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ENVIRONMENT POLICY COMMITTEE****Working Party on Resource Productivity and Waste****Labelling and Information Schemes for the Circular Economy**

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## *Abbreviations and Acronyms*

B2B	-	Business to business
B2C	-	Business to consumer
BSI	-	British Standards Institute
CAMDS	-	China Automotive Material Data System
CBI	-	Confidential Business Information
CE	-	Circular Economy
CELIS	-	Circular Economy Labels and Information Schemes
CFF	-	Circular Footprint Formula
CiP	-	Chemicals in Products
EEE	-	Electric and electronic equipment
ELIS	-	Environmental Labels and Information Schemes
EOL	-	End-of-life
ETC/SCP	-	European Topic Centre on Sustainable Consumption and Production
G2B	-	Government to business
G2C	-	Government to consumer
GADSL	-	Global Automotive Declarable Substance List
GASG	-	Global Automotive Stakeholder Group
GOTS	-	Global Organic Textile Standard
GPP	-	Green Public Procurement
GRI	-	Global Reporting Initiative
ICCA	-	International Council of Chemical Associations
IEC	-	International Electrotechnical Commission
IMDS	-	International Material Data System
IS	-	Information System
ISO	-	International Standards Organisation
LCA	-	Life-cycle Assessment
LCI	-	Lifecycle Inventory
METI	-	Japan's Ministry of Economy, Trade and Industry
MSRL	-	Manufacturing Restricted Substances List
OEF	-	Organisation Environmental Footprint
OEF SR	-	Organisation Environmental Footprint Sector Rules
OEM	-	Original Equipment Manufacturer
PEF	-	Product Environmental Footprint
PEFCR	-	Product Environmental Footprint Category Rules Guidance
PPM	-	Product and Production Methods
REACH	-	Registration, Evaluation, Authorisation and Restriction of Chemicals
RICs	-	Resin Identification Codes
RoHS	-	Restriction of Hazardous Substances
SERI	-	Sustainable Electronics Recycling International
SVHCs	-	Candidate List of Substances of Very High Concern (in REACH Directive)
VCO	-	Value Chain Outreach

## *Executive Summary*

Global raw materials use has grown to almost 90 Gt in 2017 and is projected to more than double by 2060. Increasing materials use and waste generation are putting growing pressure on environmental systems. Resource efficiency and the transition to a circular economy (CE) have become important elements of environmental and green growth policies. These efforts aim at decoupling materials use and related environmental impacts from economic growth.

Paucity of information, information asymmetries and competency gaps are considered key barriers towards increased resource efficiency and circularity, causing d-optimal decision-making along all phases of the value chain. Upstream in the value chain, firms may miss opportunities to more resource-efficient procurement from higher tiers. At the consumption stage, consumers make misinformed purchasing decisions, leading to market inefficiencies and increased environmental externalities. Further downstream, recycling firms are unable to process potentially valuable secondary material, which can be due to missing information on waste streams and their material composition. In the public sector, these information deficiencies inhibit the greening of public procurement towards more resource efficient and circular products.

Circular Economy Labels and Information Schemes (CELIS) compose the group of labels, certifications, standards of information schemes that fully or at least partially address one or more resource efficiency or circular economy elements. CELIS can play an important role in fostering circular economy activities. They can empower market actors to distinguish and discriminate products based on environmental performance, which stimulates market development and innovation in resource efficient products and services. Information systems also enable better supply chain management and allow firms to identify environmental impacts and risks in their supply chains.

CELIS can broadly be divided into consumer-oriented labels (B2C) and information systems that facilitate the information flow between businesses (B2B). The design and information content of the information system differs according to the target group. Whereas consumer-oriented labels generally provide aggregated and simplified information to improve the clarity and comparability of products for consumers (e.g. EU Ecolabel, Blauer Engel or Nordic Swan labels), B2B information systems tend to be more detailed and sophisticated (e.g. IMDS database or chemSHERPA).

Many labels, certificates, standards and information systems that, at least partially, provide information on resource efficiency and circular economy aspects, exist already. In particular, the last two decades have seen a multiplication of environmental labelling and information schemes of varying scope, size and nature. Labels and information schemes with specific natural resources and waste focus have grown at a similar rate. However, while there has been a reasonable amount of work on environmental labels and information schemes more generally, most studies have focused on consumer-oriented labels and only few studies have systematically reviewed the entire CELIS landscape.

This paper provides an overview of the current CELIS landscape, assesses the drivers and barriers to a greater uptake of B2B information systems, and identifies circular economy aspects that are underdeveloped in the existing consumer labels landscape.

### ***Business-to-business information systems***

The fragmentation of value chains across the globe has increased the complexity of their management. Improved information sharing across tiers of the value chain can facilitate a better management of environmentally related risks and uncertainties in supply chains.

Different drivers have led to the development of information systems and declarable substances lists in different industry sectors:

- Regulatory interventions, such as information disclosure requirements at the point of sale, have incentivised some industries to develop information systems in order to facilitate the information flow from upstream tiers. For instance, in the automobile sector an International Material Data System (IMDS) was developed in response to the European end-of-life vehicle directive.
- Scrutiny from civil society actors has been a second driver for developing information systems. This has particularly been the case in industries, where much of the brand value is based on reputation and brand recognition, such as the textiles and fashion industry, where B2B information is used to inform consumer labels.

While existing B2B information systems have contributed to some environmental and social benefits, several barriers remain to a larger uptake and harmonisation of these systems:

- Confidential business information and intellectual property rights can pose a barrier to information disclosure. For instance, firms may consider relevant information such as material composition or the presence of hazardous substance necessary to keep confidential to protect their intellectual property. When designing information systems, a balance needs to be found between providing sufficiently detailed information without infringing on intellectual property rights.
- Furthermore, the multiplication and proliferation of different information systems and circular economy metrics increases transaction costs for companies to adopt these systems. While in some sectors a single information system has evolved as the dominant tool (e.g. IMDS in the automobile sector), other sectors have struggled to agree upon a standardised tool (e.g. chemicals in products systems in the electronics industry). Harmonisation and standardisation are therefore key to increase the industry uptake and improve the value and usability of data.

### ***Consumer-oriented information and labels***

Consumer-oriented information and labels can help shift demand towards more resource efficient and circular products and are also relevant for public procurement purposes. Consumer information and labels for the circular economy can comprise multiple lifecycle aspects and can inform consumers about a product's origin, its use-phase performance (e.g. energy efficiency), its lifespan (e.g. durability, reparability and upgradeability), or its end-of-life (e.g. recyclability). To date, most consumer-oriented information is associated with upstream and end-of-life aspects. Finally, labels and certificates for secondary products can also support the uptake of used-goods trading and reuse of products

(i) Labels providing information on a *product's lifespan* are a small but increasingly emerging label segment. These include labels that inform about the expected useful lifespan of a product, which can lead to consumers switching to products with longer lifespans. Different types of information are relevant: reliability (i.e. the expected service lifespan after production until the first failure), reparability (i.e. the extent to what the lifespan can

be extended beyond the first and subsequent events of failure through repair), upgradeability (i.e. the ability of a product to continue being useful by enhancing its effectiveness or performance) and durability (i.e. the useful lifespan of a product until it becomes unrepairable for technical, economic or obsolescence reasons).

Two factors influence the optimal lifespan from an environmental point of view of a product: the trade-off between environmental impacts of different phases of the lifecycle and the rate of efficiency improvements in the use phase. Extending product lifespan is most desirable in product groups with high impacts related to production- and EOL-phases, low impacts during the use-phase and low efficiency improvements. Examples are mobile phones, notebooks, clothes, or furniture. As improvements in efficiency from new products diminish over time and the greening of the energy mix progresses, lifetime extension increasingly becomes the preferable option for most energy related products in most OECD countries.

There is considerable work ongoing on national and multilateral levels to support the incorporation of criteria that incentivise extending product life spans into criteria sets used by ecolabels. A number of initiatives currently develop frameworks, metrics and standards for durability and reparability, which provide the basis for the inclusion of product lifespan criteria in product information and existing labels. So far, however, producers appear to have been reluctant to adopt voluntary product lifespan labels. For instance, the few labels with reparability criteria that currently exist for different electrical and electronic equipment (EEE) show relatively low adoption rates, suggesting that regulatory intervention might be required.

*(ii) Labels and certificates for used goods* can improve the market for and trade in used goods. Often, markets of used goods are less transparent than markets of new products and reservations by consumers about the quality of used goods remain a barrier to used goods trading. Labels and certificates for used goods can be effective in increasing confidence and transparency for consumers, but may be challenging to develop due to confidential business information retained by the original equipment manufacturer (OEM).

Used goods labels, certificates and end-of-waste criteria can also help differentiate legitimate exports of used EEE from illegal exports of waste EEE. These types of labels and information schemes could receive significant support from the industry as they help to reduce business risks related to safety and reputational issues that arise for original equipment manufacturers when their products are traded on used goods markets.

### ***There is a need for policy intervention to strengthen CELIS***

Consumer-oriented information and labels that encourage consumers to opt for longer-lived products or to repair and use them for longer timeframes currently remain niche and their uptake is low. Only few consumer-oriented labels include product lifespan criteria. Governments can facilitate methodological advances to support the integration of product lifespan criteria, such as durability, reparability, in product groups where this is expected to lead to reduced lifecycle impacts of products. The uptake and broader integration of these criteria can also be stimulated through corresponding requirements in public procurement and in extended producer responsibility systems.

Second, more can be done to encourage enterprises and industrial sectors to develop information systems that can help to improve resource efficiency along value chains and to ensure their standardisation and harmonisation. Governments can instigate the development of such information systems through regulatory information disclosure requirements, for instance at the point of sale. Facilitating dialogues between stakeholders

of upstream and downstream value chains can also help to improve the usefulness of information collected.

Some sectors are beginning to see a multiplication of different private (enterprise-level) information systems and consumer labels. Here, governments can support the harmonisation of information systems and the metrics that they use, in order to reduce transaction costs. Ideally this would be done at the international level. Multilateral fora such as the G7 or G20, as well as the International Organization for Standardization (ISO), World Trade Organization (WTO) and OECD, are well placed to provide a platform for these efforts.

## 1. Introduction

In recent years, resource efficiency and the transition to a circular economy (CE) have become important elements of environmental policy and green growth, as illustrated in multilateral initiatives at the G7 (G7, 2015<sup>[1]</sup>) the G20 (G20, 2017<sup>[2]</sup>) or the European Union (European Commission, 2018<sup>[3]</sup>), as well as in national initiatives and circular economy roadmaps in countries like China, Finland, The Netherlands or France (Plan Climat, 2017<sup>[4]</sup>; Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016<sup>[5]</sup>; Thieriot, 2015<sup>[6]</sup>; Ministry of the Environment Finland, 2017<sup>[7]</sup>).

At the same time, for the private sector, enhancing resource efficiency in value chains is an important challenge that is now increasingly being addressed. Raw materials, energy and water account for a substantial part of the production costs in the manufacturing sector and as value chains are becoming increasingly globally dispersed, it is a challenge for firms to identify and implement resource efficiency measures. Resource scarcity and materials criticality may also cause risks in supply chains (Coulomb et al., 2015<sup>[8]</sup>). Further downstream, waste streams, such as plastics, are rapidly increasing in volume and their leakage into the environment causes harm to environmental systems, calling for increased circularity of material flows and material recovery.

One key barrier towards increased resource efficiency in value chains is the lack of information or information asymmetry, which causes market failures and leads to sub-optimal decision making for firms, as well as for consumers (Rizos et al., 2016<sup>[9]</sup>; AMEC, 2013<sup>[10]</sup>). In upstream value chains, firms lose out on cost savings from more resource-efficient procurement from higher tiers of the supply chain. At the consumption stage, consumers make misinformed purchasing decisions, which lead to market inefficiencies and exacerbate environmental externalities. Further downstream, recycling firms are unable to process potentially valuable secondary material, due to missing information on chemical additives and potentially hazardous content in waste streams. Also in the public sector, knowledge-related barriers often inhibit greening public procurement (GPP).

Circular Economy Labels and Information Schemes (CELIS) can be effective ways to promote resource efficiency and other circular economy activities through enabling consumers, businesses and institutions to make more informed purchases. The basic concept behind any environmental label and information scheme (ELIS) is to enable a distinction on the market of companies that manufacture products or deliver services more efficiently and with less environmental impacts. Labels and certificates help companies, which prioritise CE performance to compete on such product characteristics and realise an advantage in the market. Consumers on the other hand are able to easily identify the best environmental performing product through environmental labels, which can act as a market pull towards more environmentally friendly products and services (Cordella and Hidalgo, 2016<sup>[11]</sup>).

Eco-labels have been used for over forty years, and as environmental issues change and new environmental challenges arise, the ELIS landscape has been constantly evolving. In particular the last two decades have seen a multiplication of environmental labelling and information schemes of varying scope, size, nature and effectiveness, including the emergence of new types of schemes (Grùère, 2013<sup>[12]</sup>).

Many labels, certificates, standards and information systems already exist that, at least partially, provide information on circular economy issues, both public schemes (e.g. EU Ecolabel, the Blue Angel/Blauer Engel, Nordic Swan) and private schemes (e.g. Programme for the Endorsement of Forest Certification (PEFC), EPEAT, BIFMA/NSF ANSI level certification, Cradle-to-Cradle). Some of these have been found to lead to significant environmental benefits (AEAT, 2004<sup>[13]</sup>).

### Box 1. Previous ELIS work at the OECD

The OECD has a long history of influencing the development of environmental labels. Following the first report on environmental labelling in 1976, extensive reviews of existing and planned schemes were carried out in the 1980s and into the 1990s, contributing to promoting their use and effectiveness. Later work turned to interactions of environmental labelling and information schemes (ELIS) and international trade. Recent OECD work has focused on the multiplication of schemes, which has produced three reports since 2013.

- A first report (Gruère, 2013<sup>[12]</sup>) documented the scale and nature of the growth and multiplication of ELIS. It provided a new characterisation of the many types of schemes and presented quantified growth trends. The report also mapped the complex and dynamic landscape of ELIS actors, including suppliers and users as well as other institutions and stakeholders involved in development and operation of schemes.
- A second strand of the work (Prag, Lyon and Russillo, 2016<sup>[14]</sup>) investigated the implications of the growth of schemes around the world, notably for environmental effectiveness and international trade and also considered responses to ELIS multiplication by government and non-government actors, as well as the implications of these responses for environment and trade.
- A third report (Klintman, 2016<sup>[15]</sup>) centred on how public policies have guided and regulated ELIS, with a particular focus on self-made environmental claims. This included a comparative analysis of guidelines and regulatory instruments examined definitions, standards, labelling requirements as well as monitoring and enforcement.

Several countries have recognised the importance of information schemes for a successful circular economy transition. France's new circular economy roadmap puts specific focus on consumption habits and consumer information. One of the measures proposed is to conduct a comprehensive assessment of existing environmental labels that are relevant to the circular economy and to develop more refined information applications for the public (Plan Climat, 2017<sup>[4]</sup>). In The Netherlands, the National Circular Economy roadmap calls for the development of quality certificates for end-of-life plastics, in order to improve consumer confidence in plastic recyclates (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016<sup>[5]</sup>). Similar work on information availability and accessibility is undertaken at the level of the European Union (EU) in the framework of the EU Circular Economy Package (European Commission, 2018<sup>[16]</sup>).

While there has been a reasonable amount of work on environmental labels and information schemes more generally<sup>1</sup>, issues that are central to RE and the CE, such as product lifespan labels or labels for used goods have received less attention so far. In addition, most research has focused on consumer-oriented labels and information schemes, and business-to-business information systems, which are important to achieve resource efficiency within value chains, are less explored.

Against this backdrop, this paper intends to provide a more comprehensive review of labels and information schemes in the resource efficiency and circular economy sphere. Following this section 1, which introduces the issue and lays out the relevance of the analysis, section 2 reviews relevant existing work and provides a definition of what can be considered ‘circular economy labels and information schemes’ (CELIS) within the context of this paper. Section 3 describes different typologies that can be used to characterise CELIS. Section 4 maps the existing CELIS landscape. Section 5 discusses in more detail different issues and limitations related to CELIS. This section is divided into two sub-sections investigating business-to-business information systems and consumer-oriented labels and information schemes respectively. Finally, section 6 identifies policy implications based on the findings of the review.

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<sup>1</sup> This includes substantive work on product and organisation environmental footprint indicators by the European Commission.

## 2. Labels and information schemes and the circular economy

### 2.1. Why are environmental labels needed?

As a basic premise, it is safe to assume that not all actors in the economy have a comprehensive understanding of the resource footprint and environmental impacts of products and services. Environmental labels and information schemes (ELIS), can inform actors about different environmental criteria, enabling them to make more informed choices and actions.

Environmental labels and information schemes can have a number of benefits (Sexsmith and Potts, 2009<sup>[17]</sup>).

- They can *inform consumer choices* and empower consumers to distinguish and discriminate products based on their environmental performance.
- From a policy perspective, they can *promote economic efficiency*, as labelling is generally cheaper than regulatory controls and can thus form a suitable substitute or complement.
- They can *stimulate market developments, innovation and economic growth* in green sectors by steering demand towards more environmental friendly products.
- Lastly, environmental labels can *encourage continuous improvements* by providing an incentive structure for firms to invest in measures that reduce their environmental and resource footprint.

In the circular economy and resource productivity sphere, information asymmetries are often the cause of unexploited resource efficiency potentials in supply chains and suboptimal consumption patterns by consumers (Rizos et al., 2016<sup>[9]</sup>; AMEC, 2013<sup>[10]</sup>). This information or competency gap is present along the whole value chain and among all actors of the economy. To give a few examples:

- Manufacturers, are exposed to environmental and social risks in upstream value chains.
- Consumers often make misinformed purchasing decisions, which cause market inefficiencies and may enhance environmental externalities.
- Recyclers are unable to process potentially valuable secondary material, due to missing information on chemical additives and potentially hazardous content in waste streams.
- In the public sector, knowledge-related barriers often inhibit greening public procurement (GPP).

Circular economy labels and information schemes (CELIS) can help to overcome some of these barriers and information gaps, indirectly contributing to improvements in resource efficiency.

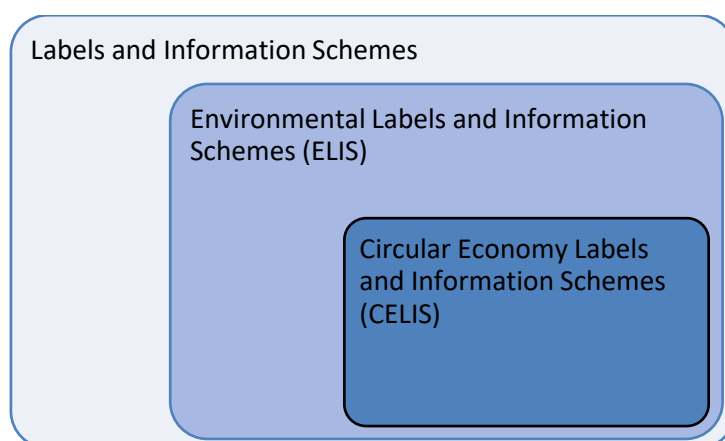
## 2.2. What are circular economy labels and information systems?

In order to provide a boundary framework for what can be considered under Circular Economy Labels and Information Schemes (CELIS), one needs to define the two key terms that CELIS comprises: Environmental Labels and Information Schemes (ELIS) and Circular Economy (CE).

### 2.2.1. Environmental Labels and Information Schemes definition

Previous work at the OECD has defined Environmental Labels and Information Schemes (ELIS) as “any policies and initiatives that aim to provide information to external users about one or more aspects of the environmental performance of a product or service” (Gruère, 2013<sub>[18]</sub>). Users may or may not require the information, but they can have access to it. Circular Economy Labels and Information Schemes (CELIS) can be thought of as a sub-set of the broader ELIS group that provides information to external users about all environmental performances that relate to circular economy issues.

**Figure 2.1. CELIS as a subset of ELIS**



### 2.2.2. Circular Economy definition

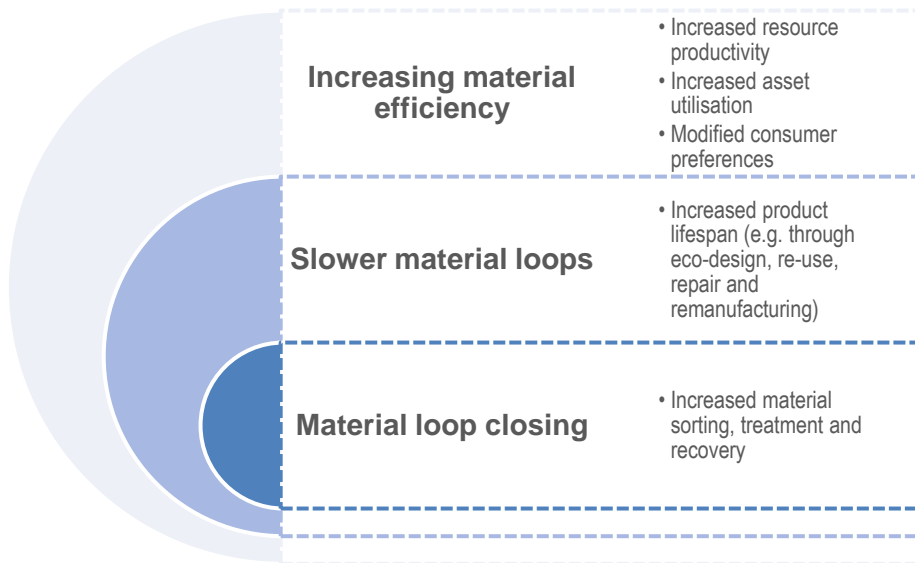
Although there is no universally agreed definition of the circular economy to date, the transition to a circular economy generally entails approaches that lead to lower rates of extraction and use of natural resources, reduced waste generation and increased resource efficiency. Due to the ambiguity of the term it is important to provide a clear scope of what is considered part of the circular economy, before one can review environmental labels and schemes acting in this space.

Ongoing OECD work on this topic has conceptualised the circular economy along three different elements (McCarthy, Dellink and Bibas, 2018<sub>[19]</sub>):

- *Narrowing resource flows* aims at a more efficient use of natural resources, materials, products and components along all phases of the value chain. This part addresses the “structural” waste in current consumption patterns and underutilisation of assets (e.g. office space and private vehicles), through improved asset utilisation.

- *Slowing resource loops* stresses the need for fundamental changes in the economic system towards more durable products and increased lifetime through reuse, repair and remanufacture services.
- *Closing resource loops* aims at minimising raw material extraction and waste output through improved end-of-life sorting, treatment and increased material recovery (see Figure 2.2).

**Figure 2.2. Three different elements of the circular economy**



Source: adapted from (McCarthy, Dellink and Bibas, 2018<sup>[19]</sup>)

Each element can contain different aspects of the circular economy, such as, but not limited to, product life extension, repair and recycling activities or resource efficiency improvements. Labels can be attributed to one or multiple aspects in the circular economy domain (Table 1).

**Table 1. Label attributes and their according circular economy element**

OECD categorisation	Label attribute
Narrowing resource flows	Fuel efficiency
	Resource efficiency
	Toxicity labels
	Organic food production
Slowing down resource loops	Durability
	Reparability
	Reusability
	Ability to remanufacture
Closing resource loops	Recyclability
	Recycled content
	Renewable resource content

### *2.2.3. Circular economy label or information scheme definition*

Following the two characterisations for environmental labels and information schemes and the circular economy, a circular economy label or information scheme (CELIS) in the context of this report and future OECD work on this topic can be considered the group of labels, certifications, standards of information schemes that fully or at least partially address one or more of the circular economy elements which are depicted in Table 1.

### 3. Characterisation of CELIS

The previous section shows that there is a broad scope and diversity among labels and information schemes that can serve the goals of resource productivity and the circular economy. Several typologies have been developed and used to characterise ELIS. These are laid out in this chapter.

#### 3.1. The ISO typology

The most widely used typology relies on the ISO 14020 series by the International Standards Organisation (ISO), which separates environmental labelling schemes into three types, namely ISO Type I, II and III:

- Type I (ISO 14024) is the standard for ecolabels, defined as multi-criteria, whole life-cycle, approach-based, third-party voluntary labelling schemes that distinguish some of the best performing products according to predetermined environmental criteria and apply to diverse product categories. The awarding body may be either a governmental organisation or a private non-commercial entity. Examples include the EC Eco-label, Cradle to Cradle, EPEAT, BIFMA/NSF level, Nordic Swan and German Blue Angel.
- Type II labels (ISO 14021 & 14022) are self-declared claims, privately made, that describe a product based on one or more characteristics following general guiding principles. Examples of such claims include “made from x% recycled material”. The standard also provides guidance as to the proper use of ubiquitous symbols and terms (e.g., “recyclable”, “biodegradable”).
- Type III (ISO/TR 14025) consists of quantified information based on life-cycle assessments. (ISO 14040 and 14044 provide normative reference and requirements and guidelines for the design of such lifecycle assessments.)

Furthermore, ISO 14051 and 14052 provide a framework and guidance for implementation of material flow cost accounting. This standard is however not intended for the purpose of third party certification.

The ISO classification does not capture the full diversity and range of different labels. For instance, single-issue labels that are third-party audited but neither life-cycle nor multi-criteria assessments such as Forest Stewardship Council (FSC) and organic food labels do not fall under any of the three categories in the ISO 14020 series. Uncertified self-made schemes are also part of ELIS, but do not fall under any ISO standardisation. Those often refer to generic environmental characteristics such as “biodegradable”, “circular”, “organic”, which imply a specific environmental performance but lack clear definitions.

#### 3.2. OECD characterisation

To cover all CELIS types along a more comprehensive categorisation one can include additional criteria about the characteristics of the labels. Previous OECD work identified a set of characteristics for ELIS, which includes different modes of communication, and standard attributes (Table 2) (Gruère, 2013<sup>[12]</sup>). These can be equally applied for characterising and mapping the CELIS landscape. Note that previous OECD work on ELIS characterisation and analysis has predominantly focused on B2C ELIS. B2B information schemes have so far only been discussed on the margins. As a consequence, this characterisation matrix is also most suitable for B2C labels, whereas B2B labels may need to be characterised along different or complementary dimensions.

**Table 2: Main characteristics of ELIS**

Type of criteria	Categorical responses	Examples
<b>Modes of Communication</b>		
Communication channel	Business-to-business (B2B), Business-to-consumer (B2C), Business-to-government (B2G), Government-to-consumer (G2C)	B2B: Sustainable Apparel Coalition; B2C: Forest Stewardship Council; G2C: Der Blaue Engel, US EPA Safer Choice.
Means of communication	Seal, report or declarations. That can be further decomposed into ISO types and exceptions: organic, other single-issue label, resource efficiency label.	Seal: Types I ecolabels Declarations: Type III labels
Communication scope: category of good or service targeted	Agriculture and food, textile products, forest products, buildings and furniture, energy, transportation, biofuels, tourism, household appliances, electronics, cosmetics, cleaning products.	Agriculture and Food: Protected Harvest; Textile: Oeko Tex Standard 100; Forest products: Forest Stewardship Council; Appliances: Top Runner Program.
Communication content: Environmental attributes	Natural resource, energy, sources of pollution (chemicals), biodiversity, climate, waste, other, multiple	Natural resource: Water Stewardship; Energy: Energy Star; Biodiversity: Shade Grown Coffee; Climate: Carbon Labels.org; Waste: Biodegradable.
<b>Standard Characteristics</b>		
Standard setter	Self-setting External certifier	Type II ELIS: self-claims; ISEAL Alliance members: external certifiers
Leadership or ownership	Private, public, non-profit, hybrid	Private: Crade2Cradle; Public: Der Blaue Engel; Non-profit: Oeko-Tex Standard 1000; hybrid: Roundtable on Sustainable Soy Association
Mode of governance	Voluntary versus mandatory	Voluntary: UL Environment Mandatory: EnerGuide.
Transparency	Availability of information on the standard setting process (yes or no), publication of awardees (yes or no).	Open: EU Ecolabel Not: Bonsucro
Methods for environmental assessment	Life-cycle approach (LCA) based or not	LCA based: Environmental Choice Canada Non-LCA based: USDA National Organic Program.
Monitoring and auditing	First-party, second-party, third-party	First-party: EPA SmartWay Second-party: Green Seal Third-party: Bio-Suisse
Standard focus	Product standard, prPPM, nprPPM, service	Product Standard: Energy efficiency labels prPPM: Imprim'Vert nprPPM: Timberland Green Index
Standard scope	Regional, national, international	Regional: Pure Catskills National: Korean EcoLabel International: Forest Stewardship Council

*Note:* prPPM= product related process and production methods, nprPPM= non-product related PPMs.

*Source:* Adapted from (Grùère, 2013<sup>[12]</sup>)

### 3.3. Characterisation along the value chain

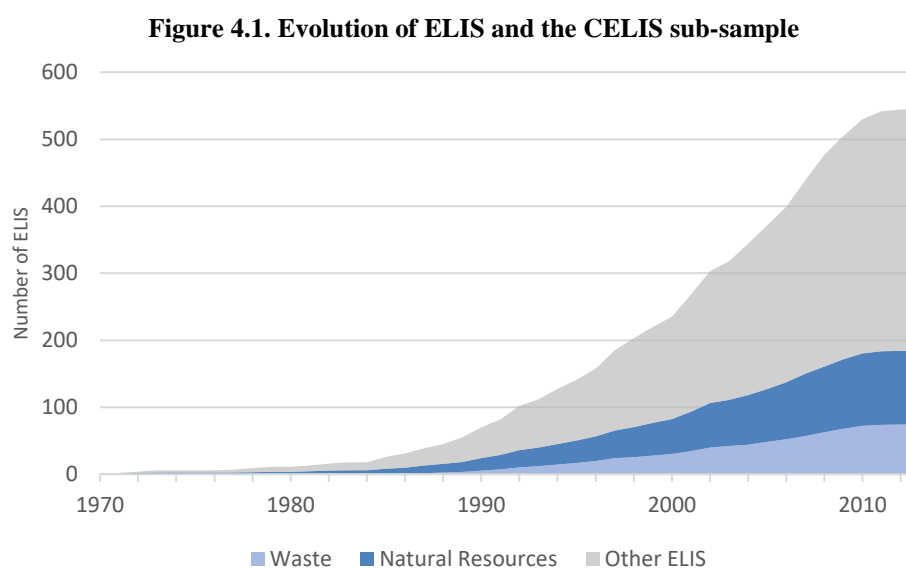
Circular economy labels and information schemes can also be categorised along the different phases of the value chain that are covered in their assessment criteria. For instance, the global organic textile standard or the “fair mined” gold certificate provide information on the origin of materials. The SEB reparability label provides information about the design for reparability. Energy labels inform about the energy efficiency of a product during their consumption phase. Waste separation labels, such as the French Triman or compostability marks provide information about the end of life treatment of products. Other labels cover the entire lifecycle, such as the EU Environmental Footprint label, the Cradle2Cradle (C2C) certificate, or the new German single-use plastic mark which comes into in July 2021 (Table 3).

**Table 3. Selected CELIS covering different phases of the value chain**

Primary materials extraction	Design, production, retail	Use, consumption	End of life (Re-use, Recycling, Disposal)	Entire life-cycle
Forest Stewardship Council (FSC) 100%	SEB "Product 10Y Repairable" label	Energy Star	Compostability mark (e.g. BPI)	Blauer Engel
Fairtrade	EWG verified	EU Energy Label	TerraCycle	Nordic Swan
Global Organic Textile Standard	LEED certification	LEED®-EB: O&M	Global Recycled Standard	EU Ecolabel
UTZ certified	BREEAM certification	BREEAM In-USE	How2Recycle	C2C certified
Organic food labels	TÜV TOXPROOF		SCS Zero waste certification	EPEAT
Marine Stewardship Council (MSC) certification			Triman	BASF Eco-efficiency label
Fairmined Gold certification			ASTM Resin Identification System	TRUE zero waste certification
Alliance for Water Stewardship				Global Green Tag cert.
IRMA certification (Initiative for Responsible Mining Assurance)				Carbon Trust reduction label

## 4. Mapping of the CELIS landscape

A variety of environmental labels and information schemes and among them also a variety of labels which fulfil circular economy requirements are already existing and in use. Based on the ELIS database which was compiled during previous OECD work (Gruère, 2013<sup>[12]</sup>) a rough mapping of the existing CELIS landscape can be conducted, by selecting all ELIS that are considered to have a natural resource or waste attribute.

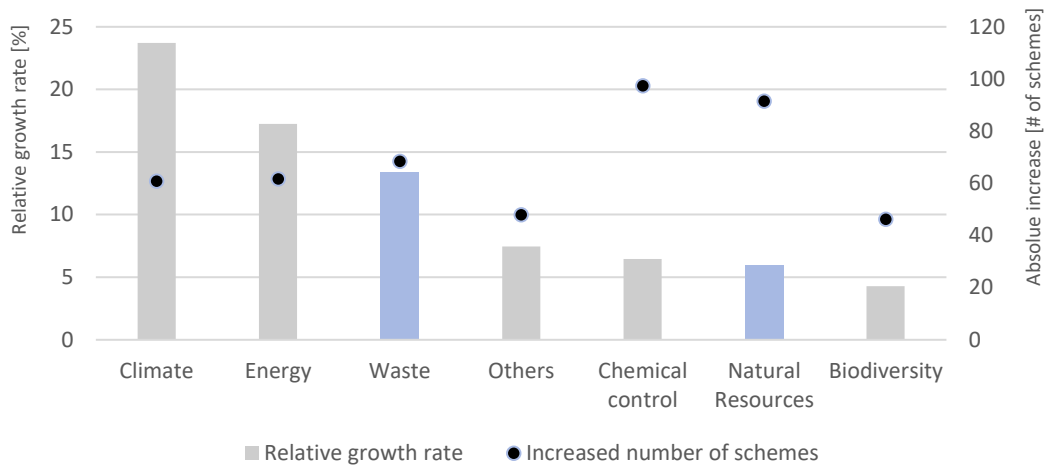


*Note:* All ELIS with specific waste and natural resource attributes were considered CELIS in this assessment of the database.

*Source:* Ecolabel Index database, based on (Gruère, 2013<sup>[12]</sup>)

Figure 4.1 shows a rapid increase of environmental labels and information schemes since 1990 from less than 100 to nearly 550 ELIS. Also the sub-selection of labels with natural resource or waste attributes has increased in that period. Between 1990 and 2012, waste labels have experienced an annual growth rate of 13% and labels with natural resource attributes of 6%. Whilst climate and energy labels have experienced the largest relative increase, the absolute growth rates of natural resources and waste attributes are among the highest (Figure 4.2).

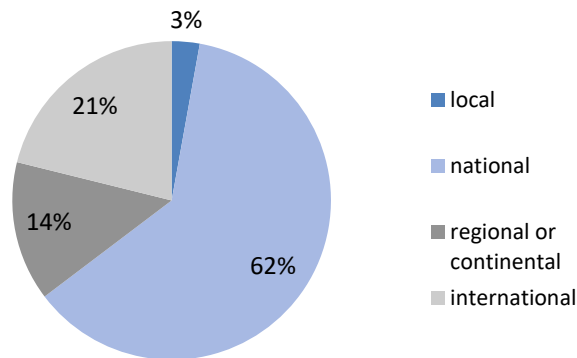
**Figure 4.2. Relative and absolute growth of labels divided by attributes (1990-2012)**



Source: Ecolabel Index database, based on (Gruère, 2013<sup>[12]</sup>)

As Figure 4.3 shows, most ELIS are national initiatives (62%) and act predominantly in one country. Some labels are used beyond the national scope, of which are 21% of international and 14% of regional or continental scope. Some few labels also exist for local issues (3%).

**Figure 4.3. Scope of existing ELIS with natural resource or waste attributes**



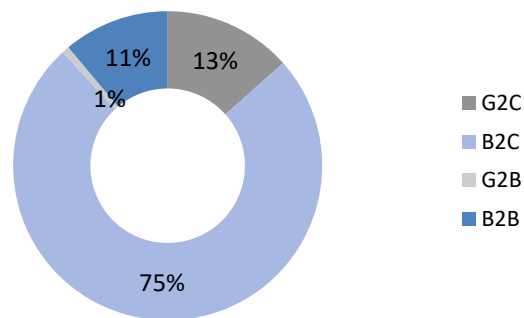
Source: Ecolabel Index database, based on (Gruère, 2013<sup>[12]</sup>)

#### 4.1. Communication channels and modes

CELIS can provide different communication channels and thus can serve different purposes. The large majority of CELIS labels are consumer-oriented labels. Business-to-consumer labels (B2C) form the biggest sub-group (75%), which includes all consumer-oriented labels that are set up by private organisations. An example is the FSC Recycled content label by the Forest Stewardship Council. Government-to-consumer (G2C) labels form the second largest group (13%). G2C labels are consumer-oriented labels that are set

up by public authorities, such as the Japanese Eco Mark or the German ‘Blauer Engel’. B2B labels are used for information transfer between businesses either upstream (e.g. for sustainable sourcing) or downstream (e.g. for different end-of-life purposes and waste management). These make up 11% of the existing CELIS labels. Only less than 1% of existing CELIS labels serve the information transfer between governments to business (Figure 4.4).

**Figure 4.4. Communication channels for existing ELIS with natural resource or waste attributes**



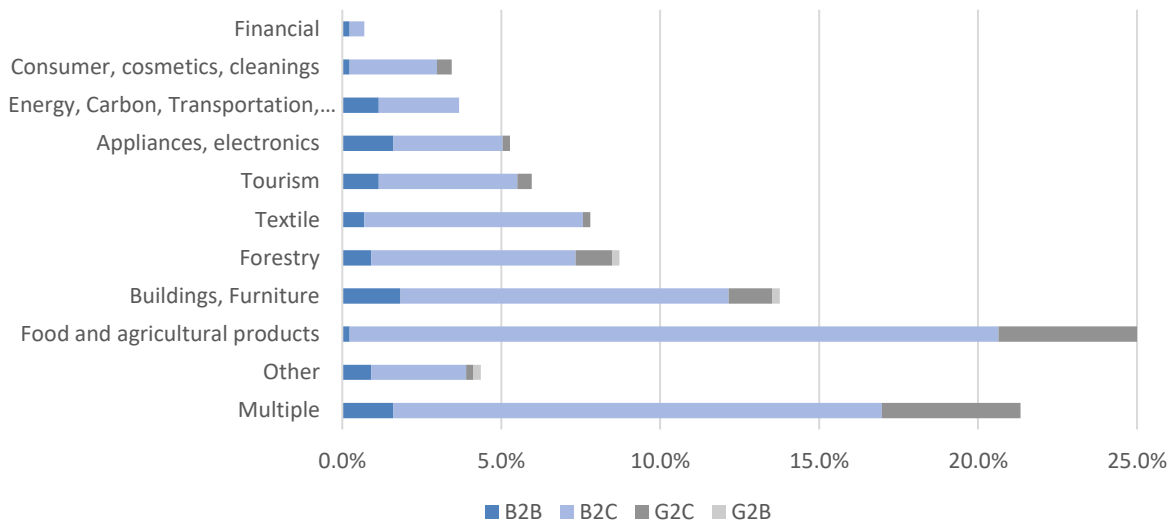
Source: Ecolabel Index database, based on (Gruère, 2013<sup>[12]</sup>)

## 4.2. Sector-specific distribution

Figure 4.5 shows the product-groups and sectors which are currently most targeted by CELIS. One quarter of all CELIS is associated with food and agricultural products and large shares address buildings (14%), forestry (9%) and textile (8%) industries.

Also the composition of communication channels differs per sector. Labels for food and agricultural products, for instance, are almost entirely consumer-oriented, whereas labels for appliances and electronics and building and furniture have a relatively higher share of B2B labels.

**Figure 4.5. Sector-specific distribution of CELIS and composition of communication channels**



Source: Ecolabel Index database, based on (Gruère, 2013<sup>[12]</sup>)

Note: Of the 62 labels that associated with the building sector, 34 contain aspects of energy or energy efficiency. Of the 23 labels that are associated with appliances and electronics, 12 contain aspects of energy or energy efficiency.

While this overview provides a sense of the current use of CELIS, it should be noted that this mapping exercise did not preclude a comprehensive and up-to-date data collection. The database that could be accessed for this review dates back to 2013. Additional labels may well have been developed since. Also, labels that target criteria of particular CE interest such as product life extension and reparability may not be captured in this database, as they may have still been in development at the time. Nevertheless, this mapping provides initial insights in the characteristics of the existing CELIS landscape.

### 4.3. Single-issue vs. lifecycle CELIS

Most labelling and information schemes, which can be considered CELIS are single-issue labels or certificates. Single-issue labels can be defined as the group of labels that focus on one specific part of the value chain (e.g. use-phase: fuel consumption, production phase: organic food labels) or on one environmental impact category (e.g. water footprint or carbon footprint labels) (Gruère, 2013<sup>[12]</sup>).

Whilst single-issue labels are effective in enabling the comparability of products on one specific environmental aspect, their narrow focus risks that other environmental impacts are disregarded in this comparison, which can lead to environmental burden shifting. For instance, electric vehicles may be labelled as a preferable option over gasoline cars with regards to climate impacts, but may lead to increased impacts on other environmental dimensions such as material criticality and eco-toxicity related to upstream mineral depletion or environmental pollution associated with end-of-life treatment of batteries (Hawkins et al., 2012<sup>[20]</sup>).

For furthering a circular economy transition and to narrow, extend and close material loops, a careful consideration of environmental performance across all impact categories and stages of the value chain is required. Hence, a lifecycle approach is desirable if one wants to assess the “circularity” performance of products, services and materials. The ultimate goal should thus be the development of comprehensive, multi-attribute, life cycle-focused sustainability standards and ecolabels, which consider potential negative trade-offs.

#### **Box 1. Life cycle analysis: a brief summary**

Life-cycle assessments (LCA) commonly compile an inventory of relevant energy and material inputs and environmental releases across the entire lifecycle and provide quantifiable data, which enables comparisons across and between products and product groups. LCA is an internationally standardised methodology for establishing the environmental footprint of a particular product (good or service). Within the requirements of ISO 14040 and 14044, an LCA must comprise the following steps:

- Goal and scope definition which defines the goal and intended use of the LCA, and scopes the assessment concerning system boundaries, function and flow, required data quality, technology and assessment parameters,
- Inventory analysis (LCI) which consists in collecting data on inputs (resources and intermediate products) and outputs (emissions, wastes) for all the processes in the product system.
- Impact assessment (LCIA) phase, during which inventory data on inputs and outputs are translated into indicators of potential impacts on the environment, on human health, and on the availability of natural resources.
- Interpretation of results where the results of the LCI and LCIA are interpreted according to the goal of the study and where sensitivity and uncertainty analysis are performed to qualify the results and the conclusions.

A LCA can either be undertaken for a product in isolation, or for one product relative to another. Because their underlying scope and assumptions often differ, it is generally difficult to compare the results from different LCA studies. The increasing global fragmentation of value chains, with products consisting of intermediary parts, produced in various locations by different producers, further complicates lifecycle assessments.

While the multi-impact, holistic nature of LCAs can help to avoid a narrow outlook on environmental concerns, there are several drawbacks and difficulties, which restrain the dissemination of LCA methodology. The flexibility in methodological choices can cause large deviations in LCA results. Also, multiple assumptions need to be made during all phases of the LCA to ensure a coherent analysis (see Table 4) (EC JRC, 2011<sup>[21]</sup>). The methodology thus needs to be meticulously defined to allow comparability between products and product groups.

**Table 4. Challenges associated with each life-cycle phase**

Phase	Problem
Goal and scope of definition	Functional unit definition Boundary selection End-of-Life assumptions Alternative scenario considerations
Life-cycle inventory analysis	Allocation Negligible contribution ('cut-off') criteria Local technical uniqueness
Life-cycle impact assessment	Impact category and methodology selection Spatial variation Local environmental uniqueness Dynamics of the environment Time horizons
Life-cycle interpretation	Weighting and valuation Uncertainty in the decision process
All	Data availability and quality

Source: (EC JRC, 2011<sub>[21]</sub>)

There is a question on where to set boundaries and 'cut-offs' and how fine-grained the analysis should be. For instance, should secondary environmental impacts that arise in second or third tier suppliers be considered? What is the time frame of the analysis? And what is the assumed end-of-life fate of products? Constraining analyses in a coherent manner is essential.

Additionally, there is an issue around the impact equivalence of different types of environmental issues. Environmental impacts in LCAs are commonly converted into equivalence units, but the conversion proves more difficult for some impact categories than for others. Biodiversity, resource depletion and eco-toxicity are frequently mentioned as poorly-covered in impact analyses. Furthermore, it is challenging to differentiate between local and global issues in LCAs (e.g. biodiversity vs. GHG emissions) (EC JRC, 2012<sub>[22]</sub>). Finally, the weighting and valuation of the different impact-categories can lead to different interpretation of results.

The European Commission (EC) has dedicated substantial efforts to design a standardised method, in order to increase the comparability of LCA results, as part of their 'Single Market for Green Products Initiative' (Sala et al., 2017<sub>[23]</sub>). Since 2013, a lifecycle based methodological framework for assessment of Environmental Footprint of Products (PEF) and Organisations (OEF) has been developed, which considers multiple environmental impact categories. The PEF and OEF aims at a coherent LCA harmonisation at European level in order to reduce the flexibility provided by the current standardisation requirements (e.g. ISO 14044 for LCA).

The PEF also includes a 'circular footprint formula' (CFF), which considers instructions for the assessment of environmental impacts at the end of life of a product, taking into account different EOL management options. This includes detailed instructions for burdens and benefits related to secondary material inputs/outputs, energy recovery and disposal. Furthermore, it includes a factor that allocates benefits and burdens between multiple lifecycles when a material is recycled (parameter A). The advantage of this formula towards the previous EOL-formula for PEF is that it no longer arbitrarily favours incineration over reuse and recycling (Bach et al., 2018<sub>[24]</sub>).

A five-year environmental footprint pilot phase took place between 2013 and 2018 to test the elaborated methodology across different product groups. This resulted in the development of validated product environmental footprint category rules (PEFCRs) for 21 product categories and organisation environmental footprint sector rules (OEFSRs) for two sectors.

The European Commission now continues a transition phase, during which the implementation of the existing PEFCRs is further monitored and possible policies for implementing and the mainstreaming the PEF and OEF to other product groups and organisational sectors are investigated (European Commission, 2018<sub>[25]</sub>).

There is evidence that some firms are already using the established PEFCRs methodology and the Lifecycle Inventory datasets (LCI) to assess environmental footprints for their products. The European initiative thus seems successful so far. The majority of participating stakeholders demands to move from the pilot phase to the implementation phase.

The European ‘Single Market for Green Products Initiative’ gives a sense of the complexity of designing a standardised assessment method, which includes all impacts categories at all stages of the lifecycle. The project involved multiple institutions, including the European Commission and the Joint Research Centre (JRC) and rigorous stakeholder discussions.<sup>2</sup> Challenges lie in particular in the detailed conceptualisation and methodology of this attempt and to produce robust category rules that are comparable, reproducible and consistent. There is a trade-off between assuring standardisation and comparability of results and risking an over-simplification of the assessment, which omits potentially relevant environmental issues (European Commission, 2017<sub>[26]</sub>). High ambiguity ranges in the different LCA methods may lead to distrust in LCA as an indicator. In some cases single-issue labels may then serve as a more effective second-best option, given the methodological challenges and costs involved in life-cycle assessments. So far, however, stakeholders seem to be positive about the developed PEFCRs and OEFSRs.

To sum-up, the diversity and types of CE labels and information systems is broad and their number is increasing. In particular, the last two decades have seen a multiplication of environmental labelling and information schemes of varying scope, size and nature. Existing data suggests that most CELIS are consumer-oriented, focus on food products and are implemented at the national level. Also, most are single-issue labels. But, there is experimentation with LCA-based labels, especially in the European Union, where the ‘Single Market for Green Products Initiative’ is gradually leading to industry take up of lifecycle labelling for specific product groups. In the long-run countries should work towards developing comprehensive, multi-attribute, life cycle-focused sustainability standards and ecolabels that purchasers can use to identify products that are most sustainable in all aspects.

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<sup>2</sup> For more information on life-cycle assessment related to the ‘Single Market for Green Products’ initiative, see the results and deliverables of the product environmental footprint pilot phase (European Commission, 2018<sub>[139]</sub>).

## 5. Key issues of environmental labels in the circular economy transition

Circular economy labels and information schemes can play an important role in fostering resource efficiency and influencing the transition to a circular economy. Several issues are apparent with regards to environmental information systems and the circular economy transition. Whereas some of these issues have already been widely discussed, others have been relatively less explored.

CELIS can be roughly divided into consumer-oriented labels (i.e. business-to-consumer (B2C) and government-to-consumer (G2C)) and information schemes that facilitate the information flow between businesses (B2B). Whereas consumer-oriented labels generally provide aggregated and simplified information to improve the clarity and comparability of products for consumers, B2B information systems tend to be more detailed and sophisticated (Box 2).

### Box 2. B2B vs. B2C CELIS

A distinction can be made between characteristics of consumer-oriented labels and information schemes that act at the interface between businesses. In some cases, one scheme can also serve multiple communication channels (e.g. business-to-consumer labels can also be used by business or governments for procurement purposes), yet the design and information content of the information system differs and is often dependent on the target group.

Consumer-oriented labels commonly aggregate information in a single seal or communicate through a simplified ‘traffic light’ system, to enable the consumer to quickly read and process information. Consumers tend to look primarily for – and respond to – clarity, credibility and comparability in labels (UL Environment, 2015<sup>[27]</sup>). Thus, communication vehicles for consumer-oriented product environmental footprints should be simple, transparent and easily accessible (European Commission, 2017<sup>[28]</sup>).

In transactions between businesses, on the other hand, more quantitative and detailed information may be required. B2B information systems thus tend to comprise more sophisticated and rigorous information, comprising a larger and more detailed set of criteria.

The remainder of this section is structured into two sub-sections and aims to fill the identified knowledge gaps in the CELIS landscape. The first part investigates business-to-business information schemes that are being used in different industrial sectors and reviews the drivers that have contributed to their development and the barriers to their broader uptake. The second part of the chapter investigates consumer-oriented labels, focusing specifically on product lifespan labels and labels for used goods and secondary materials.

### 5.1. Business-to-business information systems and labels for resource efficiency and the circular economy

#### 5.1.1. Introduction

Globalisation has led to a fragmentation of value chains across the globe. This has increased the complexity of value chain management, making it more difficult for firms to identify and realise resource efficiency improvements as well as managing uncertainties and risks in their supply chains that are connected to upstream suppliers (OECD, 2013<sup>[29]</sup>).

Whilst the increased outsourcing of production processes has increased productivity, it also gave rise to potential market failures around information asymmetries in global value chains. Insufficient information availability about activities of lower tiers can lead to suboptimal decision making of upstream actors and vice-versa. For instance, the source and composition of procured products is important information for producers to be aware of, in order to assess total material, environmental and social footprint of their products and to manage risks associated to upstream production. Similarly, information on hazardous substances used in upstream production is crucial in order to adapt quickly to emerging regulatory changes that address these substances. In most supply chains, this information is currently not, or insufficiently, available, and where it is available, it is often not effectively passed on from one step in the value chain to the next.

Business-to-business (B2B) information systems can be useful tools to provide more transparency in value chains, to support due diligence efforts and to disclose environmental performance and resource footprints. Improved information sharing across tiers can help identify ‘environmental hotspots’ in value chains and lead to resource efficiency improvements and risk reductions. A variety of B2B information systems and metrics that address aspects of resource efficiency and the circular economy have already been developed in different sectors (See Box 3 on ongoing initiatives on circular economy metrics). Some metrics have been created voluntarily through private sector initiatives, others as a response to regulatory measures that impose requirements for information disclosure.

### **Box 3. Metrics and the circular economy**

Whereas information systems tend to provide data on a product level, harmonised circular economy metrics can provide useful information to track and compare progress on a firm level. Firms can use circular economy metrics to (1) drive business performance or strategy, (2) justify achievements externally, (3) integrate circularity across the business, (4) manage risks associated with the existing linear business model, or to (5) track the impact of their circular activities.

To date, there is not a common framework for measuring circularity. According to a stocktake analysis by the World Business Council for Sustainable Development (WBCSD), 74% of the firms use their own metrics framework to track their CE performance, with a high heterogeneity across scope and criteria (WBCSD, 2018<sup>[30]</sup>). Harmonising existing CE metrics would increase comparability and reduce transaction costs for firms (especially SMEs that may not have the financial means to report and comply with a wide range of different metrics).

Several initiatives are ongoing or have started to establish harmonised and comparable CE metrics (PACE and Circle Economy, 2020<sup>[31]</sup>). Notable circularity metrics for businesses include the Circular Transitions Indicator framework, developed by WBCSD together with a consortium of 26 member companies (WBCSD, 2020<sup>[32]</sup>), the Circularity Indicators Project (“Circulytics”) by the Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2019<sup>[33]</sup>), Circle Assessment by Circle Economy (Circle Economy, 2020<sup>[34]</sup>), the CIRCelligence metric tool by Boston Consulting Group (BCG, 2020<sup>[35]</sup>), as well as the GRI360 Waste Standard by the Global Reporting Initiative (GRI).

Especially in vertically integrated companies it is likely that there are a variety of information systems in use, which are not disclosed to the public. For these companies, it is their inherent motivation to have information systems that help identify and achieve cost optimisations within their supply chains. It is challenging to collect detailed information on such systems, but it can be assumed that a significant number of firms is using information tools for value chain management. Policy action is more needed, where market failures

provide barriers to the development of information systems and where this leads to information asymmetries.

The following section provides an overview of B2B CE-relevant information schemes that are in use in different industries. Four sectors are discussed in more detail: textiles, automotive industry, electrical and electronic equipment (EEE) and the construction sector. Whilst this overview does not intend to provide an exhaustive list of information systems in the respective sectors, it aims to generate insights into the main systems that are of relevance to resource efficiency and material circularity, the drivers that have led to their implementation and the potential barriers to their further uptake.

### 5.1.2. Sector case studies

#### *Textiles: Information systems for chemicals management*

Environmental and climate impacts of the textiles system occur in every phase of the value chain, including the use of resources, land and chemicals, as well as the emission of greenhouse gases. The European Environment Agency (EEA) estimates that in the EU, supply chain pressures of clothing, footwear and household textiles are the fourth highest pressure category for the use of primary raw materials and water, second highest for land use and the fifth highest for greenhouse gas emissions (European Environment Agency, 2019<sub>[36]</sub>). Globally, the apparel and footwear industries are estimated to account for 8% of the world's greenhouse gas emissions (Quantis, 2018<sub>[37]</sub>).

Textile production processes commonly involve of a large amount and variety of chemicals. About 3500 substances are used in textile production, of which 750 have been classified as hazardous for human health and 440 as hazardous for the environment (KEMI, 2014<sub>[38]</sub>). It is estimated that about 20% of global industrial water pollution comes from textile dyeing and finishing treatment, affecting the environment and the health of workers and local communities (Kant, 2012<sub>[39]</sub>). During the use phase, washing textiles releases chemicals and microfibers into household waste water and at the end of life, the multitude of chemicals and materials used can pose challenges to material recovery (Ellen MacArthur Foundation, 2019<sub>[40]</sub>).

Supply chains in the textile industry are complex, globally dispersed and constantly evolving, which makes it difficult to ensure transparency and traceability. Keeping track of all chemicals that have been used along the way and identifying 'environmental hotspots' and other supply chain risks is a challenge. As upstream processing steps tend to generate the largest environmental impacts (e.g. through the use of resources, water, energy and chemicals), information systems are needed for fashion brands downstream to identify and tackle 'environmental hotspots'. European regulations, such as the REACH legislation, have put the responsibility on the industry in Europe to manage and evaluate risks of chemicals in their supply chain. Accessing information on chemicals in products is key for compliance.

Due to the supply chain complexity, the fashion industry is vulnerable to environmental and social risks. There are several cases where practices in upstream textiles value chains affected major brands negatively. Tragic examples are the Nike child labour scandal in the 1990s, or the 2013 collapse of the eight-story garment factory in Bangladesh (known as the Rana Plaza incident), from which several large fashion brands sourced their products (Khurana and Ricchetti, 2016<sub>[41]</sub>). Other cases relate to unsustainable practices and use of toxic chemicals or raw materials. In response to these incidents, companies have started to develop tools, strategies and initiatives to minimise social and environmental risks and to provide transparency to consumers.

While the development of chemical information systems has often been motivated by health related aspects, they can also help reducing the environmental footprint in the textile industry, as much of the environmental impacts of textiles are linked to the use of chemicals and environmental harmful substances in upstream production. To define a harmonised approach to managing chemicals the industry has developed a manufacturing restricted substances list (MRSL). The MRSL provides a list of priority chemicals and specifies a maximum concentration for each substance (Zero Discharge of Hazardous Chemicals Programme, 2015<sup>[42]</sup>). The MRSL serves as an industry-wide reference in multiple initiatives. It also serves as reference in the hazardous chemicals section of the OECD Due Diligence Guidance for the garment sector, which encourages to stop using banned chemicals on the MRSL, to communicate the MRSL to all suppliers operating at higher-risk stages of the supply chain and to identify substitutes for MRSL-listed chemicals, based on scientifically-based hazard assessments (OECD, 2018<sup>[43]</sup>).

Oeko-Tex Standard 100 is a health label testing on contents of harmful chemicals, which applies to textile products at all processing levels. The Sustainable Textile Production (STeP) by Oeko-Tex complements the content-orientated information system with a more process-oriented standard for certifying sustainable manufacturing processes. The Oeko-Tex 'Detox to Zero' certificate provides independent verification of chemicals management systems and quality of waste water. Oeko-Tex Standards are widely used by brands, retail companies and manufacturers to monitor and communicate environmental sustainability achievements across their supply chain. With over 160,000 issued certificates and 10,000 participating companies, the Oeko-Tex Standard 100 is widely used (Oeko-Tex, 2019<sup>[44]</sup>).

Besides chemicals use disclosure, B2B CELIS in the textiles industry can also have a resource-specific focus and assess environmental and social criteria along the production chain. One example is the Global Organic Textile Standard (GOTS), which certifies textiles with a minimum of 70% organic fibres (GOTS, 2018<sup>[45]</sup>). The Better Cotton Initiative (BCI) Standard System also provides a standard for the quality of cotton supply chains (BCI, 2018<sup>[46]</sup>).

The Higg Index is a suite of assessment tools, which has been developed by the Sustainable Apparel Coalition and allows brands, retailers, and manufacturers in the apparel and footwear industry to measure environmental, social and labour impacts across the lifecycle. Three modules exist in the Higg Index focusing on products, facilities and brand and retail. The Higg Materials Sustainability Index, which is embedded in the product module is of particular relevance in the circular economy context. It is used as a B2B tool and includes environmental metrics on hazardous chemicals, water use, energy and deforestation (Sustainable Apparel Coalition, 2019<sup>[47]</sup>).

With increasing public concerns about plastic microfiber shedding of textiles, there has also been first developments in providing information on this issue related to different textiles. California proposed a federal bill to require new clothing that is composed of more than 50% synthetic material to bear a consumer label at the point of sale with specified information if the garment sheds plastic microfibers when washed. Although the bill was not passed, similar information requirements may appear in the near future, which could lead to the development of information systems in the textiles industry.

Various brands also developed their own tools to identify environmental hotspots in their upstream value chains. Nike invested USD 6 million to develop tools for material assessment and environmental design to examine the lifecycle impacts of the materials and support designers to make the most sustainable choices when designing new products (Nike, 2010<sup>[48]</sup>; Derrig et al., 2010<sup>[49]</sup>). The Luxury group Kering developed an information

tool (“Environmental Profit & Loss”), which helps measuring and quantifying the environmental impact of its activities in order to identify environmental hotspots and reduce environmental impacts across their supply chain (Kering, 2018<sub>[50]</sub>).

Overall, the driver for information systems in the textiles sector has been motivated by a combination of different factors coming from public demands and regulatory changes. Environmental as well as social scandals have led to public mistrust and the demand for more transparency in upstream supply chains and chemical regulations of importing countries (e.g. EU REACH legislation) put increasing responsibility on textile companies to manage their and ensure that higher tier suppliers are complying with the regulations and information disclosure.

However, many of the current textile labels do not extend beyond the product use phase to the end of life and mainly consider resource efficiency earlier in the value chain. Currently, there are limited recovery options at the end of life for textile products. Given the significant impact of the clothing industry in resource use and waste generation, this gap may need to be addressed. Furthermore there is little information provided about the amounts of plastic microfiber shedding of different materials. Future labels and information systems in the textiles sector focus at facilitating materials recovery and providing consumer information on plastic microfiber shedding of synthetic textiles.

#### Automobile industry: Information systems for end-of life vehicles

End-of-life vehicles (ELVs) constitute a substantial share of waste generation in OECD countries. In the European Union alone, ELVs generate between 6-7 million tonnes of waste per year (Eurostat, 2019<sub>[51]</sub>). Much of the material in ELVs is already recycled (80-90%), but a sizeable share is still being landfilled as automotive shredder residue (ASR). One reason for this is the information gap between manufacturers, consumers and end-of-life actors, which leaves recyclers with insufficient information to safely extract and recycle materials (Miller et al., 2014<sub>[52]</sub>). There has been increasing policy action to address the issue and to improve conditions for ELV material recovery and recycling, such as the EU end-of-life vehicle directive<sup>3</sup>, which sets guidelines on hazardous substances for new manufactured cars or similar ELV recycling regulations and producer responsibility schemes in Japan, Korea or China (Sakai et al., 2014<sub>[53]</sub>).

Several information systems have been developed by the car manufacturers to comply with mandatory information requirements, through e.g. the European ELV Directive and other regulations and to track materials use and avoid the usage of critical substances in their products. The multiplication of different types of regulations and laws on declarable substances in various jurisdictions has led to the development of the Global Automotive Declarable Substance List (GADSL), a globally harmonised list with clear criteria and a transparent process. The GADSL has been developed jointly by vehicle manufacturers, automotive components suppliers and the chemical industries and covers all substances that are either already regulated or in the regulatory pipeline in any region of the world. It provides a definitive list of substances prohibited or requiring declaration with the target to minimise individual requirements and ensure cost-effective management of declaration practice along the complex supply chain. GADSL is used as a reference spreadsheet in the

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<sup>3</sup> The objective of the ELV-Directive is the prevention of waste from vehicles and the reuse, recycle, & recovery of end-of life vehicles and components, improving environmental performance for all economic operators involved. Automobile producers are required to provide information to treatment facilities, concerning dismantling, and re-use (European Commission, 2000<sub>[57]</sub>).

IMDS Basic Substance List and in company-specific databases for material declaration of automobile parts (GASG, 2018<sup>[54]</sup>).

The IMDS (International Material Data Systems) is an example of an information system that was developed in response to information disclosure requirements. The information system was originally a joint development of Audi, BMW, Daimler, EDS, Ford, Opel, Porsche, Volkswagen and Volvo, but has since become a global standard for the industry. Various regulations around the world require automotive manufacturers to report on the material content of their vehicle. IMDS serves as a common system to simplify compliance with the different requirements when trading parts and components globally (IMDS, 2018<sup>[55]</sup>). To date, IMDS contains around 40 name-brand manufacturers, representing more than 90 different brands of vehicles and more than 120,000 automotive suppliers of materials and components (Oeko Institut e.V., 2018<sup>[56]</sup>).

IMDS serves as a tool to collect information about substances and materials of products from upstream sub-contractors. The database contains a list of every part, in every car, for all participating international automobile manufacturers. Each listing record includes weight, size and material composition of every component. Tier 1 suppliers collect and bundle the information from sub-tier suppliers and submit the total material content to the original equipment manufacturer (OEM). This provides automobile manufacturers and parts suppliers with a standardised documentation process, which allows automobile manufacturers to comply with national and international standards and mandatory information requirements. The system aims not only to achieve legal compliance, but is also an integral part of the industries quality processes in upstream production. In conjunction with GADSL, the IMDS has become the state of the art information system in material declarations along the supply chain in the automotive sector (European Commission, 2000<sup>[57]</sup>; GASG, 2018<sup>[54]</sup>).

IMDS includes provisions for maintaining the confidentiality of proprietary information while still making the required declarations regarding material substance content. However, this is a delicate balance, also considering that information useful for other actors in the value chain to be submitted in IMDS might go beyond regulatory requirements and is therefore difficult to be collected by OEMs or Tier 1 suppliers. Whilst IMDS is used as information system for material declaration for individual parts in upstream value chains and contains minute information about material contents of all parts, the database does not provide public access to information of the parts and materials used in final vehicles. Only the OEM is able to retrieve this information, as sharing is sensitive with regards to intellectual property rights (Oeko Institut e.V., 2018<sup>[56]</sup>). Where confidential information cannot be shared by the OEM, third party inspection may be required.

The centralisation of the information stored B2B information systems by third party trustees may also represent a potential barrier to global uptake. For instance, in China, the automotive industry chose to develop an alternative to IMDS due to these issues, the China Automotive Material Data System (CAMDS). It has nearly the same functionalities, but it is conceived differently in part and calls for a slightly different procedure and conversion tools are required to transform information from the IMDS to the CAMDS system, causing friction in the information flow. Trust in third parties is therefore key, when information is stored centralised in information systems of third party operators.

Besides IMDS, CAMDS and GADSL, which are mostly used for information transmission in upstream value chains, the International Dismantling Information System (IDIS) has been developed specifically for the purpose of dismantling of ELVs. IDIS provides pre-treatment and dismantling information of potentially recyclable parts for almost all the

world's vehicles.<sup>4</sup> Coding standards facilitate identification of components suitable for reuse and recovery. Similar to IMDS, the initial IDIS system was developed in the 1990s to fulfil regulatory requirements concerning ELVs. To date, IDIS contains dismantling information on 75 brands of cars and is available in 31 languages and 40 countries in Europe and Asia (among others India, China, Japan, Russia, South Korea) (IDIS, 2019<sub>[58]</sub>).

Overall, several information systems appear to be in use in the automobile industry, which collect detailed information about materials and chemicals in car components. The driver for developing these has been largely a response to compliance with emerging information disclosure requirements for ELVs in different jurisdictions. IMDS and the IDIS have crystallised into the dominant, state-of-the-art information systems that are currently used in the industry. IDIS is specifically designed to provide dismantling information to ELV dismantlers and recyclers.

#### *Electrical and electronic equipment: information systems for improved recycling*

Many countries pose restrictions on hazardous substances in electrical and electronic equipment (EEE). In the European Union, the RoHS (EU Directive on the restriction of hazardous substances), the WEEE directives (Waste Electrical and Electronic Equipment Directive) and the REACH regulation have had a strong impact on the way electronic products are designed, how they are collected and treated at end-of-life, and how information on hazardous substances is generated and shared. The RoHS directive requires EU member states to ensure that electrical and electronic equipment (EEE) placed on the market does not contain a defined set of hazardous substances. Products that comply with RoHS display the CE mark, which indicates the conformity with health and safety standards. Other regions have followed and similar regulations to RoHS can be found in countries such as Argentina, Brazil, California, China, Vietnam, South Korea and India.

Japan takes a different approach to the direct ban found in many countries. Instead, the Japanese Recycling Law JIS C 0950 (commonly referred to as J-MOSS), obliges manufacturers and importers to “mark the presence” of a defined set of chemical substances for EEE. J-MOSS is thus a regulation that aims to facilitate the information flow between manufacturers, consumers and recyclers. The standard sets control criteria for six RoHS-specified hazardous substances for seven types of electrical and electronic equipment: personal computers, unit-type air conditioners, television sets, refrigerators, washing machines, clothes dryers, and microwaves. When the content of a specified substance in a product reaches beyond the set criteria, a “content mark” is required on the product packaging and website disclosing information on the substance and contamination level (Jeita, 2008<sub>[59]</sub>).

To comply with RoHS and other hazardous substance restrictions around the world, firms need to demonstrate that effective production controls are in place. The manufacturer is responsible for ensuring the compliance of the whole product, including any components or intermediary products that may be used in its assembly. The manufacturer must thus retain control over the relevant information by sub-contractors to be able to ensure compliance.

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<sup>4</sup> The data that a vehicle manufacture provides is not controlled or reviewed by third parties, which may limit the reliability of the information. This is also the case for IMDS.

In contrast to the automotive sector, these regulatory pressures have not yet led to the development of a dominant information system, which is widely used across the industry. Different ‘Chemical in Products’ (CiP) information systems are in use by companies to comply with the regulation. Many companies currently report in their own format, which causes considerable burden to mid-stream operators. There are however initiatives to develop industry-wide information systems to facilitate the exchange of information.

Similarly to GADSL for the automobile industry, the Standard IEC 62474 by the International Electrotechnical Commission (IEC) provides a comprehensive list of declarable substances for electronic and electrical products included in different regulatory systems worldwide. The standard facilitates reporting and compliance, as well as the transferring and processing by defining a common data format. It provides a validated open database, which includes a list of substances, substance groups and common material classes. In some information systems the list of IEC 62474 is used as a template for information transfer requirements (IEC, 2019<sub>[60]</sub>). Besides IEC 62575, IPC 1752 is another materials declaration management standard that remains to be used in the IT product sector (IPC, 2021<sub>[61]</sub>).

ChemSHERPA is an example of a CiP information systems that aims to harmonise information flows by providing a standardised information system. It was developed in 2015 by the Japan Ministry of Economy, Trade and Industry (METI). The METI realised that 64% of companies used their own data format for chemical management, which resulted in high data handling costs for firms. ChemSHERPA was developed with the intent to become the prominent information system for chemicals management for EEE. It is designed to be flexible and compatible with different declarable substance lists. List templates for GADSL, Reach Annex XVII, Chemical Substances Control Law and IEC 62474, depending on which laws and regulations are of concern in the final market (European Commission, 2016<sub>[62]</sub>). As of October 2017, 102 companies have agreed to the dissemination of chemSHERPA (METI, 2017<sub>[63]</sub>). The Japanese Ministry continues its efforts to disseminate the information system in EEE supply chains.

Besides hazardous chemicals, conflict minerals and materials criticality are other potential hidden risks in value chains for EEE. The origin of conflict minerals or critical raw materials, such as for instance cobalt may be of interest for producers, as well as retailers and consumers. The new EU “Conflict Mineral Regulation” requires respective EU importers to comply with, and report on, supply chain due diligence obligations as of January 2021 if the minerals originate from conflict-affected and high-risk areas. This Regulation is inspired by the US Dodd-Frank Act, which imposes similar reporting obligations and due diligence measures for US companies (European Union, 2017<sub>[64]</sub>). This requirement may trigger new developments of information systems in the field, with some examples emerging. The most prominent example is the Global Tin project, a collaboration between Minespider, Google, Volkswagen, Cisco, SGS, and Minsur, and partially funded by the European Commission (European Commission, 2019<sub>[65]</sub>). Another example is the Cobalt Blockchain project, a partnership by IBM and the responsible source group (RCS Group, including Ford, Huayou Cobalt and LG Chem). The group pilots a blockchain based information system to monitor the supply chain of cobalt in the Democratic Republic of Congo, providing a tool for responsible cobalt sourcing (Lewis, 2019<sub>[66]</sub>).

As for other product groups, there seems to be a lack of communication between end-of-life actors and upstream producers. Recyclers express that recycling and EOL considerations are not sufficiently incorporated in product design and material composition, whereas manufacturers have the perception that they receive little guidance

from recyclers on how products could be better designed for recycling (Norden, 2011<sup>[67]</sup>). Further communication is needed between the two actors and the design of CELIS for the purpose of material recovery should be done in a multi-stakeholder setting in order to assess the feasibility of information that can be provided as well as their relevance for improving recycling.

To sum-up, in contrast to other sectors, CiP systems for EEE product groups have not yet resulted in the development of a standard system. Generally, chemical information systems for EEE can improve conditions for material recovery, as information on presence of substances of concern is often not readily available to those who handle waste and prepare it for recovery. Many companies currently report in their own format, which causes considerable burden to mid-stream operators and often, this information does not reach actors at the end-of-life. There are initiatives to develop industry-wide information systems to facilitate the exchange of information. Examples are the IEC 62474 information list, which lists all declarable substances for electronic and electrical products worldwide and chemSHERPA, an initiative by the Japan Ministry of Economy, Trade and Industry (METRI) to establish an internationally dominant information systems for chemicals reporting. Also EPEAT category criteria incentivise material disclosure and the provision of information to improve recyclability (EPEAT, 2021<sup>[68]</sup>).

#### *Construction: Material passports for buildings*

Globally, infrastructure and construction have the highest resource footprint of all sectors and will be a key driver of materials use in the future. Non-metallic minerals, which are mainly used for construction are projected to grow rapidly from 35 Gt in 2011 to 82 Gt in 2060 (OECD, 2019<sup>[69]</sup>). Increasing circularity and resource efficiency in the construction sector is thus relevant in any effort to reduce global resource footprints. An important aspect of circularity in the construction is thereby the reuse of building products and materials.

One of the main challenges in reusing building materials is the availability and robustness of data and the absence of warranties and manufacturing data hampers future reuse (Hobbs and Adams, 2017<sup>[70]</sup>). Improved data management at the design stage and throughout an asset's life cycle could enable a more effective reuse of building components and materials.

The EU H2020 funded project "Buildings as Material Banks" (BAMB) addresses this gap by piloting a material passport platform for buildings. Material banks contain digitalised datasets that describe the characteristics of individual materials and components in buildings. Material passports then provide detailed information of the material composition of individual building components or of entire buildings. The BAMB project brings together 16 European parties from industry, academia and policy to develop a first prototype of a material passport platform, which is currently in its pilot phase. So far, a total of 428 material passports have been generated for 407 components and products and seven material passports have been created by building owners (EPEA Nederland, 2019<sup>[71]</sup>).

Among the lessons learned from the project so far is that there appears to be a need for standardisation and harmonisation in order for materials passports to become useful information systems. The proliferation and diversification of material databanks with different requirements may in the long-term cause higher transaction costs for stakeholders and decreases trust and accuracy. Standardisation can save costs and workload for manufacturers and may lead to a greater uptake of material databanks and material passports.

Several initiatives are ongoing to facilitate this, such as the ‘Luxemburg CE Dataset Initiative’ by the Ministry of the Economy of Luxembourg and the DOEN Foundation’s Healthy Printing initiative, which aims to develop a standardised approach to materials passport datasets. Other examples include the Scandinavian Coclass and eBVD projects, which aim at standardisation of data for buildings, the Dutch CB23 project, which aims to standardise material passports in The Netherlands and ISO/CEN’s work on a Product Data Template methodology to standardise data for products in the construction industry (EPEA Nederland, 2019<sup>[71]</sup>).

In addition to reuse of building products and materials at the end of life, another important aspect of resource efficiency in the construction sector is the responsible upstream sourcing of primary or secondary raw materials. Information systems and certification schemes can help the sustainable sourcing of materials, such as the Framework Standard for Responsible Sourcing (BES 6001), developed by BRE Global, which provides a Responsible Sourcing League Table showing all current BES 6001 certificates, by construction product category, and the rating achieved by each company (BRE Group, 2019<sup>[72]</sup>). Also, the Concrete Sustainability Council has developed a label for sustainable concrete certifications (CSC, 2019<sup>[73]</sup>).

### 5.1.3. Conclusions

Based on the projects and initiatives in this review, there appear to be two main drivers for the development of B2B information systems:

First, legislation and policies that require information disclosure at the point of sale push companies to develop information systems that enable them to obtain information from OEMs and upstream tiers in order to meet compliance. The IMDS in the automobile sector is one example of an information systems that was developed in response to a legislation, in this case the European end-of-life vehicle directive.

Second, public awareness and pressure from civil society can lead to the development of information systems by individual firms and sectors, in particular in sectors where much of the brand value is based on reputation. For instance, in the textiles and fashion industry, social and environmental scandals have led to the development of labels and standards that aim to ensure sustainable sourcing and to mitigate risks (e.g. GOTS and Oeko-Tex). Several fashion brands have also developed their own environmental management and material assessment tools, to identify environmental hotspots in their supply chains.

B2B information systems have already led to a variety of environmental and social benefits. They provide businesses with better information and toolkits to identify environmental hotspots and risks in their supply chains and react accordingly. Declarable substance lists and chemical information systems have enabled the disclosure, and in some cases, phase-out of hazardous substances, facilitating a better material recovery and recycling at the end of life. Information systems have also improved the act of material recovery itself, by providing information for dismantling, such as IDIS for EOL automobiles.

Nevertheless, several barriers to a greater uptake and harmonisation of B2B information systems remain:

First, confidential business information may pose a potential obstacle to the development of B2B information systems. Intellectual property rights may form a ‘natural boundary’ to information disclosure and when designing information systems, a balance needs to be found between providing sufficiently detailed information without violating intellectual property rights.

Second, the multiplication and proliferation of different information systems increases transaction costs for companies to comply. Whilst in some sectors, information systems have evolved into one harmonised system (e.g. IMDS in the automobile sector), other industries are struggling to achieve harmonisation (e.g. CiPs in the EEE industry). The proliferation of different circularity metrics increases the transaction costs for firms to provide information. Particularly for SMEs, the proliferation of different information systems and metrics often poses an obstacle to information disclosure as transaction costs are too high. Mainstreaming and harmonising CE metrics may thus reduce transaction costs and increase comparability.

Third, trust is key, when information is stored and managed centrally by a third party organisation. The use of centralised IT systems could represent a barrier to their uptake at global level due to the sensitivity of putting all data in the hands of a single global trustee. Blockchain and distributed ledger technologies are attracting increasing attention as one possible solution to ensure trust in information flows and different initiatives emerging. One example is the Chemchain project, which aims at developing an open-source blockchain platform to transfer chemical information along the supply chain (European Commission, 2019<sup>[74]</sup>).

## 5.2. Consumer-oriented labels for resource efficiency and the circular economy

### 5.2.1. Introduction

Raising public awareness about the circular economy performance of products can shift purchasing power and demand and steer supply chains towards more resource efficient and circular products. Overall, consumer awareness with regards to circular economy and resource efficiency has grown in recent years and major brands have started to recognise recyclability and recycled content as a factor in motivating consumer purchasing (e.g. Coca Cola or Evian).

As the mapping exercise in Section 4 shows, the majority of existing CELIS are consumer-oriented schemes. Consumers are exposed to a multitude of labels and certificates that address natural resources and environmental performance. However, whilst several studies have looked at the environmental benefits of consumer-oriented ecolabels, there appears to be no assessment specifically on consumer labels for the circular economy (AEAT, 2004<sup>[13]</sup>; Rubik, Scheer and Iraldo, 2008<sup>[75]</sup>; Iraldo and Barberio, 2017<sup>[76]</sup>).

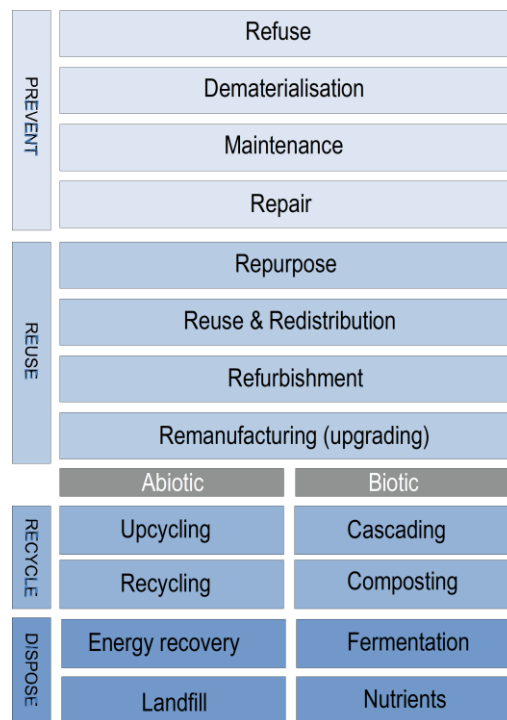
As the circular economy comprises a wide range of environmental actions activities, also labels for the circular economy comprise multiple aspects<sup>5</sup> (McCarthy, Dellink and Bibas, 2018<sup>[19]</sup>). Often, different ‘circular’ activities are possible to address the same issue. For instance a damaged product can be repaired to increase its lifespan, dismantled to re-use parts in a different product, remanufactured, or incinerated to make use of the embedded energy. Whilst all activities either *narrow*, *slow down* or *close* material loops, each of the action has different environmental outcomes. In some cases, one action may be preferred over the others.

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<sup>5</sup> See Section 2.2 for a more comprehensive discussion and definition of CELIS.

De Groene Zaak and Ethica (2015<sup>[77]</sup>) developed a ‘circularity ladder’, which provides an indication of the ‘environmental desirability’ of different end-of-life treatments. Extending product lifespans through maintenance and repair is in most cases the preferred option, followed by different modes of recycling. Yet, especially consumer labels that focus on product lifespan extension and reuse are still relatively scarce.

**Figure 5.1. Circularity ladder**



Source: (De Groene Zaak and Ethica, 2015<sup>[77]</sup>)

This section aims to explore existing circular economy related consumer labels and the remaining gaps in more detail.

### 5.2.2. Product lifespan labels

The useful service life in most product groups has decreased over the last years, due to an interplay of technological, psychological and economic obsolescence (Prakash et al., 2016<sup>[78]</sup>). Products can become obsolete prematurely for economic reasons of producers (economic obsolescence), fashion (psychological obsolescence) or, in the case of electronic equipment, insufficient technological compatibility with newest hard- and software (technological obsolescence) (Cox et al., 2013<sup>[79]</sup>). Extending the lifespan of a product (whether by the original owner through repair or by subsequent owners through reuse) can often increase resource efficiency and lead to better environmental outcomes (see Box 4). For instance, removable and replaceable components in electronic products can help extend the lifespan of a product beyond the lifespan of its individual parts.

There is an apparent information asymmetry with regards to product lifespan and reparability attributes for consumers. A recent study by the European Commission showed that consumers are usually poorly informed about the durability and reparability of products at the point of purchase and that consumers would like to receive better information (European Commission, 2018<sub>[80]</sub>).<sup>6</sup> This is confirmed in a Eurobarometer consumer survey, which found that 92% of the respondents across the EU27 indicated that the lifespan of products should be better indicated (European Commission, 2012<sub>[81]</sub>). In addition, there is evidence that consumers are willing to trade-off price and lifespan characteristics of products to some extent (European Commission, 2018<sub>[80]</sub>).

**Box 4. Environmental benefits of product lifespan extension versus product replacement**

Two aspects are important to consider in order to determine the optimal lifespan of a product from an environmental point of view.

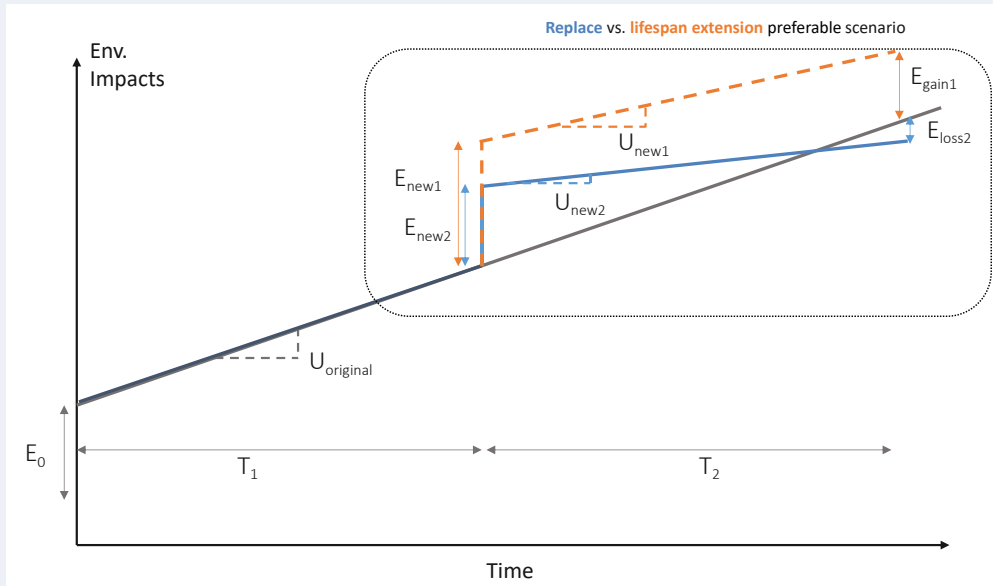
First, there is a trade-off between environmental impacts of different phases of the lifecycle, specifically between production and end-of-life impacts vs. use-phase impacts. Extending the lifespan of a product reduces impacts associated with production (e.g. resource extraction and use) and end-of-life management (e.g. waste treatment and disposal), but increases impacts of the use phase, as the product remains in use longer (e.g. fuel consumption or emissions).

Second, the rate of efficiency improvements in the use phase determines how often or quickly a product should be replaced from an environmental point of view. In product groups with rapid efficiency improvements, lifespan extension may hinder the diffusion of more efficient products.

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<sup>6</sup> See Deloitte (2016<sub>[140]</sub>) for a more comprehensive analysis of barriers to increased reparability.

**Figure 5.2. Depending on environmental impacts of production and use phase, lifespan extension may lead to an environmental gain or loss**



Source: Adapted from (Cooper and Gutowski, 2017<sup>[82]</sup>)

Particularly in product groups with *high* impacts associated with production- and EOL-phases, *low* impacts during the use-phase and *low* efficiency improvements, extending product lifespans can lead to impact reductions (Scenario 1 in Figure 5.2). An example are mobile phones or notebooks, which require valuable metals and minerals for production, but have a relatively low energy consumption and thus relatively low impacts during the use-phase (Umweltbundesamt, 2012<sup>[83]</sup>). Other examples of products that tend to be discarded too early are products with little to no environmental impact during the use phase, such as clothes, furniture or office buildings (Gutowski et al., 2011<sup>[84]</sup>; Skelton and Allwood, 2013<sup>[85]</sup>).

For product groups with relatively *low* impacts during production and EOL phases, *high* impacts during the use-phase and *rapid* efficiency improvements, replacements may be environmentally preferable to allow for a faster diffusion of efficiency improvements (Scenario 2). An example were white goods or air conditioning units between 1990-2010, when these product groups underwent substantial efficiency improvements (Kim, Keoleian and Horie, 2006<sup>[86]</sup>).

As efficiency improvements in new products diminish over time and the greening of the energy mix progresses, lifetime extension increasingly becomes the preferable option for most product groups in most OECD countries (Oeko-Institut e.V., 2018<sup>[87]</sup>; CLASP Europe, 2016<sup>[88]</sup>).

Providing information on the durability of a product can positively steer consumer demand towards longer-lived products. Several stated preference surveys concluded that product lifespan labelling shifts consumption patterns of consumers towards products that last longer (see Box 5).

### Box 5. Stated preference surveys on product lifespan labelling

Since there are only few labels in use, which incorporate criteria that incentivise product longevity, ex-post analyses and revealed preferences on the effect of such labels on consumer choices do not yet exist. Stated preference surveys aim to assess the potential effect of such labels ex-ante and a variety of such studies have been conducted in recent years:

A study on consumers engagement in the circular economy (n= approx. 12,000) commissioned by the European Commission found that when durability or reparability information was provided, consumers were almost three times more likely to choose products with the highest durability on offer, and more than two times more likely to choose products with the highest reparability ratings (European Commission, 2018<sup>[80]</sup>).

A study by the European Economic and Social Committee on the influence of lifespan labelling on consumers across four different regions (n=2,917) showed that the sales of the longer-lasting product group was increased through information disclosure by on average 13.8%, with above-average increases for suitcases (+ 23.7%), printers (+ 20.1%), trousers (+ 15.9%), sport shoes (+ 15%) and coffee makers (+ 14.4%) (European Economic and Social Committee, 2016<sup>[89]</sup>).

A study commissioned by the German Federal Ministry for Environment, Nature Conservation, Construction and Nuclear Safety tested the effect of a lifespan label on purchasing decisions for electrical products in a simulated online shop situation (n=10,444). The findings confirmed that a longer lifespan at the same price has a positive effect on sales of the product. However, the willingness to pay for a longer lifespan was only limited. Combining product lifespan labelling with information about the average operating cost per year resulted in a stronger effect on behaviour (BMUB, 2017<sup>[90]</sup>).

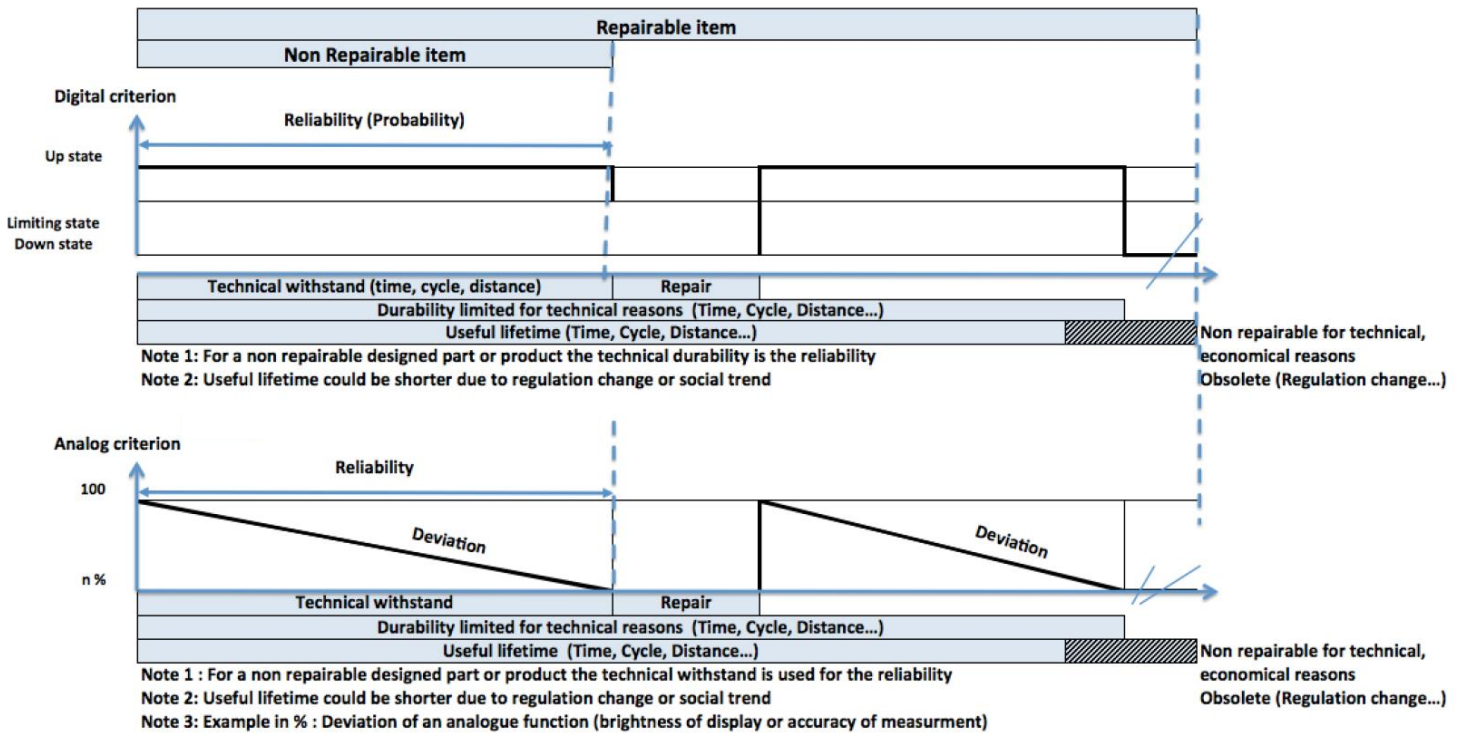
Lastly, a survey on purchasing electrical appliances among German consumers (n=409) finds information on product lifespan to be the second strongest purchase criterion next to price (Jacobs, 2018<sup>[91]</sup>).

#### *Durability definition*

The standard EN45552:2020 defines durability as “the ability of a part or product to function as required, under defined conditions of use, maintenance and repair, until a limiting state is reached”. A “limiting state” is reached when required functions of a product or any part thereof are no longer delivered due to failure or breakdown. In this definition, maintenance and repair services are included in the durability concept to some extent (CEN-CENELEC, 2019<sup>[92]</sup>).

Reparability is defined as the process of restoring a faulty product to a condition where it can fulfil its intended use. The durability and useful lifetime of a non-reparable product or component thus lasts only until the first event of failure, whereas the durability and useful lifetime of a reparable product extends beyond the first event of failure until it becomes unreparable for technical, economic or obsolescence reasons.

Figure 5.3. Products lifespan and durability concepts as defined in EN45552:2020



Source: (CEN-CENELEC, 2019<sup>[92]</sup>)

Three pieces of information can thus lead to extending the useful lifespan of a product in different ways: reliability and overall durability information, reparability and upgradability (Bocken et al., 2016<sup>[93]</sup>). Each of these information segments is discussed hereafter in more detail.

Durability and reliability labels

Durability and reliability<sup>7</sup> labels provide information on the expected service life and useful lifespan of a product or component to consumers. So far, only few labels exist that convey specific information on the useful lifespan to consumers.

Developing a robust methodology for assessing durability and reliability is complex. One of the issues is that reliability is a statistical measure and statistical measures cannot be tested at the point of sale where labels are required. More generally, there are limited ways of testing durability and tests take a long time, which makes surveillance and enforcement challenging. Designing testing methods that enable sufficiently robust differentiations between products is thus a challenge.

In May 2019, the EU Horizon 2020 project “PROMPT” (Premature Obsolescence Multi-Stakeholder Product Testing Program) was launched, which aims to establish an independent test program to evaluate the service life of electronic consumer goods. The

<sup>7</sup> A distinction can be made between reliability labels (indicating the expected service life until the first event of failure) and durability labels (indicating the expected useful lifespan including one or multiple failure and repair iterations).

multi-stakeholder consortium covering research institutes, consumer associations and repair companies, aims to develop an independent durability testing programme for four electronic product groups (smartphones, TVs, washing machines and vacuum cleaners) (PROMPT, 2019<sup>[94]</sup>).

Some durability testing methods and labels have already been developed. Examples include a product performance and endurance testing for lighting and luminaires by TÜV SÜD (TÜV SÜD, 2019<sup>[95]</sup>), the independent LONGTIME label (LONGTIME, 2019<sup>[96]</sup>) or the internal company certificate “le choix durable” by the electrical retailing company Fnac Darty (Fnac Darty, 2019<sup>[97]</sup>). However, the uptake of these remains limited.

Durability information could also be linked to other policy tools that do not require testing. Warranty claims and minimum lifetime requirements could be used as a proxy for product lifespan. Legal warranties and commercial guarantees give the consumer certain legal and/or contractual rights to have their products repaired or replaced. For instance, the new EU eco-design regulation includes minimum lifespan criteria for some product groups such as vacuum cleaners<sup>8</sup> (European Commission, 2019<sup>[98]</sup>).

While legal warranties strengthen consumer rights, they do not necessarily lead to increased resource efficiency, as it does not clearly prioritise repair over replacement or reimbursement in cases of defect. It does however incentivise producers to design new products, such that the expected service lifespan exceeds the legal warranty period.

### Reparability labels

Reparability can be defined as “the ability to restore the functionality of a product after the occurrence of a fault” (JRC, 2018<sup>[99]</sup>). Repairing extends the useful lifespan of a product beyond its expected service life. The practice of repairing is already well established among consumers: according to a Eurobarometer survey, in the European Union almost 80% make an effort to get appliances repaired before they consider buying a new one (Eurobarometer, 2014<sup>[100]</sup>). Yet, to date, information about the reparability of a product remains often insufficiently disclosed in B2C transactions, making it difficult for consumers to choose products that are easily repairable (Bracquené et al., 2018<sup>[101]</sup>).

Some consumer-labels and standards exist that provide reparability information, but the adoption rate of voluntary labels remains low. As of January 2021 France has established the first mandatory label for reparability for a selected group of electronic products (see Table 5).

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<sup>8</sup> The following requirements are included: (1) Minimum operational motor lifetime: 500 hours; and (2) Minimum durability of the hose (if any): still usable after 40 000 oscillations under strain.

**Table 5. Review of existing reparability labels, standards and information schemes**

Name	Description	Product groups	Uptake in market
CEN-CENELEC standard EN45554:2020	The standards defines parameters and general methods for the assessment of the ability to repair, reuse and upgrade energy related products and aims to define reusability indexes or criteria (see also Box 6).	Electrical and electronic equipment	Published in February 2020, no information on adoption so far.
Austrian standard ONR 192102:2014	The systems is composed of 40 criteria for white goods and 53 criteria for brown goods. It includes mandatory pass/fail requirements and requirements based on graded classes. Based on the points rewarded a final rating rates the product in 'good', 'very good' or 'excellent'.	Electrical and electronic appliances (white and brown goods)	24 washing machines and 40 vacuum cleaners tested, no standard awarded yet.
i-Fixit scoring system	A 0-to-10 score is assigned by iFixit to the different categories of devices, a score of ten represents the easiest product to repair on the market. The scoring system considers indicators such as: ease of disassembly, availability of service manuals, types of fasteners used, type and number of required tools, possibility to upgradable the device, and modular design.	Smartphones, tables, laptops	36 laptops, 105 phones and 56 tablets labelled with a reparability score.
"Design for Reparability" tool	Similar to the approach developed by iFixit, the 'Design for Reparability' tool includes 20 criteria related to the ability of consumers to repair a product themselves (DIY repair). The tool's aim is to assess brown goods (TVs, audio equipment and other household appliances). 0-2 points can be earned per criteria, the overall score is then normalised on a 1-10 scale.	So far smartphone and tablets. Prospective use: TVs, audio equipment other small household appliances (brown goods)	Currently still in development phase.
"Product 10Y Repairable" label	The "Product 10Y Repairable" label is an in-house label by the Groupe SEB. It applies with the aim of promoting the reparability of small household appliances that they commercialise. The label provides information on (1) the proximity to authorised repair centres, (2) possibility to fully dis- and reassemble the product without risk of damaging and (3) availability of spare parts (to be in stock for minimum 10 years), their cost and delivery time.	Small household appliances (only for Groupe SEB products)	Only household appliances sold by Groupe SEB
French reparability index	A mandatory reparability index adds a grade out of 10 to the labels of washing machines, laptops, smartphones, TVs and lawn mowers. The score is calculated based on criteria including: ease of disassembly, price, availability of spare parts and access to repair information. So far, the label covers washing machines, laptops, smartphones, TVs and lawn mowers.	Washing machines, laptops, smartphones, TVs and lawn mowers. (More product groups planned in 2021.)	Mandatory label in France as of 1 January 2021

*Note:* See (JRC, 2018<sup>[99]</sup>; Bracquené et al., 2018<sup>[101]</sup>) for a more detailed evaluation of the four labels and information schemes.

*Source:* (Austrian Standards, 2014<sup>[102]</sup>; iFixit, 2019<sup>[103]</sup>; Flipsen, Bakker and Bohemen, 2016<sup>[104]</sup>; Groupe SEB, 2019<sup>[105]</sup>)

In 2007 the Austrian Standardisation Institute developed a first reparability standard: ONR 192102:2014. This quality standard for household appliances and consumer electronics provides information on the reparability of a product and includes eco-design guidelines for the construction of appliances that allow repair services at reasonable prices. The assessment comprises around 40 different criteria that aim to make reparability measurable and testing methods currently exist for washing machines and vacuum cleaners (CE Stakeholder Platform, 2019<sup>[106]</sup>; Austrian Standards, 2014<sup>[102]</sup>). So far, 24 washing machines and 40 vacuum cleaners have been tested for this standard, yet none of the products has sufficiently met the reparability criteria. The main reason for not receiving the standard was that firms provided insufficient information and guidelines for repairing the product in case of defect.

The French government in cooperation with the French environmental and energy agency (ADEME) developed a mandatory reparability label. As announced in France’s 2018 roadmap to a circular economy and passed by the French anti-waste bill (“loi anti-gaspillage”), the country introduced a mandatory reparability index for household electrical appliances as of January 2021 (Plan Climat, 2017<sub>[4]</sub>). The label provides a reparability score out of 10, which is added to the labels of washing machines, laptops, smartphones, TVs and lawn mowers (Indice de réparabilité, 2020<sub>[107]</sub>). The index aims to be extended to more product groups after 2021.

On European level, European Commission requested the three European standardisation organisations (CEN, CENELEC and ETSI) to develop standards on material efficiency that would establish future ecodesign requirements on durability, reparability and recyclability for energy-related products. The CEN-CENELEC Joint Technical Committee 10 (CEN-CLC JTC 10)<sup>9</sup> “Energy-related products - Material Efficiency Aspects for Ecodesign” conducted work in this respect and produced eight horizontal standards and one technical report that provide generic principles and a common framework for the development of future product-specific standards by product technical committees (European Commission, 2018<sub>[108]</sub>). Among these is a standard on reparability (EN45554:2020) and a standard on durability of energy-related products (EN45552:2020) (see Box 6).

**Box 6. CEN-CLC/JTC 10 Standards on material efficiency of energy-related products**

As mandated by the European Commission (Mandate M/543), CEN-CLC/JTC 10 developed eight general standards with a wide applicability, addressing different aspects of material efficiency.

**Table 6. CEN/CLC/JTC 10 Published Standards**

Standard name	Description	Publication date
EN 45559:2019	Methods for providing information relating to material efficiency aspects of energy-related products	01.03.2019
EN 45558:2019	General method to declare the use of critical raw materials in energy-related products	01.03.2019
EN 45556:2019	General method for assessing the proportion of reused components in energy-related products	07.06.2019
EN 45555:2019	General methods for assessing the recyclability and recoverability of energy-related products	27.11.2019
EN 45554:2020	General methods for the assessment of the ability to repair, reuse and upgrade energy-related products	21.02.2020
EN 45552:2020	General method for the assessment of the durability of energy-related product	11.03.2020
EN 45557:2020	General method for assessing the proportion of recycled material content in energy-related product	29.04.2020
FprEN 45553	General method for the assessment of the ability to remanufacture energy-related products	10.07.2020
CLC/prTR 45550	A compilation of definitions related to material efficiency	04.12.2020

Source: (CEN-CENELEC, 2020<sub>[109]</sub>)

<sup>9</sup> The CEN-CENELEC Ecodesign Coordination Group (ECO-CG) coordinates and advises on standardisation activities in the fields of Ecodesign and Energy Labelling. The group serves as a focal point concerning standardisation issues relating to the Ecodesign Standardisation Requests delivered under Directive 2009/125/EC on Ecodesign of energy-related products and the EU framework Regulation 2017/1369 on ‘Energy labelling of energy-related products’ and their future versions.

The new standards developed by CEN-CLC/JTC 10 are intended to be used horizontally and to inform other EU policy tools, such as updates of the ecodesign directive to make products more durable and repairable, as well as new ecodesign and labelling efforts announced in the European Green Deal (European Parliament, 2020<sub>[110]</sub>). It is also discussed to gradually include reparability criteria into the mandatory EU energy label and to have a unique label covering energy and resource efficiency criteria, starting with household appliances (i.e. refrigerators and washing machines).

In parallel, the European Commission has started work on a repairing scoring system. A first technical study aimed to analyse and develop a potential scoring system for three product groups (Laptops, Vacuum Cleaners, Washing Machines) (Cordella, Alfieri and Sanfelix, 2019<sub>[111]</sub>).

#### **Box 7. The role of standards and standardisation for CELIS**

Whilst standards are its own category and not directly a label or an information systems, they can be a key enabler for a harmonised and efficient information flow across value chains. Standards limit the amount of reference documents and by “standardising” information input, they reduce transaction costs for reporting. With the multiplication and proliferation of green claims and private ecolabels, standards can also serve as a reference to distinguish the stringency of different labels. ISO, IEC and ITU are examples of major standardisation organisations at the global level.

Standards are in itself not legally binding and always voluntary. However they may be used by laws and regulations as a reference. Thus complying with the standard can help and facilitate compliance with regulation. For instance, the standards that are currently being developed in CEN-CLC JTC 10 do not in itself pose requirements on the industry. However, if legislation refers to this standard as a minimum requirement, standards can then, in combination with that regulation become legally binding. Additionally, standards can be used as criteria for Green Public Procurement.

#### Labels for upgradability

Upgradability can prevent technological obsolescence and extend the useful lifespan of products, especially for electronic and electrical equipment. Upgradability can be understood as “the ability of a product to continue being useful by enhancing the quality, value, effectiveness or performance” (Bocken et al., 2016<sub>[93]</sub>).

Computers or smartphones, for instance, are usually discarded before the end of their useful product life, due to their performance not being able to keep up with the rapid pace of technological product innovation. Upgradeability of individual parts in products would allow extended product lifespans and resource savings. Similarly to other label segments, information on upgradeability could increase consumer demand of products that allow for easy replacements and updates of individual components or software.

### Box 8. Product lifespan aspects in the EU Ecolabel

The EU Ecolabel considers different product lifespan criteria in the assessment for some of their 24 product groups. Durability aspects and minimum lifespan requirements, for instance, are included in assessments for shoes, vacuum cleaners, televisions and the wood and metal components of furniture. For other product groups reparability aspects are part of the assessment, including furniture, mattresses, sanitary tapware (European Commission, 2019<sup>[112]</sup>). Upgradeability criteria are included for computers, where certain components are required to be easily accessible and replaceable and the availability of spare parts must be ensured for at least five years (European Commission, 2016<sup>[113]</sup>).

The EU Ecolabel scheme is a voluntary label and industry uptake remains low in some product groups. Whilst the number of products registered has increased steadily over the past years, the number of participating companies (licenses) has only increased by less than 100 since 2013 and remains modest for the European Union as a whole. As of January 2020, 77 358 products and services are registered and 1 623 licenses awarded to participating companies. Uptake is large for tourist accommodation services and various cleaning and hygiene product groups, but less so for electronic and electrical equipment (e.g. televisions) (European Commission, 2018<sup>[114]</sup>).

To sum-up, product lifespan labels for the circular economy still remain in early stages of development. The challenge lies in defining a robust methodology for assessing durability, which poses an obstacle for developing a reliable label. Some product lifespan labels (durability as well as reparability labels) exist, but their market uptake is limited. Work is ongoing at the national and international level to drive product lifespan labelling forward. However, so far, the industry seems reluctant to adopting the voluntary product lifespan labels that have already been developed.

#### 5.2.3. Labels and certificates in used-goods markets

Secondary and used-goods markets are an integral part of the circular economy as they enable refurbishment and reuse, a key circular business model. A study conducted in The Netherlands estimates that the useful lifespan of products traded on used goods marketplaces is 1.6 longer than their standard lifespans (CE Delft, 2019<sup>[115]</sup>).

However, although increasing, used good trading remains a niche economic activity. Often, markets of used goods are less transparent than markets of new products, which inhibits trading and purchasing for consumers. A key barrier to the uptake of used-goods trading seems thus to be reservations by consumers about the quality of the used goods (Verivox, 2019<sup>[116]</sup>; Shimabukuro and Leandro, 2016<sup>[117]</sup>; Clausen et al., 2010<sup>[118]</sup>).

Providing better information on the quality of used goods can encourage used goods trading, as envisaged in the circular economy white paper of the Paris metropolitan region, which states second-hand product labelling as one of the measures that need to be implemented for their urban transition towards a more circular economy (ADEME Paris, 2017<sup>[119]</sup>).

Standards and quality labels for used goods can be of interest for consumers and original producers alike. Consumers may gain more confidence about the quality of used products and OEMs, can get re-assurance that safety liabilities and reputation are protected by re-use organisations.

There is an increasing demand for used-goods trading, in particular for EEE products, such as mobile phones. As innovation rates of new mobile phones converge, refurbished phones become more attractive for the consumer. According to Counterpoint Research, the global market for refurbished smartphones grew by 13% in 2017 (in contrast to 3% market growth for new phones in the same year). For 2017, the total market share of refurbished smartphones reached close to 10% of the total global smartphone market, with 140 million units being sold (Counterpoint Research, 2018<sup>[120]</sup>).

For some used goods, governments already require regulated markets, specifically for items which have safety and legal concerns, such as used firearms or cars. For these product groups, government licensing bodies require certification and registration of the sale, to prevent the sale of stolen, unregistered, or unsafe goods.

In most other cases, however, used consumer goods markets remain informal or less regulated (e.g. eBay, Leboncoin, craigslist) and quality assurance is either missing, or conducted through peer-to-peer ratings and feedback systems within the market community. But, since the quality of used goods can strongly vary across products or vendors, ensuring trust and confidence for consumers is essential to build demand.

In EEE product segments, quality standards for used EEE can also facilitate and assure trade, as it can help differentiate legitimate exports from illegal exports of WEEE under the guise of being sent abroad for re-use. The international Correspondents Guidelines agreed under the Basel Convention and the EU WEEE Directive call for a “test” to differentiate between re-use and the illegal exports of waste – but no specifications about the test is given so far. Governments have yet to adopt final guidance under the Basel Convention on the question of how the functionality of a used product is to be defined for purposes of demonstrating legitimate reuse. This regulatory gap risks illegal exports of WEEE labelled as reuse and generates reputational risks for EEE producers. Quality standards for used goods can thus provide an opportunity to EEE producers to protect their reputation by ensuring their products are not illegally sent abroad for material recovery.<sup>10</sup> Quality standards could also be useful as a reference to testing guidelines under the Basel Convention.

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<sup>10</sup> In this context the end-of-waste criteria of the EU Waste Framework Directive are also relevant, which specify when certain waste ceases to be waste (when it has undergone a recovery operation) and obtains a status of a product or a secondary raw material.

### Box 9. Selected examples of labels, certificates and standards for used goods

The Responsible Recycling Standard for Electronics Recyclers (R2:2013) and the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment are standards that require documentation and assurance measures related to the management of equipment destined for reuse and resale. The standard mandates specific testing and quality assurance for “fully functional” products with the aim to reduce the risk of improper transboundary movements of hazardous waste and end-of-life equipment and components (SERI, 2014<sub>[121]</sub>; E-Stewards, 2014<sub>[122]</sub>).

The PAS 141:2011 standard, developed by the British Standards Institute (BSI), is a voluntary standard designed to build confidence in reused mobile device consumer markets. It sets a benchmark for minimum functionality standards for reusable mobile devices. Electrically safe and functionally fit for purpose mobile devices receive a PAS 141 Registered mark. Besides consumer confidence, it also aims to reduce reputational risks and safety liability of original producers (OECD, 2011<sub>[123]</sub>; WRAP, 2013<sub>[124]</sub>; Quariguasi-Frota-Neto et al., 2014<sub>[125]</sub>). The stated goals of the standard are:

- to encourage reuse as promoted by the WEEE Directive (2002/96/EC), Article 1;
- to provide a framework for assuring consumers of the quality and safety of reused electronic and electrical equipment (REEE);
- to provide a framework for assuring manufacturers that the placing of REEE on the market will not adversely affect their brands; and
- to discourage the illegal export of WEEE under the guise of reuse by providing a tool to the Environmental Agencies for differentiating between REEE and WEEE.

RCube, a Paris-based non-profit association involved in waste reduction and re-use, offers a quality label for refurbished products. The label is developed with the intention to encourage used good trading. Testing methods exist for refurbished phones and are currently extended to other consumer products (Rcube, 2019<sub>[126]</sub>).

The American Law Label (or “Yellow Tag”) informs consumers of hidden contents and filling materials in bedding and furniture and ensures that the product has been sanitised before resale. In some US States this label is mandatory for certain groups for quality assurance (American Law Label Inc., 2018<sub>[127]</sub>).

Overall, quality standards and labels for used products appear to be relatively scarce. Whilst these labels can be effective in increasing confidence and transparency for consumers and may also reduce liabilities of original producers, this label landscape is so far not extensively developed. One reason for this may be that information required for the development of used goods labels is retained as confidential business information by the original equipment manufacturer.

#### 5.2.4. Other consumer labels with relevance to resource efficiency and the circular economy

Other notable consumer-oriented labels for resource efficiency and the circular economy include waste separation labels and labels on secondary (raw) materials and recycled content. Each group of labels is discussed below with selected examples.

Waste separation labels

Waste separation labels can guide consumers in sorting waste, which improves conditions for recycling. Some jurisdictions require mandatory waste sorting markings for all applicable products placed on the market, other waste separation labels are voluntary and may be motivated by an industry's corporate responsibility efforts.

**Box 10. Selected examples of waste separation labels and standards**

The public 'Triman' label in France is a mandatory waste label that marks all household waste that is recyclable. The label was set up by the government to provide a unified signage for all recyclable products that are placed on the French market under Extended Producer Responsibility (EPR) schemes (ADEME, 2015<sub>[128]</sub>).

The ASTM D7611 International Resin Identification Coding System (RICs) contains a set of symbols with number codes that identify the plastic resin out of which a plastic product is made (ASTM International, 2019<sub>[129]</sub>). The ASTM Standard in itself is voluntary, but may become mandatory in certain jurisdictions, when referred to in a legislation. This is for instance the case in several US states. The coding system provides information about the plastic resin type, which municipal waste management organisations can refer to for setting criteria for waste separation. For instance, as a response to the China plastic waste import restrictions, and pressures on local recycling infrastructure, several US waste management companies now instruct citizens to only sort plastic #1 and #2 (i.e. PTE and HDPE) for recycling (Waste Dive, 2019<sub>[130]</sub>).

The private How2recycle label is a voluntary waste sorting label available in the US. Firms may choose to put this label on their products to provide consumers with sorting and recycling guidance (How2Recycle, 2019<sub>[131]</sub>).

Recycled content labels

Labels on secondary (raw) materials and recycled content can differentiate and drive the demand for recycled materials. The OECD analysis on secondary plastics markets, for instance, suggests that labelling recycled content of plastics products could further the demand for secondary plastic materials and improve the overall competitiveness of recycled plastics materials (OECD, 2018<sub>[132]</sub>).

### Box 11. Selected examples of recycled content labels

SCS Global Services, a certification body, developed a voluntary standard for recycled content claims, as well as a recycled content certificate, based on this standard, which is applicable for different materials (SCS Global Services, 2019<sub>[133]</sub>).

The Sustainable Forestry Initiative (SFI) as well as the Forest Stewardship Council (FSC) offer labels on recycled content for wood and paper products (FSC, 2018<sub>[134]</sub>; Sustainable Forestry Initiative, 2019<sub>[135]</sub>). Both are examples where a recycled content label has differentiated and driven demand for a secondary material. Since the first FSC label was created in 1993, the demand for this label has increased steadily, as firms are increasingly recognising the improved market access and the competitive advantage of adopting the recycled content label. The FSC is now certifying almost 30,000 products in 112 countries and the secondary paper market is well-established in most countries (FSC, 2016<sub>[136]</sub>).

### 5.2.5. Conclusions

Consumer-oriented labels for the circular economy can shift purchasing power and demand and steer supply chains towards more resource efficient and circular products. However, these labels are often voluntary and their market penetration and market impact remain small.

*Product lifespan labels* for the circular economy are still in early stages of development. Some product lifespan labels already exist, but their adoption rate is low. A challenge lies in defining a robust methodology for assessing durability, which appears to be the main obstacle to their development. Some product groups seem more. Lifespan extension is likely to be most environmental preferable for product groups with relatively low environmental impacts at the use-phase and low improvement rates in use-phase efficiency (e.g. electrical and electronic equipment) and the development of lifespan labels may thus focus on these first.

There is work ongoing at the national and European levels to drive product lifespan labelling forward. Notable efforts include the European standardisation mandate executed by CEN-CENELEC (CEN-CENELEC, 2019<sub>[92]</sub>) ongoing work on a reparability scoring systems at the French environmental and energy agency ADEME, as well as the EU Horizon 2020 project “PROMPT” on premature obsolescence of energy-related products.

*Labels and certificates for used goods* also remain scarce. They aim at providing consumers with more information about the quality of used goods and to improve the transparency in used goods markets. These labels may have significant development potential as the global market for refurbished EEE continues to increase in size and market share.<sup>11</sup>

Labels and certificates for used goods can have multiple benefits. They can improve the conditions for used good trading and thereby extend product lifespans and save resources. Additionally, they can provide quality assurances for traded used products and thus mitigate risks linked to safety, health and the environment. Finally, in the case of WEEE and other hazardous product waste, labels on used goods can help differentiate transboundary trade of used EEE from illegal exports of WEEE under the guise of reuse.

<sup>11</sup> The global market for refurbished smartphones reached 10% in 2017, with a growth rate of 13%, compared to only 3% for new smartphones in the same year (Counterpoint Research, 2018<sub>[120]</sub>).

This label segment may in particular receive support from the industry as it can reduce business risks related to safety liabilities and reputation of original producers when their products are traded as used goods.

*Other consumer-oriented labels*, such as waste separation labels or recycled content labels can improve the conditions for recycling by improving the waste stream and increasing the market demand for recycled materials. Both labels can thus contribute to material circularity.

Overall, it is important to note that the development and implementation of consumer labels are only useful as long as they are being used by the receiving end. Previous OECD work found that the multiplication of different types of environmental product labels and certificates risks consumer confusion and negative effects on international trade due to increased compliance and transaction costs (Prag, Lyon and Russillo, 2016<sup>[14]</sup>). In a recent survey by the European Commission nearly half of the consumers did not recognise any of the labels that were shown to them in the study and only 32% of consumers stated that labels actually influenced their purchasing decision (European Commission, 2017<sup>[137]</sup>). When designing policies for consumer-oriented labels the risk of multiplication and accompanying diminishing effectiveness may want to be considered.

## 6. Policy Implications

The diversity and types of CE labels and information systems are broad and their number is increasing quickly, similarly to environmental labels more generally (Prag, Lyon and Russillo, 2016<sup>[14]</sup>; Klintman, 2016<sup>[15]</sup>). In particular, the last two decades have seen a multiplication of environmental labelling and information schemes of varying scope, size and nature. Existing data suggests that most CELIS are consumer-oriented, focus on food products and are implemented at the national level. The proliferation of CELIS has implications for consumers and producers. Multiplication tends to increase compliance costs for producers to meet the many (regional) requirements. This can also have negative implications for international trade and competitiveness. Similarly, consumers may have difficulty in differentiating the criteria behind the many labels, which can lead to confusion and overall loss of credibility of CELIS. Competition may also drive down stringency of labels and standards, as different schemes bid for market share. Policy intervention is needed to address these issues; to reduce the complexity of the CELIS marketplace, while maintaining high standards.

A related issue is that most CELIS are single-issue labels, which are effective at enabling the comparability of products on specific environmental aspects, but carry the risk that their narrow focus leads to environmental burden shifting. Governments have a role to play in helping develop more complex methodologies that allow for life-cycle-based labels, such as spearheaded by the European Union, with its “Single Market for Green Products Initiative”, which developed lifecycle labelling for specific product groups.

Beyond the more general need to contain the proliferation of CELIS and to improve the methodologies that they are based upon, there are two aspects of the CELIS agenda that require further government attention: (i) there is a lack of consumer-oriented labels that encourage consumers to opt for longer-lived products or to use them for longer; (ii) relatively little has been done so far to encourage enterprises and industrial sectors to develop information systems that are standardised and harmonised across value chains and that can help to improve resource efficiency along them.

### 6.1. Consumer-oriented labels that encourage longer products life spans

Extending product lifespan slows down resource use and can be environmentally beneficial for certain product groups. Stated preference surveys have shown that providing information on the longevity of a product can be an effective means of steering consumer demand towards longer-lived products (see Box 5). Efforts currently focus on the development of methodologies that allow to determine different lifespan aspects such as durability, reparability and upgradeability. Similarly, there are efforts to develop product quality labels for secondary goods, which can help to improve demand for used goods in the market and also lead to extending product lifespans.

Governments have a role to play in facilitating the development of sound methodologies, ideally harmonised at the international level and in furthering their up-take in the market. The latter can be achieved by using CELIS labels in the context of public procurement or in extended producer responsibility schemes. An example is the US Environmental Protection Agency’s Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasers which covers more than 20 categories and gives preference to multi-attribute standards and ecolabels for which a competent certification program has been confirmed.

When choosing product groups to which lifespan labels are applied, the focus should be on product groups that have a proportionally large environmental footprint at the production and end-of-life stages of their life-cycle and where innovation rates of use-phase efficiency improvements are relatively modest. Product groups such as computers, hand-held electronic devices or other EEE would appear well suited as a starting point for these types of labels. Lifespan labels may lead to fewer environmental gains in product groups that generate a proportionally large share of their environmental footprint during the use-phase and exhibit dynamic product innovation that leads to improvements of use-phase efficiency. In some instances lifespan extension may then even delay the diffusion of energy- or fuel-efficiency improvements. Yet, as efficiency improvements in new products tend to diminish over time and the greening of the energy mix progresses, lifetime extension is likely to become environmentally beneficial for more and more product groups.

## 6.2. Business-to-business information systems and labels

The fragmentation of value chains across the globe has increased the complexity of value chain management. Improved information sharing across tiers of the value chain can facilitate a better management of environmentally related uncertainties and risks in supply chains.

Ultimately, firms need to be leading the development of B2B information systems, but governments can play a facilitating role. Regulatory information disclosure requirements have in some cases provided an important driver for the development of information systems by industry to achieve compliance. The IMDS in the automobile sector is one example of an information system that was developed in response to the EU end-of-life vehicle directive.

Often, Information Systems are developed for reporting requirements at the point of sale, but only seldom take into account information requirements by recyclers at a product's end of life. Governments can play a role in facilitating dialogue between stakeholders of upstream and downstream value chains in order to improve the usefulness of information systems for all stakeholders along the value chain and improve their uptake. For instance, the principles of the Value Chain Outreach (VCO) initiative developed by International Council of Chemical Associations (ICCA) can serve as guidance for developing adequate multi-stakeholder information systems (ICCA, 2019<sup>[138]</sup>).

Whereas in some sectors the availability and uptake of CE information systems is slow and needs to be encouraged through policy measures, other sectors are beginning to see a proliferation of different private (enterprise-level) information systems. While such efforts are laudable in principle, the multiplication of different circular economy metrics in these systems can also lead to increased transaction costs for firms, and pose particular challenges to SMEs that have more limited resources. There appears to be a role for governments to support the harmonisation of information systems and the metrics that they use, in order to reduce transaction costs. Ideally this would be done at the international level. Multilateral fora such as the G7 or G20, as well as the ISO, WTO and OECD, are therefore well placed to provide a platform for these efforts.

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