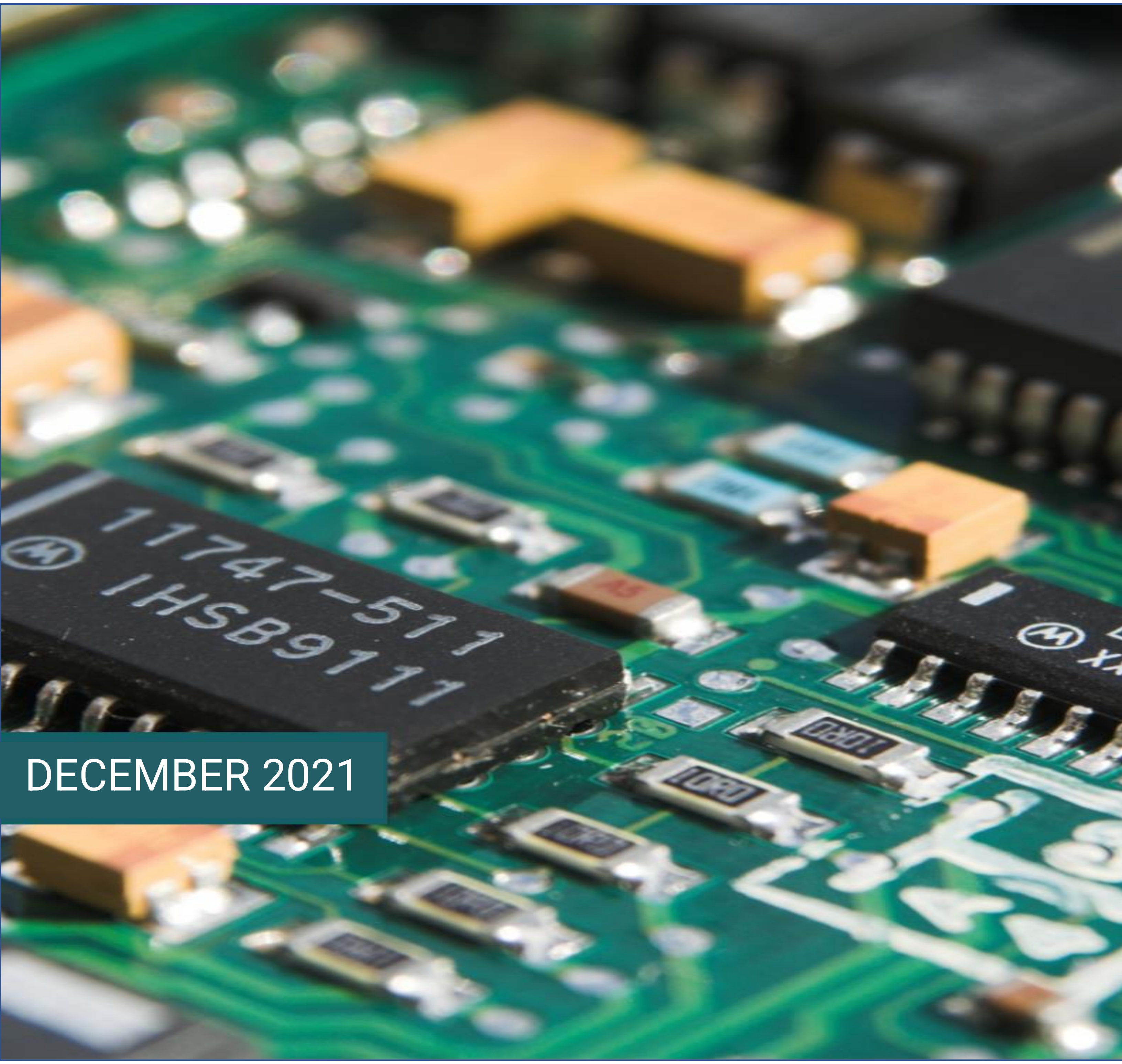
Addressing the Issue of Chemicals of Concern in Electronics

Challenges and recommendations for labelling initiatives



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Summary of key takeaways

- This document addresses the role that labelling initiatives can play in managing chemicals of concern (CoC) and proposes recommendations to scale up these initiatives' effectiveness to track and control the use of CoC along the electronics value chain.
- Ensuring access to chemical information by all stakeholders involved in the value chain is an important first step towards minimizing chemical hazards of electronic products, while enabling circularity.
- Whereas legislation can control market access and include specific provisions on the use of CoC, ecolabels can recognize best practices and serve as a practical tool for the industry to enhance transparency and traceability through the value chain and drive progress beyond regulations.
- All ecolabels assessed in this document include information disclosure requirements related to chemicals residing in the products, and provide CoC-related criteria that require or incentivize reduction of specific chemicals for individual materials or components. Most ecolabels provide general categories of prohibited chemicals, and/or make reference to lists of chemicals of concern, and few provide a list of chemicals that are allowed for use under the product category.
- Conformity assessment varies between labelling initiatives and by type of chemicals. Options include suppliers' self-declaration of conformity, inspection, third-party verifiers, and use of chemicals management systems.
- There are key challenges and gaps that currently impede labelling initiatives to effectively improve chemicals management in the electronics sector. These include the complex and international nature of value chains, cost- or capacity-related barriers to the adoption of ecolabels, and knowledge gaps about the presence of CoC that may undermine ecolabels' and auditors' capacity to assess and certify products.

1 Introduction

1.1 Background, aims and scope

Chemicals provide a variety of specific functions in electric and electronic products or in their manufacturing process. However, some of these chemicals are hazardous and can cause concern related to their potential for adverse impacts on human health and the environment. Such impacts can occur throughout the product's life cycle, including raw material extraction, processing and manufacturing, but also during product use or at end-of-life (SAICM, 2019). However, decisions influencing product ingredients are usually taken at upstream stages of the value chain. Actions to address chemicals of concern (CoC) in products thus need to consider the entire value chain, which requires a comprehensive and holistic perspective of the entire life cycle of products.[1]

The flow of information on hazardous substances across the life cycle of electronic products allows various stakeholders to make more informed choices related to the use of chemicals in products. The sound management of CoC throughout the value chain is therefore essential to increase the electronics industry's contribution to more sustainable consumption and production patterns.

Chemicals-related regulatory requirements set baselines by providing the minimum requirements for the management of CoC in products along the value chain. However, the development of regulation and its effective enforcement require an adequate administrative structure and availability of funding and technical expertise, which is often challenging especially in weak institutional contexts. In this context, voluntary and non-binding tools work as important complementary instruments to regulation and are critical to provide stakeholders with clarity and transparency on chemicals used in electronic products and to promote the use of safer chemicals and products. Some stakeholders have committed to provide clear and transparent information on chemical uses across value chains through various voluntary initiatives. For instance, a multi-stakeholder coalition formed by businesses, governments, health care organizations, investors, and non-governmental organizations have come together and endorsed the Principles for Chemical Ingredient Disclosure. These principles have the objective of increasing access to information about chemicals in products and their hazards (BizNGO, 2021).

[1] For more information on taking a value chain approach to reduce COC please see: https://saicmknowledge.org/node/17673

Labelling initiatives can be used as another effective way to manage CoC in products and value chains as they have the potential to recognize and award ambitious approaches and can strengthen market incentives. Ecolabels are additional means of requiring disclosure of information across the value chain, measuring and improving business performance, promoting transparency in regards to key information, and communicating the sustainability aspects of products to consumers. At the same time, ecolabels can support businesses in giving transparency to their production processes and disclosing credible and reliable information on the sustainability attributes of products. As ecolabelling initiatives have the potential to increase stakeholders' knowledge of various aspects of the products, including of substances and materials used in different stages of the life cycle of a product, they can play an important role in advancing the management of CoC.

This document forms a deliverable of the SAICM GEF 9771 project *Global best practices on emerging chemical policy issues of concern under the Strategic Approach to International Chemicals Management (SAICM)* funded by the Global Environment Facility (GEF).

The aim of this document is to explore how ecolabels that cover electronic products may be able to further incentivize reduction and/or improved management of chemicals of concern. The report provides an assessment of how ecolabels covering electronic products currently address chemicals of concern, discusses the main challenges that labelling programmes currently face in this regard, and puts forward recommendations on how CoC-related criteria can be further incorporated into these programmes. Ultimately, the document aims to increase the ambition of different stakeholders to track and control chemicals along the value chains of electronic products.

Access to chemical hazard information is a central factor in the achievement of the Sustainable Development Goals, notably Goal 12: Responsible Consumption and Production, targets 12.4 (with respects to the management of chemicals and all wastes throughout their life cycle), and 12.8 (concerning people having the relevant information for sustainable development).

Target 12.4
By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

Target 12.8
By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

THE GLOBAL GOALS
For Sustainable Development

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

1.2 Definitions

Electrical and electronic equipment (EEE) generally refers to products or equipment which require electric or electromagnetic fields in order to work properly. The electronics sector designs, produces, installs, and repairs equipment such as mobile devices, computers, televisions, and components (e.g. semiconductors). The sector is growing rapidly, mainly as a result of increased consumer spending around the world, whereas increased competition and efficiency of the manufacturing process are reducing the costs of production and making electronic products cheaper for individuals. EEE usually consist of various parts, components, and subassemblies, which are in turn composed out of a variety of materials that contain many different chemicals. More than 500 chemical substances have been identified as being used in the manufacture of electronic components, such as plating chemicals, cleaners, solvents, polymers and their additives (e.g. flame retardants), and solders (OECD, 2010).

Information tools are ways of communicating with consumers (individual consumers, governments or businesses) on attributes related to products. They can take different forms such as labels, standards and certifications, product declarations, marketing claims, and ratings (UNEP & ITC, 2017). *Ecolabelling*, in particular, is a voluntary method of environmental performance certification and labelling that identifies products that are proven to be environmentally preferable

(GEN, 2021). There are various labelling initiatives concerning electronics (e.g. energy labels), this report focuses on those that aim to provide holistic information relating to environmental attributes of electronic products across the product life cycle, i.e. environmental labels or ecolabels. Ecolabels usually appear on the product packaging or in any reference material (e.g. websites) and they work on the basis of providing transparency to the environmental attributes of the related product, thus encouraging behaviour change towards sustainable consumption and production.

Different types of *environmental labelling initiatives* exist, and they are commonly classified by the International Organization for Standardization (ISO) into three main different types:

- ISO Type I labels, often referred to as ecolabels, identify overall environmental preference of a product based upon life cycle considerations. An ecolabel is awarded by an independent and impartial third party to products that meet specific environmental criteria. Type 1 ecolabels are licensed for use only upon fulfilling a set of criteria.
- ISO Type II is a self-declared environmental label (often single attribute in focus, sometimes indicated by a company's own environmental logo).
- ISO Type III is a product declaration that provides more detailed quantitative information of products. It takes the form of a matrix and is similar to declarations of the nutritional characteristics of products.

This report mainly addresses the first type of labelling initiatives, more specifically ecolabels that have specific criteria addressing the use of certain chemicals in electronic products.

1.3 Methodology

This report provides information on how ecolabels for electronic products have covered the issue of CoC, and discusses the main challenges that labelling programmes currently face in this context. It then goes on to provide recommendations on how CoC-related criteria can be further incorporated into these programmes. The analysis therefore targets primarily owners of such programmes, and the stakeholders who participate in the criteria development processes, but at the same time hopes to inform national governments on how to best support ecolabelling, and to provide relevant information to companies certifying their products against such programmes.

The assessment was based on publicly available criteria documents identified through online research. Challenges and recommendations identified in the research were discussed and complemented during the workshop "Addressing the challenge of chemicals of concern, enabling circular electronics" organised by UNEP on the 10th and 11th of November 2020. The workshop included a presentation of preliminary results of the mapping of labelling initiatives as well as perspectives from representatives of selected ecolabels and industry stakeholders. In addition, the results were peer-reviewed by members of the Working Group Type 1 ecolabels from the One Planet network Consumer Information Programme, which aims to share knowledge and build capacity on Type 1 ecolabels globally.

The assessment first identified 19 ecolabels addressing electronics globally. Six (6) of these ecolabels were found to only cover energy related criteria, so these were left out from the research. All 13 ecolabels that received comprehensive examination included explicit criteria on CoC. The selection of ecolabels and product categories took into account the need to ensure balanced representation and diversity, both in terms of geography and product categories. The assessment covers ecolabels from Europe, the Americas and Asia Pacific[2] that have specific criteria addressing the use of certain chemicals in electronic products. Electronic product categories covered in the assessment were diverse and include televisions, air conditioners, household energy meters, computers and keyboards, printers and multifunction devices, displays, and white goods.

The table below provides a description of ecolabels that were included in the analysis.[3]

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[2] Ecolabels reviewed are: EU Ecolabel, Blue Angel, EPEAT, ECMA TR/370 – European Computer Manufacturers Association, TCO Certified, ABNT, Nordic Swan, EcoMark Japan, EcoMark India, China Environmental Labelling, Good Environmental Choice Australia, Green Label Thailand, Sello Ambiental Colombiano.

[3] This is not an exhaustive list of all ecolabels that address electronic products worldwide. Labels were selected for their illustrative potential for representing the variety of approaches available in the market. UNEP does not endorse any of the organisations presented in this publication in any way or for any purpose. Quality and quality control are the sole responsibility of the organizations.

Name	Logo	Description	Geographical distribution	Electronic Products Categories
ABNT Environmental Label		ABNT Ecolabel is a voluntary certification that certifies environmentally friendly products. It is managed by ABNT, the National Forum for Standardization, that is responsible for developing technical standards in Brazil. It is a Type 1 ecolabel.	Brazil	Printers, copiers and imaging equipment, computers
Blue Angel		The Blue Angel is awarded to products that are more environmentally-friendly than others serving the same use. It is managed by the German government. It is a Type 1 ecolabel.	Germany	Air conditioners, vacuum cleaners, computers and keyboards, printers, multifunction devices, and others
China Environmental Labelling		China Environmental Labelling aims to promote green purchase and green manufacturing in China. It is managed by the China Environmental United Certification Centre – CEC. It is a Type 1 ecolabel.	China	Washing machines, refrigerators, cameras, multi-function copier devices, vacuum cleaners, and others
ECMATR/370		ECMA's TR/370 voluntary product declaration standard identifies and defines the environmental attributes related to ICT (Information and Communication Technology) and CE (Consumer Electronics) products, during their entire life cycle. It is managed by the European Computer Manufacturers Association.	Worldwide	Computers
EcoMark India		The EcoMark India is operated on a national basis and provides certification for consumer products which meet certain environmental criteria. It was instituted by the Government of India and is managed by the Bureau of Indian Standards. It is a Type 1 ecolabel.	India	Refrigerators, televisions, fans, steam irons, desert coolers, electric food mixer, and others

EcoMark Japan		The EcoMark Japan programme requests that the lifecyle of products is taken into consideration for every product category. It is operated by the Japan Environment Association. It is a Type 1 ecolabel.	Japan	Personal computers, imaging equipment such as copiers, printers, projectors, televisions and servers
EPEAT		EPEAT is a global ecolabel for sustainable electronics, addressing environmental and social impacts throughout the product life cycle. US federal government purchasers are required to procure EPEAT registered products. It is managed by the Global Electronics Council (GEC) in the United States. It is a Type 1 ecolabel.	Worldwide	Servers, computers and displays, imaging equipment, televisions, mobile phones, and PV modules and inverters
EU Ecolabel		EU Ecolabel is designed to encourage businesses to market products and services that are kinder to the environment and for European consumers. Each state of the European Economic Area designates a Competent Body, an independent organisation that implements the EU Ecolabel scheme at national level. It is a Type 1 ecolabel.	All member states of the European Union, as well as Norway, Liechtenstein and Iceland	Electronic displays (televisions, monitors, digital signage displays)
Good Environmental Choice Australia (GECA)		GECA's scheme is a multi-sector ecolabeling programme that aims to enable consumers to choose products and services that have a lower impact on the environment and human health. It is managed by Good Environmental Choice Australia (GECA). It is a Type 1 ecolabel.	Australia	Imaging equipment, air conditioners
Green Label Thailand		The Green Label is an environmental certification awarded to specific products that are shown to have minimum detrimental impact on the environment. It	Thailand	Computers, lamps, televisions

		was launched by the Thailand Environment Institute (TEI) in association with the Thai Industrial Standards Institute (TISI) and Thai Ministry of Industry. It is a Type 1 ecolabel.		
Nordic Swan		The Nordic Swan Ecolabel works to reduce the environmental impact from production and consumption of goods. It was established by the Nordic Council of Ministers as a voluntary ecolabelling scheme for the Nordic countries. The ecolabel is managed by state-owned companies in Denmark, Finland, Iceland, Norway and Sweden. It is a Type 1 ecolabel.	Denmark, Finland, Iceland, Norway, Sweden	Imaging equipment, primary batteries, rechargeable batteries and portable chargers, TVs and projectors, white goods (refrigerators and freezers, washing machines, dishwashers, tumble dryers)
Sello Ambiental Colombiano – (Colombian Environmental Mark)		Sello Ambiental Colombiano aims to encourage environmentally friendly practices by manufacturers in Colombia. It was developed by the Colombian Ministry of Environment based on the fundamental principles of standard ISO 14024. Its use is jointly regulated with the Ministry of Trade, Industry and Tourism.	Colombia	Computers, imaging equipment (toners)
TCO Certified		TCO Certified is a sustainability certification focused on IT products. Criteria are designed to drive social and environmental responsibility throughout the product life cycle. It is a Type 1 ecolabel.	Worldwide	Displays, notebooks, tablets, smartphones, desktops, all-in-one PCs, projectors, headsets, network equipment, data storage products and servers

Table 1: Selected ecolabels covered in the assessment

2 The issues of chemicals of concern in the electronics value chain

Tracking and controlling chemicals along the value chain of electronic products is challenging mainly because of three main factors:

1. Long and complicated international value chains for chemicals and materials
2. Lack of knowledge on the impacts upstream (i.e. raw materials extraction and manufacturing process) and downstream (end-of-life); and
3. Rapid technological developments and increased diversity and volume of EEE being produced across the world

Taking a holistic approach by considering impacts and actors all along the value chain is crucial to minimize negative impacts of the electronics industry on the environment and human health, and to increase the sector's contribution to more sustainable consumption and production patterns. Moving towards circular electronics likewise calls for practices that are implemented across the upstream, mid-stream and downstream of the value chain, with the objective of retaining products at their highest possible value for as long as possible. This approach relies on the guiding principle of "reduce by design", which aims to reduce the amount of material and hazardous chemicals used during the production and use phases (UNEP, 2019). Circular processes from the user-to-user perspective include refuse, reduce and re-use, from the user-to-business intermediary perspective repair, refurbish and remanufacture, and from the business-to-business perspective repurpose and recycle.[4]

[4] More information on the UNEP approach to and experience in building circularity, including in the electronics sector, is available on the UNEP Circularity Platform: https://www.unep.org/circularity

Figure 1 below illustrates the currently mainly linear electronics global value chain and the main activities related to each phase. It is worth noting that there are various stages in the value chain of electronics and there are several stakeholder interactions and tiers of suppliers within each of these stages, usually involving many countries around the world[5].

Better management of chemicals of concern is a key enabling factor to move towards circularity in the electronics value chain. As hazardous substances can impact human health and the environment through all stages of the value chain, from material extraction and production to the use phase of a product and its end-of-life, value retention strategies without sound management of hazardous chemicals can be limited. Although initiatives that aim to enable circular electronics are emerging, particularly for high-value products, the linear “take-make-dispose” approach still prevails in the current electronics value chain (UNEP, 2019).

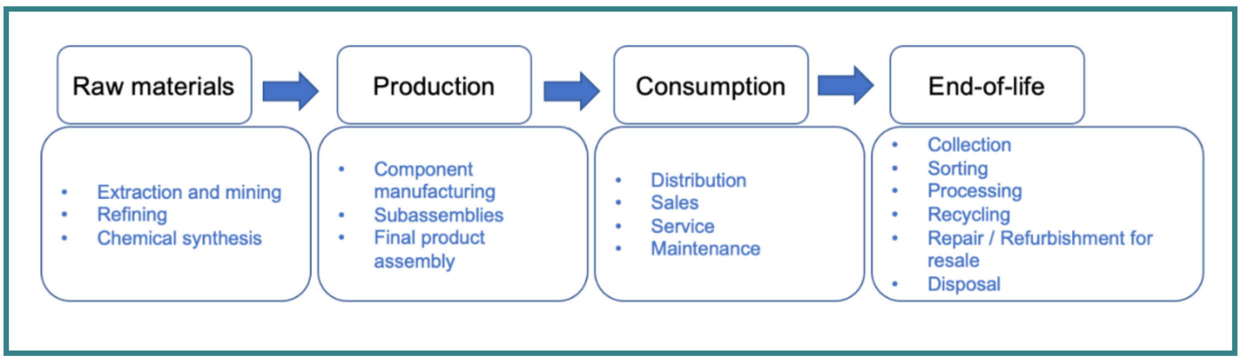

Figure 1: Representation of the electronics global value chain adapted from UNEP (forthcoming)

[5] Life cycle considers the entire resource flow and related social and economic impacts across a good or service’s life, whereas the value chain covers all stages in a product’s life, from supply of raw materials through to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation (UNEP, 2017).

2.1 The role of labelling initiatives

Some countries have established regulatory frameworks to address the management of hazardous chemicals related to electronic products (UNEP, 2020). The majority of these frameworks, however, still lack regulatory approaches for the use of CoC in electronics and capacities for development and enforcement of such regulations are limited. Also, due to the complex and international nature of value chains in the electronics sector, lack of alignment between existing regulatory approaches are challenging for industry that usually operates across borders.

Ecolabels have the potential to enhance the management of value chain networks and increase stakeholders' knowledge of various aspects of products, therefore supporting transparency and traceability in value chains. The pressure to know where and how products are produced has increased substantially over the last two decades. There is therefore an increasing demand on businesses to disclose clear, reliable and traceable information on the sustainability attributes of products and their production processes (UNEP & ITC, 2017). At the same time, with the rise of global value chains, notably in the electronics sector, it is a challenge to identify all downstream and upstream stakeholders and track all materials and substances involved in different stages of the life cycle of a product.

In addition to increasing power for consumers and civil society, as this access to information through ecolabels enables them to make informed choices, ecolabels can support efficient operations in value chains since access to trustworthy information can enable companies to coordinate and optimize key processes, functions, and relationships with other tiers of the value chain. In essence, ecolabels allow relevant knowledge and data at the product and manufacturer levels to be circulated amongst stakeholders throughout the value chain since these tools can work as mechanisms for transmitting clear sustainability information from one tier to another.

2.2 Results of the analysis

It is important to understand how existing labelling initiatives on electronics have addressed CoC, and to develop recommendations on how CoC-related criteria could be strengthened or incorporated into ecolabels. The analysis undertaken in the framework of this document showed that:

Regarding the content of criteria:

- All the assessed labels include information disclosure requirements related to chemicals residing in the products.
- All the assessed labels provide CoC-related criteria which require or incentivize the reduction of specific chemicals for individual materials or components (e.g. for plastic casings, housing parts, casings and casing parts). Types of chemicals addressed include hazardous substances, heavy metals, flame retardants, plasticizers, mercury, refrigerants, and non-halogenated substances. (see Box 1 for an example of product registry).
- The majority of labels provide general categories of prohibited chemicals (e.g. no substances classified as carcinogenic cat. 1A or 1B as per the Globally Harmonized Systems of Labelling and Classification, GHS), and/or make reference to lists of CoC, but few also provide a list of chemicals that are allowed for use under the product category (see Box 2 for an example)

Box 1 - EPEAT.NET

EPEAT provides an online Registry of products covered under the ecolabel, which allows purchasers to see which product meets which specific chemical criterion. Product information is updated daily and is third party verified. Detailed category-specific product reports and criteria can be downloaded as an Excel file (available for computers and displays, imaging equipment, mobile phones, photovoltaic modules and inverters, servers and televisions).

Box 2 - TCO Certified Accepted Substance List

TCO provides a public list of substances that are approved for use in the products and manufacture of certified products. The list is under progressive development and the substances may be reassessed in light of new scientific findings. Plasticizers, flame retardants and process chemicals that achieve a benchmark score of 2, 3 or 4 by a Licensed GreenScreen Profiler are added to TCO Certified Accepted Substance List and may be used in the products and manufacture of certified products.

- National regulations are commonly mentioned in internationally recognized ecolabels. In general, ecolabelled products often need to comply with the following main regulations as a first step to reach the certification:
  - Regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)
  - Regulation on the classification, labelling and packaging of substances and mixtures (CLP Regulation)
  - Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS directive)
- Some ecolabels also incentivize hazard or risk assessments to be conducted for specific CoC as well as documented actions taken in response to the assessment results.
- Some ecolabels are starting to incentivize reduction of process CoC which are used during the manufacturing process but do not actually end up residing in the product, but have potential impacts on the health of workers in the electronics industry.
- Chemicals-related criteria for different product categories generally follow a similar approach within the same ecolabel (i.e. products are addressed in a conceptually very similar way), but the criteria for individual product groups usually differ in specific aspects. One label, for instance, does not allow the use of chemicals that are known or presumed to exhibit carcinogenic, mutagenic or reprotoxic (CMR) effects in plastic casings of computers, keyboards, or stationary air conditioners (i.e. Cat. 1A or Cat. 1B) whereas the criteria for plastic casings of household energy meters also do not allow substances that are suspected of exhibiting CMR effects (Cat. 2).[6]
- Differences in criteria of the same product category between different labels were observed, in particular where there is no official regulation which sets the baseline.

[6] Classification of CMRs in the EU is based on the strength of evidence showing that they present one of the CMR types of hazards to human health. The International Agency for Research on Cancer uses 4 classes for carcinogen classification, also based on the strength of evidence regarding their hazard to humans: Cat. 1 A, Cat. 1 B, Cat. 2 and effects on or via lactation.

Regarding the verification requirements:

- Conformity assessment varies between labelling initiatives and by type of chemicals. This means that each ecolabel uses specific methods to demonstrate that the requirements related to the use of chemicals are fulfilled. Options can include supplier's declaration of conformity, inspection, third party verifiers, and use of chemicals management systems. For example, some ecolabels require that information is provided to the awarding competent body in the form of safety data sheets and lists identifying material type, quantity of chemical used and location within the product (see Box 3 for an example). Applicants can also be requested to declare compliance with requirements through a signed self-declaration and submit a declaration of conformity with specific legislations (see Box 4 for an example). Other ecolabels request that declaration is provided by the chemical supplier (e.g. flame retardant suppliers) to the best of his/her knowledge at the given time, also based on information from raw material manufacturers.

Box 3 - Good Environmental Choice Australia (GECA)

GECA demands that conformance with requirements shall be stated in writing and signed by Chief Executive Officer or an authorised representative of the applicant company. This statement shall be supported with documentation that may vary depending on the product category. For example, for copying machines and printers, in addition to Safety and Data Sheets, this statement shall be supported by documentation that:
- identifies the toners or inks used and their ingredients;
- includes safety data sheets or other information to demonstrate the risks, if any, assigned to the toners or inks used; and
- a report of the results of the Ames test.

Box 4 - Brazilian Association of Technical Standards (ABNT)

Before the certification, ABNT sends the company a document in Excel format with all the criteria, so that the company can carry out a self-assessment. The document then automatically informs the classification of the company in relation to the requirements of the procedure, according to its assessment. Having obtained the approved classification, the company will be able to schedule the certification audit with ABNT. During the certification audit, ABNT verifies compliance with the requirements, using the same document used by the company for its self-assessment. ABNT then checks if the company's self-assessment is correct or if there is any discrepancy.

3 Challenges and gaps

In view of creating opportunities to advance circularity in the electronics sector, it is important to recognize that there are key challenges and gaps that currently impede labelling initiatives to effectively improve chemicals management through their programmes.

First, the complex and international nature of value chains in the sector aggravates existing gaps in knowledge and communication of information related to the use of chemicals, from the point of view of both ecolabels and industry stakeholders. To start addressing this challenge, standards have been established for the sharing of data about material composition of electronic products. For instance, the International Electrotechnical Commission introduced the IEC 62474, which establishes requirements for reporting of substances and materials and aims to facilitate transfer and processing of data. Similarly, the IPC 1752 establishes a standard reporting format for material declaration data exchange between supply chain participants and supports reporting of materials, components, printed boards, sub-assemblies, and products.

Despite the efforts, tracking and controlling chemicals and chemicals-related information through long and complicated value chains is still a challenging task. This applies in particular to small- and medium-sized enterprises (SMEs) but also remains challenging for larger companies. Even when companies in the sector communicate lists of restricted substances (RSL) to their suppliers, they may have little knowledge on which exact substances or materials are used in the manufacture of the specific components. Such knowledge gaps may lead to challenges during the certification process and undermine ecolabels' and auditors' capacity to assess and certify products.

Also, establishing comprehensive criteria that support the shift towards circular electronics by covering products throughout the whole life cycle including use and end-of-life phases is still a challenge as it requires shared effort across the value chain. This is important because in addition to potential risks for human health and the environment through direct exposure, the presence of CoC in any stage of the value chain of electronics can limit practices that extend the lifetime of products, thus reducing the potential for closing material loops in a holistic and circular perspective (Pivnenko and Astrup, 2016).

Given the fact that criteria are usually developed at different times and by different independent multi-stakeholder groups for each product category, it is common that CoC-related criteria differ across product categories for the same components and materials (e.g. criteria for plastic casings in different product categories). Better alignment and interoperability of criteria would simplify certification on the side of the ecolabels, provide increased clarity to users, and reduce costs for manufacturers. However, lack of alignment between CoC-related criteria within the same ecolabel may reflect advances in knowledge about impacts of specific chemicals in specific products and/or more effective verification approaches. Thus, care must be taken to not miss opportunities to address CoC (and other environmental and public health) issues that are relevant to only one product category or region, for example.

Especially in the context of SMEs and in developing or emerging economies, cost or capacity related barriers to the adoption of ecolabels can compromise the role they could play to push for greater transparency on information on CoC and to support efforts towards minimizing chemical hazards of electronic products. Such barriers can lead to situations where ecolabels are theoretically available but local companies are not able to obtain certification of their products due to the lack of resources or internal capacity, or there might be cases where criteria are so rigorous that meeting them might not be technically feasible. Therefore, developing criteria that are rigorous enough to drive towards increased sustainability, but not so rigorous that no products will be certified is key for successfully establishing product sustainability standards. At the same time, third party laboratories have a crucial role to play in improving national testing capacity in order to ensure that information provided by companies to ecolabels is substantiated and truthful. Analytical standards are important in this context as a tool to ensure enforceability and verifiability.

Also, as consumer awareness for chemicals related issues in electronics is recognized to be low, engaging representatives from consumer or environmental advocacy organizations not only in increasing consumers' awareness on the issue but also in the development of relevant criteria for labelling is key. Engagement of those organizations can however be challenging and costly, especially in developing or emerging economies. However, involving a wider group of actors (e.g. value chain partners such as retailers, industry association members, and NGOs) to jointly develop the basis of criteria has the potential to increase acceptance, credibility and impact of ecolabels (UNEP & ITC, 2017).

Finally, in addition to making clear information available to stakeholders, there is a challenge when it comes to the level of comprehensibility of information on chemical hazards throughout the value chain. For instance, previous research has identified that individual consumers usually assume that products with an ecolabel or without hazard pictograms are free from harmful chemical substances (Hartmann and Klaschka 2017). Also, studies have identified that the understanding of chemical hazard communication is generally low and factors such as demographic characteristics, gender, level of education and cultural differences as some of the key factors that influence understanding of information on a label (Sathar, Dalvie and Rother 2016).

4 Opportunities and recommendations

The transparency and traceability of information about chemicals in electronics value chains is a critical issue, in which ecolabels have a key role to play. Labelling initiatives have the potential to address both the demand and the supply sides, as they can be used both as tools for consumers (including businesses, governments and individual consumers) to make informed choices around product purchase, use and end of life, as well as to incentivize producers to trace and improve life cycle management of chemicals present in products.

The knowledge about the presence of CoC in electronics is especially relevant in the context of enabling circular electronics, allowing for the 9Rs (reduce by design, refuse, reuse, reduce, repair, refurbish, remanufacture, repurpose and recycle) to be pursued in a way that is safe for both people and the environment. CoC should be identified and their use should be explicitly addressed and progressively eliminated through systematic reduction strategies, and strategies that aim to promote substitution to safer chemicals.

Based on the current research and consultations held in the context of this project, the following recommendations are put forward with the aim to enable CoC in electronics to be addressed more effectively by labelling initiatives:

- Ecolabelling initiatives should **include the management of CoC as one of the main objectives of the labelling system** to minimize impacts or potential impacts from hazardous chemicals to human health and the environment, and address CoC in required criteria while also leveraging optional criteria to further incentivize leadership.
- Ecolabelling initiatives should ensure that **chemicals-related criteria consider the entire life cycle of a product**, from upstream (including raw material extraction, and manufacturing and use phases) to downstream (end-of-life), in order to enable circularity in the electronic sector.
- Because electronic products are no longer developed for national markets and have value chains spanning across the entire globe, **increasing alignment and interoperability of criteria across labelling initiatives** is crucial, and mutual recognition of the labelling initiatives amongst each other is key. First, this is useful because it can maximize the market signal by aggregating procurement demand from various government entities and other purchasers. Second, this can save costs and resources used by ecolabels to develop

new criteria. Third, this can save costs of companies and producers operating across borders. For this to happen in practice, exchange of information amongst ecolabels is essential, including how CoC criteria are developed, background documents used to develop criteria, and feasibility studies. This becomes even more important in cases where scientific evidence on potential concerns of chemicals is emerging and needs to be accounted for by ecolabels. One concrete example happened in 2019 when titanium dioxide (TiO2) entered into assessment for potential classification as a suspected carcinogenic substance (Carc 2) by the European Chemicals Agency (ECHA) and in the years that followed, ecolabels differed in how they took the new studies into account, leading to significant variety in criteria. It is therefore recommended that ecolabel activity is coordinated to avoid such fragmentation in the absence of regulatory reference points.

> Initiatives such as the Global Ecolabeling Network (GEN) and the Consumer Information Programme Working Group on Type 1 ecolabels can play an important role in this regards, as they aim to create opportunities for shared expertise and knowledge to promote the importance of providing clear, transparent and trustworthy labelling.

- Information exchange is crucial to identify and address any CoC along the value chain. In order to do so, **transparency of information related to the use of chemicals** is essential for informed decision making, which would be facilitated by the alignment and interoperability of labelling initiatives. Ecolabels are not the sole tool that can contribute to this goal - new mechanisms and solutions enabled by blockchain and proposals on digital product passports can also enable tracking and tracing of products, including the presence of CoC.
- **Criteria** related to the use of chemicals should be based on the **latest scientific evidence** and must be **continuously updated** to guide towards a more environmentally friendly market segment for fast developing products like electronics. In addition, if the criteria related to the use of chemicals are updated for one product category following stricter guidance, other **similar categories should also be updated, or common criteria approaches across product categories should be explored**.
- Ecolabelling initiatives should **provide a list of prohibited chemicals** and/or **general categories of prohibited chemicals** (e.g. no substances classified as carcinogenic 1A/1B), and/or establish a **list of chemicals that are allowed for use** under the label. Ecolabels

should also impose **information requirements related to chemicals** that are used. Requirements regarding health and safety and the working conditions of workers should also include reference to CoC.

- Provisions should be made for the consideration of impacts of alternative chemicals. Given the dynamic and complex nature of electronic products, it is critical to address prioritized assessment and identification of safer alternatives in order to avoid regrettable substitutions. Labels therefore should provide **criteria specific for conducting prioritized hazard assessment and selection of safer alternatives**.
- Ecolabels, retailers, industry associations and NGOs should aim at **increasing consumer awareness** on the issue of chemicals in electronics, and jointly develop education campaigns to improve the understanding of chemical hazard communication.
- In-country **testing capacity** should be built by third party laboratories and auditors for accurate and better measurement of the presence of CoC. This is key to ensure that industry can be held accountable and that ecolabel requirements can in fact be met by industry.
- Stakeholders in this field should make better use of the **complimentary roles that ecolabelling and regulatory approaches** can play in different contexts. In general, regulation is a strong driver in advancing the better management and phase out of CoC in electronics. In countries with advanced regulatory approaches for CoC in electronics, regulations are responsible for controlling market access and ecolabels recognize best-in-class solutions. However, in contexts where regulatory approaches are currently lacking and thus the respective driving force is not as strong, ecolabelling can provide useful entry points for advancing the issue of CoC, for example related to sustainable procurement.

5 Conclusion

This document sheds light on the role that labelling initiatives can play in managing chemicals of concern in electronic products, in line with the UN Sustainable Development Goal 12. It recognises the importance of managing chemicals of concern throughout the value chain, starting at product design stage, to enable circularity in the electronics sector. The document highlights challenges currently faced by ecolabels and puts forward opportunities and recommendations to enhance their effectiveness to the management of CoC with a view to improving labelling initiatives as a means of supporting transparency and traceability of CoC.

Ensuring good access to chemical information to all stakeholders involved in the value chain is an important first step towards minimizing chemical hazards of electronic products. **Ecolabels have the potential to provide important information to anyone who deals with hazardous chemicals at any stage of the product's life cycle** (UNEP, 2019). Whereas national or regional legislation can control market access and include specific provisions on the use of CoC, ecolabels can recognize best practices and serve as a practical tool for industry to better track and control the use of CoC along the value chain and drive progress beyond regulations. In the view of the global interest that voluntary actions help advance the sound management of chemicals and waste, including in the context of the beyond 2020 process on sound management of chemicals and waste[7], strengthening efforts to monitor ecolabels' progress in the field can be a meaningful approach. Of equal interest might be to hold discussions on how to scale up their effectiveness in all world regions. With the goal of achieving coordinated and aligned labelling initiatives which improve the flow of clear and reliable information on CoC, it is important to reinforce that ecolabels can be used to communicate environmental credentials and also to manage performance through the value chain, i.e. as a value chain risk management tool that can help industry stakeholders to control for various risks including those related to hazardous substances.

[7] Accessible at: [Intersessional Process (saicm.org)]

Recommended next steps

- Join efforts to scale up ecolabels' effectiveness to manage CoC in electronic products and value chains
- Maximize alignment and interoperability of CoC-related criteria across ecolabels
- Make better use of the complimentary roles that ecolabelling and regulatory approaches can play to advance the issue of CoC in electronics

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