

TOPIC 14: ELECTRONIC WASTE MANAGEMENT (E-WASTE)

Senior One ICT | Understanding, Managing, and Reducing Electronic Waste
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Connecting to What You Already Know

- **This topic builds on what you studied in earlier topics. Make sure you can answer YES to all of the following:**
 - I know the names and functions of common hardware components. (Topic 2)
 - I understand health and environmental risks linked to ICT use. (Topic 8)
 - I am aware of the wide range of ICT devices used in daily life. (Topic 1)
 - I understand what responsible and ethical use of technology means. (Topics 7 & 8)
- **The BIG QUESTION for this topic:**
 - What happens to a computer, phone, or television when it is no longer useful? Where does it go — and why does it matter?

 **Opening Discussion:** Look around your home. How many old or broken electronic devices can you think of? What has your family done with them in the past?

What You Will Learn in This Topic

- **By the end of Topic 14, you should be able to:**
 - Define electronic waste (e-waste) and give examples of e-waste items.
 - Explain what e-waste management is and describe good practices.
 - Describe the health, environmental, economic, and resource impacts of improper e-waste disposal.
 - Identify the roles of government, industry, and citizens in managing e-waste.
 - Plan and create an ICT-based public awareness campaign on e-waste.
 - Apply e-waste management guidelines in a school setting.
 - Use key terms: EPR, Urban Mining, Basel Convention, Right to Repair, Circular Economy.

14.1 What is Electronic Waste (E-Waste)?

- **Electronic waste (e-waste) refers to any DISCARDED, SURPLUS, BROKEN, or END-OF-LIFE electrical or electronic device.**
- It includes equipment that has reached the end of its useful life OR is no longer wanted by its owner. (UNEP, 2019)
- E-waste is the FASTEST GROWING category of waste in the world.
- E-waste items often contain BOTH valuable materials (gold, copper, lithium) AND hazardous substances (lead, mercury, cadmium).
-  **KEY FACT: A single smartphone contains over 60 different elements from the periodic table — including gold, silver, platinum, cobalt, and rare earth metals — many of which are finite and difficult to mine sustainably.**
- **UG UGANDA FACT: Uganda generates approximately 17,000 tonnes of e-waste per year. A significant portion is improperly disposed of — burned, buried, or dumped — releasing toxic chemicals into soil, water, and air. (Global E-waste Monitor)**

Examples of E-Waste – It Is Not Just Old Computers!

Category	Examples
Computing Devices	Desktop computers, laptops, tablets, keyboards, mice, printers, scanners
Communication Devices	Mobile phones, landline phones, fax machines, routers, modems
Household Electronics	Televisions, radios, DVD players, washing machines, microwaves, air conditioners
Batteries and Cables	Phone batteries, laptop batteries, power banks, chargers, USB cables
Other Electronics	Cameras, calculators, photocopiers, gaming consoles, solar panels

 **Class Audit:** In pairs, list 5 electronic devices in your home that are broken or no longer used. Which category does each fall into? Could any of them be repaired or donated?

14.2 What is E-Waste Management?

- E-waste management is the process of **COLLECTING, PROCESSING, and DISPOSING** of electronic waste in a **SAFE, ENVIRONMENTALLY FRIENDLY, and LEGAL** manner.
- **Good e-waste management has TWO main goals:**
 - MINIMISE harm to people and the environment.
 - MAXIMISE the recovery of valuable materials.
- It involves: Collection → Segregation → Recycling → Refurbishment → Safe Disposal
- Good e-waste management also requires: Public awareness, adherence to laws, and use of authorised collection and recycling systems. (WHO, 2021)
- The opposite — **IMPROPER disposal** — means burning, burying, or dumping, which causes serious harm to communities.

 **Think:** What is the difference between 'disposing' of an old phone and 'managing' it as e-waste? Why does the method matter?

Good Practice 1: Donations and Refurbishment

- Rather than **DISCARDING** functional or repairable devices, they can be **DONATED** to schools, community centres, libraries, and charities.
- This **EXTENDS** the useful life of the device and **REDUCES** e-waste.
- **Examples in Uganda:**
 - Schools in rural Uganda can receive donated computers from urban schools or companies.
 - Computers for Schools Uganda (CFSU) collects donated devices, **REFURBISHES** them, and gives them to under-resourced schools.
 - Businesses donate decommissioned equipment to certified refurbishers.
-  **IMPORTANT: Before donating any device, ALL personal data must be SECURELY ERASED to protect privacy and personal information.**

 **Discuss:** Your school has 10 old but working computers. Which organisation in Uganda could you contact to donate them? What must you do to the data first?

Good Practice 2: Electronics Recycling

- **RECYCLING** involves breaking down e-waste into its component materials — metals, plastics, glass — and **REUSING** those materials to make new products.
- This reduces the need to mine raw materials and **REDUCES POLLUTION**.
- **Valuable materials recovered from e-waste include:**

Material	Found In	Value / Use
Gold	Circuit boards, connectors	Used in new electronics, jewellery
Silver	Circuit boards, contacts	Used in new electronics, photography
Copper	Wiring, motors	Used in construction, new electronics
Lithium	Batteries	Used in new batteries for EVs and phones
Rare Earth Metals	Screens, magnets	Used in motors, wind turbines, electronics

Good Practice 3: Take-Back Programs

- Take-back programs are initiatives where **MANUFACTURERS, RETAILERS, or GOVERNMENT AGENCIES** accept used electronics from consumers for proper disposal or recycling.
- **Examples in Uganda and globally:**
 - MTN Uganda has run campaigns encouraging customers to return old SIM cards and handsets.
 - Kampala Capital City Authority (KCCA) has conducted e-waste collection drives in Kampala.
 - International companies like Samsung and Dell run global take-back and recycling programs.
- **EXTENDED PRODUCER RESPONSIBILITY (EPR):**
 - A policy that makes **MANUFACTURERS** legally and financially responsible for managing their products at end-of-life.
 - It incentivises companies to design **LONGER-LASTING** and **EASIER-TO-RECYCLE** products.

 **Real World:** When you buy a new phone, what happens to your old one? Does the shop offer to take it back? Should this be mandatory by law?

Good Practices 4 & 5: Eco-Design, Policy & Public Awareness

- **ECO-DESIGN AND CIRCULAR PRODUCT INNOVATION:**
 - Modular design — allows individual components (battery, screen, camera) to be replaced without discarding the entire device.
 - Use of RECYCLED materials in manufacturing reduces dependence on raw material extraction.
 - Standardised connectors and chargers reduce accessory waste and simplify recycling.
- **POLICY, LEGISLATION & INTERNATIONAL COOPERATION:**
 - Governments should enforce national e-waste laws aligned with the BASEL CONVENTION on hazardous waste exports.
 - Ban the export of non-functional e-waste to developing countries disguised as 'donations'.
- **PUBLIC AWARENESS & EDUCATION:**
 - Launch sustained campaigns through schools, social media, and community events.
 - Incorporate e-waste literacy into school curricula from primary level.

14.3 Why Does Proper E-Waste Management Matter?

- **Improper disposal of e-waste causes FOUR major categories of harm:**
 - 1. HEALTH IMPACTS – toxic substances harm the human body.
 - 2. ENVIRONMENTAL IMPACTS – poisons soil, water, and air.
 - 3. ECONOMIC IMPACTS – missed opportunities for jobs and resource recovery.
 - 4. RESOURCE WASTE – valuable finite materials are permanently lost.
- **Proper management is important because it:**
 - Prevents environmental POLLUTION and reduces HEALTH RISKS from lead, mercury, and cadmium. (WHO, 2021)
 - Promotes RESOURCE CONSERVATION by recovering valuable metals and plastics. (UNEP, 2019)
 - Supports SUSTAINABLE DEVELOPMENT and reduces the need for destructive raw material

 **Preview:** We will now look at each of the four impact areas in detail. As we go, note which impacts could directly affect people in YOUR community.

14.3.1 Health Impacts of Improper E-Waste Disposal

- E-waste contains **TOXIC SUBSTANCES** that are released when devices are burned or broken apart carelessly.
- These substances can contaminate AIR, SOIL, and WATER — entering human bodies through breathing, eating, and drinking.
- **MOST AT RISK: Children who play near e-waste dumpsites. Adults who burn e-waste to extract metals.**
- **Health effects include:**
 - Impaired BRAIN DEVELOPMENT and learning difficulties (especially in children).
 - RESPIRATORY problems and reduced lung function.
 - KIDNEY FAILURE and liver damage.
 - CANCER and hormonal disruption.

 **Local Reality:** In Uganda, some people burn old electronics to recover copper wire for sale. What are the health risks to that person, their family, and their neighbours?

Hazardous Substances Found in E-Waste

Substance	Found In	Health Risk
Lead (Pb)	CRT screens, circuit boards	Brain damage, kidney failure — especially in children
Mercury (Hg)	Fluorescent lamps, batteries, screens	Nervous system damage, kidney failure
Cadmium (Cd)	Rechargeable batteries, screens	Kidney damage, lung disease, cancer
Brominated Flame Retardants	Plastic casings, circuit boards	Hormonal disruption, cancer risk
Arsenic	Microchips, LEDs	Cancer, skin diseases, nervous system damage



Quick Check: Which substance found in circuit boards is especially dangerous to children's brain development? Where is mercury commonly found in electronics?

14.3.2 Environmental Impacts of Improper E-Waste Disposal

- **When e-waste is improperly disposed of, the damage spreads far beyond the dumpsite:**
- **SOIL CONTAMINATION:**
 - Toxic metals LEACH into soil, killing crops and making land unusable for farming.
- **WATER CONTAMINATION:**
 - Toxins enter GROUNDWATER — contaminating wells and rivers used for drinking and cooking.
- **AIR POLLUTION:**
 - Burning e-waste releases DIOXINS and FURANS — highly toxic gases that cause cancer and contribute to climate change.
- **FOOD CHAIN CONTAMINATION:**
 - Animals and fish that consume contaminated plants or water pass toxins UP THE FOOD CHAIN —

 **Think Locally:** If e-waste is dumped near Lake Victoria or the River Nile, how could it eventually affect the health of fishing communities far away?

14.3.3 & 14.3.4 Economic and Resource Impacts

- **ECONOMIC IMPACTS — Proper management creates OPPORTUNITIES:**
 - Formal e-waste recycling creates JOBS in collection, sorting, processing, and refurbishment.
 - Valuable materials recovered from e-waste REDUCE THE COST of manufacturing new products.
 - Countries that manage e-waste well ATTRACT FOREIGN INVESTMENT and avoid environmental fines.
- **RESOURCE CONSERVATION:**
 - Manufacturing new electronics requires MINING precious metals and rare earth minerals — a destructive and energy-intensive process.
 - Recycling e-waste REDUCES THE NEED FOR MINING and CONSERVES natural resources for future generations.

 **Opportunity:** If Uganda established 5 formal e-waste recycling centres, what kinds of jobs could they create? How would this benefit the economy?

14.4 Roles of Government, Industry, and Citizens

- **Effective e-waste management requires COLLABORATION among all stakeholders:**
- **GOVERNMENT:**
 - Develop and ENFORCE national e-waste laws aligned with the Basel Convention.
 - Set mandatory EPR targets and financial penalties for non-compliance.
 - Fund public awareness campaigns and community collection drives.
- **INDUSTRY (Manufacturers and Retailers):**
 - Design ENVIRONMENTALLY FRIENDLY products that last longer and are easier to recycle.
 - Implement take-back programs and ensure SAFE RECYCLING at end of product life.
- **CITIZENS (You and Me!):**
 - RESPONSIBLY DISPOSE of electronic devices — never burn or dump them.
 - Participate in recycling programs. REDUCE consumption. Repair before replacing.

E-Waste Management in Uganda – The Local Context

- **Uganda generates approximately 17,000 TONNES of e-waste per year. (Global E-waste Monitor)**
- **KEY ORGANISATIONS IN UGANDA:**
 - NEMA (National Environment Management Authority) – oversees environmental protection including e-waste policy.
 - KCCA (Kampala Capital City Authority) – has conducted e-waste collection drives in Kampala.
 - CFSU (Computers for Schools Uganda) – collects, refurbishes, and redistributes donated computers to schools.
 - MTN Uganda – has run campaigns encouraging return of old handsets and SIM cards.
- **CHALLENGES FACING UGANDA:**
 - Lack of formal e-waste recycling facilities outside Kampala.
 - Widespread practice of burning e-waste for metal extraction.
 - Low public awareness about the dangers of improper disposal.
 - Import of second-hand electronics that quickly become e-waste.

14.5 E-Waste Management Guidelines for Schools

- Schools generate significant e-waste: old computers, monitors, keyboards, mice, printers, toner cartridges, batteries, and cables.
- The 4Rs framework for schools: REDUCE → REPAIR → REUSE → RECYCLE

Guideline	Action Steps
Assess all e-waste	Conduct a regular audit. Classify items as: Working, Repairable, Donate, Recycle, or Dispose.
Donate working devices	Contact CFSU or local NGOs to donate functional equipment to under-resourced schools.
Partner with recyclers	Identify a registered e-waste recycler. Contact KCCA or NEMA for approved recyclers.
Safe storage	Store unusable e-waste in a designated, labelled storeroom. NEVER dump or burn it.
Educate the community	Include e-waste in school assemblies, notice boards, and the ICT curriculum.
Secure data before disposal	Use data wiping software (e.g., DBAN or Eraser) to permanently delete all data.
Document all disposals	Keep records of what was disposed, the method used, and the organisation that collected it.



SCENARIO: The School ICT Lab Crisis (Group Activity)

- During a school inspection, the headteacher discovers that the ICT lab has 12 broken computers, 30 dead batteries, and old cables and keyboards piled in a corner. A local person has offered to **BUY ALL** the broken equipment for scrap metal and plans to **BURN IT** to extract the metal.
- Your ICT teacher asks your group to **ADVISE THE SCHOOL**. Answer in your exercise book:
 - (a) What are the **RISKS** if the school sells the equipment to the scrap buyer who plans to burn it?
 - (b) What **ALTERNATIVE OPTIONS** does the school have for disposing of the broken computers responsibly?
 - (c) What steps must the school take **BEFORE** donating the working parts to another school?
 - (d) How can you use ICT skills to help the school **RAISE AWARENESS** about this issue among students and parents?
 - (e) **DRAFT** a simple e-waste disposal **POLICY** (5–7 rules) the school could adopt to prevent this problem in future.

14.4 Planning an ICT-Based Public Awareness Campaign

- A PUBLIC AWARENESS CAMPAIGN uses various media — posters, videos, social media, presentations — to INFORM and EDUCATE people about an important issue.
- An effective campaign should:
 - Understand the problem clearly.
 - Set CLEAR OBJECTIVES — what do you want people to KNOW or DO?
 - Identify a TARGET AUDIENCE — students? parents? local businesses?
 - Design effective COMMUNICATION STRATEGIES.
 - Use multiple COMMUNICATION CHANNELS.
 - Include a strong CALL TO ACTION.
 - Encourage COMMUNITY PARTICIPATION.

 **Think:** If you had to communicate ONE message about e-waste to your community, what would it be? How would you say it in a way people would remember?

Steps to Plan and Create Your E-Waste Campaign

- Step 1: DEFINE YOUR TARGET AUDIENCE – Are you speaking to students? Parents? Local businesses? Teachers?
- Step 2: SET YOUR MESSAGE – What is the ONE key thing you want people to know or do? (e.g., 'Don't burn your old phone!')
- Step 3: CHOOSE YOUR CHANNELS – WhatsApp, school assembly, posters, notice board, school newsletter.
- **Step 4: CREATE YOUR MATERIALS using ICT tools:**
 - Digital Poster – Use Microsoft Publisher, Canva, or Google Slides to design a striking poster.
 - Infographic – Use Canva or Piktochart for a visual summary of e-waste facts.
 - Video – Use a smartphone and Windows Movie Maker or iMovie for a short awareness video.
 - Presentation – Use Microsoft PowerPoint or Google Slides for a school assembly.
 - Social Media Post – Design graphics for Facebook, Instagram, or WhatsApp Status.
- Step 5: TEST your materials – Is the message CLEAR? Is the design ATTRACTIVE?
- Step 6: LAUNCH – Present at assembly, post on notice board, share digitally.
- Step 7: EVALUATE – Did people respond? Survey the audience BEFORE and AFTER.



Group Campaign Activity (Groups of 4–5)

- **RESEARCH TASKS:**
 - (a) Find the name and location of at least TWO e-waste recycling or collection facilities in Uganda.
 - (b) Find ONE law or policy in Uganda that relates to e-waste management. (Hint: Research NEMA Uganda)
- **CREATION TASKS (using the school ICT lab):**
 - Create a DIGITAL E-WASTE AWARENESS POSTER using Microsoft Publisher, Canva, or Word. Must include: headline, at least 3 key facts, a call to action, and an image.
 - Create a SHORT POWERPOINT PRESENTATION (5–8 slides) on 'Why E-Waste is a Problem in Uganda'. Include: What is e-waste, How Uganda generates e-waste, Health dangers, Environmental damage, What we can do.
 - Write a SHORT SCRIPT for a 90-second school assembly announcement on e-waste management. Practise and present it to the class.
- **PRESENTATION: Share your findings and materials with the class.**



Role Play Activity: The School E-Waste Crisis

- In groups of FOUR, perform a role play demonstrating the responsibilities of the following characters in managing a school's e-waste crisis.
- Each character should speak for at least 2 minutes:
 - Character 1 – The HEADTEACHER: Responsible for making decisions. What policy will the school adopt?
 - Character 2 – The ICT TEACHER: Expert adviser. What should be done with the broken equipment?
 - Character 3 – A STUDENT LEADER: Voice of the learners. How will students be educated and involved?
 - Character 4 – A COMMUNITY MEMBER or PARENT: Concerned about health risks. What are their fears?
- Your role play must answer:
 - What will the school do with 12 broken computers, 30 dead batteries, and old cables?
 - Who will the school contact for help? What steps will they take?



Homework Assignment

- **Complete ALL THREE tasks and bring your work to the next lesson:**
- **TASK 1 – INTERVIEW:**
 - Interview ONE person at home (parent, older sibling, or neighbour) about what they do with old mobile phones, broken appliances, or used batteries. Write a ONE-PAGE summary including: What they currently do, Whether they are aware of the risks, What YOU advised them to do differently.
- **TASK 2 – RESEARCH:**
 - Research: What is NEMA Uganda (National Environment Management Authority)? What role does it play in e-waste management in Uganda? Write a HALF-PAGE summary.
- **TASK 3 – VIDEO:**
 - Using your phone or home computer, create a 1-MINUTE VIDEO on 'E-Waste Do's and Don'ts' and share it with your class WhatsApp group or email it to your teacher.



Key Terms – Topic 14 Glossary

Term	Definition
E-Waste	Any discarded, surplus, broken, or end-of-life electrical or electronic device.
E-Waste Management	The safe, legal, and environmentally friendly collection, processing, and disposal of e-waste.
Extended Producer Responsibility (EPR)	A policy making manufacturers legally responsible for managing their products at end-of-life.
Urban Mining	Recovering valuable metals and materials from discarded electronics, treating waste as an 'ore'.
Basel Convention	An international treaty regulating the movement of hazardous waste (including e-waste) between countries.
Right to Repair	A movement advocating that manufacturers must make spare parts available so devices can be fixed instead of discarded.
Circular Economy	An economic model that eliminates waste by keeping materials in use through reuse, repair, and recycling.
Refurbishment	Repairing and upgrading old devices so they can be used again.
CFSU	Computers for Schools Uganda — refurbishes donated computers and distributes them to schools.



Revision Questions – Topic 14

- **Answer the following questions in your exercise book:**
- 1. Define 'e-waste'. Give FIVE examples of e-waste items found in Ugandan homes.
- 2. State FOUR good practices in e-waste management and explain each briefly.
- 3. Why must data be securely erased before donating a computer? What software can be used?
- 4. Name THREE hazardous substances found in e-waste. For each, state where it is found and ONE health risk it causes.
- 5. Explain TWO ways that improper e-waste disposal damages the environment in Uganda.
- 6. What is Extended Producer Responsibility (EPR)? Give ONE example of how it works.
- 7. State THREE specific actions YOUR SCHOOL should take to manage its e-waste responsibly.
- 8. Explain the difference between: (a) Urban Mining and traditional mining (b) Circular Economy and linear economy.
- 9. Why is the Basel Convention important for countries like Uganda?

Summary: The 4Rs of E-Waste Management

- **Remember these four actions — in order of preference:**
- 1. REDUCE – Buy less. Choose quality over quantity. Repair before replacing. Ask: Do I really need a new device?
- 2. REPAIR – Fix broken devices rather than discarding them. Support right-to-repair.
- 3. REUSE – Donate working devices to schools, NGOs, or families who need them. Extend the life of equipment.
- 4. RECYCLE – When a device is truly at end-of-life, ensure it goes to a certified e-waste recycler — not a bonfire.
- **Your personal commitment:**
 - As a future citizen and ICT user, YOU have a responsibility to manage electronic waste safely. Every device you handle responsibly protects your community's health, environment, and future.
- **Sustainable management of electronic waste is not merely an environmental obligation — it is an ECONOMIC OPPORTUNITY, a PUBLIC HEALTH IMPERATIVE, and a measure of our COMMITMENT TO FUTURE GENERATIONS.**

End of Topic 14

Electronic Waste Management (E-Waste)

Remember: Reduce → Repair → Reuse → Recycle