United Nations Institute for Training and Research

Planet

IMPACT STORY

SCYCLE'S CONTRIBUTION TOWARDS SUSTAINABLE AND CIRCULAR ELECTRONICS SYSTEMS

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Developed by SYCLE and reviewed by PPME[1]

Background

Context & Rationale

Electronics are the world's fastest-growing waste stream, and yet most countries still lack the data, systems, and institutional capacities required for effective management. UNITAR's Sustainable Cycles (SCYCLE) Programme has not only built the world's most comprehensive multi-level monitoring architecture—spanning global, regional, and national e-waste and material-flow analyses—but also develops the expert networks, methodological leadership, and practical system knowledge needed to support real-world transition processes.

SCYCLE's work goes far beyond quantifying e-waste volumes. It provides a deep understanding of what is inside electronic products, how valuable materials can be recovered efficiently and safely, and which legal, economic, and policy frameworks are necessary to make these recovery systems work. Because SCYCLE supports countries directly in system design, regulatory development, implementation planning, and capacity building, the programme delivers evidence and practical guidance from a single, trusted source.

This unique combination of data, expertise, and system-level experience enables governments, international organizations, and industry partners to move from analysis to action, and from fragmented measures to coherent circular electronics strategies.

Intended Outcomes

SCYCLE's multi-level monitoring architecture is designed to achieve far more than the generation of accurate statistics. Its overarching purpose is to enable governments, industry, financial institutions, and academic partners to make informed, strategic decisions that accelerate the global transition toward sustainable and circular electronics systems. The programme pursues the following outcomes:

[1] The methodology used for developing this Impact Story differs from the methodology for impact stories for learning related programmes proposed by PPME.

• **Trusted and comparable evidence:** Establishing globally aligned, scientifically robust data on e-waste and material flows as the basis for policymaking, investment decisions, and system optimisation.

• **Evidence-based policy and system design:** Supporting governments and regional bodies in developing or reforming legislation, Extended Producer Responsibility (EPR) frameworks, collection and recycling systems, monitoring mechanisms, and enforcement structures, grounded in real-world flow dynamics.

• **Support to industry and markets:** Enabling manufacturers, recyclers, repairers, refurbishers, and financial institutions to use SCYCLE's data and expertise to shape business strategies, evaluate risks and opportunities, improve recovery processes, and align with circularity and ESG objectives.

• **Strengthening science, education, and innovation:** Providing a globally recognised evidence base that is increasingly used in universities, training institutions, and even school curricula around the world, with SCYCLE graphics and methods becoming standard reference points in teaching and research.

• **Holistic circularity approach:** Looking beyond waste by examining how smart design, durability, reparability, and material choices can prevent waste in the first place and ensuring that any e-waste that does arise is channelled into circular, zero-waste, low-emission recovery pathways.

• **Institutional and technical capacity:** Building long-term capabilities within ministries, regulators, customs, Producer Responsibility Organizations (PROs), recyclers, and academic institutions to operate, govern, and continuously improve e-waste and circular economy systems.

• **Behavioural change across the system:** Supporting a shift from compliance-based approaches toward strategic system steering, where data actively informs target-setting, resource allocation, investment planning, enforcement, and circular business models.

• **Global alignment and coherence:** Promoting harmonised methodologies, indicators, and definitions to enable comparability across countries and regions, and to align with SDGs, UN frameworks, and emerging regulations in the European Union (EU) and other regions and countries worldwide.

These outcomes reflect SCYCLE's mission to combine data, policy expertise, system design, capacity development, and circularity innovation in a single, integrated approach to drive systemic and measurable change worldwide.

The Change Story

SCYCLE's journey spans more than two decades and began before the programme became part of UNITAR. Originating within United Nations University (UNU) in 1995, SCYCLE initially focused on Zero Emissions, sustainable production and consumption, and high-level policy advice. Early engagements quickly revealed a fundamental challenge: governments, companies, and international institutions lacked reliable data on electronic products, waste

generation, material flows, and recovery systems. Without this evidence base, meaningful policies, investment decisions, enforcement strategies, and circular solutions were extremely difficult to design.

Recognising this gap, SCYCLE positioned itself early and prominently in the field of e-waste statistics, material-flow analysis, and systemic modelling. Over time, this work evolved into today's multi-level monitoring architecture, combining global, regional, and national studies with methodological excellence and practical system insights. When SCYCLE joined UNITAR in 2022 as a mature and globally recognised programme, it brought with it a legacy of scientific credibility, conceptual leadership, and hands-on transition expertise. For instance, the Global E-waste Monitor 2024 was downloaded 12,406 times in its three available languages (English, Spanish, and French) and featured in over 2,100 articles. The most recent Global E-waste Monitor 2025 has already generated 496,266 impressions and 7,715 clicks (up to 15 December 2025). At the national level, the National E-waste Monitors for Tajikistan and Norway have been downloaded 270 and 306 times until December 2025, respectively.

A defining feature of SCYCLE's evolution has been its deep partnerships with all relevant stakeholder groups: governments, industry, recyclers, repair and refurbishment actors, statistical institutions, academia, civil society, and international organizations. Sustainable solutions are only possible when these actors collaborate, share data, and co-create approaches. This applies particularly to the monitoring domain: all methodologies applied by SCYCLE are reviewed, validated, and aligned with leading global statistical institutions, ensuring scientific rigour, comparability, and broad acceptance.

Through this combination of evidence, system knowledge, partnerships, and credibility, SCYCLE transitioned from a data provider to a co-designer of policies, systems, and circular economy pathways worldwide. Stakeholders increasingly rely on SCYCLE not only to understand the problem, but to build the solutions enabling a shift from fragmented actions to coherent, data-driven, and collaborative system transformation.

Links with the Sustainable Development Goals

SCYCLE's work is aligned to SDG 12 "Responsible consumption and production", target 12.1 "Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries".

Evidence of Outcome & Policy Uptake

A particularly strong demonstration of SCYCLE's influence is its **current engagement in the European Commission's Impact Assessment of the Waste from Electrical and Electronic Equipment (WEEE) Directive**, conducted jointly with Norion, 3Drivers and Ricardo. The consortium relies on SCYCLE's material-flow expertise and globally aligned monitoring methods to evaluate product and waste streams and assess the impacts of various regulatory options. SCYCLE's role includes analysing real flows, evaluating system performance, testing regulatory options, and assessing their environmental, economic, and social impacts.

This engagement builds on a long track record: as early as 2008, SCYCLE (then under UNU) led the official WEEE Review for the European Commission, shaping core elements of the subsequent revision of the Directive.

A milestone of global relevance is the formal integration of the UNU-KEYS—SCYCLE's internationally recognised classification and quantification system—into European reporting and methodological frameworks. The UNU-KEYS today serve as an official reference for categorisation, data harmonisation, and reporting consistency. Their adoption within EU governance mechanisms demonstrates the high level of regulatory trust in SCYCLE's scientific standards.

Beyond WEEE, SCYCLE's expertise is also sought within the Restriction of Hazardous Substances (RoHS) Directive, particularly for the assessment of exemption requests, where deep knowledge of materials, substitution technologies, and effects on recycling and circularity is essential. SCYCLE's involvement highlights that its work extends to the intersection of materials policy, environmental protection, and technological feasibility.

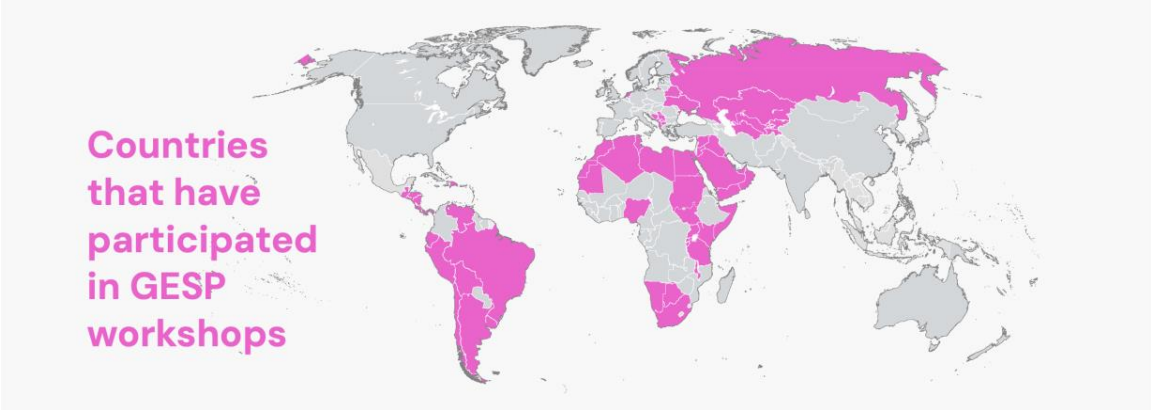
This influence extends globally: many countries and regions apply SCYCLE's frameworks when drafting or refining legislation, such as EU Member States, designing EPR systems, or planning investments. A recent example is the use of SCYCLE data as a reference in the Urban Mine Platform, as part of the Horizon Europe project FutuRaM. Findings of project reports may also feed into other Europe's evolving policy framework. The alignment of SCYCLE's methods with leading statistical institutions ensures scientific robustness, comparability, and widespread acceptance.

Across continents, one pattern is clear: SCYCLE's evidence, system expertise, and methodologies drive tangible change in legislation, system architecture, institutional mandates, and market behaviour, making SCYCLE not just a data provider but a co-creator of governance and circularity solutions.

Global & National Impact Beyond the EU

SCYCLE's influence extends far beyond the EU (see Figure 1). In many regions around the world, the programmes monitoring systems, methodological standards, and transition expertise form the backbone of national and regional strategies for managing electronics, reducing waste, and accelerating circular economy solutions.

Figure 1 - Global E-waste Statistics Partnership (GESP) workshops



Note: GESP provides an open-source portal for e-waste data.

In Africa, SCYCLE's regional and national assessments have supported policy development, system design, and EPR frameworks across numerous countries, including Ethiopia, Nigeria, Kenya and Tanzania. As an example, SCYCLE supported the draft of a national implementation plan of the Basel Convention guidelines for Tanzania in 2022, through the ReduCE-waste project. Flow studies have revealed undocumented informal and transboundary streams, enabling realistic target-setting, improved enforcement, and integrated collection and recycling systems.

In the Arab States and West Asia, SCYCLE's monitoring and policy advisory work enabled countries to harmonise definitions, establish national inventories, and embed e-waste into broader circular economy agendas, translating regional visions into concrete action.

Across Latin America, SCYCLE's analyses inform national legislation, implementation plans, and investment decisions. Ministries apply SCYCLE's methods to calibrate financial mechanisms, adjust targets, and design national registries.

In Asia, SCYCLE works with ministries, statistical offices, recyclers, and multinational companies to align systems with global standards, improve reporting, and develop new recovery models. SCYCLE's datasets and tools appear in university curricula, research programmes, and circular innovation initiatives.

Across all these regions, countries consistently adopt SCYCLE's methods, rely on its evidence, and build their systems around its expertise. The programme's capacity-building work ensures that these systems become resilient, adaptive, and capable of sustaining circular transitions over time.

Capacity Development as the Engine of Change

Capacity development has always been one of SCYCLE's most powerful levers for systemic transformation. Reliable data and sound policies only create impact when institutions and market actors have the skills, tools, and structures to act on them. SCYCLE equips governments, regulators, customs authorities, PROs, recyclers, manufacturers, financial institutions, and academia with the capabilities required to build and operate effective electronics and circularity systems.

SCYCLE's training initiatives combine material-flow expertise, policy design, financial modelling, enforcement mechanisms, business innovation, infrastructure planning, and operational know-how. Participants learn to interpret data, design monitoring systems, evaluate regulatory options, analyse risks, and translate evidence into practice. Many countries embed SCYCLE's tools into their own academies, inspectorate programmes, and university curricula.

A core strength of SCYCLE is its multidisciplinary team, bringing together environmental scientists, material and substance experts, statisticians, economists, system modellers, policy specialists, and technology and operations experts. Where additional depth is required, SCYCLE integrates external specialists to ensure cutting-edge knowledge and global best practices.

SCYCLE's co-creation approach ensures stakeholders collaboratively design systems, review legislation, analyse scenarios, and develop solutions tailored to local realities. This generates behavioural change: institutions become more strategic, markets more transparent, and system actors more capable of driving their own circular transitions.

The results are clear: stronger regulatory enforcement, improved detection of illegal shipments, upgraded recycling and refurbishment practices, optimised PRO operations, evidence-based national planning, and more circular investment decisions.

Through this anchored and participatory knowledge-building, SCYCLE ensures that systems become living, adaptive structures that continue improving long after initial support concludes.

Significance of the change

The significance of SCYCLE's work lies in the fact that it produces systemic, enduring and multi-level change that goes far beyond the provision of data or technical advice. SCYCLE's monitoring architecture, policy expertise, and capacity development efforts together enable countries, regions, and industries to make decisions that are evidence-based, forward-looking, and aligned with global sustainability and circularity ambitions.

Three dimensions of impact stand out:

1. SCYCLE's scientific methodologies—including the UNU-KEYS and flow-based analytical frameworks—have become reference standards in some of the world's most influential regulatory systems. Their formal adoption in legislation and policy guidance demonstrates that SCYCLE's work has moved from informing decisions to shaping the rules of the game.

2. SCYCLE's involvement in the design, evaluation and reform of policies, laws, EPR systems and financing mechanisms shows that the programme acts as a co-architect of national and regional electronics governance systems. This elevates SCYCLE from a data provider to a governance partner whose expertise is instrumental in structuring how markets, institutions and infrastructures function.

3. SCYCLE's holistic approach—spanning prevention, design, reuse, repair, material recovery, safe recycling, and circularity—creates coherent transition pathways, ensuring that policy, industry practice, technology and system operations reinforce each other.

Behavioural changes triggered by SCYCLE's work are also significant: regulators apply evidence proactively, enforcement agencies strengthen controls, recyclers improve quality standards, producers adjust business models, and educational institutions embed SCYCLE's methods.

By aligning stakeholders across disciplines and regions, SCYCLE strengthens national systems and contributes to global harmonisation and progress toward circular electronics. It enables countries to transition from isolated measures to strategic, data-driven, and resilient circular ecosystems generating impact long after individual interventions conclude.

Lessons Learned

SCYCLE's work over more than two decades demonstrates that sustainable transitions in the electronics sector require more than data, more than policies, and more than training. Several important lessons have emerged:

1. Evidence only becomes powerful when it is embedded in long-term cooperation. Monitoring data and analytical insights generate real change only when they are connected to sustained collaboration with national authorities, industry actors, and regional institutions. Long-lasting partnerships create trust, ensure continuity, and enable reforms that go far beyond project cycles.

2. Co-design beats consultation. Countries and stakeholders achieve the most progress when they actively shape solutions alongside SCYCLE, rather than merely receiving recommendations. Co-design leads to stronger ownership, more realistic system structures, and smoother implementation.

3. Holistic system thinking is essential. Fragmented interventions, whether upstream (design, prevention) or downstream (recycling, enforcement), rarely succeed in isolation. Sustainable solutions require integrated approaches that connect product design, business models, logistics, finance, regulation, operations, and end-of-life pathways into one coherent system.

4. Standardisation and methodological alignment matter. Aligning SCYCLE's methods with global statistical leaders ensures international comparability and credibility. This not only strengthens national reporting and policy harmonisation but also increases regulatory uptake as demonstrated through the adoption of methods such as the UNU-KEYS.

5. Capacity building creates lasting change. System transformation depends on people. When regulators, recyclers, customs officers, producers, and financial institutions understand data, legislation, risks and opportunities, they actively shape and improve their systems. Knowledge becomes infrastructure.

6. Behavioural change is a strategic outcome, not a by-product. Effective e-waste and circular systems emerge when actors shift from compliance-driven behaviour to strategy-

driven system steering. SCYCLE's work shows that behavioural change among ministries, market actors, and institutions is one of the strongest indicators of long-term impact.

7. Multi-stakeholder engagement is the foundation of sustainability. Whether at local, national, regional, or global level, no single institution can address the complexities of electronics systems alone. SCYCLE's networked approach—uniting governments, industry, academia, civil society, and international organizations—is essential for building resilient and future-proof solutions.

These lessons highlight that SCYCLE's impact is not the result of singular interventions, but of a consistently applied, integrative approach that blends evidence, expertise, partnership and co-creation. This is what enables SCYCLE to support countries and industries in achieving meaningful and lasting circularity.

Looking Forward

Looking ahead, SCYCLE is positioned to play an increasingly strategic role in guiding the global transition toward sustainable and circular electronics. The growing recognition of SCYCLE's methodologies, partnership networks, and system expertise provides a strong foundation for expanding impact at multiple levels.

In the coming years, SCYCLE will continue to:

• Advance global and regional monitoring systems. The next generation of monitors will integrate enhanced modelling, upstream design metrics, digital product passports, and circularity indicators. This will reinforce global alignment and support countries as they update strategies, reporting obligations, and long-term planning.

• Support the evolution of regulatory frameworks. As countries and regions revise or develop electronics, chemical, and circular economy legislation, from WEEE and RoHS to EPR laws, repair and reuse frameworks, eco-design regulations, and zero-waste strategies; SCYCLE will continue to serve as a trusted advisor. Its evidence and system expertise help ensure that emerging regulations are implementable, coherent, and compatible with global standards.

• Strengthen national system design and implementation capacity. SCYCLE will continue helping governments build robust, financially sustainable, and inclusive system architectures, including mechanisms for enforcement, long-term financing, informal-sector integration, and value-chain cooperation.

• Enable innovation and circular business models. By working with manufacturers, recyclers, refurbishers, repairers, and financial institutions, SCYCLE supports new circular business strategies, investment pathways, and technologies that enhance resource efficiency and reduce emissions.

• Build the next generation of experts. SCYCLE will continue supporting universities, academies, and training institutions in embedding advanced circular electronics knowledge into curricula. This fosters a global cadre of professionals capable of designing and operating future-ready systems.

• Contribute to global governance and sustainability agendas. Through its strong role in UN processes and international platforms, SCYCLE will support the development of harmonised methodologies, global indicators, and coordinated implementation across SDGs, Basel Convention processes, and emerging international circularity frameworks.

A central dimension of SCYCLE's future relevance lies in its alignment with the aspirations articulated in UN80 / "Shifting Paradigms". SCYCLE already implements what the UN system increasingly seeks to achieve: the institutional integration of research, evidence, policy advisory work, and capacity development within one coherent programme.

This combination creates higher efficiency, reduced duplication, tighter coherence between evidence and implementation, faster translation of knowledge into practice, and more strategic, system-wide impact.

Importantly, SCYCLE demonstrates that research and training cannot be treated as separate pillars if the UN wishes to move beyond the role of "training organiser" and ensure transformative results. SCYCLE's model shows that training is most effective when it is firmly rooted in research and evidence, and research delivers the highest value when it is directly connected to capacity building, institutional practice, and system operation.

This integrated approach embodies the spirit of ONE UN: combining complementary strengths into unified, impact-oriented workflows. SCYCLE therefore serves as a scalable model for how the UN system can enhance coherence, strengthen its offer to Member States, and deliver more meaningful and lasting results in line with the ambitions of UN80.