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ITU-T Recommendation on e-waste management and circular economy

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E-waste training

Some useful Recommendations on e-waste and circular economy

- **E-waste management**
  - **L.1030**: E-Waste management framework for countries
  - **L.1031:** Guideline on implementing the e-waste reduction target of the Connect 2020 Agenda
  - **L.1021** Extended Producer Responsibility (EPR) Guidelines for Sustainable E-waste Management
- **Circular economy**
  - **L.1020: Circular economy: Guide for operators and suppliers on approaches to migrate towards circular ICT goods and networks**
  - **L.1022: Circular Economy: Definitions and concepts for material efficiency for Information and Communication Technology (on approval phase)**

E-waste, why do we need management?

- Some points:
  - negative effects due to the presence of hazardous substance if e-waste is not managed.
  - Negative effect if it is not properly managed.

"There are many reasons why countries should establish or reinforce their e-waste management national systems. According to the European Union (EU) WEEE directive, the appropriate management of WEEE is paramount due to the presence of hazardous substances, such as "mercury, cadmium, lead, hexavalent chromium, polychlorinated biphenyls (PCBs) and ozone-depleting substances". Consequently, if not treated properly, WEEE could have significant negative environmental, economic, and social effects.
It has been observed, for instance, that improper management of e-waste can have severe effects on human health, causing allergies, respiratory diseases and cancer. Furthermore, leaching, open-air burning and heating, as well as uncontrolled discharge of scrap, acids, cyanides and other by-products from processing operations pollute the soil, groundwater and food. On the contrary, effective recycling of e-waste has a direct positive impact on the environment, economy and society." [from ITU-T L.1030]

Benefits of E-waste management

- **A new type of Mining**
  - Prevention is paramount **as 20-50 million tonnes of e-waste is generated globally each year. E-waste is one of the fastest growing waste streams in the world. E-waste is also an economic opportunity**. Equipment can contain rare metals, including gold, silver, palladium, lithium, ruthenium, antimony, indium and tin, as well as base metals (e.g., copper, lead and zinc). E-waste is a rich source of precious metals compared to primary ores . The case is often made that for every ton of ore at a gold mine only 5 g of gold can be extracted, whereas 1 ton of mobile phones can contain up to 400 g of gold [b-SMG]. …. Moreover, one ton of personal computer waste contains more gold than 17 tons of gold ore.
- **A new type of JOB**
  - Reuse, refurbishing and recycling offer direct business development opportunities for communities, thus contributing to job creation. On a per-ton basis, sorting and processing recyclables alone generate 10 times more jobs than dumping or incineration. For example, computer reuse and recycling creates **296 more jobs for every 10000 tons of material disposed each year.**

Connect 2020 Agenda

- The Connect 2020 Agenda is a global initiative headed by ITU. It sets out the shared vision, goals and targets for Global Telecommunication/ICT Development that Member States have committed to achieve by the year of 2020.
- ITU-T Resolution 200 approved in the Plenipotentiary Conference in Busan, 2014, (Target 3.2). *"Volume of redundant e-waste to be reduced by 50% by 2020"*
- **The result of this is ITU-T Recommendation L.1031**
- This Recommendation specifies a three-step guideline that relevant stakeholders can use to reach the e-waste goal of the Connect 2020 Agenda.
- Aligned with the following sustainable development goals (SDGs):
- SDG 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable
- SDG 12 Ensure sustainable consumption and production patterns
- SDG 13 Take urgent action to combat climate change and its impacts

Implementing the e-waste reduction target Recommendation ITU-T L.1031

Recommendation ITU-T L.1031 describes 3 step approach to implement a reduction target for e-waste:

1. **Step 1: Develop a comprehensive e-waste inventory;**
   - guidance on developing an e-waste inventory based on techniques developed by the Basel Convention and the Swiss Federal Laboratories for Materials Science and Technology (EMPA).

2. **Step 2: Develop a sustainable e-waste management system;**
   - information on designing e-waste prevention and reduction programmes based on strategies developed by ITU-T and other international organizations.

3. **Step 3: Outline the requirements for successfully implementing e-waste programmes.**
   - outlines the supportive measures required for successfully reaching the Connect 2020 e-waste reduction goal.

The e-waste hierarchy (Basic Concept)

- The action to be performed to manage waste.
  1. Prevention reduce waste production
  2. Re-use
  3. Recycling
  4. Other recovery
  5. Disposal

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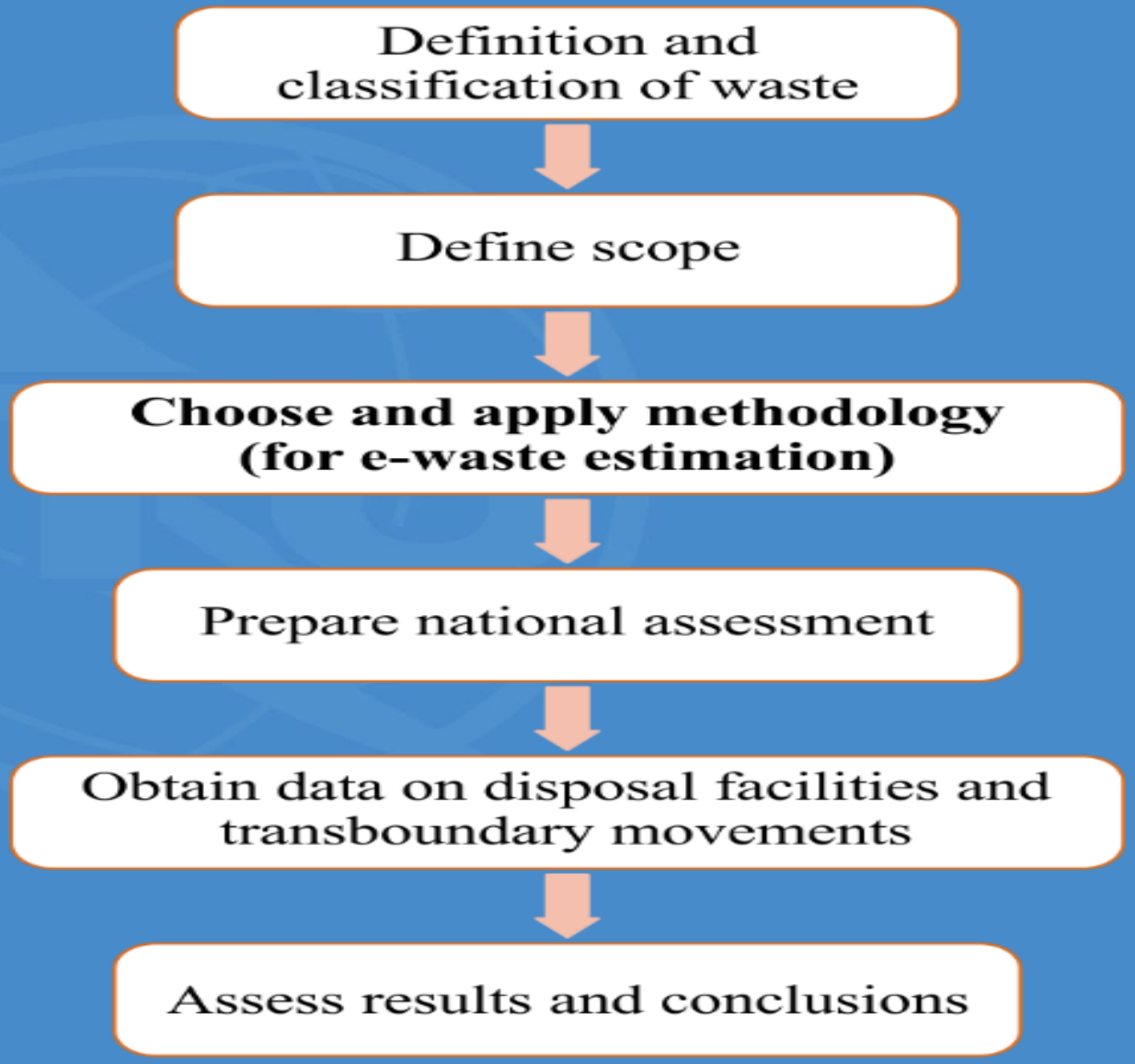
Step 1 how much e-waste we have?

- 6 steps of constructing an e-waste inventory.
- It is the base to plan the design e-waste reduction programme
- volume of e-waste generation in a given city and the ways in which waste electrical and electronic equipment (WEEE) are managed



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Step 1 Definition and classification of e-waste

- United Nations University (UNU) guideline on e-waste classification and indicators.
- UNU's classification of EEE, (UNU-KEYS), follows the criteria specified here:
  1. It categorizes products based on similar functions and material composition, including hazardous substances and valuable materials and other related end of life (EoL) attributes.
  2. Products within the same category have the same average weight and lifespan distributions which simplify quantitative assessment for similar products.
  3. Large e-waste products with lot of data potentially available are assigned separately

E-Waste UNU classification (not exhaustive)

- The advantage:
  - harmonized statistical coding of the international trade codes, the harmonized system (HS).
  - Possible harmonize with existing database.
- Issue:
  - Not covers all (RBS are not present) need adjustment

0408	Flat Display Panel TVs (LCD, LED, Plasma)
0501	Lamps (f.i. pocket, Christmas, excl. LED & incandescent)
0502	Compact Fluorescent Lamps (incl. retrofit & non-retrofit)
0503	Straight Tube Fluorescent Lamps
0504	Special Lamps (f.i. professional mercury, high & low pressure sodium)
0505	LED Lamps (incl. retrofit LED lamps & household LED luminaires)
0506	Household Luminaires (incl. household incandescent fittings)
0507	Professional Luminaires (offices, public space, industry)
0601	Household Tools (f.i. drills, saws, high pressure cleaners, lawn mowers)
0602	Professional Tools (f.i. for welding, soldering, milling)
0701	Toys (f.i. car racing sets, electric trains, music toys, biking computers)
0702	Game Consoles
0703	Leisure (f.i. large exercise, sports equipment)
0801	Household Medical (f.i. thermometers, blood pressure meters)
0802	Professional Medical (f.i. hospital, dentist, diagnostics)
0901	Household Monitoring & Control (alarm, heat, smoke, excl. screens)
0902	Professional Monitoring & Control (f.i. laboratory, control panels)
1001	Non Cooled Dispensers (f.i. for vending, hot drinks, tickets, money)
1002	Cooled Dispensers (f.i. for vending, cold drinks)

Hazardous waste

- E-waste often contains hazardous substances including lead, lithium, mercury, cadmium, selenium, arsenic, etc.
- In Basel Convention hazardous wastes are defined as:
  a) wastes that belong to any category contained in its Annex I (list of waste categories defined by hazardous substances contained in them and wastes to be controlled), unless they do not possess any of the characteristics contained in Annex III (hazardous characteristics such as flammable, poisonous, infectious, corrosive, toxic, etc.)
  b) wastes that are not covered by this definition but are defined as, or are considered to be, hazardous wastes by the domestic legislation
- See annex A of Recommendation ITU-T L.1031 for a complete list.

Two different ways to estimate e-waste

- The market supply methodology
  - Look on what is put in the market and what go out

- The consumption based methodology
  - Look on what we have at home

The market supply methodology (2 steps)

- Estimation of EEE put on the market
  - ***Amount of EEE put on the market = Domestic production + Amount of new imports + Amount of second-hand imports – Amount of export***.
  - Data from domestic production, Import/Export second hand imports.
- Estimation of e-waste generated based on the average lifespan of each equipment category.
  - ***Amount of e-waste generated in a year t = amount of EEE put on the market in year (t – average lifespan of equipment)***
  - *Data from lifespan from statistics available.*

The consumption-based methodology 2 steps

- Assessment of the amount of EEE in use or stored at the consumer level (survey)
  - Private consumer (home)
    - The type and amount of installed EEE
    - Average lifespan of each equipment
    - Size of the household
    - Income class of the household
  - Institutional and corporate consumer (company)
    - The type and amount of installed EEE in the organization
    - Average lifespan of each equipment
    - Size of the organization (number of staff)
- Estimation of e-waste generated based on information obtained from the surveys
  - ***Amount of e-waste generated (metric tons) annually = amount of equipment stockpiled/average lifespan of the equipment***

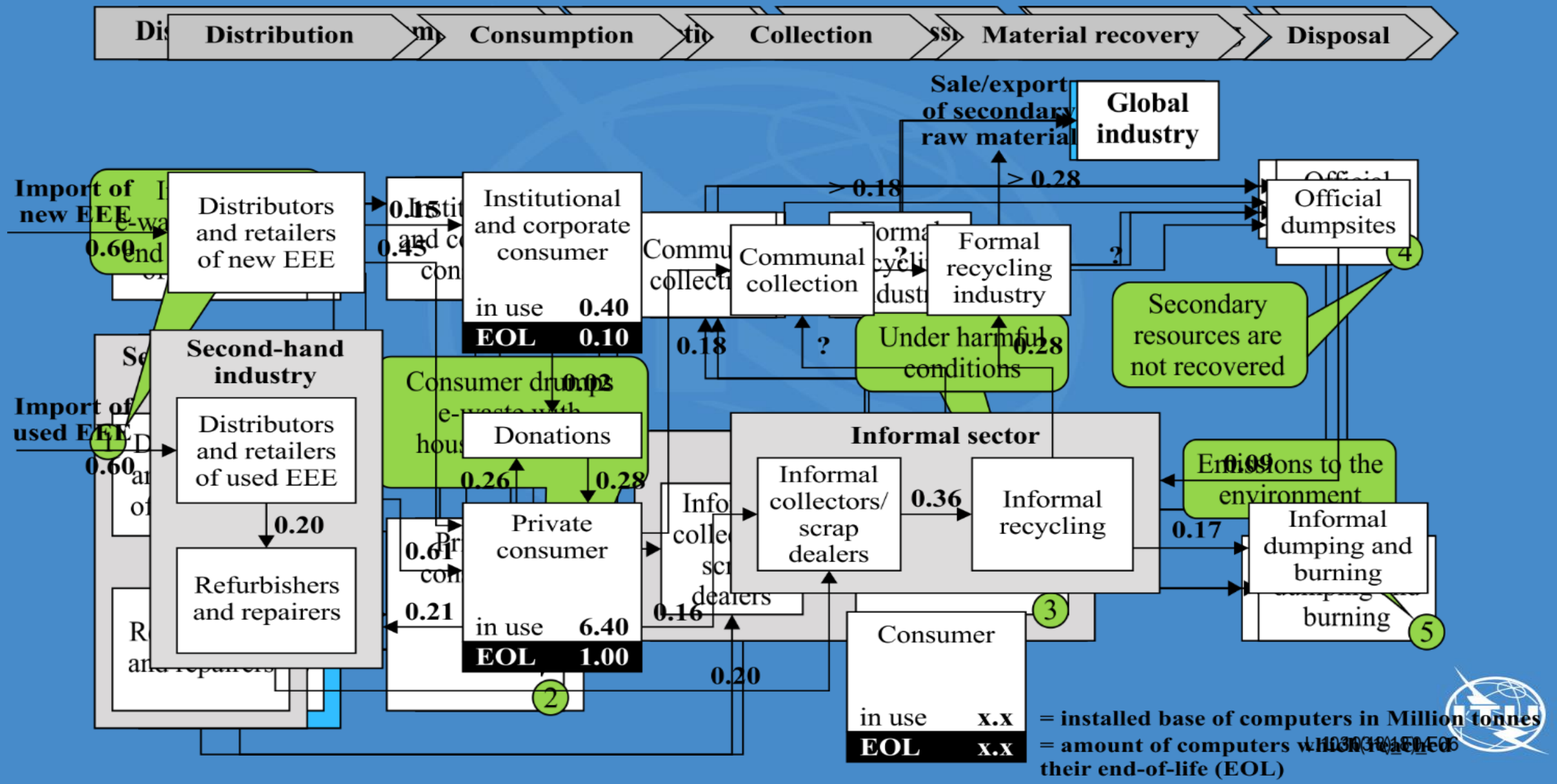
Prepare a national e-waste assessment

- We suggest to follow EMPA methodologies
- Establish the scenario involving all stakeholder
- 4 key components:
  - Policy and legislation (what are implemented now)
  - Stakeholder assessment (who are the actors in the country, their role)
    - Manufacturers, importers, distributors,
    - Consumers
    - Collectors, refurbishes, recyclers,
    - Final disposers, most affected communities
- Mass flow assessment (graphic representation of the movement, current mass flow , future mass flow)

Impact assessment (socioeconomic and environmental impacts “hot spot”)

- Environmental impacts may include the following areas:
  - Emissions to air and water
  - Solid waste
  - Human health
  - Pressure on resources
  - Pressure on ecosystem
- Socio-economic impacts may include the following areas:
  - Impacts on employees
  - Impacts on local communities
  - Impacts on society

Mass flow visualization



Step 2: Development of sustainable e-waste management systems

- Remember the waste hierarchy
  - Encourages eco-design and measures
  - Encourages responsible consumptions and increases the longevity of EEE by extending the use phase of an EEE and delaying reaching the end-of-life phase.
  - Advocate for solutions using less materials
  - Reduce packaging, though policies regulating packaging wastes
- EPR
- Green procurement for the ICT sector

Extended Producer Responsibility (Recommendation ITU-T L.1021)

- What is EPR?

- A policy principle to promote total life cycle environmental improvements of product systems by extending the responsibility of the manufactures of the product to various parts of the entire life cycle of the product and especially to the take-back, recycling and final disposal of the product.

Which are the possible benefits?

- environmentally friendly or ecodesigns to encourage cost-effectiveness and pollution prevention;
- the use of nontoxic materials and processes;
- innovation for more efficient design and production;
- improved resource efficiency material inputs and energy consumption;
- reduced pollution from production and waste treatment;
- the manufacturing of more durable products;
- the manufacturing of more reusable and recyclable products;
- responsible usage of electronics;
- the reuse and refurbishment of used products;
- minimal disposal to landfills or incineration;
- safe disposal of harmful materials;
- the creation of profitable business opportunities and a recycling industry niche;
- the contribution to a circular economy that promotes sustainable production and consumption, thereby directly contributing to the fulfilment of the United Nations sustainable development goals (SDGs).

Different types of EPR: Collective producer responsibility versus individual producer responsibility

- determine whether responsibility is assigned individually or collectively.
  - Individual producer responsibility (IPR) :producers are responsible for their own products
  - **Voluntary versus legislation or compulsory**
  - More and more countries are considering EPR as mandatory or as a combination of both such as negotiated agreements between government and industries [ITU-T L.1021].
- **Allocation of responsibilities and stakeholders**

Governments	**Assessment of e-waste; stakeholders' buy in; regulations and laws**
Producers	Design, management and finance schemes for EoL
Retailers/importers	Selection of brands and informing consumers, choice of schemes for collection.
Consumers	Sustainable usage.

Take-back system

	Advantages	Disadvantages
Full scope	Covers all products. Does not need further legislation when new product comes on market or if new environmental problem is identified.	Adds complexity to the system. Adds strain to recycling infrastructures. Leads to focus on recycling of non-problematic but valuable fractions.
Phased scope	Focuses take-back system on specific product types/groups. Can allow for iterative build-up of scope and infrastructure in parallel. Can ensure that problematic products and fractions are dealt with as a priority.	Leaves large part of the e-waste without an official take-back system. Many will be reluctant to move on to full scope.

Options for managing a take-back system

	Advantages	Disadvantages
Government	Have powers of enforcement, levying fines and banning noncompliant producers. No potential conflict of interest.	Adds complexity to the system. Adds strain to recycling infrastructures. Leads to focus on recycling of non-problematic but valuable fractions.
Third party organization TPO	More flexible. Can adjust rules and outcomes easily. Easier to develop relationship with relevant stakeholders. Strong business incentive to minimize costs while optimizing operation process.	Lacks enforcement mechanisms. Potential excessive focus on their members, may ignore stakeholders and community concerns. Potential conflict of interest.

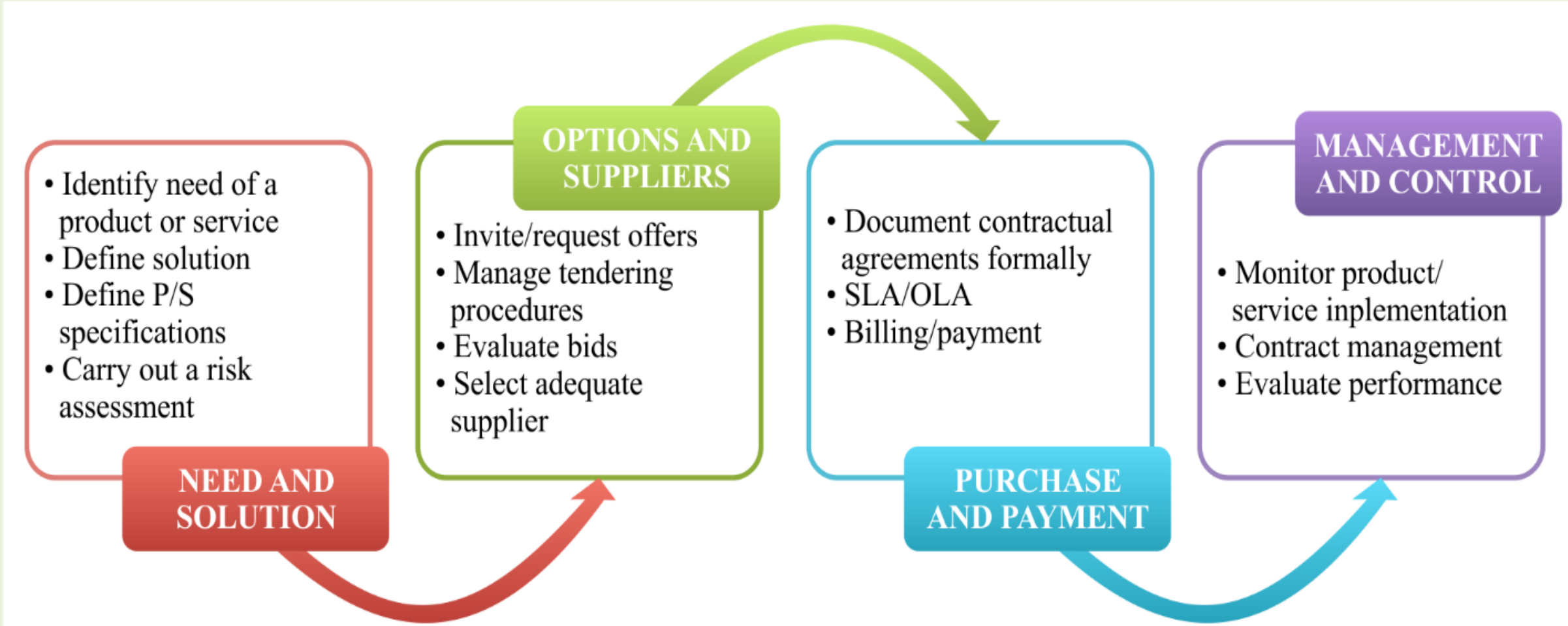
Other point to decide on take-back system

- Mode of collection
  - Permanent drop-off facility;
  - Special drop-off events;
  - door-to-door pick up
- **Defining the financing of the take-back system**
  - entire society, through contribution in the form of taxation;
  - consumers, involving them paying a fee when purchasing a new product
  - various degrees of the EPR principles

Take-back summary

Phase	Description
Modes of collection for take-back	– Permanent drop-off facility – Special drop-off events – Special drop-off points – Door to door collection
Modes of processing	– Pre-processing: separation of products, primary dismantling, secondary dismantling – End-processing: re-use and recycling of components, recovery of precious metals, exporting components, final disposal through landfill or incineration.
Modes of management	– Producer responsibility organizations (PROs) – Producers individually – Government entities
Financing schemes	– Financing methods: adopting eco-designs that are cost-effective to offset the costs of EPR or using recycling materials to offset the costs of EPR.

Green procurement



Step 3: Adopt supportive measures to facilitate a sustainable e-waste management system

- Stakeholders' involvement
- Awareness raising and capacity building
- Monitoring the implementation of the strategy and plan
- Strengthening international cooperation

Recommendation ITU-T L.1030: E-Waste management framework for countries

- What is the intention of this Recommendation:
- Provide a framework on how to implement in a country an e-waste management system considering:
  - resource mobilisation,
  - collection mechanisms,
  - financial mechanisms
  - engagement with all relevant stakeholders

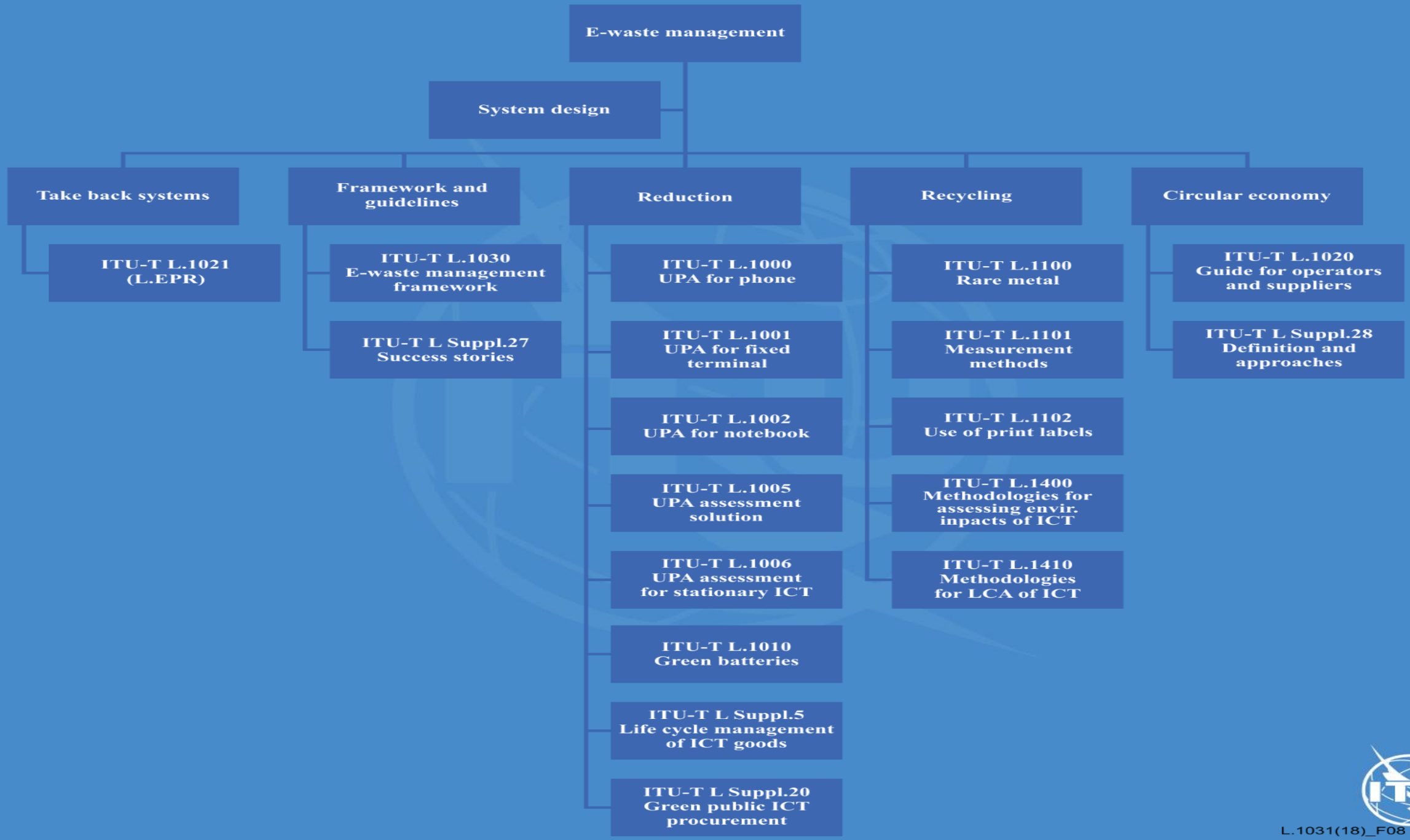
E-waste management legislation step by step

Involve and consult stakeholders;

Public found availability (promotion, awareness campaign, incentives for collection, Assess recycler…)

identify sources of e-waste generation and compile an inventory of e-waste

Carry out a survey on collection and recycling capabilities


E-waste management
System design
Take back systems
ITU-T L.1021 (L.EPR)
Framework and guidelines
ITU-T L.1030 E-waste management framework
ITU-T L Suppl.27 Success stories
Reduction
ITU-T L.1000 UPA for phone
ITU-T L.1001 UPA for fixed terminal
ITU-T L.1002 UPA for notebook
ITU-T L.1005 UPA assessment solution
ITU-T L.1006 UPA assessment for stationary ICT
ITU-T L.1010 Green batteries
ITU-T L Suppl.5 Life cycle management of ICT goods
ITU-T L Suppl.20 Green public ICT procurement
Recycling
ITU-T L.1100 Rare metal
ITU-T L.1101 Measurement methods
ITU-T L.1102 Use of print labels
ITU-T L.1400 Methodologies for assessing envir. inpacts of ICT
ITU-T L.1410 Methodologies for LCA of ICT
Circular economy
ITU-T L.1020 Guide for operators and suppliers
ITU-T L Suppl.28 Definition and approaches

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Thank You for your attention

Please remember to re-cycle