SRI
SUSTAINABLE
RECYCLING
INDUSTRIES

# Turning Waste into Resources for Development

PIONEERING SUSTAINABLE E-WASTE MANAGEMENT
IN THE GLOBAL SOUTH (2013 - 2025)

SUSTAINABLE RECYCLING INDUSTRIES

# Sustainable Recycling Industries Programme (SRI)

**Funding**
State Secretariat for Economic Affairs (SECO), Switzerland

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Economic Affairs
Education and Research EAER
**State Secretariat for Economic Affairs SECO**

**Implementation**
Swiss Federal Laboratories for Materials Science and Technology (Empa),
World Resources Forum (WRF)

Empa
Materials Science and Technology

WORLD RESOURCES FORUM

**Contact**
sri@wrforum.org
World Resources Forum, Lagerhausstrasse 9, CH-8400 Winterthur, Switzerland

**Publication year:** 2025

**Layout:** Wolfram Egert

Licence: Unless marked otherwise, this work is licensed under the Creative Commons Attribution-ShareAlike 4.0 International (CC-BY-SA 4.0) license. Additional rights clearance may be necessary for the elements that do not fall under the CC-BY-SA 4.0 license.

All images © SRI (unless specified)

# Table of Contents


4 Introduction

5 Foreword
- 5 SECO
- 6 Empa
- 6 WRF

7 What is SRI

11 Results Colombia

13 Results Egypt

15 Results Ghana

17 Results Peru

19 Results South Africa

21 Knowledge management

23 Impact stories
- 24 Colombia
- 25 Egypt
- 26 Ghana
- 28 Peru
- 29 South Africa

30 Overall Impacts
- 31 Selected indicators and key impacts

32 Implementation partners

33 The SRI team

# Introduction

**With the growth of the global economy and the digitalization of today's businesses and society, electrical and electronic equipment (EEE) has become more affordable and widespread. Combined with shorter usage cycles, this has made Waste Electrical and Electronic Equipment (WEEE or e-waste) the fastest growing waste stream worldwide.**

ON one hand, e-waste often contains hazardous substances that pose serious health and environmental risks when improperly managed. On the other, it holds valuable materials (especially metals) making it a significant source of secondary raw materials. In industrialized countries, e-waste management is typically regulated under Extended Producer Responsibility (EPR), which has led to the creation of take-back schemes and the growth of a professional recycling industry.

In developing countries, the value of secondary raw materials has also driven a rapid expansion of e-waste recycling activities over the past decade. Individuals and businesses in this sector often provide livelihoods for themselves and their communities, contributing to the circular economy. However, in the absence of adequate regulation, oversight, and technical capacity, these activities, often carried out in the informal sector, can result in serious human and environmental harm. Issues include unsafe recycling practices, child labour, tax evasion, illegal operations, and unfair competition due to externalized social and environmental costs.

To address these challenges, the State Secretariat for Economic Affairs (SECO) began supporting partner countries in the Global South early on, helping them transition toward more sustainable e-waste management systems. These efforts led to the launch of the Sustainable Recycling Industries (SRI) Programme in 2013. Its overarching goal is to create enabling framework conditions for the development of a sustainable recycling industry for e-waste and related waste streams.

The first phase (2014–2018) supported Egypt, Ghana, India, Peru, Colombia, and South Africa in developing tools and guidance for environmentally and socially responsible e-waste management. A second phase began in 2019, focusing on five of those countries, with activities continuing in Africa (Egypt, Ghana, and South Africa) and Latin America (Colombia and Peru).

As the SRI Programme concludes after twelve years of implementation, this report aims to provide an overview of the positive impacts achieved. It highlights key progress, lessons learned, and the groundwork laid for ongoing efforts toward sustainable e-waste management.

# Foreword

## SECO

For more than two decades, the State Secretariat for Economic Affairs (SECO) has been supporting partner countries in establishing framework conditions that promote sustainable, inclusive and resource-efficient forms of production and economic activity as part of its economic cooperation and development efforts. The Sustainable Recycling Industries (SRI) programme, which ran in six countries between 2014 and 2025, plays a key role in these efforts. Functioning recycling systems based on economic criteria and verified norms and standards are central to all considerations relating to the circular economy.

The fact that SRI was implemented in different social and economic contexts not only made the work challenging, but also provided the backdrop for an intensive exchange of experience and knowledge across national borders. All those involved embarked on a journey that confronted them with a series of technical, economic and organisational challenges. For example, setting up functioning country teams required not only a good knowledge of the country-specific environment and contacts with important local players and companies, but also a feel for the appropriate weighting of different characters and orientations. While knowledge of the customs and workings of the national bureaucracy was of paramount importance for project work in one country, in another country, ways and means had to be found to encourage the various economic players to cooperate in an environment where trust was lacking.

Over the years, the SRI team has tackled all of the above-mentioned difficulties and found pragmatic solutions to the challenges that arose. In addition, SRI's focus has become increasingly holistic, as evidenced by the fact that, in addition to recycling issues, repair and reuse have become increasingly important. This was only possible thanks to a dedicated team that has always been able to adapt to new contexts.

**Philipp Ischer**

Programme Manager in Economic Cooperation and Development
State Secretariat for Economic Affairs (SECO), Switzerland

# Empa

**Heinz Böni**

Head of Research Group
"Critical materials and
resource efficiency (CARE)"
2001-2024
Swiss Federal Laboratories
for Materials Science and
Technology (Empa)

"By reinforcing institutional frameworks and strengthening the recycling industry, SRI made a meaningful contribution to climate protection, resource conservation, and the creation of numerous green jobs. Empa brought a wealth of knowledge to the programme, counting on more than 30 years of expertise in e-waste recycling and over two decades of experience in development cooperation. While our role has been to support and enable, the successful implementation of the programme and its lasting impact are the result of the commitment and leadership of our partner countries."

# WRF

**Mathias Schluep**

Managing Director,
World Resources Forum
Association (WRFA)

"SRI is also the story of individuals, the development of their skills, and careers, the growth of their networks, and the exchange of ideas across national borders, continents, and various international projects. SRI partner countries have become key players in driving sustainable e-waste management in their regions. From the outset of its existence, the World Resources Forum has been given the opportunity to play a crucial in this development as the overall coordinator of the programme. This includes providing a platform for our partner countries to share their experiences and needs with the international community of practice."

# What is SRI?

SECO has been working with partner countries in the Global South on the management of WEEE since 2003. Initially, e-waste was perceived as a combined waste, environmental and social problem, hence the pioneer "Swiss e-waste Programme" focused primarily in aspects such as improving the living conditions of those affected by unsound treatment practices, and reducing health and related hazards while also maintaining and strengthening the attractiveness of the activity for business development.

With the implementation of the Sustainable Recycling Industries (SRI) programme, running from 2013 to 2025, the focus has evolved towards the opportunities presented by the recovery of raw material content of the waste and the business potential of optimizing value chains. SRI's approach is based on the premise that these opportunities have the potential to drive the necessary evolution of the e-waste management sector. With appropriate measures this should further alleviate adverse social and environmental issues often connected to not regulated and informal settings.

Hence, the overarching objective of the programme is to contribute to favourable framework conditions that enable the development of a sustainable recycling industry for e-waste and related waste streams.

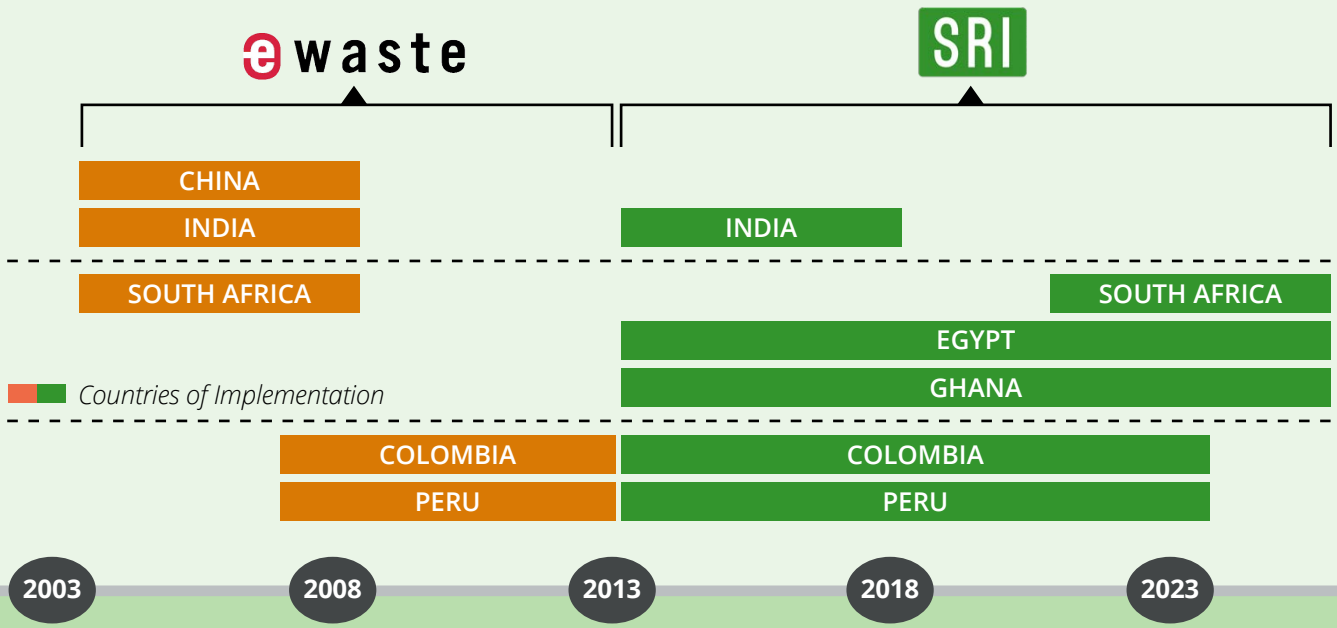
While the initial collaborations included China and India, the focus later expanded towards Africa and Latin America (*Figure 1: Timeline describing the history of SECO's of interventions in the e-waste topic*).

## Expected impacts

- **Improve the living conditions** of those affected by unsound e-waste treatment.
- **Reduce hazards** of the activity, while maintaining business attractiveness.
- Strengthen the **economic performance** and improve the working conditions.

## Expected impacts

- The **sustainable integration** and participation of small and medium enterprises from developing and transition countries in the **global recycling** of secondary non renewable resources.
- **Favourable framework conditions** enable the development of a sustainable recycling industry for e-waste and **related waste streams**.



The logical frame developed for the second phase of SRI proposed four key aspects that define the management of e-waste: policy and legislative framework, normative requirements, optimised value chains and management of problematic waste fractions.

In conjunction, these aspects reinforce each other, ensuring the long-term sustainability of the achieved impacts. The Programme's intervention strategy has been designed to achieve outcomes for each of these aspects (Figure 2: SRI Phase 2 logical frame).

## PROGRAMME OUTCOMES

### Country components[1]

**1.** An adequate **policy and legislative framework** enables implementation of a sustainable e-waste management system

**2.** **Normative requirements** and performance measurement ensure a level playing field

**3.** Optimized value chains and skilled **businesses** advance recycling industry's professionalization

**4.** Locally-adapted concepts provide solutions for the safe treatment of **problematic waste fractions**

### Knowledge management component[2]

**5.** SRI concepts and methods are strengthened in exchange with the **international community of practice** and have proliferated as **global public goods**.

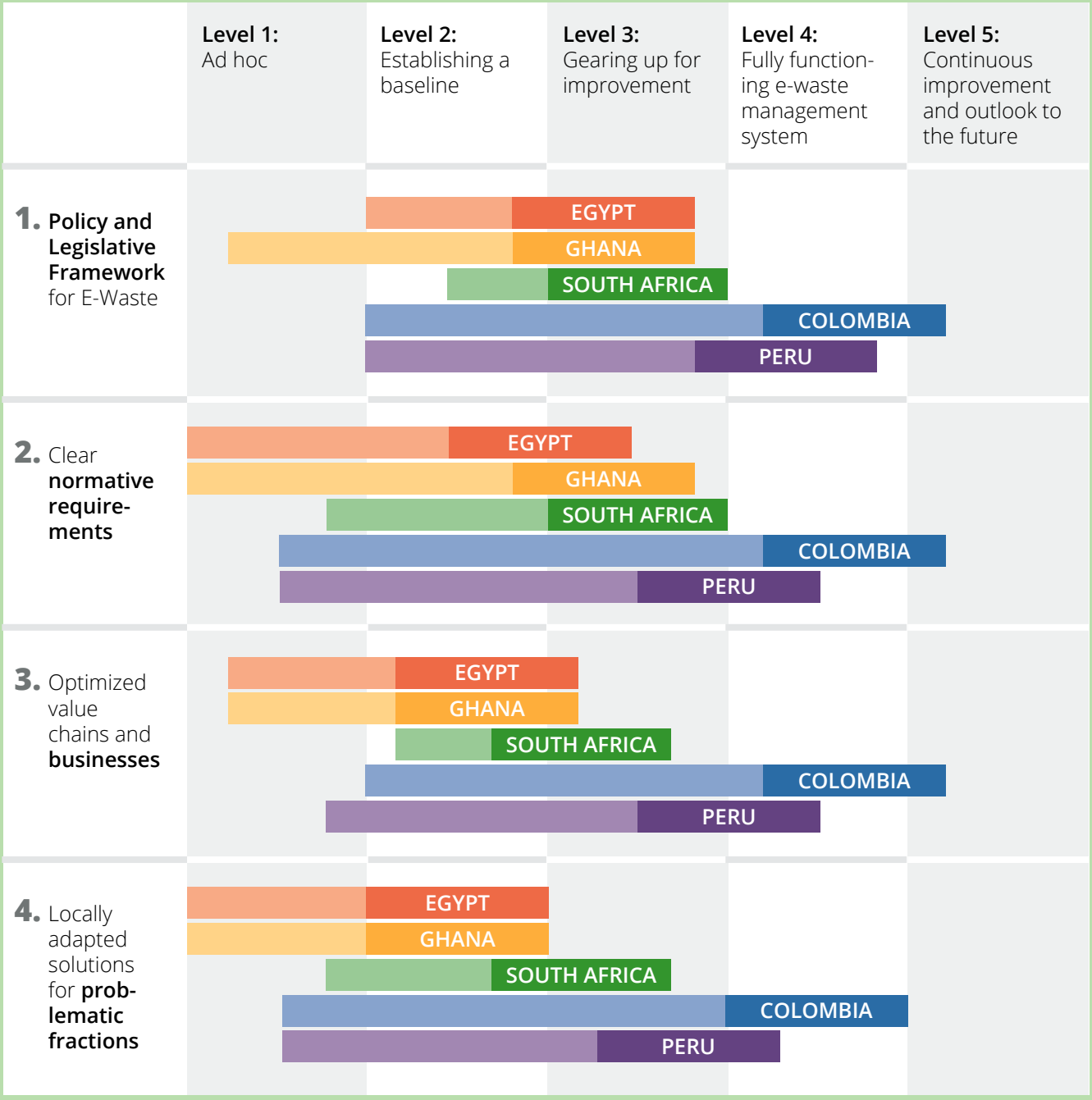
## OVERALL IMPACT

**Favourable framework conditions enable the development of a sustainable recycling industry for e-waste and related waste streams**

*1) focus of implementation in partner countries; 2) focus of implementation: global*

After more than a decade of implementation, clear progress has been achieved in developing the e-waste sector in the partner countries. Figure 3 (*'Maturity matrix' reflecting the implementation countries' state of progress at the end of the Programme on the four country-specific outcomes)* presents an evaluation of the progress made on each of the four programme outcomes.

## MATURITY MATRIX



The SRI team on a site visit in Switzerland in 2019.

The following sections of this document provide a more detailed overview of the results achieved in each partner countries.

# Results Colombia

## Milestones

**2013**
Start of the SRI project

Law 1672 introducing a categorisation of e-waste, and the legal basis for EPR of lightbulbs, batteries and IT

First licensed recyclers

**2017**
Formation of a national association of e-waste recyclers (ACORAEE) with 11 founding companies

National policy for the integrated management of e-waste

**2020**
National Technical Standards for collection, treatment and sustainable management of secondary materials

Register of producers and importers, legal obligations

**2023**
Informal sector study and strategy

End of the SRI project in Colombia

| INITIAL CHALLENGES | IMPACT AREA | MAIN ACHIEVEMENTS |
|---|---|---|
| The regulatory framework covered only three e-waste streams, and the involvement of actors in the e-waste management chain was limited to only a few. | **Policy & legislative framework:** Support the development of an adequate policy and legislative framework enabling the implementation of a sustainable e-waste management system. | • A national policy for the integrated management of e-waste was published in 2017 by the Ministry for the Environment (Minambiente), defining Colombia's strategy for handling e-waste in the years ahead.<br>• The publication of the 'Technical Guide for the Management of WEEE' and related education & training tools disseminate key aspects of the topic to a wider audience, ensuring proficient implementation of the national policy by key stakeholders.<br>• Industry and government organized two national congresses on e-waste management in 2021 and 2023, demonstrating their commitment and showcasing Colombia's leadership in e-waste management in Latin America. |
| No technical standards for the management of e-waste existed, and only a few recyclers adhered to the standards required by their clients. | **Normative requirements:** Establish normative requirements and introduce methods for measuring performance against them, for ensuring a level playing field. | • Building upon the European CENELEC standard, Colombia developed its own Technical WEEE Standards (NTCs) through the Colombian standardization organization, ICONTEC.<br>• Subsequently, a conformity assessment system was established to facilitate the adoption of the standard by e-waste recycling companies.<br>• Auditors have been trained and certified to assess performance and the implementation of good practices against the NTCs by e-waste recycling companies. |
| The infrastructure for e-waste recycling was underdeveloped, operating companies lacked interaction and organization, and collection rates were below 5%. | **Business environment:** Nurture the recycling business environment and value chain fostering the professionalization of the industry. | • A national training program for e-waste recycling professionals and technicians has been institutionalized collaboratively with the Colombian National Training Service (SENA).<br>• The formation of the national association of e-waste recyclers (ACORAEE) in 2017, as the first of its kind in Latin America, contributes to the professionalization of the industry.<br>• A study on informality in the management of e-waste serves as the foundation for Colombia's future strategy for integrating the informal sector with the formalized system. |
| Existing e-waste regulation (national policy for mgt. of hazardous waste) still lacked adoption guidance for recyclers, especially for the treatment of hazardous fractions. | **Problematic fractions:** Provide solutions for the safe treatment of problematic waste fractions that are adapted to the local conditions. | • An alliance with SENA promotes the implementation of good practices for the proper management of hazardous fractions.<br>• A Labor Competence Standard is being prepared and a respective training program for e-waste managers developed.<br>• Tools for the identification of plastic fractions contaminated with POP brominated flame retardants have been developed in cooperation with Minambiente and UNDP. |

# Results Egypt

## Milestones

**2016**
Launch of SRI in Egypt

**2017**
First auditor trainings and pilot audits conducted

Law No. 15/2017 for Industrial Licensing adopted:Introduces streamlined licensing for industrial facilities, including e-waste recyclers

**2020**
Waste Management Law No. 202/2020 enacted: Establishes a legal framework for e-waste management and introduces EPR

**2021**
Publication of EPR Implementation Options for Egypt

**2022**
Executive Regulation No. 722/2022 for Waste Law issued: Clarifies legal guidelines for e-waste handling, collection, transportation, treatment, and disposal.

**2023**
EGWM association formed

.....

Formal Recycling Facilities expanded: Egypt reaches 27 licensed WEEE recyclers and 9 battery recycling facilities

**2024**
3 start-ups incubated through the E-Khorda Incubation Programme. This includes Battarity, which works on establishing Egypt's first lithium battery recycling plant

**2025**
E-waste hub platform launched

.....

SRI Egypt ends

| INITIAL CHALLENGES | IMPACT AREA | MAIN ACHIEVEMENTS |
|---|---|---|
| Lack of comprehensive regulatory framework specifically addressing e-waste mgt. Absence of an Extended Producer Responsibility (EPR) system as a financing mechanism. | **Policy & legislative framework:** Support the development of an adequate policy and legislative framework enabling the implementation of a sustainable e-waste management system. | • Enactment of Waste Management Law No. 202, establishing the foundation for Extended Producer Responsibility (EPR) (2020).<br>• Executive regulation No. 722 (2022) classified e-waste as "hazardous waste with conditions," simplifying rules for its collection, sorting, and transport.<br>• Delivery of an EPR implementation report, a fee calculation model, and facilitated stakeholder consultations to support the Ministry of Environment (MoE). |
| Lack of technical standards for environmentally sound e-waste collection, transport and recycling. | **Normative requirements:** Establish normative requirements and introduce methods for measuring performance against them, for ensuring a level playing field. | • Development of the Technical Standard for Environmentally Sound WEEE Mgt., in close collaboration with the MoE.<br>• Following this, key procedures and tools for establishing a conformity assessment system were outlined.<br>• Training sessions were conducted for public and private sector auditors to enable them evaluating the compliance of e-waste recyclers.<br>• At MoE's request, an external expert conducted specialized assessments to evaluate the efficiency and quality of Egyptian e-waste treatment companies extracting precious metals (2023). |
| The business environment lacked the policy stability, investment incentives, and institutional support, discouraging formal recyclers to compete with the prevailing informal sector. | **Business environment:** Nurture the recycling business environment and value chain fostering the professionalization of the industry. | • Development of Curricula for e-waste mgt. and refurbishment. The latter was implemented in technical vocational WE Schools resulting in the training of 20+ professors.<br>• Coordination of two incubator programs, engaging 26 entrepreneurs and leading to the establishment of 6 SMEs in e-waste recycling and refurbishment.<br>• Establishment of the Eco Green Waste Mgt. (EGWM), a nonprofit organisation representing and promoting the e-waste recycling sector, hosting over 27 members (2024).<br>• Development of an online platform connecting households, businesses, informal collectors, and the formal recycling sector. |
| In the absence of standardized classification, tracking and proper treatment options, most problematic fractions are managed informally. | **Problematic fractions:** Provide solutions for the safe treatment of problematic waste fractions that are adapted to the local conditions. | • A first of its kind baseline assessment identified the most significant hazardous substances in electronic equipment based on the volumes handled by Egyptian recyclers. It was complemented with another study on the current management practices of such fractions.<br>• A feasibility study explored most effective options for managing lithium batteries and e-waste plastics containing brominated flame retardants.<br>• A study on the end-of-life of cooling appliances expanded the project's scope beyond ICT, emphasizing the environmental importance of properly managing these devices. |

# Results Ghana

## Milestones

**2016**
Baseline Assessment on E-waste Management in Ghana

**2017**
First workshop on e-waste plastic sorting and recycling

**2018**
Technical Guidelines on Environmentally Sound E-Waste Management

**2021**
Training of e-waste auditors from the Environmental Protection Agency

.....

Standard Operating Procedures on Environmentally Sound Mgmt. of ULABs

**2022**
Formation & registration of the Used Tyres Upcyclers Association

.....

Setting up an e-waste plastic sorting line at Electro Recycling Ghana

**2023**
Support to IRECOP in setting up a waste tyre recycling line

.....

Registering of the Eastern Region Scrap Dealers Association

**2024**
Training & auditing of ULABs facilities based on Std. Operating Procedures

.....

Finalising "Technical and Vocational Education and Training Curriculum on Recycling Technologies"

.....

Initiating the establishment of an e-waste collection centre in Koforidua

**2025**
Greater Accra Region: Formation of a scrap dealers umbrella association

.....

Studies on "EoL Mgmt. of Photovoltaic Panels" & "Potential Waste Tyre Mgmt. through Pyrolysis"

| INITIAL CHALLENGES | IMPACT AREA | MAIN ACHIEVEMENTS |
|---|---|---|
| Ghana's E-waste Act was passed in 2016 but guidelines and details of implementation were still lacking. | **Policy & legislative framework:** Support the development of an adequate policy and legislative framework enabling the implementation of a sustainable e-waste management system. | • Development and official adoption of Technical Guidelines on Environmentally Sound E-Waste Management<br>• Development and official adoption of Technical Guidelines on Environmentally Sound Management of Used Lead-acid Batteries<br>• Support in shaping the country's e-waste related financing mechanism through a national E-waste Fund |
| Unsound recycling of used lead-acid batteries (ULAB) exposed many workers and communities to toxic lead emissions. | **Normative requirements:** Establish normative requirements and introduce methods for measuring performance against them, for ensuring a level playing field. | • Establishing of technical minimum standard for ULAB mgt. through the Standard Operating Procedures (SOPs). These SOPs are now also used in various other African countries<br>• Training programmes for plant managers and government auditors.<br>• Comprehensive sector assessment and facility improvement plans.<br>• Government shut-down orders for worst polluting ULAB recycling plants with reopening only after implementation of improvement plans.<br>• Policy-brief for continuation of improvement process |
| At project start, controlled recycling was almost non-existent and informal operators were mostly unorganised. | **Business environment:** Nurture the recycling business environment and value chain fostering the professionalization of the industry. | • Set-up of an e-waste plastic sorting and recycling line at Electro Recycling Ghana<br>• Support of the establishment of an e-waste collection centre in Koforidua.<br>• Formation of the Eastern Region Scrap Dealers Association (ERSDA)<br>• Formation of the Greater Accra Regional Scrap Dealers Assoc. (GARSDA) as an umbrella organisation of 15 groups.<br>• Development of a Technical and Vocational Education and Training curriculum on Recycling Technologies, which is taken over by the Commission for Technical Vocational Education and Training (CTVET) |
| Open burning of waste tyres was a major source of pollution in urban and semi-urban environments in Ghana. | **Problematic fractions:** Provide solutions for the safe treatment of problematic waste fractions that are adapted to the local conditions. | • Initiating the formation of the Used Tyres Upcyclers Assoc. The association bundles the activities of SMEs using tyres to manufacture furniture and supports product marketing.<br>• Conduction and publication of a baseline study on management of End-of-Life (EoL) photovoltaic (PV) panels.<br>• Feasibility analysis for co-processing of tyres in a cement plant. The analysis revealed that using tyres as substitute for coal within international established emission limits is theoretically possible.<br>• Analysis of pyrolysis plants for tyres to identify meaningful approaches and minimum standards for this pathway. |

# Results Peru

## Milestones

**2013**
Start of the SRI project

**2016**
Law of Integrated Solid Waste Management approved, including the Special Regime for solid waste management

**2019**
Special Regime for the Management of e-waste

**2020**
Creation of the e-waste recyclers association ASORAEE

.....

Guideline for the registry of new e-waste operating companies

**2022**
Publication of 3 new Technical Standards on e-waste management practices

**2023**
End of the SRI project in Peru

| INITIAL CHALLENGES | IMPACT AREA | MAIN ACHIEVEMENTS |
|---|---|---|
| Insufficient regulations on e-waste management and inadequate enforcement by the responsible authorities, particularly local governments. | **Policy & legislative framework:** Support the development of an adequate policy and legislative framework enabling the implementation of a sustainable e-waste management system. | • SRI supported the national environmental authority (MINAM) in the creation of a special regulation for the handling and disposal of e-waste (issued 2019) along with guidelines for the release or donation of e-waste by government entities.<br>• Through multiple training sessions and technical support, key stakeholders are now equipped to effectively implement the updated regulations and participate in developing strategies to optimize the value chain.<br>• 30 municipalities received technical assistance for the implementation of a pilot program aimed at source segregation of e-waste in private households. |
| Outdated technical standards for the sound treatment of e-waste and absence of conformity assessment methodologies for existing e-waste recovery facilities. | **Normative requirements:** Establish normative requirements and introduce methods for measuring performance against them, for ensuring a level playing field. | • New technical standards for the collection, classification, storage and the recovery of e-waste have been formulated and validated in collaboration with key stakeholders in the Peruvian e-waste value chain.<br>• Auditors and operators were trained to assess compliance of recycling facilities with these technical standards.<br>• Voluntary compliance has been actively promoted, resulting the successful implementation of e-waste standards across recycling facilities. |
| Low rates of e-waste recycling and recovery due to low professionalization of the companies operating in the waste recovery sector. | **Business environment:** Nurture the recycling business environment and value chain fostering the professionalization of the industry. | • Technical trainings for professionals of e-waste recycling facilities have been institutionalized with the National Industrial Labor Training Service (SENATI).<br>• New guidelines and trainings encouraged formerly informal and non-compliant e-waste operating companies, as well as new ones, to formalize and officially enter the growing e-waste sector under the new regulatory landscape.<br>• An analysis of the informal sector has been conducted to explore opportunities for integration into the formalized industry under certain regulatory and economic conditions. |
| Lack of adequate methodologies for a safe treatment of plastics from e-waste. | **Problematic fractions:** Provide solutions for the safe treatment of problematic waste fractions that are adapted to the local conditions. | • E-waste professionals were trained in techniques for the identification and classification of plastic types in e-waste, in order to foster their reuse in the industry.<br>• An exchange between e-waste recycling and plastic processing companies has laid the groundwork for future commercial opportunities. |

# Results South Africa

## Milestones

**2021**

Conducted a WEEE Asset Release Pilot

**2022**

Development of the iLembe WEEE Land-scape Report

**2023**

National WEEE Policy Comparative Overview

.....

Launch of the 'WEEE are iLembe' website

**2024**

Launch of the 'WEEE are SA' website

.....

First Gazetting of the WEEE Policy by the DFFE (National Government)

**March 2025**

Development of draft Norms and Standards and supporting documents for all types of WEEE Manage-ment operators as part of the future devel-opment of a Conformity Assessment Scheme

.....

Distributed a report on Map-ping of WEEE Incentives in South Africa to unlock WEEE Policy-related finance opportunities

**May 2025**

Development of a Small-Scale E-Waste Facility Framework Re-port to support small business development in the e-waste management value chain

.....

Development of a Municipal WEEE Compass to guide local government on all aspects of e-waste management

.....

A self-teaching WEEE Master-class Learning Tool integrated in the 'WEEE are SA' website

| INITIAL CHALLENGES | IMPACT AREA | MAIN ACHIEVEMENTS |
|---|---|---|
| An absence of an overarching Waste Electrical and Electronic Equipment (WEEE) Policy document as a comprehensive framework with defined objectives and actions. | **Policy & legislative framework:** Support the development of an adequate policy and legislative framework enabling the implementation of a sustainable e-waste management system. | • Developed a comprehensive National WEEE Policy, based on structured multi-stakeholder engagement, that was handed over to the Department of Forestry, Fisheries and the Environment (DFFE) for gazetting.<br>• Developed a comprehensive National Policy Costing Framework outlining key outcomes, stakeholders, potential funding sources, and an estimated five-year budget for all six policy objectives.<br>• Created a Municipal WEEE Compass to educate and guide municipalities on the legal and management landscape for WEEE, including safe asset release and collection infrastructure establishment. |
| Lack of technical guidelines or standardised procedures for proper processing and final treatment of WEEE, which created challenges for establishing consistent quality controls and environmental safe-guards. | **Normative requirements:** Establish normative requirements and introduce methods for measuring performance against them, for ensuring a level playing field. | • Developed WEEE Norms and Standards to be introduced voluntarily over three years before becoming legally required. These provide comprehensive standards for typical formal WEEE management operations – from collection to advanced processing and preparation for end processing – while sustainably incorporating informal sector players were safe and feasible.<br>• Developed the key strategic building blocs of a Conformity Assessment Scheme for South Africa via a tailor-made auditing protocol. |
| Significant barriers faced SMMEs* in the WEEE mgmt. sector incl. a complex regulatory environment, limited access to affordable financing and technical support, and ack of information and educational resources about WEEE mgmt. | **Business environment:** Nurture the recycling business environment and value chain fostering the professionalization of the industry. | • Created WEEEareSA, a dedicated national knowledge platform and educational tool to empower South Africans with information for safe and responsible WEEE management.<br>• Mapped existing incentives and related support programmes (including incubators and accelerators) that are available to South African WEEE management players.<br>• Developed a Small-Scale WEEE Facility Framework report that presents an assessment of good practice and provides recommendations for SMME development in the WEEE management value chain. |
| The absence of technical capacity, appropriate technologies, and economic incentives for managing problematic WEEE fractions represented a critical weakness in South Africa's WEEE management system. | **Problematic fractions:** Provide solutions for the safe treatment of problematic waste fractions that are adapted to the local conditions. | • Conducted three specialised cross-cutting webinars throughout 2024 focusing on problematic WEEE fractions: Lithium-ion batteries, solar panels, and WEEE Plastics.<br>• Explored emerging technology approaches for managing these challenging materials in the South African context.<br>• Compiled and published three comprehensive reports with key findings and recommendations for each problematic fraction. |

*small, medium, and micro enterprises

# Knowledge Management

The Knowledge Component refers to an overarching outcome of SRI, focused on consolidating and sharing the key learnings of the Programme. While its activities have mainly aimed at reinforcing implementation success through communication (dissemination of SRI outputs) and synergy building (engagement with key stakeholders and events), a fundamental goal of this outcome has been to lead the development process of the ISO 59014 Standard. Based on the principles of the ISO IWA 19 Guidance, conceived during the first phase of SRI, the standard seeks to establish a common framework for the management of secondary materials.

## Milestones

in the development of the standard

**February 2021**
Registration of New Work Item Proposal (NWIP)

**May 2021**
First JWG-14 session (Joint Working Group)

**September 2022**
Kigali JWG14 session

**November 2022**
Working Draft 3 registered as Committee Draft.

**August 2023**
Draft International Standard (DIS) registered

**March 2024**
15th JWG14 session

**June 2024**
Final International Draft Standard (FIDS) submitted

**October 2024**
ISO 59014 published

**Objective:** The ISO 59014 standard aims to establish principles, requirements, and guidance to ensure sustainability and traceability in the recovery of secondary materials, supporting circular economy implementation and minimizing environmental and social impacts along the secondary materials' value chain. It aligns with the ISO 59000 (Circular Economy) and ISO 14000 (Environmental Management) families.

## Key contributions:

- Defines operational, managerial, and traceability requirements for organizations involved in secondary materials recovery.
- Proposes a recovery pathway methodology based on life-cycle thinking and circular economy principles.
- Addresses environmental and social risks, particularly in informal and subsistence activities (SAs).
- Promotes safe working conditions and responsible engagement of individuals engaged in subsistence activities supporting waste recovery.
- Introduces traceability systems to track materials and ensure compliance with sustainability standards.

## 8 principles the standard is based on:

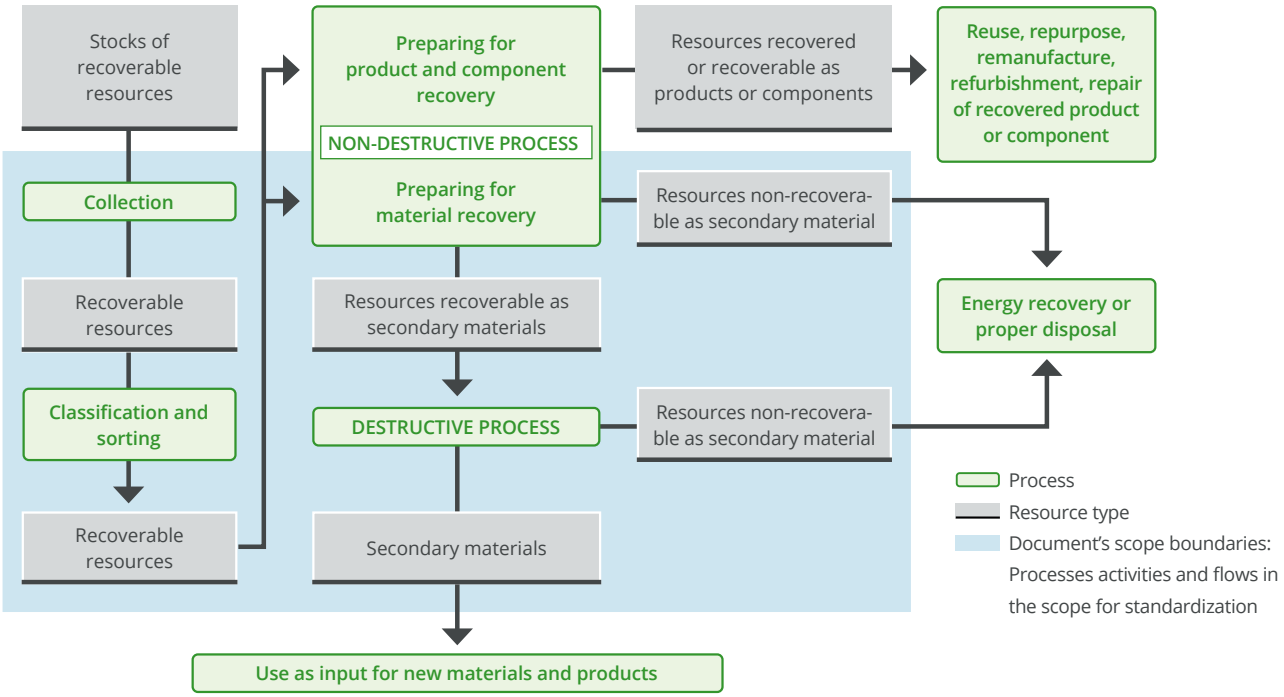
- Respect for stakeholders' interests: Consideration of all affected parties.
- Value chain responsibility: Accountability for environmental and social risks and impacts.
- Responsibility towards individuals in subsistence activities: Support for these individuals engaged in waste management and recycling.
- Safe, healthy, and equitable work conditions.
- Environmental protection: Preventing negative impacts, mitigating them and restoring ecosystems.
- Resource conservation: Maximizing resource efficiency along the life cycle and minimizing virgin resource use.
- Life cycle perspective: Addressing impacts at all life cycle stages.
- Enabling circular resource flow: Designing recovery systems that extend product and material lifespan.

**Target users:** This standard is for any organization, big or small, anywhere in the world, that wants to recover materials in a responsible and organized way – while ensuring their activities are sustainable, transparent, and follow circular economy and life cycle thinking.

## Expected benefits for organizations

The ISO 59014 is a pioneering standard covering aspects that can deeply and positively impact on the performance of recovery processes. Its value proposition lies in providing organizations regardless of size or location with:

- a certifiable standard
- supplementary guidance for organizations engaging with individuals with subsistence activities,
- the possibility to demonstrate their progress in transitioning from a linear to a circular economy
- reduced needs of client audits
- improved capacities and competencies of workers generated and key actors in the value chain
- reinforced credibility by local and central governments.



# Impact stories

While SRI's approach had the same structure over the five countries of implementation, the final results of the proposed measures reflected the local specificities and particular challenges of each location. The following are just a narrow selection of examples of how SRI's activities materialized in practice.

# Colombia

## CORPORACIÓN ECOCÓMPUTO

Ecocómputo is currently the largest post-consumer program focused on WEEE in Colombia. Formally known as a "WEEE Collection and Environmental Management System", this type of program connects consumers with manufacturers and retailers to ensure proper treatment and disposal of electronics once they are discarded.

Established in 2012 with support from the pioneering Swiss e-Waste Programme, Ecocómputo initially focused on computer-related products. After years of steady growth, it now works with over 80 manufacturers and retailers of electrical and electronic equipment (EEE) and operates over 350 WEEE collection points across 450 cities and towns in Colombia.

Since its launch, SRI has developed strong ties with Ecocómputo as a key implementation partner. The program's successful deployment has contributed to a significant expansion of Ecocómputo's reach and impact.

Some of the key benefits brought to Ecocómputo through the SRI collaboration include:

- **Policy participation:** inclusion of Ecocómputo to participate in the development key policy instruments such as Colombia's National Policy for the Integrated Management of WEEE, led by the Ministry of Environment and Sustainable Development (MinAmbiente); the creation of a technical guide for the integrated management of WEEE; and a study on informality in WEEE management in Bogotá, which included diagnoses and proposals for coordination with the formal sector.
- **International expertise:** Collaboration with Swiss experts and exposure to international best practices (through study tours and comparative analyses) contributed to the development of expanded financing models for WEEE management through the comparative analysis of international standards, offering valuable references for optimizing Ecocómputo's operations.
- **Knowledge sharing:** SRI co-financed an international conference where Ecocómputo's progress was showcased (WEEE International Congress Bogotá 2023). The event brought together more than 2,650 participants from 23 countries, establishing itself as a key platform for global dialogue and learning in the field of e-waste management.

Ecocómputo representatives working on a WEEE collection campaign day.

# Egypt

## GREEN WASTE MANAGEMENT ASSOCIATION (EGWM)

In response to the growing need for coordinated, professional representation of the formal e-waste recycling sector in Egypt, SRI catalyzed the creation of the Egyptian Green Waste Management Association (EGWM). Conceived as part of SRI's strategic vision to strengthen institutional frameworks and bridge the gap between the informal and formal sectors, the idea for EGWM emerged from ongoing dialogue with formal recyclers and key stakeholders seeking a unified platform to promote responsible e-waste practices.

EGWM was formally established as a non-governmental organization in 2023 with support from the SRI project and the Egyptian Ministry of Communications and Information Technology (MCIT) and Ministry of Environment (MoE)/Waste Management Regulatory Authority (WMRA). The association brings together licensed recyclers, sector experts, and aligned private actors with the shared objective of professionalizing e-waste management in Egypt. Its creation marked a significant step toward institutionalizing the formal e-waste sector and enhancing its visibility nationally.

The core purpose of EGWM is to represent the interests of formal recyclers, advocate for favorable policies, and facilitate capacity building across the sector. It serves as a knowledge-sharing and networking hub, fostering cooperation among recyclers and bridging the gap between policy and practice. The association also plays a proactive role in liaising with government bodies, investors, and international partners to unlock new opportunities for sustainable growth.

Through EGWM, Egypt's formal recyclers have found a collective voice that not only amplifies their concerns but also positions them as key contributors to the country's circular economy. The association has already begun building strategic alliances and influencing sectoral dialogue, reinforcing the long-term impact of SRI's interventions in Egypt.

Fostering a professionalized e-waste management sector is a key goal of the EGWM Association.

# Ghana

## EASTERN REGION SCRAP DEALERS ASSOCIATION (ERSDA)

Before 2021, scrap dealers across Ghana's Eastern Region operated in isolation, scattered, informal, and largely invisible to regulators and formal businesses. Baba Dawuni, then one of the 250 independent operators in Koforidua, remembers how disconnected and vulnerable their community was. ***"At the time, we didn't even know each other,"*** he says. ***"But after SRI came, anywhere we go in the Eastern Region, we know each other. We now know where the scrapyards are and who is working where."***

This transformation began with the Sustainable Recycling Industries (SRI) program in Ghana, which identified the need to support and formalize informal e-waste workers. Through regional mapping exercises, trust-building meetings, and targeted capacity building, SRI helped catalyse the formation of the Eastern Region Scrap Dealers Association (ERSDA) in 2022 – a milestone that changed the course of e-waste management in the region. Baba Dawuni was elected as the association's first chairman.

For the first time, informal recyclers were part of a recognised, structured association that could engage with policymakers and formal businesses. This new status enabled the creation of a formal e-waste collection point in Koforidua. A private entrepreneur, seeing the potential of partnering with a well-organized collector network, invested in the facility, which now acts as a transfer hub linking ERSDA members to licensed recycling companies.

Beyond infrastructure, the training and education provided by SRI have had a profound impact on the lives and practices of scrap dealers.

Baba reflects: ***"Before, we didn't know how to properly handle materials. I used to mix recyclable and non-recyclable items, and even used battery acid to treat wounds. But after SRI's training, we now know how dangerous those practices are and we have stopped. Even when I see someone using torchlight batteries around food, I get scared for them because I know the risks."***

SRI also raise awareness on environmental hazards, such as the dangers of unsound dismantling of CRTs. ***"They told us how the gas can travel for miles and cause harm, we did not know that before. Now we have stopped,"*** Baba explains.

ERSDA's success helped lay the foundation for broader national efforts. Inspired by this model, SRI in 2024, supported the reorganization of a more complex umbrella group: the Greater Accra Region Scrap Dealers Association (GARSDA). This was a particularly sensitive process, especially after the 2021 eviction of informal recyclers from the Agbogbloshie site in Accra, which had strained relations between government agencies and informal workers. The creation of GARSDA helped re-establish dialogue and trust, positioning organized scrap dealers as legitimate partners in the country's e-waste policy and business landscape.

ERSDA thus exemplifies how SRI's targeted support to informal sector networks can drive systemic change. By formalizing associations, enabling local business opportunities, and fostering public-private collaboration, SRI contributed to a more inclusive and sustainable e-waste management system in Ghana, one that acknowledges the critical role of informal workers while guiding them toward improved practices and integration into the formal economy.

Today, as chairman of ERSDA, Baba Dawuni is not just a scrap dealer – he's a community leader at the forefront of change: ***"SRI has helped us immensely, they have given us knowledge, recognition and a better future".***

. . . . . .

A meeting at the ERSDA in Koforidua with presence of the association members.

# Peru

## SAR AMBIENTAL

SAR is a Peruvian solid waste operating company (EO-RS). The business initiative was born in 2006 as San Antonio Recycling and since 2019 changed its name to SAR Ambiental. From the beginning and until now, it is dedicated to close the cycle of WEEE management through the sound treatment of WEEE.

In 2012 SAR started activities under the Extended Producer Responsibility (EPR) principle, within the framework of the Ministry of Environment's (MINAM) new WEEE regulations promoted by Empa, with the support of the Swiss Cooperation. These norms defined the objectives, strategies, roles and functions of actors, increasing treatment goals, among other aspects of management and handling of WEEE.

With the implementation of the regulations, the technical support of the SRI project and the entrepreneurial vision of the company's owners, SAR Ambiental has achieved sustained growth in WEEE treatment volumes, serving the country's main management systems.

The main achievements of SAR Ambiental during the SRI implementation period were:

- **Increase in the amount of WEEE recovery:** from around 500 tons per year in 2012 to 8000 tons of treatment in 2023, serving the main WEEE management systems.
- **Increased investment in infrastructure:** from a rented facility of around 3,000 m2 to its own 8,500 m2 plant in an industrial zone in the south of Metropolitan Lima. The current capacity of the SAR recovery infrastructure is 15,000 tons of WEEE in a single shift. SAR Ambiental's increased investment in infrastructure is around USD 3 million.
- **Generation of local employment:** In 2023 there was a permanent workforce of 100 workers coming from the communities near the operations plant. Workers are provided with all legal labor benefits.
- **Management systems:** As of 2023 SAR Ambiental has a triple ISO 9001, 14001, 45001 management certification.
- **End-of-life tire (ELT) conditioning:** MINAM, based on the regulatory process developed for WEEE, has also approved a EPR standard for ELTs. As a result, since 2024 SAR has also been processing 250 tons of ELTs/month.

In the words of Oscar Espinoza, Operations Manager at SAR Ambiental: ***"... thanks to the Swiss Cooperation, who promoted the innovative EPR approach, the national waste regulations underwent significative upgrades, setting ground for enabling the circular economy in Peru."***

Mr. Oscar Espinoza receiving delegates from the Swiss Embassy in Lima at the SAR Ambiental facilities in Lima.

# South Africa

## ‘WEEE ARE SA’ ONLINE PLATFORM

During 2021–2022, the SRI:SA team undertook a range of initiatives as part of the iLembe local project component. A number of challenges were identified in the local e-waste recycling sector, including a lack of facilities to support e-waste recycling, limited awareness about correct e-waste management, and little coordination across different stakeholders. These challenges high-lighted the need for a more collaborative approach and a shared vision towards to e-waste management in the region.

In late 2022, the SRI:SA team conceptualised WEEE are iLembe, a local e-waste partnership initiative aimed at creating a shared vision for awareness around e-waste management and a platform through which projects and interventions can be facilitated, supported and promoted to enhance the iLembe e-waste industry. After extensive consultation, WEEE are iLembe was officially launched in June 2023.

Within 6 months of its launch, substantial interest was generated not only in the iLembe region, but throughout the entire South Africa. The website received 18,000 visitors, and a substantial number of emails and calls were received requesting support in identifying recyclers and drop-off points for e-waste. The initiative was featured in 12 online and print publications, and on national television.

After this initial success and further engagement with key stakeholders, in late 2023, a scale-up was conceptualised. In June 2024, WEEE are SA was launched[1] as national platform dedicated to raising awareness about responsible consumption, reuse, recovery and recycling of e-waste in South Africa. Since then, the website has received 19,000 visitors, the initiative has been featured in 6 online publications, and the team has taken part in 4 radio and television interviews.

With the SRI programme ending in June 2025, WEEE are SA will continue to operate as a knowledge platform via the website and social media pages. Arrangements are underway to embed the website into Circular South Africa, and it is expected that this partnership will ensure that awareness around e-waste management is South Africa will continue to be driven for many year to come.

1) Available at *https://weeearesa.org/*

The “WEEE are SA” platform seeks to act as a central platform dedicated to raising awareness about responsible consumption, reuse, recovery and recycling of e-waste in South Africa.

# Overall impacts

From a global perspective, it can be rightly said that the impact of SRI has generated change at the system level in the five implementation countries. While strengthening the progress made in its preceding phase, SRI Phase 2 has achieved tangible improvements in the e-waste management ecosystem of each of the five implementation countries.

The main achievements in **strengthening the framework conditions for e-waste management** can be summarized as follows:

- Specific e-waste legislation and committed government partners can be found in all countries. Take back obligation schemes based on Extended Producer Responsibility (EPR) are fully implemented or implementation process have been launched.
- Industry stakeholders such as producers, retailers and associations demonstrate a stronger commitment and engagement with the sector.
- National conformity assessment schemes (incl. standards, audit processes) have been developed and institutionalized, ensuring quality and a level playing field.
- Recyclers have organized themselves through associations, indicating the formation of a professionalised and connected industry sector, even to value chains beyond national borders.
- Training opportunities for both authorities at different levels and operators working in the recycling sector have multiplied.
- Government and industry led educational and communicational campaigns have been conducted, creating awareness for the general public.

Additionally, SRI produced significant contributions to the international community of e-waste management practice, setting the ground for replication and upscaling of its achievements:

- The development and publication of the **ISO 59014 Standard on sustainability and traceability of secondary materials,** a fundamental guidance document for organizations involved in the processing of secondary materials.
- An extensive library of reports covering multiple aspects of the implementation of e-waste management improvements in the various thematic and geographic areas covered by the Programme. The reports prove a wide range of comparison and starting points for replicating lessons learned in comparable situations. This library is publicly available on the SRI website.

# Selected indicators and key impacts

## Formally registered e-waste recycling companies

## Formally registered workers in the e-waste recycling sector

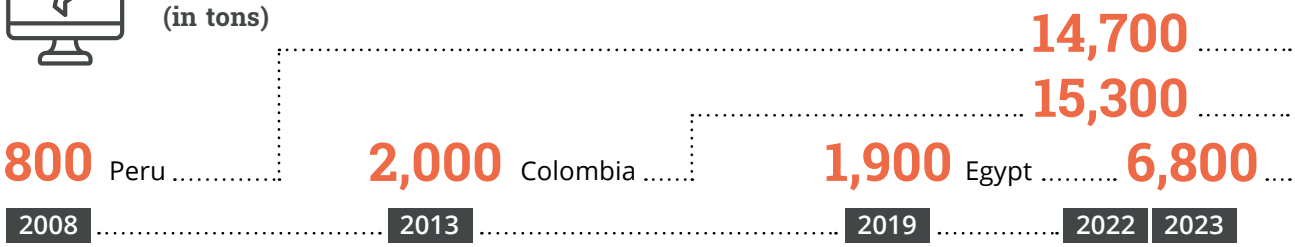
### ISO Standard

The ISO 59014 Standard on Sustainability and traceability of the recovery of secondary materials published, after a 3+ years co-development process under ISO, involving **85+** representatives from **21+** countries.

### Global Public Goods

Over **70** reports published on the SRI website, including: technical recycling guidelines, technical conformity assessment procedures, local assessments and implementation reports, policy recommendations, among others.

## Volume of e-waste processed by formal recyclers (in tons)

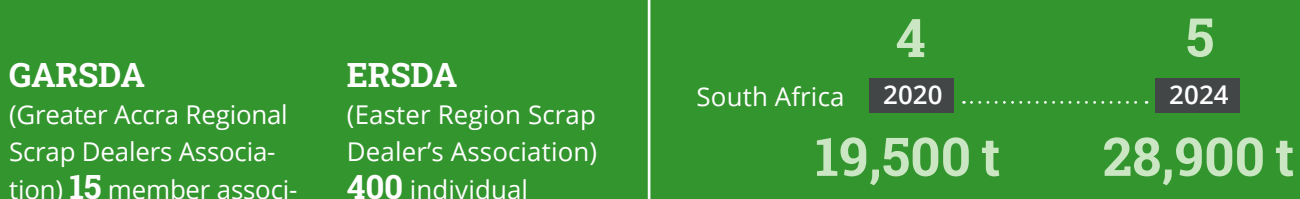



## Formation of recycler's associations Ghana (2024)

**GARSDA**
(Greater Accra Regional Scrap Dealers Association) **15** member associations; **3,000** persons.

**ERSDA**
(Easter Region Scrap Dealer's Association) **400** individual members

## PROs
(Producer responsibility organizations)




**Volume of e-waste processed by PROs**

# Implementation partners

The implementation of SRI has been possible through the involvement of numerous organizations and individuals who, in spite of being geographically dispersed, have collaborated jointly over more than a decade. As a result of this long-standing mutual collaboration, a strong "e-waste community" has been forged.

## Funding

State Secretariat of Economic Affairs (SECO), Switzerland

## Implementation

| | |
|---|---|
| Global | Swiss Federal Laboratories for Materials Science and Technology (Empa) |
| Global | World Resources Forum Association (WRF) |
| Colombia | Centro Nacional de Producción Más Limpia (CNPL) |
| Egypt | Center for Environment and Development for the Arab Region and Europe (CEDARE) |
| Egypt | Dss+ (DSS Sustainable Solutions Switzerland SA) |
| Ghana | Mountain Research Institute (MRI) |
| Ghana | National Cleaner Production Centre (NCPC) |
| Ghana | Ökoinstitut e.V. (Germany) |
| Peru | IPES – Promoción del Desarrollo Sostenible |
| South Africa | Envirosense |
| South Africa | ConsultAL |
| South Africa | Lumec |

## Institutional partners

| | |
|---|---|
| Colombia | Ministerio de Ambiente y Desarrollo Sustentable (MinAmbiente) |
| Colombia | Asociación Nacional de Empresarios (ANDI) |
| Egypt | Ministry of Environment – Environmental Affairs Agency |
| Egypt | Ministry of Communications and Information Technology (MCIT) |
| Egypt | Waste Management Regulation Authority (WMRA) |
| Ghana | Ministry of Environment, Science, Technology and Innovation (MESTI) |
| Ghana | Environmental Protection Agency (EPA) |
| Peru | Ministerio del Ambiente del Perú (MINAM) |
| South Africa | Department of Forestry, Fisheries and the Environment (DFFE) |
| Switzerland | Swiss Association for Standardization (SNV) |

# The SRI team*

*at the closing event in Geneva (Switzerland) in September 2025.

SUSTAINABLE RECYCLING INDUSTRIES

sustainable-recycling.org

**Turning waste into resources for development**

SRI builds capacity for sustainable recycling in developing countries. The programme is funded by the Swiss State Secretariat of Economic Affairs (SECO) and is implemented by the Institute for Materials Science & Technology (Empa) and the World Resources Forum (WRF). It builds on the success of implementing e-waste recycling systems together with various developing countries for more than ten years.