Trading Services for a Circular Economy

SITRA

Ministry for Foreign Affairs of Finland

IISD
International Institute for Sustainable Development

Saara Tamminen
Malena Sell
Tim Forslund
Alice Tipping
Marta Soprana
Christophe Bellmann

October 2020

Published by the International Institute for Sustainable Development

Trading Services for a Circular Economy

October 2020

This report is a joint effort by IISD and the Finnish Innovation Fund Sitra. It was written by Saara Tamminen, Malena Sell, and Tim Forslund for Sitra, and Alice Tipping, Marta Soprana, and Christophe Bellmann for IISD.

The Finnish Innovation Fund Sitra

The Finnish Innovation Fund Sitra is a future fund that collaborates with partners from different sectors to research, trial and implement bold new ideas that shape the future. Our aim is a Finland that succeeds as a pioneer in sustainable well-being. Sitra was founded in 1967 as a gift from Parliament to the 50-year old Finland. We are an independent public foundation operating directly under the supervision of the Finnish Parliament.

At Sitra, we work with partners to lead the way in the transition to a fair and competitive carbon-neutral circular economy – a new kind of society in which our everyday lives and well-being are no longer based on excessive consumption and fossil fuel use.

Sitra has received recognition for its national and international work on sustainability and circular economy.

Head Office

Itämerenkatu 11-13
PO Box 160
00181 Helsinki
Finland R3B 0T4

Tel: +358 294 618 991
Website: wwww.sitra.fi/en
Twitter: @SitraFund

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) is an independent think tank championing sustainable solutions to 21st–century problems. Our mission is to promote human development and environmental sustainability. We do this through research, analysis and knowledge products that support sound policymaking. Our big-picture view allows us to address the root causes of some of the greatest challenges facing our planet today: ecological destruction, social exclusion, unfair laws and economic rules, a changing climate. IISD's staff of over 120 people, plus over 50 associates and 100 consultants, come from across the globe and from many disciplines. Our work affects lives in nearly 100 countries. Part scientist, part strategist—IISD delivers the knowledge to act.

IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Province of Manitoba and project funding from numerous governments inside and outside Canada, United Nations agencies, foundations, the private sector, and individuals.

Head Office

111 Lombard Avenue
Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: www.iisd.org
Twitter: @IISD_news

Acknowledgements

The authors would like to thank reviewers for their helpful comments on the study methodology and on a previous draft of this report, including: Niina Blomberg, Mari Carlson, Aino Friman, Maarit Keitanen, Eleanor Reyes Mateo, Marie Isabelle Pellan, Karsten Steinfatt, Lotta Toivonen, Lee Tuthill, Pasi-Heikki Vaaranmaa, Shunta Yamaguchi, Misato Sato, and Ruosi Zhang.

This report has been produced with the support of the Ministry of Foreign Affairs of the Government of Finland.

The opinions expressed and the arguments employed in this report do not necessarily reflect those of the peer reviewers and funders, nor should they be attributed to them.

Executive Summary

In recent years, governments have been looking for solutions to the environmental challenges associated with unsustainable patterns of natural resource extraction, processing, and use. Many countries have adopted roadmaps or guidelines for a transition toward a more circular economy—a model that promotes enhanced resource efficiency and the decoupling of economic growth from extractive, wasteful, and polluting processes.

Moving from a linear, extractive produce–use–discard model to a more circular approach will involve a paradigm shift and significant changes to existing business models. In today's highly integrated world economy, international trade will play a critical role in enabling this transition by facilitating the diffusion of circular solutions and exploiting international comparative advantages.

While most thinking in this area has focused on the role of trade in goods, much less attention has been paid so far to the role of trade in services in supporting this transition. Yet **services play an essential role in supporting circular economy businesses along the value chain**, including the product design stage through R&D or eco-design; the sourcing stage through the collection and sorting of waste material and its transformation into secondary raw material; or the production stage through remanufacturing or refurbishing. More traditional services such as installation, assembly, testing, or maintenance and management are also indispensable to the sales of goods and are usually commercialized as a package. Services also increasingly substitute the sale of goods themselves, with product ownership remaining with the supplier. Technological advances, including artificial intelligence or sensor technology, have largely enabled the development of such services ranging from sharing platforms to pest-control services through the use of chemicals in agriculture and lighting services under which clients pay for a specific level of brightness.

This report compiles new evidence on trade in services related to the circular economy based on a survey conducted among 96 individual firms involved in circular economy business models and complemented by a series of in-depth interviews. The sample was not random, and therefore the answers cannot be considered representative of the general composition of firms. However, the results provide first insights on services and trade in services trade related to the circular economy—topics that have not been deeply researched until now.

A Range of Services Are Relevant to the Circular Economy

Out of 96 firms, 57 reported selling services related to the circular economy. Interestingly, most of these service providers were small or micro-sized firms. Around 1/3 of the firms reported activities in manufacturing sectors, and 1/4 in professional services and utilities, including waste and recycling services. The remaining firms operate in various different industrial sectors. Around half of the firms have adopted circular supply models by replacing virgin resource inputs with bio-based, renewable, and recovered materials, or resource recovery models that recycle waste into secondary raw materials. A slightly smaller proportion applied product life extension models of existing products and product service systems, and

around 1/3 used sharing models. Resource savings constituted a strong driver for adopting circular business models, and most firms highlighted customer demand as the largest driver of growth for circular economy solutions.

The firms indicated that a **very wide number of services were relevant to their circular economy activities; the most common services bought or sold were recycling services, R&D, and other professional services, including IT services**. The diversity of services documented in the study reflects the broad range of activities covered under the circular economy and the heterogeneity of the firms that responded. The findings also point to the fact that many services related to the circular business models are rather general services (such as R&D or professional services) that are also provided outside circular economy activities.

Firms export a wide range of services related to the Circular Economy

Around 70% of the responding providers of services related to the circular economy export these services to foreign customers. The firms operate in various countries and continents worldwide, but most of them have their head offices in Europe. Based on the survey results and interviews, **the most-traded services related to the circular economy included IT services; other professional, technical, and business services (such as technical testing or environmental consulting services); leasing or rental services without an operator; R&D services; maintenance, repair, and installation (except construction) services; sewage and waste collection services; and professional services related to construction services.**

Most of the service exporters participating in the survey were small or micro-sized enterprises (around 60% of sample). **Interestingly, around 50% of these small or micro-sized firms report having an office or a subsidiary in a foreign country**, which is unusual in the context of typical patterns of SME activity. It is perhaps explained, on the one hand, by the fact that the firms seemed to be specialized in exporting. In 65% of responding firms, service exports brought over 10% of their annual turnover. This is significantly higher than the typical share of total exports in firms' turnover, which is usually under 5%. On the other hand, it was harder to find firms that imported services related to the circular economy. Out of around 50 firms reporting service purchases, only half imported these services. The services imported varied, but digital services, R&D and manufacturing services were mentioned frequently.

Exports Are Delivered Digitally and Via Foreign Subsidiaries

In theory, export of circular economy solutions can happen in any of the four services trade delivery modes (as identified in the General Agreement on Trade in Services [GATS] agreement), in addition to the possibility of being embedded in goods exports. Based on the survey results, **over half of the circular economy service providers exported services related to the circular economy digitally (i.e., mode 1 of services supply). The second most common way to export these services was via foreign subsidiaries (i.e., mode 3**

of services supply), with around 45% of respondents using this model. Around 30% of the respondents reported exporting these services via more than one mode of supply. This focus on delivery of services related to the circular economy through modes 1 and 3 reflects the broader picture of delivery of services internationally.

Regulatory Differences Across Jurisdictions Are Problematic

Respondents reported a wide range of barriers to trade in services related to the circular economy. Based on the responses, however, the **most frequent barriers relate to differences in regulations**, with over 25% of the respondents referring to these. Some 20% of the firms reported in particular that diverging regulations on secondary material and waste trade (or on other circular economy or carbon dioxide accounting-related issues) created trade barriers. These differences in regulations also included the varying implementation of common standards and regulations, such as those in the EU. Many respondents also reported difficulties on the demand side relating to old business practices, risk aversion of customers, and resistance to new business models.

Interestingly, responding exporters of services related to the circular economy seemed not to face significant protectionist pressure from domestic producers in export markets. The barriers noted above should also be considered in context: almost 40% of the respondents to the survey did not report facing any major difficulties in their export activities, and over half did not find major obstacles to importing services related to circular economy activities. This may reflect the fact that the circular economy as an emerging concept involves a range of novel services for which there is little competition or the responding firms operate in markets with low trade barriers or have little trade experience.

Removing Trade Barriers Requires an Integrated Approach

Well-designed trade policies can support a global transition toward a more circular economy by removing trade barriers to circular economy-related goods and services, exploiting comparative advantages for the sustainable use of resources, and supporting clean technology diffusion and uptake.

Given the large spectrum of services related to the circular economy, removing horizontal barriers affecting services trade in general and promoting an enabling environment for innovation is likely to benefit a transition toward a more circular economy. **In light of the close interaction between goods and services (which the survey and interviews confirm), there is also a need to foster an integrated approach to the removal of trade barriers affecting the circular economy**. The potential benefits of trade liberalization in goods such as waste and scrap, second-hand goods, or recycled material are likely to increase significantly if associated services are liberalized at the same time. Such an integrated approach should look comprehensively at both tariff and non-tariff barriers, including domestic regulations, standards, and conformity assessment procedures. This could be achieved by identifying clusters of goods and services particularly relevant to the different circular economy business models for future liberalization.

Non-Discriminatory Domestic Circular Economy Required

In addition to removing trade obstacles, when designing domestic policies that incentivize a circular economy transition (e.g., through extended producer responsibility (EPR) schemes, eco-design policies, circular procurement, or circular economy-related standards and regulations), governments should be mindful of the potential of trade in accelerating such a transition. Ensuring that such circular economy policies are designed and implemented in accordance with international commitments and do not discriminate against foreign competitors would go a long way in avoiding unnecessary barriers to trade and the uptake of circular economy solutions.

Enhanced Interoperability of Regulations and Conformity Procedures

With many of the traders of services related to the circular economy being MSMEs, regulatory differences across jurisdictions may constitute significant obstacles to trade. In a circular economy, these can take the form of eco-labelling; standards on material content or performance, recyclability or reparability; or product-quality standards for secondary raw materials, refurbished, remanufactured, and second-hand goods. **Several survey responses pointed to the need for transparent and consistently applied regulation, particularly regarding waste**, underlining the practical importance of this issue. From a trade perspective, complying with those requirements entails costs, particularly when products and services are exposed to different regulations and standards across multiple jurisdictions. This is particularly challenging for MSMEs and firms in developing countries who lack the ability to comply with different requirements. This calls for promoting enhanced interoperability of regulations and conformity procedures through harmonization, mutual recognition, or equivalences. Increased collaboration and participation in international standard-setting bodies and the adoption of international standards can help minimize such differences.

Enhanced Role of the International Trade System

Advancing a global circular economy transition will require concerted action at the international level, not least because no individual country can achieve the transition on its own. International trade disciplines such as those enshrined in the World Trade Organization (WTO) rules can help in this process. Relevant WTO bodies such as the Technical Barriers to Trade (TBT) committee or the Committee on Trade and Environment (CTE) can provide unique multilateral platforms for exchanging information, guidance, best practices, and experience-sharing. Implementation of the WTO Agreement on Trade Facilitation could also help facilitate trade in goods closely linked to services relevant to the circular economy. The international trade system could also serve as a platform for more advanced collaboration—for example, by reviving negotiations on environmental goods and services or by addressing aspects of service trade that could support the circular economy under the WTO Plurilateral Initiative on Electronic Commerce.

Similarly, governments could ensure that free trade agreements reflect the objectives of the circular economy. In particular, they could consider whether increasing market access commitments under regional trade agreements (RTAs) might provide their businesses with more competitive options for a cluster of goods and services related to the circular economy. These could include professional services, recycling and repair services, or waste management services. The strong digital element of trade in circular economy-related services discussed above also suggests that particular attention should be paid to disciplines related to data flows and localization requirements.

Finally, RTAs can serve as a vehicle to foster regulatory cooperation. Such provisions could encourage harmonization or mutual recognition agreements of specific upstream and downstream circular economy standards and test procedures—ideally within a specific timeframe. This could cover upstream standards such as eco-design or EPR schemes or downstream standards, such as quality standards for refurbished, remanufactured, and second-hand goods.

Table of Contents

Key Terms

Circular economy: An economic model that does not focus on producing more and more goods, but in which consumption is based on using services—sharing, renting, and recycling—instead of owning. Materials are not destroyed in the end but are used to make new products over and over again (Finnish Innovation Fund Sitra, 2020). Under this model, the current links between economic growth, greenhouse gas (GHG) emissions, and resource consumption weaken, and the regeneration of natural ecosystems is enabled.

Services related to the circular economy: The range of service activities included in circular business models, from upstream activities (e.g., research and development [R&D], product design and supply of renewable materials) through downstream activities (e.g., sharing platforms and collection of material to recycling). Services related to the circular economy include therefore both services used as intermediate inputs in circular business models and services that are sold as the end-product to the customer.

Services trade: Refers to services exchanged between residents and non-residents of an economy, including services provided through foreign affiliates established abroad. Services refer in this context to service commodities (such as software, consulting, legal, transport, tourism, etc. services). It should be noted that the services trade is not only limited to foreign trade by enterprises that are classified in service sectors: various firms in the manufacturing sector also trade service commodities.

Acronyms

ACCTS	Agreement on Climate Change, Trade and Sustainability
AI	artificial intelligence
APEC	Asia–Pacific Economic Cooperation
BOO	build–own–operate
BOOT	build– own–operate and transfer
BOPs	balance of payments
CE	circular economy
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
COP 23	23rd annual Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change.
CPC	Central Product Classification
CTE	Committee on Trade and Environment
CTL	Closing the Loop
DMC	Domestic Material Consumption
DRC	Democratic Republic of the Congo
EGA	Environmental Goods Agreement
EPR	extended producer responsibility
EU	European Union
GATS	General Agreement on Trade in Services
GDP	Gross Domestic Product
GDPR	General Directive on Data Protection
GHG	greenhouse gas
HS	Harmonized System
ICT	information and communications technology
IISD	International Institute for Sustainable Development
ILO	International Labour Organization
IoT	Internet of Things
IPR	intellectual property restrictions

IRP	International Resource Panel
ISIC	International Standard Industrial Classification of All Economic Activities
ISO	International Organization for Standardization
IT	information technology
MaaS	mobility-as-a-service
MNE	multinational enterprise
MSME	micro, small and medium-sized enterprises
OECD	Organisation for Economic Co-operation and Development
PSS	product service systems
R&D	research and development
RTAs	regional trade agreements
SDGs	Sustainable Development Goals
SMEs	small or micro-sized enterprises
TBT	technical barriers to trade
TFA	trade facilitation agreement
TiVA	trade in value added
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	value added tax
WBCSD	World Business Council for Sustainable Development
WIOD	World Input-Output Database
WRAP	Waste and Resources Action Programme
WTO	World Trade Organization

Introduction

In recent years, environmental challenges associated with unsustainable patterns of natural resource extraction, processing, and use have prompted governments to look at alternative models of economic growth. Many countries have adopted roadmaps or guidelines for a transition toward a more circular economy. This has been done in order to decouple economic growth from extractive, wasteful, and polluting processes—and move toward a low-carbon future.

Moving from a linear, extractive produce–use–discard model to a more circular approach will, nonetheless, involve a paradigm shift and require significant changes to existing business models. In spite of the recent challenges posed by trade tensions and the COVID-19 pandemic, our economies are nonetheless still highly integrated, and international trade will remain critical to enabling this transition. Where appropriate safeguards and regulations are in place, it can do so by facilitating the diffusion of circular solutions and by exploiting international comparative advantages and scale effects to promote more efficient use of finite resources.

While a considerable amount of circular economy thinking has focused on the role of trade in goods and its relationship to a circular economy, much less attention has been paid so far to the role of services and trade. Yet, services that help keep resources in the system for longer are at the heart of new circular economy business models. These include both traditional services associated with manufacturing, such as construction, repair, or maintenance services as well as entirely new types of services, often enabled by digital innovation, such as co-access mechanisms or models focused on selling a service related to a product—e.g., leasing or repair services—rather than the product itself. Furthermore, in a circular economy, the emphasis is placed upstream in order to design out inefficiencies and waste throughout product value chains and life cycles. This involves an increasing use of services—a trend that the post-COVID-19 recovery may help accelerate.

To fill knowledge gaps around the role of services trade in a circular economy transition, this report compiles new evidence from a survey conducted among 96 individual firms involved in circular economy business models and complemented by a series of in-depth interviews.

After a short background section focusing on the circular economy as a concept, its main rationale, and its impact on business and trade, Section 2 of this paper focuses on the role of services in improving the circularity of economic activity, drawing on the profiles of the firms involved in the survey and a set of specific case studies. Section 3 then looks at the extent to which those services are traded internationally, by whom, and under which modes of supply. It also assesses the role of digitization and of existing barriers affecting trade in this area. In doing so, it relies not only on the qualitative insights from the survey and in-depth interviews but also on international trade statistics for the services related to the circular economy identified in Section 2. Finally, based on the findings, Section 4 suggests options for policy-makers to improve the global availability of services that could contribute to a circular economy and possible avenues to advance these options internationally.

1.0 Background

1.1 The Circular Economy as a Concept

Since the industrial revolution, the extraction, processing, consumption, and disposal of natural resources have provided the physical basis for economic growth. This model, however, has brought significant environmental consequences in the form of resource scarcity, pollution, biodiversity loss, and climate change, prompting questions about its sustainability.

In recent years, the rapid industrialization of emerging economies and continuous high consumption in industrialized countries have pushed global demand for resources to unprecedented levels, with the weight of materials consumed worldwide more than doubling in 40 years (McCarthy et al., 2018). In the absence of new policies, the Organisation for Economic Co-operation and Development (OECD) projects that global materials use, including metallic ores, non-metallic minerals, biomass, and fossil fuels, will continue to increase from 89 Gt in 2017 to 167 Gt in 2060, further exacerbating environmental challenges associated with extraction and processing (OECD, 2019a). GHG emissions from materials use will increase from 41 Gt carbon dioxide (CO_2) equivalent in 2011 to 75 Gt CO_2 equivalent in 2060, with concrete and metal accounting for 24% of total GHG emissions. Beyond climate change, the toxic effects of key metals extraction and processing on humans and ecosystems are projected to double by 2060, mostly driven by the scale of materials use (OECD, 2019a).

These challenges have prompted governments to look at alternative models such as the circular economy to secure a more sustainable growth path. In Europe, Denmark, Finland, France, Greece, the Netherlands, Portugal, Romania, Slovenia, and Sweden have already established circular economy roadmaps or national strategies. In 2015, the European Commission adopted a circular economy package. This was followed by a second circular economy action plan in 2020, which, among other things, introduces a proposal to establish a new "right to repair,"[1] new product design requirements, as well as new targets and criteria for waste management and public procurement while also underscoring support for circular business models (European Commission, 2020). China, which became the first country to pass legislation establishing the circular economy concept as a development strategy in 2008, implements various tax incentives such as VAT rebates for companies with higher recycling rates and a refund for specific products (World Business Council for Sustainable Development [WBCSD], 2019). In 2017, Nigeria, Rwanda, and South Africa launched the African Circular Economy Alliance at the 23rd Conference of the Parties to the UN Convention on Climate Change (UNFCCC) (COP 23), along with UN Environment and the World Economic Forum. The Alliance held its first annual and board meetings at the Africa Green Growth Summit in November 2018 in which Niger, Senegal, Malawi, and the DRC joined the

[1] Such a right could require business to take a series of measures aimed at making products repairable by design, informing consumers about their repairability, and establishing unrestricted access to repair manuals, software updates, and reasonably priced spare parts.

Alliance.[2] Finally, India's strategy for resource efficiency recognizes the role of the circular economy (Preston et al., 2019).

Notwithstanding all these initiatives, there is no universally agreed definition of the CE, which remains an umbrella concept centred around a collection of existing resource life-extending strategies (Blomsma, 2017). The Ellen MacArthur Foundation defines it as "an economy that provides multiple value-creation mechanisms which are decoupled from the consumption of finite resources" (Ellen MacArthur Foundation & McKinsey, 2015, p. 23). The concept is built around three pillars: designing out waste and pollution; keeping products and materials in use; and regenerating natural systems (Ellen MacArthur Foundation, 2015). Chatham House refers to a systemic approach to resource efficiency in which "end-of-life" products and materials are recycled, repaired, or reused through circular value chains with waste from one process becoming an input into other processes (Preston et al., 2019).

This paper uses the Finnish Innovation Fund Sitra's definition, which refers to the circular economy as an economic model which does not focus on producing more and more goods, but instead promotes consumption based on using services—sharing, renting, and recycling—instead of owning. Materials are ultimately not destroyed but are used to make new products over and over again. (Finnish Innovation Fund Sitra, 2020) Under this model, the current links between economic growth, GHG emissions, and resource consumption weaken, and the regeneration of natural ecosystems is enabled.

Like most other definitions, this approach emphasizes the need to promote resource efficiency and decoupling from economic outputs. Resource efficiency is usually understood as "adding greater value to resources, but also as maintaining that value by keeping resources in use for longer, and reducing the environmental impacts associated with the whole life cycle of resources, from their extraction to their disposal" (Ekins & Hughes, 2017, p. 22). Resource decoupling, on the other hand, occurs when economic outputs grow while the resources used to generate such output is either shrinking (absolute decoupling) or growing but at a slower pace (relative decoupling) (McCarthy et al., 2018).

Resource efficiency and decoupling can be pursued through three main mechanisms usually referred to as closing resource loops, slowing resource loops, and narrowing resource flows (Bocken et al., 2016). As opposed to a more linear model, where natural resources are extracted, transformed, and ultimately disposed of in incineration or landfill facilities, the term "closing resource loops" refers to the substitution of new materials by secondary materials through the use of recycled components, second-hand goods, or repaired and remanufactured products. Slowing resource loops aims at extending the useful lifetime of a product by enhancing its durability, while approaches aiming at narrowing resource flows focus on a more efficient use of natural resources, materials, and finished products, through, for example, sharing or improved technology (McCarthy et al., 2018).

[2] See: https://pacecircular.org/african-circulareconomy-alliance.

1.2 The Rationale for a Transition Toward a Circular Economy

The rationale behind decoupling and resource efficiency is environmental but also social, economic, and political. First, as highlighted above, the traditional growth model based on intensive resource extraction and use has generated significant environmental costs and is not sustainable in the long term. Every year, 1.3 billion tons of solid waste is produced in cities worldwide (World Bank, 2012). Around 50% of all industrial CO_2 emissions come from the production and processing of five materials, namely steel, cement, paper, plastic, and aluminum—most of which have secondary equivalents that are much less energy intensive to produce (McCarthy et al., 2018).

In this context, decoupling could reduce not only extraction rates but also the negative environmental externalities associated with extraction and processing. In doing so, it could support the achievement of various environmental commitments such as those enshrined in the Paris Agreement on climate change or the United Nations Sustainable Development Goals (SDGs), including Goal 12, which focuses on responsible consumption and production with specific targets related to waste reduction. The UNEP International Resource Panel (IRP) estimates, for example, that energy efficiency approaches could reduce natural resource use globally by 28% in 2050, and bring global GHG emissions to 63% below their 2015 levels (Ekins & Hughes, 2017). In Europe, Finnish Innovation Fund Sitra estimates that a more circular economy can cut emissions from heavy industry by 296 million tons CO_2 per year by 2050, out of 530 Mt in total (Material Economics, 2018). Recycling materials could also contribute to energy savings. For example, producing aluminum from scrap results in a 90%–95% reduction in energy use (Gardner, 2017). Additionally, the extraction and processing of materials, fuels, and food make up more than 90% of biodiversity loss and water stress globally (IRP, 2019).

Second, circular value chains may reduce countries' exposure to resource supply risks. This is particularly the case for materials from extractive industries, which are highly geographically concentrated and essential for certain industrial applications. In recent years, several governments have been concerned about their excessive dependence on a few exporting countries for minerals such as rare earth elements or cobalt which constitute critical inputs in the manufacturing of smartphones and electric vehicles (Preston et al., 2019). By reducing reliance on such primary materials, the circular economy is often seen as a way to protect businesses against the scarcity of resources and isolate them from price volatility (European Commission, 2015).[3]

A third rationale relates to the CE's potential to foster remanufacturing, employment, and GDP growth by saving costs and developing new sectors. Estimates by McKinsey found that a circular economy transition in Europe could bring total annual benefits of up to EUR 1.8 trillion by 2030, corresponding to a 7 percentage point increase in GDP (Ellen MacArthur Foundation & McKinsey, 2015). In China, a circular economy trajectory could

[3] On the other hand, such a shift may significantly affect export earnings of countries whose economies rely heavily on a narrow basket of primary commodities, with most losses being incurred by developing and non-OECD countries (OECD, 2015).

save businesses and households up to USD 11.2 trillion in 2040 (Arup & Ellen MacArthur Foundation, 2018). New opportunities will emerge in sectors such as secondary material production, repair, and remanufacture (or the sharing economy), creating new jobs and incentives for reindustrialization (McCarthy et al., 2018).[4] A Waste and Resources Action Programme (WRAP) study suggests that a circular economy transition could grow employment in Europe in the repair, waste and recycling, rental and leasing sectors by 1.2 to 3 million jobs by 2030, while reducing unemployment by 250,000 to 520,000 (WRAP, 2015). In several developing countries, the circular economy already contributes significantly to employment generation as illustrated by the case of Ghana, where 80% of electronic products are currently refurbished, providing jobs for over 30,000 people in Accra, the capital of Ghana, and the city of Lagos in Nigeria (Tearfund, 2017).[5] Additionally, some evidence has emerged that suggests that firms applying circular business models were more resilient to supply chain disruptions during the early phase of the COVID-19 pandemic (VITO, 2020).

1.3 New Business Models Under the Circular Economy

Transitioning to a more circular economy will require significant changes to economic activity and the operation of the private sector. Much attention has therefore focused on how business processes can be adjusted to become more circular. Many pioneers have recognized the opportunities presented by adopting circular business models and are already innovating in this area. For them, the transition to a circular economy is more about scaling up nascent business models rather than a complete shift.

The OECD (2019b) identifies **five business models that can support a transition toward a more circular and resource-efficient economy** (see Figure 1). While most of them are not new, they have been recontextualized—partly using new technologies—and are increasingly applied to a wider range of sectors. Services play an important role in many of these business models: some models are, in fact, based on services.

- **Circular supply models** replace primary materials inputs with bio-based, renewable, or recovered materials. Under this model, often associated with "cradle-to-cradle" product design, waste materials are turned into inputs in the manufacturing of a new product.
- **Resource recovery models** focus on producing secondary materials from waste streams generated by households, businesses, or industry. These business models involve the collection and sorting of waste material and its transformation into

[4] While a transition to a circular economy may create new job opportunities, some have raised concerns about the quality of such jobs. Certain activities such as recycling, sorting, and repair may be more labour intensive but can also entail lower wages or workers being exposed to toxic and harmful substances. Aware of these challenges, the International Labour Organization (ILO) has convened a Global Dialogue Forum on Decent Work in the Management of Electrical and Electronic Waste highlighting the need for governments to put in place and enforce labour laws that protect workers, while creating social dialogue to ensure that the circular economy aligns with decent work and Just Transition principles (ILO, 2019).

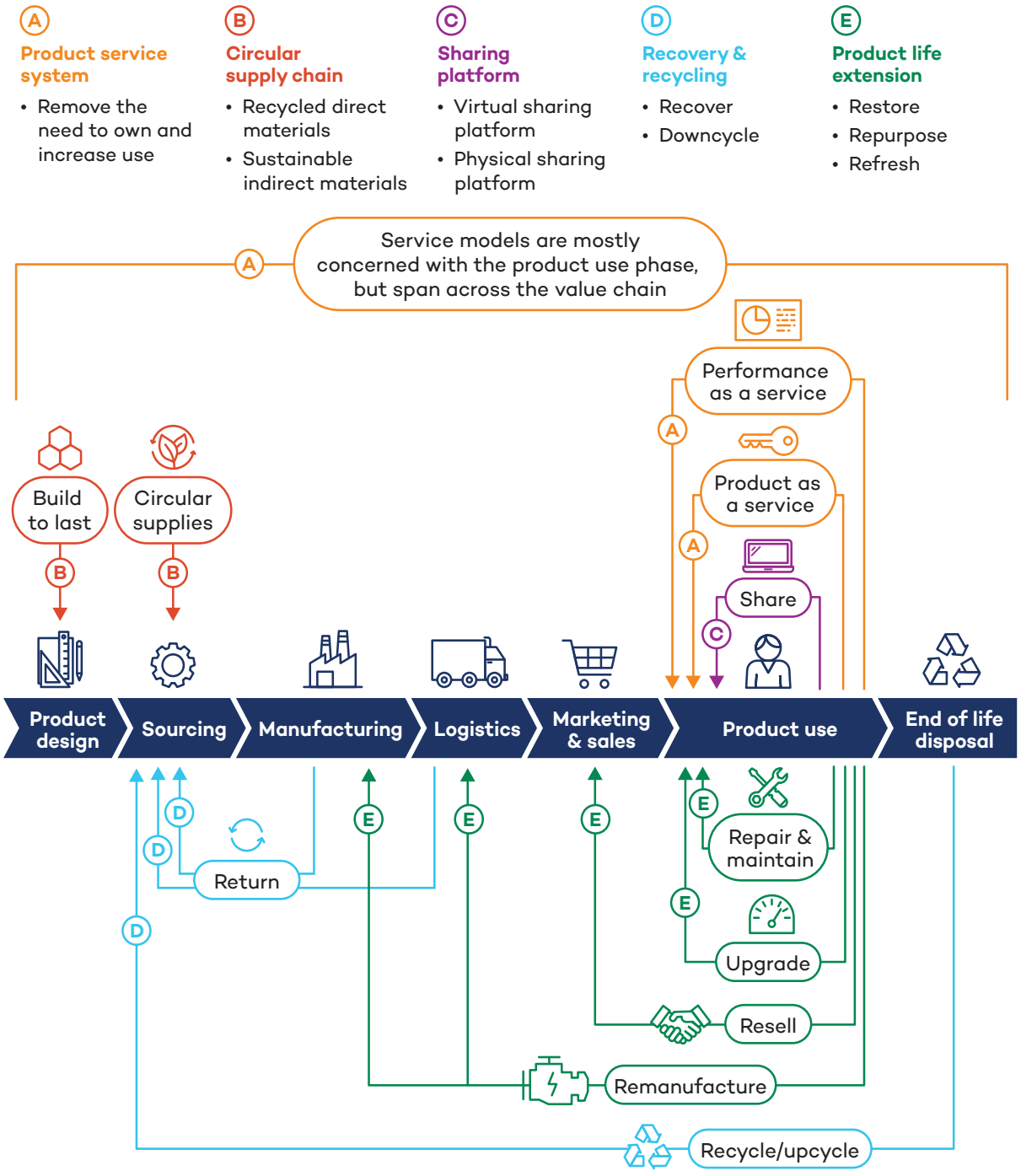
[5] It should be noted, however, that at this point circular economy activities in developing countries often happen in the informal sector. Formalizing these sectors represents a challenge but also an opportunity for moving towards a more circular economy.

secondary raw material such as metals, plastics, or paper which are then sold to other firms.

- **Product life extension models** aim at increasing the lifespan of a product by enhancing its durability. By maintaining embedded materials in the economy for a longer period, this model reduces the pressure for extracting new resources. This can be achieved by (a) improving design to achieve longer durability, (b) reusing products otherwise discarded before reaching their end of life (e.g., second-hand goods); (c) fixing or repairing defective components of degraded products; or (d) refurbishing or remanufacturing products into a new life.
- **Sharing models** usually refer to sharing under-utilized consumer goods and assets (e.g., housing or vehicles) through co-ownership or co-access mechanisms. Most of these practices are supported by online platforms (e.g., Airbnb) which facilitate transactions and reduce risks of sharing assets.
- Finally, **product service systems (PSS)** focus on selling a service rather than the product itself. In principle, a PSS provider is responsible for the materials and products necessary to deliver the service, creating an incentive to reduce resource consumption to increase its profitability. The literature on PSS points to three main configurations of these systems: product-oriented, use-oriented and, results-oriented PSS.[6] A product-oriented PSS involves the offering of a product complemented with services, such as maintenance and take-back provisions. A use-oriented PSS is based on selling consumer access to, or use of, a product rather than its ownership. Examples of such systems include online platforms such as Netflix or Spotify, where users consume different media without having ownership of the underlying product. Finally, results-based PSS is focused on the attainment of a desired result agreed with the customer. Examples include pest-control services through the use of chemicals in agriculture or lighting services under which clients pay for a specific level of brightness.

[6] See: Kjaer et al. (2018) and Tukker (2004).

Figure 1. Comparing circular economy business models and the traditional linear value chain



Most circular opportunities are in the product use phase, bringing companies closer to their customers.

Source: Arponen, 2019 (Finnish Innovation Fund Sitra).

Some of these five circular business models are more amenable to rapid scaling up than others. Overall, most sectors do not have market penetration rates of circular business models above 5% to 10%, but large disparities exist between sectors, business models, or materials.[7] Waste recycling or reuse and repair activities are well-established, but even there, efficiency rates vary widely depending on the type of material produced. For metals such as tin, iron, steel, or platinum, recycling rates can be as high as 70%.[8] By contrast, non-metallic minerals are usually too cheap or difficult to recycle.[9] Similarly, biomass and fossil fuel-based materials do not easily lend themselves to recycling, with the exception of some fossil fuel-based materials like plastics.[10] Other models, like the sharing models, have benefited from technological innovations such as the digitization of the economy and the emergence of online platforms. These have significantly helped to speed their scaling up process.

The impact of different business models on resource efficiency varies greatly between models. While lifecycle analyses tend to show that circular products typically have a much smaller environmental footprint, these effects are not distributed evenly along the value chain. For example, remanufacturing is associated with reducing resource pressure upstream while product services models with impacts at the product use-phase (OECD, 2019b).

1.4 Trade in Goods in the Circular Economy

The relationship between the circular economy and trade is an emerging field without a long history of literature to draw upon. Overall, in a world economy characterized by cross-border production networks organized along highly complex value chains, where products cross multiple jurisdictions before reaching their final stage, international trade is likely to play a critical role in a successful transition toward a circular economy. Domestic material consumption (DMC)—i.e., the net amount of materials used in an economy – has been stagnating over the last 30 years in OECD countries, but when raw material equivalents embedded in traded products are taken into account the material footprint of OECD countries has increased by nearly 70% over the same period (OECD, 2020, in press).

Changes in production and consumption patterns resulting from a circular economy transition will likely affect the direction and geography of global trade flows. Assessing the net effects of such a transition is beyond the scope of this paper. It is, however, safe to assume that it will reduce import demand for primary resources, most probably at the expense

[7] Even within sectors, the differences in penetration rates between business models can go from 80% in automotive product service systems to 1% in automotive remanufacturing (OECD, 2019b).

[8] Note that this does not necessarily translate into high shares of recycled content in existing commodities, not least because production volumes of both primary and secondary material grow at the same time. For example, while the recycling sector is projected to more than triple by 2060, the share of secondary materials in total materials will remain limited and only become significant for some metals (OECD 2019a).

[9] Exceptions include concrete waste downcycled as road filler or processed materials such as glass.

[10] Plastics have an estimated recycling rate of nearly 20% but a market share of recycled material of less than 10% (OECD, 2018).

of resource-rich countries.[11] At the same time, it may stimulate trade opportunities in services sectors linked to manufacturing, such as waste management, recycling, refurbishing, reuse, or repair services and the emergence of new business models substituting certain goods with the provision of services.

Currently, trade in goods related to circular economy activities occurs at virtually all stages of the value chain from trade in waste and secondary materials, through second-hand goods, to goods for refurbishment and remanufacturing.

According to the OECD, global **trade in waste and scrap** reached USD 95 billion in 2018 with metals accounting for 82% of exports in value terms, followed by paper (12%) and plastics (3%) (OECD, 2020a, in press). In countries where effective environmental regulations and treatment standards are in place, such trade can support a global circular economy transition by allowing materials to be sorted, recycled, or remanufactured in a cost-effective manner by exploiting comparative advantages and scale effects. However, some observers have raised concerns regarding exports to emerging economies and developing countries with underdeveloped waste management capacity or laxer environmental standards (Yamaguchi, 2018). This is the case, for example, regarding e-waste, usually considered hazardous waste because of the toxic substance it contains and because of its effect on air, water, and soil pollution when burned for disposal or dipped in acid to recover rare metals.

In response to these challenges, several different initiatives have emerged. For example, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes sets up a framework to regulate transboundary movements of hazardous wastes to ensure that trade takes place in accordance with the principles of environmentally sound management.[12] The OECD Decision on Control of Transboundary Movements of Wastes Destined for Recovery Operations places controls on cross-border movement of recoverable wastes between OECD Members.[13]

Besides those international instruments, several countries have introduced unilateral trade restrictions. Starting in January 2018, China—by far the largest importer of waste—imposed trade restrictions on waste and scrap in an effort to protect its environment.[14] Following China's initiative, India banned imports of solid plastic waste in March 2019.[15] Similar initiatives are being contemplated in other countries. These measures put pressure on exporting countries to deal with plastic and other waste that used to be exported and will

[11] For resource-rich countries, the gradual substitution of primary raw materials with secondary raw materials may significantly affect their export earnings. These countries are mostly developing economies who rely on extractives-led growth for their development. For them, decoupling economic growth from resource use will imply significant changes to their industrial strategy (Preston et al., 2019). At the same time, some authors suggest that shifting towards a circular economy may represent an opportunity to pursue economic diversification and grow domestic or regional markets, as the development of higher-value downstream processing is encouraged (IEEP, 2019).

[12] See: http://www.basel.int/

[13] See: https://legalinstruments.oecd.org/public/doc/221/221.en.pdf

[14] See http://english.www.gov.cn/policies/policy_watch/2018/02/05/content_281476036805432.htm

[15] See Amendment in Hazardous Waste (Management& Transboundary Movement) Rules, posted by the Ministry of Environment, Forest and Climate Change on March 6, 2019. https://pib.gov.in/PressReleseDetail.aspx?PRID=1567682

likely change the international landscape of global trade in this area. In the short term, however, exporters lacking domestic capacity to process these materials are likely to increase domestic stockpiling, incineration, and landfilling (OECD, 2020a, in press).

Trade in secondary material is a further opportunity to improve the circularity of production. Secondary raw materials recovered from waste can become valuable resources for importing countries if such trade is supported by waste streams of appropriate quality and adequate capacity to process the recyclable material. Waste-importing countries are often also manufacturing hubs, which makes it economically efficient to reuse recycled materials in proximity. The main obstacles to scaling up trade in this area include the need 1) to secure quality and content of secondary materials (e.g., through recyclability standards, certification, or eco-design) and 2) to remove the export restrictions frequently applied to waste and scrap. It is worth noting, in addition, that trade in secondary material is currently difficult to track, not least because the current harmonized system (HS) for classifying goods based on six-digit codes does not distinguish secondary raw materials from waste and scrap.[16]

Trade in second-hand goods, such as used cars or second-hand textiles, is a further opportunity to improve the circularity of economic activity but also faces technical and policy challenges. While it can contribute to promoting the reuse of products, it may also result in technological lock in. For example, importation of old and inefficient second-hand vehicles can be problematic for developing countries trying to reach their Nationally Determined Contribution targets (ICTSD, 2017). Trade in this area has also been subject to restrictions as part of domestic industrial policies. For example, several East African states decided in 2015 to impose a ban on second-hand textiles to protect their domestic industry from the surge of cheap second-hand clothes imported from third countries (Preston et al., 2019). Like trade in secondary material, trade in second-hand goods is difficult to track, and for the same reasons.

A final opportunity to note is **trade in goods for refurbishment and remanufacturing**. End-of-life products are considered as waste in some countries, which prevents companies from sending them abroad for refurbishment or remanufacturing (OECD, 2020).

While most of the current thinking has focused on the role of trade in goods and its relationship to circular economy principles, less attention has been paid so far to trade in services. The next sections of this report discuss the work done so far and present new insights gathered through a survey and interviews of a selection of companies around the world engaged in circular economy activities.

[16] The Harmonized System is an international nomenclature for the classification of products. It allows participating countries to classify traded goods on a common basis for customs purposes.

2.0 Services and the Circular Economy

2.1 The Role of Services in a Circular Economy

As described in the previous section, the transition from a linear and extractive produce–use–discard economy toward a sustainable circular economy involves a paradigm shift. Services are likely to play a critical role in this process. They are inseparable parts of PSSs and sharing models. They are also often key to unlocking the full potential of the different business models described in Section 1.3, for example by enabling resource recovery or product life extension and substituting goods. At the same time, new circular economy business models are fostering the development of entirely new models for supplying services, often enabled by digital innovation.

As with other sectors, **services have become an increasingly important part of goods manufacturing**—a phenomenon often referred to as the "servicification of manufacturing." Today, a whole range of services such as R&D, logistics, or post-assembly services are closely associated with, if not fully embedded in, business models related to selling goods. Customers are often sold entire solutions for their problems instead of individual goods or services. The circular economy is no exception. Miroudot and Cadestin (2017) describe this "servicification of manufacturing" as taking place via three main channels:

1. Manufacturing firms increasingly use services as intermediate inputs for their productions.
2. Within manufacturing firms, an increasing number of jobs are related to support service functions such as distribution, logistics, marketing, sales, after-sale services, IT, back-office support, and management.
3. Manufacturing firms increasingly offer services to complement or substitute their goods sales.

As illustrated in Figure 1, different stages of a circular value chain depend directly on the delivery of services, including: the product design stage through R&D or eco-design; the sourcing stage through the collection and sorting of waste material and its transformation into secondary raw material; or the production stage through remanufacturing or refurbishing. More traditional services such as installation, assembly, testing, or maintenance and management are also indispensable to the sales of goods and are usually commercialized as a package.

Similar considerations have been discussed in ongoing international negotiations on environmental services, in the context of the WTO. While environmental services constitute a specific category under existing international services classification (e.g., CPC 94 and W/120), several environmentally related services, including ancillary activities not listed under those categories, are nonetheless essential inputs to environmental projects. To illustrate this point, the Swedish National Board of Trade (2014) drew on interviews with 15 firms to identify a wide range of services that directly accompany the sales of a sample of environmental goods (see Table 1), a list which goes well beyond the narrow definition of environmental services.

This set of services may not reflect the breadth of the circular economy as a whole, but in this nascent research field, it nonetheless can serve as a first proxy for a list of services relevant to circular economy activities.

Table 1. List of indispensable services accompanying environmental goods

Type of services	Purposes of the services	Stage in relation to the delivery of goods	Mode of services supply[17]
Assembly and installation	Guarantee the basic functioning of the product	• In connection with delivery (when associated with spare parts it can be a part of after-sales)	1, 2, 3, 4
Technical testing and analysis services	Guarantee the basic functioning of the product, e.g., fulfill regulatory demands	• In connection with delivery • After delivery	1, 2, 3, 4
Educational services	Guarantee a proper use of the product; improve product and user efficiency	• In connection with delivery	2, 3, 4
Advisory and consultative services	Increase customer satisfaction; fulfill regulatory demands	• Before delivery	1, 3, 4
Maintenance and repair services	Guarantee the basic functioning of the product	• After delivery	1, 3, 4
Computer services	Guarantee the basic functioning of the product	• Before delivery • In connection with delivery • After delivery	1, 4
R&D	Customize the product, e.g., fulfill regulatory demands and adapt to local conditions	• Before delivery • After delivery (related to upgrades)	1, (3, 4)
Environmental protection services	Comply with regulations	• Before delivery • After delivery	1, 3, 4

Source: Swedish National Board of Trade, 2014.

As noted above, extended producer responsibility for collection, repair, and disposal of goods is directly relevant to the circular economy. The international demand for and supply of collection, repair, or disposal services that these requirements generate is therefore an inherent example of international trade linked to the circular economy. Further, new models of insurance are being created to respond to new circular economy business models, for example providing "on-demand micro-insurance" that applies while a product is used in sharing

[17] Please see Section 3.3 for an explanation of these four modes of supply in international services trade.

business models, rather than simply when ownership changes hands (Musgrove, 2020). Beyond their role in supporting circular use of goods, services increasingly substitute for the sale of goods themselves, with the product ownership remaining with the supplier. Examples of such systems include the renting of textiles or clothing, or car sharing.

It is worth highlighting here that the **technological advances of the Fourth Industrial Revolution (4IR)—including artificial intelligence or sensor technology—have largely enabled the development of a range of new kinds of services, from pest-control services through the supply of chemicals in agriculture, to lighting services**. Others have benefitted from the digitalization of the economy through the emergence of online platforms such as Spotify or Airbnb. Data has also helped companies like Winnow[18] design out large amounts of food waste from their own operations by helping restaurants measure and monitor their product flows. Similarly, such digitally enabled monitoring has also helped ABB[19] optimize, among other things, its servicing intervals—including pre-emptive servicing—and minimize risks. More broadly, beyond the firm level, improved monitoring and greater access to data have created many new opportunities for exchange across firms and sectors in order to increase efficiencies. Many new digital (and digitally enabled) services are instrumental in facilitating these exchanges across different systems.

Throughout this paper **we use the term "services related to the circular economy" to refer to the range of service activities included in circular business models, starting from upstream activities (e.g., R&D, product design, and supply of renewable materials) all the way to downstream activities (e.g., sharing platforms, collection of material, and recycling). Services related to the circular economy therefore include both services used as intermediate inputs in circular business models and services that are sold as the end-product to the customer.**

2.2 Services Related to the Circular Economy: Insights from survey and interviews

To obtain new information on the different services related to the circular economy and the role of services (and trade in services) in the transition to the circular economy, we conducted an international firm survey and a series of in-depth interviews. For a detailed description on the methodology and additional information, please refer to Appendix A.

In total, 96 individual firms involved in one or more of the circular economy business models answered our Internet-based survey. In addition, 16 in-depth interviews were conducted with different sized and types of firms. Since the purpose of the survey and interviews was to collect information on services and services trade related to the circular economy, it was distributed in particular to firms that have been already identified as having some circular economy activities or are starting them. The sample is therefore not random, and the answers cannot be considered representative of the general composition of firms. However, the **results provide**

[18] https://www.winnowsolutions.com/

[19] https://global.abb/group/en

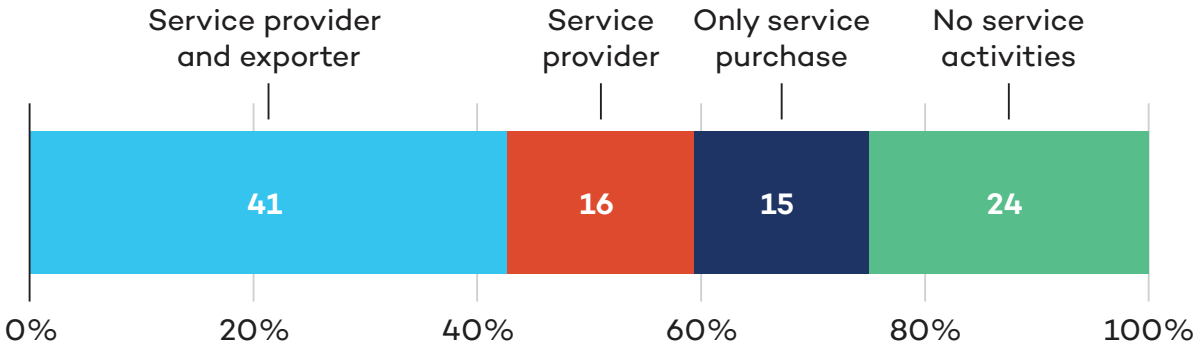
empirical insight on services and services trade related to the circular economy—topics that have not been deeply researched until now.

In the following subsections, we discuss first the insights drawn from the survey regarding the respondents' engagement in the sale and purchase of services related to circular economy activities, and then the findings on how these services are traded internationally (imported or exported). We then discuss possible barriers to trade in services that firms encounter, both in general and as noted by respondents.

While the survey was distributed internationally, 90% of the responses originate from firms that have their head offices in Europe, with most respondents from Finland, followed by the other Nordic countries, the UK, the Netherlands, and Germany.

Out of a total of 96 firms, 57 reported sales of services related to the circular economy, and a majority of them—over 70% of the respondents (see Figure 2)—reported exports of these services. 48 firms indicated purchasing services related to the circular economy. In total, 72 firms out of the 96 firms reported either selling or buying services related to the circular economy. The remaining 24 firms provided detailed information on their circular economy activities in general but did not indicate major provisions or purchases of services related to these or did not have time to finalize the survey. These 24 firms are not included in the following descriptions. For descriptive information on all these 96 firms in total, please see Appendix A. In the following subsections, we discuss the information collected related to firms providing services related to the circular economy and then the information collected on the services firms purchase.

Figure 2. Division of survey respondents by service provision



Source: Authors' elaboration based on survey responses.

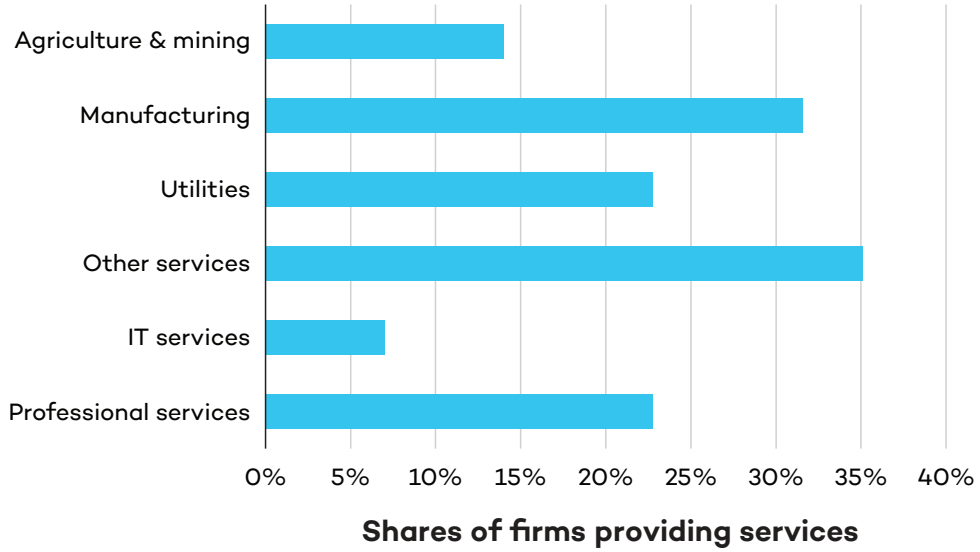
In What Sectors Are Firms Providing Services Related to the Circular Economy Active?

The 57 providers of services related to the circular economy are active in a variety of sectors. Here the term "providers of services related to the circular economy" refers to all firms that report engagement in services related to the circular economy and report offering

"services to support improved and more efficient use of resources and materials, or their re-use."

Figure 3 presents the division of firms' industrial categories at aggregated levels.[20] Around 1/3 of the firms report activities in manufacturing sectors, 23% in professional services and in utilities, including e.g., waste and recycling services. Otherwise, the sectors to which the firms belong are rather diverse, with participants from many different types of service industries. It should be noted that many firms report activities in various industries even at these aggregated levels, and therefore the shares account for more than 100% of the total number of firms.

Figure 3. Share of firms by aggregated industrial category

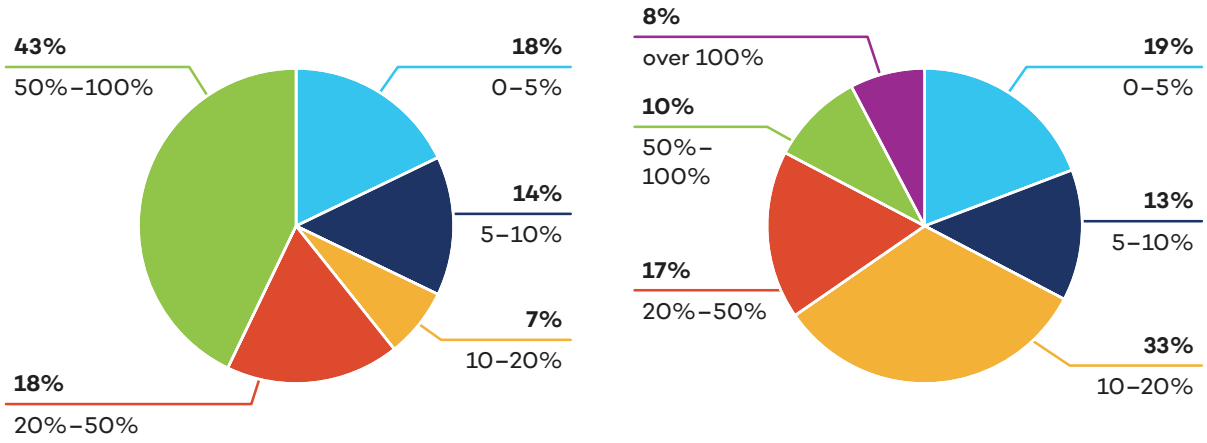


Source: Authors' elaboration based on survey responses.

The firms had a strong services focus, with 41% of respondents indicating that the sales of services bring a share of 50%–100% to their total annual corporate turnover, while 18% of respondents indicated that it contributes 20%–50% to their turnover. In addition, 4/5 of the respondents expected their circular economy activities to grow on average by at least 10% or more every year in the coming years. About half in total expected the growth to be even over 20% and some (8%) expect them to over double every year (see Figure 4).

[20] Agriculture and mining includes ISIC categories 01-09, manufacturing categories 10-33, Utilities categories 35-39, IT services 60-63, Professional services categories 69-79 (including, e.g., head office services, legal, R&D and renting services) and Other services all other industries. The responses in the survey were collected at 2-digit level, but the numbers of observations are too low to report at that level.

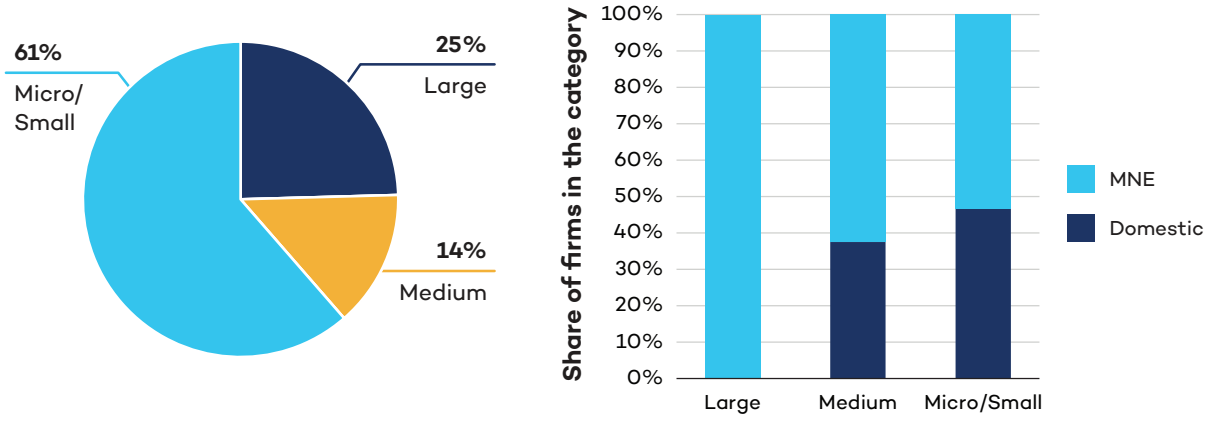
Figure 4. Share of turnover from service activities (left figure) and expected growth rate of circular economy activities (right figure)



Source: Authors' elaboration based on survey responses.

Most of the service providers (61%) are small or micro-sized firms in terms of their number of employees (less than 20 employees) and turnover. However, as many as 50% of these small/micro-sized firms report having subsidiaries abroad, and many of these firms also report sales of services abroad via these subsidiaries (i.e. via mode 3 of service trading supply, see Section 3.4). This is a significantly higher share than is typically seen in such relatively small firms. In total, around 2/3 of the firms have subsidiaries abroad, and all of the large firms (with over 250 employees) are multinationals (MNE) (see Figures 5a & 5b). In terms of the age of the firms, around 60% of the firms are over 10 years old, some 30% between 2–10 years old and 10% starting firms of less than 2 years old. **The survey responses thus highlight the active involvement of specialized small and micro-sized firms in trade in services related to the circular economy**.

Figures 5a (left figure) & **5b** (right figure): Shares of firms by size and international status (MNE or domestic), circular economy service providers



Source: Authors' elaboration based on survey responses.

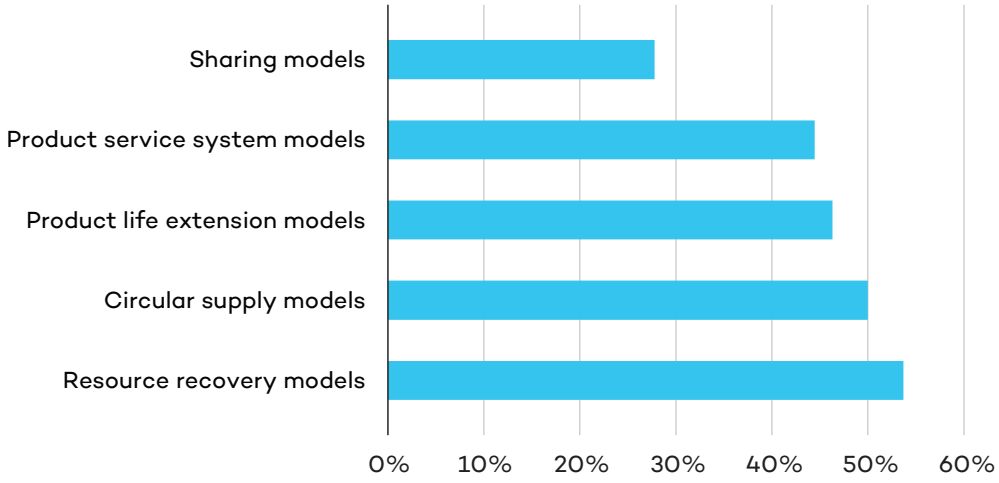
What Circular Economy Models Do Respondent Firms Use?

The most common two circular business models applied by these firms were 1) circular supply models that replace virgin resource inputs with bio-based, renewable, and recovered materials, and 2) resource recovery models that recycle waste into secondary raw materials, with around 50% of firms indicating that they use either or both of these business models (see Figure 6). Around 40%–45% of firms apply product life extension models of existing products and PSSs. Sharing models were used by almost 30%.

As can be seen from the total, most of the firms report being involved in various circular economy business models. In particular, it seems common for firms to report involvement in both the circular supply model and in resource recovery models at the same time. In many cases these two models are also combined with product life extension models. Various firms seem to also operate in PSS models, sharing models, and the product life extension model at the same time.

When asked about which circular business models were most important to them, resource recovery models, circular supply models, and PSSs were most frequently mentioned. Around 25% of the respondents indicated these as the most important model for them.

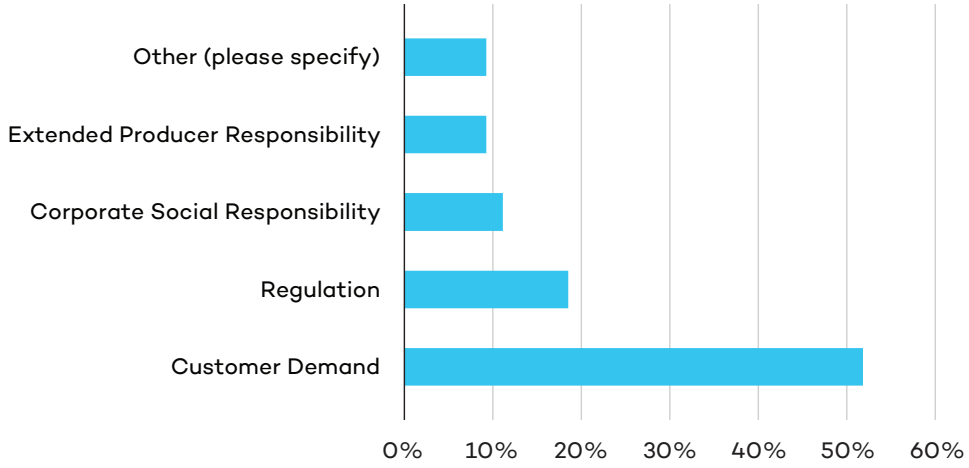
Figure 6. Circular economy business models used by respondents, by number of firms using the model compared to total number of firms



Source: Authors' elaboration based on survey responses.

The rationale for adopting circular business models varied according to the firm, with resource savings constituting a strong driver for many. Beyond these associated savings, firms also mentioned the connection to achieving wider goals of sustainable development, not least through a reduced climate impact. Over 50% of these firms listed **customer demand as the largest factor thought to drive the growth of their circular economy solutions.** Around 20% considered regulations in general as a major driver, and 10% specifically cited EPR schemes. See Figure 7.

Figure 7. Factors driving growth in demand for circular economy solutions (percentage of respondents identifying each factor)



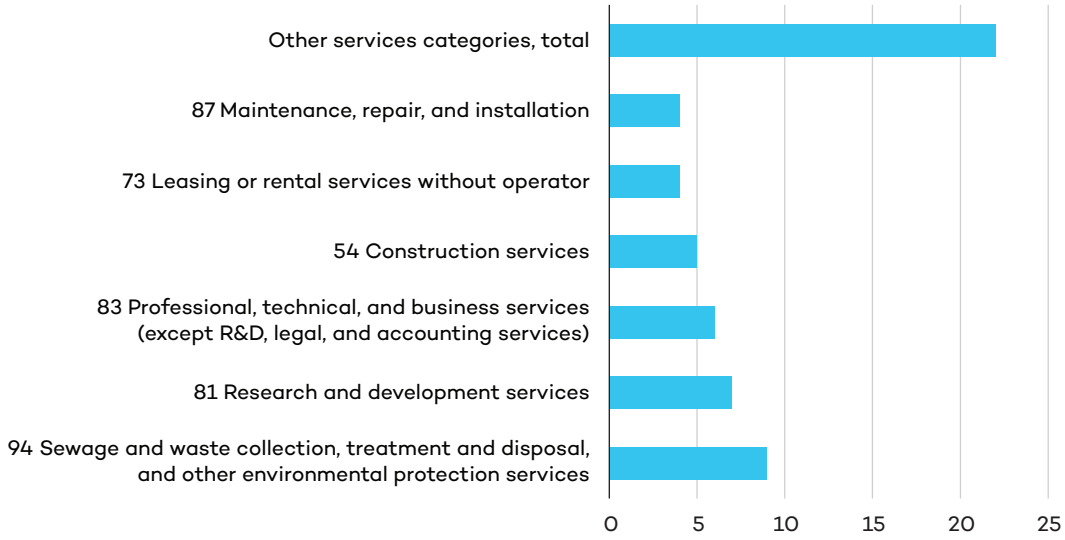
Source: Authors' elaboration based on survey responses.

What Type of Service Solutions Do Respondents Provide?

Figure 8 provides an overview of the largest service categories (following UN CPC 2.1[21] 2-digit categories) and the number of firms indicating the respective category to be their most important service provision related to circular economy activities. As the figure highlights, **services related to the circular economy the firms provide are very diverse**. On the one hand, some of the services support daily operations. For example, 16% of the firms indicate that they provide services that fall under Category 94, "Sewage and waste collection, treatment and disposal and other environmental protection services." In detailed survey answers, these firms mention services ranging from waste collection to recycling, handling of hazardous materials, reprocessing and selling secondary materials, to demolition activities, waste-to-energy services and landfilling (though the last is typically not considered to be in line with circular economy principles). Some services, on the other hand, support long-term competitiveness and productivity increases. For instance, over 10% of the firms indicate providing R&D services or professional, technical, or business services (including IT services) related to circular economy activities. These different types of services could alternatively be categorized into downstream and upstream services.

[21] CPC *prov*. is typically used in trade agreements.

Figure 8. Services provided by respondents (by number of respondents)



Source: Authors' elaboration based on survey responses.

While Categories 94 and 81 account for the largest two sets of services identified, most services fall somewhere in between the two opposites of supporting daily operations and ensuring long-term competitiveness (or alternatively, services focused on upstream and downstream operations). Moreover, as the large share of miscellaneous services in Figure 8 illustrates, the firms also offer a range of other services. Many of the other categories at 2-digit level have too few firms to present in the figure, or the services are difficult to classify for the firms. These other services mentioned in the survey and in our interviews most notably include utility services such as energy- and water-related services.

Many services provided by respondents are business-to-business, include cleaning services, industrial processes (e.g., air-as-a-service), efficiency upgrades, training, product-testing services, along with other services enabled by digitalization that facilitate firms' operational processes. Among the latter, tracking and monitoring, often enabled by sensors or bar codes, play an important role in both reducing energy consumption, minimizing stocks, improving safety, and extending the longevity of existing products, components, and materials. Software services play an important role in this context by providing continuous upgrades. More generally, the responses suggest that digital solutions often enable many other activities, such as multimodal transportation services, management of online platforms, insurance services, or leasing of workwear and carpets.

Case study examples I–III provide more in-depth examples of service provision related to the circular economy.

Case study I

Selling water desalination as a service as a way to enhance resource efficiency in addressing water scarcity challenge.

Problem: Reverse osmosis, the most frequently used technique for desalination, has three main challenges. First, the brine going back to the sea sinks to the ocean floor and damages marine life. Second the whole process is highly energy intensive (in Saudi Arabia for example, roughly 25% of daily oil production is used to make water (UNESCO, 2014). Third, reverse osmosis membranes have a useful life of about five years and are generally not recycled.

Solution: Oisann Engineering in Norway, created Waterfountain, which is a more energy-efficient system-wide innovation that preserves marine life by not producing brine and can be powered by wind turbines. Waterfountain uses standard reverse osmosis membranes that will last longer than five years.

Business model: Oisann Engineering is exploring different models, based on the size of the Waterfountain. There are three models producing between 1,000 and 100,000 cubic meters per day. The smallest model, Waterfountain 10, will be sold to the end user, or offered through an offtake agreement with the possibility of transferring the unit to the customer after a few years. Known as build–own–operate (BOO) or build–own–operate and transfer (BOOT) these options are not commonly offered for private resorts or smaller towns. By selling water as a service but not the desalination plant per se, this model reduces the risk for potential buyers and provides incentives for enhanced resource efficiency. The Waterfountain 10 will be operated locally while monitored and controlled from Norway.

An obstacle to the widespread adoption of innovation in the water industry is the generally risk-averse nature of the industry, which of course protects consumers. Yet as a result, there is a tendency to replicate a plant or concept already built and in operation. Therefore, even after being validated by experts, innovation does not automatically translate into commercial success. Oisann Engineering believes the scalability, environmental, and economic advantages of Waterfountain will overcome this obstacle.

Case Study II

Selling "circularity as a service" to smart phone and other device consumers through waste compensation programs; funding the recycling of waste phones in developing countries.

Problem: Out of the two billion phones being produced yearly, only a very small minority is being recycled, let alone recycled responsibly. In Europe and the U.S., 70% of the used phones are sent to the emerging world as second-hand goods (see Green Alliance, n.d.). Once these devices reach their end-of-life they need to be disposed of as electronic and chemical waste, causing significant problems in the most vulnerable places, where expensive recycling facilities are lacking. At the same time, many IT procurers are struggling to turn "green" or "circular" ambitions into results in a pragmatic, affordable way.

Solution: Closing the Loop (CTL), a Netherlands-based company created in 2014, charges a small fee to business customers that buy new IT hardware such as phones or comparable devices. This fee, known as a waste-compensation fee, is used to pay partners in Africa—mostly Cameroon, Ghana, and Nigeria (but also Gambia, Mali, Rwanda, Sierra Leone, South Africa, Uganda, and Zambia)—for the collection of end-of-life scrap phones which are no longer relevant for normal use. CTL then ships them to certified recycling facilities in Europe to be safely and cleanly turned into reusable materials—mostly gold silver and copper. This process is known as "urban mining."

Business model: This "One for One" model was first applied to cellphones, but CTL is gradually expanding its service to other devices, including tablets and laptops. It helps procurers in making their current IT purchasing "waste-free" by establishing a closed-loop process. The model contributes to resource recovery and waste reduction. It also arguably creates jobs and income in emerging markets, where people are paid to collect and store the waste in a safe and environmentally friendly way. Often, customers use part of the money they receive from selling their phones as second-hand devices to fund the services provided by CTL. From a services perspective, the company mostly sells its services to large private and public organizations that want to buy their IT in a more sustainable way. CTL also works with a number of retailers for IT and phones as well as carriers and original equipment manufacturers.

This service is affected by regulations covering the transboundary shipment of waste. While this material is not necessarily considered as hazardous waste under the Basel convention, procedures to secure permits can be lengthy due to very bureaucratic procedures and differing national regulations. A lack of clear regulations and enforcement procedures in several African countries may also generate higher costs for importers. In terms of regulations, extended producer responsibility (EPR) schemes, depending on how they are designed, may discriminate against this "One for One" model by not recognizing compensation as way to comply with such requirements.

Case Study III

Traffic monitoring, forecasts, and problem-solving services to enhance public transportation efficiency and utilization rates.

Problem: Transport is responsible for roughly a quarter of global CO_2 emissions (Wang & Ge, 2019) as well as a large share of our material footprint. Currently, public transport is largely run manually, which results in suboptimal efficiency.

Solution: The Train Brain created by Commuter Computing uses open data to monitor traffic and forecast delays in public transport. It enables traffic controllers to simulate decisions in real time, showing how different solutions will affect the entire network. This helps to optimize the system and reduce the need for new roads and more vehicles.

Business model: The Train Brain collects GPS and timetable data, processes it, and makes it available as an input for decision support. This enhanced data can in turn be used for delay forecast, but also for real time simulation (e.g., early warning, decision support or automated problem solving), planning simulations of timetables, and reporting (e.g., quality control of traffic performance). These services target city authorities who are in charge of public transport or private companies that have been mandated by local authorities to do so. Open data policies by government or local authorities significantly facilitate the use of such models. The EU directive mandating that transport data should be open has the potential to enable increased trade in such services. International harmonization of such policies could also go a long way in promoting similar business models.

In practice, however, differences in the level of compliance and implementation at the EU level are slowing down the process. In a similar vein, restrictions on data flows and localization could potentially affect trade in this area. Finally, by design, such business models rely heavily on non-discriminatory and efficient government procurement rules and procedures.

To conclude, our **survey and interview results suggest some services related to the circular economy are rather general, such as R&D or professional services, and could be provided outside circular economy activities**. However, the survey and interviews also provide evidence that circular business activities include various circular economy-specific services from recycling, repairing, and PSS services to digital services and business models aimed at improving material use and introduction of new sustainable materials to replace virgin materials and fossil fuels.

What Kind of Services Do Respondents Purchase for Circular Economy Activities?

Besides supplying services, many firms also buy services, and these can be an essential part of their circular business activities. In total, some 48 firms answered that they purchase services for their circular economy activities.

Table 2 presents the most important service categories firms report purchasing (at 2-digit level). Again, **the most common services purchased related to circular economy activities were sewage and waste collection, treatment and disposal, and other environmental protection services, although R&D and information and communications technology (ICT) services were also mentioned as playing an important role**, from data to cloud services. All these categories account for around or over 10% of the observations. Otherwise, the answers are very diverse. About a quarter of firms (13 in total) preferred to provide a short explanation of the services they buy instead of using the classifications. In addition, another 21 firms reported purchases of services in many different 2-digit categories, but the numbers per category are too small to report. They indicate purchasing such things as legal, financial, insurance, payment, educational, and construction services. The firms also report purchases of manufacturing services on physical inputs owned by others and other support services. In light of the COVID-19 pandemic, digital communications services (e.g., Zoom, Teams, Webex), although not mentioned, may have grown in importance.

Table 2. Services purchased by respondents (number of observations by service category)

Service category	Number of observations
94 Sewage and waste collection and treatment	6
81 R&D services	4
84 Telecommunications, broadcasting and information supply services	4
Other categories at 2-digit level in total	21
Short explanation (no 2-digit classification)	13

Source: Authors' elaboration based on survey responses.

The descriptions presented earlier in this section provide a good picture of the firms that purchase services related to the circular economy. Only 15 firms in the survey sample purchase services but do not provide any themselves. In other words, the firms are rather heterogeneous with regard to industrial classification, size, or circular business model orientation. Again, the majority of the firms, even some of the smallest, are multinationals.

3.0 Trade in Services Related to the Circular Economy

In total, some 70% of the providers of services related to the circular economy reported sales to foreign customers in the survey. While this share is relatively high, the absolute number of observations is limited to 41 firms. Subsection 3.1 provides a quick look at these service exporters and service exports based on the results of the survey. As the number of observations is limited, Subsection 3.2 looks more broadly at global trends in trade in those services for context. Subsection 3.3 discusses the modes of delivery through which these services are traded, following the GATS classification.

The next three subsections of this section then discuss particular aspects of the context of policy discussions around trade in services relevant to a circular economy. Subsection 3.4 provides a view of existing trade commitments and Subsection 3.5 on the role of digitization in services related to the circular economy. Subsection 3.6 analyzes some of the remaining trade barriers affecting these services trade based on the survey and interview results.

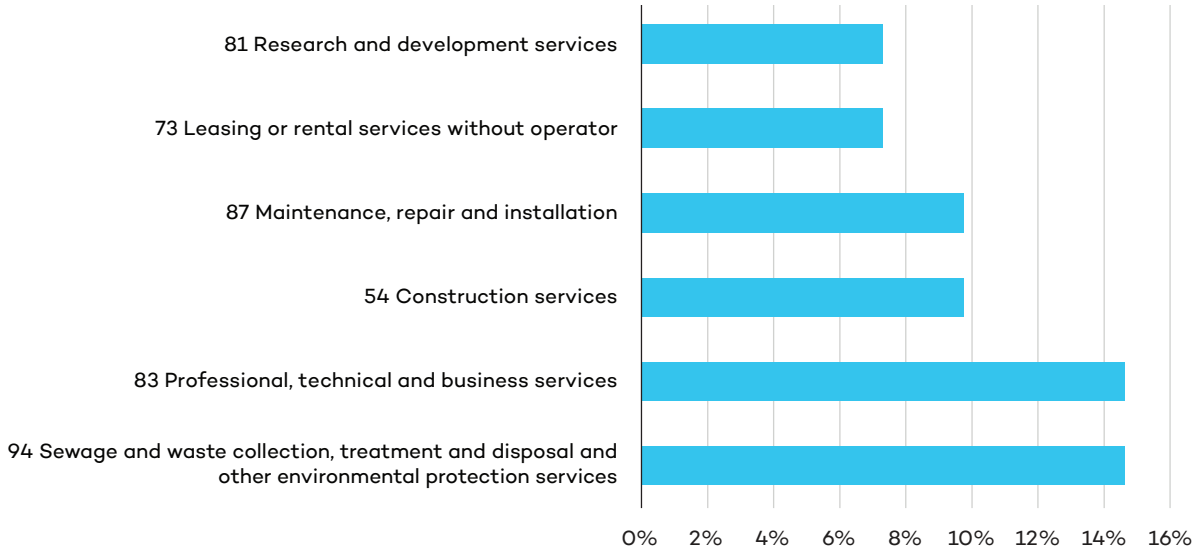
3.1 Trade and Traders in Services Related to the Circular Economy

Based on the survey results and interviews (see Figure 9), the services related to the circular economy that appear to be particularly frequently traded include:

- IT services
- Other professional, technical, and business services (such as technical testing or environmental consulting services)
- Leasing or rental services without an operator
- R&D services
- Maintenance, repair, and installation (except construction) services
- Sewage and waste collection services
- Professional services related to construction services.

Taking into account that the overall numbers of firms reporting each of these service categories as their main service export commodity are relatively low and that a few firms also report supplying various other services, the list provided above should be considered illustrative rather than exhaustive. For the purposes of this report, the analysis focuses on the services mentioned above.

Figure 9. Share of exporters reporting a particular category of services as their main export (CPC ver 2.1 at 2-digit level)



Source: Authors' elaboration based on survey responses.

Table 3 shows the number of firms reporting activities under the five main circular business models, the number of firms exporting these services, and the share of these exporters out of all the firms using each business model. In absolute numbers, most respondents use the resource recovery business model and the PSS model. Users of these models also include the highest relative shares of services exporters. Out of the 33 firms that report providing services related to PSS, over 50% also export these services. For the resource recovery model, the share of service exporters is 44%, and for the rest around 30%. The lowest share of services exporters is found in firms operating in circular supply models, although this business model includes the largest number of responses.

Table 3. Numbers of observations and exporters by circular business model

Circular business model	Number of firms, total	Service exporters, number of firms	Share of service exporters, % of total
1. Circular supply models	55	15	27%
2. Resource recovery models	48	21	44%
3. Product life extension models	40	15	38%
4. Sharing models	22	7	32%
5. PSS models	33	17	52%

Source: Authors' elaboration based on survey responses.

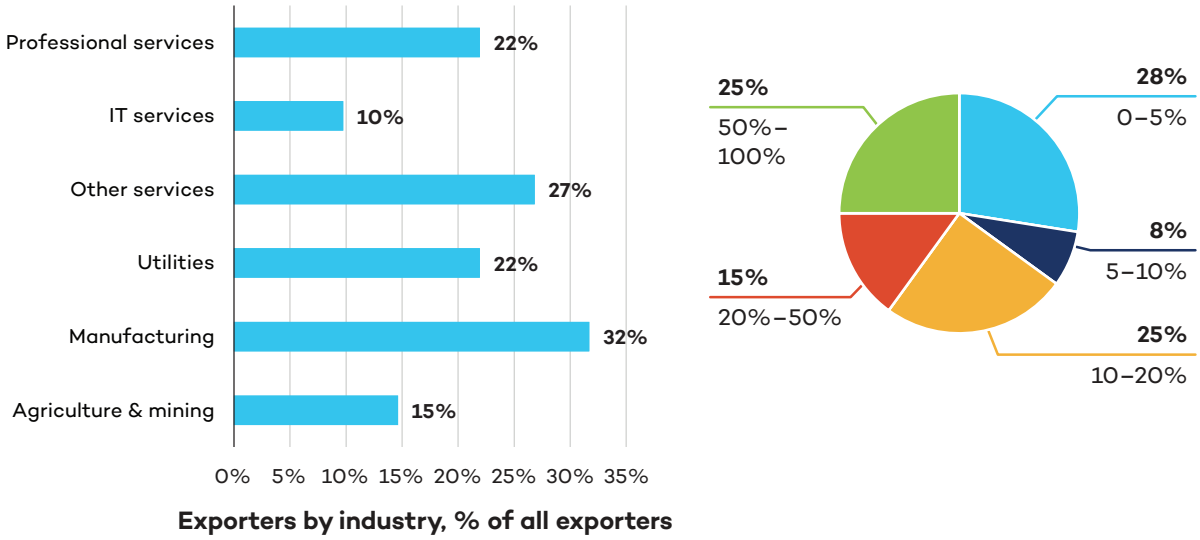
Similar to the general picture of service providers described in Section 2, most of the service exporters participating in the survey are small or micro sized firms (around 70% of sample) followed by large firms (around 20%). However, most of these firms are also multinationals (around 70%) and over 50% of small firms report having subsidiaries abroad. As services are often traded via an office or subsidiary in a foreign country, i.e., via mode 3, this relatively high share of multinational firms is not surprising. However, **the large share of multinationals within the micro, small and medium-sized enterprises (MSMEs) responding to the survey is unusual in light of the generally low involvement of MSMEs in services trade**. According to results presented by the WTO (2019b) from various developed countries, in general less than 10% of MSMEs are involved in services trade. Based on the same source, in Finland (where most survey respondents have their head offices), exports accounted for less than 20% of MSMEs' annual turnover in 2014 in various service sectors.

In absolute terms, the **majority of service exporters in the survey are firms operating in the manufacturing industries**. These represented 32% of total exporters. This share is consistent with that of service providers operating in this sector (see Figure 3 and the previous section). The shares of exporters are mostly similar to the shares of service providers per sector as well. However, exporters from the IT sector accounted for 10% of all services exporters while representing only 7% of total service providers. In the "other services" category, export intensity seems lowest; only 27% of exporting firms originate from these sectors while in total 35% of all service providers belong to this sector (see Part a) of Figure 10).

While in general, services represent over 20% of respondents' turnover, the share of turnover from service exports is only somewhat smaller. Figure 10, part b, shows that in 65% of the firms, service exports bring over 10% of the annual turnover. This is significantly higher than the typical share of exports in firms' turnover, which in most exporting firms is under 5%.[22] In our survey sample, only 28% of respondents indicate that service exports bring 0%-5% of their annual turnover. These responses indicate that **while not that many firms participating in the survey report service exports, the ones who did are very heavily specialized in services exports related to the circular economy**.

[22] See for example, Mayer and Ottaviano (2008) for a review of the importance of exports to firms' annual turnover from different countries.

Figure 10. Respondents indicating involvement in exporting services: a) service exporters by industry classification, % of exporters (left figure), and b) share of annual turnover from exports of services related to the circular economy, % of exporters (right figure)



Source: Authors' elaboration based on survey responses.

Out of the roughly 50 firms reporting service purchases, only half report importing them from related companies in other countries or entirely unrelated suppliers internationally. The services imported vary, but digital services, R&D, and manufacturing services, in particular, are mentioned by multiple respondents. Most of the **service importers are multinationals, and they also export circular economy-related services themselves**.

3.2 Value of Trade in Services Related to the Circular Economy

The survey results help to illustrate how services related to the circular economy are traded, but are far too limited to give a sense of their global scale and value. In order to provide some context to the survey responses, this subsection presents estimates of global trade in the kinds of services related to the circular economy. Measuring trade in services is notoriously challenging: services are often intangible, perishable, and cannot be stored, which means their trade across borders is more difficult to capture in official customs statistics than trade in goods.[23] The data sources on services trade that exist are also dispersed and inconsistent. Furthermore, statistical shortcomings are compounded by the fact that there is no perfect correspondence between the service classification systems used for negotiating and policy-making purposes (i.e., GATS W/120[24] and the CPC), and the balance of payments (BOPs) classification framework that is used for international trade statistics.

[23] Trade statistics also cannot distinguish the value of intangible services (e.g. data processing services) from the value of tangible intermediate goods like energy, materials, end devices and ICT-infrastructure that may be embedded in the supply of the service itself.

[24] For more information on the different classification systems see Appendixes B and C.

The lack of harmonization between services classification and trade statistics systems means BOP statistics may not capture all services that may be related to the circular economy nor the extent to which they are traded across borders. The global figures therefore give a broad, albeit incomplete, sense of the scale of international trade in the services related to the circular economy.

WTO statistical data shown in Table 4 reveal that computer services (inclusive of maintenance and repair of computer equipment) account for the highest share of total commercial services exports (8.2%) among services related to the circular economy, followed by R&D services (3.1%). Waste treatment and de-pollution services account for the lowest share of commercial services exports. Imports of services related to the circular economy follow a similar pattern. However, these data should be handled with care. Aggregate services categories like computer services encompass services related to the circular economy as well as services that are not at all related to it. As noted above, the data in Table 4 tend to be over-inclusive, making it difficult to assess to what extent the portion of services related to the circular economy actually contributes to the overall value of each services category.

Table 4. Trade in services related to the circular economy (2018 or most recent year available)

	Exports (USD billion)	Share of total commercial services exports	Growth rate (2012–2018)	Imports (USD billion)	Share of total commercial services imports
Computer services	475	8.2 %	66.3%	211	3.9%
Other professional services	188 (2017)	3.5% (2017)	29.3% (2012–2017)	164 (2017)	3.2% (2017)
R&D services	179	3.1%	46.9%	193	3.5%
Maintenance and repair services	100	1.7%	80.9%	64	1.2%
Waste treatment and de-pollution services	1.4 (2017)	0.03% (2017)	n/a	1.3 (2017)	0.03% (2017)
Professional services related to construction services	45 (2017)	0.9% (2017)	57.9% (2012–2017)	26 (2017)	0.5% (2017)
Operating leasing services	47 (2017)	0.9% (2017)	32.6%	41 (2017)	0.8%
Manufacturing services on inputs owned by others	110	1.9%	11.9%	75	1.4%

Source: Authors' elaboration based on WTO data available at https://timeseries.wto.org

Exports in many broad service categories relevant to the circular economy experienced significant growth in the last few years, ranging between 30% for operating leasing services and 70% for computer services during 2012–2018. However, in the same period, exports of narrower categories of services related to circular economy activities (including manufacturing services on inputs owned by others and waste treatment and de-pollution services) grew at only a 12% rate. Imports of services related to the circular economy follow a similar pattern. Although the data are too broad to draw firm conclusions, it is possible that the growth rates of the "narrower" service categories like waste treatment, services which are arguably more closely related to the circular economy, may be more reflective of the actual growth rate of trade of services related to it.

G20 countries account for the bulk of exports and imports in services related to the circular economy. Western Europe leads in exports across almost all these services categories, with the exception of maintenance and repair services (excluding computer equipment), where Asia-Pacific Economic Cooperation (APEC) members predominate. Notably, Western Europe dominates exports in waste treatment and de-pollution services, with Canada and South Korea being the only two non-EU countries exporting these services, though available data is limited.

Table 5. Top 10 exporters and importers of services related to the circular economy (most recent year available)

	Computer services (2018)	Other professional services (2017)	R&D services (2018)	Maintenance and repair services (2018)	Waste treatment and de-pollution services (2017)	Professional services related to construction services (2017)	Operating leasing services (2017)	Manufacturing services on inputs owned by others (2018)
EXPORTERS	**Ireland** **India** **Germany** China U.S. Netherlands UK France Sweden Israel	**U.S.** **Belgium** **UK** Germany France Netherlands Canada France Hong Kong Ireland	**U.S.** **Germany** **France** UK Israel Japan Ireland Belgium Canada Sweden	**U.S.** **Germany** **France** China Singapore Switzerland Netherlands Poland Canada Chinese Taipei	**Netherlands** **Germany** **Belgium** Greece Denmark Poland France Czech Republic Hungary Portugal	**UK** **Germany** **France** Austria Italy Sweden Belgium Netherlands Denmark Poland	**Ireland** **U.S.** **France** Singapore Germany Netherlands Belgium Russia Austria Spain	**China** **France** **Germany** Netherlands Italy Poland Belgium Philippines Spain Romania
IMPORTERS	**U.S.** **Germany** **China** Singapore Netherlands France Japan Belgium UK Sweden	**U.S.** **Belgium** **Netherlands** Germany France Canada Luxembourg UK France Ireland	**U.S.** **Ireland** **Germany** Japan Singapore Switzerland France Belgium Netherlands Sweden	**Germany** **France** **U.S.** Japan Switzerland China Netherlands Russia Belgium Poland	**Italy** **Netherlands** **France** Germany Belgium Greece Luxembourg Poland Romania Czech Republic	**Germany** **France** **Belgium** UK Austria Italy Denmark Sweden Netherlands Poland	**France** **Germany** **Singapore** Russia U.S. Netherlands Belgium Hong Kong Italy South Korea	**Hong Kong** **South Korea** **France** Germany Ireland Netherlands Japan Italy Austria Belgium

Source: Authors' elaboration based on WTO statistical data available at: https://timeseries.wto.org

Traditional gross value-based export statistics (see, e.g., UN Comtrade data) suggest that "pure service exports" account for only around 20%–25% of world exports. While the figures above give a sense of what is currently captured in global statistics, this is likely to be an underestimation of the real value of global services trade.

The increasing fragmentation of global value chains means gross export values provide a poor picture of the importance of different export commodities (goods and services) to economies. A majority of world exports consist of intermediate, not final, products, a fact highlighted in multiregional input–output databases (such as WIOD and TiVA). Therefore, the gross value of goods exports overestimates their importance to economies. On average, the share of domestic value-added in the gross value of exports has been around 50%–70% in manufacturing sectors, where the use of imported intermediate inputs has increased over time, and around 70%–90% in business service sectors (OECD, 2020). For Finland, Haaparanta et al. (2017) estimated that gross exports of service commodities accounted for 30% of total gross exports in 2016 while their value-added share was around 36%.

Services trade is also growing rapidly. The decreasing need to provide services face-to-face and fragmentation of value chains means that direct service exports have increased in importance in recent years. Based on the WTO World Trade Report 2019, global services trade has increased annually on average by 3% since 2011, while trade in goods has increased by 1%. In particular, services trade in computer services and R&D grew on average by over 10% annually between 2005 and 2017. These services are traded especially in modes 1 and 4. In total, in 2017, mode 3 of services trade accounted for 59% of world services trade, mode 1 for 28%, mode 2 for 10% and mode 4 for just 3% (WTO, 2019b). Looking ahead, the WTO (2019b) concludes that services trade is likely to be especially affected by the following megatrends in the future: 1) increasing digitalization, 2) demographic changes that affect services demand and comparative advantage in service supply between countries, 3) rising global incomes increasing demand for high-skilled services, and 4) climate change and other environmental problems that increase the demand for sustainable services.

Last, as described in the previous section, service provisions and inputs are also an increasingly important part of the value of traded goods. For example, Haaparanta et al. (2017) found that in Finland, over 50% of the gross exports of the electrical equipment industry were exports of services in 2015, and the value-added they generated accounted for an even higher share. Crozet and Milet (2015) find similarly that in all French manufacturing industries, covering a sample of 50,530 firms, 76% of the firms sell some services, and 22% report selling more services than goods. Miroudot & Cadestin (2017) report similar findings from other countries. The difference between goods and services companies is thus also becoming less and less clear cut. By analyzing the contributions of services inputs to gross exports, service activities within manufacturing firms, and direct service exports, Miroudot

and Cadestin (2017) conclude that in total, the overall contribution of services value-added to gross exports is close to two thirds in developed countries.[25]

These trends suggest the importance of services (and services trade) and their role in the circular economy is likely to be much higher than official statistics currently capture.

3.3 Modes of Supply of Trade in Services Related to the Circular Economy

The next step in our analysis is to examine how services related to the circular economy are traded; in other words, under what "modes of supply" trade takes place. Export of circular economy solutions can, in theory, happen in any of the four services trade delivery modes, in addition to the possibility of being embedded in goods exports (e.g., software included inside electronic equipment). Analysis of and information on the importance of the different modes is important for policy-making, as the trade barriers facing services trade differ between the modes. The four main services trading modes identified in the GATS agreement[26] are:

1. **Cross-border supply**: Services supplied from the territory of one country into the territory of any other, including, e.g., all digitally sent services.
2. **Consumption abroad**: Services supplied in the territory of the service supplier to the service consumer of another country, including, e.g., tourism services or educational courses followed in another country.
3. **Commercial presence**: Services supplied by a service supplier of one country, through commercial presence in the territory of another country, including, e.g., service supplied through a subsidiary or local office.
4. **Presence of natural persons**: Services supplied by a service supplier through the presence of natural persons in another country, including, e.g., consulting or maintenance services provided by a natural person in a foreign country.[27]

The servicification concept articulated by Miroudot and Cadestin (2017) helps to explain how these modes of supply could function as both services and manufacturing firms can engage in trade of services via the following channels:

[25] Based on TiVA statistics, services account for half of world trade as intermediate inputs. In addition, Miroudot and Cadestin (2017) conclude that within manufacturing firms, service activities account for about 40% of value creation. So, for the manufacturing sector alone, service value added goes up from 37% to 53% in gross exports when considering the in-house provision of services (in the sample of developed countries covered in the report). Adding exports of services firms, they arrive to the final estimate that services value added to gross exports is close to two-thirds.

[26] https://unstats.un.org/unsd/tradekb/Knowledgebase/50665/Modes-of-Supply

[27] Note that although the GATS uses the term "member" in describing these modes of supply, the concepts are expressed here with reference to "countries" because this trade could of course take place with, or between, non-WTO members.

1. Foreign services used as inputs in the production of circular economy goods or services from non-related firms.
2. Service imports or exports taking place within the fragmented international value chains of multinational firms (e.g., R&D or IT services that are centralized and provided to all parts of the firm from one location).
3. Direct service exports to foreign (non-related) customers either separately or in relation to goods.

The Swedish National Board of Trade (2014) analyzed particular services that accompany trade in environmental goods and concluded that trade in these accompanying services takes place under all four GATS modes of supply, but mode 3 (commercial presence) and mode 4 (movement of natural persons) seem predominant since the provision of these services typically takes place at the customer's site. Some mode 1 supply (cross-border trade) can also take place, e.g., in cases where monitoring of operations is conducted via the Internet.

Disaggregated data on services trade by mode of supply is limited but does provide a sense of how services related to the circular economy are provided across borders. For example, available estimates for EU member states in 2013 indicate that manufacturing services on inputs owned by others were supplied primarily via mode 2, maintenance and repair services were delivered through a combination of modes 2, 3, and 4, and the others as a combination of mode 1, 3, and 4 (Rueda-Cantuche et al., 2016).

This generally reflects the assumptions set out in the Manual on Statistics of International Trade in Services 2010 (UN, 2011), which considers services defined here as relevant to the circular economy to be delivered as follows:

- Computer services: via mode 3 and a combination of mode 1 and 4
- R&D services: via mode 3 and a combination of mode 1 and 4
- Manufacturing services on inputs owned by others: via mode 2 and 3
- Maintenance and repair services: via mode 2 and 3
- Waste treatment and de-pollution services: via mode 3 and a combination of mode 2 and 4.

Considering that technological progress and increasing digitization enable cross-border supply (mode 1) to play a more central role in services trade, it is likely that this would also apply to services related to the circular economy. For example, computer services and R&D services are likely to be increasingly supplied via mode 1, as opposed to mode 4.

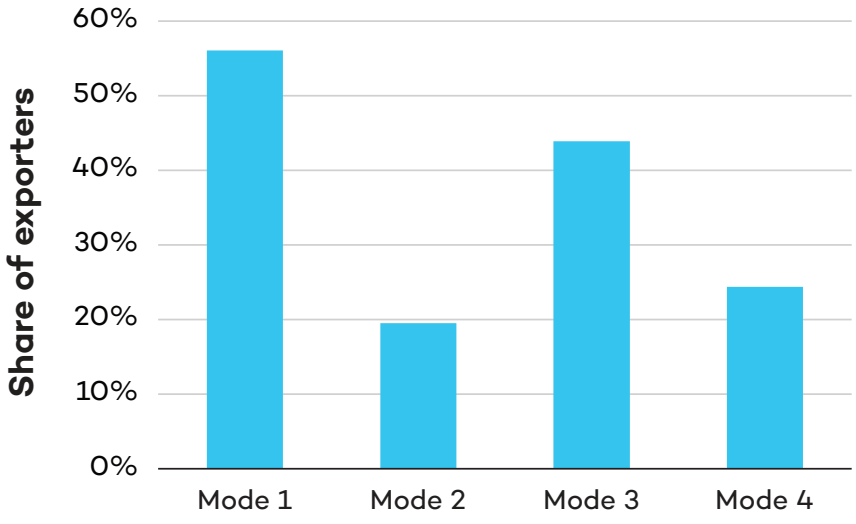
Several real-life examples illustrate how this trade takes place. Sulapak[28] grants licences to replace traditional plastic materials with a biodegradable and microplastic-free recipe that is designed to fit existing production lines and moulds. In other words, instead of exporting their biodegradable products as ready-made goods, they export them as a service (especially via mode 1). Others offer products and services jointly through an integrated approach,

[28] https://www.sulapac.com/portfolio/#universal

like Risutec,[29] which exports forestry machinery with a software system embedded. MaaS Global[30] exports their mobility-as-a-service in a digital way (in mode 1) as the Whim software, but they also have subsidiaries and employees abroad (modes 3 and 4). Airbnb[31] exports software services for renting private apartments and houses via their website (mode 1), reducing the waste of space. The company also has offices in various countries. On the other hand, maintenance and repair services, as well as waste treatment and de-pollution services, are likely to continue to be supplied primarily via mode 3. Relex solutions,[32] for example, exports artificial intelligence services (i.e., software services) that minimize waste in supply chains in various service modes, and they have also set up offices abroad (mode 3).

These general trends and descriptions are well reflected in the survey answers. While the number of services exporters is limited, and the survey responses cannot be considered to represent all circular economy firms involved in service exports, the findings are well in line with expectations. Based on the results, **most respondent firms (around 55%) export their services related to the circular economy to foreign clients via telecommunications or the Internet (mode 1). The second most common delivery mode is via commercial presence abroad (mode 3) with 45% of respondents using it** (see Figure 11). It should be noted that around 30% of the respondents report supplying services related to the circular economy via more than one mode of supply. Some firms, like Tamturbo,[33] which has developed compressed air as a services solution, supply their services under mode 1 in some markets and under mode 3 in others. Therefore, the sum of percentage shares reported in Figure 11 is not equal to 100%. Mode 2 was the least commonly reported mode among the respondents.

Figure 11. Service trade modes used by the responding exporters, % of exporters



Source: Authors' elaboration based on survey responses.

[29] https://www.risutec.fi/en/

[30] https://whimapp.com/

[31] https://www.airbnb.com/

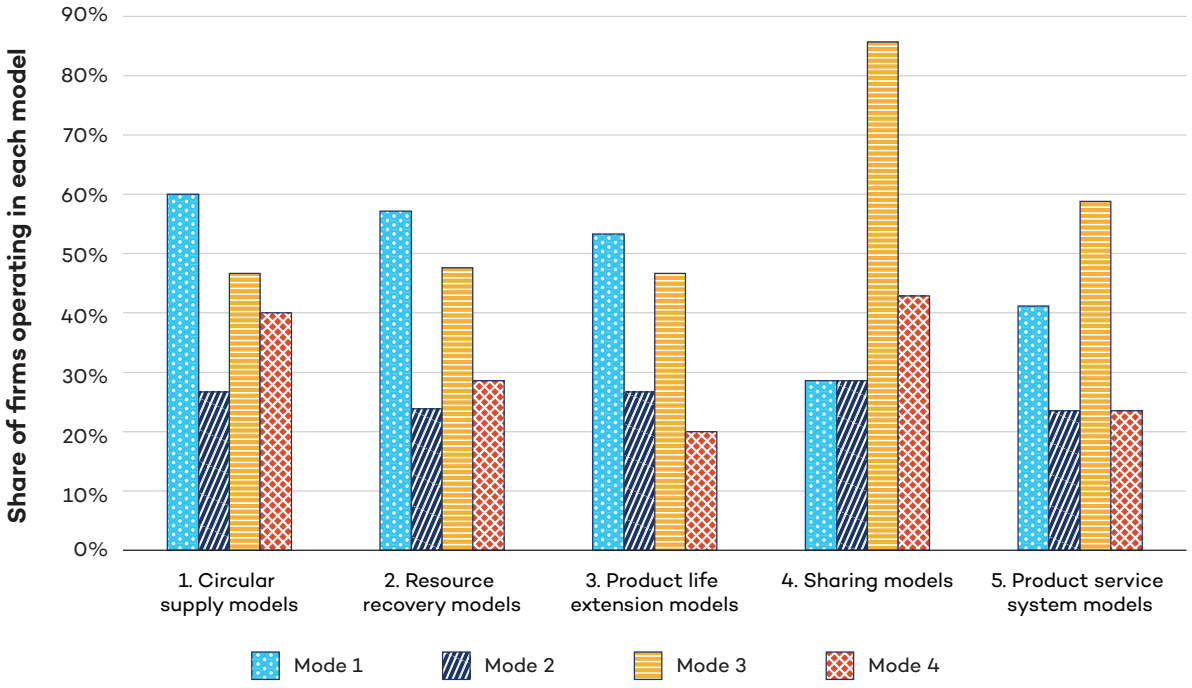
[32] https://www.relexsolutions.com/company/

[33] https://www.tamturbo.com/

At the level of service categories, the number of responses to the survey by services trade mode are mostly too low to report. However, as expected, IT-related services and business services (category 83 of CPC) seem to be mostly traded via mode 1, and sewage and waste treatment services (category 94) via mode 3.

For the five main circular economy business models, the survey results provide a perspective on the most used services trading modes (see Figure 12). **Mode 1 seems to be the most common way of trading the services related to the circular economy within the first three circular economy business models: circular supply, resource recovery, and product life extension**. Over 50% of the exporters in these models report exporting services in this mode. The second most popular trading mode in these business categories is mode 3, commercial presence, with around 50% of respondents reporting use of this mode. **In sharing models and PSS, the most used trading mode is commercial presence (mode 3)**. For example, over 80% of firms providing sharing services report service exports via mode 3. In all models, use of mode 2 for service trading is least used by the respondents. Again, it should be noted that many firms report sales in various circular business models and via many modes of services trade. The absolute number of observations in some of these categories is relatively low, and thus the results should be considered as only indicative, not representative, of trade in services related to the circular economy in general.

Figure 12. Modes of services trade by circular economy business model, % of firms operating in each model



Source: Authors' elaboration based on survey responses.

The firms were not asked for information on where they sell services related to the circular economy. However, the answers reported on their main office and location of subsidiaries provide some information on their international trading activities in mode 3. As mentioned in

section 2, most of the firms have their head office in Europe. A majority of the multinational firms (MNEs) report having offices also outside Europe, in various other countries and continents around the world. In addition, all MNEs have an office at least in some other country on the same continent as the head office.

In addition, as the difference between exports of goods and services is becoming more blurred, some services related to the circular economy are also traded as goods. For example, Swappie[6] offers the service of refurbishing used iPhones, but instead of setting up offices to provide the service in different countries, they do all the work in Finland and send the refurbished phones to foreign customers as goods.[34]

Three case studies developed from the interviews as a part of our research illustrate how some of this trade takes place.

Case study IV: Hygglo - Renting instead of buying

Hygglo's model lets users rent out the products they have at home, making use of idle goods.

Problem: A regular household requires many different products and tools, but often only for a short time, resulting in the consumption of many products with a low use rate over their life cycle.

Solution: Hygglo's peer-to-peer sharing platform lets users share their inventory of everything from home appliances to vehicles, garden or hiking equipment, allowing previously idle goods to be used more. The platform is available through their app or website.

Business and export model: The renter can avoid purchasing new and more expensive products, while the person who rents out the product can capitalize on their existing stock of goods. Trust is essential for sharing platforms. Hygglo provides an insurance on the rented products based on electronic identification and it facilitates the transactions against a share of the rent income (16%). Via the digital platform, Hygglo currently have their office in Sweden, but they operate also in Norway. In other words, they export these services in GATS mode 1 to Norway. Even between the Nordic countries, there are large disparities in the taxation thresholds that apply to the vendors on the platform, which may affect the number of people willing to rent their products.

CEO and Founder Ola Degerfors highlights that the demand side needs more attention, including from policy-makers. For example, subsidies or tax reductions could perhaps increase the interest of households in renting shared products. Degerfors also sees increased utilization as a key driver for the circular economy: Extended lifetime of products might act as an incentive for designers to make longer-lasting products and for policy-makers to pay more attention to the need to make long-lasting products. Increased utilization of already-made products decreases the need to manufacture more products and therefore the GHG emissions and natural resource use related to their production.

[34] The reverse may also be true. The proliferation of intelligent products enabled by or embedded in the Internet of Things ("IOT"), which enables services related to the circular economy such as preventive maintenance, also helps blur the good–service distinction (Chander, 2019).

Case study V: Textiles as a service

Lindström rents out textiles as a service, ensuring their optimal use.

Problem: For many businesses, work uniforms, carpets, and hotel textiles tie up capital in operations far removed from their core business. Value is lost as they are discarded or replaced too early in their life cycle.

Solution: Lindström lets businesses rent textiles as a service from regional service centres, maintaining them at regular intervals.

Business and export model: Lindström reaches over 100,000 customers in 24 countries through local subsidiaries (GATS mode 3), covering countries ranging from Asia (China, South Korea, and India) to many markets in Eastern Europe, although Finland remains the largest market. Their contracts ensure steady revenue streams and customer retention, while the companies that use their services do not have to invest capital into textile products. Moreover, their business model has allowed Lindström to provide other services such as personal protective equipment, washroom sanitation maintenance, and cleaning services.

As the company has lengthy experience and considerable internal resources and knowledge, challenges for Lindström are mostly confined to new operations and markets where their local business ecosystem have not yet been established. Local legislation that is created around linear concepts also means that some of their business models need to be adapted.

Case study VI: Reusable postal packaging as a service

RePack's reusable packaging service helps reduce waste in online retail, as customers have an incentive to return the packaging to RePack.

Problem: Global e-commerce tripled between 2014 and 2019.[35] The growth mostly relies on single-use packaging, and has drastically increased the volume of packaging waste.

Solution: Providing reusable postal packaging as a service for online customers. The packaging is adjustable and comes in different sizes, ensuring that as little air as possible is transported. Each piece can be used up to 20 times, which lowers the carbon footprint of postal packaging by 80% per package and generates significantly less waste compared with single-use plastic.

Business and export model: RePack, which operates a PSS (GATS mode 1 & 3), has leasing agreements with more than 150 online stores in 15 countries. While the parent company in Europe is based in Finland, RePack has established a separate entity in the U.S. market. The customer pays for the RePack packaging, which is partly refunded through a voucher upon returning the packaging free of charge from any public mailbox. Customer commitment to the stores is strengthened through this model with some stores opting to solely offer RePack's packaging.

[35] https://www.weforum.org/agenda/2020/01/carbon-emissions-online-shopping-solutions/

One difficulty relates to the classification of goods and services. RePack's solution is considered as a good. While the VAT in Finland is the same for both categories, its application in other jurisdictions varies. In some countries, goods are subject to VAT while services are not, which adds to the complexity.

As policy-makers consider how best to use trade policy to support the transition toward the circular economy, key elements for their consideration include: 1) existing commitments in trade agreements on services related to the circular economy, 2) the digitization of services trade, and 3) how regulatory or information barriers can impact trade in services related to the circular economy. The next subsections consider each of these questions in turn.

3.4 Existing Commitments on Trade in Services Related to the Circular Economy

Existing commitments on trade in services related to the circular economy also play a role in the design of policy responses. GATS commitments in services vary according to sector. Full commitments on market access and national treatment in a given sector essentially mean that a WTO Member is committed to providing access for foreign suppliers to its domestic services market, and there is no fundamental discrimination between foreign and domestic suppliers. Comprehensive commitments can foster competitiveness, meaning that domestic businesses have more options to choose a services supplier to improve their circular economy activities.

However, commitments in trade agreements are not the same as actual regulation—they provide an overall framework and a minimum level of market liberalization. If a member has not undertaken full commitments in a sector, they are not obliged to provide wide and non-discriminatory market access or national treatment to foreign service providers. However, governments may be more liberal in practice than they have committed to be: in these circumstances the actual level of market access or national treatment in a given market can be much better than what the member has committed to provide under GATS.

Overall, Adlung and Roy (2005) found that more WTO members have scheduled commitments on tourism, financial, business, and telecommunication services than on other sectors. Regarding services related to the circular economy, our review of members' GATS schedules reveals that a **higher number of members scheduled commitments on IT services (i.e., software implementation, data processing, and database services) and telecommunication services (i.e., online information and/or data processing) than have scheduled commitments on leasing or renting without operators services, or on services incidental to manufacturing**. For instance, over half of the members have scheduled commitments on software implementation services, whereas only one third scheduled commitments on leasing or renting services without operators related to other machinery or equipment.

The depth of GATS commitments also varies according to sector. Members' GATS schedules indicate that in **IT services, R&D services, and services incidental to manufacturing,**

most members undertook full commitments[36] for market access in modes 1, 2, and 3. However, only half of the members that undertook commitments in maintenance and repair of aircraft, vessels, rail, and road transport equipment and sewage services inscribed full commitments on modes 1, 2 and 3. Across all services sectors related to the circular economy, the fewest number of commitments to market access or national treatment relate to mode 4[37] (i.e., movement of natural persons). It would seem, then, that low levels of commitments tend to be found in services that members prefer to have provided locally or where they want to protect a nascent services sector. The absence of commitments in mode 4 is perhaps not surprising given that committing to allow the presence of foreign service providers is often particularly politically sensitive for governments.

In RTAs, WTO members generally undertake more and better commitments in a much greater proportion of services subsectors than they have under the GATS (Roy, 2011). A case in point is Colombia, which scheduled no commitments on maintenance and repair of aircraft and maritime vessels under GATS but agreed to full liberalization in these services subsectors under the Canada–Colombia RTA.[38]

3.5 The Digitization of Services Trade and the Circular Economy

The provision and trade of services, including those related to the circular economy, have been reshaped in the last few years as part of the digitization of economic activity. Over the last two decades, the world economy has undergone a transformation spurred by digitalization and technological breakthroughs. Advances in computing power, storage capacity, bandwidth, and computer processing speed have led to the emergence of new digital technologies (e.g., IoT, artificial intelligence [AI], blockchain, and 3D printing). These advances have had a profound impact on the production of goods and services, consumer habits, and trade, by radically changing the nature of assets used to generate value, the way asset ownership is imparted, and where value is generated (OECD, 2020b, in press; WTO, 2018).

At the centre of the digital revolution is data collection and transmission. IoT technology, for example, involves embedding Internet connectivity in physical objects. Connecting sensors and measurement devices to those objects allows information about their use to be transmitted as data via the Internet, thus enabling a company for instance to lease physical goods as a service, e.g., leasing a water pump by the hour rather than selling the pump outright. Some of these operations can require movement, storage, and processing of large volumes of data (OECD, 2020b, in press). Similarly, the development of machine learning, defined as an AI application that can be used to improve efficiency in services production by allowing machines to perform human-like cognitive functions, depends on the availability and

[36] When a member inscribes no limitations on market access or national treatment in a given sector and/or mode of supply, it undertakes a "full commitment" in that sector and mode of supply.

[37] When a member does not undertake commitments in a given sector and/or mode of supply, it retains the ability to introduce or maintain measures inconsistent with market access or national treatment for that sector and/or mode of supply: it does so by using the term "unbound" in its GATS schedule.

[38] See Canada–Colombia RTA: https://rtais.wto.org/UI/PublicShowMemberRTAIDCard.aspx?rtaid=162. See Colombia's GATS schedule here: https://www.wto.org/english/tratop_e/serv_e/serv_commitments_e.htm

quality of data that tech companies use to train AI algorithms (i.e., training data) as well as the availability and quality of data processed by AI software (i.e., processing data) used by private and public entities (WTO, 2018).

For economic efficiency, data must frequently be moved across borders to locations with large processing capacity and then returned to the users. Each of the many international transactions of services supplied digitally involves a transfer of data across borders. In the digital era, therefore, the ability to move data across borders is crucial for the daily operations of businesses worldwide, either as part of a company's business offers or of processes within it (Rentzhog & Anér, 2014).

Digital technologies are key enablers for productivity, innovation, and growth in the global economy. Their role is likely to become even more central because of their particularly significant impact on services, whose contribution to economic growth and international trade is expected to continue to rise (WTO, 2018).

This impact of digital technologies on services and trade in services has manifested in a variety of ways. First of all, **digitalization has affected the production of services**. For example, new technologies have allowed companies to create a wide array of new and enhanced services, such as large-capacity data storage and processing (often referred to as "cloud services"). Also, a number of services have increased in digital intensity, as exemplified by the widespread use of digital technologies in the finance and business sectors. First of all, digitalization has contributed to prompting a significant shift from goods to services production, as exemplified by the decrease in CD production over time in favour of online streaming services. The effect **digitalization has had on services production** has, in turn, enabled services to play a key role in the emergence of new business models that support the circular economy. Cases in point are online services platforms like Rent the Runway, whose customers rent—rather than buy—clothes for a subscription fee. This a business model aims at prompting a more efficient and sustainable use of textiles and clothing products. An example from a very different industry is Chemycal, an online tool that uses blockchain technology to allow its users to track chemicals throughout the supply chain (Pardo, 2018).

Secondly, digitalization has also affected the composition of international trade. Trade in services—and especially trade in digitally intensive services—increasingly accounts for a larger share of the total value of global trade (WTO, 2018). The introduction of new technologies has allowed companies to reduce production costs and enabled more services to be traded across borders. The costs of communications services have decreased, enabling cross-border supply (mode 1) to play a more central role in services trade by increasingly becoming the primary mode of service supply. This, in turn, has opened the door for more firms, especially from developing countries and of smaller size, to supply their services in the international market (van der Marel, et al., 2017; WTO, 2018). Additionally, technological advances have led to a notable increase in the share of companies that are wholly digital, meaning that business is digital and they sell no physical goods (Rentzhog & Anér, 2014). As a result, services trade has grown rapidly and is playing a greater role in national economies (van der Marel, et al., 2017). It is worth recalling here that many of the respondents to our survey relied on delivering services through mode 1 by digital means.

In summary, digitalization has enabled entirely new services characteristic of the circular economy (like ride-sharing services) to be created and sold locally and internationally. It has also enabled traditional services that can support more circular business models (like engineering services) to be provided across borders more cheaply. Lastly, the reliance of so much economic activity on data—and thus on the international business of data gathering and processing services—has fundamentally changed the context within which the shift to a circular economy will be pursued.

Policy barriers to digital, and by extension, digitally enabled services trade are growing. Four kinds stand out as potentially problematic. First, some governments seek to condition market access for services to use of domestically produced systems or processing capabilities, whether to reduce perceived security risks resulting from using foreign technology or service suppliers, or to capture a greater share of the rents of profitable activities. Trade in services related to the circular economy, such as data processing services, leasing, or rental services, and R&D services, are particularly affected by policies that condition market access on the use of domestically produced systems, when these reduce the interoperability of communication networks and systems. Second, trade in data-intensive services can also become more difficult where policies and regulations affect the free movement of data (e.g., local data storage or processing requirements). Third, well-balanced and transparent privacy and cybersecurity regulations are also key to the smooth exchange of data across international borders that trade in many services related to the circular economy require, but are far from ubiquitous. Fourthly, the advantages of being able to efficiently supply services digitally across borders at low cost can also be hobbled by requirements of commercial presence, whereby companies must be incorporated in jurisdictions in which they want to sell services.

The regulation of personal and non-personal data is particularly challenging for international trade in digitally enabled services. Not all data are equal before the law. For example, in the EU, the processing and transfer of non-personal data is subject to less stringent requirements (see Regulation (EU) 2018/1807) than personal data, about which consumers are more sensitive (see the General Directive on Data Protection (GDPR) i.e. EU Regulation 2016/679). However, in practice, the distinction between personal and non-personal data is not always easy for businesses to make. For example, in big data analytics, distinguishing between the regulatory requirements that must be complied with for the two categories of data can be very difficult and costly for services suppliers. Also, for AI-based applications, personal identification of an individual and their data can still occur even if non-personal data are used to train the machines.

The digital revolution is not without challenges in the context of a shift to a more circular economy. New technologies such as blockchain and AI require more powerful IT infrastructure (i.e., more computing power, greater storage, and faster bandwidth) to operate. This drives up energy consumption and demand for key components of the IT infrastructure like metals and minerals, especially silicon and rare earth elements.[39] Unless these inputs are

[39] It can also be argued, however, that this increase in demand could be offset by the fact that the use of digital transmissions in international services trade acts as a substitute for traditional forms of transport and associated consumption of energy and raw materials.

from recycled sources, building more infrastructure and consumer devices can contribute to greater resource use, which arguably runs counter to the resource efficiency objective advocated by the circular economy concept. Even basic digital network infrastructure requires reliable Internet connections and adequate electricity systems to function, which are in short supply in many developing countries.

Trade in digitally enabled services is a potential source of economic growth that is partly delinked from primary resource use, which would support circular economy objectives. However, **ensuring that trade in digital services themselves, as well as trade in digitally enabled services, contributes to circular economy goals—and is accessible to all economies—requires addressing a number of challenges, in particular the crucial fact that the IT devices and technology required to operate digital and digitally enabled services are produced using significant amounts of natural resources and energy**.

There are some obvious avenues to explore. First, it is necessary to design measures to ensure the circularity of the IT infrastructure that digital services rely on. Secondly, it is important to find a balance in policy settings between technical and economic efficiency. Lastly, it would be advisable to ensure that technical designs of digitally enabled products comprising services related to the circular economy (e.g., with embedded sensors and other technical elements) are compatible with circular designs, e.g., for reuse and recyclability.

3.6 Barriers to Trade in Services Related to the Circular Economy

While trade barriers restricting cross-border flows of used products and secondary material feedstock are relatively well documented (OECD, 2019b), the role of service trade barriers has been less analyzed.

Overall, it is safe to say that many of the trade barriers affecting services in general are likely to affect trade in services related to the circular economy as well. Specific barriers to digital trade in services are discussed above, and open data limitations or restrictions on data flows and localization have been raised by respondents to the survey and interviews as one particular obstacle affecting their business. An analysis of the market barriers affecting services more generally can therefore provide some critical insights on how policy settings can increase access to services that support circular economy business models.

According to the WTO (2019b), services trade suffers from significantly higher trade barriers than goods trade. The global average cost of international trade is 4.3 times higher than that of domestic trade for services, while the same difference between international and domestic trade costs is less than 2.5 for manufacturing commodities. Trade costs in services are related to a number of factors including transportation costs, information and transaction costs, technology, ICT, or the quality of governance regimes.

According to the WTO, the most important impediments relate to trade policy barriers and differences in regulatory regimes (WTO, 2019b). These include differences in qualification requirements and procedures, technical standards or licensing requirements. In particular, the

duplicative or divergent nature of regulations or conformity assessment procedures are often considered as one of the key obstacles preventing trade, particularly for MSMEs. In other cases, market access barriers result from specific limitations imposed in a particular market on the number of services suppliers, the total value of services transactions or operations, or the number of natural persons allowed in the country. They also can take the form of performance requirements, e.g., through local content requirements.

Notwithstanding these obstacles, services trade costs are expected to decline significantly (by as much as 60% for some services groups) thanks to a declining need to provide services face-to-face, reduction in the need for a common language and improvements in regulations, contract environments, and broadband connections (WTO, 2019b).

Furthermore, in the case of the circular economy, **while local content requirements or other protectionist policies discriminating against foreign service providers can constitute barriers to services trade, some interviewed firms remarked that such requirements tend to be more present in traditional services or technology areas**. As a relatively new field of activity, the circular economy sometimes faces less protectionist pressure from import-competing producers compared to other sectors. For example, state-of-the-art technology-led solutions that enable collection and sensor-based sorting systems for resource recovery in the food, recycling, or mining industries face relatively little direct competition, and perhaps as a result fewer protectionist measures in foreign markets.

This potentially lower level of trade barriers to circular economy trade is also present in the survey and interview answers in general. As Figure 13 presents, **almost 40% of the respondents did not report facing any major difficulties in their trading activities**. However, part of this could be explained by a potential lack of experience in trade or the low trade barriers in the EU single market area. The large majority of the firms reporting no major export barriers are either small/micro-sized firms or quite young firms.

Barriers to Exports of Services Related to the Circular Economy

Respondents to the survey and interviewed firms did point to some specific obstacles to their exports, some of which apply specifically to the circular economy. Figure 13 shows the share from nearly 50 respondents reporting different types of export difficulties by broad categories. Typically, the responses included multiple issues.

By far **the highest amount of market access difficulties reported related to differences in regulations, in particular divergent regulations on secondary material or waste trade, or other circular economy or CO_2 accounting-related issues**. Over 25% of the respondents referred to differences in regulations generally, while some 20% of the firms reported barriers related to diverging regulations on secondary material and waste trade, or other circular economy or CO_2 accounting-related issues. Because many of the traders of services related to the circular economy are MSMEs, regulatory differences are likely to affect them in particular. In general, MSMEs have been found to be more hindered by regulatory differences, which can generate higher trade costs for them.[40] International harmonization of

[40] https://www.oecd.org/cfe/smes/ministerial/documents/2018-SME-Ministerial-Conference-Parallel-Session-1.pdf

circular economy policies and increasing transparency could go a long way toward reducing duplicative requirements or divergent regulations.

Similarly, in the EU area for example, survey respondents mentioned the varying implementation of common standards and regulations as a hindrance to trade flows. However, technical standards in the EU have also been seen as a success story, and the more limited standardization among jurisdictions outside the union may be a greater hurdle to tackle. Some companies were actively involved in standards development, at both the EU level—through institutions such as the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC)—and at the ISO; they saw this as a positive, albeit slow, way forward.

At the broadest level, the expansion of circular economy activities largely depends on the existence of good framework conditions at the national level, including energy pricing, power infrastructures, and environmental policies and incentives (e.g., recycling requirements or circular economy targets). **One of the constraints companies often face relates to the fact that existing systems, legislation, or funding schemes remain mostly based on the old linear thinking and do not necessarily support or favour new circular models such as those described above**. This contributes to slowing down the transition to more circular models and limits companies' ability to exploit new opportunities. For example, Mobility-as-a-Service (MaaS) applications can be hard to introduce if the market and data access is complicated due to old transport policy settings. Similarly, the EU Package Travel Directive is mentioned as a complication to MaaS applications, which have to comply with it.[41]

Different practices related to GHG emissions—and specifically CO_2 accounting standards and the level of statistics collected around the world—were also mentioned as a specific barrier to new circular economy applications which aim to reduce these emissions. These new circular economy applications could be used more easily in different markets if they were able to refer to comparable carbon footprint/handprint calculations for marketing purposes. While CO_2 accounting standards should help drive demand for circular economy services, diverging standards and differences in assessment procedures across jurisdictions may generate additional trade costs, particularly for MSMEs. Greenwashing is considered a problem in some markets due to these problems.

In addition to pure services barriers, **restrictive policy measures targeting goods trade can also affect trade in services related to the circular economy**. For example, EPR schemes, depending on how they are designed, may discourage trade in end-of-life products or second-hand goods. Such trade is sometimes considered as leakage or a way to escape recyclability requirements—and EPR Schemes do not always recognize offsets as a way to comply with such requirements.[42] Under the Basel Convention, some materials in products covered by EPR schemes may also be considered as hazardous waste, and procedures to

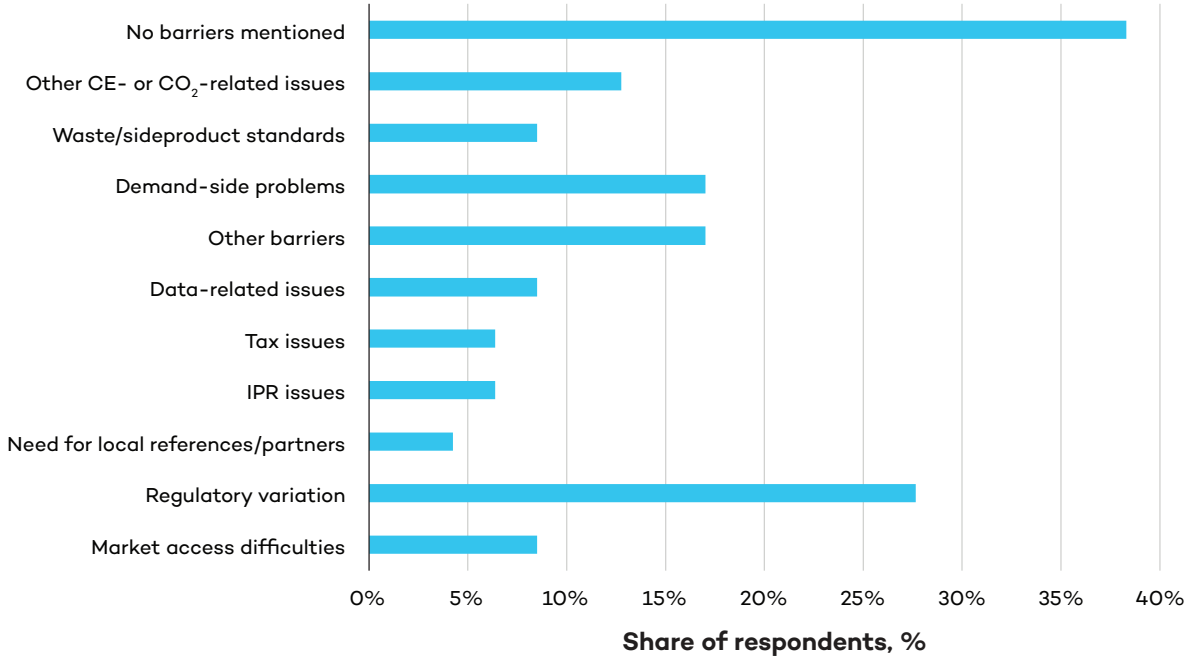
[41] The directive applies to combinations of at least two types of travel services (transport, accommodation, car rental, or other services such as guided tours) including travel packages and linked travel arrangements. MaaS services link travel services typically within only one city and therefore the regulations made for more extended travel packages are challenging to follow.

[42] For more information about Extended Producer Responsibility (EPR) schemes, see https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm

secure permits can be lengthy.[43] A lack of clear regulations and enforcement procedures in several developing countries also generate higher costs for importers. In turn, these restrictions directly affect trade in services associated with recycling.

Specifically related to circular economy business models, many respondents also report difficulties on the demand side in addition to old frameworks based on linear production models. Over 15% of the respondents report such difficulties. Instead of actual policy-related problems, these demand-side issues relate mainly to old customs and business practices, risk aversion of customers, and resistance to new business models in some countries. For example, if a service is traditionally produced with labour, new capital and IT-intensive applications can be perceived as disruptive. Therefore, even after being validated by experts, innovation does not automatically translate into commercial success. When it comes to sharing models, again, creating demand for them seems to need more than just marketing in new markets, and old customs change slowly. Similarly, for some commodities (such as cars), the intangible value placed on ownership can take time to change.

Figure 13. Export barriers reported in the survey and interviews by broad category, % of respondents



Source: Authors' elaboration based on survey responses.

By design, several business models rely heavily on non-discriminatory and efficient government procurement rules and procedures. This is the case, for example, of MaaS models aimed at improving the quality, efficiency, and ultimately utilization rates of public transportation such as trains or buses. It appears that incumbents in each market and lengthy

[43] For the Basel Convention, see http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-IMPL-CONVTEXT.English.pdf. For more information on the Basel Convention and its role in controlling transboundary movements of hazardous wastes, see http://www.basel.int/Portals/4/Basel%20Convention/docs/pub/leaflets/leaflet-control-procedures-en.pdf

bureaucracy seem to create market access barriers. Market access difficulties are reported by some 10% of the respondents.

Data access, tax treatment, and IPR-related barriers are reported by a few respondents. In particular, data issues are mentioned in relation to digital business activities in China and Russia. In sharing and leasing services, the VAT treatment of the business solution as a good instead of a service is mentioned as a hindrance. Similarly, the tax treatment of income from sharing activities is considered to potentially affect demand for them. In many countries, this type of income is considered taxable capital income from the first Euro earned, and this might affect people's desire to rent their property in sharing platforms. Several companies also highlighted weak intellectual property protection as a concern in certain export markets, preventing firms from selling certain goods with embedded intellectual property (IP) protected technologies.

In general, **respondents report a wide range of barriers to circular economy service exports, many of which are very sector specific**. Beyond services, some of the barriers identified by survey respondents may be relevant to both trade and investment policy. In this respect, policy questions specific to international investments related to the circular economy could be a useful avenue for further research. Various problems are also associated with trade in goods such as export duties, customs procedures, and export restrictions.[44] In the survey, these broader issues are grouped in the "other" category in Figure 13.

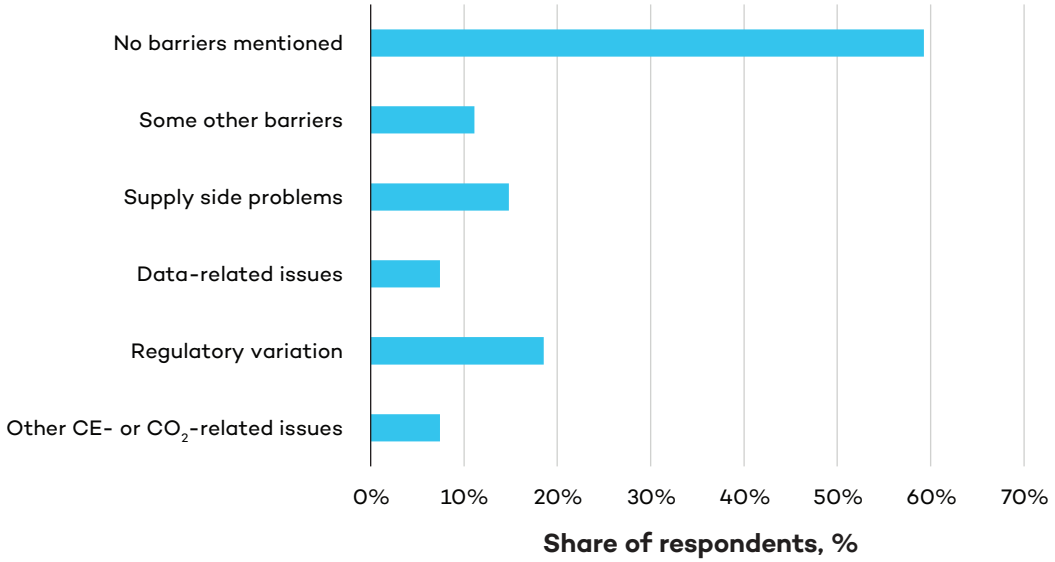
Barriers to Imports of Services Related to the Circular Economy

Similar to the export barriers, most of the respondents (almost 60%) to the survey and interviews did not find major obstacles to importing different types of services related to their circular economy activities (see Figure 14). However, the total number of firms reporting service imports and related barriers to those (or their absence) is just 27.

The import barriers reported also vary, but the single largest category is again regulatory variations related, for example, to waste and secondary materials, but also regulatory differences more generally. The ongoing development of circular economy markets is reflected in difficulties to obtain specific intermediate goods and services, and heavy competition for some of them. Also, purchase restrictions were mentioned by one respondent. In addition to underdevelopment of secondary material markets in some countries, insurance services for sharing services, for example, are mentioned as a relatively new field for insurance firms. The "other circular economy or CO_2-related issues" category refers to problems in carbon footprint standards and the low supply and high prices for purchasing such calculations. Data access, security, and compliance issues are reported by a couple of firms. In addition, single complaints on various other types of issues are reported (the category "some other barriers" in Figure 14). These relate to IPR issues and problems with goods, waste, and secondary material imports.

[44] Where barriers reported relate to procedures for import and export of goods used in providing services relevant to the circular economy, the WTO Trade Facilitation Agreement (TFA) could become relevant. Implementation of the TFA could help improve the transparency and predictability of regulations and procedures at borders and bring benefits to trade in goods and services relevant to the circular economy.

Figure 14. Import barriers reported in the survey and interviews by broad category, % of respondents



Source: Authors' elaboration based on survey responses.

4.0 Considerations for Policy-Makers

Based on the findings from the survey, the in-depth interviews, and the existing literature, this section discusses possible policy options to reduce obstacles affecting trade in services that support a transition toward a more circular economy, at a time when supply chains are potentially seeing large shifts as a consequence of the COVID-19 pandemic. The section also considers policy options for governments to incentivize such a transition and how to design them in a way that does not create unnecessary barriers to trade in services. Finally, it suggests possible avenues at the international level to advance those policy options.

4.1 Removing Trade Barriers Affecting Services Related to the Circular Economy

As highlighted above, trade can support a global transition toward a more circular economy by exploiting comparative advantages and scale effects in closing resource loops, slowing resource loops, and narrowing resource flows. With the proper safeguards and regulations in place, trade can contribute to lowering tariff and non-tariff barriers to environmental goods and services and support clean technology diffusion and uptake (WTO, 2019a).

As shown in this report, a wide range of services play a critical role in supporting the different business models underpinning the circular economy. These include both traditional services such as construction, repair, or maintenance services and new forms of services related to sharing models involving co-ownership or co-access mechanisms, or PSSs focusing on selling a service rather than the product itself. These circular economy services are not limited to domestic activities. As illustrated by the response from the survey, they are both procured and supplied across borders.

A first policy implication resulting from this reality is that **removing horizontal barriers affecting services trade in general and promoting an enabling environment for innovation is likely to benefit a transition toward a more circular economy**. A second implication—resulting more from the close interaction between goods and services in this area—is the **need to foster an integrated approach to the removal of trade barriers affecting the circular economy**. In other words, the potential benefits of trade liberalization in goods such as waste and scrap, second-hand goods, or recycled material are likely to increase significantly if associated services are liberalized at the same time. Such an integrated approach should look comprehensively at both tariffs and non-tariff barriers including domestic regulations and administrative rules, standards, and conformity assessment procedures. This could be achieved by identifying clusters of goods and services of particular relevance to the different circular economy business models for future liberalization. In particular, if WTO Members were to relaunch the Environmental Goods Agreement (EGA) negotiations, this would provide the possibility to update product lists to have a stronger emphasis on circular economy goods and integrate services from the outset. In addition, stand-alone services related to the circular economy (i.e., services un-related to goods) could be considered for inclusion as well.

From a pure services perspective, the analysis presented in this paper points toward the need to focus commitments on removing barriers affecting primarily commercial presence (mode 3), and ensuring the free flow of data to facilitate services trade (mode 1) which survey responses suggest are the modes used most frequently, and potentially on the movement of natural persons (mode 4). Given the importance of on-site service support in relation to services related to the circular economy, companies with a large amount of business in third countries often need to establish a commercial presence abroad. This is the case, for example, of maintenance or repair services in technology-led solutions such as sensor-based sorting systems that optimize resource recovery and minimize waste, which require continued presence and local knowledge.

When a company does not have a commercial presence, critical services related to the circular economy are often provided by sending specialized personnel at the customer's/user's facilities. The facilitation of cross-border movement of people who supply such services is therefore vital for an efficient circular economy transition, although it can, as noted above, be politically sensitive. Finally, as highlighted in Section 3, technological progress and increasing digitization have enabled cross-border supply to play a more central role in services trade related to the circular economy. Services like data processing, leasing or rental, or R&D services are particularly affected by policies that impede access to communication, infrastructure and systems interoperability, and by regulations that affect the free movement of data. The issue of data flows is part of the discussion in negotiations on e-commerce at the WTO noted above

4.2 Designing Non-Discriminatory Policy Incentives to Foster a Transition to the Circular Economy

In addition to removing trade barriers, when designing domestic policies to incentivize a circular economy transition, governments should be mindful of the potential of trade in accelerating such a transition. The main policy tools at their disposal include EPR schemes, eco-design policies, circular procurement, or eco-labelling and various circular economy-related standards and regulations, to list just a few. Similarly, instruments that create fiscal incentives for circular solutions can be important for their uptake by consumers, especially where the circular solution is more expensive than its linear counterparts. In turn, these different tools interact with trade policies in different ways.

Initiatives promoting EPR to post-consumer stages through take-back requirements, deposit-refund systems, taxes and subsidies or recycling requirements are among the most common policy instruments used to promote the circular economy. In practice, they tend to target e-waste, electronic equipment, packaging, or batteries. A first trade-related concern in this area is the extent to which EPR schemes may discriminate against foreign competitors. **Ensuring that circular economy policies are designed and implemented in a non-discriminatory fashion in accordance with international commitments should therefore be a priority**. Another concern is the extent to which exports destined for recycling are recognized as complying with recycling requirements under EPR schemes. As illustrated by the case of cellphone recycling presented in Case Study II,

recognizing compensation schemes complying with sound environmental management may play a critical role in stimulating resource recovery and product life extension activities.

Taxation of leasing services also came up in the survey and interviews as a potentially useful policy lever to support services related to the circular economy. The responses suggest governments could consider amending policies that treat the leasing of assets as a good for VAT purposes when what is actually traded is a service. Respondents also suggested that tax incentives for asset leasing services might help make the leasing alternative more attractive for individual persons to use (both as sellers and as consumers).

Circular public procurement by national and subnational governments represents another promising avenue to promote resource efficiency. According to the WTO Secretariat,[45] government purchases of goods and services account for 10% to 15% of the GDP of individual economies. To the extent that such policies do not discriminate against foreign service providers, they may offer significant new international trade opportunities to innovative companies specialized in the delivery of services related to the circular economy, as illustrated by the example of public transportation described in this paper.

Finally, **domestic regulations, standards, and conformity assessment procedures are essential policy tools to promote a circular economy transition, and their importance was underscored in survey and interview responses.** By laying down the characteristics of goods and services or their related processes and production methods—and defining mandatory or voluntary guidelines and procedures to determine compliance—these measures can contribute significantly to the advancement of environmental objectives. In a circular economy, these can take the form of eco-labelling; standards on material content or performance, recyclability, or reparability; or product-quality standards for secondary raw materials, refurbished, remanufactured, and second-hand goods. From a trade perspective, complying with those requirements entails costs, particularly when products and services are exposed to different regulations and standards across multiple jurisdictions. This is particularly challenging for SMEs and firms in developing countries who lack the ability to comply with different requirements. This calls for promoting enhanced interoperability of regulations and conformity procedures through harmonization, mutual recognition or equivalences (Institute for European Environmental Policy [IEEP], 2019; Yamaguchi, 2018). Discussion of streamlining regulations related to the extraction and use, and potentially trade policy treatment, of secondary materials could be a priority, from a circular economy perspective. Increased collaboration and participation in international standards-setting bodies and the adoption of international standards can also minimize such differences. Several survey responses also pointed to the need for transparent and consistently applied regulations, particularly regarding waste, underlining the practical importance of this issue.

To address this concern, **governments could consider focusing policy effort on streamlining circular economy regulation, standards, and assessment procedures within trading blocs or among key markets to help providers of services related to the circular economy to operate at global or regional levels with greater economies of scale**. As the circular economy is a relatively new and emerging concept, there is, however,

[45] See https://www.wto.org/english/tratop_e/gproc_e/gproc_e.htm

a lack of international standards around which domestic regulations could converge. Encouraging the development of ongoing international or regional initiatives in this area would constitute a first step toward enhanced operability of regulations. First-movers will be in an advantaged position. For example, the EU's Circular Economy Action Plan (2020) will expand the scope of the current Eco Design Directive and foresees the development of numerous sector- and product-specific circular economy standards.[46] The EU could work with its RTA partners to co-develop standards for circular economy goods and services of mutual interest, thereby widening their scope of application from the outset.

4.3 Advancing a Global Circular Economy Transition at the International Level

Advancing a global circular economy transition will require concerted action at the international level, not least because no individual country can operate such a transition on its own. However, domestic policies and regulations are often developed in isolation and sometimes result in duplicative procedures or unnecessary divergences across different jurisdictions, which in turn can generate significant compliance costs, particularly for SMEs. International trade disciplines such as those enshrined in WTO rules can help in this process. Implementation of the WTO TFA, for example, could help smooth trade in goods related to circular economy activities and thereby to the success of circular economy models that integrate goods and services trade.

Overall, WTO rules do not prevent members from implementing good faith environmental policies, as long as they do not discriminate arbitrarily between countries where the same conditions prevail or constitute disguised protectionist measures. Beyond "not being an obstacle," the **multilateral trade system can also play a role in fostering enhanced cooperation on the circular economy**. For example, relevant WTO bodies and committees provide a unique multilateral platform for exchanging information, guidance, best practices, and experiences, as illustrated by the work of the TBT committee in the WTO (Wijkström, 2015) or the work of the CTE.[47] By requesting members to notify in advance environmental measures with potential trade effects, and providing a multilateral space to discuss experiences on good regulatory practices and specific trade concerns, the relevant WTO committees also enhance cooperation among members and help pre-emptively settle divergences before they reach the formal dispute settlement mechanism.

Increasing cooperation between governments can also pave the way for more developed countries and those with more expertise in the circular economy to provide technical assistance and capacity building in developing countries. This can be done as part of the Aid for Trade initiative, for example by supporting developing countries' implementation of the Basel Convention and their participation in informed and well-managed trade in waste.

[46] For EU's Circular Economy Action Plan (2020), see https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

[47] See for example https://www.wto.org/english/news_e/news19_e/envir_03dec19_e.htm

The multilateral trade system may also serve as a platform for more advanced collaboration. Under the Doha Round launched in 2001, WTO members have engaged in ongoing negotiations on the liberalization of environmental goods and services. In the absence of consensus on how to approach such negotiations, in 2014, a sub-group of members launched the EGA, a plurilateral initiative aimed at bringing together a critical mass of like-minded countries.[48] While the EGA was initially designed to focus on goods, there might be opportunities, in the post-COVID-19 context, to revive those negotiations by enlarging the scope and incorporating trade in environmental services. Similarly, at the 2017 WTO Ministerial Conference in Buenos Aires, a subset of WTO members launched a Plurilateral Initiative on Electronic Commerce. After an initial discussion phase, negotiations currently involving 84 WTO members started in spring 2019.[49] While not directly focusing on the circular economy, these negotiations touch upon certain aspects (such as data flow restrictions) which may directly affect trade in services related to the circular economy. More recently, Costa Rica, Fiji, Iceland, New Zealand, and Norway launched a new initiative called the Agreement on Climate Change, Trade and Sustainability (ACCTS), focusing on removing trade barriers to environmental goods and services, promoting eco-labelling, and removing fossil fuel subsidies.[50] While none of these plurilateral initiatives specifically refer to the circular economy, they could be used as strategic avenues to remove existing barriers affecting trade in services related to the circular economy.

In a similar vein, **governments could consider whether increasing market access commitments under RTAs might help provide their businesses with more competitive options for a cluster of goods and services related to the circular economy**. These might include professional services, recycling and repair services, or waste management services. The strong digital element of trade in circular economy-related services discussed above suggests that particular attention should be paid to disciplines related to data flows and localization requirements. Increased supply of digital services, including internationally, could help to support domestic firms building data-intensive circular economy activities. Facilitating trade in this area requires however effective regulation to provide appropriate and proportionate protection for privacy and proprietary data. It also requires clarity regarding how IP rights are protected if technology is transferred to local partners (which one respondent cited as a problem for circular economy-related services exports).

Finally, **RTAs can also serve as a vehicle to foster regulatory cooperation**, for example by promoting the use of international standards as a basis for domestic regulations and by encouraging harmonization, mutual recognition, and equivalences of standards and regulations across jurisdictions. While specific circular economy references in free trade agreements remain scarce, RTAs can be used to encourage different countries to streamline circular economy regulations by integrating Circular Economy Annexes or stand-alone chapters. Such provisions could encourage harmonization or mutual recognition agreements of specific upstream and downstream circular economy standards and test procedures—ideally

[48] See: https://www.europarl.europa.eu/legislative-train/theme-a-balanced-and-progressive-trade-policy-to-harness-globalisation/file-environmental-goods-agreement-(ega)

[49] See: http://trade.ec.europa.eu/doclib/press/index.cfm?id=1974

[50] See https://www.mfat.govt.nz/en/trade/free-trade-agreements/climate/agreement-on-climate-change-trade-and-sustainability-accts-negotiations/

within a specific timeframe. This could cover upstream standards such as eco-design or EPR schemes or downstream standards, such as quality standards for refurbished, remanufactured, and second-hand goods. For example, the 2020 new EU Circular Economy Action Plan aims to ensure that free trade agreements reflect the enhanced objectives of the circular economy.[51]

[51] For EU's Circular Economy Action Plan (2020), see https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

Conclusion

This report has explored how international trade in services contributes to the circular economy business models based on new empirical research, including interviews and a survey of a small but heterogeneous group of firms. Many of the firms selling services related to the circular economy are found to be MSMEs with an unusual degree of international exposure and engagement in international trade, likely because they are specialized in particular services. The most-traded services related to the circular economy included IT services; other professional, technical, and business services (such as technical testing or environmental consulting services); leasing or rental services without an operator; R&D services; maintenance, repair, and installation (except construction) services; sewage and waste collection services; and professional services related to construction services.

The report identifies digitalization, in particular, as a key driver of change in international services trade. It has enabled entirely new services that are characteristic of the circular economy (like ride-sharing services) to be created and sold locally and internationally. It has also enabled traditional services that support the circular business models (like engineering services) to be provided across borders more cheaply. Many of the respondents to the survey export services related to the circular economy internationally by digital means (through mode 1 of international services supply) as well as through commercial presence (mode 3). Lastly, the reliance of so much economic activity on data—and thus on the international business of data gathering and processing services—has fundamentally changed the context within which the shift to a circular economy will be pursued.

The report also explored the barriers firms face in seeking to export and import services related to the circular economy. While a good proportion of survey respondents did not report barriers to exports of services relevant to the circular economy, many of the trade barriers raised related to differences in regulations covering goods as well as services between jurisdictions. This supports the argument that an integrated approach to policy regarding both trade in services and goods might be the most effective in the context of the transition to the circular economy. The report discussed also how policies might be designed, and how international cooperation through multilateral, plurilateral, or regional arrangements could be used to support international trade in services related to the circular economy, and the transition to a circular economy more broadly.

References

Adlung, R. & Roy, M. (2005). Turning hills into mountains? Current commitments under the GATS and prospects for change (WTO Staff Working Paper No. ERSD-2005-01). *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=922058

Arponen, J. (2019). *Creating value from customer-centric circular business models*. Finnish Innovation Fund Sitra. https://www.resourceefficient.eu/sites/easme/files/Creating%20value%20with%20CE%20biz%20models_Jyri%20Arponen.pdf

Arup & Ellen MacArthur Foundation. (2018). *The circular economy opportunity for urban & industrial innovation in China*. https://www.ellenmacarthurfoundation.org/publications/chinareport

Blomsma, F. (2017). *Making sense of circular economy.* https://spiral.imperial.ac.uk/handle/10044/1/47907#:~:text=Blomsma-F-2017-PhD-Thesis.pdf&text=One%20concept%2C%20circular%20economy%2C%20has,of%20resource%20life-extending%20strategies

Bocken, N., de Pauw, I., Bakker, C. & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering, 33*(5), 308–320. https://www.researchgate.net/publication/309699661_Product_design_and_business_model_strategies_for_a_circular_economy

Brandi, C. (2017). *Trade elements in countries' climate contributions under the Paris Agreement*. International Centre for Trade and Sustainable Development (ICTSD). http://www.ictsd.org/sites/default/files/research/trade_elements_in_countries_climate_contributions.pdf

Chander, A. (2019). The Internet of Things: Both goods and services. *World Trade Review, 18*(S1). S9-S22. https://econpapers.repec.org/article/cupwotrrv/v_3a18_3ay_3a2019_3ai_3as1_3ap_3as9-s22_5f00.htm

Crozet, M., & Milet, E. (2015). *Should everybody be in services? The effect of servitization on manufacturing firm performance* (CEPII Working Paper). http://www.cepii.fr/PDF_PUB/wp/2015/wp2015-19.pdf

Ekins, P., & Hughes, N. (2017). *Resource efficiency: Potential and economic implications. A report of the International Resource Panel*. UNEP. https://www.resourcepanel.org/file/312/download?token=gM4QyNY1

Ellen MacArthur Foundation. (2017). *What is a circular economy?* https://www.ellenmacarthurfoundation.org/circular-economy/concept

Ellen MacArthur Foundation & McKinsey. (2015). *Growth within: A circular economy vision for a competitive Europe*. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf

European Commission. (2015). *Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Closing the loop – An EU action plan for the Circular Economy*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614

European Commission. (2020). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

Finnish Innovation Fund Sitra. (2020). *Definition of circular economy*. https://www.sitra.fi/en/dictionary/the-circular-economy/

Flemish Institute for Technological Research (VITO). (2020). *Two out of three circular companies well resistant to corona crisis*. https://vito.be/en/news/two-out-three-circular-companies-well-resistant-corona-crisis

Gardner, J. (2017). *Circular economy & decarbonisation: Lessons from industry*. Hoffmann Centre for Sustainable Resource Economy. https://hoffmanncentre.chathamhouse.org/article/circular-economy-and-decarbonisation-lessons-from-industry/

Green Alliance. (n.d.). *A circular economy for smart devices: Opportunities in the US, UK and India*. https://www.green-alliance.org.uk/resources/A%20circular%20economy%20for%20smart%20devices.pdf

Haaparanta, P., Tamminen, S., Heikkinen, S., Aunesluoma, J., Nilsson Hakkala, K., Kiviluoto, J., Lavikainen, K., & Rissanen, A. (2017). *100 years of a small open economy – The development, effects and future of Finnish foreign trade. Publications of the Government's analysis, assessment and research activities 73/2017* (available only in Finnish).

Institute for European Environmental Policy (IEEP). (2019). *EU circular economy and trade: Improving policy coherence for sustainable development*. https://ieep.eu/uploads/articles/attachments/f560794d-c411-4895-8ae9-910c65548f33/EU%20trade,%20CE%20and%20sustainable%20development%20(IEEP%202019)%20FINAL.pdf?v=63741577228

International Labour Organization (ILO). (2019). *Global Dialogue Forum on Decent Work in the Management of Electrical and Electronic Waste* (e-waste). https://www.ilo.org/wcmsp5/groups/public/--ed_dialogue/---sector/documents/meetingdocument/wcms_685681.pdf

International Resource Panel (IRP). (2019). *Global resources outlook 2019 – Key messages*. https://www.resourcepanel.org/file/1193/download?token=9U_4QeaB

Laumann Kjaer, L., Pigosso, D.C.A., Niero, M., Bech, N.M., & McAloone, T.C. (2018). Product-service system for a circular economy: The route to decoupling economic growth from resource consumption. *Journal of Industrial Ecology, 23*(1), 22–35.

Material Economics. (2018). The circular economy – A powerful force for climate mitigation. Transformative innovation for prosperous and low-carbon industry. Material Economics Sverige AB, https://media.sitra.fi/2018/05/04145239/material-economics-circular-economy.pdf

Mayer, T. & Ottaviano, G.I.P. (2008). The happy few: The internationalisation of European firms - New facts based on firm-level evidence. *Intereconomics 43*, 135–148.

McCarthy, A., Dellink, R., & Bibas, R. (2018). *The macroeconomics of the circular economy transition: A critical review of modelling approaches* (OECD Environment Working Papers No. 130). OECD Publishing. http://dx.doi.org/10.1787/af983f9a-en

Miroudot, S. & Cadestin, C. (2017). *Services in global value chains: From inputs to value-creating activities* (OECD Trade Policy Papers No. 197). OECD Publishing.

Musgrove, A. (2020, May 14). *Swedish insurtech startup Omocom gets €3.7 million to insure the circular economy*. TechEU. https://tech.eu/brief/omocom-funding/?fbclid=IwAR0NEV9WRHwGjKGN_SjMOYIefpGbb7--8glGnIo2cvOn9fIkV-QCkd2WzEs

Organisation for Economic Co-operation and Development (OECD). (2010). *Extended balance of payments services classification (EBOPS 2010)*. http://www.oecd.org/sdd/its/EBOPS-2010.pdf

Organisation for Economic Co-operation and Development. (2015). *Material resources productivity and the environment* (OECD Green Growth Studies). OECD Publishing. https://www.oecd-ilibrary.org/environment/material-resources-productivity-and-the-environment_9789264190504-en

Organisation for Economic Co-operation and Development. (2018). *Improving markets for recycled plastics: Trends, prospects and policy responses*. OECD Publishing. https://dx.doi.org/10.1787/9789264301016-en

Organisation for Economic Co-operation and Development. (2019a). *Global material resources outlook to 2060: Economic drivers and environmental consequences*. OECD Publishing. https://doi.org/10.1787/9789264307452-en

Organisation for Economic Co-operation and Development. (2019b). *Business models for the circular economy: Opportunities and challenges for policy*. OECD Publishing. https://doi.org/10.1787/g2g9dd62-en

Organisation for Economic Co-operation and Development. (2020a, in press). *Trade and circular economy – Policy alignment* (OECD Trade and Environment Working Papers). OECD Publishing. https://www.oecd-ilibrary.org/trade/oecd-trade-and-environment-working-papers_18166881

Organisation for Economic Co-operation and Development. (2020b, in press). *Digitalisation and the circular economy* (OECD Environment Working Paper). OECD Publishing. https://www.oecd-ilibrary.org/environment-and-sustainable-development/oecd-environment-policy-papers_23097841

Organisation for Economic Co-operation and Development Statistics. (2020). *Trade in Value Added (TiVA)*. https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm

Pardo, R. (2018). *How the circular economy can benefit from the digital revolution*. European Policy Centre. https://www.epc.eu/en/Publications/How-the-Circular-Economy-can-benefit-from-the-Digital-Revolution~1e6f04

Preston, F., Lehne, J., & Wellesley, L. (2019). *An inclusive circular economy: Priorities for developing countries*. Chatham House. https://www.chathamhouse.org/publication/inclusive-circular-economy-priorities-developing-countries

Regulation (EU) 2018/1807. *On a framework for the free flow of non-personal data in the European Union (Text with EEA relevance)*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1807&from=EN

Regulation (EU) 2016/679. *On the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance)*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2016:119:TOC

Rentzhog, M. & Anér, E. (2014). *The new services era – Is GATS up to the task? E15Initiative*. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum. http://e15initiative.org/publications/the-new-services-era-is-gats-up-to-the-task/

Roy, M. (2011). Services commitments in preferential trade agreements: An expanded dataset. *SSRN Electronic Journal*. https://ssrn.com/abstract=1957564

Rueda-Cantuche, J.M., Kerner, R. Cernat, L., & Ritola, V. (2016). *Trade in services by GATS modes of supply: Statistical concepts and first EU estimates* (DG Trade Chief Economist Note No. 3/2016). http://trade.ec.europa.eu/doclib/docs/2016/december/tradoc_155119.pdf

Swedish National Board of Trade. (2014). *Making green trade happen – Environmental goods and indispensable services* (3rd Ed.). National Board of Trade. ISBN: 978-91-86575-86-1.

Tearfund. (2017). *How will Europe's eco-design measures affect the circular economy in low-income countries?* https://www.tearfund.org/~/media/files/tilz/circular_economy/2017-tearfund-europe-ecodesign-measures-en.pdf

Tukker, A. (2004). Eight types of product-service system: Eight ways to sustainability? Experience from SusproNet. *Business Strategy and the Environment, 13*. 246–260. https://venturewell.org/wp-content/uploads/Tukker-2004-Business_Strategy_and_the_Environment.pdf

UN Comtrade. (2020). *International trade statistics database*. https://comtrade.un.org/

United Nations. (2011). *Manual on statistics of international trade in services 2010*. https://unstats.un.org/unsd/publication/seriesm/seriesm_86rev1e.pdf

United Nations. (2015). *Central Product Classification Version 2.1, Series M: Miscellaneous Statistical Papers, No. 77 Ver. 2.1*. United Nations. ST/ESA/STAT/SER.M/77/VER.2.1. https://unstats.un.org/unsd/classifications/unsdclassifications/cpcv21.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) & United Nations World Water Assessment Programme (WWAP). (2014). *The United Nations world water development report 2014: Water and energy*. UNESCO. http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2014-water-and-energy/

Van der Marel, E., Lamprecht, P., Deringer, H., & Erixon, F. (2017). *Boosting trade in services in the digitalisation era*. Bertelsmann Stiftung. https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/NW_Study_Trade_in_Services_Digitalisation_01.pdf

Wang, S., & Ge, M. (2019). *Everything you need to know about the fastest-growing source of global emissions: Transport*. World Resources Institute. https://www.wri.org/blog/2019/10/everything-you-need-know-about-fastest-growing-source-global-emissions-transport

Waste and Resources Action Programme (WRAP). (2015). *Economic growth potential of more circular economies*. http://www.wrap.org.uk/sites/files/wrap/Economic%20growth%20potential%20of_more%20circular%20economies.pdf

World Business Council for Sustainable Development (WBCSD). (2019). *Policy enablers to accelerate the circular economy: Scaling up action across regions and stakeholders*. https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Resources/Policy-enablers-to-accelerate-the-circular-economy

Wijkström, E. (2015). *The third pillar: Behind the scenes, WTO committee work delivers*. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum (WEF).

World Bank. (2012). *What a waste: A global review of solid waste management*. https://openknowledge.worldbank.org/handle/10986/17388

World Trade Organization (WTO). (1991). *Services sectoral classification list*. MTN. GNS/W/120. https://www.wto.org/english/tratop_e/serv_e/mtn_gns_w_120_e.doc

World Trade Organization. (2018). *World Trade Report 2018 – The future of world trade: How digital technologies are transforming global commerce*. https://www.wto.org/english/res_e/publications_e/wtr18_e.htm

World Trade Organization. (2019a). *The role of trade in promoting circular economy highlighted at WTO Environment Week*. https://www.wto.org/english/news_e/news19_e/envir_03dec19_e.htm

World Trade Organisation. (2019b). *World trade report 2019 – The future of services trade. World Trade Organisation*. https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf

Yamaguchi, S. (2018). *International trade and the transition to a more resource efficient and circular economy: A concept paper*. OECD Publishing, https://dx.doi.org/10.1787/847feb24-en

Appendix A. Additional Information on the Survey and Interviews

The survey was conducted as an Internet survey via SurveyMonkey. Since circular economy firms are still in the minority in many countries and firms trading services are also, the survey was targeted directly to firms that are already involved in circular business activities or are planning to be. In other words, the survey sample is not random and does not provide a description of the general prevalence of circular economy activities or services related to the circular economy. The survey questions are listed later in this section.

The request to answer the survey was distributed by email in Finland to around 700 firms known to have, or have an interest in, circular economy activities and by email and targeted Twitter outreach to firms internationally. The survey was open from the middle of February 2020 to the beginning of April 2020, but most answers were collected in February 2020 before the escalation of the global coronavirus pandemic. Additional rounds of requests to answer the survey in March 2020 were not successful likely due to the crisis.

In total, around 130 firms started answering the survey, but some answers were duplicates and some firms did not report any activities in circular business models. These observations were dropped from the descriptive analyses.

Circular Economy Firms That Participated in the Survey

In total, 96 firms involved in circular business activities provided answers via the survey. Some basic information on all of them is provided here. As mentioned in Section 2, 54 of the firms indicated that they sell services related to the circular economy, and 48 firms indicated that they purchased such services. In total, 72 firms out of the 96 either sold circular service activities or purchased them (or both). The remaining 24 firms indicated involvement in circular business activities, but not in selling or purchasing services related to the circular economy. See Figure 2 in the main text for an overview of the survey answers by the firms involved in circular service activities.

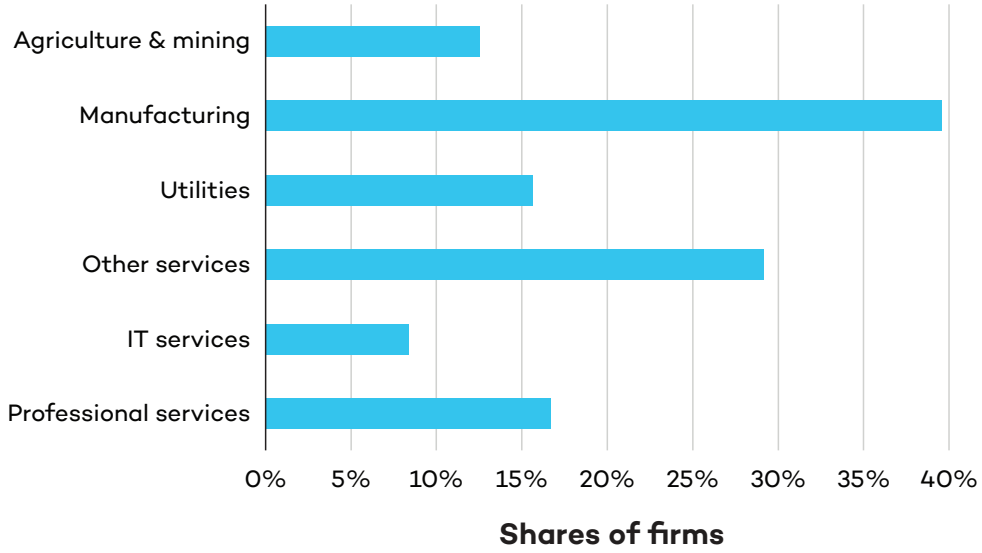
In the following, we provide some basic information on all the (96) firms that responded to the survey. As all of these firms indicate they operated in the circular economy, these figures highlight what kind of circular economy firms answered the questionnaire.

In terms of industrial classifications, no single industrial sector category accounts for more than 11% the total number of firms, and on average, the firms participating in the survey reported production in two different industries at a 2-digit[52] level. The largest numbers in the sample were listed as activities of head offices management consultancy activities (M70) at 11%; waste collection, treatment, and disposal activities, and materials recovery (E38) at 10%; manufacture of machinery and equipment (C28) at 9%; followed by the manufacture of chemicals and chemical products (C20) at 7%. All other industries account for smaller shares.

[52] The firms reported their industry classification based on the ISIC rev 4.

Figure A1 presents the division of firms' industrial categories at more aggregated levels.[53] It should be noted that many firms report being active in various industries even at this aggregated level, and therefore the shares account for more than 100% of the total number of firms.

Figure A1. Shares of all survey firms by aggregated industrial category



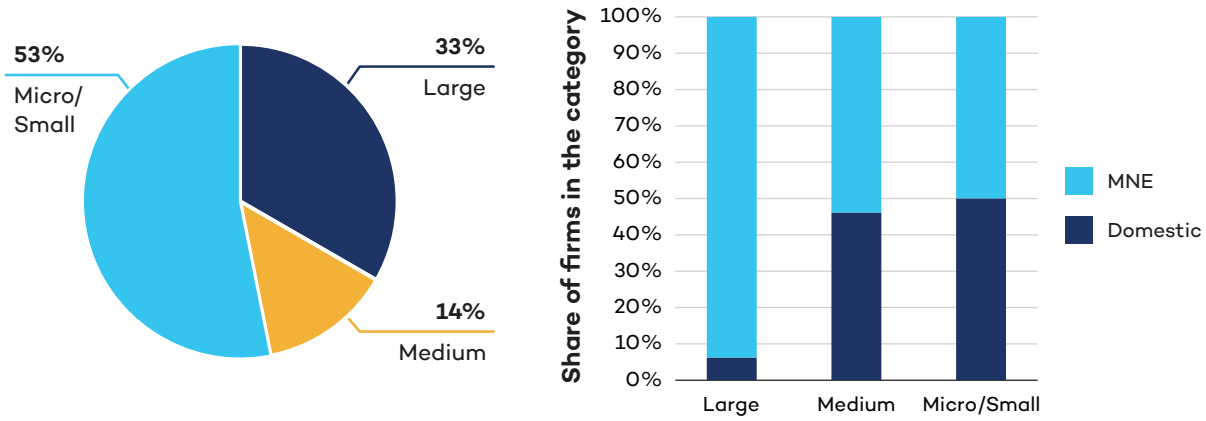
Source: Authors' elaboration based on survey responses.

Figures A2 present the size categories of all firms and their international status by size. Over half of the firms are micro/small with fewer than 20 employees, and 1/3 are large firms with over 250 employees. The median and average number of employees per firm were 34 and 8,500 respectively. In total, 67% of the firms have subsidiaries abroad (i.e., are MNEs), and around 50% of the micro/small firms are MNEs. Almost all of the large firms are MNEs.

Almost 60% of all the survey firms have their head offices in Finland and another 33% in some other European country. See Figure A3.

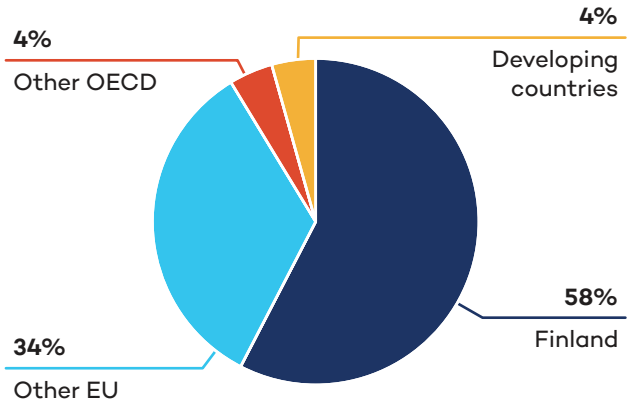
[53] Agriculture and mining includes ISIC categories 01-09, Manufacturing categories 10-33, IT services 60-63, Professional services categories 69-79 (including e.g., head office services, legal, R&D and renting services) and other services all other industries.

Figure A2. Shares of firms by size and international status (MNE or domestic)



Source: Authors' elaboration based on survey responses.

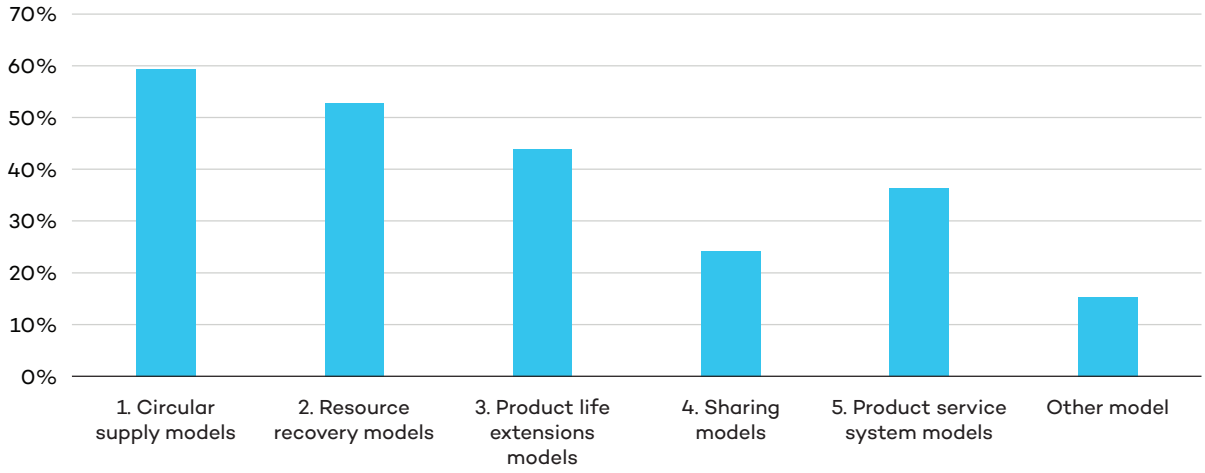
Figure A3. Shares of respondents by country of head office



Source: Authors' elaboration based on survey responses.

In terms of the circular business models applied by these firms, the most common two were to either replace virgin resource inputs with bio-based, renewable, and recovered materials, or to use recovery models that recycle waste into secondary raw materials, with almost 60% and over 50% of firms respectively indicating that they use these business models (see Figure A4). As can be understood already from the totals, most of the firms are involved in various circular economy business models. On average, the survey firms indicate using over two circular business models. Around 45% of the firms apply product life extension models of existing products, followed by PSSs (37%) and sharing models (24%). The most commonly adopted model (replacing the material inputs) was also listed by the firms as the most important (by 37%), followed by resource recovery models (20%), PSS (19%) and product life extension (14%), while only 2% mentioned sharing models as the most important.

Figure A4. Circular economy business models used by respondents, by number of firms using the model compared to total number of firms

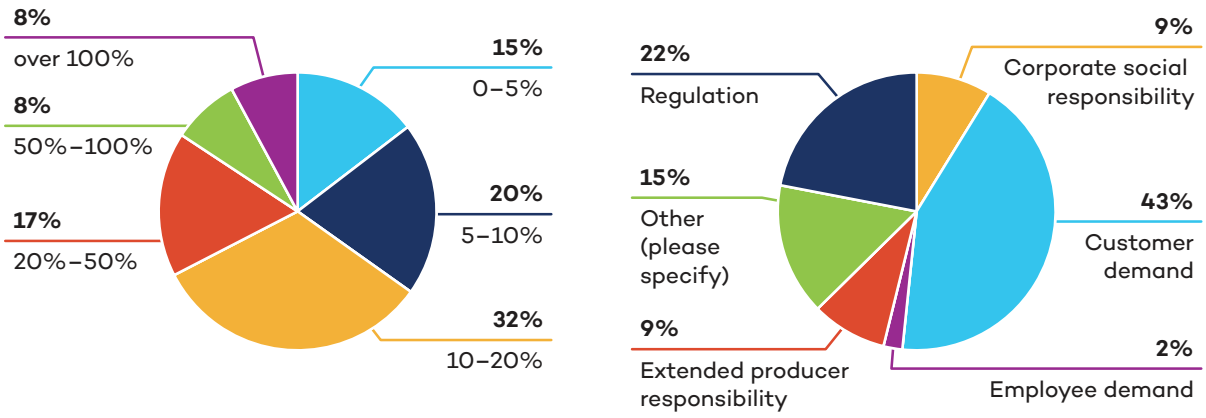


Source: Authors' elaboration based on survey responses.

The answers to the question "How do resource efficiency and/or circular models and practices contribute to the achievement of your overall business strategy?" varied greatly. However, resource savings seemed to constitute a strong driver. Beyond these associated savings, firms also mentioned the connection to achieving wider goals of sustainable development, not least through reduced climate impact (10 out of 78).

Figure A5 provides a view of how fast respondents expect their circular activities to grow on average annually and what factors are especially driving this growth. Around 1/3 of the firms estimated their circular activities would grow by 10% to 20% year by year, and another 1/3 that the growth will be higher than 20% annually. Roughly 15% estimate the growth to be small, between 0% and 5% annually. Customer demand was listed as the largest factor driving this growth, with 44% of firms indicating this as the main driver. Another 22% of the firms considered regulations as one of the main drivers. In addition, in their short written answers many firms indicated all of the listed factors as drivers for their circular activities or especially customer demand in combination with regulations.

Figure A5. Estimated growth rate of circular activities annually (left figure) and expected drivers for the growth in circular activities (right figure), % of answers



Source: Authors' elaboration based on survey responses.

Circular Economy Firms Interviewed

In addition to the survey, information about circular economy services trade, and particularly information related to possible trade barriers in services trade related to the circular economy, was collected via semi-structured firm interviews. In total 16 firms were interviewed between December 2019 and April 2020 by Finnish Innovation Fund Sitra and IISD. Some of these firms were selected based on prior information on their trade in services related to the circular economy, and some indicated in the survey that they would be willing to take part in a more in-depth interview. Additional respondents from the survey were selected from the firms had indicated either exports or imports of circular economy-related service provisions. The interviews took about 30–60 minutes and concentrated on the trade barriers on exports and imports of services related to the circular economy. Interviewed firms included both small and large firms. The case study examples of circular economy firms were also built based on the interviews.

The firms interviewed include:

- ABB
- Cireco
- Closing the Loop
- Commuter Computing
- Global Circular Solutions
- Hygglo
- Lindström
- MaaS Global Oy
- Mo Industripark AS
- Oisann Engineering AS

- Outokumpu
- Repack
- Risutec
- Tamturbo
- Tomra
- Water Fountain

List of Survey Questions

BASIC INFORMATION

1. What is your main business area and industrial sector classification? (Drop down options of ISIC rev 4 digit codes from which firms can select one or multiple industries)
2. At what year was the firm established?
3. How many employees do you have globally?
4. In which country do you have your head office?
5. What was your global turnover in recent years?
6. Does your firm have subsidiaries abroad? If yes, where?

CIRCULAR BUSINESS ACTIVITIES

According to the OECD, a circular economy: "involves using resources more efficiently across their life cycle by closing, extending and narrowing material loops that could result in decoupling of primary raw material consumption from economic growth. The transition to a circular economy entails approaches that may lead to lower rates of extraction and use of natural resources. This in turn leads to improved resource efficiency and the promotion of sustainable materials management."

7. Does your company use some of these circular economy business models? Tick all models that apply:
    - *Circular supply models replace traditional material inputs derived from virgin resources with bio-based, renewable, or recovered materials; (example)*
    - *Resource recovery models recycle waste into secondary raw materials; (example)*
    - *Product life extension models extend the use period of existing products; (example)*
    - *Sharing models facilitate the sharing of under-utilised products; (example)*
    - *Product service system models, where goods are sold as a service, so e.g. renting equipment instead of selling the equipment.*
    - *Other models/practices to increase resource and material efficiency, please specify:*

8. Which one is most important for you?

How do resource efficiency and/or circular models and practices contribute to the achievement of your overall business strategy? What specific benefits do resource efficiency and/or circular models and practices provide to your company? Please provide a short explanation.

9. How quickly do you expect these activities to grow on average by year?

10. What factors might drive this growth?

PROVIDING SERVICES RELATED TO CIRCULAR ECONOMY

11. Do you offer services to support improved and more efficient use of resources and materials, or re-use, for example waste treatment linked to recycling, as part of your circular business activities?

12. If yes, what kind of services are these? Are these linked to sales of goods? Please provide a short explanation and/or select applicable service categories from the below list.

13. What share of your total annual corporate turnover do the sales of circular economy service bring?

14. Do you sell these services internationally to foreign clients or to foreign subsidiaries (for Multi-National Corporations)? If yes, please fill in how you provide them.

15. What share of the annual turnover of your overall company do these international service sales (i.e., exports) bring approximately?

16. What are the main drivers for your service exports?

17. What factors make it difficult to sell internationally? Please provide some examples including details on the issues and in which country/countries they occur.

BUYING SERVICES RELATED TO CIRCULAR ECONOMY

18. Do you purchase services to support improved and more efficient use of resources and materials, or their re-use, for example waste treatment linked to recycling, as part of your circular business activities? If yes, what kind of services? Please provide a short explanation and/or select applicable service categories from the below list.

19. Are these services provided to you from related companies in other countries (for Multi-National Corporations) or from entirely unrelated suppliers internationally?

BARRIERS

20. What factors make it difficult to purchase these services from foreign suppliers? Please provide some examples including details on the issues and in which country/countries they occur.

OPTIONAL QUESTIONS:

Name of the company:

ISIN number:

Would you be willing to participate in a more detailed interview?

No;

Yes, please provide contact details:

Appendix B. Classifying Services Related to the Circular Economy

Analysis of global services trade relies on taxonomies that classify services in different categories. Identifying how services can be classified is therefore a first step in understanding how services related to the circular economy are traded around the world. This Annex provides background to the discussion in Section 3 of this report.

BOX B1. Background to Services Classifications

Existing services classification systems are either product-based (e.g., UN Central Product Classification [CPC] [United Nations, 2015], the WTO Services Sectoral Classification [WTO, 1991], and the OECD's Extended Balance of Payments Services Classification [EBOPS] 2010 [OECD, 2010]) or activity-based (e.g., International Standard Industrial Classification of All Economic Activities [ISIC]). The CPC, developed in the late 1980s, was the first attempt to cover the whole spectrum of outputs of the various service industries in a classification system (UN, 2015). Its first provisional version (CPC Prov.) became the basis for the WTO Services Sectoral Classification (W/120). WTO members generally use the W/120 classification system to inscribe commitments in their services schedules of commitments under the GATS and in bilateral and RTAs, although they are not obliged to.

Given that the W/120 system has not been amended since 1991, there are concerns about how digital services are to be classified under this system and, consequently, to what extent commitments inscribed in existing GATS schedules of commitments apply to new types of services that are not explicitly mentioned in W/120 (or CPC Prov. upon which W/120 is based). Terms like the "cloud" or "search engines" for example, do not appear in the CPC Prov., although their functions may be described in it. The CPC, on the other hand, has been revised multiple times to reflect changes in economies worldwide and technological advancement. Its most recent version (CPC 2.1) was adopted in 2015. However, CPC Prov. would continue to be used in lieu of CPC 2.1 to interpret the scope of commitments inscribed in GATS services schedules (UN, 2015). Used primarily for statistical purposes, the EBOPS2010 classification relies on a high level of detail that enables the drawing of parallels with the GATS classification framework.[54]

An overview of the existing classification systems shows that the range of services identified by the survey and interviews as services related to the circular economy are classified across an array of macro-categories (mainly business services, environmental services, transport services, and telecommunication services) and sub-categories, with differences in taxonomy emerging from system to system. Table A1 sets out how the services related to the circular economy mentioned in Section 3.1 are classified across the main classification systems. For classification purposes, Table A1 includes a residual category (i.e., other services related to

[54] See https://www.wto.org/english/tratop_e/serv_e/itip_user_guide_e.htm

manufacturing) that, although not explicitly mentioned by the surveyed firms, covers a range of services that may be related to the circular economy.

The first column (Sector) sets out the macro-categories of service types identified in the survey. The second column (W/120) refers to the GATS Services Sectoral Classification list. It contains the sub-categories of sectors potentially relevant to the circular economy that belong within the relevant macro-category under the first column according to the GATS services classification system. The third column (CPC ver. 2.1) refers to version 2.1 of the UN CPC. It contains the sub-categories of sectors potentially relevant to the circular economy that belong within the relevant macro-category under the first column, according to the latest version of the UN services classification system. The fourth and last column (EBOPS 2010) refers to the Extended Balance of Payments Services Classification. It contains the sub-categories of sectors potentially relevant to the circular economy that belong within the relevant macro-category under the first column, according to the latest version of the services classification system developed by the OECD and Eurostat in consultation with the International Monetary Fund.

Notably, no macro-categories and subsectors contained in the table are specific to services related to the circular economy. For example, the sub-sector "data processing services" identified in column W/120 under the "computer services" macro-category may comprise both data processing services related to the circular economy and those that are not.

Table A1. Comparison of classification of services identified as related to the circular economy

Sector	W/120	CPC ver. 2.1	EBOPS 2010
Computer services	1. Business Services B. Computer and related services • b) Software implementation services • c) Data processing services • d) Database services 2. Communication Services C. Telecommunication services • m) online information and/or data processing (incl. transaction processing)	83 Professional, technical and business services (except research, development, legal and accounting services) • 8313 Information technology (IT) consulting and support services • 8314 Information technology (IT) design and development services • 8315 Hosting and information technology (IT) infrastructure provisioning services	9 Telecommunications, computer, and information services 9.2 Computer services • Software-related services • Data processing services
Other professional services	1. Business Services A. Professional services • e) Engineering services • f) Integrated engineering services F. Other Business Services • c) Management consulting service • e) Technical testing and analysis services • m) Related scientific and technical consulting services	83 Professional, technical, and business services (except research, development, legal, and accounting services) • 83116 Supply chain and other management consulting services • 83117 Business process management services • 8344 Technical testing and analysis services • 83931 Environmental consulting services	10 Other Business Services 10.2 Professional and management consulting services • 10.2.1.3. Business and management consulting and public relations services 10.3 Technical, trade-related and other business services • 10.3.1.3 Scientific and other technical services
Leasing or rental services without operator	1. Business Services E. Rental/Leasing Services without Operators • a) Relating to ships • b) Relating to aircraft • c) Relating to other transport equipment • d) Relating to other machinery and equipment • e) Other	73 Leasing or rental services without operator • 731 Leasing or rental services concerning machinery and equipment without operator • 732 Leasing or rental services concerning other goods	10 Other Business services 10.3 Technical, trade-related and other business services • 10.3.3 Operating leasing service

Sector	W/120	CPC ver. 2.1	EBOPS 2010
R&D services	1. Business Services C. Research and Development Services • a) R&D services on natural sciences • c) Interdisciplinary R&D services	81 Research and development services • 811 Research and experimental development services in natural sciences and engineering • 813 Interdisciplinary research and experimental development services • 814 Research and development originals	10 Other business services 10.1 Research and development services
Maintenance, repair and installation (except construction)	1. Business Services F. Other Business Services • n) Maintenance and repair of equipment (not including maritime vessels, aircraft or other transport equipment) 11. Transport services A. Maritime services • d) Maintenance and repair of vessels B. Internal Waterways Transport • d) Maintenance and repair of vessels C. Air Transport Services • d) Maintenance and repair of aircraft E. Rail Transport Services • d) Maintenance and repair of rail transport equipment F. Road Transport Services • d) Maintenance and repair of road transport equipment	87 Maintenance, repair and installation (except construction) services • 871 Maintenance and repair services of fabricated metal products, machinery and equipment (including computers, transport machinery and equipment, and other machinery and equipment) • 872 Repair services of other goods (including footwear and leather goods, garments and household textiles, and furniture) • 873 Installation services (other than construction)	2. Maintenance and repair services n.i.e. • Maintenance and repairs on ships, aircraft and other transport equipment 9 Telecommunications, computer, and information services 9.2 Computer services • Maintenance and repairs of computers

Sector	W/120	CPC ver. 2.1	EBOPS 2010
Sewage and waste collection	6. Environmental services • A. Sewage services • B. Refuse disposal services • C. Sanitation and similar services • D. Other	94 Sewage and waste collection, treatment and disposal and other environmental protection services • 941 Sewerage, sewage treatment and septic tank cleaning service • 942 Waste collection services • 943 Waste treatment and disposal services • 944 Remediation services • 945 Sanitation and similar services • 949 Environmental protection services n.e.c.	10 Other Business services 10.3 Technical, trade-related and other business services • 10.3.2.1 Waste treatment and de-pollution services
Professional services related to construction services	1. Business Services A. Professional services • e) Engineering services • f) Integrated engineering services	83 Professional, technical and business services (except research, development, legal and accounting services) • 83321 Engineering services for building projects • 83322 Engineering services for industrial and manufacturing projects • 83323 Engineering services for transportation projects • 83324 Engineering services for power projects • 83326 Engineering services for waste management projects (hazardous and non-hazardous) • 83327 Engineering services for water, sewerage and drainage projects • 83329 Engineering services for other projects	10 Other Business Services 10.3 Technical, trade-related and other business services • 10.3.1.2 Engineering services
Other services related to manufacturing	1. Business services F. Other business services • i) Services incidental to manufacturing	88 Manufacturing services on physical inputs owned by others	1. Manufacturing services on physical inputs owned by others

Appendix C. Classification of Services Related to the Circular Economy

Computer Services

Under the GATS framework, computer services related to the circular economy are covered under Business Services as "software implementation services," "data processing services," and database services under "computer and related services," and as "online information and/or data processing (incl. transaction processing) under "telecommunication services." In CPC ver 2.1 computer services related to the circular economy could be classified as "information technology (IT) consulting and support services," "information technology (IT) design and development services," and "hosting and information technology (IT) infrastructure provisioning services" under "Professional, technical and business services (except research, development, legal and accounting services)." Under EBOPS 2010 computer services related to the circular economy can be found under "computer services," which include software-related services and data processing services.

Other Professional Services

Under the GATS classification system, other professional services related to the circular economy could include "engineering services" and "integrated engineering services" under the "professional services" category as well as "management consulting services," "technical testing and analysis services" and "related scientific and technical consulting services" in the "other business services" sub-sector. In CPC ver 2.1, on the other hand, four subsectors under the sub-category "professional, technical and business services (except research, development, legal and accounting services)" could comprise professional services related to the circular economy, namely "supply chain and other management consulting services," "business process management services," "technical testing and analysis services" and "environmental consulting services." In the EBOPS 2010 classification system, other professional services related to the circular economy could fall under two subsectors, i.e., "business and management consulting and public relations services" and "scientific and other technical services."

Leasing or Rental Services Without Operator

In W/120, leasing or rental services without operator services could be classified according to the physical asset leased, as services "relating to ships," "relating to aircraft," "relating to other transport equipment," and "relating to other machinery and equipment." In CPC ver. 2.1 they could be classified as "leasing or rental services concerning machinery and equipment without operator," and "leasing or rental services concerning other goods" (which includes "leasing or rental services concerning textiles, clothing and footwear"). In the EBOPS 2010 system, they would fall under the "operating leasing service" category.

R&D Services

On the classification of R&D services, there is a substantial level of convergence among the WTO Services Classification List, CPC ver. 2.1, and the EBOPS 2010 system. All include R&D services under business services.

Maintenance, Repair and Installation (Except Construction)

W/120 divides maintenance, repair, and installation (except construction) services between those that are related to transport equipment and those related to "equipment" generally: maintenance and repair is covered under business services (i.e., "maintenance and repair of equipment [not including maritime vessels, aircraft, or other transport equipment]") and transport services (i.e., "maintenance and repair of vessels," "maintenance and repair of vessels," maintenance and repair of aircraft," "maintenance and repair of rail transport equipment, and "maintenance and repair of road transport equipment"). In CPC ver. 2.1, this category of services is divided between machinery and equipment, and other goods: "maintenance and repair services of fabricated metal products, machinery, and equipment" (including computers, transport machinery and equipment, and other machinery and equipment); "repair services of other goods" (including footwear and leather goods, garments and household textiles, and furniture); and "Installation services (other than construction)." In the EBOPS 2010 system, these services can be classified as "maintenance and repair services n.i.e.," which includes maintenance and repairs on ships, aircraft and other transport equipment, and, very specifically, "maintenance and repairs of computers" under computer services.

Sewage and Waste Collection

In the GATS classification framework, environmental services accommodate most services related to sewage and waste collection. Though the latter is not explicitly mentioned in W/120, environmental services cover "sewage services," "refuse disposal services," "sanitation and similar services," and "other." A separate self-standing category in CPC ver.2.1, sewage and waste collection services, includes "sewerage, sewage treatment and septic tank cleaning service," "waste collection services," "waste treatment and disposal services," "remediation services," "sanitation and similar services, and "other environmental protection services n.e.c." These services can be found in the EBOPS 2010 classification system under "other business services" as "waste treatment and de-pollution services."

Other Services Related to Manufacturing

Services incidental to manufacturing related to the circular economy (most importantly, recycling and materials recovery services) could be classified under "business services" as "other business services" in the GATS framework and "manufacturing services on physical inputs owned by others" in CPC ver. 2.1. In EBOPS 2010, the latter is a self-standing category.