenant de tubes cathodiques et autres verres activés, etc.	SD	Dangereuse pour l'environnement
16. 2 .6	Equipements mis au rebut autres que ceux visés aux rubriques 16.2.1 à 16.2.5	S	
16. 2 .7	Composants dangereux retirés des équipements mis au rebut		Dangereuse pour l'environnement
16. 2 .8	Composants retirés des équipements mis au rebut autres que ceux visés à la rubrique 16.2.7	S	
16. 2 .9	Déchets non spécifiés		

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