OECD Trade and Environment Working Papers 2021/02

International trade and circular economy - Policy alignment

Shunta Yamaguchi

https://dx.doi.org/10.1787/ae4a2176-en

OECD

TRADE AND ENVIRONMENT WORKING PAPERS

The OECD Trade and Environment Working Paper series is designed to make available to a wide readership selected studies by OECD staff or outside consultants.

OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and the arguments employed are those of the authors.

Working Papers describe preliminary results or research in progress by the author(s) and are published to stimulate discussion on a broad range of issues on which the OECD works. Comments on Working Papers are welcomed, and may be sent to the Environment Directorate or the Trade and Agriculture Directorate, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France. Comments on Working Papers may also be sent to env.contact@oecd.org or tad.contact@oecd.org.

This document has been prepared under the auspices of the Joint Working Party on Trade and Environment (JWPTE) and declassified by the Environment Policy Committee (EPOC) under the OECD reference number COM/TAD/ENV/JWPTE(2020)2/FINAL.

The publication of this document has been authorised by Rodolfo Lacy, Director, Environment Directorate, OECD.

OECD TRADE AND ENVIRONMENT WORKING PAPERS

are published on the OECD's trade (www.oecd.org/trade) and environment (www.oecd.org/environment) web pages, as well as on the *OECD iLibrary* web pages (www.oecdilibrary.org).

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Abstract

International Trade and Circular Economy – Policy Alignment

Shunta Yamaguchi

Circular economy policies and initiatives largely take place domestically, and yet they have important interlinkages with international trade. These links occur through various channels, including circular supply chains in products and materials, end-of-life value chains in waste and scrap, secondary raw materials and second-hand goods, and trade in services reflecting the greater role for the services sector in a circular economy transition.

This report explores how to make circular economy policies and trade policies mutually supportive by mapping out potential misalignments and identifying opportunities to align and strengthen both policy areas. The report highlights the various interlinkages between international trade and circular economy, and examines the interactions between trade and circular economy at the policy level, focussing on the multilateral trade regime and regional trade agreements, as well as specific policies to promote the circular economy, such as extended producer responsibility and product stewardship schemes, taxes and subsidies, green public procurement, environmental labelling schemes, and standards. The report concludes with a forward-looking agenda to make trade and circular economy objectives mutually supportive by identifying potential actions that can be taken at the national level, potential issues that require international co-operation at the global level, and indicating knowledge gaps that merit further research.

JEL classification: F18, O13, Q53, Q56

Keywords: Trade and environment, trade policy, environment policy, resource efficiency, circular economy.

Résumé

Les politiques et les initiatives en faveur de l'économie circulaire sont mises en œuvre en grande partie au niveau national, et pourtant elles ont des liens étroits avec le commerce international. Ces liens se font par divers canaux, notamment les chaînes d'approvisionnement circulaires en matériaux et produits, les chaînes de valeur des déchets et de la ferraille, les matières premières secondaires et les biens d'occasion, et le commerce des services qui ont un rôle important dans la transition vers une économie circulaire.

Ce rapport explore les moyens de renforcer mutuellement les politiques d'économie circulaire et les politiques commerciales en cartographiant leurs désalignements potentiels. Le rapport met en évidence les différents liens entre le commerce international et l'économie circulaire, et examine les interactions entre les politiques publiques commerciale et d'économie circulaire, en se concentrant sur le régime commercial multilatéral et les accords commerciaux régionaux, ainsi que sur les politiques spécifiques visant à promouvoir l'économie circulaire. Ces dernières incluent la responsabilité élargie des producteurs et les programmes de gestion des produits, les taxes et les subventions, les marchés publics écologiques, et l'étiquetage et les normes liés à l'économie circulaire. Le rapport conclut par un programme prospectif visant à renforcer mutuellement les objectifs du commerce et de l'économie circulaire en identifiant les actions potentielles qui peuvent être mises en œuvre au niveau national, les problèmes potentiels qui nécessitent une coopération internationale au niveau mondial, et en indiquant les lacunes en matière de connaissances qui méritent des recherches plus approfondies.

Classification JEL: F18, O13, Q53, Q56

Mots clés: Commerce et environnement, politique commerciale, politique environnementale, efficacité dans l'utilisation des ressources, économie circulaire.

Acknowledgements

This report is part of the work mandated under the 2019-20 Programme of Work and Budget of the Environment Policy Committee under output result 2.3.4.5.2 (Trade and Material Resources). The work was conducted under the auspices of the OECD Joint Working Party on Trade and Environment (JWPTE).

This report was authored by Shunta Yamaguchi of the OECD Secretariat. The report benefited from valuable comments provided by delegates to the JWPTE. Comments and suggestions from colleagues at the OECD Secretariat, not least Elisa Lanzi, Rob Dellink, Peter Börkey, Frithjof Laubinger and Andrew Brown from the Environment Directorate, Grégoire Garsous and Jane Korinek from the Trade and Agriculture Directorate, and Stephanie Venuti from the Directorate for Financial and Enterprise Affairs, are gratefully acknowledged. Katjusha Boffa provided editorial assistance. Work on this report was conducted under the overall supervision of Shardul Agrawala. The author is responsible for any remaining omissions or errors.

This document has been produced with the financial assistance of the European Union and Switzerland. The views expressed herein do not necessarily reflect the official views of the OECD or of the governments of its member countries and can in no way be taken to reflect the official opinion of the European Union or Switzerland.

Table of Contents

Tables

Figures

Boxes

Executive Summary

The circular economy concept aims to transform the current linear economy into a circular model that would gradually reduce the consumption of finite material resources by recovering materials from waste streams for recycling or reuse, using products longer, and exploiting the potential of the sharing and services economy. It is closely related to resource efficiency and sustainable materials management. By reducing the use of primary materials, a circular economy could limit the associated negative environmental effects arising from the use of materials throughout their lifecycle. Economic and social benefits are also key objectives for countries pursuing circular economy policies.

While circular economy policies and initiatives largely take place domestically, they have important interlinkages with international trade. These links occur through various channels, from circular supply chains in materials and products, to end-of-life value chains in waste and scrap, secondary raw materials and second-hand goods. Services trade is also essential as a circular economy transition entails a greater role for the services sector.

In this context, this report explores how to make circular economy policies and trade policies mutually supportive by mapping out potential misalignments and identifying opportunities to align and strengthen both policy areas.

Circular economy policies mainly planned and implemented at the national level include taxes (e.g. on virgin materials) and subsidies (e.g. for recycling), extended producer responsibility (EPR) and product stewardship schemes, eco-design policies, green public procurement, eco-labelling and circular economy related standards (e.g. material content).

Trade policies provide potential opportunities for a circular economy transition. Multilateral trade rules established by the World Trade Organization (WTO) determine certain principles such as non-discrimination, technical barriers to trade, and transparency. In particular, the WTO Technical Barriers to Trade Agreement strongly encourages members to adopt international standards for national policy making to facilitate trade and harmonise technical regulations as widely as possible. Harmonisation of standards, for example with regard to material content or material quality (e.g. for secondary raw materials) can facilitate the transition to a circular economy. Regional trade agreements (RTAs) provide additional opportunities to set forth bilateral and regional commitments for a circular economy transition. So far, explicit circular economy provisions are considered in a few RTAs, specifically in three draft agreements involving the EU.

To make circular economy policies and trade policies mutually supportive, some actions can be pursued at the national level while others require international co-operation. Policy makers could consider the following potential actions within their ***domestic policy space***.

- ***Circular economy policies*** should be designed and implemented in a non-discriminatory fashion, in line with multilateral trade rules, and without being excessively restrictive to meet their objectives. Policies that may have trade effects need to be notified and fulfil consultation requirements as set forth by WTO rules.
- Regarding specific policies, ***EPR and product stewardship schemes*** could be further examined on how they account for end-of-life value chains. EPR schemes have generally contributed to reducing waste disposal and increasing recycling rates. However, some schemes appear to over-incentivise waste trade by effectively

allowing exporters to claim that waste exports are 100% recycled without accounting for intermediate processing losses. Additional efforts could be made to better understand the fate of waste shipments abroad. To reduce illegal waste trade, efforts can be made to strengthen enforcement and collect better data. To address potential free-riding of EPR schemes by global traders through online sales, different measures could be considered, including single electronic registries, peer-review reporting systems, or requirements for online sellers to display their producer responsibility organisation registrations.

- In addition, ***circular economy related standards*** are emerging at the national or regional level, such as those related to material content, recyclability, reparability, sustainable production, material quality and product quality. In accordance with WTO rules, standard setting initiatives should be transparent with timely notifications, and aligned with international standards to the extent possible.
- As a complement to these circular economy policies and initiatives, the definitions on ***waste and scrap, second-hand goods, and goods for refurbishment and remanufacturing*** could be revisited to facilitate trade that may contribute to a circular economy, and distinguishing them from unwanted fractions.

International co-operation can also provide further opportunities for policy alignment.

- For instance, ***EPR and product stewardship schemes*** can exchange global information on competent bodies and free-riders in order to tackle illegal waste trade and free-riding from online sales.
- Furthermore, wherever appropriate, ***circular economy related standards*** that appear to be critical for a circular economy transition could be considered for harmonisation or mutual recognition of conformity assessment procedures at the international level to facilitate trade for a circular economy. These can include, for example, material quality standards for secondary raw materials and standards for sustainable production. Stakeholders may also wish to engage in the development of relevant international standards.
- Finally, regarding ***waste and scrap, second-hand goods, and goods for refurbishment and remanufacturing,*** different definitions and their relation with the Harmonized System (HS) codes could be clarified. Better understanding is also necessary on the drivers of trade in waste and scrap, and second-hand goods, and their impacts on the environment, as well as the rationale and impacts of imposing trade restrictions on waste and scrap, and secondary raw materials.
- International co-operation can particularly be considered under multilateral frameworks (e.g. Basel Convention, WTO, OECD) or RTAs.

Several ***knowledge gaps*** remain. Very little is currently known on how global supply chains can be aligned with a circular economy transition, including an environmentally sustainable and just transition for the extractive sector. More analysis is also required on how trade can provide additional opportunities to support circular business models and their global activities, including the establishment of reverse logistics in end-of-life value chains. Potential avenues in securing circular and resilient value chains via enhanced transparency and traceability could be explored in the emerging field of innovation and trade facilitation mechanisms. The role of services trade in supporting these circular business models is also an under researched area. These gaps notwithstanding, there are already sufficient elements that can be tackled to make significant progress.

1. Introduction

Resource demand in the coming decades will substantially increase following the boost in global population and economic growth. This will lead to various environmental consequences including water stress, biodiversity loss, climate change and local pollution through the production, consumption and end-of-life management of these materials. These pressures call for the better utilisation of materials to sustain our economies and the planet.

To address the environmental concerns linked with materials use, several countries have started to adopt and implement "circular economy" policies to close material loops and reduce the demand for primary materials. These policies are closely related to resource efficiency and sustainable materials management policies. [1] The circular economy concept aims to transform current linear economic models into circular models that extend the life of products, promote reuse, repair, refurbishment, remanufacturing, and recycling, and exploit the potential of the sharing and services economy. These circular approaches would gradually reduce the consumption of finite material resources and also limit the associated negative environmental effects arising from the use of materials throughout their lifecycle. Economic and social benefits are also main objectives for countries aiming to implement circular economy policies, as they are for countries that focus more on sustainable materials management or on resource efficiency. This report focuses on the circular economy concept, but many – though not all – of the key insights from this report also extend to policy approaches to improve resource efficiency and reduce the environmental impact of materials use.

International trade is a critical element to consider in implementing circular economy policies. While circular economy policies and initiatives largely take place domestically within national boundaries, there are important interlinkages with international trade. Indeed, this is because the world is interconnected through global value chains. Links between circular economy and trade can occur through various channels, from circular supply chains in raw materials, intermediate goods, and final products, to end-of-life value chains in waste and scrap, secondary raw materials and second-hand goods. This can also involve services trade as a circular economy transition generally entails a greater role for the services sector.

For this reason, the interface between trade and circular economy policies is increasingly attracting the attention of both trade negotiators and environmental policy makers. Trade

[1] While there is no universally agreed definition of circular economy to date, the OECD (2020[6]) takes a broad perspective in defining the circular economy as an economic system that (i) maximises the value of materials and products circulating in the economy; (ii) minimises material consumption, with a particular focus on virgin materials, toxic and hazardous substances, and specific waste streams; (iii) prevents waste generation; and (iv) reduces hazardous components in products and waste. In a similar vein, previous OECD work (McCarthy, Dellink and Bibas, 2018[7]) illustrates the circular economy as a concept to close, extend and narrow material loops by promoting reuse and recycling, using products longer, and enhancing material productivity, to reduce environmental impacts across a material's lifecycle. Taking this broad view, the circular economy concept is closely related to resource efficiency and sustainable materials management approaches.

and circular economy linkages were discussed at the WTO Public Forum in October 2018[2] and the WTO Committee on Trade and Environment in November 2019. The topic was also raised as a part of the World Circular Economy Forum in October 2018,[3] and June 2019.[4] In February 2020, the OECD organised a two day workshop on international trade and circular economy to establish a multi-stakeholder dialogue (OECD, 2020[1]).[5]

Despite this growing awareness of the interlinkages between trade and circular economy, there are limited comprehensive studies available to date that shed light on these issues. A recent report by Dellink (2020[2]) explores the impacts of a circular economy policy package on trade patterns in a modelling framework. Another report, (Kettunen, Gionfra and Monteville, 2019[3]), examines the interlinkages between trade and circular economy policies and initiatives at the EU level. The trade and circular economy concept paper by Yamaguchi (2018[4]) highlighted three additional areas of work: (i) securing policy coherence between trade and circular economy; (ii) understanding the nature of trade in waste and scrap, secondary raw materials, second-hand goods, and goods for refurbishment and remanufacturing, and (iii) role of international co-operation to make value chains more circular.

This report explores how to make circular economy policies and trade policies mutually supportive by mapping out potential misalignments and identifying opportunities to strengthen their common policy space to use resources more efficiently across their life-cycle and reduce associated environmental impacts. The study is based on a review of the following bodies of data and literature: (i) trade data available at the international and regional level; (ii) studies on the multilateral trade regime, regional trade agreements and the environment; and (iii) studies on developments in international trade and circular economy, resource efficiency and sustainable materials management policies.

The rest of the report is structured as follows. Section 2 highlights the interlinkages between international trade and circular economy. Section 3 examines the interactions between trade and circular economy at the policy level, specifically focussing on how trade policies can provide opportunities and challenges to a circular economy transition, and how circular economy policies can work within existing international trade regimes. Section 4 provides a forward-looking agenda to make trade and circular economy objectives mutually supportive by identifying potential actions that can be taken at the national and international level, and indicating knowledge gaps that merit further research.

2 See: https://www.wto.org/english/forums_e/public_forum18_e/public_forum18_e.htm.

3 See: https://www.sitra.fi/en/projects/world-circular-economy-forum-2018/.

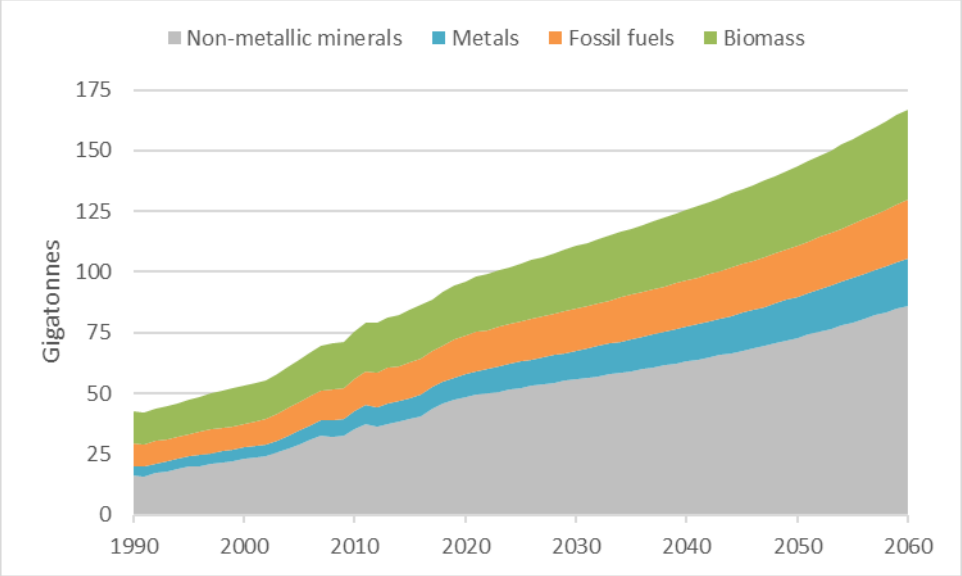
4 See: https://www.sitra.fi/en/projects/world-circular-economy-forum-2019/.

5 This report draws on the outcomes of this OECD workshop on international trade and circular economy, and the insights shared by trade and environment experts from governments, inter-governmental organisations, the private sector and the civil society. For details, see OECD (2020[1]).

2. What is the circular economy concept?

Between 2017 and 2060, global material use is projected to nearly double from 89 to 167 gigatonnes, driven by an increase in global population and economic growth (see Figure 1) (OECD, 2019[5]). The surge in natural resource demand will lead to various environmental consequences that arise from the extraction, consumption and end-of-life management of these materials, including water stress, biodiversity loss, climate change and local pollution. Environmental impacts from extraction and processing are estimated to more than double in this period (OECD, 2019[5]). While associated impacts will vary widely by material and their specific production processes, primary materials on average cause much more environmental damage than secondary materials (OECD, 2019[5]). In addition, greenhouse gas emissions related to materials management (from the combustion of fossil fuels for energy, from agriculture, from manufacturing, and from construction activities) will more than double in 2060 reaching 50Gt CO_2 equivalent emissions. Seven key metals – iron, aluminium, copper, zinc, lead, nickel and manganese – will account for 12% of total GHG emissions. Cement production will specifically account for an additional 12% of total GHG emissions. These environmental pressures call for a better management of materials used by society.

Figure 1. Projected global materials use to 2060



Source: OECD (2019[5]).

In this context, improved resource management through circular economy and similar policies and initiatives are attracting attention across the globe. Many countries are taking action to adopt policies to close, extend, and narrow material loops. Circular economy roadmaps were established by China in 2013, the European Union in 2015 (and updated in 2020), Finland, France, and the Netherlands in 2016, and Portugal and Slovenia in 2017. Japan adopted the Fundamental Law for Establishing a Sound Material-Cycle Society in Japan and the United States is implementing the Sustainable Materials Management Program Strategic Plan.

There is no universally agreed definition on circular economy to date. The OECD (2020[6]) defines circular economy as an economic system that (i) maximises the value of materials and products circulating in the economy; (ii) minimises material consumption, with a particular focus on virgin materials, toxic and hazardous substances, and specific waste streams; (iii) prevents waste generation; and (iv) reduces hazardous components in products and waste. Previous OECD work (McCarthy, Dellink and Bibas, 2018[7]) illustrates this as a concept to use resources more efficiently across their life-cycle by *closing*, *extending* and *narrowing material loops,* which eventually could result in decoupling primary raw material consumption from economic growth. The expected benefits of adopting circular economy principles are four-fold: (i) reduced extraction of virgin natural resources; (ii) lessened exposure to (geo-political) supply risk; (iii) reduced environmental pressures (including synergies with climate objectives); (iv) new economic and employment opportunities (McCarthy, Dellink and Bibas, 2018[7]).

Closing material loops aims to increase the utilisation of end-of-life products through recycling and use of secondary materials, as well as enabling multiple product lifecycles through reuse, repair, refurbishment and remanufacturing. *Extending materials loops* include initiatives to enhance product durability, either by extending a product's life or exploiting reuse and repair opportunities. *Narrowing material loops* entail various efforts towards resource efficiency by increasing material productivity throughout the product value chain and expanding the sharing and service economy. These characteristics are summarised in Table 1 below.

Table 1. Characteristics of a circular economy

	Features	Key effect	Policy examples
Closing the resource loop	• Recycling • Product repairing and remanufacturing	• Decreased demand for primary materials • Increased use of secondary materials	• Subsidies to secondary materials • Subsidies to recycling sector
Slowing the resource loop	• Longer-lived products • Product reuse and repair	• Decreased demand for primary materials • Better quality and durability of goods with higher prices	• Extended producer responsibility (EPR) • Product design standards
Narrowing the resource flow	• Increased material productivity • Improved asset utilisation • Changes in individual behaviour	• Decreased demand for primary materials • Expanded sharing and services economy	• Resource efficiency standards • Carpooling driving allowances

Source: McCarthy, Dellink and Bibas (2018[7]).

Circular economy policies generally entail approaches that may lead to lower rates of extraction and use of natural resources, including through resource efficiency policies. The circular economy concept is therefore closely related to improving resource efficiency where more economic value is produced with a particular amount of resources (McCarthy, Dellink and Bibas, 2018[7]). It is also largely aligned with the principles of a Sustainable Materials Management approach to promote sustainable materials use targeted at reducing negative environmental impacts and preserving natural capital throughout the life-cycle of materials (OECD, 2012[8]). The circular economy concept is also directly related to the Sustainable Development Goals (SDG) Goal 12 ensuring "sustainable consumption and

production patterns".[6] It is especially important to have an integrated approach where circular economy objectives need to be balanced with achieving other environmental outcomes such as climate change mitigation (Hund et al., 2020[9]) by strengthening synergies and avoiding key trade-offs.

[6] In this context, the circular economy concept has synergies with bioeconomy strategies and initiatives, which aim to ensure the sustainable extraction and management of biomass. Examples of these include the US Billion Ton Challenge and EU Bioeconomy Strategy.

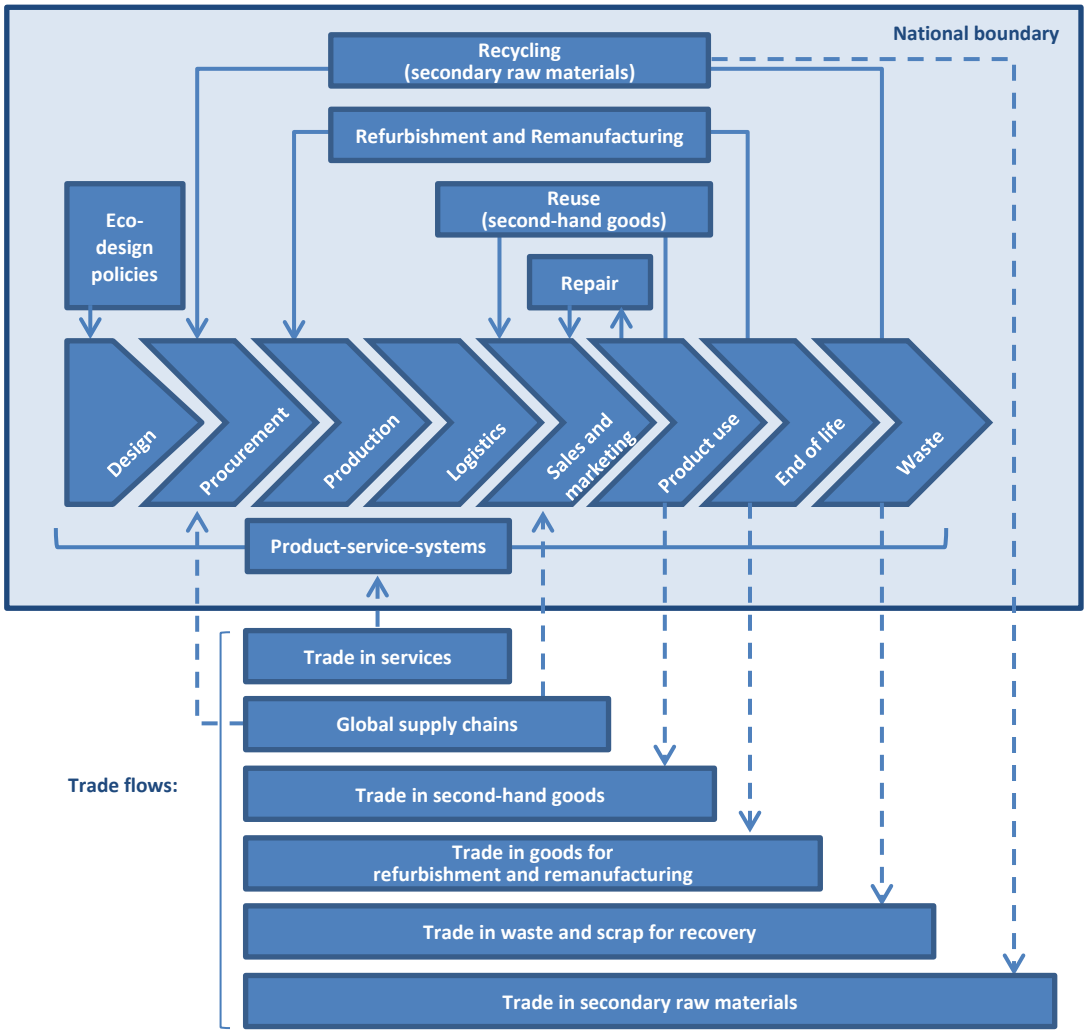
3. What are the interlinkages between circular economy and trade?

This section first outlines the main sources of interaction between circular economy and trade. It then further explores the implications of a circular economy on specific trade flows of (i) supply chains, (ii) end-of-life live value chains, and (iii) services.

3.1 Why is trade important for a circular economy transition?

Circular economy initiatives - such as recycling to close material loops, eco-design to extend material loops, higher-value loops such as repair, reuse, refurbishment and remanufacturing, as well as product service systems - largely take place domestically within national boundaries. However, the circular economy can have important interlinkages with international trade in several ways (see Figure 2).

Figure 2. Linkages between international trade and circular economy



Source: Author update of Figure 1 in Yamaguchi (2018[4]).

In relation to goods, two distinct trade flows can influence the circularity of an economy, i.e. trade within supply chains and trade of end-of-life products. For example, upstream efforts on eco-design or managing material content would need to take account of supply chains that stretch across borders, as imports can occur through trade in raw materials and intermediate goods that feed into production processes as well as final products for end-user consumption. Concerning end-of life value chains, products reaching their end-of-life can be collected (processed) and exported as trade in waste and scrap, trade in secondary raw materials, trade in goods for refurbishment and remanufacturing, and trade in second-hand goods.

In addition to trade in goods, circular economy can also have implications on trade in services. A circular economy transition generally has a higher degree of service sector involvement such as maintenance, repair, and product service systems, and may bring about new opportunities for services trade (Yamaguchi, 2018[4]).

3.2 Supply chains

Ensuring environmentally sustainable supply chains is an important aspect of the transition towards a more resource efficient and circular economy. The emergence of global value chains with cross-border trade in raw materials, intermediate goods, and final products enables associated environmental impacts to occur in places different from where final consumption takes place.

There are two key ways to measure material consumption in our economies. First, domestic material consumption (DMC) is an indicator that measures the amount of materials directly used in an economy. It is defined as the domestic extraction of materials, plus all physical imports minus all physical exports (OECD, 2020[10]; 2015[11]; Eurostat, 2018[12]).[7] Thus, this indicator is made up of two components that measures two different things in terms of weight, namely raw materials (extracted domestically) and physical products (crossing borders). This asymmetry of measuring raw materials and physical products is sometimes perceived as a shortcoming because the weight of traded products does not represent the larger amount of raw material inputs required at their production stage.[8]

Second, a complementary indicator is material footprint,[9] also known as raw material consumption (RMC), which represents the domestic final use of products in terms of raw material equivalents. It captures the amount of domestic and foreign extraction of materials needed to produce the final products used domestically, and is defined as domestic extraction of materials, plus imports in raw material equivalents, minus exports in raw material equivalents (OECD, 2020[10]; 2015[11]; Eurostat, 2018[12]).

[7] DMC is the amount of materials used in an economy in terms of weight (materials extracted or harvested in the country, plus materials and products imported, minus material and products exported). OECD data refer to metals, non-metallic minerals (construction minerals, industrial minerals), biomass (wood, food) and fossil energy carriers.

[8] For example, raw materials inputs needed for energy feedstock does not become physically part of the final product.

[9] See: OECD (2020[10]) database on material resources, which includes material footprint as "the global allocation of used raw material extracted to meet the final demand of an economy": https://stats.oecd.org/.

The material footprint of certain economies can be significantly larger than their DMC (OECD, 2016[13]; Giljum, Bruckner and Martinez, 2015[14]; Wiedmann et al., 2015[15]). This means that material extraction occurs at various stages of a product's global value chain. Therefore, consumption-based indicators – such as material footprint – are important to correctly measure efforts to decouple material consumption from economic growth.

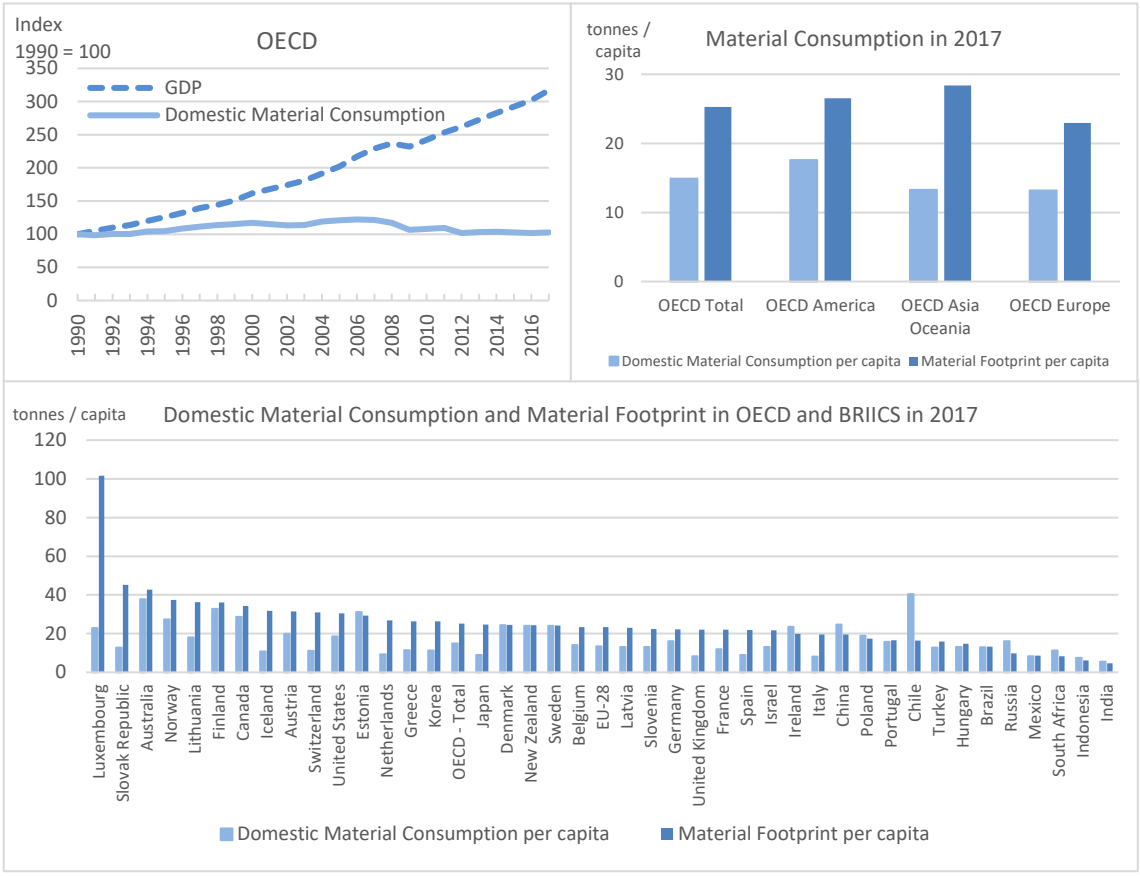
Indeed, between 1990 and 2017, the OECD experienced a 220% economic growth rate, while DMC remained flat and stable (Figure 3, upper left panel). With a focus on DMC, OECD countries seemingly appear to achieve absolute decoupling of the material use from economic growth.

However, when taking account of raw material equivalents in traded products consumed by OECD countries, the use of materials is greater. With a focus on material footprint, the material use per capita in the OECD increases significantly compared to a narrow focus on DMC. This is with the exception of a few countries including Chile, Denmark, Estonia, Ireland, New Zealand, and Sweden. In 2017, the OECD's material footprint per capita was 25 kilo tonnes compared their DMC per capita of 15 kilo tonnes, highlighting that total material use increased by 67% when taking account of raw material equivalents in traded products (Figure 3, upper right panel).

In contrast, a number of resource rich economies, notably Chile and BRIICS, have higher DMC per capita than material footprint per capita. This can be explained by their export intensive activities related to intermediary goods as well as final products (Figure 3, bottom panel).

For these reasons, raw materials equivalents in traded products is very important. As many economies are interdependent on traded products, securing environmentally sustainable supply chains need to be part of a country's considerations in pursuing a circular economy.

Figure 3. Material use in the OECD



Note: Domestic material consumption (DMC) represents the amount of materials directly used in an economy in terms of weight. It is defined as the domestic extraction of materials, plus all physical imports minus all physical exports. The data refer to metals, non-metallic minerals (construction minerals, industrial minerals), biomass (wood, food) and fossil energy carriers. Material footprint represents the domestic final use of products in terms of raw material equivalents in terms of weight. It is defined as domestic extraction of materials, plus imports in raw material equivalents, minus exports in raw material equivalents.
Source: OECD (2020[10]) indicators - Gross Domestic Product (GDP), Domestic Material Consumption (DMC), Material Footprint.

At the global level, the substitution of primary raw materials by secondary raw materials does not appear to be happening to date. Focussing on metals and minerals, Dussaux and Glachant (2019[16]) empirically test whether increased domestic recycling and supply of secondary raw materials offset dependency on primary raw material imports. They find that increased domestic recycling boosts domestic supply of secondary raw materials and subsequently decreases import dependency of secondary raw materials. However, they also find that increased domestic recycling does not affect the import levels of primary raw materials. These findings suggest that complete substitution of primary raw materials by

secondary raw material is not happening so far.[10] This also reflects findings of related work that focus on global trends of material use (OECD, 2019[5]; UNEP, 2019[17]).

Looking into possible future scenarios, a modelling study by Dellink (2020[2]) explores how the widespread implementation of circular economy policies may impact trade patterns in the coming decades. This study analyses the consequences of a stylised package of circular economy policies on trade patterns to 2040, using the OECD's ENV-Linkages model.[11] Results show that, compared to a scenario with no additional circular economy policies, the policy package leads to more substitution of primary with secondary raw materials, although the secondary sector remains small. Furthermore, the study finds that, even under the assumption that all countries adopt a uniform policy package, the policies imply changes in trade patterns, especially for material-related commodities (e.g. metals). This results from differences in countries' comparative advantage in treating materials.

The substitution of primary raw materials to secondary raw materials will not happen overnight and would largely depend on the specifics of each commodity and the recycling and recovery technologies in place. Some studies indicate that secondary materials will only replace primary materials at the margins, in part due to downcycling with the current technologies available (OECD, 2021, forthcoming[18]). Other studies similarly estimate that complete substitution of primary raw materials by secondary raw materials is unlikely to occur at all in the immediate future, due to cost–competitiveness issues, technological challenges and the limited supply of end-of-life materials to meet the growing demand of certain materials (Hund et al., 2020[9]; UNEP, 2013[19]).[12]

Nevertheless, the adoption and implementation of ambitious circular economy policies, as projected in the modelling exercise, is expected to gradually substitute primary raw materials by secondary raw materials. Hence, the demand for trade in primary raw materials may eventually decrease with the uptake of ambitious circular economy policies.

This means that, resource rich economies may need to shift their economies in terms of infrastructure and labour force (Yamaguchi, 2018[4]; Kettunen, Gionfra and Monteville, 2019[3]; Preston and Lehne, 2017[20]; Pacini, 2018[21]). The OECD workshop on international trade and circular economy (OECD, 2020[1]), highlighted that some resource rich economies are also considering of the transition to a more circular economy and

[10] The study by Dussaux and Glachant (2019[16]) focuses on primary and secondary raw material imports and domestic recycling, however, does not test effects on exports, which is subject to further analysis.

[11] The stylised package of circular economy policies in Dellink (2020[2]) includes virgin material taxes, subsidies to promote recycling and use of secondary raw materials. See Dellink (2020, p. 15[2]) Box 1 for further details.

[12] For example, while 75% - 85% of steel is globally recycled, around one-third of global steel production still relies on primary material inputs, because most part of steel is locked up in long-term durable structures and thus the supply of steel scrap is not enough to meet current levels of demand (Hund et al., 2020[9]; UNEP, 2011[94]). Furthermore, the demand for lithium and cobalt particularly used in batteries for electric vehicles is expected to increase by 500% by 2050 (Hund et al., 2020[9]). Some recycling processes currently available lead to losses in the material itself and may not be technically or economically feasible to recover specific materials such as lithium, whose recycling rates remain below 1% to date (Hund et al., 2020[9]; UNEP, 2013[19]). Moreover, certain applications require high purity and quality materials that are not retrievable with current recycling technologies, such as the case for cobalt used in batteries (Hund et al., 2020[9]).

making efforts to make their extractive sector more sustainable. In adopting and implementing circular economy policies, discussions also pointed out the need to ensure a just transition for the extractive sector conferring for labour and social aspects.

For resource rich economies, efforts towards diversification and scale-up by fostering production transformation away from their dependence on primary material production can be key strategies (OECD, 2016[22]). Aligning scale up and transformation efforts with emerging circular economy and sustainability standards such as material content, recycled content, avoiding hazardous content, recyclability, reparability, and sustainable production could be one way forward to a reduction in environmental impacts from materials.

In order to ensure that a product's value chain is environmentally sustainable, the entire product life cycle needs to be taken into consideration (De Lange, Walsh and Sheeran, 2018[23]). In other words, how products are produced and what they consist of matter to a circular economy transition. Making environmental footprint information available throughout a product's value chain and environmental labelling and standards could provide opportunities for a step forward. Ensuring the adoption of internationally recognised standards on responsible business conduct (RBC) is another key pathway to securing environmental sustainability in global supply chains.[13] The resolution on mineral resource governance adopted by the United Nations Environment Assembly (UNEA4) in March 2019 may provide additional avenues to explore the different governance initiatives and approaches relating to sustainable management of metal and mineral resources.[14]

Nevertheless, domestic policies to ensure sustainable supply chains may have unintended implications on global value chains and trade, and thus need to be designed and implemented in a non-discriminatory fashion. These issues are further examined under Sections 4.2.4 and 4.2.5.

3.3 End-of-life value chains

End of life products can cross borders in various forms including trade in waste and scrap, secondary raw materials, goods for refurbishment and remanufacturing, and second-hand goods. The following subsections highlight related issues in these areas.

3.3.1 Trade in waste and scrap

The landscape of trade in waste and scrap is rapidly evolving. While general trends show volumes of global trade in waste and scrap increasing over the past two decades, new measures further restrict trade in waste and scrap either multilaterally – i.e. under the Basel Convention plastic waste amendments - or unilaterally – e.g. the Chinese import restrictions on plastics, unsorted paper, and other waste and scrap.

According to the OECD trade and environment indicators developed by Garsous (2019[24]) and updated based on UN COMTRADE data, global trade in waste and scrap reached 182 million tonnes in weight and USD 95 billion in value in 2018 (Figure 4, upper panel). Metal, paper and plastic waste and scrap all together accounted for 97% in total value and 95% in total weight in 2018 (Figure 4, middle panel). In particular, metal waste and scrap

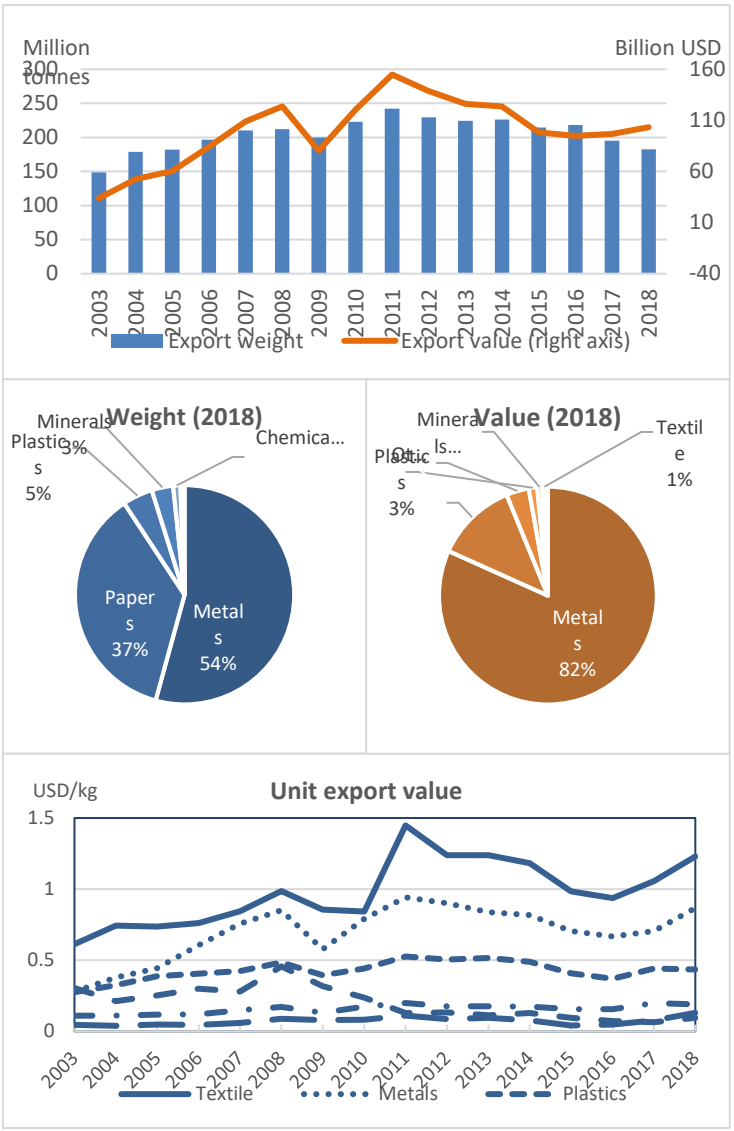
[13] See: OECD (2021, forthcoming[97]) "Responsible Business Conduct tools and instruments to address environmental challenges".
See also OECD MNE Guidelines: https://mneguidelines.oecd.org/mneguidelines/.

[14] See the resolution on mineral resource governance adopted by the United Nations Environment Assembly on 15 March 2019 (UNEA4): https://undocs.org/UNEP/EA.4/Res.19.

accounted for 82% of total value and 54% of total weight in 2018 making them the most traded category of waste and scrap. This was followed by paper (12% in total value, and 37% in total weight in 2018), and plastics (3% of total value, and 5% of total weight in 2018).

Over the period of 2003 to 2018, the amount of waste and scrap trade peaked in 2012, and generally increased over time by 204% in value, while 23% in weight, implying that the unit value of waste and scrap has significantly increased during the past decade. In the same period, the unit value of metals increased by 210%, paper by 73%, and plastics by 58% (Figure 4, lower panel). This reflects that waste and scrap continue to be resources with intrinsic economic and commercial value.

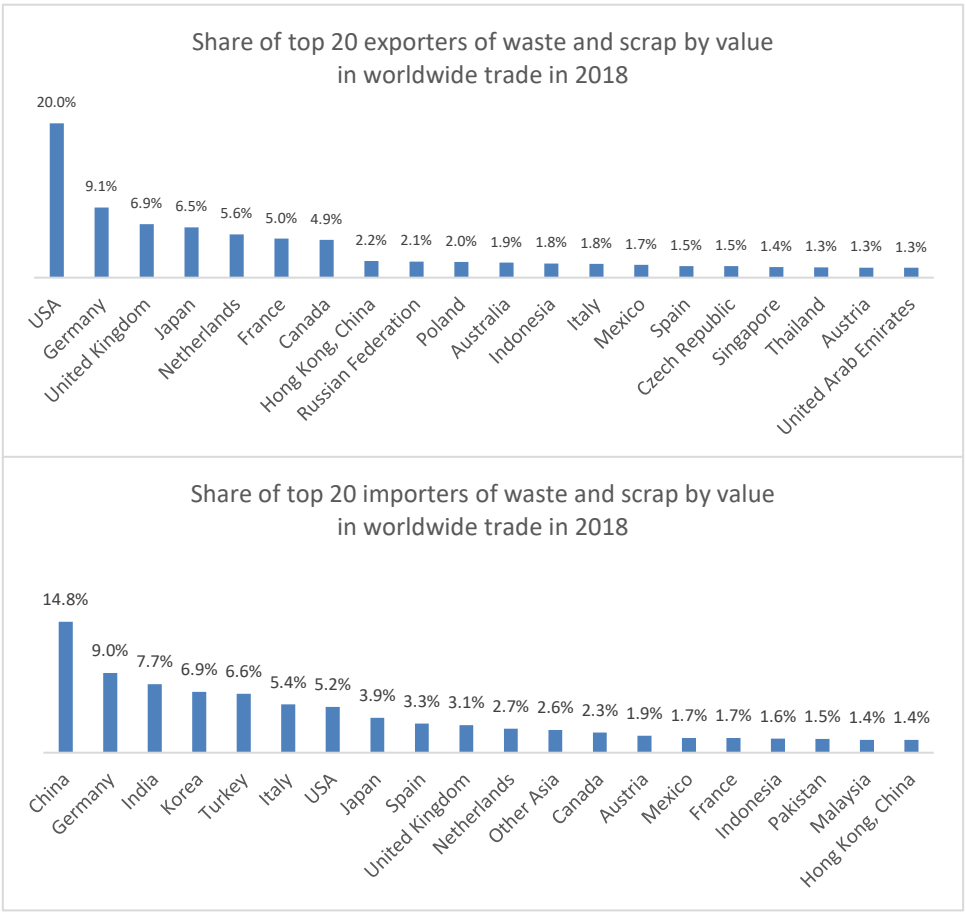
Figure 4. Trends of waste and scrap trade



Note: Waste and scrap items are those contained in the list of 62 Harmonized System (HS) codes used in Garsous (2019[24]) provided by (Kellenberg, 2012[25]).
Source: Author based on Garsous (2019[24]) and UN COMTRADE.

Waste and scrap trade involves a limited number of countries (Figure 5). In 2018, the top 20 exporters and importers accounted for 80% of worldwide exports and 85% of worldwide imports respectively. Major exporters were OECD countries including the United States, Germany, United Kingdom, Japan, Netherlands, France and Canada. Major importers were both OECD and non-OECD countries involving Germany, Korea, Turkey, Italy, United States, Japan, Spain, United Kingdom, and the Netherlands as well as China, and India. Notably, China continued to be the largest importer of waste and scrap despite the import bans imposed from 2018 (see Box 1 for further details of the Chinese import ban). This is because the Chinese ban mainly addresses plastic waste and scrap, unsorted paper waste and scrap, and certain fractions or metal waste and scrap, while sorted paper and majority of metal waste and scrap continue to be imported.

Figure 5. Share of top 20 traders of waste and scrap

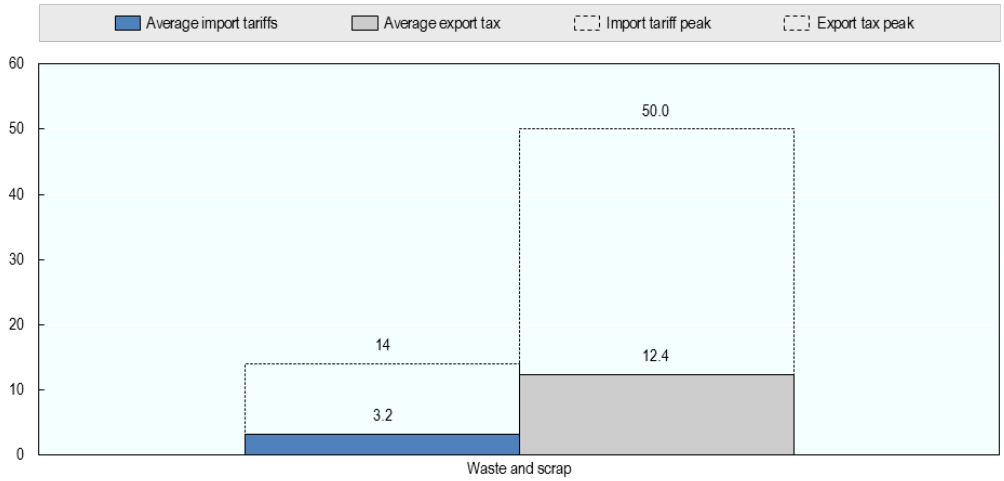


Note: Waste and scrap items are those contained in the list of 62 Harmonized System (HS) codes used in Garsous (2019[24]) provided by (Kellenberg, 2012[25]).
Source: Author based on Garsous (2019[24]) and UN COMTRADE.

Current restrictions on trade in waste and scrap appear to more significant for exports than for imports. According to OECD (2021, forthcoming[18]), export restrictions are prevalent for metal waste and scrap and can take various forms including export prohibitions, quotas, taxes, non-automatic export licensing requirements, and any other export restriction. During 2012-2014 for metallic waste and scrap, the average of non-zero export taxes was 12.4% (with a maximum of 50%), while the average import tariff was 3.2% (with a

maximum of 14%) (Figure 6). In 2014, 40% of traded copper waste and scrap, 30% of traded aluminium waste and scrap, and 20% of iron and steel waste and scrap, were subjected to at least one type of export restriction (OECD, 2021, forthcoming[18]).

Figure 6. Average and maximum import tariffs and export taxes on metallic waste and scrap



Note: Average import tariffs are simple averages of ad-valorem tariffs imposed by OECD countries, EU countries, and China over the period 2012-2014. Export tariffs are simple averages of all ad-valorem export taxes recorded in the OECD Inventory of Restrictions on Exports of Industrial Raw Materials over the period 2012-14. Tariff and tax peaks represent the highest value in the respective sets.
Source: OECD Inventory of Export Restrictions on Industrial Raw Materials and UNCTAD TRAINS.

Trade can provide potential opportunities to transform waste into resources. It can contribute to achieve economies of scale in collecting waste destined for recycling and (material and energy) recovery operations. Furthermore, trade can channel waste and scrap to countries with comparative advantage in sorting and processing them into valuable materials (OECD, 2021, forthcoming[18]; 2018[26]; Yamaguchi, 2018[4]; Higashida and Managi, 2013[27]).

However, potential consequences in waste and scrap trade also need to be considered (OECD, 2018[26]; Yamaguchi, 2018[4]; Shinkuma and Managi, 2011[28]). For example, waste and scrap can be traded to destinations with insufficient recycling and waste management capacity (Kellenberg, 2012[25]; Farrelly, Schneider and Stupples, 2016[29]; Yanai, 2014[30]). Moreover, many of these destinations have issues related to illegal waste trade and the informal sector (OECD, 2016[31]; Shinkuma and Managi, 2011[28]; Huisman et al., 2015[32]; INTERPOL, 2020[33]).

In response to these challenges in waste and scrap trade, a number of initiatives emerged in the form of unilateral and multilateral measures, including in China and under the Basel Convention respectively. These recent and on-going developments will re-shape the landscape of trade in waste and scrap, and require close examination. Claiming that waste imports are polluting the environment, China has started to impose import restrictions on waste and scrap taking effect in several phases from January 2018 (See Box 1).

Box 1. China's import restriction on waste and scrap

China made three notifications to restrict imports on waste and scrap. Two WTO notifications were made on 18 July 2017 and 15 November 2017. The prior listed 24 types of waste and scrap to be prohibited for imports from 1 January 2018 and the latter set forth a maximum level of contamination (0.5% by weight) for 11 categories of waste and scrap to come into effect from 1 March 2018. [15] A further announcement was made on 13 April 2018 to further add 32 categories of waste and scrap to be prohibited for imports taking effect sequentially either from 31 December 2018 or 31 December 2019. [16]

According to these announcements, import bans are mainly applied on plastic waste and scrap, unsorted paper waste and scrap, and certain fractions of metal waste and scrap, as well as other specific waste fractions. All of these trade restrictions are applied with the motivation to prevent and control environment pollution.

These import bans imposed by China since 2018 are already changing the patterns of waste and scrap trade for specific commodities. Over the period of 2016 to 2018, the amount of worldwide trade in plastic waste and scrap decreased by 60% and those destined to China decreased by 98% since the peak in November 2016 (see Figure 7).

These measures have potential consequences in several ways as the fractions of plastic waste and scrap that used to be traded are now managed or stockpiled domestically or diverted to other outlets. First, for exporters lacking domestic capacity to process these materials, the restrictions may provoke increased domestic stockpiling, incineration, and landfilling (at least in the short term). Second, the trade restrictions can risk diverting waste and scrap exports to countries with relatively weak treatment standards including alternative sinks mainly in South and South-East Asia. Indeed, some countries have periodically experienced a surge in annual imports between 2016 and 2018, notably Thailand (772%), Turkey (648%), Malaysia (314%), Indonesia (284%), India (137%), and Viet Nam (133%). In response, a number of countries have started to consider replicating Chinese-like import controls and bans for waste and scrap imports including those by India, Indonesia, Thailand, Malaysia, and Viet Nam (Staub, 2018[34]; Kettunen, Gionfra and Monteville, 2019[3]). India introduced import bans on plastic waste and scrap from August 2019.[17] Thailand has similarly announced to impose a complete import ban on plastic waste and scrap by 2021.[18] Malaysia and Viet Nam have made moves to reduce the issuances of licences and permits to import waste and scrap.[19]

15 See: WTO notifications G/TBT/N/CHN/1211 and G/TBT/N/CHN/1233.

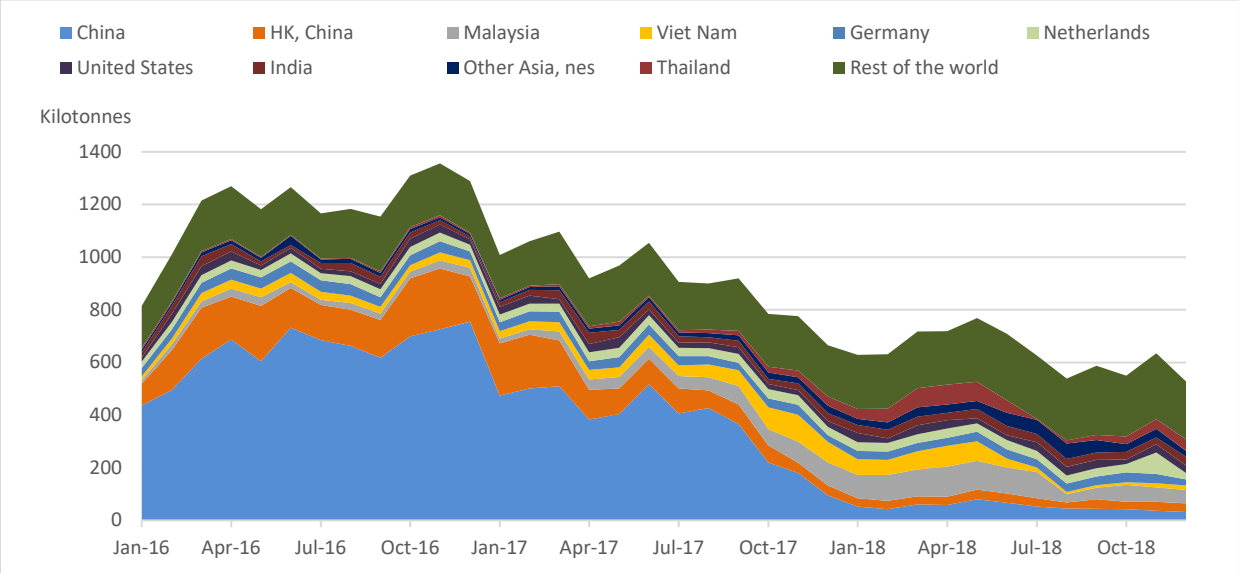
16 See: www.bir.org/assets/Documents/China/Legislation/2018/Announcement-No.-6-of-2018-Final.pdf.

17 See: https://resource-recycling.com/plastics/2019/08/14/plastic-shipments-to-india-stall-as-ban-draws-near/.

18 See: https://www.reuters.com/article/us-thailand-environment-plastic/thailand-kicks-off-2020-with-plastic-bag-ban-idUSKBN1Z01TR.

19 See: https://www.reuters.com/article/us-vietnam-waste/vietnam-to-limit-waste-imports-as-shipments-build-up-at-ports-idUSKBN1KG0KL.

Figure 7. Monthly exports of plastics waste and scrap by destination



Note: Other Asia, nes (not elsewhere specified) includes trade data for territories belonging to Asia, but not specified by country in the data set (e.g. Chinese Taipei).
Source: Author based on UN COMTRADE (HS code 3915).

The Basel Convention is also seeking to address some of these increasing environmental concerns over waste and scrap trade. At the Conference of the Parties to the Basel Convention (Basel COP 14) from April to May 2019, Parties adopted amendments to the Convention to increase controls on the transboundary movement of plastic waste and scrap that will come into effect from January 2021.20 Parties also adopted on an interim basis, the revised technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment.21 These amendments and updates will

[20] At Basel COP 14, Parties agreed on detailed amendments to better address plastics in the three categories of Annex II (wastes requiring special consideration) and Annex VIII (hazardous waste) that would be subject to Basel controls and Annex IX (non-wastes) that would be exempted from Basel controls. These distinctions are expected to improve controls over transboundary movements for hazardous, contaminated or mixed plastic waste that are difficult to recycle, while exempting certain mixtures of plastic waste destined for recycling from the Convention. These new rules will come into effect from 2021. The text of the amendments is contained in the decision BC-14/12, which is available at: http://www.basel.int/TheConvention/ConferenceoftheParties/Meetings/COP14/tabid/7520/Default.aspx.

[21] Some issues remain in distinguishing export of wastes for refurbishment, as this can be a potential loophole for end-of-life products to be exported under the guise of "repairability." For this reason, the Basel Convention will continue its work on e-waste under the Expert Working Group and carry forward discussion to the next Basel COP in 2021. Details of the provisional adoption of the revised technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment is contained in the report UNEP/CHW.14/28, which is available at: http://www.basel.int/TheConvention/ConferenceoftheParties/Meetings/COP14/tabid/7520/Default.aspx.

increase controls over transboundary movements of hazardous, contaminated or mixed plastic waste that are difficult to recycle, while exempting certain mixtures of waste destined for recycling from the Convention to facilitate trade (IISD, 2019[35]).

In a similar vein, in December 2019, the EU announced the European Green Deal,[22] which lays out commitments to tackle climate and environmental-related challenges. This strategic document indicates that "The Commission is of the view that the EU should stop exporting its waste outside of the EU and will therefore revisit the rules on waste shipments and illegal exports." These recent and on-going developments to restrict waste and scrap trade at the multilateral, supra-national and national levels will reshape the landscape of trade in waste and scrap and requires close examination.

There are also issues arising from the definition and classification of waste in different jurisdictions as well as the trade codes based on the Harmonised System (HS code). (OECD, 2021, forthcoming[18]; Yamaguchi, 2018[4]; OECD, 2010[36]) Amendment proposals for HS codes have been made by the Secretariat of the Basel Convention to the World Customs Organization in the past (Secretariat of the Basel Convention, 2013[37]). Two issues have been identified in this process. First, the current HS codes that cover waste and scrap do not distinguish between those that are hazardous or non-hazardous, leaving the task to custom authorities to check on a case-by-case basis. No visible distinction can be made to clearly distinguish hazardous and non-hazardous waste making this a difficult task. Second, distinguishing waste from second-hand goods is also extremely difficult. While there is a distinction in HS codes between products and waste, it is sometimes difficult to make a visual distinction between the two.

As a related and notable development, the World Customs Organization (WCO) published amendments to the HS codes that include *inter-alia* new entries on electrical and electronic waste and scrap that will enter into force on 1 January 2022.[23] This new entry on electrical and electronic waste and scrap has 11 subheadings at the 6 digit level is foreseen to increase the granularity of trade data on e-waste.

Drivers and impacts of waste trade have been theoretically examined by Mazzanti and Zoboli (2013[38]). [24] According to their study, environmental impacts of waste trade can emerge from transportation and waste management operations. In certain circumstances, depending on the proximity of transport, and the available waste management technologies as well as environmental rules in place, waste trade could theoretically increase or decrease overall environmental impacts.

[22] See: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.

[23] See WCO published amendments to the Harmonized System (HS) nomenclature (HS8549 on electrical and electronic waste and scrap): http://www.wcoomd.org/en/media/newsroom/2020/january/wco-has-published-accepted-amendments-to-hs-2022.aspx.

[24] Mazzanti and Zoboli (2013[38]) identify nine potential drivers of waste trade: (i) gate fees and transportation, (ii) administrative costs, (iii) tariffs and non-tariff barriers, (iv) differences in environmental taxes and policy stringency, (v) differences in treatment capacity across countries, (vi) different incentives for recycling and recovery (energy), (vii) differences in legislation and classification, (viii) need for specific technologies, and (ix) geographic characteristics of countries and regions.

Trade flows in waste and scrap in itself does not indicate an increase or decrease in environmental pressures. The question is rather if traded waste and scrap is processed and recovered in an environmentally sound manner and closely in-line with circular economy objectives (OECD, 2010[36]; Shinkuma and Managi, 2011[28]). More ambitiously, it would be important to understand to what extent waste and scrap trade potentially contributes to upcycling and downcycling,[25] and further recovery processes down the waste hierarchy.[26] In this sense, distinguishing trade in waste for material recovery and those intended for energy recovery would be particularly important despite the potentially challenging task. Furthermore, facilitating trade in secondary raw materials would be important to use resources more efficiently across their life-cycle and reduce their associated environmental impacts. For this reason, understanding the nature, rational and impacts of imposing trade restrictions, in particular export restrictions on waste and scrap, and secondary raw materials, would be issues that merits further investigation (OECD, 2021, forthcoming[18]; 2010[36]).

3.3.2 Trade in secondary raw materials

Trade in secondary raw materials (e.g. sorted metal scrap, recycled plastic pellets)[27] is an important element of circular economy policy. In an ideal world, it would be worthwhile to track global trade flows of secondary raw materials to understand their nature.

However, the current HS codes based on six digits do not allow distinguishing secondary raw materials from waste and scrap. Indeed, the OECD (2015[11]) report on material productivity and resources highlight that there are significant information gaps concerning international trade data on recycled or secondary raw materials that limit the calculation of material flow indicators at the international level.[28] While the study by Dussaux and Glachant (2019[16]) focus on domestic recycling and their impact on secondary raw materials imports, their method in identifying secondary raw materials in trade is through a narrow set of 31 HS codes on certain metal waste and scrap that is still a vague proxy of their recyclable content.

---

25 Both upcycling and downcycling encompasses material recovery processes. Upcycling involves the transformation of waste into secondary raw materials and their subsequent use in relatively high value applications. Downcycling entails a transformation process of waste into secondary raw materials where recovered materials are of an inferior quality and can only be used as an input in a limited subset of applications (OECD, 2019, p. 17[48]).

26 The waste hierarchy is a concept to guide waste management policies in many OECD and non-OECD countries. While there is no universally agreed definition to date, the waste hierarchy generally gives first order priority to limit the generation of waste, then to recycle and recover materials from what is generated, followed by energy recovery from waste, and only then to dispose of what remains, in order to minimise environmental impacts associated with various solid waste management options. See OECD (2019[48]) Box 5.1 for details.

27 Secondary raw materials are materials that have been manufactured and used at least once, and that are recovered (from the waste stream or from used products) to be used again for further manufacturing (OECD, 2008[93]).

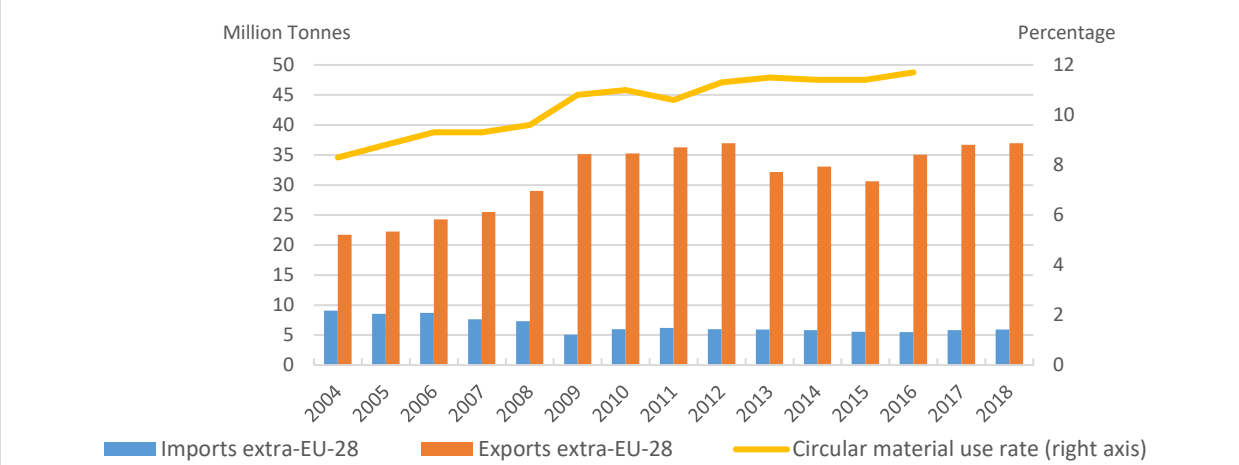
28 Beyond trade data for secondary raw materials, the limited availability of underlying data on mineral recycling rates and lifetime of materials in durable structures can also pose challenges to understand the flow of secondary raw materials internationally.

When focussing at a regional scale, more detailed data exists on trade in secondary raw materials. In the EU, Eurostat publishes data on trade in secondary raw materials based on the EU's eight digit Combined Nomenclature (CN) which provides more granularity than six digit HS codes. In 2016, EU secondary raw materials exports represented roughly 36% of total waste and scrap trade.[29] In combination with the circular material use rate, that is the share of material recovered and fed back into the economy in overall material use, a regional picture appears in the uptake of secondary raw materials.

At a glance, the EU is processing more secondary raw materials domestically, and advancing their trade balance of these materials. From 2004 to 2016, EU's circular material use rate increased by 3.4 percentage points from 8.3% to 11.7% (See Figure 8). Driven by increased domestic circular material use, exports of secondary raw materials increased by 70% from 21.7 million tonnes in 2004 to 36.9 million tonnes in 2018. Correspondingly, imports dropped by 35% from 9 million tonnes in 2004 to 5.9 million tonnes in 2018.

Securing the quality and content as well as establishing markets for these materials is essential for their uptake. Therefore, the role of material quality standards, material content standards, certification schemes as well as eco-design, eco-labelling and government procurement schemes are expected to be critical to scale up a resource-efficient and circular economy (OECD, 2018[26]; 2016[31]; 2016[13]; Prag, Lyon and Russillo, 2016[39]).

Figure 8. EU trade in recyclable raw materials and circular material use



Note: Trade in recyclable raw materials include five categories of plastic; paper and cardboard; precious metal; iron and steel; copper, aluminium and nickel, based on selected codes available at https://ec.europa.eu/eurostat/documents/8105938/8465062/cei_srm020_esmsip_CN-codes.pdf.
Circular material use rate measures the share of material recovered and fed back into the economy in overall material use as indicated in https://ec.europa.eu/eurostat/tgm/web/table/description.jsp.
Source: Author based on Eurostat (2019) indicators on "trade in recyclable raw materials" and "circular material use rate".

[29] Total waste trade is based on UN COMTRADE data and HS codes on waste and scrap identified by Kellenberg (2012[25]). These are documented trade flows and excludes undocumented or illegal waste trade.

3.3.3 Trade in second-hand goods, goods for refurbishment and remanufacturing

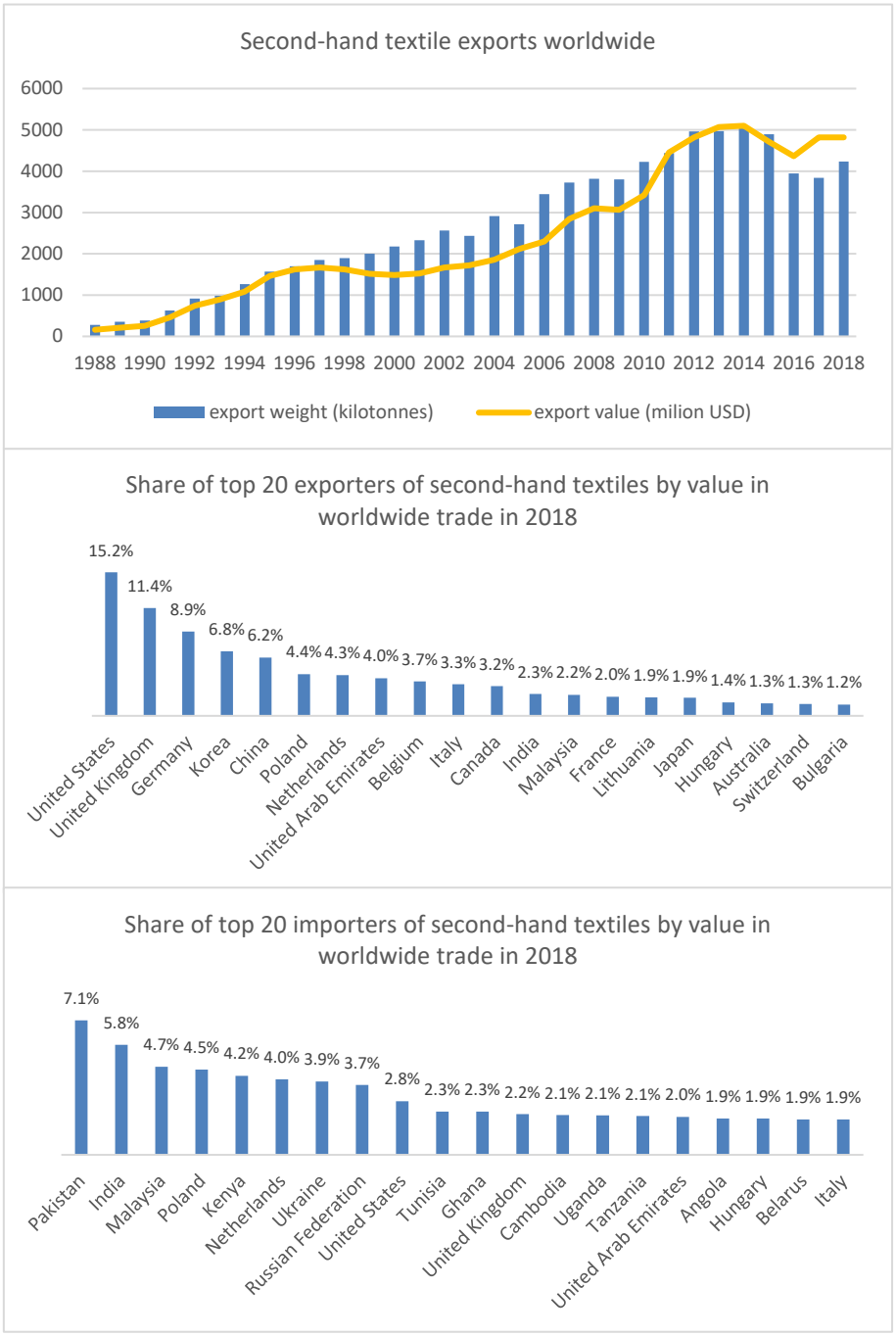
Trade in second-hand goods can be considered as a positive means to keep materials in use before these products reach their end-of-life. This is typically the case when there is demand for second-hand goods abroad but not domestically. Data on global trade in second-hand goods could help understand the nature of these products and their overall contribution to use resources efficiently across their life-cycle and to limit associated environmental impacts. However, data remains very scarce, as it is difficult to distinguish them from new products or waste in the HS codes.

At the global level, data is available on trade in second-hand textiles as well as used tyres.

Between 1988 and 2018, global exports on second-hand textiles increased 12 fold by weight and 26 fold by value, and reached 3.4 billion tonnes and USD 4.2 billion in 2018. Exports were largely from OECD countries, which represented 77% of total export value in 2018. Notably, in addition to OECD countries, a number of non-OECD countries including China and India were also among the top 20 exporters. In contrast, imports were mainly made by non-OECD countries which represented 66% of total import value in 2018. Top 20 importers include countries from South and South-East Asia and Africa plus a number of OECD countries (Figure 9).

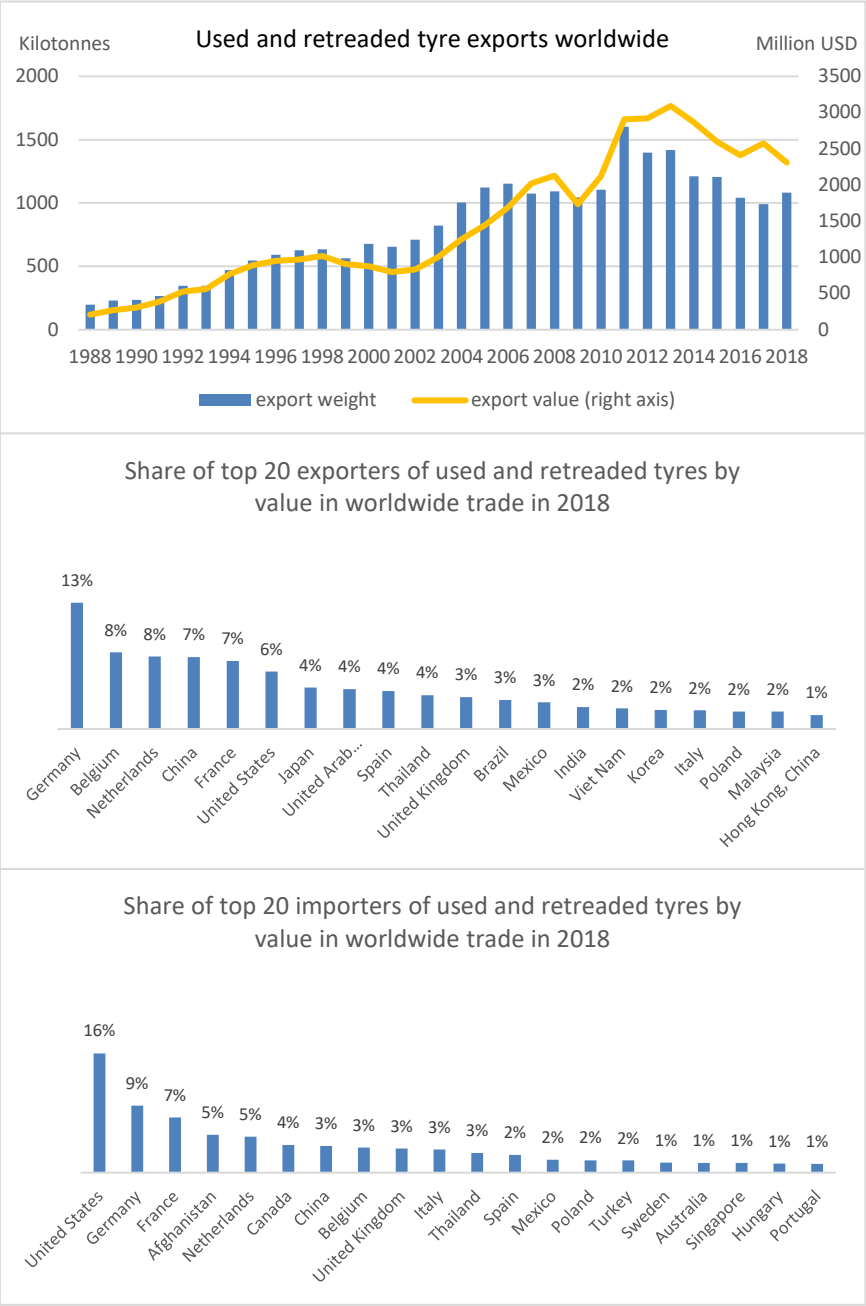
Over the same period of 1988 to 2018, global exports on used and retreaded tyres grew 5 fold in weight and 11 fold in value, marking 1 billion tonne and USD 2.3 billion in 2018. The majority of importers and exporters were both from OECD countries, representing 70% and 72% of trade value respectively in 2018 (Figure 10).

Figure 9. Trends in second-hand textile trade



Note: Data is based on used clothing (HS630900), used or new rags sorted (HS631010), and new or used rags unsorted (HS631090).
Source: Author based on UN COMTRADE.

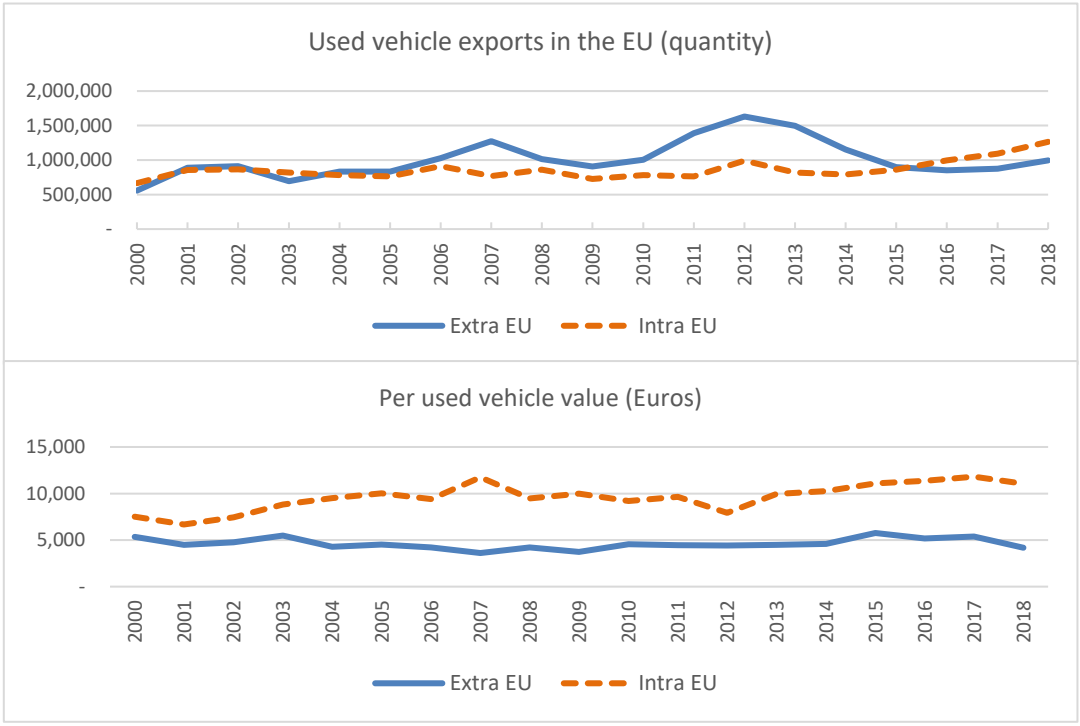
Figure 10. Trends in used and retreaded tyre trade



Source: Author based on UN COMTRADE (HS4012).

There is further documentation on trade in second-hand vehicles from Eurostat. Over the period of 2000 to 2018, the number of EU exports of second-hand vehicles grew by 79% from 558 thousand units in 2000 to 996 thousand units in 2018. This was outpaced by intra-EU exports that grew by 90% over the same period from 762 thousand units in 2000 to 1265 thousand units in 2018. The average per unit value for second-hand vehicle exports was EUR 4,165 for external exports, while over double for intra-exports reaching EUR 11,038 (Figure 11).

Figure 11. EU exports of used vehicles



Source: Author based on Eurostat (2019).

Despite the potential benefits of second-hand goods trade to contribute to a circular economy, there are potential trade-offs to take into consideration. Trade in second-hand goods can create lock-in of importing economies into old and inefficient technologies, such as second-hand vehicles with high emissions (Czaga and Flies, 2005[40]). For this reason, some countries have established import restrictions and bans of second-hand goods (e.g. old and inefficient second-hand vehicles) as a part of their Nationally Determined Contributions (NDCs) under the Paris climate accord (Brandi, 2017[41]). There can also be issues related to potential downcycling of end-of-life products depending on the level of recycling, recovery and waste management technologies available at their destination. Second-hand goods trade is also a concern for some importing countries as they can be a potential loophole for illegal trade in hazardous or contaminated waste that would otherwise be subject to Basel controls. Second-hand goods can also raise potential issues with the right-to-repair and their relationship with protecting Intellectual Property Rights in certain trade agreements.

Refurbishment and remanufacturing of goods can provide significant positive economic and environmental benefits by reducing the cost of economic inputs compared to new manufactured goods and by enabling to use materials efficiently throughout a product's life-cycle. They also present important opportunities for international trade, especially in foreign markets that require lower prices for products. Therefore, they provide win-win-win opportunities for the economy, trade and the environment (UNEP, 2018[42]).

However, the uptake of refurbished and remanufactured goods remains fairly limited despite of these multiple benefits. For example, the remanufacturing industry represents up to 2% of overall production in the United States according to a study in 2012 (U.S.

International Trade Commission, 2012[43]), and similarly up to 1.9% of overall EU production in another study in 2015 (European Remanufacturing Network, 2015[44]).

This limited uptake could be partly due to the nature of the sectors that are suitable for refurbishment and remanufacturing. Sectors with refurbishment and remanufacturing markets include heavy equipment, airplanes, vehicles, certain electrical and electronic equipment (e.g. computers, liquid crystal displays, printers and toner cartridges), and medical devices (Kojima, 2017[45]). These value retention processes seem generally suitable for capital intensive goods as opposed to fast moving consumer goods (OECD, 2020[1]).

Additional challenges for refurbishment and remanufacturing are classified in a report by the International Resource Panel (UNEP, 2018[42]) and include four main categories, namely: (i) regulatory and access barriers (which encompasses trade regulations); (ii) collection infrastructure barriers; (iii) technological barriers; and (iv) market barriers.

Regarding trade, several factors are identified that restrict the movement of goods for refurbishment and remanufacturing, which applies to both "cores" (used product or module, intended for the remanufacturing) and refurbished and remanufactured products. Companies can sometimes face difficulty in retrieving their end-of-life products across borders for further refurbishment and remanufacturing, as these products can be classified as waste in some jurisdictions and not allowed for re-shipment (UNEP, 2018[42]; European Union, 2017[46]). Some countries (e.g. Brazil, India) have been reported to restrict the movement of non-new products and cores (UNEP, 2018[42]). Other countries (e.g. China, Indonesia,) have imposed import restrictions and bans on cores and refurbished and remanufactured goods (UNEP, 2018[42]; Kojima, 2017[45]).

There are signs to allow trans-border flows of these goods by re-examining and updating the regulation and definition of goods for refurbishment and remanufacturing and waste in some countries in response to requests from the private sector. However, there are also concerns from some importing governments that these trade flows on end-of-life products should not be a guise for trade in hazardous and contaminated waste. This issue is currently being investigated by the Basel Convention under their Expert Working Group (EWG) on e-waste (IISD, 2019[35]).

3.4 Trade in services

Typically, circular economy policies tend to boost service sectors relative to manufacturing sectors. Service-intense sectors such as waste management, recycling, refurbishment and remanufacturing, reuse, and repair are expected to grow as manufactures substitute secondary raw materials for primary raw materials and consumers substitute services for goods (McCarthy, Dellink and Bibas, 2018[7]). Many goods can also be replaced by product service systems where the end user buys a service instead of the good itself (Valles, 2016[47]). As an example, some lighting companies are exploring the possibility to provide lighting services instead of selling light bulbs and to retain ownership of its lighting equipment, from installation and maintenance, to end-of-life recovery (McCarthy, Dellink and Bibas, 2018[7]). The sharing economy is also emerging such as in car sharing services.

New business models such as product service systems could support the circular economy concept by changing the pattern of material use in the economy and thus have potential to reduce environmental pressures that result from current systems of production and consumption (OECD, 2019[48]). Typically, product service systems can provide incentives for eco-design and more efficient product use. For example, the service provider retaining

the ownership of the product, will have incentives to utilise longer lived and durable products, use products more efficiently, and assume responsibility for collecting, processing and managing their end-of-life products. However, these potential benefits could be offset by several opposing factors: (i) consumer preferences for renting new products can provide incentives for shorter product lives; (ii) consumers lacking product ownership may not use leased goods carefully thus leading to shorter product lives; and (iii) environmental implications of longer lived products can either be positive or negative depending on the trade-off between reduced material inputs for production and increased environmental footprint during consumption (OECD, 2019[48]). New business models and product service systems are not by default beneficial for the environment. Therefore, in order for these systems to be supportive of the circular economy concept, the environmental sustainability of these systems need to be taken into consideration.

New business models and product service systems that support the circular economy concept may provide new opportunities for international trade. Circular economy business models may trigger trade in services that may not be captured as tangible goods in import-export statistics, such as software solutions that involve reuse and refurbishment rather than ownership of in-country products (Sauvage and Timiliotis, 2017[49]). There are also new business models where consumers and suppliers remain in contact. This is partly due to increasing services embodied in goods, e.g. regular software changes to capital goods. These new ongoing relationships between producers and consumers can facilitate remanufacturing, recycling and take-back programmes. For these reasons, a circular economy transition entails the shift of trade not only of goods, but also of services.

General Agreement on Trade in Services (GATS)[30] distinguishes four modes of trade in services: Mode 1 – cross-border trade; Mode 2 – consumption abroad; Mode 3 – commercial presence abroad; and Mode 4 – temporary presence of natural persons abroad.[31] Circular economy related services, such as repairing and maintenance services, could be supplied through "Mode 3", commercial presence, or "Mode 4" temporary presence of natural persons abroad. There could also be opportunities where online services that support new business models for a circular economy, such as car sharing applications, are provided remotely from another country through "Mode 1" through cross border trade.

A study by IISD and SITRA (2020[50]) conducted surveys and interviews with the private sector involved in circular economy business models in order to compile emerging evidence on trade in services related to circular economy. The survey covered 96 individual firms undertaking circular business activities and found that around 70% of the respondents export circular economy related services to foreign customers. These exports included both upstream and downstream services related to circular economy from R&D, construction and installation, technical testing, and environmental consultation, to services including maintenance and repair, sewage and waste collection, and leasing and rental services. Digital trade was the most frequently used mode of operation, with approximately 55% of service providers exporting circular economy related services through Mode 1 (cross-border trade). The second most commonly used mode of operation was through foreign subsidiaries, via Mode 3 (commercial presence), reaching around 45% of circular economy services providers in the sample. Interestingly, most of these circular economy service exporters were small and micro-sized enterprises, which represented around 60% of the

[30] See GATS: https://www.wto.org/english/tratop_e/serv_e/gatsqa_e.htm.

[31] See below for details on the four "Modes" of services trade distinguished by GATS: https://www.wto.org/english/tratop_e/serv_e/gatsqa_e.htm.

respondents. This appears to reflect the specialisation of circular businesses and start-ups emerging in this field. The study also identified that the most common trade barrier encountered in circular economy related services by business respondents were differences in regulations between jurisdictions (e.g. diverging regulations on secondary raw materials and waste and scrap trade). This can partially be explained by the close interaction between trade in goods and services in general. While this report is indicative, these results are not considered as a general representation of firms, because the survey samples were not a randomly selected and are limited in their geographical coverage.

Given that further opportunities for services trade related to a more resource efficient and circular economy may emerge especially through digital technology and innovation, this understudied area could be a subject to further investigation.

4. Trade and circular economy policy interaction

This section highlights (i) how trade policies can provide opportunities and challenges to a circular economy transition, and (ii) how circular economy policies can work within existing international trade regimes. These two angles are explored in the following subsections.

4.1 Trade policies

This first part of this section focuses on multilateral trade rules. The second part then sheds light on the current state of play in regional trade agreements.

4.1.1 Multilateral trade rules

As discussed in Section 3, the implementation of circular economy policies may have various trade implications. This sub-section outlines multilateral trade rules so that circular economy policies do not pose unnecessary restrictions to international trade. The analysis does not intend to interpret or apply WTO rules to specific circular economy policies, as this role is under the responsibility of the WTO dispute settlement mechanism.

WTO rules cover policy instruments including taxes, internal charges, and "laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use […]". These rules can encompass various circular economy policies, such as extended producer responsibility schemes, design for environment initiatives, material taxes and subsidies, as well a material content and quality standards. Product quotas and bans are also subject to these rules. Multilateral trade rules generally apply to measures taken by government and not those by the private sector.

Preliminary discussions at the WTO have highlighted that the multilateral trade regime could potentially contribute to the circular economy concept through five channels: (i) trade rules, (ii) transparency and peer review, (iii) policy dialogue, (iv) negotiations, (v) and capacity building. While there may be important avenues to advance on the trade and circular economy agenda through policy dialogues and multilateral trade negotiations, the three issues of existing trade rules, capacity building and transparency will be the main focus of this section.

The following specific issues are covered in order: (i) non-discrimination, (ii) general exceptions, (iii) technical barriers to trade, and (iv) transparency.

Non-discrimination

WTO rules set forth fundamental principles on non-discrimination. The non-discrimination principle requires members to treat products from other members no less favourably than "like" products available domestically (i.e. National Treatment) and from other countries (i.e. Most Favoured Nation (MFN)). These obligations on non-discrimination are stipulated under the General Agreement on Tariffs and Trade (GATT) Article I on Most Favoured

Nation (MFN) and Article III on National Treatment.[32] "Like" products are products that are considered identical under WTO rules and further explained below in Box 2.

These non-discriminatory principles based on National Treatment and Most Favoured Nation treatment shape the design of domestic policies, *inter alia* circular economy policies, to be fair and non-distortive for trade. Discriminatory regulations related to circular economy have been subject to trade disputes in the past. Turning to existing examples from WTO sources,[33] three trade disputes related to circular economy have been recorded so far.

The first example is the Beer Can dispute between the US and Canada in 1992.[34] The US brought a claim against Canada over environmental taxes on alcoholic drinks that were distributed in non-refillable containers or were not part of deposit/return systems,[35] typically because "[several] provinces authorized the private delivery of provincial beer, but not of imported beer".[36] The panel did not address the validity of the environmental tax *per se* however found that "the practice […] to prohibit the private delivery of imported beer to the points of sale while according domestic brewers the right to deliver their products to the points of sale was inconsistent with Article III:4" (on non-discrimination based on national treatment).[37]

The second example is a dispute on a set of measures, including bans, fines, state regulations against imports of retreaded tyres by Brazil, and challenged by the EU in 2005.[38] The WTO Appellate Body upheld the Panel's finding that the import ban was provisionally justified as a necessary measure to protect human, animal or plant life or

[32] See GATT: https://www.wto.org/English/Docs_E/legal_e/gatt47_01_e.htm.

GATT, Article I (1): "With respect to customs duties and charges of any kind imposed on or in connection with importation or exportation or imposed on the international transfer of payments for imports or exports, and with respect to the method of levying such duties and charges, and with respect to all rules and formalities in connection with importation and exportation, and with respect to all matters referred to in paragraphs 2 and 4 of Article III, any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties."

GATT, Article III (4): "The products of the territory of any contracting party imported into the territory of any other contracting party shall be accorded treatment no less favourable than that accorded to like products of national origin in respect of all laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use. The provisions of this paragraph shall not prevent the application of differential internal transportation charges which are based exclusively on the economic operation of the means of transport and not on the nationality of the product."

[33] https://www.wto.org/english/tratop_e/dispu_e/find_dispu_cases_e.htm.

[34] GATT Panel Report, Canada – Import, Distribution and Sale of Certain Alcoholic Drinks by Provincial Marketing Agencies, DS17/R, adopted 18 February 1992, BISD 39S/27.

[35] *IBID*, §5.33.

[36] *IBID*, §5.10.

[37] *IBID*, §5.16.

[38] See: WTO dispute case DS332 available at: https://www.wto.org/english/tratop_e/dispu_e/find_dispu_cases_e.htm.

health (within the meaning of GATT Article XX(b)).[39] However the Appellate Body found that exemptions for MERCOSUR, as well as imports of used tyres, resulted in the import ban to be applied in a manner that was arbitrary or an unjustifiable discrimination and a disguised restriction on international trade.

The third example is a dispute over the imposition of recycling fees on motor vehicles by the Russian Federation brought forward to the WTO by the EU and Japan in 2013.[40] The European Union and Japan claimed against the Russian Federation for imposing a recycling fee on motor vehicles giving preferable conditions to domestic manufactures over their foreign counterparts. A WTO Panel established in 2013 is currently examining this case.

Box 2. What is a "like" product?[41]

WTO rules require measures, *inter-alia* for the environment, to be non-discriminatory between "like" products. Two questions emerge in this context: (i) are the products at stake "like" products?, and (ii) if so, are the measures at issue treating foreign products that originate from WTO Member countries less favourably than a domestic product?

There is no universal definition of a "like" product to date. WTO dispute settlement panels determine them on a case-by-case basis whenever a dispute arises. The multilateral trading regime has traditionally focussed on physical characteristics to pursue this task. For example, one Panel report determined "like" products by focusing on physical characteristics, end-uses, tariff classification and substitutability, from a consumer's point of view.[42]

Environmental sustainability has also been subject to the determination of a "like" product, however, with different outcomes. For example, in one case focussing on the prohibition of import, sale and use of asbestos, the Appellate Body reversed the Panel's finding and explained that the determination of likeness needed to include the competitive relationship between products, as well as health risks posed by the two products, due to their different

[39] The Report of the Appellate Body (WT/DS332/AB/R, §179) upholds the Panel's finding that "[…] risks of dengue fever and malaria arise from the accumulation of waste tyres and that the objective of protecting human life and health against such diseases "is both vital and important in the highest degree". The Panel noted that the objective of the Import Ban also relates to the protection of the environment […] the Panel analyzed the trade restrictiveness of the Import Ban and its contribution to the achievement of its objective. It appears from the Panel's reasoning that it considered that, in the light of the importance of the interests protected by the objective of the Import Ban, the contribution of the Import Ban to the achievement of its objective outweighs its trade restrictiveness."

[40] See: WTO dispute cases DS462 and DS463 available at: https://www.wto.org/english/tratop_e/dispu_e/find_dispu_cases_e.htm.

[41] Box 2 draws on examples given in OECD (2001[58]) and: https://www.wto.org/english/tratop_e/envir_e/envt_rules_gatt_e.htm.

[42] Appellate Body Report on United States - *Standards for Reformulated and Conventional Gasoline*, adopted on 20 May 1996, WT/DS2/9.

physical characteristics.[43] In another example, regulations on gasoline to control their composition and emission effects in order to reduce air pollution were challenged. As the domestic and foreign gasoline products were considered as "like" products, these regulations were found discriminatory. [44]

One related issue arises on processes or production methods (PPMs), that is on how products are produced, rather than the physical characteristics of a product. From an environmental point of view, it would be important to differentiate products that are produced in an environmentally sustainable way, from other conventional products. However, two products with different processes or production methods (PPMs) are not rendered per se as "unlike".

When focussing on circular economy policies, differentiating products made of recycled materials (or secondary-raw materials) from their primary raw material counterparts is very important. For example, steel made from scrap has lower environmental impact than primary steel, and is an important element to facilitate material substitution from a circular economy perspective. To date, however, there is no clear consensus how to treat the likeness of products made from primary and secondary raw materials in international trade.

General exceptions

Article XX of the GATT includes general exception provisions that exempt certain measures from GATT rules. Two exceptions are particularly related to the environment: measures necessary to protect human, animal or plant life or health (paragraph (b)), or relating to the conservation of exhaustible natural resources (paragraph (g)).

In order to invoke these articles on general exceptions, the measure in question would first need to satisfy the preconditions set forth in the chapeau of Article XX. This ensures that "such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade". The second requirement would be to fall within the scope of the exemption. With regards to the environment, these measures would either need to be necessary to protect human, animal or plant life or health, or relating to the conservation of exhaustible natural resources.

Regarding trade disputes related to circular economy, the Panel of the Beer Can dispute between the US and Canada in 1992 did not address the validity of the environmental tax nor refer to environment related exemptions under GATT Article XX (b) or (g) to make a decision.[45]

Concerning the dispute over measures on imported retreaded tyres between Brazil and the EU in 2005, the Appellate Body upheld the Panel's finding that "the objective of the import bans relates to the protection of the environment" and "the contribution of the import ban

[43] Appellate Body Report on European Communities - *Measures Affecting Asbestos and Products Containing Asbestos*, adopted on 5 April 2001, WT/DS135/12.

[44] Appellate Body Report on United States - *Standards for Reformulated and Conventional Gasoline*, adopted on 20 May 1996, WT/DS2/9.

[45] GATT Panel Report, Canada – Import, Distribution and Sale of Certain Alcoholic Drinks by Provincial Marketing Agencies, DS17/R, adopted 18 February 1992, BISD 39S/27.

to the achievement of its objective outweighs its trade restrictiveness" within the meaning of GATT Article XX(b).[46] However, other measures on Mercosur exemptions and imports allowed for used tyres (as opposed to retreaded tyres), led the Appellate Body to conclude that the import ban was being applied in a manner that was arbitrary, discriminatory, and a disguised restriction on international trade.[47]

It is beyond the scope of this report to provide an exhaustive list of examples on how the Article XX has been interpreted by different Panels concerning trade and environment issues more broadly. However, these examples and past reports have identified that the process to prove that these measures are either "necessary to protect human, animal or plant life or health" or "relating to the conservation of exhaustible natural resources" have been crucial steps for their interpretation.

Technical Barriers to Trade

The WTO Technical Barriers to Trade (TBT) Agreement stipulates members to ensure that technical regulations, voluntary standards, [48] and related testing and certification procedures, are non-discriminatory and do not create unnecessary obstacles to trade.[49]

In the agreement, a technical regulation is mandatory, while a standard is voluntary (i.e. not mandatory), and they both impose requirements on "product characteristics or their related processes and production methods, including the applicable administrative provisions […]. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method."[50]

The TBT Agreement requires members to use international standards as the basis for their technical regulations and mandatory conformity assessment procedures, unless ineffective or inappropriate, in order to facilitate trade and avoid unnecessary obstacles such as non-

46 See: the Report of the Appellate Body (WT/DS332/AB/R, §179).

47 See: WTO dispute case DS332 available at: https://www.wto.org/english/tratop_e/dispu_e/find_dispu_cases_e.htm.

48 The WTO TBT Agreement applies to voluntary standards to the extent that they are developed by WTO members (i.e. governments).

49 See WTO TBT Agreement: https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

Article 2.1: "Members shall ensure that in respect of technical regulations, products imported from the territory of any Member shall be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country."

Article 2.2: "Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. For this purpose, technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create. Such legitimate objectives are, inter alia: national security requirements; the prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment. In assessing such risks, relevant elements of consideration are, inter alia: available scientific and technical information, related processing technology or intended end-uses of products."

50 *IBID*, Annex 1.

tariff barriers (NTBs) to trade. It also strongly encourages members, within the limits of their resources, to participate in international standard setting bodies with the view to harmonise technical regulations as widely as possible.[51]

The TBT Agreement provides a "Code of Good Practice for the Preparation, Adoption and Application of Standards". [52] It requires members to ensure that central standard setting bodies comply with the code, and to take all reasonable measures to ensure that local government and non-government standard setting bodies also follow these rules on non-discrimination, avoiding unnecessary obstacles to international trade, securing transparency (through notifications), and aligning national standards with existing international standards to the extent possible.

Circular economy policies can involve the adoption of wide-ranging standards to facilitate a circular economy transition, such as eco-design standards, eco-labelling standards, material content standards, material quality standards, recyclability standards and reparability standards. As the proliferation of different product regulations and standards in various jurisdictions could potentially hamper countries' efforts to transition towards a circular economy, such initiatives on circular economy regulations and standards are encouraged to comply with TBT Agreement obligations. Further discussion on circular economy related standards are included in Section 4.2.5.

Transparency, consultation and capacity building

Circular economy regulations and standards will be more acceptable to trading partners if: (i) early consultations are held with stakeholders, (ii) sufficient and timely information and notifications are shared to stakeholders, (iii) reasonable time is secured for stakeholders to adapt and transition, and (iv) capacity building and technical assistance is made available for developing countries to adapt to new requirements.[53]

Securing the transparency of regulations and standards are a prominent role of the WTO and stipulated across different agreements. The GATT Article X obliges members to publish laws, regulations, and judicial decisions that may have trade effects on other

[51] See WTO TBT Agreement: https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

Article 2.4: "Where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations except when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfilment of the legitimate objectives pursued, for instance because of fundamental climatic or geographical factors or fundamental technological problems."

Article 2.6: "With a view to harmonizing technical regulations on as wide a basis as possible, Members shall play a full part, within the limits of their resources, in the preparation by appropriate international standardizing bodies of international standards for products for which they either have adopted, or expect to adopt, technical regulations."

[52] See WTO TBT Agreement, Article 4 and Annex III, Code of Good Practice for the Preparation, Adoption and Application of Standards: https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

[53] This draws on OECD (2001[58]) which originally focuses on extended producer responsibility schemes but relevant to circular economy policies more broadly.

members.[54] The TBT Agreement also sets forth notification and consultation requirements for technical regulations,[55] and for mandatory conformity assessment measures.[56]

According to the Environmental Database established by the WTO Committee on Trade and Environment, among 5468 environmental notifications brought to the WTO between 2009 and 2018, around two-thirds - 3462 notifications - were notified under the TBT

[54] See: GATT: https://www.wto.org/English/Docs_E/legal_e/gatt47_01_e.htm.

[55] See: WTO TBT Agreement: https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

Article 2.9: "Whenever a relevant international standard does not exist or the technical content of a proposed technical regulation is not in accordance with the technical content of relevant international standards, and if the technical regulation may have a significant effect on trade of other Members, Members shall:

2.9.1 publish a notice in a publication at an early appropriate stage, in such a manner as to enable interested parties in other Members to become acquainted with it, that they propose to introduce a particular technical regulation;

2.9.2 notify other Members through the Secretariat of the products to be covered by the proposed technical regulation, together with a brief indication of its objective and rationale. Such notifications shall take place at an early appropriate stage, when amendments can still be introduced and comments taken into account;

2.9.3 upon request, provide to other Members particulars or copies of the proposed technical regulation and, whenever possible, identify the parts which in substance deviate from relevant international standards;

2.9.4 without discrimination, allow reasonable time for other Members to make comments in writing, discuss these comments upon request, and take these written comments and the results of these discussions into account."

[56] See: WTO TBT Agreement: https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

Article 5.6: "Whenever a relevant guide or recommendation issued by an international standardizing body does not exist or the technical content of a proposed conformity assessment procedure is not in accordance with relevant guides and recommendations issued by international standardizing bodies, and if the conformity assessment procedure may have a significant effect on trade of other Members, Members shall:

5.6.1 publish a notice in a publication at an early appropriate stage, in such a manner as to enable interested parties in other Members to become acquainted with it, that they propose to introduce a particular conformity assessment procedure;

5.6.2 notify other Members through the Secretariat of the products to be covered by the proposed conformity assessment procedure, together with a brief indication of its objective and rationale. Such notifications shall take place at an early appropriate stage, when amendments can still be introduced and comments taken into account;

5.6.3 upon request, provide to other Members particulars or copies of the proposed procedure and, whenever possible, identify the parts which in substance deviate from relevant guides or recommendations issued by international standardizing bodies;

5.6.4 without discrimination, allow reasonable time for other Members to make comments in writing, discuss these comments upon request, and take these written comments and the results of these discussions into account."

Agreement.[57] Concerning measures related to circular economy, China's announcement to restrict and ban imports of waste and scrap were indeed notified under the WTO TBT Agreement.[58]

With regards to capacity building, the TBT Agreement stipulates member's obligations to provide technical assistance to other members, mainly developing countries, upon request and on mutually agreed terms. These assistance measures include *inter-alia*, those for: (i) the establishment of regulatory bodies for conformity assessment, (ii) methods to meet technical regulations, (iii) establishment of bodies for conformity assessment with standards, and (iv) steps to be taken by producers.[59]

4.1.2 Regional trade agreements

Regional trade agreement (RTAs) is also a potential vehicle to advance the trade and circular economy agenda between willing trading partners. RTAs have incorporated environmental provisions either in the main body or in side agreements. According to the TREND Analytics database[60] established by the German Development Institute and Laval University, between 1945 and 2018, 730 agreements have been signed and among them 629 agreements include some reference to the environment.

Circular economy provisions are extremely limited to date. This is perhaps because the circular economy concept is rather new and emerged in mid 2010s. There are no concluded agreements that include direct references to circular economy to date. There are however three agreements that are currently in negotiation or awaiting ratification and include environmental provisions that refer to circular economy in their provisional text – the trade

---

57 See: https://edb.wto.org/.

58 See: WTO notifications G/TBT/N/CHN/1211 and G/TBT/N/CHN/1233.

59 See: WTO TBT Agreement: https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

Article 11.3: "Members shall, if requested, take such reasonable measures as may be available to them to arrange for the regulatory bodies within their territories to advise other Members, especially the developing country Members, and shall grant them technical assistance on mutually agreed terms and conditions regarding:

11.3.1 the establishment of regulatory bodies, or bodies for the assessment of conformity with technical regulations; and

11.3.2 the methods by which their technical regulations can best be met.

11.4 Members shall, if requested, take such reasonable measures as may be available to them to arrange for advice to be given to other Members, especially the developing country Members, and shall grant them technical assistance on mutually agreed terms and conditions regarding the establishment of bodies for the assessment of conformity with standards adopted within the territory of the requesting Member.

11.5 Members shall, if requested, advise other Members, especially the developing country Members, and shall grant them technical assistance on mutually agreed terms and conditions regarding the steps that should be taken by their producers if they wish to have access to systems for conformity assessment operated by governmental or non-governmental bodies within the territory of the Member receiving the request."

60 See: https://klimalog.die-gdi.de/trend/table.html.

part of the EU-Mexico Global Agreement,[61] the EU-New Zealand Free Trade Agreement (FTA),[62] and the EU-Australia FTA.[63] The provisions for the modernised EU-Mexico Global Agreement are as follows:

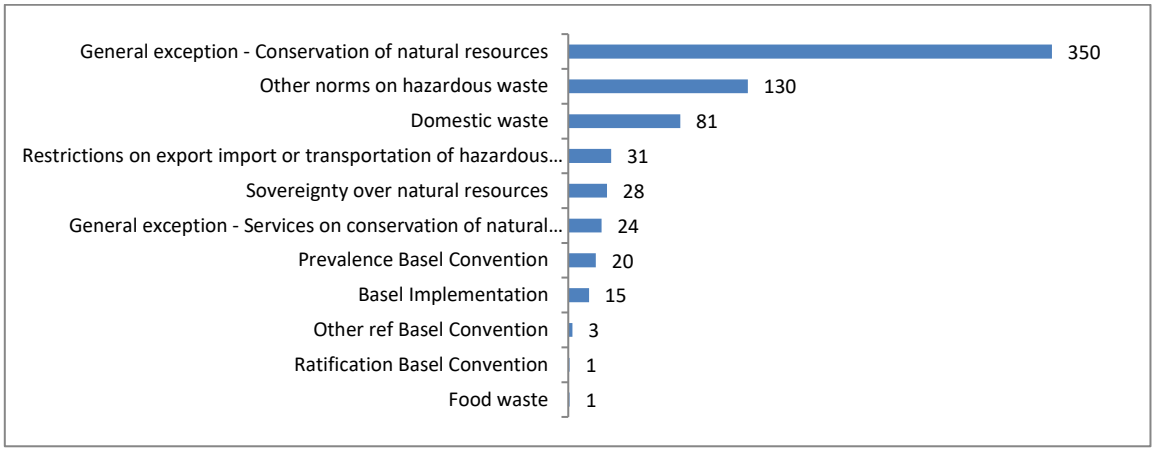
> *"The Parties recognise the importance of working together in order to achieve the objectives of this Chapter. They may work jointly on inter alia: […] (i) the promotion of inclusive green growth and* ***circular economy****."* (Emphasis added)

The EU's proposed provisions for the EU-New Zealand FTA and EU-Australia FTA are identical and reads as follows:

> *"The Parties shall work together to strengthen their cooperation on trade-related aspects of environmental policies and measures, bilaterally, regionally and in international fora, as appropriate, including in the UN High-level Political Forum for Sustainable Development, UN Environment, UNEA, MEAs, or the WTO. Such cooperation may cover inter alia: (a) initiatives on sustainable production and consumption, including those aimed at* ***promoting a circular economy*** *and green growth and pollution abatement […]."* (Emphasis added)

While direct references to circular economy is still a limited practice in RTAs, environmental provisions related to circular economy are found in RTAs. These include provisions on natural resources and waste management, as well as references to the Basel Convention. Based on the TREND Analytics, provisions related to circular economy were found in 385 RTAs out of 730 RTAs signed between 1945 and 2018 (see Figure 12).

Figure 12. Circular economy related provisions in regional trade agreements



Source: Author based on Morin, Dür and Lechner (2018[51]).

[61] Modernisation of the Trade part of the EU-Mexico Global Agreement, Trade and Sustainable Development Chapter, Article 13 (as of 23 April 2018) available at https://trade.ec.europa.eu/doclib/docs/2018/april/tradoc_156791.pdf.

[62] EU's proposal for the EU-New Zealand FTA, Trade and Sustainable Development Chapter, Article 5 (as of 15 February) available at: https://trade.ec.europa.eu/doclib/docs/2019/april/tradoc_157866.pdf.

[63] EU's proposal for the EU-Australia FTA, Trade and Sustainable Development Chapter, Article 5 (as of 25 February 2019) available at: https://trade.ec.europa.eu/doclib/docs/2019/april/tradoc_157865.pdf.

More specifically, other norms on hazardous waste include provisions on hazardous waste management. For example, the Canada-Colombia FTA's side agreement on the environment states:

> *Canada-Colombia Agreement on the Environment, Annex I: "The priority areas identified by the Republic of Colombia for consideration in the initial Work Program include, inter alia: integrated […] hazardous wastes management;"*

Provisions on domestic waste encompass issues around general management of waste. For example the Bulgaria-EC agreements indicates as follows:

> *Bulgaria-EC, art. 81(2): "2. Cooperation shall concern: - waste reduction […] and safe disposal."*

Trade restrictions on hazardous waste include explicit provisions, for example:

> *EC-Lebanon, Joint Declaration relating to Article 27 of the Agreement: "The Parties confirm their intention to prohibit the export of toxic waste and the European Community confirms its intention to assist Lebanon in seeking solutions to the problems posed by such waste."*

Finally, provisions on food waste emerged under the US-Mexico-Canada Agreement (USMCA)[64] that was signed in 2019, as follows:

> *USMCA's Environmental Cooperation Agreement, art. 10(2): "(aa) promoting sustainable production and consumption, including reducing food loss and food waste."*

In addition to specific provisions related to circular economy on natural resources, waste management, references to the Basel Convention, and specific provisions on food waste, there are broader provisions in RTAs on environmental co-operation and institutional mechanisms that enable follow up on these commitments between the Parties to the agreement (George and Yamaguchi, 2018[52]; George, 2014[53]). These commitments and mechanisms may be used as a vehicle to enhance co-operation on trade and circular economy issues that need to be addressed in an international or regional setting.

Beyond environmental provisions, ex-ante environmental impact assessments conducted under the framework of RTAs can also include reference to circular economy as a part of its analysis. The EU has included the potential opportunities of advancing a circular economy agenda as a part of their Sustainable Impact Assessments (SIAs) for trade agreements under negotiation, including the Transatlantic Trade and Investment

64 The US-Mexico-Canada Environmental Cooperation Agreement, a parallel environmental co-operation agreement to the USMCA, includes related provisions on energy and resource efficiency, sustainable materials management, clean innovation, entrepreneurship and sustainable production and consumption.

Partnership (TTIP),[65] the EU-Malaysia FTA[66] and the EU-Philippines FTA[67] (Kettunen, Gionfra and Monteville, 2019[3]). While this still appears to be a rare practice, these reports could set forth examples in analysing trade and identifying opportunities and impacts related to a circular economy transition.

4.2 Circular economy policies

This section examines how circular economy policies work within existing international trade regimes. While there is a wide range of policies to facilitate a circular economy transition, this report builds on parallel work that aims to track and analyse the impacts of circular economy policies (OECD, 2020[54]; 2020[55]; 2019[56]; 2018[57]).[68] These work streams have identified a number of essential measures aimed to drive a circular economy transition. These include: extended producer responsibility (EPR) and product stewardship schemes, landfill taxes and bans, virgin material tax, eco-design, material content, secondary certification, green public procurement, other taxes, other support measures, reparability standards. Each of these circular economy policies have different interactions with trade and are further examined below.

4.2.1 Extended producer responsibility and product stewardship schemes

Extended producer responsibility (EPR) is a concept to make producers responsible for the environmental impacts arising from their products throughout the product value chain, from product design to the post-consumption stage. The OECD defined EPR in the guidance manual released in 2001 as an "an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle" (OECD, 2001[58]). This manual defines EPR with two objectives: (i) to shift the responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities, and (2) to provide incentives to producers to incorporate environmental considerations in the design of their products. EPR is a concept that seeks to establish a mix of policy instruments that target different points in the product chain, rather than targeting a single point in the chain, to integrate signals to reduce environmental impacts of a product. An overview of EPR schemes based on the OECD (2016[31]) updated guidance manual is given in Box 3.

[65] See: SIA in support of the negotiations on a Transatlantic Trade and Investment Partnership (TTIP) Final Report (March 2017): http://trade.ec.europa.eu/doclib/docs/2018/december/tradoc_157583.pdf.

[66] See: Sustainability Impact Assessment (SIA) in support of Free Trade Agreement (FTA) negotiations between the European Union and Malaysia, Draft Interim Report (14 December 2018): http://trade.ec.europa.eu/doclib/docs/2018/december/tradoc_157583.pdf.

[67] See: Sustainability Impact Assessment (SIA) in support of Free Trade Agreement (FTA) negotiations between the European Union and the Philippines, Draft Interim Report (14 December 2018): http://trade.ec.europa.eu/doclib/docs/2018/december/tradoc_157584.pdf.

[68] See RE-CIRCLE project: https://www.oecd.org/environment/waste/recircle.htm.

Box 3. Overview of extended producer responsibility and product stewardship schemes

EPR policies emerged since the early 1990s and rapidly spread around the world over the last two decades. According to a survey conducted by the OECD (2016[31]), more than 70% of the 384 EPR policies implemented worldwide were introduced since 2001.

EPR schemes can be mandatory with binding regulation or voluntary often known as product stewardship schemes. According to the OECD (2016[31]) survey, most EPR schemes appeared to mandatory rather than voluntary. The available information suggests that voluntary schemes have targeted specific product categories with high visibility and economic viability for reverse logistics such as televisions and computers (OECD, 2016[31]).

Regarding policy instruments covered in the same survey, take-back requirements were the most widespread accounting for 72% of all existing EPR policies. This is sometimes used in combination with advance disposal fees, which accounted for 16% of overall measures. Deposit-refund systems, which accounts for 11% of the total, mainly focuses on used beverage containers and lead-acid batteries, and may be used in conjunction with take-back requirements. Other policy instruments (upstream tax and subsidy combinations, raw material taxation, recycling content requirements) introduced in the OECD (2001[58]) Guidance Manual are rarely used to date.

Concerning target products in this survey, waste electric and electronic equipment (WEEE or e-waste) were the most widespread, accounting for 35% of the total. This was followed by tyres (18%), packaging (17%), end of life vehicles (ELVs) (7%), and lead-acid batteries (4%). The remaining 18% are made up of less common products, such as waste oils, paints, chemicals, large appliances, fluorescent lights, etc. In general, products with high consumption and high disposal costs tend to be selected for EPR policies, reflecting policy and market needs.

While there is no comprehensive data to measure the effectiveness these policies to date, past results confirm that the amount of final disposal has reduced and the recycling rate has improved since these policies came into effect. In the OECD, between 1995 and 2010, the amount of material recovery in OECD countries increased from 19% to 33%, and energy recovery increased from 17% to 18% during this period (OECD, 2016[31]).

EPR policies are requirements imposed on products and therefore can have various implications to international trade. The OECD (2016[31]; 2001[58]) guidance manuals highlight that EPR policies that are compatible with trade policies can be environmentally effective, environmentally efficient, and more acceptable by the private sector. More specifically, it recommends that EPR schemes should be checked so that they are non-discriminatory against importers, do not create unnecessary barriers to trade and do not restrict trade more than necessary to achieve its purpose. It also calls for better transparency, appropriate consultations with stakeholders including related importers, as well as adequate time for producers and importer to adapt to new schemes. The guidance also encourages timely notifications of measures affecting trade to the WTO, and consideration of technical assistance to developing countries to adapt to new requirements if necessary. Initial concerns have also been raised on risks associated with the surplus recycled materials that lacked domestic markets and may be dumped on international markets at very low prices, however, no disputes have been recorded on this issue to date (OECD, 2016[31]; OECD, 2001[58]).

In general, EPR schemes so far appear to be non-discriminatory by imposing the same requirements, such as take back requirements and advance disposal fees, for domestic producers as well as importers that place products on the market. The initial EPR guidance manual raised concerns over potential trade distorting effects arising from take back requirements where domestic producers would have an intrinsic advantage over foreign counterparts, as domestic actors would be better placed to physically collect end-of-life products (OECD, 2001[58]). However, while EPR schemes generally allow for both collective producer responsibility (where producer responsibility organisations (PROs) physically collect and process end-of-life products on behalf of individual producers) and individual producer responsibility (where each producer is responsible to physically collect and process their end-of-life products), the former has prevailed in practice to achieve economies of scale (OECD, 2016[31]). For this reason, initial concerns over take back requirements do not seem to have emerged in practice so far.

EPR schemes have been fairly successful in achieving their first objective to shift the responsibility upstream toward the producer and away from municipalities, however, their role has been limited so far in achieving their second objective; to promote *eco-design* (also regarded as Design for Environment - DfE - initiatives) (OECD, 2016[31]). One reason for this is that advance disposal fees have generally been calculated on a fixed-fee "per unit" or "per-weight" basis, rather than the ease for end-of-life dismantling and processing. There are emerging initiatives to introduce differentiated or modulated fees based on material content, avoidance of hazardous content, recycled content, and additional criteria to enable better recycling and reduce associated environmental impacts. For example, France, Germany, and Italy have introduced such kinds of modulated fees.[69] While these additional criteria and standards may provide further incentives for eco-design, these initiatives are proliferating in different jurisdictions that may become potential barriers to trade if they are excessively restrictive than necessary to meet their purpose. For this reason, the OECD (2016[31]) updated guidance calls for possible harmonisation of eco-design standards in the case of globally traded products (further discussed in Section 4.2.5.).

While EPR schemes generally treat domestic producers and importers in a non-discriminatory fashion, their role in addressing end-of-life value chains and related international trade are at times unclear. There are two related issues concerning end-of-life value chains: (i) first, the way in which EPR schemes and associated recycling rates take into account waste and scrap exports for further recycling and processing, and (ii) second, the issue of leakage from official EPR systems.

Regarding the first issue on *waste and scrap exports*, a study from Eunomia (2018[59]) focused on the EPR scheme for plastic packaging in the UK and indicated that processors and exporters of plastic packaging waste are effectively allowed to claim that each tonne of material that is exported is 100% recycled, and thus receive respective recycling fees under the scheme.[70] While these waste and scrap exports are officially destined to recycling

[69] See IEEP policy brief - https://ieep.eu/uploads/articles/attachments/47856bb4-4af9-47a6-a710-7af0fe8b3518/Policy%20options%20brief%20EPR%20price%20modulation%20IEEP%20Nov%202017%20final.pdf?v=63677462325.

[70] The EPR scheme for plastic packaging in the UK enables processors and exporters of plastic packaging waste to receive recycling fees based on the amount of waste they recycle or export under the scheme. The scheme is based on tradable credits that are generated by accredited processors or exporters (called re-processors in the UK scheme) when they recycle or export waste. Producers with EPR obligations normally join producer responsibility organisations,

facilities that are reported to have competent recycling capacity and standards, recycling rates still appear to be overestimated, as equivalent fractions sent to domestic facilities would not achieve 100% recycling because of losses during their transport, recycling and processing. The report estimates that the loss of materials post-export might be 30% according to third party observations. In addition, the actual fate and treatment of waste and scrap sent abroad is largely unknown. Kellenberg (2012[25]) empirically shows that waste and scrap exports are likely destined to countries with weaker environmental policy stringency. In addition, many of these trade destinations have significant issues around waste management and the informal sector (OECD, 2016[31]; Shinkuma and Managi, 2011[28]; Huisman et al., 2015[32]). For these reasons, assuming 100% recycling for exported waste and scrap seems to be an overly simplistic assumption.

Concerning the second issue on *leakage* from official EPR systems that involves international trade, this can occur through two channels, through illegal waste trade, and through exports of second-hand goods. Regarding the first channel on illegal waste trade, Huisman et al. (2015[32]) investigated and surveyed the nature of illegal trade in e-waste in the European context. They estimate that among the 9.45 million tons of e-waste generated in Europe in 2012, only 35% of them were collected and recycled in official systems while the remaining 65% were either exported (16%), recycled under non-compliant conditions in Europe (33%), processed by the informal sector (8%), or simply discarded in waste bins (8%). It also estimates that 1.3 million tons (14%) of e-waste departed the EU in undocumented exports that would likely be classified as illegal waste trade. Similarly, in France, it is estimated that only one third of e-waste generated in its territory are directed towards official EPR systems while between 45% and 75% are either handled by informal systems or exported. In Japan, approximately half of end-of-life home appliances are captured by official EPR systems while the other half is channelled through the informal sector and second-hand product markets (OECD, 2016[31]). The motivation for illegal exports occurs from a range from lower labour costs available for dismantling of end-of-life products, to lower environmental standards and compliance costs for processing, and weaker enforcement mechanisms that can encourage illegal dumping (Huisman et al., 2015[32]; INTERPOL, 2020[33]). While preventing illegal waste trade is a challenging task, better data is needed to understand the extent of these activities, and established enforcement mechanisms are necessary to prevent these illegal activities.

Another channel is through the occurrence of exports of *second-hand goods*. While second-hand goods exports can in principal give used products a second life and reduce life cycle environmental, economic, and social impacts, they also raise several concerns. The first is the leakage of goods from official EPR systems as they are exported as used products (OECD, 2014[60]). This is not illegal in principle, but still results in a reduction of material that can be recovered through the EPR scheme and may cause environmental and health damages, when leaked products are not managed in an environmentally sound manner when reaching their end-of life. In cases where advance disposal fees are collected, these fees are not utilised for their "actual" end-of-life management. Should there be an effective EPR scheme or waste management system in their destinations, the physical and financial responsibility would be then shifted to importers or municipalities in the country of destination. However, many second-hand goods are likely sent to countries where the end-of-life management of these goods are largely unknown. For example, in Fiji, it is reported

which purchase these tradable credits from the re-processors on their behalf, to ensure that a particular proportion of packaging they handle is recycled. For further details, see: (Eunomia, 2018, p. 3[59]; OECD, 2016, p. 73[31]).

that they import second-hand hybrid vehicles from abroad, however, do not have the capacity and technology to manage end-of-life batteries, or means to export them when these vehicles reach their end-of-life (PRIF, 2018[61]). Furthermore, some second-hand goods are suspected to lock in importing economies into insufficient and substandard technologies, hampering their transition to a circular or low-carbon economy. In other words, these second-hand good may hinder the importing economy by slowing market transformation and putting additional pressures on the management of end-of-life products.

For these reasons, a number of developing countries have decided to impose import restrictions on second-hand products (e.g. old and inefficient second-hand vehicles), and explicitly indicating them in their Nationally Determined Contributions (NDC) under the Paris climate accord (Brandi, 2017[41]). Furthermore, as discussed in Section 3, comprehensive statistics on second-hand goods trade in largely lacking. While trade in second-hand goods may reduce environmental, economic, and social impacts, there are associated trade-offs, and their effectiveness and life cycle impacts remains to be an open question.

Finally, there are emerging issues related to *online sales* of goods, mainly from abroad, that can by-pass EPR regulations in the in the country of sale. Hilton et al. (2019[62]) highlight three related problems with (cross-border) online sales that are non-compliant with EPR schemes and potentially hinder their implementation. First, free-riding from physical 'take-back' obligations leads to lower collection rates for end of life products. Second, free-riding from EPR fees results in financing problems for waste management activities. Third, free-riding leads to under-estimating the number of products placed on the market results in a potential over-estimation of national recycling rates. While statistics on non-compliance are not easily available, the study estimates that non-compliance rates for e-waste are between 5% and 10% of the value of the electrical and electronic equipment market in the OECD. Online sales are growing rapidly in the past decade and reaching around one-tenth of total sales in OECD countries. Therefore, the opportunities for (cross border) free-riding of EPR schemes is only expected to increase as online-sales continue to grow. The study recommends to tackle this issue, by raising awareness among online sellers, establishing a single electronic registry in each jurisdiction, developing peer-review reporting systems to inform authorities of suspected free riders, requiring online sellers to display the details of their PRO registration online, and seeking better co-ordination and enforcement at the supra-national and international level.

4.2.2 Taxes and subsidies

Economic instruments of taxes and subsidies are used across various points in the product value chain to fulfil resource efficiency and circular economy objectives. This section will focus on three main areas of (i) landfill taxes, (ii) virgin material taxes, (iii) and government support measures for primary and secondary materials.

Landfill taxes

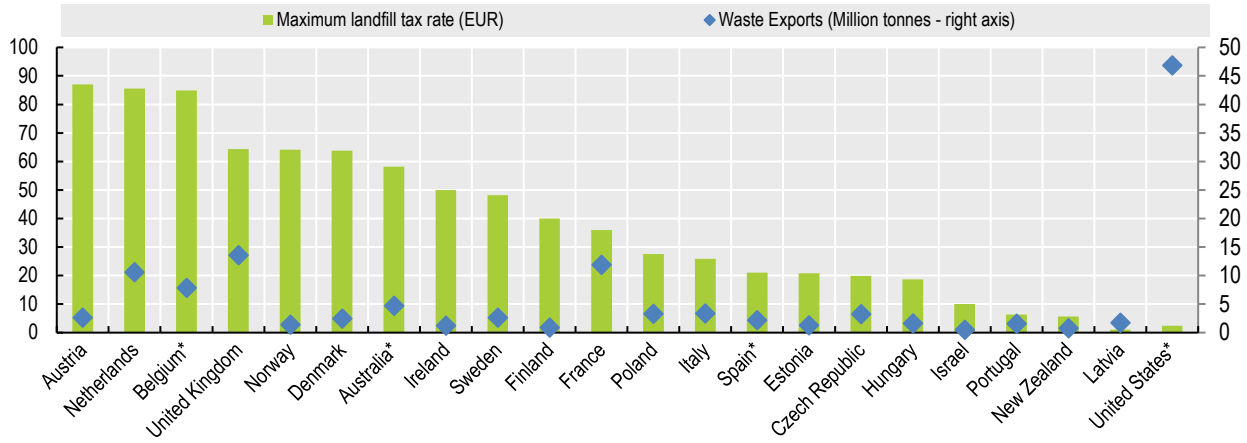
The OECD (2019[56]) report, which draws insights on waste management and circular economy from environmental performance reviews, highlights that landfill taxes (and bans) in combination with EPR schemes have been effective instruments to reduce landfilling rates and increase material recovery and recycling in OECD countries. Sweden as an example effectively combined landfill taxes with regulatory instruments to reduce landfilling of waste to less than 1% of municipal waste by 2012.

Regarding trade implication, Mazzanti and Zoboli (2013[38]) indicate landfill taxes as one possible driver for waste and scrap trade among many other drivers.[71] They argue that landfill taxes, in combination with other economic and regulatory instruments, may have stimulated waste shipments from high-tax countries.

Drawing on available data on maximum landfill tax rates (OECD, 2019[56]) and waste and scrap exports from UN COMTRADE in 2013, the correlation between landfill taxes and waste and scrap exports is not immediate (see Figure 13). Verifying the effect of landfill taxes on different waste management strategies, including exports, requires for further clarification and investigation, and a detailed econometric study.[72]

Figure 13. Landfill tax rates, and waste and scrap exports

Municipal waste landfill tax rates and waste exports 2013



Note: Tax rates refer to Flanders for Belgium, to Catalonia for Spain, and to New Jersey, North Carolina, Mississippi and Indiana for the United States. Waste and scrap items are those contained in the list of 62 Harmonized System (HS) codes used in Garsous (2019[24]) provided by (Kellenberg, 2012[25]).
Source: Author based on OECD (2019[56]), Garsous (2019[24]) and UN COMTRADE.

Virgin Material Taxes

Virgin (primary) material taxes can support circular economy objectives by promoting efficient resource use.[73] The OECD (2016[31]) guidance document indicates that virgin material taxes are hardly used as a part of EPR schemes. In combination with the OECD

[71] Mazzanti and Zoboli (2013[38]) indicate several drivers of waste trade. These include waste management and transportation costs, administrative costs, tariffs and non-tariff barriers, differences in environmental policy stringency and treatment capacity, incentives for recycling and energy recovery, differences in legislation and classification, need for specific technologies, and geographic characteristics.

[72] Such an econometric study could be based on existing frameworks, as proposed by Mazzanti and Zoboli (2013[38]).

[73] Typically, such taxes are levied only on primary materials and not on secondary materials for two reasons. First, double taxation of materials should be avoided, and secondly the environmental footprint of secondary materials use is in most cases much smaller than that of primary materials use (OECD, 2019[5]).

(2019[56]) report summarising circular economy initiatives based on OECD environmental policy reviews, virgin material taxes appear to be concentrated in their extraction phase as natural resource royalties.

Where virgin material taxes rates are low, they mainly have a revenue-raising function, rather than correcting for environmental externalities related to virgin material production, consumption and end-of-life management. For this reason, the OECD Environmental Policy Reviews have recommended the opportunities to increase the use of resource taxes to promote resource efficiency (OECD, 2019[56]).

Trade effects of virgin material taxes appear to be limited so far. These measures should be applied in a non-discriminatory way in accordance with multilateral trade rules. In certain cases, potential concerns have been raised over double taxation. For example, these materials, could be taxed multiple times along their product lifecycle such as extraction, production and consumption. While this could be an increasing concern in theory, virgin material taxes have, so far, rarely been applied in their product consumption phase, and therefore, have not raised any significant issues.

Support measures for primary and secondary materials

Primary raw materials and secondary raw materials receive various support measures along their value chain. The OECD report by McCarthy and Börkey (2018[63]) investigated the extent of support measures for primary and secondary metal production. The study finds that support measures to the metal sector is significant, reaching up to billions of dollars in some countries, and disproportionately allocated towards the primary sector. Support towards the primary sector tends to come from the national level, whereas, support towards the secondary metal producing sector is usually sourced from the provincial or municipal level of governments. Support for primary metals seem to be in forms of various tax concessions, and public provision of investment finance. Export restrictions to primary material production also confer support for domestic production that can enjoy cheaper feedstock prices.

The secondary metal production sector receives support in the form of public investment finance, such as public funds that are available for projects with resource efficiency and circular economy objectives (e.g. public investment finance available for recycling projects). Other support measures to the secondary material sector occur through induced transfers, such as through EPR schemes, landfill taxes and bans, however are difficult to quantify their effects.

The Agreement on Subsidies and Countervailing Measures (ASCM)[74] disciplines the use of trade distortive subsidies and sets forth actions that Members can take in response, including recourse to WTO dispute settlement mechanisms to seek withdrawal of these subsidies or removal of their adverse effects, or the use of countervailing measures to offset injury caused by subsidised imports. As sectors involving primary and secondary metal production processes receive different forms of government support (McCarthy and Börkey, 2018[63]; OECD, 2019[64]) these traded goods may be subject to ASCM disciplines. This is an issue that requires further elaboration.

In the OECD (2016[31]; 2001[58]) guidance manual, potential concerns were raised over the dumping of excess secondary materials onto international markets at low prices. However,

[74] See WTO ASCM Agreement: https://www.wto.org/english/tratop_e/scm_e/subs_e.htm.

such a phenomenon does not seem to have occurred in reality. No such disputes seem to have been recorded to date.

4.2.3 Green public procurement

Green public procurement of goods and services that reflects circular economy and resource efficiency objectives are important measures for governments to promote a circular economy that may provide additional opportunities for international trade.

In 2015, 84% of OECD countries incorporated policies aimed at green public procurement (OECD, 2016[13]). While general government procurement accounted for 12% of GDP and around one-third of government expenditures in 2015 (OECD, 2016[13]), green public procurement by national and subnational governments may offer new international trade opportunities to innovative companies. In the OECD, the potential impact is significant as governments on average spend 45-65% of their budgets on procurement, accounting for 13-17% of their GDP. The potential of government procurement in developing countries is even more substantial when considering the proportion of state-owned enterprises.

Government procurement can promote the purchase of environmentally preferable products or environmental services by government agencies that could bring about environmental benefits. For instance, it can promote government preference for recycled goods, energy-efficient appliances, fuel-efficient vehicles and public-transport systems, or related consultancy services such as energy audits. It can particularly support nascent markets for environmental products during their start-up phase.

In this background, green public procurement is gaining attention. According to the Environmental Policy Reviews (OECD, 2019[56]), several OECD countries – including Korea, Netherlands and Norway – have used green public procurement as an instrument to promote the use of recycled paper and other products. In particular, the Netherlands is considering green public procurement as a tool to advance a circular economy transition, by ensuring that products are repairable and can be easily broken down into recyclable components when they reach their end-of-life. While these reviews highlighted opportunities for green public procurement, it also indicated challenges for government that still overemphasise price over quality as a decisive factor in the award of contracts, as well as the need for institutional capacity building for tendering especially in municipal and local governments.

In some cases, public procurement guidelines that specifically support circular economy principles are made available for public entities as those developed by the European Commission in 2017.[75] These procurement guidelines include examples of how to make government procurement processes reflect circular economy objectives. These examples include procurement of circular goods, based on material content such as the percentage of recycled materials used or the avoidance of hazardous content, which make these products difficult to recycle when they reach their end-of-life. Additional criteria is based on their recyclability (e.g. ease of dismantling), and reparability (e.g. product life and availability of spare parts). This can also include the procurement of product service systems that are supportive of a circular economy, such as leasing and take back of office vehicles, lighting services, or copy machines (see also Section 3.4. on product services system and their environmental implications).

[75] See: http://ec.europa.eu/environment/gpp/pdf/Public_procurement_circular_economy_brochure.pdf.

Concerning international trade rules, government procurement measures are subject to the plurilateral WTO Government Procurement Agreement (GPA) for signatory states,[76] and generally needs to be conducted in a transparent and non-discriminatory manner.[77] The GPA generally enables to consider environmental sustainability criteria and specifies that "[…] procuring entities may […] prepare, adopt or apply technical specifications to promote the conservation of natural resources or protect the environment".[78] It also indicates that "technical specification means a tendering requirement that: lays down the characteristics of goods or services to be procured, including quality, performance, safety and dimensions, or the processes and methods for their production or provision […]".[79] In other words, the GPA establishes rules for its parties to refer to technical specifications that consider the associated environmental impacts along the product value chain, from production to end-of-life management, as long as they do not create unnecessary barriers to trade.

In addition, various standards that are referred to in green public procurement that supports the circular economy concept, including material content (e.g. recycled material content and hazardous material content of a product), recyclability and reparability, may have additional trade effects and are further explored in Section 4.2.5.

4.2.4 Labelling

Labelling schemes are one of the available measures in the policy took-kit to narrow information gaps along the product value chain to help economic actors make rational choices in consideration of environmental outcomes. Environmental label and information schemes generally provide the following benefits (Sexsmith and Potts, 2009):

- *Inform consumer choices*, which empowers people to distinguish and discriminate products based on their environmental performance.
- *Promote economic efficiency*, as labelling is generally cheaper than regulatory controls.
- *Stimulate market developments, innovation and economic growth* in green sectors by steering demand towards more environmental friendly products.
- *Encourage continuous improvements* by providing an incentive structure for firms to invest in measures to reduce their environmental and resource footprint.

The OECD (2021, forthcoming[65]) report provides an overview of different types of labelling schemes that contribute to a circular economy. Based on an earlier study by Gruère (2013[66]) that surveyed around 550 schemes between 1990-2012, around 75% of labels were in place to narrow the information gap between business and consumers (B2C), while the remaining 11% were measures aimed between businesses (B2B).

Concerning B2C initiatives, current labelling schemes aim upstream to extend the product lifecycle by exhibiting the durability, reparability and upgradeability of a product, or by

[76] The GPA is a plurilateral agreement within the framework of the WTO, meaning that not all WTO members are parties to the Agreement. The Agreement currently comprises of 47 WTO members. The revised GPA entered into force in 2014, advancing on the previous GPA in 1994. See: https://www.wto.org/english/tratop_e/gproc_e/gp_gpa_e.htm.

[77] See: https://www.wto.org/english/docs_e/legal_e/rev-gpr-94_01_e.htm#articleVI.

[78] IBID, Article X.

[79] IBID, Article I.

displaying the product quality for second-hand goods to facilitate their uptake by end-users. Other labels aim to inform consumers on downstream requirements of end-of-life products to promote separate collection of waste. Recycled content labels are also in place to inform the consumer on the proportion of recycled content used in a given product. These examples are compiled in Table 2 below.

Regarding B2B labels, emphasis is placed on securing sustainable supply-chains, by either specifying the material content of a product, or indicating the environmental impact of a product's production process. Detailed examples are also illustrated in Table 2.

Table 2. Labelling schemes for a circular economy

Labelling scheme	Channel	Examples
Product durability	B2C	• **EU Ecolabel** - durability assessment is included for shoes, notebooks and tablet computers, televisions and the wood and metal components of furniture.
Product reparability	B2C	• **EU Ecolabel** - reparability aspects are part of the assessment for product categories including: furniture, mattresses, sanitary tapware. • **i-Fixit scoring system** - a 0-10 scoring system that assesses the reparability of smartphones, tablets, and laptops, with 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. • **Product 10Y Repairable label** - an in-house label by the Groupe SEB that indicates the reparability of small household appliances. 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 (10 years minimum), their cost and delivery time. • **Environmental Claim Validation Program on Recyclability** – Evaluates a product's recyclability through testing or auditing. verified.by UL
Product upgradeability	B2C	• **EU Ecolabel** - Upgradeability criteria are included for computers, where certain components are required to be easily accessible and replaceable, whilst the availability of spare parts must be ensured for at least five years.
Product quality for second-hand goods	B2C	• **PAS 141:2011 standard** - a voluntary standard to build confidence in the reused mobile device market by setting a benchmark for minimum functionality standards for reusable mobile devices, developed by the British Standards Institute (BSI).
Separate collection of waste	B2C	• **Triman label** – the French EPR system requires a mandatory label to mark all household waste that is recyclable. • **How2recycle label** – is a private and voluntary waste sorting label in the United States. Firms can choose to use this label on their products to guide consumers on how their packaging should be recycled.
Material content	B2C	• **SCS Global Services, recycled content certificate** - a private certification body developed a voluntary standard for recycled content claims applicable for different materials. • **Environmental Claim Validation Program on Recycled Content** – Validates the postconsumer, preconsumer (postindustrial) or total recycled content of a product by means of auditing, verified.by UL • **Labels for recycled content for wood and paper products** – by The Sustainable Forestry Initiative (SFI) as well as the Forest Stewardship Council (FSC).
	B2B	• **IMDS** (International Material Data Systems), which collects information about substances and materials of auto products from upstream sub-contractors. • **RoHS** (EU Directive on the restriction of hazardous substances), requires EU member states to ensure that electrical and electronic equipment placed on the market does not contain a defined set of hazardous substances. Products that comply with RoHS display the CE mark. • **MSRL** (Manufacturing restricted substances list) – an industry initiative to manage chemicals in the textile sector.
Sustainable production	B2B	• **GOTS** (Global Organic Textile Standard) (GOTS, 2018[36]). • **Standard system of BCI** (Better Cotton Initiative), which evaluates the cotton supply chain, with the aim to increase market access and availability of organic cotton (BCI, 2018[37]). • **Higg Materials Sustainability Index**- a self-assessment standard to evaluate social and environmental impacts of products across the value chain for the apparel and footwear industry, launched in 2012 by the Sustainable Apparel Coalition.

Source: Author based on OECD (2021, forthcoming[65]).

While these labelling schemes appear to attract significant interest for policy makers to promote a circular economy transition, many schemes are in their nascent phase and their up-take so far seem to be limited to date. One important factor to consider is whether these schemes are mandatory or on a voluntary basis. While consumer-oriented labels for a circular economy have the potential to shift demand, and steer supply chains towards more resource efficient and circular products, they are often voluntary and their market penetration and impact remain relatively small (OECD, 2021, forthcoming[65]). There can also be confusion among consumers in interpreting these labels given their proliferation in the market (Prag, Lyon and Russillo, 2016[39]).

With regards to international trade, proliferation of labelling schemes for a circular economy can increase the compliance cost for producers to fulfil varying requirements within and across different jurisdictions (Prag, Lyon and Russillo, 2016[39]). If these requirements are over restrictive than necessary, they can become obstacles to market access and international trade.

The labelling schemes for a circular economy are based on different standards, such as the durability, reparability, upgradability and material content of a product, the criteria to measure environmental sustainability of a product's production process, as well as the product quality of a second-hand good. These various standards related to a circular economy can have further implications to international trade and are further explored in the following Section 4.2.5.

4.2.5 Standards

One important measure that has implications to trade is the adoption of wide-ranging standards to facilitate a circular economy transition. In general, standards can bring a wide range of benefits by: (i) helping governments to pursue public policy objectives, (ii) facilitating market creation, (iii) promoting market access and reducing transaction costs via common set of norms, (iv) enabling economies of scale, and (v) fostering innovation[80] (OECD, 2017[67]; 2016[68]; 2011[69]). A G7 workshop on "value chains for the circular economy" highlighted several potential benefits in adopting standards to facilitate circular economy objectives (European Union, 2019[70]):

- Standards can facilitate dialogue between different stakeholders at national, regional or international levels and enable access to international markets;
- Standardisation can create a reliable basis for collaboration between firms and diffusion of innovation in global supply chains without need of double testing;
- International standards can facilitate trade and increase trust throughout the value chain;
- National regulation making reference to international standards can facilitate market expansion with reduced compliance costs through the harmonisation of vocabulary, definitions and methodological frameworks;
- Harmonized standards for circular business models, based on a wider, life-cycle approach to product impacts would be beneficial in driving eco-design, to substitute standards focussing on reduction on specific negative environmental impacts;

[80] The industry has incentives to have their own patents included in a standard, which encourages innovation (OECD, 2014[96]; 2011[69]).

- Standard setting can facilitate the use of life cycle approach in identifying how product design can make most progress in emission and cost reduction;
- In these ways, standard setting can support the transition to a circular economy and to the achievement of the SDGs, climate targets, the 3Rs[81] and regional policy.

Circular economy related standards can take two broad approaches (European Union, 2019[71]): (i) standardising the organisational and management aspect of a circular economy, and (ii) standardising products that serve towards circular economy objectives. Box 4 gives a brief overview of standards related to management and organisation of a circular economy that are currently available and under development.

Box 4. Standards on organisation and management of a circular economy

Standards on the organisational and management system of a circular economy are currently available at the national level from the United Kingdom and France, and currently being developed beyond the national level by the International Organization for Standardization (ISO).

In May 2017, the British Standards Institution (BSI) published BS 8001 (2017) "Framework for implementing the principles of the circular economy in organizations". The standard is the first of its kind in providing practical framework and guidance for organisations to adopt and implement the principles of a circular economy. The target users of the standard are organisations of any kind, regardless of the sector, size, location and type. It is a voluntary guidance rather than a standard that sets forth requirements, thus it is not intended nor suitable for certification purposes (BSI, 2017[72]).

Similarly, in October 2018, the French National Standardization Organization (AFNOR) issued Pr XP X30-901 (2018) Circular economy - Circular economy project management system - requirements and guidelines, which sets forth voluntary standards to help companies understand the circular economy concept and implement projects that serve towards circular economy objectives. The standard provides requirements for planning, implementing, evaluating and improving a circular economy project. It covers seven areas of actions related to circular economy: (i) sustainable procurement, (ii) eco-design, (iii) Industrial symbiosis, (iii) functional economy, (iv) responsible consumption, (v) extension of service life, and (vi) effective management of materials and products at the end of their life cycle. The target is to assist managers within their organisation as well as local authorities to incorporate circular economy objectives in their projects and activities (AFNOR, 2018[73]; EREK, 2018[74]).

In 2018, the ISO established the technical committee, ISO/TC 323 Circular economy, which met for the first time in May 2019. ISO/TC 323, originally proposed by AFNOR, is expected to develop principle based standards for a circular economy (ISO, 2019[75]).

There are other standards on the organisational and management systems that are related to a circular economy, for example on certification of recycling operations and facilities.

[81] "3R" refers to the concept to reduce, reuse and recycle materials to decrease the need for virgin materials and improve resource efficiency.

In the United States, there are two accredited voluntary certification standards for e-waste recyclers. The "e-Stewards" [82] certification scheme, initiated in 2009 and recently updated in 2020, is a comprehensive set of performance requirements created specifically for the electronics recycling. As a separate initiative, the "R2 Standard" [83] updated in 2013, is a certification for the e-waste recycling facilities to help ensure their quality, transparency, and environmental and social responsibility. In the EU, a voluntary certification standard for plastics recycling and reprocessing facilities called "EuCertPlast"[84] was initiated in 2009 with the aim of standardising and encouraging environmentally-friendly plastics recycling processes. The certification scheme works according to the European Standard (EN 15343:2007) that specifies the procedures needed for the traceability of recycled plastics. There are other EU-wide initiatives in certifying waste management facilities for e-waste. Initiated in 2011, the WEEE label of Excellence (WEEELABEX)[85] is a voluntary EU standard for operators related to the collection, handling, storage, recycling, preparation for re-use and disposal of e-waste.

Given the focus of this report is on trade implications of a circular economy transition, the remainder of this section focuses on the second approach on product standardisation. Product standards related to a circular economy can include for example, material content standards including recycled content standards or hazardous content standards, recyclability standards, reparability standards, sustainable production standards, material quality standards, and product standards for second-hand goods. These standards could also form the basis of eco-design (that could be part of EPR schemes and differentiated fees), green public procurement as well as labelling.

These standards related to a circular economy can be grouped into two broad categories along the product value chain. The first group of standards target upstream value chains for product design and production such as material content standards, recycled content standards, hazardous content standards, recyclability standards, reparability standards, and sustainable production standards. The second group of standards target downstream value chains including material quality standards for waste and scrap, and secondary raw materials, and product quality standards for refurbished, remanufactured and second-hand goods. These product based standards are mapped out in Table 3 below, and further explored in the following sub-sections.

[82] See the e-Stewards "Standard for Ethical and Responsible Reuse, Recycling, and Disposition of Electronic Equipment and Information Technology": http://e-stewards.org/learn-more/for-recyclers/.

[83] See SERI "R2 standard": https://sustainableelectronics.org/r2-standard.

[84] See: "EuCertPlast": https://www.eucertplast.eu/about.

[85] See: "WEEELABEX" standard: https://www.weeelabex.org/about-us/.

Table 3. Product based standards for a circular economy

<table>
<tr><th>CE Policy</th><th>CE Standards</th><th>Value chain</th><th>Trade implications</th></tr>
<tr><td>Extended producer responsibility (EPR)</td><td rowspan="4">• material content
• recycled content
• hazardous content
• recyclability
• reparability
• sustainable production</td><td rowspan="4">Upstream
(for product design and production)</td><td rowspan="8">• Whether one country's circular economy policy or standard is undermined by another country's domestic policy choices.
• Whether a patchwork of different regulations and standards across different jurisdictions could become unnecessary barriers to market access and trade
• Aligning to or using available international standards (wherever possible)</td></tr>
<tr><td>Eco-design</td></tr>
<tr><td>Green public procurement</td></tr>
<tr><td>Labelling</td></tr>
<tr><td>Recycling</td><td>• material quality
(for waste and scrap)
(for secondary raw materials)</td><td rowspan="4">Downstream
(for waste and scrap)
(for secondary raw materials)
(for goods for refurbishment and remanufacturing, and second-hand goods)</td></tr>
<tr><td>Refurbishment and remanufacturing</td><td rowspan="3">• product quality
(for goods for refurbishment and remanufacturing, and second-hand goods)</td></tr>
<tr><td>second-hand goods</td></tr>
<tr><td>Labelling</td></tr>
</table>

Source: Author based on Yamaguchi (2018[4]) and OECD (2021, forthcoming[65]).

Material content standards (Recycled content, Hazardous content)

Securing information on chemical and material composition of products is of particular importance to ensure the recyclability of end-of life products. As discussed in Section 4.2.1., material content standards are becoming increasingly important in the context of EPR schemes to strengthen incentives for eco-design. EPR schemes such as in France, Germany, and Italy are aiming to promote eco-design by introducing differentiated or modulated fees based on material content, recycled content, avoidance of hazardous content, as well as additional criteria to reduce environmental impacts. In 2015, France introduced modulated fees for their EPR schemes where products with a certain amount of recycled content would be subject to reduced EPR fees, whereas, products with hazardous substances or elements that hamper their recyclability would be subject to increased recycling fees.

The material content of products can be regulated based on different standards and criteria. For example, automobile manufacturers may be required to report on the material content of their vehicles based on reporting standards, as provided by the International Material Data Systems (IMDS). The system serves to collect information and secure transparency on substances and materials of products from upstream sub-contractors.

Products can also be subject to regulations based on the hazardous content they exhibit. For example, the EU Directive on the restriction of hazardous substances (RoHS) is a mandatory regulation that requires EU member states to ensure that electrical and electronic equipment placed on the market does not contain a defined set of hazardous substances.

The European Committee for standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC) under their Joint Technical Committee 10 (CEN-CLC JTC 10) on "Energy-related products - Material Efficiency Aspects for Ecodesign" is undertaking a project *inter-alia* to establish standards to assess the proportion

of recycled material content in energy-related products.[86] The work programme started in August 2017 and the standard is pending approval and yet to be published as of December 2019.

In addition, there are examples of private programmes to certify a product's recycled content. SCS Global Services, a private certification body in the US, developed a recycled content certificate based on a voluntary standard for recycled content claims applicable for different materials. Similarly, a private programme run by the UL provides an "Environmental Claim Validation Program" that verifies a product's recycled content.

Recyclability standards

In adopting recyclability standards, an important aspect is to ensure that products are designed in a way that they are easier to recycle and refrain from using hazardous content. Recyclability standards are constituted as a part of modulated EPR fees and eco-design initiatives established by producer responsibility organisations (PROs) as well as labelling initiatives that serve towards circular economy objectives. These recyclability standards generally build on material content including the uptake of recycled content or avoidance of hazardous content, as illustrated in the previous subsection.

There are further efforts to develop recyclability standards. The EU CEN-CENELEC Joint Technical Committee 10 (CEN-CLC JTC 10) published standards on "assessing the recyclability and recoverability of energy-related products" in November 2019. This EU standard includes general methodology for: (i) Assessing the recyclability of energy related products; (ii) Assessing the recoverability of energy related products; (iii) Assessing the ability to access or remove certain components or assemblies from energy related products to facilitate their potential for recycling or other recovery operations; and (iv) Assessing the recyclability of critical raw materials from energy related products. The standard defines a series of parameters, which could be considered to calculate product specific recycling and recoverability rates.[87]

Reparability Standards

Reparability standards can also facilitate the transition towards a circular economy. There are several initiatives at the national level and supra national level. In 2014, Austria established a national standard (ONR 192102:2014) that sets criteria to obtain a quality mark for long-lasting, repair-friendly designed electrical and electronic devices (ONR, 2014[76]). The system assesses large consumer appliances including refrigerators and washing machines against a set of 40 criteria, and consumer electronics including televisions and media players against a larger set of 53 criteria (Cordella, Alfieri and Sanfelix, 2019[77]). The standard uses both a pass/fail criteria, and criteria based on graded classes from 5-10. The uptake of this standard however appears to be limited to date. According to OECD (2021, forthcoming[65]), 24 washing machines and 40 vacuum cleaners

[86] See: General method for assessing the proportion of recycled material content in energy-related products – CEN- CENELEC-CEN/CLC/JTC 10 – at: https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:2240017&cs=146F3F0C3434E2342477B7A2945D5E308.

[87] See: General methods for assessing the recyclability and recoverability of energy-related products (Reference EN 45555:2019) – CEN- CENELEC-CEN/CLC/JTC 10 – at: https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:2240017&cs=146F3F0C3434E2342477B7A2945D5E308.

have been tested against this standard, and none of them have fulfilled the reparability criteria.

France, as stated in their circular economy action plan in 2019, is also preparing to establish recyclability standards and a mandatory label system for electrical, electronic equipment from 2020 (Plan Climat, 2019[78]). Aligned to this mandate, the French Environmental and Energy Agency (ADEME) undertook a study to examine the international benchmark of the repair sector (ADEME, 2018[79]).

Beyond the national level, the EU CEN-CENELEC Joint Technical Committee 10 (CEN-CLC JTC 10) is preparing to publish standards on "General methods for the assessment of the ability to repair, reuse and upgrade energy-related products". [88] The standard is envisaged to define parameters and methods relevant for assessing the ability to repair and reuse products; the ability to upgrade products; the ability to access or remove certain components to facilitate repair, reuse or upgrade and define reusability indexes or criteria. The standard is yet to be approved and is planned to be published in 2020. In addition, the EU Ecolabel includes reparability as a part of the initiative for products including furniture, mattresses, and sanitary tapware.

In addition, as shown in the previous Section 4.2.4 on labelling, several local and private initiatives set forth reparability criteria of products. The i-Fixit scoring system developed in California is a 0-10 scoring system that assesses the reparability of smartphones, tablets, and laptops, with 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. The Product 10Y Repairable label is an in-house label by the Groupe SEB that indicates the reparability of small household appliances. The label provides information on (i) the proximity to authorised repair centres, (ii) possibility to fully disassemble and reassemble the product without risk of damaging it, and (iii) availability of spare parts (10 years minimum), and their cost and delivery time.

Sustainable Production Standards

Several international and private sector initiatives set forth sustainable production standards that indicate products made through sustainable value chains. As seen in the previous Section 4.2.4 on labelling, many of the initiatives emerged in the garment and textile industry.

The Global Organic Textile Standard (GOTS) initiated in 2002 and recently updated in 2019 establishes standards, certification and labelling schemes for textile products that contain a minimum of 70% organic fibres and fulfils environmental criteria on accessories, used chemicals, and wastewater treatment plants. The system is comprised of four industry organisations from Germany, Japan, United States and the United Kingdom, and related international stakeholder organizations (GOTS, 2019[80]).

The Better Cotton Standard System of the BCI (Better Cotton Initiative) provides a holistic approach to ensure sustainable cotton production. Seven principles set forth criteria for farmers to: (i) minimise the harmful impact of crop protection practices, (ii) undertake water management, (iii) ensure soil quality, (iv) promote biodiversity and sustainable land

[88] See: General methods for the assessment of the ability to repair, reuse and upgrade energy-related products (Reference EN 45555:2019) – CEN- CENELEC-CEN/CLC/JTC 10 – at: https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:2240017&cs=146F3F0C3434E2342477B7A2945D5E308.

use, (v) secure fibre quality, (vi) preserve work ethics, and (vii) an pursue an effective management system. The standard aims to increase market access and availability of sustainable and credible cotton. The system also promotes the exchange of good practices, and encourage the scaling up of collective action (BCI, 2019[81]).

Higg Materials Sustainability Index is a self-assessment standard to evaluate social and environmental impacts of products through life cycle assessment (LCA) for the apparel and footwear industry. The Sustainable Apparel Coalition launched the scheme in 2012 (Higg MSI, 2019[82]).

Material quality standards *(for waste and scrap, secondary raw materials)*

Trade in secondary-raw materials is an important driver to facilitate a circular economy transition. Securing the quality and content of these materials is essential for their uptake. For this reason, the development of material quality standards and certification schemes for secondary raw materials is critical to scale up circular economy at the global level (OECD, 2018[26]; 2016[31]; 2016[13]; Prag, Lyon and Russillo, 2016[39]; OECD, 2020[1]; Business at OECD, 2020[83]). For plastics for example, premature secondary material markets, low quality of recycled material, and lack of quality standards were indicated as barriers to increase the uptake of recycled plastics.

The EU, as a part of their Circular Economy Action Plan announced in 2016, have pledged to develop quality standards for secondary raw materials, in particular for plastics. The implementation reports indicated that the Commission is working together with the European Committee for Standardisation (CEN) to initiate a standardisation process and undertake a comprehensive mapping exercise of existing and current standardisation work related to the treatment of waste and scrap, and the quality of secondary raw materials. The standardization of secondary raw materials are perceived to help build confidence in their uptake by the industry ((European Union, 2019[84]; 2019[85]).

In addition to secondary raw materials, the development of or improvements to waste contamination standards or certification systems may enable exporters to better meet the requirements set forth under the Basel Convention and other unilateral waste import restrictions (e.g. contamination levels). Indeed, previous work by the OECD has highlighted that some exporters have faced obstacles in trading non-hazardous recyclable materials (e.g. scrap metals), where containers have been stopped by enforcement agencies without a clear indication of the applied standard or criteria (OECD, 2010[36]; 2010[86]). Part of the problem appears to stem from unclear standards on the acceptable levels of contamination. While industry standards, such as scrap specifications by the Institute of Scrap Recycling Industries (ISRI),[89] serve to facilitate business transactions between traders and recyclers, regulatory authorities have reported in the past that some of these industry specifications lack clarity (OECD, 2010[86]). For this reason, some industry representatives have called for the need to develop standards that set forth the levels of allowed contamination for non-hazardous recyclable material (OECD, 2010[86]).

Product quality standards *(for refurbished, remanufactured and second-hand gods)*

Standards on second-hand goods can also help develop markets and build confidence for the update of used products by ensuring their quality.

[89] See ISRI Scrap Specifications Circular: https://www.isri.org/recycling-commodities/scrap-specifications-circular.

The British Standards Institute (BSI) developed a voluntary standard - PAS 141:2011 - to build confidence in used and waste electrical and electronic equipment (WEEE) for reuse by setting a benchmark for minimum functionality standards for reusable electrical and electronic devices. The criteria involves environmental safety and quality assurance, as well as additional requirements for the documentation and management of the product. The standard is available for quality assessors, organisations responsible for the recycling of electronic equipment and components, and anyone dealing with the storage and packaging of electrical equipment (BSI, 2011[87]).

There are additional initiatives to set quality standards for refurbished, remanufactured goods. In 2017, the American National Standards Institute (ANSI) approved a proposed standard developed by the Remanufacturing Industries Council (RIC) on "Specifications for the Process of Remanufacturing - RIC001.1-2016". The standard establishes a benchmark on the process of remanufacturing, and provides specifications that characterize the remanufacturing process and differentiate them from other practices. The standard aims to build confidence in remanufactured products that are dependable and of a consistent high quality (RIC, 2017[88]).

Beyond the national level, the EU CEN-CENELEC Joint Technical Committee 10 (CEN-CLC JTC 10) published standards on "the proportion of reused components in energy-related products" in June 2019. The standard sets forth methods to assess the proportion of re-used components in energy-related products on a generic level.[90]

These examples of product based standards related to circular economy are compiled in Table 4 below.

[90] See: General method for assessing the proportion of reused components in energy-related products (Reference EN 45556:2019) – CEN- CENELEC-CEN/CLC/JTC 10 – at: https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:2240017&cs=146F3F0C3434E2342477B7A2945D5E308.

Table 4. Examples of product based standards for a circular economy

Value chain	CE Standards	Examples
Upstream (for product design and production)	• Material content • Recycled content • Hazardous content	• International Material Data Systems (IMDS) • EU Directive on the restriction of hazardous substances (RoHS) • EPR schemes and modulated fees such as in France, Germany, and Italy • CEN/CLC/JTC 10 - General method for assessing the proportion of recycled material content in energy-related products (pending approval) • SCS Global Services • UL - Environmental Claim Validation Program on Recycled Content
	• Recyclability	• CEN/CLC/JTC 10 - General methods for assessing the recyclability and recoverability of energy-related products (Reference EN 45555:2019)
	• Reparability	• Austrian standard on recyclability (ONR 192102:2014) • CEN/CLC/JTC 10 - General methods for the assessment of the ability to repair, reuse and upgrade energy-related products (Reference EN 45555:2019) • i-Fixit scoring system • Product 10Y Repairable label
	• sustainable production	• Global Organic Textile Standard (GOTS) • Better Cotton Standard System of the BCI (Better Cotton Initiative) • Higg Materials Sustainability Index
Downstream (for secondary raw materials, goods for refurbishment and remanufacturing, and second-hand goods)	• material quality (for waste and scrap)	• ISRI Scrap Specifications Circular
	• material quality (for secondary raw materials)	• Circular Economy Action Plan – development of quality standards for secondary raw materials (on-going)
	• product quality (for goods for refurbishment and remanufacturing, and second-hand goods)	• British Standards Institute (BSI) developed a voluntary standard - PAS 141:2011 - Reuse of used and waste electrical and electronic equipment (UEEE and WEEE). • American National Standards Institute (ANSI) "Specifications for the Process of Remanufacturing - RIC001.1-2016" developed by the Remanufacturing Industries Council (RIC) • CEN/CLC/JTC 10 - General method for assessing the proportion of reused components in energy-related products (Reference EN 45556:2019)

Source: Author based on various sources including OECD (2021, forthcoming[65]).

These various standards related to circular economy can have several implications to trade. First, there could be a question to whether one country's circular economy policy or standard is undermined by another country's domestic policy choices. For example, eco-design standards and modulated fees can be organised within EPR schemes at the national or sub-national level whereas consumer products can be designed for the global market (OECD, 2016[31]). In the absence of harmonised regulations and standards, individual schemes will only be able to provide weak and diverging signals to producers on product preferences. Harmonised standards can help reduce potential spill over effects, eliminate unintended incentives to buy and discard in different jurisdictions, and lower production costs (OECD, 2016[31]).

Second, in a similar vein, concerns have been raised that the patchwork of different regulations and standards across different jurisdictions can be seen as a barrier to trade for certain goods, including primary and secondary raw materials, waste and scrap, and second-hand goods (Yamaguchi, 2018[4]). With the emergence of global value chains, eco-

design and eco-labelling schemes that build upon these standards may play an important role to reduce life cycle environmental impacts from materials (OECD, 2016[31]; 2016[13]; Prag, Lyon and Russillo, 2016[39]). These schemes need to be designed with care so that they do not act a barriers to access international markets (Prag, Lyon and Russillo, 2016[39]). Collective effort at the international level, such as global recyclability standards, may also be required to maximise the impact of these schemes.

For these reasons, the harmonisation of standards as well as the mutual recognition of conformity assessment procedures have been recommended in various bodies of research concerning the transition to a more resource efficient and circular economy (OECD, 2018[26]; 2016[31]; 2016[13]; Prag, Lyon and Russillo, 2016[39]; Yamaguchi, 2018[4]).

Beyond existing and ongoing initiatives to set forth international standards on a circular economy, additional efforts may be necessary for harmonisation and mutual recognition of these standards to facilitate trade towards reducing global environmental impacts. There are wide ranging initiatives to set circular economy standards that may not fall within the scope of international standard setting processes. As illustrated in Table 4, national, domestic, and private standards related to the circular economy have mainly emerged in this past decade. They set forth wide ranging standards from upstream product design such as material content, recycled content, hazardous content, recyclability, reparability, and sustainable production, as well as standards for downstream end-of-life products and materials, including material quality for secondary raw materials and product quality for refurbished, remanufactured, and second-hand goods.

Such efforts can be pursued at the multilateral level, through institutions such as the WTO and OECD to create dialogue and increase transparency of these measures. The WTO notifications could be utilised to strengthen these efforts. The WTO Committee on Trade and Environment as well as the OECD Joint Working Party on Trade and Environment, could be suitable forums to further discuss these issues.

Beyond multilateral frameworks, regional efforts to promote the harmonisation or mutual recognition of circular economy standards could be pursued for example under regional trade agreements (RTAs). RTAs increasingly include institutional mechanism for Parties to follow up on environmental co-operation (George and Yamaguchi, 2018[52]; George, 2014[53]) and there are emerging signs in considering explicit circular economy related provisions in a number of agreements currently under negotiation (see Section 4.1.2). Yada et al. (2017[89]), focussing on energy efficiency standards, indicate opportunities to harmonise standards through the frameworks provided by RTAs. They argue that energy efficiency policymakers have lacked active consideration of how trade agreements can work as a vector for possible harmonisation of energy efficiency products standards and call for increased dialogue and cooperation between energy efficiency policy makers and trade officials.

Harmonisation and mutual recognition of environmental standards can be challenging because of different level of development and priorities of economies. Ensuring that regulatory convergence occurs around the highest level of standards, instead of the lowest common denominator is not an easy task (Yada et al., 2017[89]). In cases where harmonisation and mutual recognition of circular economy standards proves to be a difficult task, there may be second best options to explore in the framework of trade facilitation, regulatory co-operation, and sector specific mechanisms that are also increasingly available in RTAs (OECD, 2021, forthcoming[90]; 2020[91]; De Lange, Walsh and Sheeran, 2018[23]). For example, sector specific annexes encompassing specific environmental issues are incorporated in some RTAs including the United States-Mexico-

Canada (USMCA)[91] and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)[92] and may serve as a starting point.

[91] USMCA (n.d.), Chapter 12, Article 12.D.5: "Voluntary Approaches to Promote Energy Efficiency".

[92] Comprehensive and Progressive Agreement for Trans-Pacific Partnership CPTPP (2018), Chapter 8, Annex 8-G: "Organic Products".

5. Towards a mutually supportive agenda

This report aims to identify ways to make circular economy (and similar) policies and trade policies mutually supportive by mapping out potential misalignments and identifying opportunities to align and strengthen both policy areas. While the report focuses on the circular economy concept, many of the main insights can be extended to other policy frameworks that aim to improve resource efficiency, enhance sustainable materials management, and address the environmental consequences of resource use.

Some potential actions to align trade and circular economy polices can be pursued at the national level. Other potential actions require co-operation and co-ordination at the international level. Further issues remain as open questions and require additional research. The following sub-sections map out these issues separately.

5.1 National approaches

In order to ensure that trade and circular economy policies are mutually supportive, circular economy policies, ranging from EPR and product stewardship schemes, eco-design policies, taxes and subsidies, green public procurement, to eco-labelling initiatives, need to be designed and implemented in a non-discriminatory fashion in accordance with multilateral trade rules and without being excessively restrictive than necessary to meet their objectives. Policies that may have significant trade effects should be notified to stakeholders and fulfil consultation requirements set forth by WTO rules. Transparency of these schemes can be increased through timely notifications of draft regulations to the WTO.

EPR schemes could be (re)examined on how they account for end-of-life value chains. In particular, some schemes appear to be associated with domestic measures that over incentivise waste and scrap trade by allowing PROs and recycling entities to claim that waste and scrap exports are 100% recycled. This mechanism works in favour of meeting designated recycling targets. Even if these fractions are sent to credible and certified recycling facilities abroad, 100% recycling rates will not be achieved because of losses that occur through the value chain by transporting and processing these materials. Additional efforts are required to better understand the fate of waste shipments abroad, in order to secure the environmentally sound management of waste in the recipient country.

Increased enforcement of EPR schemes could contribute to reduce illegal waste trade. While challenging, governments could also increase efforts to collect data on illegal waste trade that partly takes place within their jurisdiction. Establishing a single electronic registry, developing peer-review reporting systems to inform authorities of suspected free riders, requiring online sellers to display the details of their PRO registration online, could decrease potential free-riding of EPR schemes that can occur through cross-border online sales.

Circular economy related standards can encompass various initiatives including material content standards, recycled content standards, hazardous content standards, recyclability standards, reparability standards, sustainable production standards, material quality standards, and product standards for second-hand goods. In particular, developing standards on the material quality of secondary raw materials, and standards on sustainable production to ensure environmentally sustainable supply chains appear to be critical for a

circular economy transition. The development of national standards related to circular economy are encouraged to be aligned to international standards wherever effective and appropriate in line with the WTO TBT Agreement. These technical regulations and standards need to be notified in a timely manner, and secure appropriate time for stakeholders to engage in consultations and transition to new requirements, in accordance with WTO rules.

Revisiting national definitions of waste, scrap, second-hand goods, and goods for refurbishment and remanufacturing, could be ways to facilitate trade that contribute to a circular economy, and distinguishing them from unwanted fractions.

5.2 International approaches

International co-operation and co-ordination can help boost countries' efforts to transition towards a circular economy in a number of ways.

EPR policies can encounter free-riding of global traders through online sales. The risk is expected to increase as the market of online sales continues to grow. In addition to domestic efforts, co-ordination at the international level can contribute to tackle free-riding from online sales.

In the context of emerging circular economy standards at the national and local level, efforts for harmonisation of these standards and mutual recognition of conformity assessment procedures will be increasingly necessary to facilitate trade that reduces environmental impacts. Development of international standards is critical in this respect. For this reason, the progress by ISO TC-323 on circular economy standards is to be seen in the coming years. In particular, developing international standards on material quality of secondary raw materials, and standards on sustainable production to ensure environmentally sustainable supply chains appear to be critical for circular economy transitions.

In addition to areas that are covered by domestic policies, the fragmentation of different definitions of waste, scrap, end-of-life products, second-hand goods, and goods for refurbishment and remanufacturing, could undermine countries' efforts to transition towards a circular economy. Moreover, better data on waste and scrap trade, illegal waste trade, trade in secondary raw materials, and second-hand goods could contribute to better understand the nature of these trade flows. Currently, HS codes at the 6 digit level do not allow to make these distinctions. International and regional dialogues between environmental policy makers and trade and customs officials are required to further understand these differences.

These international efforts could be pursued at the multilateral level, for example under the Basel Convention, at the WTO, and the OECD. International Organisations would be able to provide a platform for dialogue such as the WTO Committee on Trade and Environment (CTE) and the OECD Joint Working Party for Trade and Environment (JWPTE) that brings trade and environment policy makers to the same table. These frameworks could serve to increase transparency of on-going developments around circular economy and trade, and provide analytical work to further develop the knowledge base.

In addition to these multilateral channels, RTAs could provide additional avenues for regional and bilateral environmental co-operation. For example, efforts to exchange information on the possible harmonisation and mutual recognition of circular economy standards could be explored between the Parties to an RTA. In the case where

harmonisation and mutual recognition of standards prove to be difficult, additional ways forward can be explored for example trade facilitation and regulatory co-operation mechanisms through RTAs. As a first step, parties could consider including explicit references to circular economy in these agreements.

Finally, Official Development Assistance (ODA) and Aid for Trade (AfT) mechanisms may provide additional opportunities to create dialogue and assist developing countries to build their trade capacity and necessary infrastructure to enable trade and circular economy objectives to be mutually supportive (OECD, 2020[1]).

5.3 Knowledge gaps

Several knowledge gaps towards a mutually supportive trade and circular economy agenda are also identified.

Regarding circular economy policies, a key question on EPR policies arises on whether and how they take account of "leakage" occurring through trade in second-hand goods that are legal activities. Furthermore, landfill taxes and bans are identified as one of the successful measures to boost domestic recycling rates and reduce waste volumes directed to landfills. However, they may have contributed to increased waste trade that potentially put environmental pressures on the receiving country. This may need to be investigated.

A better understanding is necessary on how trade and global supply chains can be aligned to circular economy principles, including efforts for ensuring that the extractive sector is environmentally sustainable and securing an inclusive and just transition.

The definition and classification of waste, scrap, secondary raw materials, second-hand goods, and goods for refurbishment and remanufacturing, within jurisdictions and in HS codes remains an area that could be studied in more depth.

The nature of trade in waste and scrap, and second-hand goods, and whether they are good or bad for the environment, is an area where the evidence is weak and may deserve detailed studies. Investigation is needed on how to ensure that trade in waste, scrap and second-hand goods does not go to countries that cannot process it. In particular, there is a need for standards and information on recycling facilities. There may be opportunities to expand on the OECD Database on Transboundary Movement of Waste in this regard. Furthermore, better understanding of the nature, rationale and impacts of imposing trade restrictions - in particular export restrictions on waste and scrap, and secondary raw materials - is an issue that requires additional investigation.

Finally, more analysis is also required on how trade can provide additional opportunities to support circular business models and their global activities, including the establishment of reverse logistics in end-of-life value chains. For example, trade in secondary raw materials or trade in goods for refurbishment and remanufacturing can provide economic and environmental opportunities through economies of scale. Additional avenues in securing resilient value chains that contribute to circular economy objectives via enhanced transparency and traceability could be explored in the emerging area of digital technology and innovation, as well as trade facilitation mechanisms, trusted trader programs, and authorised economic operators available under trade and customs frameworks (OECD, 2020[1]). The role of services trade and how they contribute to the uptake of new business models for a circular economy is also an under researched area.

These potential national approaches, international approaches, and knowledge gaps are compiled in Table 5 below.

Table 5. Domestic approaches, international approaches and knowledge gaps in securing the mutual supportiveness of trade and circular economy

CE Policies, trade flows	Potential Actions
Domestic approaches	
CE policies in general	Designed and implemented in a non-discriminatory fashion in accordance with multilateral trade rules and not excessively restrictive than necessary to meet their objectives
	Notify polices that may have significant trade effects to stakeholders and fulfil consultation requirements set forth by WTO rules.
EPR and product stewardship schemes	(Re)examine how they account for end-of-life value chains. Some schemes appear to be associated with domestic measures that over incentivise trade in waste and scrap by allowing PROs and recycling entities to claim that exports in waste and scrap are 100% recycled, and meet their recycling targets. Make additional efforts to better understand waste and scrap exports in order to secure the environmentally sound management of waste in the recipient country.
	Increase enforcement to reduce illegal waste trade. Raise efforts to collect data on illegal waste trade that partly takes place within their jurisdiction
	Consider ways to decrease potential free-riding of EPR schemes that can occur through cross-border online sales, such as: (i) establish a single electronic registry, (ii) develop peer-review reporting systems to inform authorities of suspected free riders, and/or (iii) require online sellers to display the details of their PRO registration online.
Circular economy related standards	Develop standard on the material quality of secondary raw materials, and standards on sustainable production to ensure environmentally sustainable supply chains that appear to be critical for a circular economy transition.
	Develop national standards relevant to circular economy and, where possible, align them to international standardisation initiatives in accordance with the WTO TBT Agreement. For example, ISO TC-323 on circular economy is expected to be published in 2023.
	Notify regulations and standards to the WTO in a timely manner, and secure appropriate time for stakeholders to engage in consultations and transition to new requirements, in accordance with the WTO TBT Agreement.
Trade in waste and scrap, second-hand goods, and goods for refurbishment and remanufacturing	Revisit national definitions of waste and scrap, second-hand goods, and goods for refurbishment and remanufacturing, to facilitate trade that may contribute to circular economy, and distinguishing them from unwanted fractions from a circular economy perspective.
International approaches	
EPR and product stewardship schemes	Increase efforts on co-ordination of EPR policies at the international level that can contribute to tackle free-riding of global traders through online sales.
	Increase efforts for harmonisation of national and local circular economy related standards as well as mutual recognition of related conformity assessment

Circular economy related standards	procedures in order to facilitate trade towards a circular economy to utilise materials efficiently across their lifecycle and reduce environmental impacts.
	Engage in the development of international standards, such as the progress by ISO TC-323 on the circular economy.
	Develop international standards on material quality of secondary raw materials, and standards on sustainable production to ensure environmentally sustainable supply chains that are critical for a circular economy transition.
Trade in waste and scrap, secondary material, second-hand goods, and goods for refurbishment and remanufacturing	Place efforts to clarify the fragmentation of different definitions of waste and scrap, end-of-life products, second-hand goods, and goods for refurbishment and remanufacturing, that could undermine countries' efforts to transition towards a circular economy.
	Place efforts to secure better data on waste and scrap trade, illegal waste trade, trade in secondary raw materials, and second-hand goods to contribute to better understand the nature of these trade flows.
	Consider revisiting HS codes at the 6 digit level, that does not allow to make distinctions between waste and scrap, secondary materials, second-hand goods, and goods for refurbishment and remanufacturing that are critical for a circular economy transition.
	Establish international and regional dialogues to further understand differences on definitions related to these terms and their impact on trade flows (e.g. under the Basel Convention, the WTO, the OECD, RTAs, ODA and Aid for Trade (AfT))
Knowledge gaps	
EPR schemes	Examine how EPR policies take account of "leakage", that occurs through trade in second-hand goods that are not illegal activities.
Landfill taxes (bans)	Examine the drivers and impacts of waste trade and particularly on whether if landfill taxes and bans have contributed to increased waste trade that potentially put environmental pressures on the receiving country.
Trade and supply chains	Examine how trade and global supply chains can be aligned to circular economy principles, including efforts for ensuring that the extractive sector is environmentally sustainable and securing an inclusive and just transition.
Trade in waste, scrap, second-hand goods, and goods for refurbishment and remanufacturing	Examine the definition and classification of waste, scrap, secondary raw materials, second-hand goods, and goods for refurbishment and remanufacturing, within jurisdictions and in HS codes and their corresponding relationships and possible gaps.
Trade in waste and scrap, second-hand goods	Examine the nature of trade in waste and scrap and second-hand goods, and whether they are good or bad for the environment. Examine how to ensure that trade in waste, scrap and second-hand goods does not go to countries that cannot process it. Particularly, there may be a need for standards and information recycling facilities.
Trade in waste and scrap, and secondary-raw materials	Examine the nature, rationale and impacts of imposing trade restrictions, in particular export restrictions, on secondary raw materials.
End-of-life value chains (e.g. trade in secondary raw materials, goods for	Examine how trade can provide additional opportunities to support global efforts towards a circular economy (e.g. additional avenues in securing resilient value chains through trade facilitation mechanisms, trusted trader programs, and

refurbishment and remanufacturing)	authorised economic operators available under trade and customs frameworks).
Supply chains and end-of-life value chains	Examine the potential role of digital technology and innovation to support trade and circular economy policies and to clarify information and knowledge gaps in supply chains and end-of-life value chains.
Trade in services	Examine the role of services trade and how they contribute to the uptake of new business models for a circular economy is also an under researched area.

Source: Author based on various sources identified in this study.

References

ADEME (2018), "BENCHMARK INTERNATIONAL DU SECTEUR DE LA RÉPARATION", Mai 2018, https://www.ademe.fr/sites/default/files/assets/documents/benchmark_reparation_2018_rapport.pdf. [79]

AFNOR (2018), "XP X30-901 - October 2018, Circular economy - Circular economy project management system", French national standardization organization, https://www.boutique.afnor.org/standard/xp-x30-901/circular-economy-circular-economy-project-management-system-requirements-and-guidelines/article/919346/fa194960. [73]

BCI (2019), "Better Cotton Standard System - Better Cotton Initiative", https://bettercotton.org/better-cotton-standard-system/. [81]

Brandi, C. (2017), "Trade Elements in Countries' Climate Contributions under the Paris Agreement", https://www.ictsd.org/sites/default/files/research/trade_elements_in_countries_climate_contributions.pdf. [41]

BSI (2017), "BS 8001:2017 Framework for implementing the principles of the circular economy in organizations – Guide. The Britisch Standard Institution.", British Standards Institution, https://shop.bsigroup.com/ProductDetail?pid=000000000030334443&_ga=2.12961393.712633483.1578284820-798123128.1566570208. [72]

BSI (2011), "PAS 141 - Reuse of used and waste electrical and electronic equipment (UEEE and WEEE) – Process management – Specification", https://shop.bsigroup.com/ProductDetail/?pid=000000000030245346. [87]

Business at OECD (2020), "TRADE AND CIRCULAR ECONOMY, A private sector contribution to the OECD Workshop on Trade and Circular Economy Paris, 26-27 February 2020", http://biac.org/wp-content/uploads/2020/02/KM-ENVTAD-2020-02-FIN-Business-at-OECD-Workshop-on-Trade-and-Circular-Economy.pdf. [83]

Cordella, M., F. Alfieri and J. Sanfelix (2019), "Analysis and development of a scoring system for repair and upgrade of products - Final report", JRC Technical Reports, Publications Office of the European Union, Luxembourg, http://dx.doi.org/10.2760/725068. [77]

Czaga, P. and B. Flies (2005), "Used goods trade - A growth opportunity", OECD Observer, http://oecdobserver.org/news/archivestory.php/aid/1505/Used_goods_trade.html. [40]

De Lange, D., P. Walsh and P. Sheeran (2018), "Understanding the Future of Canada-UK Trade Relationships in a Circular Economy Context", November 30, 2018, https://ssrn.com/abstract=3293847. [23]

Dellink, R. (2020), "The Consequences of a more resource efficient and circular economy for international trade patterns: A modelling assessment", *OECD Environment Working Papers*, No. 165, OECD Publishing, Paris, https://doi.org/10.1787/fa01b672-en. [2]

Dussaux, D. and M. Glachant (2019), "How much does recycling reduce imports? Evidence from metallic raw materials", *Journal of Environmental Economics and Policy*, Vol. 8/2, pp. 128-146, http://dx.doi.org/10.1080/21606544.2018.1520650. [16]

EREK (2018), "Circular Economy Project Management System", European Resource Efficiency Knowledge Center, https://www.resourceefficient.eu/en/support-programme/circular-economy-project-management-system. [74]

Eunomia (2018), "Plastic Packaging - Shedding Light on the UK Data", https://www.eunomia.co.uk/reports-tools/plastic-packaging-shedding-light-on-the-uk-data/. [59]

European Remanufacturing Network (2015), "Remanufacturing Market Study", European Commission. [44]

European Union (2019), "REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the implementation of the Circular Economy Action Plan", COM(2019) 90, SWD(2019) 90 final, Brussels, 4.3.2019, European Comission, https://ec.europa.eu/environment/circular-economy/pdf/report_implementation_circular_economy_action_plan.pdf. [84]

European Union (2019), "REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the implementation of the Circular Economy Action Plan - COMMISSION STAFF WORKING DOCUMENT Accompanying the document", COM(2019) 190 final, SWD(2019) 90 final, Brussels, 4.3.2019, European Commission, https://ec.europa.eu/environment/circular-economy/pdf/report_implementation_54_actions.pdf. [85]

European Union (2019), "Tools making value chains more circular and resource efficient", Input Document, Session 3: Standardisation, G7 Workshop, 2021 March 2019. [71]

European Union (2019), "Tools making value chains more circular and resource efficient. Voluntary agreements, standardisation & non-financial reporting", Summary Report, G7 Workshop, Paris, 20-21 March 2019, https://ec.europa.eu/environment/international_issues/pdf/G7%20Private%20Sector%20Workshop%20(Paris%2020-21%20March%202019)%20-%20Summary%20Report.pdf. [70]

European Union (2017), "Promoting remanufacturing, refurbishment, repair, and direct reuse - As a contribution to the G7 alliance on resource efficiency 7-8 February 2017 Brussels, Belgium : workshop report", https://publications.europa.eu/en/publication-detail/-/publication/ac22b439-370c-11e7-a08e-01aa75ed71a1. [46]

Eurostat (2018), "Economy-wide material flow accounts", HANDBOOK, 2018 edition, http://dx.doi.org/10.2785/158567. [12]

Farrelly, T., P. Schneider and P. Stupples (2016), "Trading in waste: Integrating sustainable development goals and environmental policies in trade negotiations toward enhanced solid waste management in Pacific Islands countries and territories", *Asia Pacific Viewpoint*, Vol. 57/1, pp. 27-43, http://dx.doi.org/10.1111/apv.12110. [29]

Garsous, G. (2019), "Trends in policy indicators on trade and environment", *OECD Trade and Environment Working Papers*, No. 2019/01, OECD Publishing, Paris, https://dx.doi.org/10.1787/b8d2bcac-en. [24]

George, C. (2014), "Environment and Regional Trade Agreements: Emerging Trends and Policy Drivers", *OECD Trade and Environment Working Papers*, No. 2014/2, OECD Publishing, Paris, https://dx.doi.org/10.1787/5jz0v4q45g6h-en. [53]

George, C. and S. Yamaguchi (2018), "Assessing Implementation of Environmental Provisions in Regional Trade Agreements", *OECD Trade and Environment Working Papers*, No. 2018/01, OECD Publishing, Paris, https://dx.doi.org/10.1787/91aacfea-en. [52]

Giljum, S., M. Bruckner and A. Martinez (2015), "Material Footprint Assessment in a Global Input-Output Framework", *Journal of Industrial Ecology*, Vol. 19/5, pp. 792-804, http://dx.doi.org/10.1111/jiec.12214. [14]

GOTS (2019), "Global Organic Textile Standard International Working Group (IWG) - Global Standard gGmbH", https://www.global-standard.org/. [80]

Gruère, G. (2013), "A Characterisation of Environmental Labelling and Information Schemes", *OECD Environment Working Papers*, No. 62, OECD Publishing, Paris, https://dx.doi.org/10.1787/5k3z11hpdgq2-en. [66]

Higashida, K. and S. Managi (2013), "Determinants of trade in recyclable wastes: evidence from commodity-based trade of waste and scrap", *Environment and Development Economics*, Vol. 19/2, pp. 250-270, http://dx.doi.org/10.1017/s1355770x13000533. [27]

Higg MSI (2019), "Sustainable Apparel Coalition - Higg MSI", https://msi.higg.org/page/msi-home. [82]

Hilton, M. et al. (2019), "Extended Producer Responsibility (EPR) and the Impact of Online Sales", *OECD Environment Working Papers*, No. 142, OECD Publishing, Paris, https://dx.doi.org/10.1787/cde28569-en. [62]

Huisman, J. et al. (2015), "Countering WEEE Illegal Trade, Summary Report, Market Assessment, Legal Analysis, Crime Analysis and Recommendations roadmap", http://www.weee-forum.org/sites/default/files/documents/cwit_summary_report_final_medium_resolution_0.pdf. [32]

Hund, K. et al. (2020), "Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition", The World Bank Group, Washington, D.C., http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf. [9]

IISD (2019), "Summary of the Meetings of the Conferences of the Parties to the Basel, Rotterdam and Stockholm Conventions: 29 April – 10 May 2019", Earth Negotiations Bulletin, Vol. 15, No. 269, the International Institute for Sustainable Development (IISD), http://enb.iisd.org/chemical/cops/2019/. [35]

IISD/SITRA (2020), "Trading services for a circular economy", International Institute for Sustainable Development (IISD) and the Finnish Innovation Fund (SITRA),, https://www.iisd.org/publications/trading-services-circular-economy. [50]

INTERPOL (2020), "Stratigic Analysis Report, Emerging criminal trends in the global plastic waste market since January 2018", August, 2020, https://www.interpol.int/content/download/15587/file/INTERPOL%20Report%20_criminal%20trends-plastic%20waste.pdf. [33]

ISO (2019), "ISO/TC 323 - Circular economy", International Organization for Standardization, https://www.iso.org/committee/7203984.html. [75]

ISO (2014), "Economic benefits of standards", International Organization for Standardization, Geneva, https://www.iso.org/publication/PUB100403.html. [95]

Kellenberg, D. (2012), "Trading wastes", *Journal of Environmental Economics and Management*, Vol. 64/1, pp. 68-87, http://dx.doi.org/10.1016/j.jeem.2012.02.003. [25]

Kettunen, M., S. Gionfra and M. Monteville (2019), "EU Circular Economy and Trade Report: Improving policy coherence for sustainable development", IEEP Brussels / London., https://ieep.eu/publications/eu-circular-economy-and-trade-report. [3]

Kojima, M. (2017), "Remanufacturing and Trade Regulation", *Procedia CIRP*, Vol. 61, pp. 641-644, http://dx.doi.org/10.1016/j.procir.2016.11.251. [45]

Mazzanti, M. and R. Zoboli (2013), "International Waste Trade: Impacts and drivers", in D'Amato, A., M. Mazzanti and A. Montini (eds.), *Waste Management in Spatial Environments*, Routledge, London and New York, https://www.researchgate.net/publication/297044831_International_Waste_Trade_Impacts_and_drivers. [38]

McCarthy, A. and P. Börkey (2018), "Mapping support for primary and secondary metal production", *OECD Environment Working Papers*, No. 135, OECD Publishing, Paris, https://dx.doi.org/10.1787/4eaa61d4-en. [63]

McCarthy, A., R. Dellink and R. Bibas (2018), "The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches", *OECD Environment Working Papers*, No. 130, OECD Publishing, Paris, https://dx.doi.org/10.1787/af983f9a-en. [7]

Morin, J., A. Dür and L. Lechner (2018), "Mapping the trade and environment nexus: Insights from a new dataset", *Global Environmental Politics*, Vol. 18/1, https://www.chaire-epi.ulaval.ca/en/trend. [51]

OECD (2020), *Environment at a Glance 2020*, OECD Publishing, Paris, https://dx.doi.org/10.1787/4ea7d35f-en. [6]

OECD (2020), "Greening regional trade agreements on non-tarrif measures through technical barriers to trade and regulatory co-operation", 25 November 2020, [COM/TAD/ENV/JWPTE(2020)1/FINAL], Paris, France. [91]

OECD (2020), "Improving resource efficiency and the circularity of economies for a greener world", *OECD Environment Policy Papers*, No. 20, OECD Publishing, Paris, https://dx.doi.org/10.1787/1b38a38f-en. [55]

OECD (2020), "Material resources: Mineral and Energy Resources", *OECD Environment Statistics* (database), https://dx.doi.org/10.1787/21082980-en (accessed on 3 June 2020). [10]

OECD (2020), "OECD Workshop on International Trade and Circular Economy - Summary Report", 10 December 2020, [COM/TAD/ENV/JWPTE(2020)10/FINAL], Paris, France. [1]

OECD (2020), "Policy scenarios for a transition to more resource efficient and circular economy", 25 September 2020, [ENV/EPOC/WPIEEP(2019)11/FINAL], Paris, France. [54]

OECD (2019), *Business Models for the Circular Economy: Opportunities and Challenges for Policy*, OECD Publishing, Paris, https://dx.doi.org/10.1787/g2g9dd62-en. [48]

OECD (2019), *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264307452-en. [5]

OECD (2019), "Measuring distortions in international markets: the aluminium value chain", *OECD Trade Policy Papers*, No. 218, OECD Publishing, Paris, https://dx.doi.org/10.1787/c82911ab-en. [64]

OECD (2019), *Waste Management and the Circular Economy in Selected OECD Countries: Evidence from Environmental Performance Reviews*, OECD Publishing, Paris, https://doi.org/10.1787/9789264309395-en. [56]

OECD (2018), *Improving Markets for Recycled Plastics: Trends, Prospects and Policy Responses*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264301016-en. [26]

OECD (2018), "Macroeconomic Impacts of a Circular Economy Transition, Policy analysis", Presentation at the Working Party on Resource Productivity and Waste (WPRPW), 23 November 2018, Yokohama, Japan. [57]

OECD (2017), *International Regulatory Co-operation and Trade: Understanding the Trade Costs of Regulatory Divergence and the Remedies*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264275942-en. [67]

OECD (2016), *Extended Producer Responsibility: Updated Guidance for Efficient Waste Management*, OECD Publishing, Paris, https://doi.org/10.1787/9789264256385-en. [31]

OECD (2016), *International Regulatory Co-operation: The Role of International Organisations in Fostering Better Rules of Globalisation*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264244047-en. [68]

OECD (2016), *OECD Compendium of Productivity Indicators 2016*, OECD Publishing, Paris, https://dx.doi.org/10.1787/pdtvy-2016-en. [22]

OECD (2016), *Policy Guidance on Resource Efficiency*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264257344-en. [13]

OECD (2015), *Material Resources, Productivity and the Environment*, OECD Green Growth Studies, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264190504-en. [11]

OECD (2014), "Intellectual property and standard setting", November 2014, [DAF/COMP(2014)27], Paris, France. [96]

OECD (2014), "The State of Play on Extended Producer Responsibility (EPR): Opportunities and Challenges", Issues Paper, Global Forum on Environment: Promoting Sustainable Materials Management through Extended Producer Responsibility (EPR), https://www.oecd.org/environment/waste/Global%20Forum%20Tokyo%20Issues%20Paper%2030-5-2014.pdf. [60]

OECD (2012), *Sustainable Materials Management: Making Better Use of Resources*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264174269-en. [8]

OECD (2011), "Standard Setting", March 2011, [DAF/COMP(2010)33], Paris, France. [69]

OECD (2010), "Reducing barriers to international trade in non-hazardous recyclable materials: exploring the environmental and economic benefits, Part 1: A synthesis report", 18 March 2010, [COM/TAD/ENV/JWPTE(2008)27/FINAL], Paris, France. [36]

OECD (2010), "Reducing barriers to international trade in non-hazardous recyclable materials: exploring the environmental and economic benefits, Part 2: Findings of five country case studies", 23 March 2010, [COM/TAD/ENV/JWPTE(2008)27/ANN/FINAL], Paris, France. [86]

OECD (2008), *Measuring material flows and resource productivity, Volume I the OECD Guide*, OECD Publishing, Paris, https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf. [93]

OECD (2001), *Extended Producer Responsibility: A Guidance Manual for Governments*, https://doi.org/10.1787/9789264189867-en. [58]

OECD (2021, forthcoming), "GRPs and IRC approaches in trade agreements, An historical perspective and a stocktaking of recent chapters and provision", 7 December 2020, [GOV/RPC(2019)17/REV2], Paris, France. [90]

OECD (2021, forthcoming), "Labelling and Information Schemes for the Circular Economy", 27 May 2019, [ENV/EPOC/WPRPW(2019)2], Paris, France. [65]

OECD (2021, forthcoming), "Responsible Business Conduct tools and instruments to address environmental challenges", 21 October 2020, [DAF/INV/RBC(2020)15], Paris, France. [97]

OECD (2021, forthcoming), "The circular economy and trade in metals and minerals", 19 September 2019, [TAD/TC/WP(2018)28/REV2], Paris, France. [18]

ONR (2014), "ONR 192102: 2014 10 01 - Gütezeichen für langlebige, reparaturfreundlich konstruierte elektrische und elektronische Geräte (Quality mark for long-lasting, repair-friendly designed electrical and electronic devices)", Austrian Standards, https://shop.austrian-standards.at/action/de/public/details/527823/ONR_192102_2014_10_01. [76]

Pacini, H. (2018), "Circular Economy: The New Normal?", UNCTAD Policy Brief No. 61, United Nations Conference on Trade and Development (UNCTAD), https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=2137. [21]

Plan Climat (2019), "50 mesures pour une économie 100% circulaire", La feuille de route pour l'économie circulaire, http://www.ecologique-solidaire.gouv.fr/sites/default/files/Feuille-de-route-Economie-circulaire-50-mesures-pour-economie-100-circulaire.pdf. [78]

Prag, A., T. Lyon and A. Russillo (2016), "Multiplication of Environmental Labelling and Information Schemes (ELIS): Implications for Environment and Trade", *OECD Environment Working Papers*, No. 106, OECD Publishing, Paris, https://dx.doi.org/10.1787/5jm0p33z27wf-en. [39]

Preston, F. and J. Lehne (2017), "A Wider Circle? The Circular Economy in Developing Countries", Chatham House, https://www.chathamhouse.org/publication/wider-circle-circular-economy-developing-countries. [20]

PRIF (2018), "Pacific Region Solid Waste Management and Recycling - Pacific Country and Territory Profiles", Pacific Region Infrastructure Facility, https://www.theprif.org/documents/regional/urban-development-waste-management/pacific-region-solid-waste-management-and. [61]

RIC (2017), "American National Standards Institute (ANSI) Standards for remanufacturing", Remanufacturing Industries Council, http://www.remancouncil.org/advocate/regulatory/ansi-standards. [88]

Sauvage, J. and C. Timiliotis (2017), "Trade in services related to the environment", *OECD Trade and Environment Working Papers*, No. 2017/2, OECD Publishing, Paris, https://dx.doi.org/10.1787/dc99bf2b-en. [49]

Secretariat of the Basel Convention (2013), "AMENDMENT PROPOSALS from THE SECRETARIAT OF THE BASEL CONVENTION to THE HARMONIZED SYSTEM COMMITTEE, WORLD CUSTOMS ORGANIZATION At its 51st session, Agenda Item VIII 3 Secretariat of the Basel Convention", http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-WASTELST-CON-HarmonizedSystemCommitteeAmendment-20130402.English.pdf. [37]

Shinkuma, T. and S. Managi (2011), *Waste and recycling: Theory and empirics*, Taylor and Francis, http://dx.doi.org/10.4324/9780203828014. [28]

Staub, C. (2018), "Import restrictions ripple across Southeast Asia - Plastics Recycling Update", https://resource-recycling.com/plastics/2018/06/06/import-restrictions-ripple-across-southeast-asia/. [34]

U.S. International Trade Commission (2012), "Remanufactured Goods: An Overview of the U.S. and Global Industries, Markets and Trade", U.S. International Trade Commission, Washington, D.C. [43]

UNEP (2019), "Global Resources Outlook 2019: Natural Resources for the Future We Want", United Nations Environment Programme, Nairobi, Kenya, http://www.resourcepanel.org/reports/global-resources-outlook. [17]

UNEP (2018), "Re-defining Value – The Manufacturing Revolution. Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy", A Report of the International Resource Panel, United Nations Environment Programme, Nairobi, Kenya. [42]

UNEP (2013), "Metal Recycling: Opportunities, Limits, Infrastructure", A Report of the Working Group on the Global Metal Flows to the International Resource Panel. Reuter, M. A.; Hudson, C.; van Schaik, A.; Heiskanen, K.; Meskers, C.; Hagelüken, C., United Nations Environment Programme, Nairobi, Kenya. [19]

UNEP (2011), "Recycling Rates of Metals: a status report", International Resource Panel, United Nations Environment Programme, Nairobi, Kenya. [94]

Valles, G. (2016), "The Circular Economy in International Trade", United Nations Conference on Trade and Development (UNCTAD), Geneva,, https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1400. [47]

Wiedmann, T. et al. (2015), "The material footprint of nations", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 112/20, pp. 6271-6276, http://dx.doi.org/10.1073/pnas.1220362110. [15]

WSC (2018), *International Standards and trade agreements*, World Standards Cooperation. [92]

Yada, J. et al. (2017), "Harmonization of product energy efficiency standards and free trade agreements: the role of international cooperation", International Partnership for Energy Efficiency Cooperation (IPEEC), http://www.iea-4e.org/. [89]

Yamaguchi, S. (2018), "International Trade and the Transition to a More Resource Efficient and Circular Economy: A Concept Paper", *OECD Trade and Environment Working Papers*, No. 2018/03, OECD Publishing, Paris, https://dx.doi.org/10.1787/847feb24-en. [4]

Yanai, A. (2014), "Environmental Provisions in Japanese Regional Trade Agreements with Developing Countries", IDE DISCUSSION PAPER No. 467, March 2014,, https://ir.ide.go.jp/?action=repository_uri&item_id=37709&file_id=22&file_no=1. [30]