UN environment programme

International Resource Panel

Environment and Trade Hub

SUSTAINABLE TRADE IN RESOURCES

GLOBAL MATERIAL FLOWS, CIRCULARITY AND TRADE

Acknowledgements

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Sustainable Trade in Resources

Global Material Flows, Circularity and Trade

Discussion paper by UNEP's Environment and Trade Hub and the International Resource Panel

Preface

The COVID-19 pandemic has caused dramatic shocks in global supply and demand, leading to an unprecedented contraction in international trade that is affecting all regions. Overall, international trade could shrink by an estimated one-fifth in 2020.[1]

The COVID-19 crisis is exacting a particularly heavy economic toll on commodity-dependent countries, primarily in sub-Saharan Africa and Latin America. Developing countries (excluding China) could lose nearly $800 billion in export revenues in 2020 due to reduced trade volumes and depressed energy and commodity prices.[2] The sharp decline in commodity prices since the outbreak of the pandemic has weakened external balances, triggering large capital outflows, exchange rate depreciations and higher external borrowing costs. These factors constrain countries' abilities to service their debt, potentially leading to debt crises.[3]

The pandemic has highlighted the interconnectedness of countries and the importance of global value chains and a resilient trading system. Impaired global value chains are contributing to increased trade costs, and trade has fallen more steeply in product sectors that have complex value chains. Debate over the impacts of COVID-19 on the structure of global production and global supply chains is ongoing, with consideration being given to the length of existing supply chains, sourcing decisions and the classification of strategic goods.

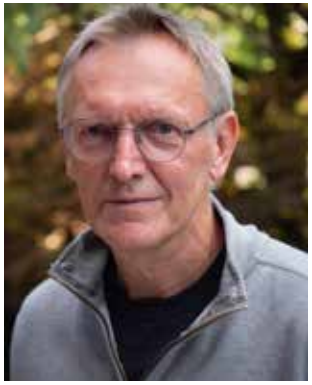
Governments around the world can focus on building the resilience of supply chains and better understanding their strengths and vulnerabilities. Close monitoring of material flows through tools like the International Resource Panel's Global Material Flows Database will be critical for informed decision-making regarding sustainable value chains. Consideration should be given to creating trade and investment policies that can best support economic and climate resilience.

1. UNCTAD 2020a
2. UNCTAD 2020b
3. UN-DESA 2020

As history demonstrates, trade plays an important role in post-crisis recovery. Countries are thus urged to implement informed policies to ensure that trade helps drive the recovery towards a more resilient, green and circular economy.

While the reduction in the movement of some goods, services and people due to COVID-19 has reduced greenhouse gas emissions, it can also impede trade flows of green goods and services such as certified products and low-carbon and energy-efficient technologies. This is owing to the shut-down of factories, drops in demand and closure of many borders leading to a fragmentation of supply chains including in climate technology. Moreover, it has slowed momentum on addressing important environment and climate issues.

It is crucial that policy-makers act to both facilitate trade in environmental goods and services, and address the adverse effects of trade on climate change, pollution and biodiversity through appropriate recovery measures. Economic stimulus packages introduced in response to the pandemic should promote green goods and services such as renewable energy technologies. Rapid recovery of green trade and investment will help stimulate economic recovery and achieve the green transition.



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Purpose of this paper

Research by the International Resource Panel (IRP) has drawn attention to the observed shift in environmental burdens from high-income importing countries to low-income exporting countries, and has called for effective trade policies to address the impacts of trade from an environmental and resource-efficiency standpoint (UNEP 2015).

In response, UNEP's Environment and Trade Hub has joined forces with the IRP Secretariat to update the IRP's findings on trade footprints, and to draw policy conclusions on how trade can help achieve a transition towards a fairer, more sustainable and circular economy.

The purpose of this discussion paper is to enhance understanding among trade and environment policymakers regarding trade flows of material resources – including their environmental impacts – and regarding trade's potential to contribute to the transition to a greener, more circular economy. The paper summarises the IRP's analysis on so-called upstream requirements of trade flows, drawing on the IRP reports *International Trade in Resources* (2015), *Global Material Flows and Resource Productivity* (2016), *Sustainable Natural Resource Use* (2017) and *Global Resources Outlook* (2019). It uses updated data to 2017 on trade flows and on the raw material equivalents of trade flows derived from the IRP Global Material Flows Database.

The paper builds on the work of UNEP's Environment and Trade Hub to offer policy implications focusing on the role of trade in moving production and consumption away from linear to more circular models.

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List of Abbreviations

EECCA	Eastern Europe, Caucasus and Central Asia
EU	European Union
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
IO	input-output
IRP	International Resource Panel
ISO	International Organization for Standardization
LCA	life cycle analysis
MEA	multilateral environmental agreement
OECD	Organisation for Economic Co-operation and Development
UNCTAD	United Nations Conference on Trade and Development
UN-DESA	United Nations Department of Economic and Social Affairs
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
US	United States
WTO	World Trade Organization

Executive Summary

Economic and human development are inextricably linked to demand for natural resources and energy. Biomass, fossil fuels, metals and minerals underpin national economies, provide crucial nutrients and raw materials for industrial activities, and are inputs to almost every sector of the global economy. As global demand for material resources has increased dramatically in recent decades, rising international trade has become an essential means to overcome the constraints posed by local resource scarcity (UNEP 2015).

While the contribution of international trade in fuelling economic expansion has long been recognised, its impact on the environment is more ambiguous. Trade can prove damaging to the environment by boosting overall resource production and use, shifting production to countries with less-stringent environmental legislation, and increasing energy use and pollution linked to transportation (UNEP 2015).

Yet, when accompanied by appropriate measures, trade can enable and accelerate the transition to a greener, more circular economy – for instance, by facilitating access to green technologies and to other environmental goods and services.

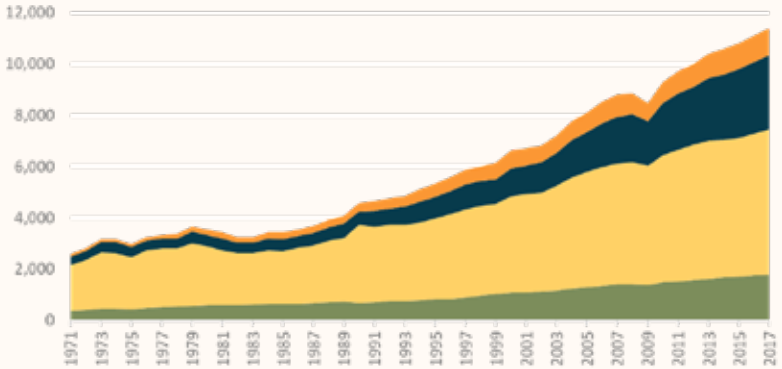
Trends in international trade

Over the past half century, the physical trade in material resources – biomass, fossil fuels, metals and non-metallic minerals – has increased dramatically worldwide. It has grown roughly linearly since 1970, with brief disruptions in 1975, 1980-82 and, most recently, 2008-2009, when the global financial crisis precipitated a 3.6 per cent drop in the 2009 trade volume (UNEP 2017).

The composition of trade has changed in recent decades, with numerous countries shifting to becoming net importers of resources, but very few switching to becoming net exporters. In the new millennium, emerging economies such as China and India have become net importers, whereas a number of high-income countries such as the United States and Australia have become important global exporters, in part in response to higher resource prices. The shift towards fewer net exporters of resources signals an increased vulnerability of the world trading system, as rising demand is being met by ever fewer producers.

GLOBAL PHYSICAL TRADE

Million tonnes



Biomass Fossil fuels Metals Minerals

Trade in material resources - biomass, fossil fuels, metals and minerals - has grown strongly over the past half century.

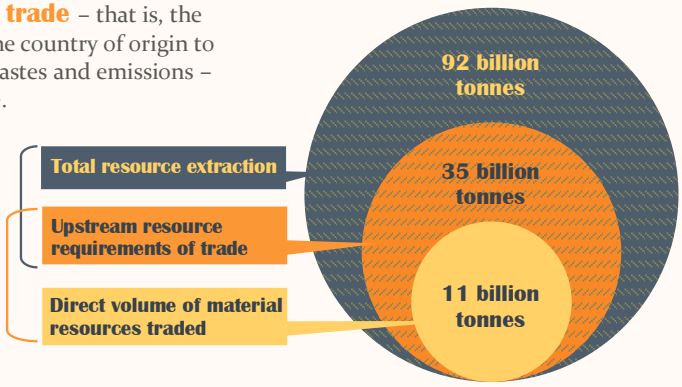
The volume of trade has increased at a faster pace than the volume of extracted resources, signifying a growing dependency of the global economy on material resource trade.

Source: IRP 2020

Assessing **upstream resource requirements of trade** – that is, the additional materials, energy, water and land used in the country of origin to extract and produce traded goods but left behind as wastes and emissions – can serve as proxies for the ecological impacts of trade.

One-third of the total volume of materials resources extracted in the world economy are linked to the production of traded goods.

The indirect or embodied materials in trade far exceed – by a factor of three – the direct volume of material resources traded across nations.



Global, 2017

Source: IRP 2020

Material footprints of trade

In addition to rising international trade in material resources, the so-called upstream resource requirements of traded commodities have also increased. These represent the additional materials, energy, water and land used in the extraction and production of traded goods but left behind as wastes and emissions in the exporting country. They can sereve as a useful proxy for the ecological impacts of trade (UNEP 2015).

In 2017, these indirect or "embodied" materials in trade amounted to 35 billion tons, exceeding the direct volume of goods traded across nations (11 billion tons) by a factor of three. At a global scale, this means that fully one-third of the total of 92 billion tons of materials extracted in the global economy are destined to produce goods for trade (UNEP 2020).

The upstream requirements of trade have often increased more rapidly than direct trade flows. Between 1990 and 2017, the raw material equivalents of trade grew 4.5 per cent annually, whereas direct physical trade grew 3.5 per cent annually – implying an "outsourcing" of material use through trade (UNEP 2020).

Comparing the raw material-based equivalent of the physical trade balance – known as the raw material trade balance – with the physical trade balance (that is, physical imports minus physical exports) reveals a large increase in the total tonnage attributable to trade when upstream material flows are taken into account.

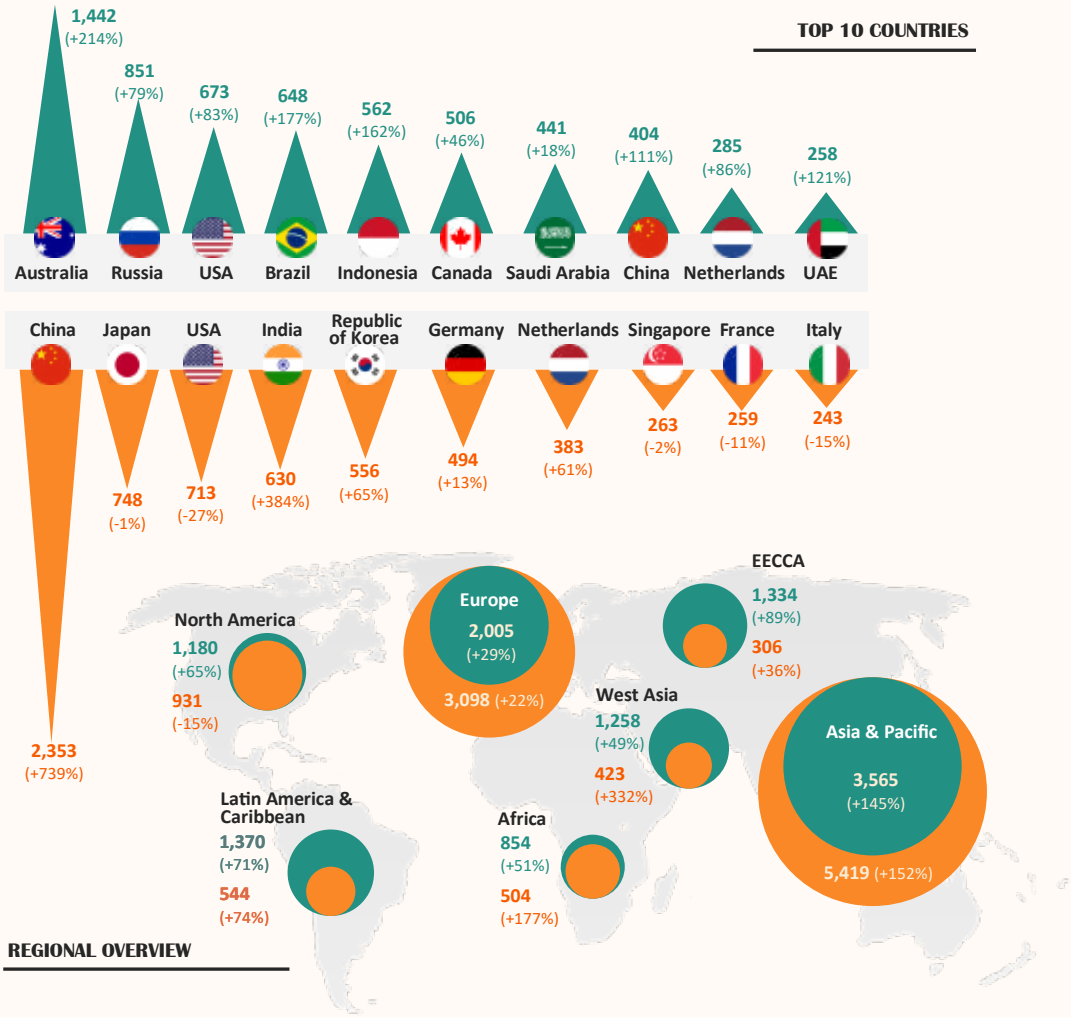
This comparison also points to notable changes in net importer/exporter status. While Europe has maintained and increased its relative share and dominance as the world's major importer of primary materials, Asia and the Pacific has shifted from being the largest importer to becoming a net exporter of raw materials. This is mainly because many of the primary resources seemingly consumed in Asia and the Pacific are used to produce manufactured goods for export. North America has also switched from being a net exporter to becoming a significant importer of raw materials. Among the net exporters, the relative importance of West Asia and of Latin America and the Caribbean has diminished greatly compared to the figures based on the physical trade balance. Africa has moved from being a minor net exporter to becoming the third most important one.

Similar analysis by income group shows that the raw material trade balance for high-income countries is large and growing. This reveals the high and ever-increasing dependence of affluent nations on the resource base and manufacturing capacity of the rest of the world. Analysis by the International Resource Panel, taking into account the upstream resource requirements of trade,

MATERIAL RESOURCE EXPORTS & IMPORTS

Million tonnes, 2017 (% change from 2000)

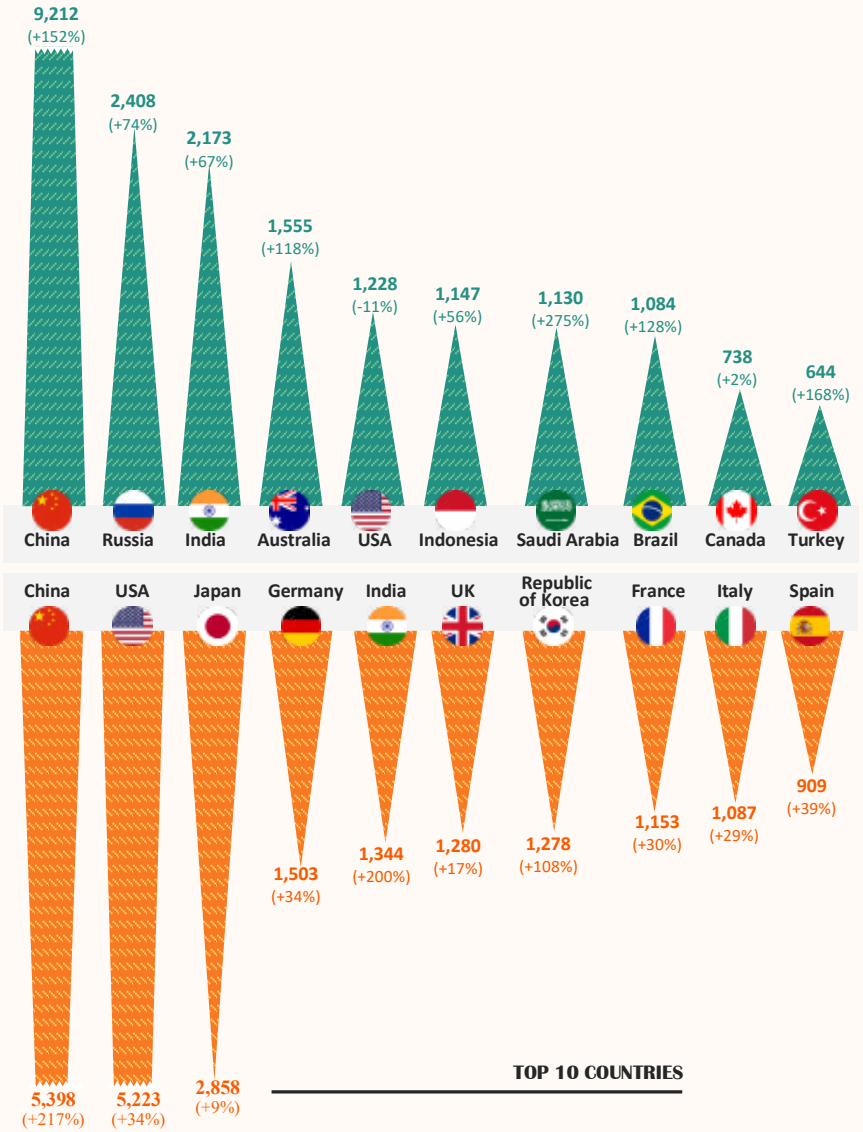
In recent decades, numerous countries shifted towards becoming net importers of resources (including emerging economies like China and India), whereas very few switched to becoming net exporters. This signals a growing vulnerability of the global trading system, as rising demand is being met by ever fewer exporters.



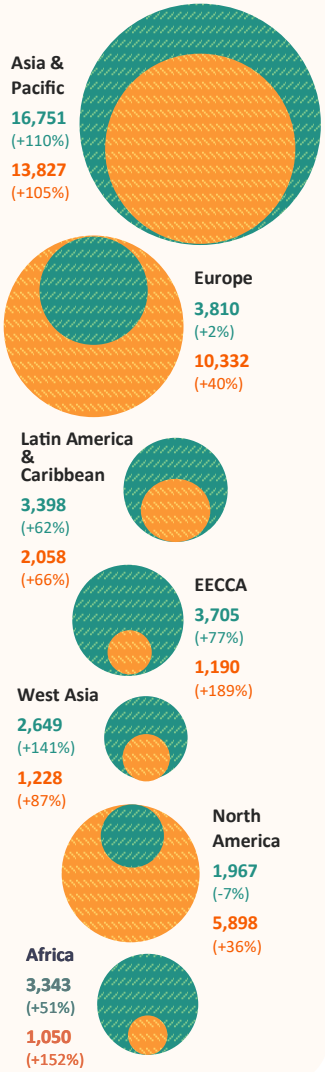
Source: IRP 2020

RAW MATERIAL EQUIVALENTS OF EXPORTS & IMPORTS

Million tonnnes, 2017 (% change from 2000)



REGIONAL OVERVIEW



highlights that resource-intensive processes have shifted from high-income, densely populated importing countries to low-income, more sparsely populated exporting countries. This signifies a corresponding shift in associated environmental burdens (UNEP 2015).

Role of trade in accelerating the transition to a green and circular economy

Given that the extraction, processing, use and disposal of material resources deeply affects the planet's climate, environment and underlying resource base, urgent and concerted action is needed to make the global economic system sustainable. Decoupling economic growth from unsustainable resource use and environmental degradation is vital if we are to transition to the decarbonised and sustainable future that is required to implement the United Nations 2030 Agenda and the Paris Agreement on climate change. A transition to a circular economy – one where greater efficiency is achieved by closing, extending and narrowing material loops – can play a key role in reducing demand for material resources, thereby minimizing the harmful environmental impact associated with resource extraction. This should go hand-in-hand with raising environmental and social standards for resource extraction globally, in particular in countries with weaker governance structures.

With mutually supportive policies in place, international trade can facilitate the transition towards more sustainable and circular modes of production and consumption.

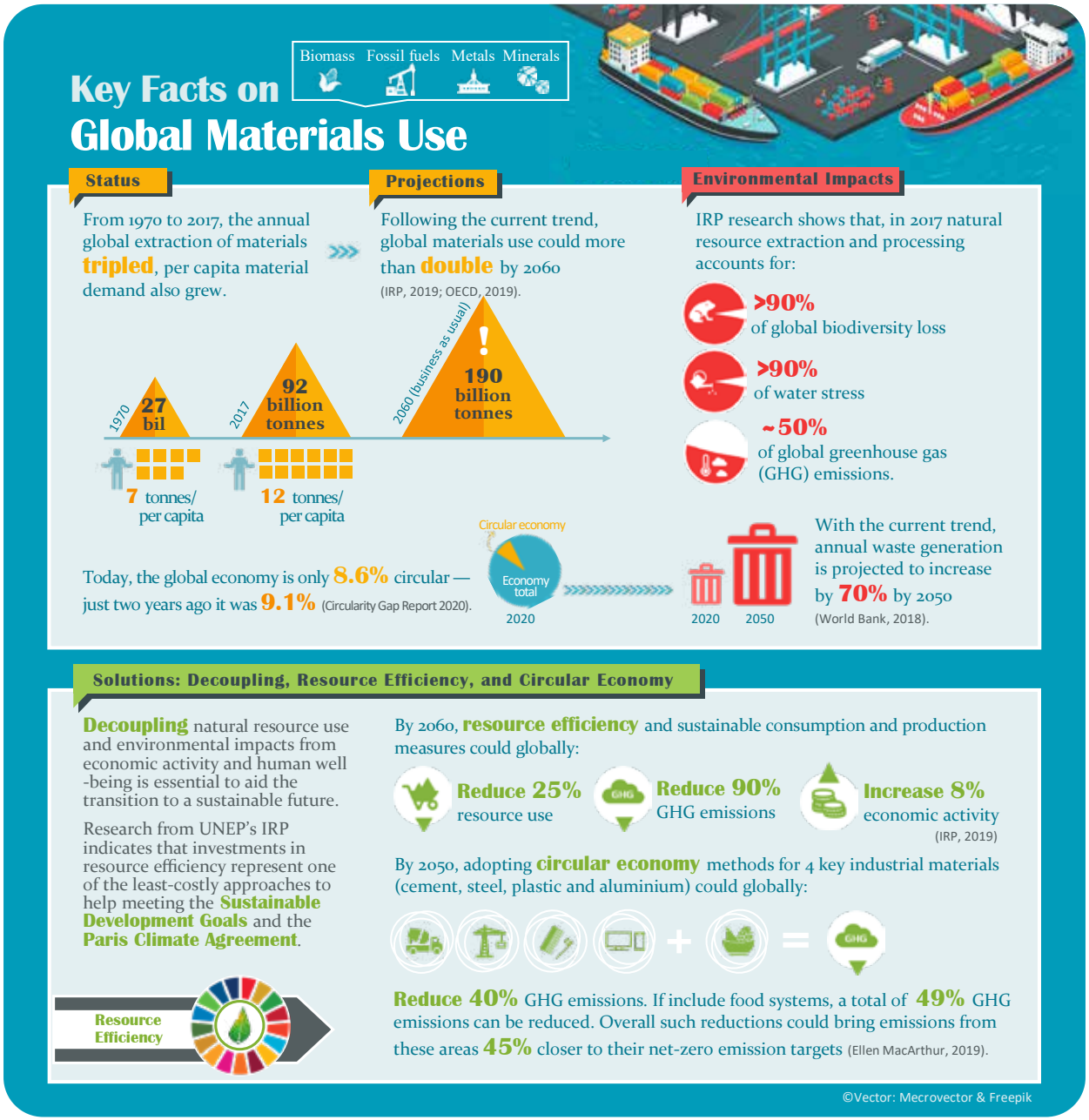
Multilateral trade rules set out by the World Trade Organization (WTO) need to strike a balance between enabling countries to adopt environmental protection and circular economy measures and related technical regulations and standards, while abiding by the principle of non-discrimination in trade. Environmental considerations, including those related to resource extraction, should be prioritized in ongoing multilateral trade negotiations. The WTO could also serve as a platform for countries to share best practices on environmental issues and could contribute to enhancing transparency in environmental practices.

Regional trade agreements could be used to alleviate barriers to trade and investment in environmental goods and services by harmonizing product standards that are relevant to circularity and by tailoring market access commitments to industries such as waste management. In addition, there is a critical need to ensure that regional trade agreements do not undermine commitments made under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, by better aligning their respective provisions. Regional trade agreements

can also play a key role in reducing the growth rate of material resource extraction – for instance, by discouraging or prohibiting harmful fossil fuel subsidies and liberalizing trade in renewable energy.

Reducing future resource demand through decoupling and circular economy strategies is desirable from an environmental standpoint; however, it is also important to consider the implications – in terms of lost export earnings – for low-income, resource-dependent countries. For these countries, governance strategies would be needed to capture a greater share of value by adding value to the extractive products, and break away from the enclave nature of the extractive sector by diversifying their economies including into emerging sectors such as recycling and renewables. Developed countries and the global community need to afford developing countries sufficient policy space to do so, including through reform of the international trade and investment regime that constrains the use of the full range of policy instruments to achieve resource-based industrialization at the local level (IRP 2020).

Trade agreements should be leveraged in a way that aids developing countries in reducing the environmental impacts associated with resource extraction, while mitigating any negative spillover effects resulting from a circular economy transition. At a minimum, this will require targeted capacity-building and development assistance.



Source: IRP 2020

Credit: BBand SIRI/shutterstock

1. Introduction

Economic and human development are inextricably linked to demand for natural resources and energy. Biomass, fossil fuels, metals and minerals underpin national economies, provide crucial nutrients and raw materials for the green and climate-neutral economy, and are inputs to almost every sector of the global economy.

Over the last few decades, global demand for material resources – namely biomass (such as wood and crops for food, energy and plant-based materials), fossil fuels (such as coal, natural gas and oil), metals (such as iron, aluminium and copper) and non-metallic minerals (including sand, gravel and limestone) – has increased dramatically. As a result, limits to the supply of resources, both environmental and economic, have become ever more visible. The extraction and processing of natural resources accounts for more than 90 per cent of our biodiversity loss and water stress and approximately half of our climate change impacts (IRP, 2019).

Looking ahead, global resource demand is set to continue increasing at an unsustainable pace. Meeting the needs of a growing and increasingly affluent and urban population will require material resource extraction to double from 92 to 190 billion tonnes by 2060 under historical trends (IRO, 2019). Even under a "towards sustainability" scenario, material resource extraction will continue to grow – albeit at a decreased rate – to reach 143 billion tonnes by 2060, fuelled by a growing and more prosperous population and a low-carbon technological transition (IRP, 2019). This means that while a shift towards circularity and more efficient resource use are important elements in addressing material resource supply security, they can nevertheless only meet part of the future projected demand for material resources.

Through international trade, countries can overcome the constraints of local resource scarcity, as trade facilitates moving resources from locations of supply to centres of demand (UNEP 2015).

While the contribution of international trade in fuelling economic expansion has long been recognised, its impact on the environment is more ambiguous. In theory, trade can improve global resource efficiency if it encourages the extraction of resources and the production of traded commodities in countries where smaller amounts of waste and emissions are produced. However, trade in material resources can prove damaging to the environment by boosting overall resource production and use, shifting production to countries with less-stringent environmental legislation, and increasing energy use and pollution linked to transportation (UNEP 2015).

In an attempt to determine whether international trade leads to a more efficient allocation of

resource extraction and use, the so-called upstream resource requirements of traded commodities provide useful insights. Instead of looking only at the environmental impact of physical traded volumes of material resources, these upstream requirements take into account the additional materials, energy, water and land used in the extraction and production of traded goods but left behind as waste and emissions in the exporting country (UNEP 2015).

Analysis by the International Resource Panel (IRP) of global flows of upstream material requirements of trade remains inconclusive as to whether or not international trade improves global resource efficiency. It reveals, however, that industrialized countries depend on raw materials provided by developing countries. This, in turn, results in a corresponding shift in the environmental burden related to extraction and processing activities from developed (importing) to developing (exporting) regions (UNEP 2015).

Given that the extraction, processing, use and disposal of material resources deeply affects the planet's climate, environment and underlying resource base, urgent and concerted action is needed to decouple economic growth from resource use and environmental impacts. Trade, when accompanied by appropriate measures, can play an important role in enabling and accelerating the transition to a greener, more circular economy – for example, by facilitating access to green technologies and to other environmental goods and services. Trade and other policy measures should seek to improve the environmental and social standards for material resource extraction, ensuring sustainable production and sourcing globally.

This paper first highlights the trends in material resources trade. It should be noted that in doing so, the paper for the most part aggregates trade figures of different material resources (namely, biomass, metals, non-metallic minerals and fossil fuels) which can restrict its analytical value. The paper moves on to analyse how a transition to a circular economy could reduce the growth of demand for material resources, thereby alleviating the associated environmental impact. It explores the role that trade agreements can play in promoting circularity and the potential implications for developing countries. It concludes with recommendations for environment and trade policymakers to ensure that trade works better for people and the planet.

2. International Trade in Resources

Credit: Miks Mihails Ignats/shutterstock

2.1 Trends in international trade in resources

Key messages

- Trade in material resources has grown strongly over the past half century. The volume of trade has increased at a faster pace than the volume of extracted resources, signifying a growing dependence of the global economy on material resource trade.
- In recent decades, numerous countries shifted to becoming net importers of resources, whereas very few switched to becoming net exporters. This signals a growing vulnerability of the global trading system, as rising demand is being met by ever fewer exporters.
- In recent decades, Asia and the Pacific and Europe have been net importers of material resources. In 2011, North America switched to becoming a net exporter, albeit by a small margin. All other regions were net exporters.
- In the new millennium, emerging economies such as China and India have become net importers. A number of high-income countries such as the United States and Australia have become important global exporters, in part in response to higher resource prices.

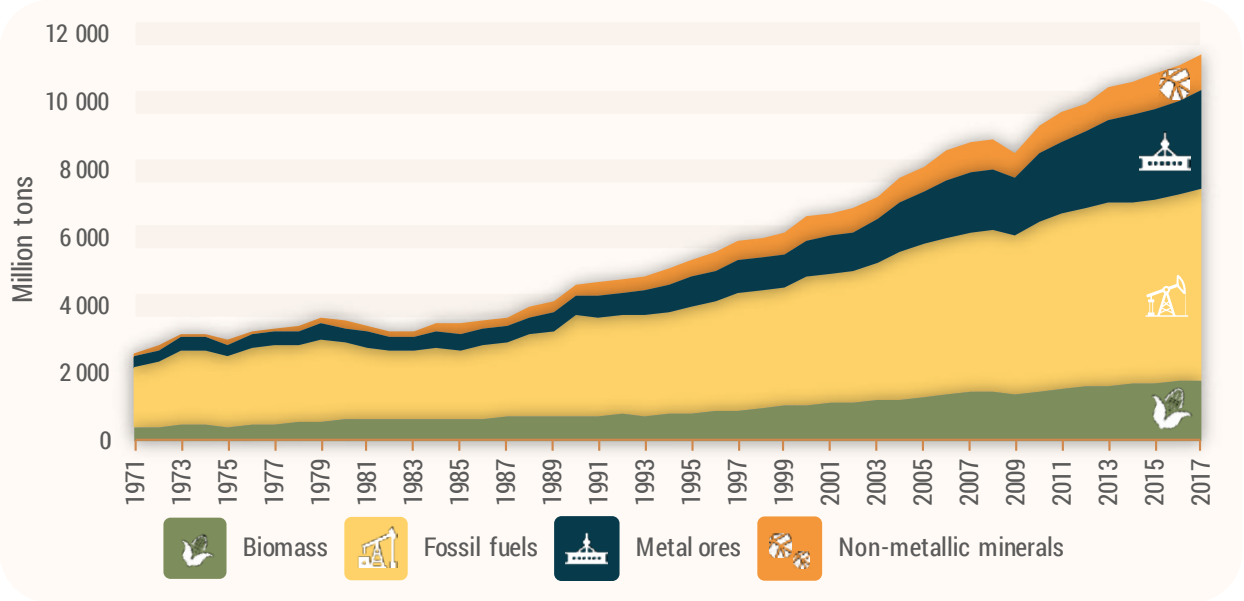
World trade has expanded greatly over the past few decades, fuelled by the progressive liberalisation of markets and by the accelerating demand for resources from a growing and increasingly urban and more prosperous global population. The physical volume of international trade increased more than four-fold between 1970 and 2017, from 2.7 billion tons to 11.6 billion tons.[1] International trade accounted for 13 per cent of the 92 billion tons of material resources extracted and used worldwide in 2017.

Over the past half century, global trade in material resources has grown roughly linearly, with brief disruptions in 1975, 1980-82 and, most recently, 2008-2009, when the global financial crisis precipitated a 3.6 per cent drop in the 2009 trade volume (Fig. 1) (IRP 2017).


Credit: Christina Bodouroglou

1. As measured by the total volume of global exports, amounting to 11,566 million tons in 2017 (UNEP 2020).

Figure 1. Global physical trade by material composition, 1970-2017



Note: Physical trade is measured as (imports + exports)/2.
Source: UNEP 2020

Since 1970, the volume of physically traded material resources has risen at a faster pace (3.2 per cent per year) than the amount of extracted resources (2.6 per cent per year). This signifies both a lengthening of production chains and the growing importance of trade for supplying countries with the resources they need (IRP 2017; UNEP 2015; UNEP 2020).

The material composition of trade has remained relatively stable over the past five decades (UNEP 2015). In 2017, fossil fuels accounted for around half of global physical trade flows, and metal ores represented another one-quarter (Fig. 1); together, these two material resources comprised around 75 per cent of global physical trade.

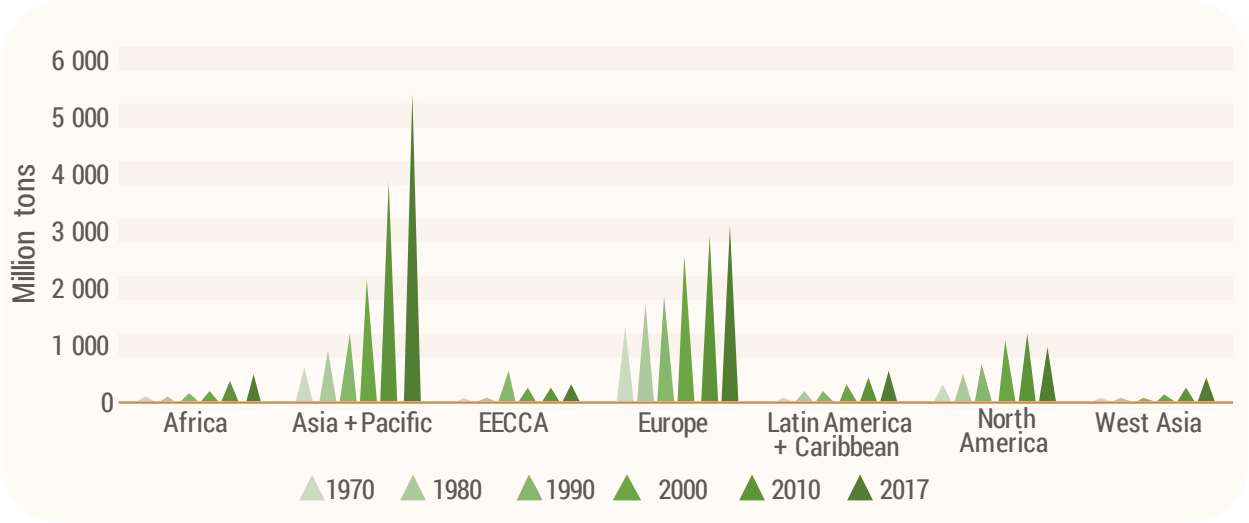
Other material resources, such as biomass and non-metallic minerals, including sand and gravel, are for the most part locally sourced (UNEP 2015). However, if domestic supply is insufficient to meet demand – as is the case for biomass (including food) in parts of the Middle East and recently also in China – trade becomes critical (UNEP 2015).

Biomass and non-metallic minerals accounted for 15 per cent and 10 per cent, respectively, of global physical trade flows in 2017 (Fig. 1).

Geographically, Asia has experienced the highest growth in material resource use, becoming the world's largest material resource importing and exporting region (Fig. 2 and Fig. 3) (IRP 2017). In 2017, Asia and the Pacific accounted for 48 per cent of total physical imports, followed by Europe (28 per cent) and North America (8 per cent) (Fig. 2).

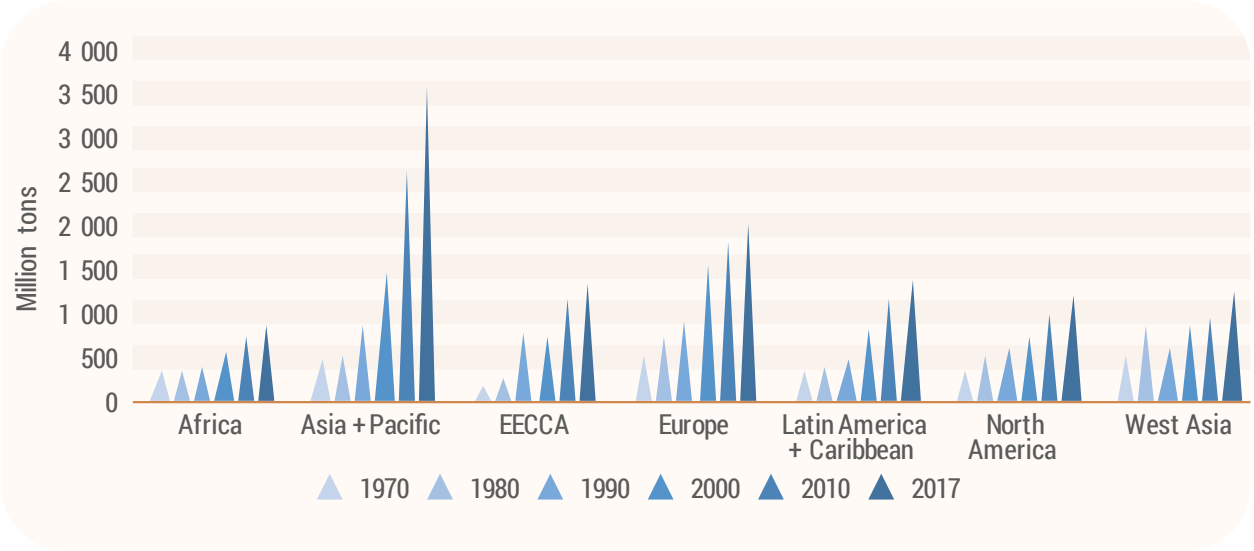
That same year, Asia and the Pacific represented 31 per cent of physical exports, followed by Europe (17 per cent) (Fig. 3) (IRP 2017). China, India and the Russian Federation were responsible for a large share of Asia's exports (IRP 2017). Fossil fuels have tended to dominate export volumes in all regions except Latin America, although following the 2008-2009 financial crisis the export volumes of fossil fuels and metal ores were equivalent (IRP 2017).

Figure 2. Material imports by region, 1970-2017



Source: UNEP 2020

Figure 3. Material exports by region, 1970-2017



Source: UNEP 2020

In recent decades, many countries have shifted from being net exporters of material resources to becoming net importers. Conversely, only a handful of countries have shifted from being net importers to becoming net exporters of material resources. This signals an increased vulnerability of the world trading system as global interdependence rises, as rising demand is being met by ever fewer exporters. A decline in one or more exporters' capacity due to resource depletion or geopolitical reasons could have a significant destabilizing effect (UNEP 2015).

The physical trade balance, calculated as physical imports minus physical exports, is a useful indicator to assess the geographical distribution of suppliers and consumers in the world economy, and provides insights into a country's role in global supply chains (IRP 2019; UNEP 2015). When the physical trade balance is positive, it means that the weight of a country or region's imports is greater than the weight of its exports. Conversely, when the trade balance is negative, the weight of a country or region's exports is greater than the weight of its imports.

In recent decades, the physical trade balance has been positive for Asia and the Pacific and for Europe, whereas it has been negative for West Asia, for Eastern Europe, Caucasus and Central Asia (EECCA), for Africa and for Latin America and the Caribbean. In 2011, North America switched from a positive to a negative trade balance, albeit by a small margin (Fig. 4) (IRP 2017).

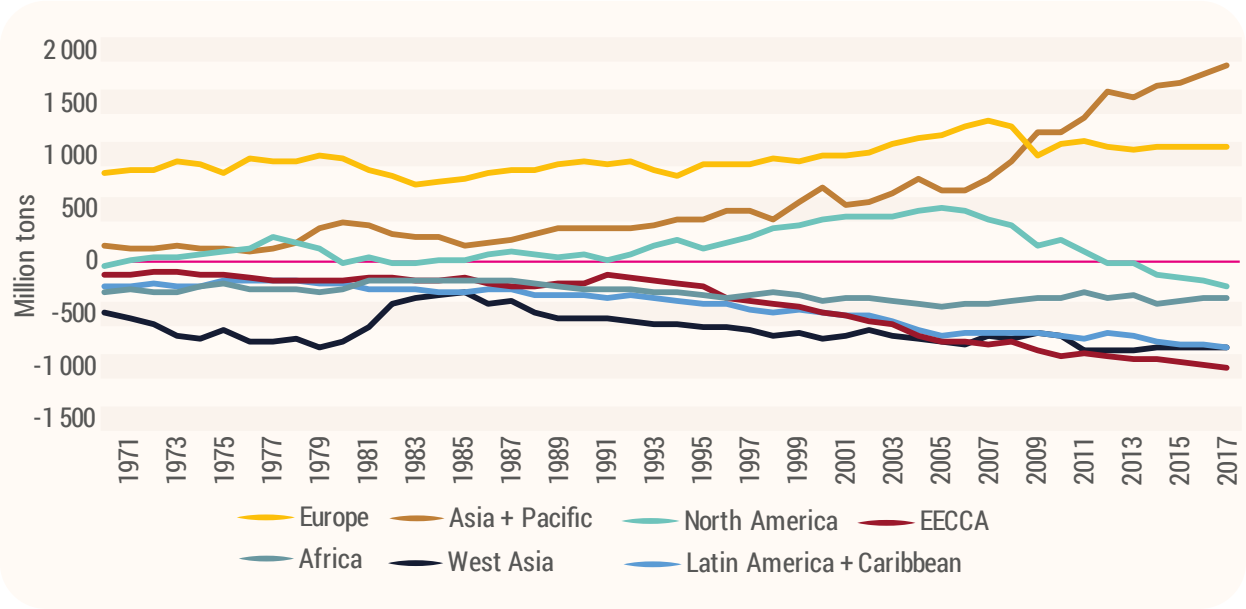
Europe was the world's major net importing region for most of the 1970 to 2017 period, with its annual physical trade balance remaining relatively stable at around 1 billion tons (Fig. 4.) (IRP, 2019). Minor volatility in Europe's trade balance reflected events such as reduced reliance on Middle Eastern petroleum in the early 1980s in the aftermath of the 1970s oil price shocks, and reduced demand during the 2008-2009 global financial crisis (IRP 2019). Meanwhile, Asia and the Pacific, fuelled by rapid economic expansion, experienced ongoing growth in its net imports, with acceleration in the new millennium. Asia and the Pacific supplanted Europe as the world's major net importing region in 2009, with its physical trade balance reaching 70 per cent higher than Europe's by 2017 (IRP 2019).

West Asia was the largest net exporting region from 1970 to 2006, and was then surpassed by EECCA over the subsequent decade. In both West Asia and EECCA, fossil fuels have dominated exports. West Asia's physical trade balance in the early 1980s mirrored that described above for Europe as countries sought to substitute Middle Eastern petroleum with other supply sources in the wake of the 1970s oil price shocks.

Global exports of material resources per capita doubled from 0.7 tons in 1970 to 1.6 tons in 2017.


Credit: Lobodan Ilytro/shutterstock

Figure 4. Physical trade balance by world region, 1970-2017



Source: UNEP 2020

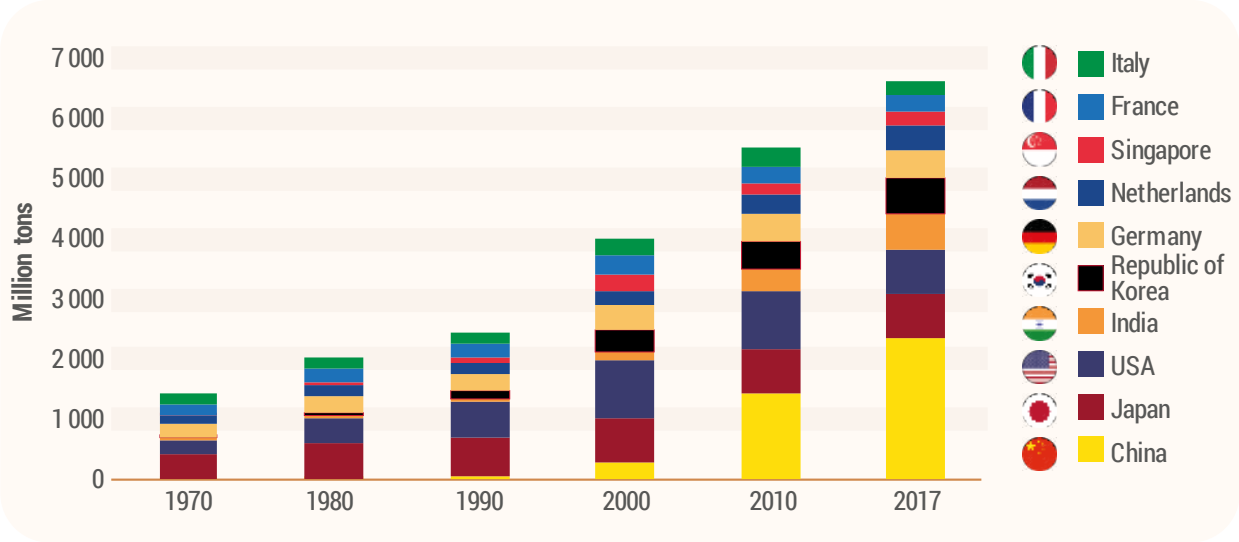
Since the turn of the millennium, notable changes have occurred in global trade relations for material resources. Prior to 2000, high-income countries/regions had positive physical trade balances, signalling that they were net importers of material resources, whereas lower-middle-income and especially upper-middle-income countries/regions were net exporters. This pattern has since changed, as certain countries – specifically high-income countries that do not belong to the Organisation for Economic Co-operation and Development (OECD) (mainly oil-exporting countries) and some high-income OECD countries (such as the United States, Australia, Canada and New Zealand) – have become major global material resource suppliers, partly in response to rising resource prices in the twenty-first century.

Meanwhile, some upper-middle-income countries, such as China, were net importers in 2017, as they have become major importers of material resources needed to feed industrial production (IRP 2017; UNEP 2015). Low-income countries had a seemingly consistent physical trade balance between 1970 and 2017, largely because they account for relatively small volumes of global trade (IRP 2019).

By country, China is the dominant global importer in the physical volume of material resources traded (Fig. 5). Although China leads in net global imports as a whole, however, its net imports per capita, at 1.4 tons in 2017, are less than a third of those in Japan and less than a fifth of those in the Republic of Korea (IRP 2019).

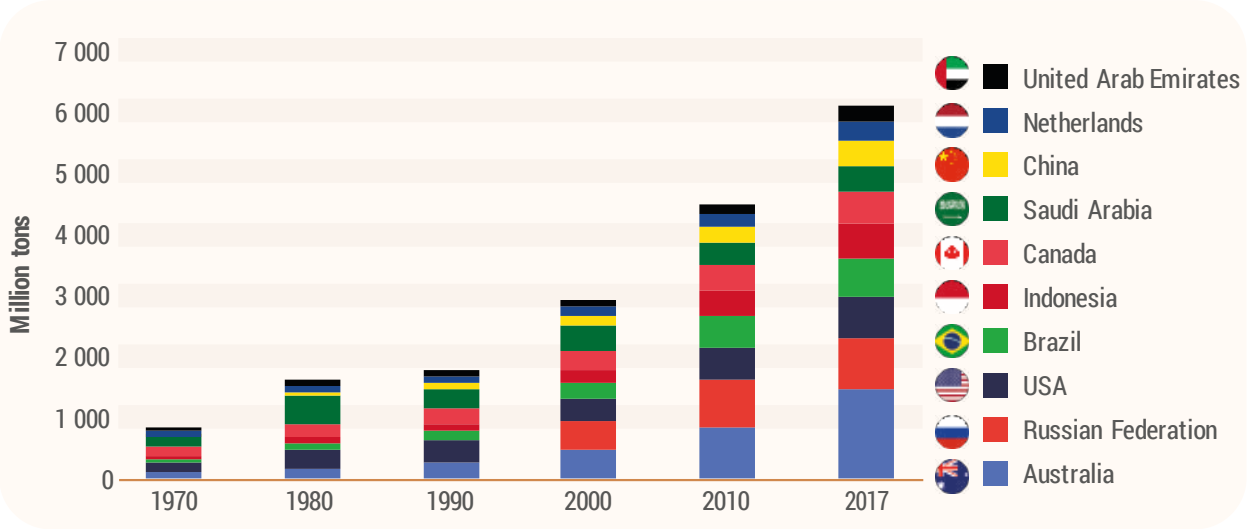
The world's largest exporter of material resources in 2017 was Australia, followed by the Russian Federation, the United States, Brazil, Indonesia, Canada and Saudi Arabia (Fig. 6). Australia's dominant material resource exports are ferrous ores and coal, Brazil's are ferrous ores, and those in the Russian Federation, Saudi Arabia, Norway and the United Arab Emirates are petroleum and/or natural gas.

Figure 5. Material imports by top 10 countries, 1970-2017



Source: UNEP 2020

Figure 6. Material exports by top 10 countries, 1970-2017



Source: UNEP 2020

2.2. Upstream resource requirements of international trade

In addition to analysing physical trade flows, analysis of the so-called upstream resource requirements of traded commodities can provide valuable insights into the implications of rapidly rising trade for global resource and environmental efficiency. These upstream requirements refer to the additional resources (materials, energy, water and land) that are used in the country of origin for producing traded goods, but that are ''left behind'' as wastes and emissions. Also known as ''resources embodied in trade'', they can serve as indicators of the environmental impacts of trade (UNEP 2015).

Despite intensive research efforts, estimating the upstream requirements of traded goods is a complicated task. Different methodological approaches arrive at widely varying results that do not permit straightforward comparisons and the

drawing of robust results.[2] Depending on the estimation method and type of resource, measurements of upstream resource requirements range between 40 per cent and, in some cases, 400 per cent of traded material resources (UNEP 2015).

The IRP assesses the raw material equivalents of trade flows – that is, the amount of primary raw materials required along the supply chain to produce commodities (IRP 2017).[3] The raw material equivalent of the physical trade balance is known as

2. In studies, methods used to estimate upstream resource requirements for materials include environmentally extended input-output models (IO), life-cycle assessments (LCA) as well as "hybrid" LCAIO approaches. Energy requirements can be expressed either as energy resources used or as CO2 emissions caused by the use of energy resources. For upstream water requirements, the term "virtual water accounts" is commonly used. Upstream land requirements have been addressed as "global hectares" in the footprinting tradition as well as, indirectly, by accounting for so-called Human Appropriation of Net Primary Production (HANPP) (UNEP 2015).
3. The IRP's global material flows database calculates raw material equivalents of trade flows for the period 1990-2017 using the global, multi-regional input-output framework Eora, developed by the University of Sydney (Lenzen *et al*. 2013) and a new global material extraction satellite data set detailing 42 material extraction categories for every country in the world. Standard input-output analytical procedures based on the conceptual framework developed by Leontief (1974) are applied (UNEP 2016). See UNEP 2020.

Key messages

- Assessing the upstream resource requirements of trade – that is, the additional resources used in the country of origin for producing traded goods but left behind as wastes and emissions – can serve as a proxy for measuring the ecological impacts of trade.
- When considering the whole life cycle of traded products, trade is responsible for much larger amounts of material extraction than direct trade flow indicates. Accounts of the raw material equivalents of direct trade of material resources reveal the real contribution of trade to material resource exploitation.
- One-third of the total volume of material resources extracted in the world economy is linked to the production of traded goods. Furthermore, the indirect or embodied materials in trade (35 billion tons in 2017) far exceed – by a factor of three – the direct volume of goods traded across nations (11 billion tons in 2017).
- The raw material trade balance, based on the attribution of globally extracted materials to traded goods, shows that only Europe and North America have remained net importers of material resources. By contrast, Asia and the Pacific has shifted to becoming a net exporter of material resources driven by large export volumes of manufactured goods.
- The raw material trade balance for high-income countries is large and growing, revealing the high and ever-increasing dependence of affluent nations on the resource base and manufacturing capacity of the world.

the raw material trade balance, which takes into account the upstream material flows involved in producing a ton of exported product, rather than just the tonnage of the product itself (UNEP 2016).[4]

The raw material equivalents of imports and exports reveal that trade mobilizes much greater amounts of materials than direct traded flows indicate (UNEP 2016). In 2017, the material requirement for trade was three times the direct trade – in other words, more than 35 billion tons of material resources were extracted globally to produce 11 billion tons of directly traded goods. This means that fully one-third of the total 92 billion tons of material resources extracted in the global economy that year were destined to produce goods for trade. Between 1990 and 2017, raw material equivalent trade grew 4.5 per cent annually, whereas direct physical trade grew 3.5 per cent annually.

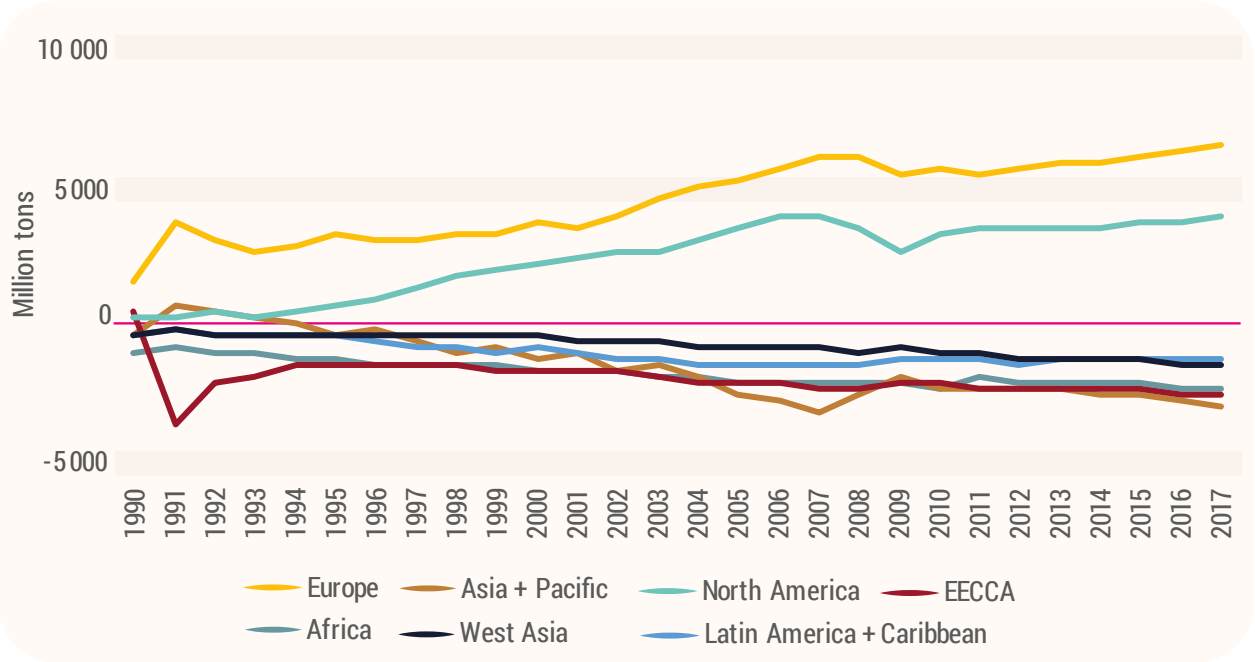
Not surprisingly, when upstream material flows are taken into account, the total tonnage attributable to trade increases dramatically, with net exports in 2017 of 10.5 billion tons in the raw material trade balance, compared to 3.3 billion tons in the physical trade balance (Fig. 7 versus Fig. 4).

4. For example, the physical trade balance would typically only add one ton to a region's export account for each ton of aluminium it exported. By contrast, the raw material trade balance will capture much of the mass of the original bauxite as initially extracted, plus the coal and gas used to produce that aluminium from bauxite, plus some of the materials used to make the plant in which the aluminium was produced, and so on (UNEP 2016).

In addition to the major growth in raw material equivalent trade, changes have occurred in the net importer/exporter status of regions. While Europe has maintained its dominance as the world's major importer of material resources – and increased its relative share – Asia and the Pacific has shifted from being a minor net importer to becoming a net exporter. This is mainly because many of the primary resources consumed in Asia and the Pacific are used to produce manufactured goods for export. North America has also switched from being a minor net exporter of material resources to becoming a major net importer.

When looking at the raw material trade balance as compared to the physical trade balance, the relative importance of West Asia and of Latin America and the Caribbean as net exporters decreases. Meanwhile, Africa moves from being a minor net exporter to becoming the third most important one. The EECCA region moves from being the most significant net exporter in terms of the physical trade balance to the second most significant one in terms of raw material trade balance, after Asia and the Pacific. The rate of growth of EECCA's raw material trade balance is much slower and more stable than seen previously for physical trade balance. The change in the status of Asia and the Pacific from net importer to net exporter is attributed mainly to China's rise as the region's major manufacturing country (UNEP 2016).

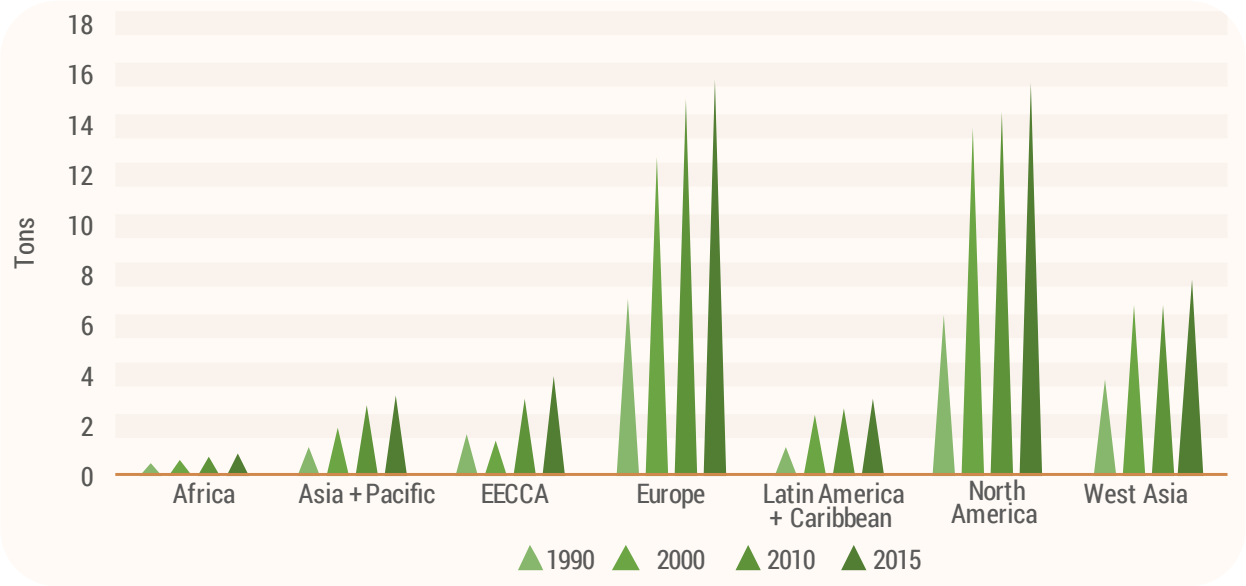
Figure 7. Raw material trade balance by world region, 1990-2017



Source: UNEP 2020

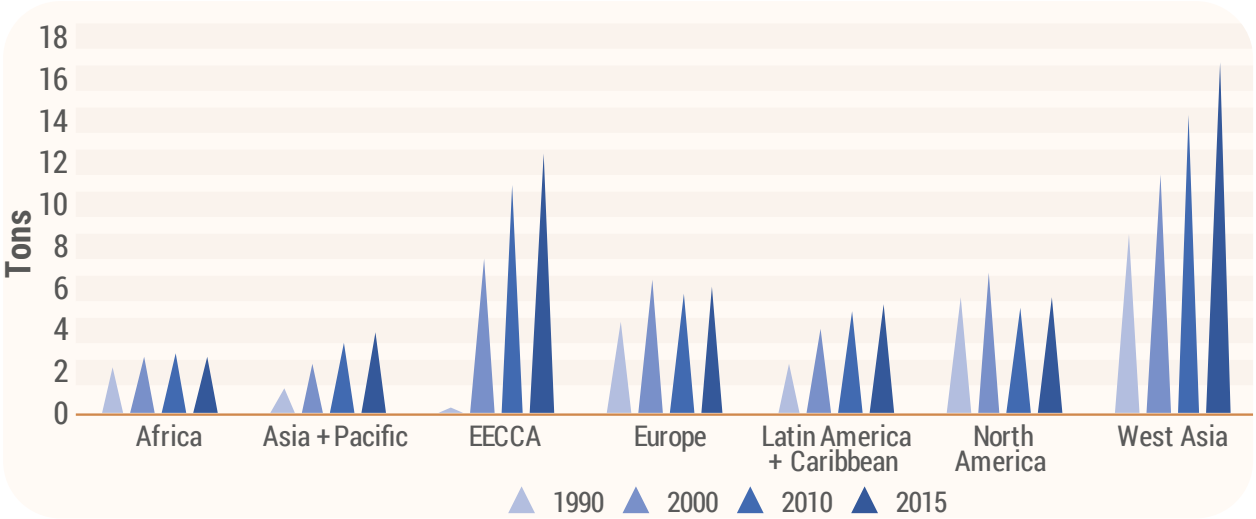
On a per capita basis, the raw material equivalents of imports are highest in Europe and North America, at four times the world average (Fig. 8). This reflects these regions' high levels of affluence and consumption. The oil-exporting regions of West Asia and EECCA exhibit the highest per capita raw material equivalents of exports (Fig. 9). As a consequence, the raw material trade balance depicts Europe and North America as net importers and West Asia and EECCA as net exporters of materials embodied in trade (Fig. 10). The remaining regions have relatively low per capita raw material trade balances, although large differences exist among countries (IRP 2017).

Figure 8. Per capita raw material equivalent of imports by region, 1990-2015



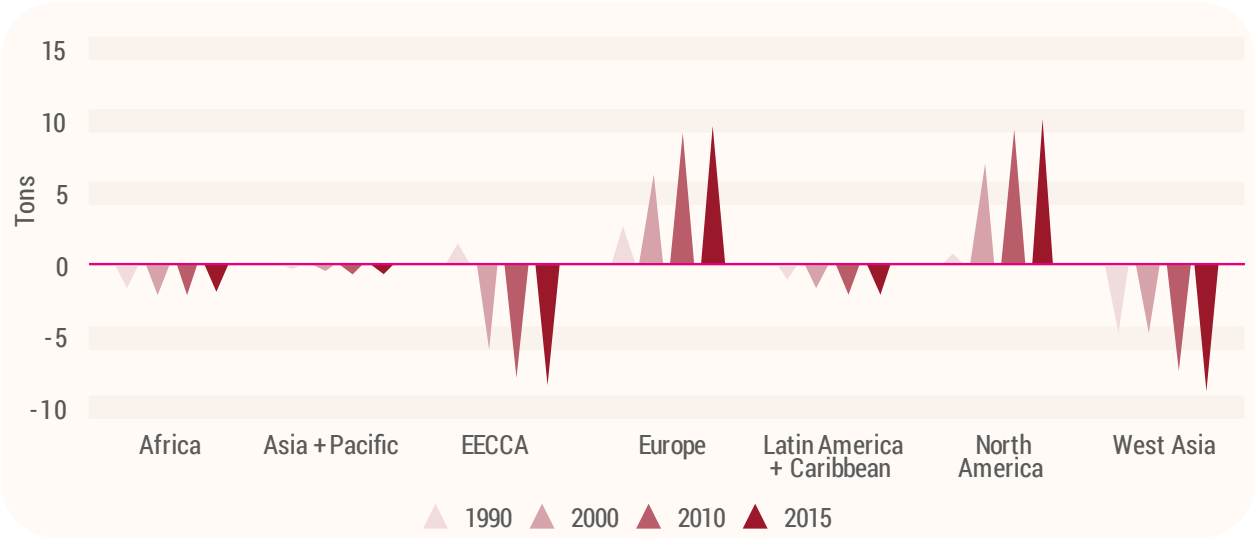
Source: UNEP 2020

Figure 9. Per capita raw material equivalent of exports by region, 1990-2015



Source: UNEP 2020

Figure 10. Per capita raw material trade balance by region, 1990-2015



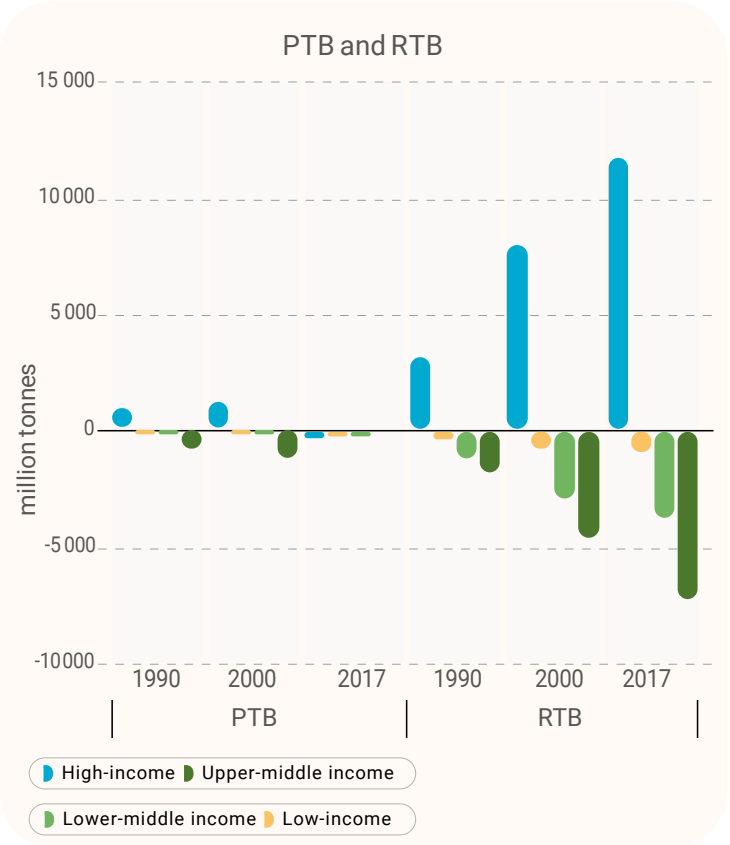
Source: UNEP 2020

Figures 11 and 13 compare the physical trade balance and the raw material trade balance by income group. When looking at the physical trade balance, high-income countries appear as net exporters of around 300 million tons of material resources in 2017. In terms of the raw material trade balance, however, the trade of high-income countries corresponded to a net virtual transfer of the equivalent of 11.8 billion tons of primary extraction from elsewhere in the world to this group.

By contrast, the physical trade balance reveals upper-middle-income countries (such as China) as net importers of around 120 million tons of material resources in 2017. In terms of the raw material trade balance, however, the trade by upper-middle-income countries was equivalent to the net export of the equivalent of 7.3 billion tons of primary extraction out of this group to the rest of the world.

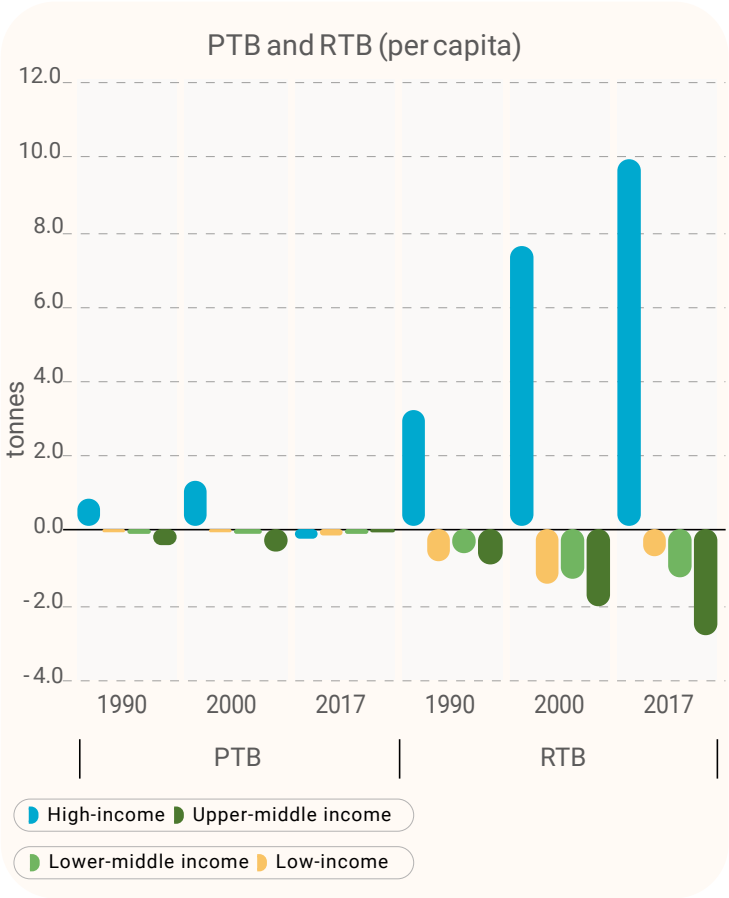
Thus, Figures 11 and 13 clearly illustrate that economic activity in affluent countries is heavily reliant

Figure 11. Distribution of physical trade balance (PTB) and raw material trade balance (RTB) across income bands, for 1990, 2000 and 2017



Source: IRP 2019, Fig. 2.18

Figure 12. Comparison of per capita physical trade balance (PTB) and raw material trade balance (RTB) across income bands, for 1990, 2000 and 2017



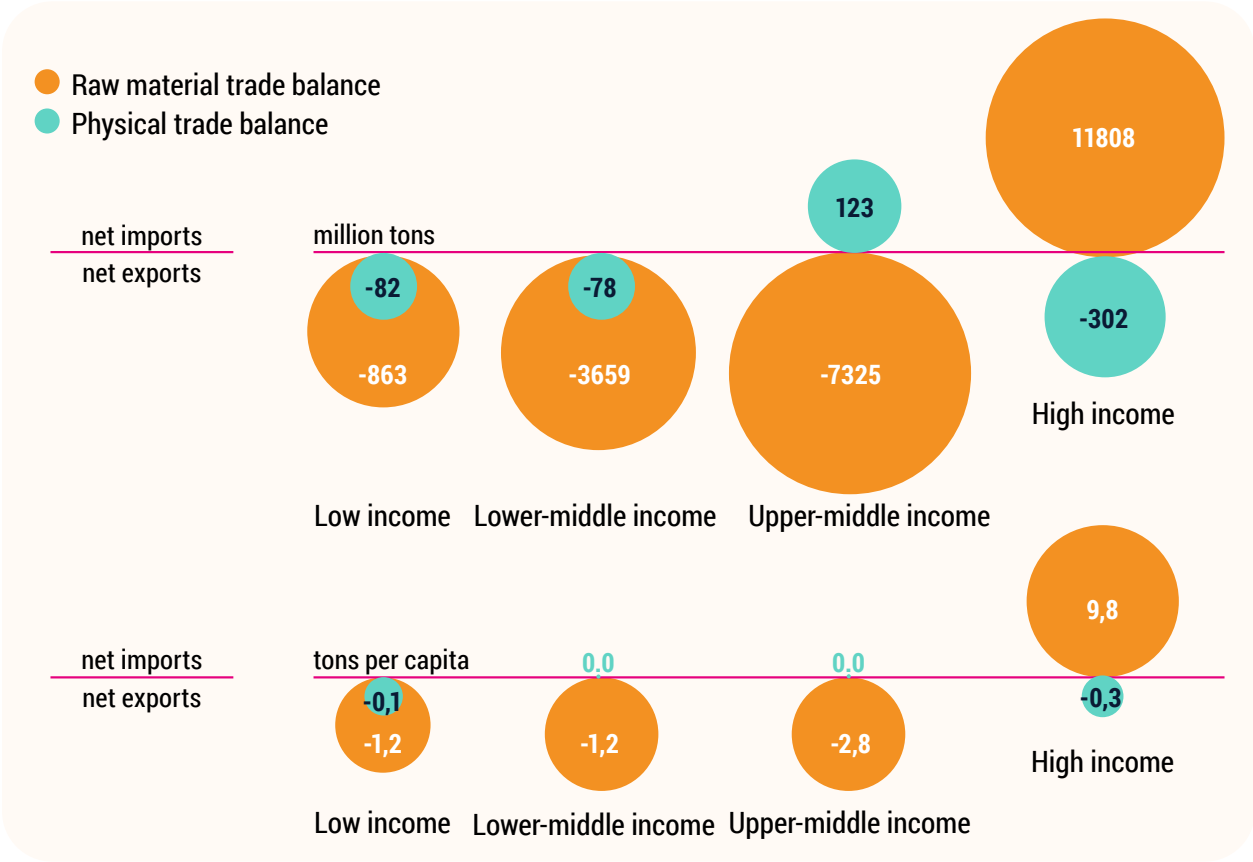
Source: IRP 2019, Fig. 2.19

on large and growing levels of primary material extraction in other countries, which are effectively "imported" in virtual form and embodied in traded commodities (IRP 2019).

Looking at the raw material trade balance on a per capita basis (Fig. 12 and Fig. 13) indicates that in 2017 each person in the high-income group was dependent on the mobilization of an average of 9.8 tons of material resources elsewhere in the world. This reliance on external materials has been rising at a rate of 1.6 per cent annually since 2000.

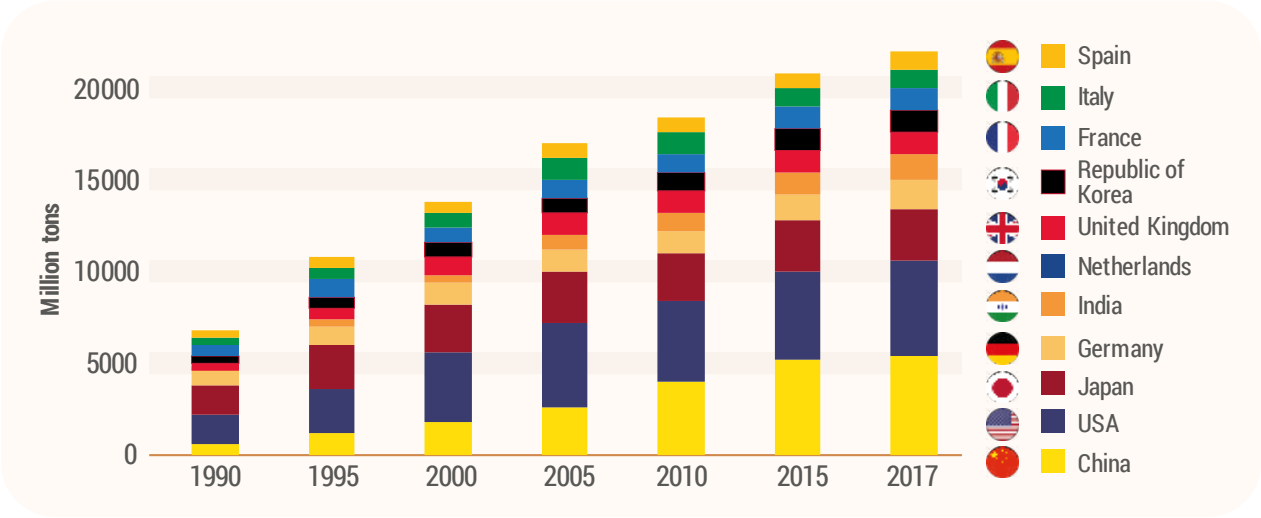
At a country level, the figures for the 10 largest importers and exporters of raw material equivalents between 1990 and 2017 (Fig. 14 and Fig. 15) are comparable to those provided in the previous section for physical imports and exports.

Figure 13. Distribution of physical trade balance and raw material trade balance, by country income, 2017



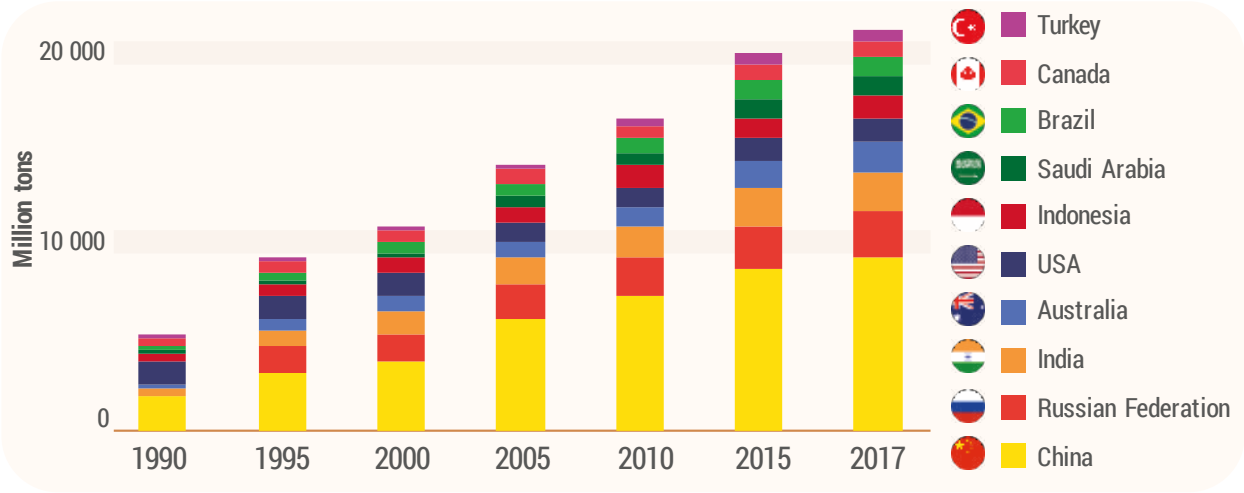
Source: IRP 2019, Summary, Fig. VI

Figure 14. Raw material equivalent imports by top 10 countries, 1990-2017



Source: UNEP 2020

Figure 15. Raw material equivalent exports by top 10 countries, 1990-2017



Source: UNEP 2020

2.3 Implications of trade for environmental and resource efficiency

Key messages

- Trade raises distributional concerns, by shifting environmental problems related to extraction and processing activities from high-income importing countries to low-income exporting countries.
- Trade could in theory enhance global resource efficiency by enabling extraction of resources and production of commodities in places where smaller amounts of wastes and emissions are produced.
- In the absence of appropriate policies, increased trade can have damaging effects on the environment and can accentuate inequalities.

Two significant conclusions can be drawn from the trends in material resource trade explored in the previous section. First, high-income economies are heavily reliant on the extraction of material resources in other countries, which has distributional implications. High-income countries have much larger positive trade balances when measured in raw materials than in direct trade, whereas for low-income countries the opposite is true. This signifies a shift in resource-intensive processes from high-income and densely populated importing countries to low-income and more sparsely populated exporting countries (UNEP 2015). This pattern of production and trade leads to a corresponding shift in environmental and health impacts related to extraction and processing activities from high-income importing countries to middle- and low-income exporting countries (IRP 2019).

If not properly managed and mitigated, the environmental impacts associated with the extraction and processing of resources for export include the depletion of natural assets, the production of wastes, the release of harmful emissions, the loss of biodiversity, land degradation and water pollution. In addition, domestic efforts to curb greenhouse gas emissions in one country may be offset by rising imports from countries that have weaker environmental standards and less-stringent legal commitments to reduce emissions.

Second, the trends show that in recent decades the upstream material resource requirements of international trade generally have been rising at a faster rate than both direct trade flows and material resource extraction. This is attributed to an overall increase in trade levels, a greater share in the trade of high-processed goods, declining metal ore grades, decreasing energy returns upon energy investment, and the need to feed an

expanding population from land with diminishing productivity. These factors likely negate any benefits of a potentially more resource-efficient allocation of extraction and production activities through global trade (UNEP 2015).

The joint effect of these factors leads to the conclusion that trade results in a shift in the environmental burden from developed (importing) to developing (exporting) regions. This calls for the design and implementation of appropriate policies aimed at limiting the damaging environmental and distributional impacts of trade. Since most of this shift is driven by demand for resources in developed countries, a shift away from a linear economy towards a circular economy could reduce the environmental impact of material resource trade and support countries in achieving their environmental, climate and economic goals. This goes hand in hand with raising environmental and social standards for resource extraction globally, in particular in countries with low levels of governance. The following section discusses how trade can contribute to this transition, as well as potential implications for developing countries.

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3. Resource Trade, Circularity and Implications for Developing Countries

3.1 Reducing demand for material resources by transitioning to a circular economy

Key messages

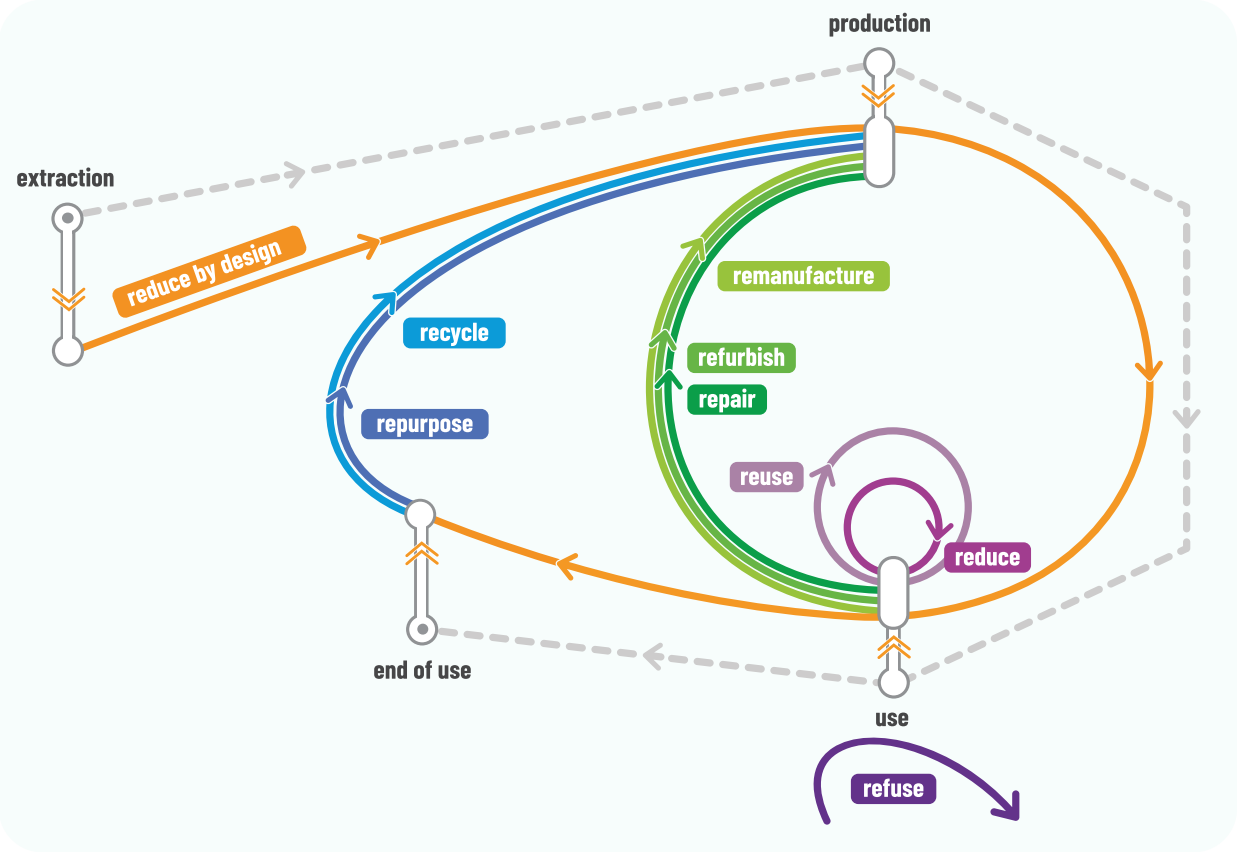
- Circularity can play a key role in decoupling economic growth from environmental degradation by greatly reducing the need for resource extraction and use of energy inputs.
- The impact of the adoption of circularity on the environmental costs associated with primary resources will, in part, depend on the difference between the input of energy and resources required to create the secondary raw material compared to the inputs needed to produce the primary raw material. This will differ for different material resources.
- While countries are mostly adopting circular economy principles at a national level, trade and trade flows play a critical role in a transition to a circular economy due to global value chains.

In an attempt to reduce their dependence on raw material imports and to preserve the environment, a number of (mostly high-income) countries/regions have started to adopt policies related to a "circular economy" (Box 1) – including China, the European Union (EU), Finland, France, Japan, the Netherlands and Scotland (van der Ven 2020). Some developing countries also have adopted initiatives incorporating circular economic principles. For example, in 2017 South Africa, Rwanda and Nigeria launched the African Circular Economy Alliance, aimed at sharing best practices for the design and implementation of legal and regulatory frameworks that promote the circular economy. The COVID-19 pandemic has demonstrated the fragility of international supply chains, leading many countries to strengthen their resolve to reduce their dependence on imported material resources.

Broad adoption of circular economy principles and/or resource efficiency[5] could greatly reduce the need for material resource extraction and the use of energy inputs (Preston and Lehne 2017), thereby minimizing the energy use and environmental impact associated with extracting and processing material resources. The IRP has predicted that resource efficiency, sustainable consumption and production, emissions reduction and carbon

5. Resource efficiency generally refers to the technical efficiency of resource use; resource productivity, or the extent to which economic value is added to a given quantity of resources; and the extent to which resource extraction or use impacts on the environment. Improving resource efficiency therefore involves reducing the environmental impacts associated with the whole life-cycle of resources, from their extraction to their disposal (UNEP 2017). The concept of circularity, while similar, goes beyond resource efficiency in terms of its scope. It encapsulates principles such as reuse, recycling and remanufacturing with approaches that can enable the closing, extending and narrowing of material loops. Emphasis is placed on innovation, the development of new business models and product design standards (Preston and Lehne 2017).

Figure 16. The UNEP circularity approach



Source: UNEP (2019). UNEP circularity platform

Box 1. What is the circular economy?

While there is no universally agreed definition of circularity, the concept is grounded in the characterization of the world as a web of fundamentally interconnected and interdependent networks – one where greater efficiency is achieved by closing, extending and narrowing material loops. This sits in contrast to the traditional linear produce-consume-discard model. In a circular model, resources maintain at their highest value possible.

As illustrated in Figure 16, circularity builds upon value retention loops, and circular processes can be grouped into four categories, from the most impactful to the least:

- **Reduce by design:** Reducing the amount of material used, particularly raw material, should be applied as an overall guiding principle from the earliest stages of design of products and services.
- **From a user-to-user perspective:** Refuse, reduce and re-use.
- **From a user-to-business intermediary perspective:** Repair, refurbish and remanufacture.
- **From a business-to-business perspective:** Repurpose and recycle.

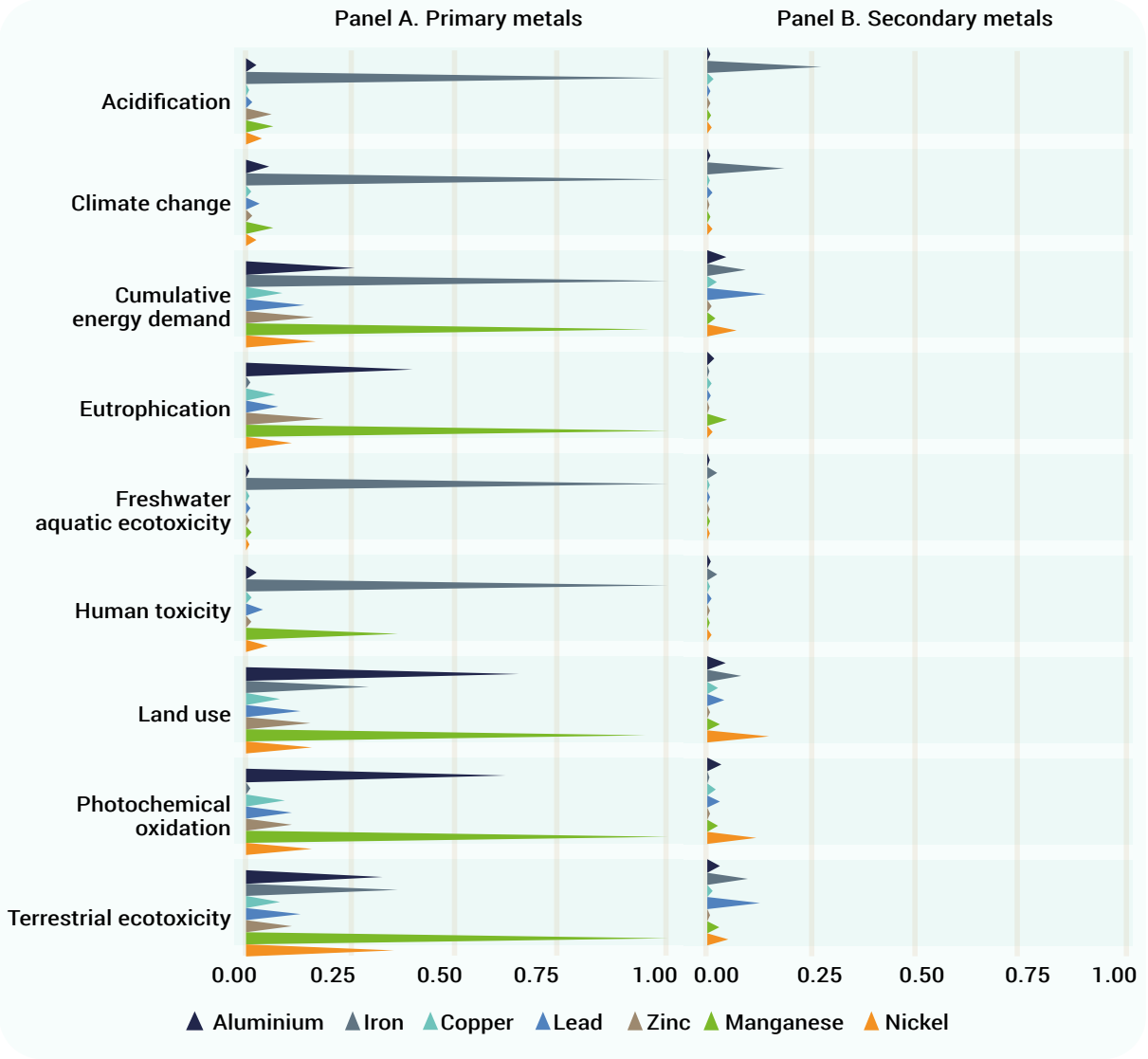
removal policies could reduce greenhouse gas emissions 90 per cent by 2060 (IRP 2019).

Specifically, the uptake of circular economy principles can reduce material resource use in a number of different ways. These include (IRP 2019):

- **Reducing materials through intensifying use of products.** For example, the sharing economy promotes sharing of cars or leasing of clothes, as opposed to owning these items.
- **Reducing excess material use through lightweight design.** For instance, it is possible to make car components or buildings more lightweight by optimizing their design, or by material innovations.
- **Reducing materials through material substitution.** For instance, bamboo has been proposed as a potential substitute for less-sustainable resources such as steel reinforcement, clothing and bio-oil. Likewise, biomaterials sourced from plants or algae can play an important role in displacing non-renewable minerals and metals. However, these benefits should be balanced against the embodied emissions and environmental impacts of the substitute materials (Preston *et al.* 2019).

In addition, a transition to a circular economy can reduce demand for material resource use through incentivizing the re-use of materials. This includes:

Figure 17. Comparative environmental impacts of primary versus secondary metals



Source: OECD 2019

- **Remanufacturing.** This involves taking a used product and restoring it to an almost new, or sometimes even better, condition. On average, producing remanufactured goods consumes much less energy compared to producing new goods, thus reducing the environmental impacts associated with resource extraction.
- **Re-use of industry waste and offcuts.** This involves, for instance, re-using blanking sheets of materials by other manufacturers who need to cut smaller pieces from the same type of material.
- **Exchange, second-hand trading and repair.** This includes opportunities for the re-use of products including cars, clothing, books furniture, household items, etc.
- **Re-use of containers and packaging materials.** This includes, for example, charging a small fee for a plastic bag to incentivize re-use.

Recycling is another integral part of a circular economy transition, which can further reduce the environmental impact associated with resource extraction. Unlike, for instance, material re-use, recycling requires the input of energy and other resources, in order to turn scrap materials into raw materials, and then again into a new product (Preston *et al.* 2019). The environmental benefits associated with recycling and the use of secondary materials thus depend on the input required in the recycling process, and how this compares to the inputs required when extracting and processing the material resources. While the inputs required for recycling are typically greater than the inputs required to reuse the materials, they are, for most products, an order of magnitude lower than what is required for primary production given that fewer steps are involved.

However, the large variations among different materials must be considered when determining whether to employ circular principles. For example, because the energy needed for glass recycling is similar to the energy required for virgin glass production (Preston *et al.* 2019), the environmental gains from glass recycling are limited. On the other hand, the production of metal scrap material, or secondary raw materials, is usually less energy intensive than the production of primary metals, and has a much lower environmental impact in terms of acidification, land use and terrestrial ecotoxicity (Fig. 17) (OECD 2019).

A transition to a circular economy is driven mainly by national policies. Although different countries have adopted different types of circular economy policies, common approaches at the national level include the adoption of taxes and subsidies, extended producer responsibility schemes, eco-design policies, circular procurement, eco-labelling and other standards that relate to the circular economy (OECD 2019). While circular initiatives largely take place domestically, international trade

plays a critical role in the transition to a circular economy, as global value chains have made the world interconnected (OECD 2019).

3.2 Trade, circularity and developing countries

Key messages

- A transition to a circular economy will affect trade flows between developed and developing countries. Despite a large number of unknowns, the following shifts in trade patterns can be expected: a decrease in trade in primary raw materials; an increase in trade in secondary raw materials; new opportunities for trade in services; a shift towards trade in products that meet circular standards; and a changing pattern of trade in waste and scrap for recycling.
- Anticipated shifts in trade can create both challenges and opportunities for developing countries. While these shifts present the opportunity for job creation and build competitiveness in new sectors, they will likely pose significant challenges for developing countries with a high dependence on raw material exports, weak governance structures and/or limited capacity to upskill or retrain workers.

As explained earlier, international trade is a key factor fuelling the demand for material resources. In recent decades, resource-intensive processes have shifted from high-income and densely populated importing countries to low-income and more sparsely populated exporting countries (UNEP 2015). This has led to a corresponding shift in the environmental and health impacts associated with extraction and processing activities from high-income importing countries to middle- and low-income exporting countries (IRP 2019). Most of the demand for these extractive processes, however, is fuelled by developed countries. This means that the uptake of circular economy principles predominantly in high-income countries could lead to a reduction in resource demand, and thereby reduce the environmental burden associated with resource extraction on middle- and low-income exporting countries.

A shift towards circularity, however, will alter trade flows between high-income and low- and middle-income countries, which is anticipated to have important consequences for these latter countries. The exact impact of a transition to a circular economy on international trade is difficult to anticipate as it depends on a range of variables, including the scope and speed of the circular transition (whether it is limited to a handful of countries or there is a large uptake of circular economy principles) as well as socioeconomic trends such as population growth and rising standards of living (van der Ven 2020). Despite these unknowns, several important shifts in international trade flows can be expected (van der Ven 2020):

- slower trade growth in primary raw materials;
- changing patterns of trade in waste and scrap for recycling;
- increased trade in secondary raw materials, second-hand goods and goods for re-manufacture;
- emergence of trade in new services, such as waste management, recycling, refurbishment, remanufacturing, etc.;
- shifts in trade towards products that meet circular economy standards.

The linkages between international trade and the circular economy are shown in Figure 18.

Some of the key opportunities and challenges arising from the circular economy transition in relation to trade and the environment are summarised in Table 1.

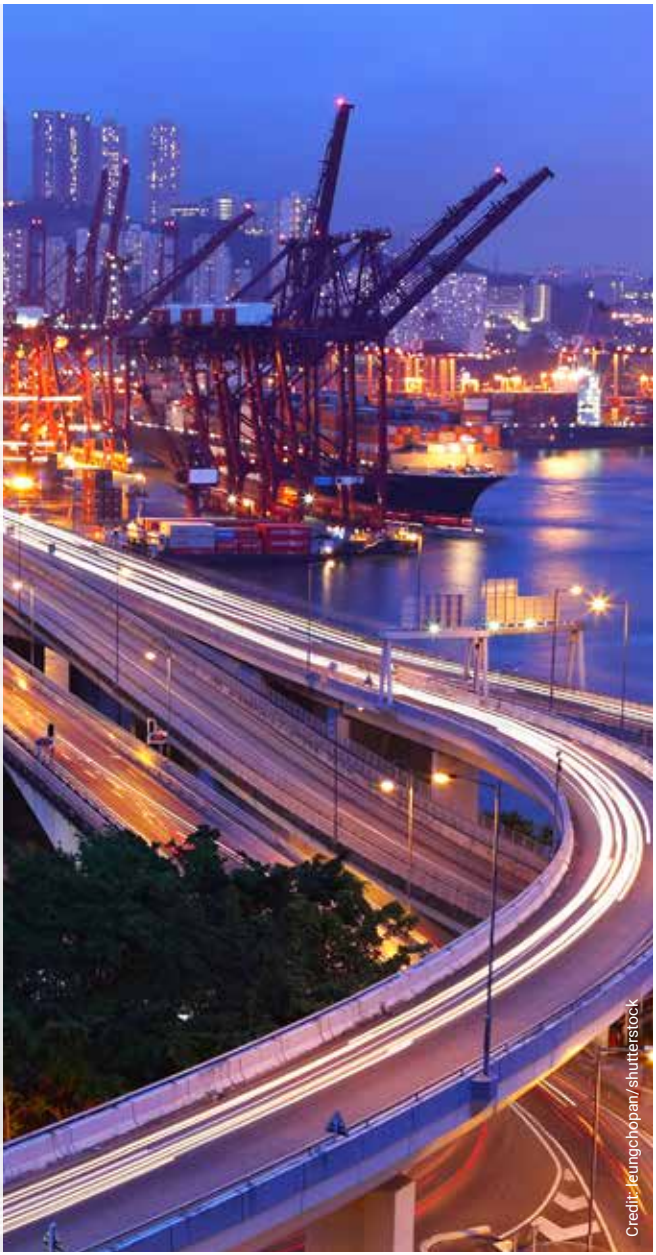
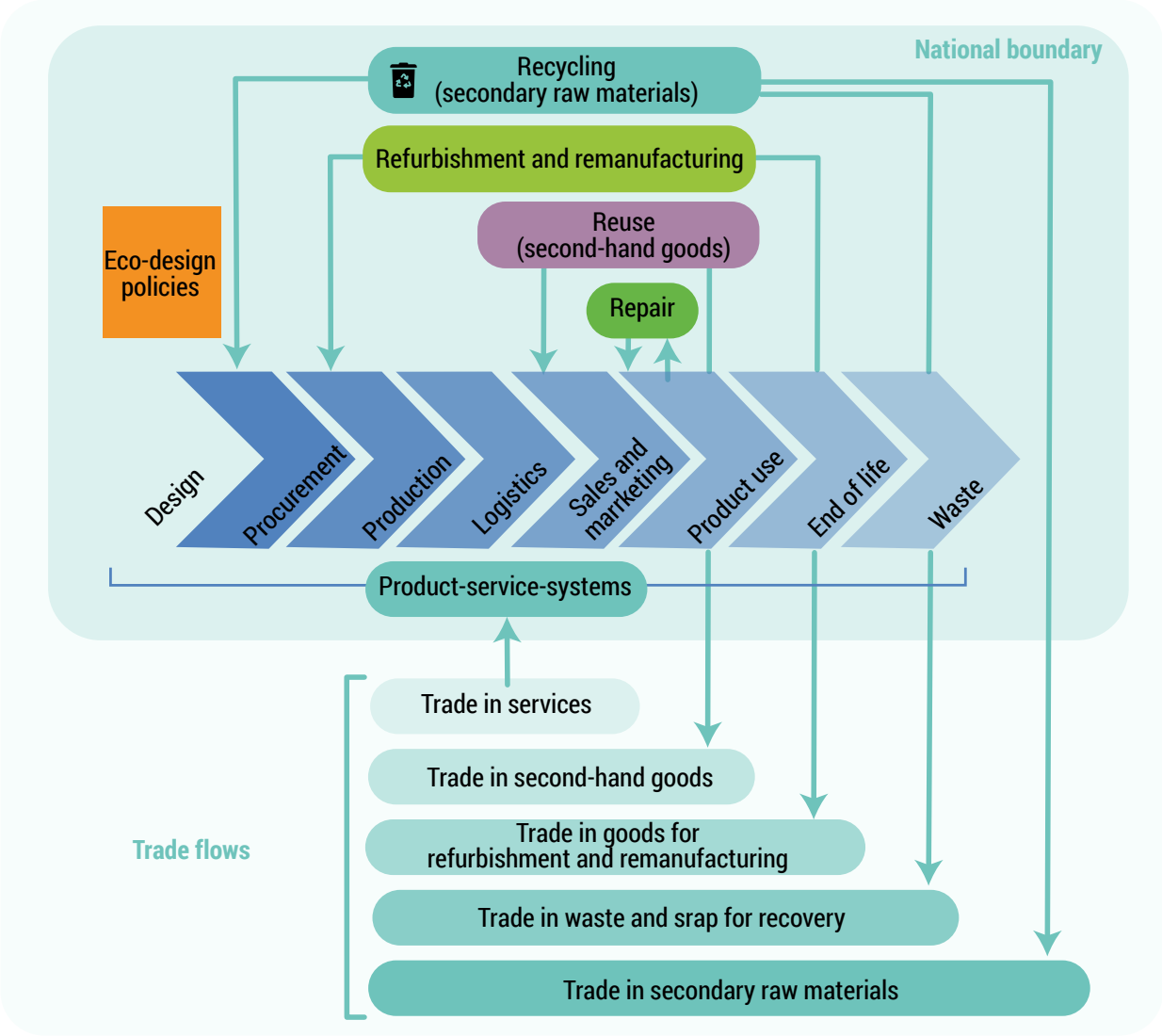

Credit: Jeungchopan/shutterstock

Figure 18. Linkages between international trade and the circular economy



Source: Yamaguchi 2018, reproduced with permission from the author

Table 1. Opportunities and challenges arising from the circular economy transition

	Opportunities	Challenges
Reduction in demand for material resources	• Environmental benefits – less water, land, energy* required for extraction and processing. • Reduced exports of material resources could grow domestic markets in developing countries as the development of higher-value downstream processing is encouraged.	• Economic implications for countries dependent on resource exports for income and jobs. Resource-rich / -dependent countries will need to diversify in alignment with circularity and sustainability frameworks and implement appropriate compensation and adjustment measures.
Changing patterns of trade in waste and scrap	• Reduced exports of waste (perhaps until such a time as the quality of waste exports and processing capability in the importing country can be assured) and increased domestic recycling. • If the above assurances can be made, more waste could be exported to countries with comparative advantage in sorting and processing into valuable materials. • Potential to substitute primary with secondary materials.	• Evidence suggests the direction of traded recyclable waste tends towards countries with less-stringent environmental standards and regulations and low processing costs. • Potential contribution to downcycling. • Risk that importing countries do not have the waste management capacity and/or have issues with illegal trade.
Increased trade in secondary raw materials, second-hand goods and goods for re-manufacture	• New reuse, repair and re-manufacturing business opportunities – job creation and green growth. • Potential for the creation of regional hubs for re-manufacturing and trade.	• Potential contribution to downcycling. • Definition and classification issues. • Could create loopholes for illegal trade in hazardous or contaminated waste. • Trade restrictions.
Shifts in pattern of trade in services	• Growth of sharing economy. • Innovative business models. • New employment opportunities.	• Trade barriers. • Digital divide could mean benefits are not evenly shared.

* According to the International Energy Agency, producing aluminium from scrap reduces the use of energy inputs by up to 95 per cent.

These anticipated shifts in trade flows create both opportunities and challenges for developing countries. For instance, the anticipated substitution of primary raw materials with secondary raw materials – which is expected to happen over time[6] – will mean, all other things equal, that demand for primary raw materials might decline. This could have serious implications for resource-rich developing countries, where revenues from resources constitute a large part of economic growth (OECD 2018). One study assessing the impact of an EU-wide transition to a circular economy on the region's critical and non-critical raw material trading partners found that 24 developing countries rely on raw material exports to the EU for between 1 per cent and 8 per cent of their gross domestic product (GDP) (Centre of Expertise on Resources [COE-R] 2016).[7]

A key factor that will determine the impact of a circular economy transition on developing countries is how many major importers will follow an ambitious circular pathway. This could have a significant impact on those developing countries with a high dependence on raw material resource exports.

In the EU study, 10 developing countries were found to have a GDP dependence ratio of over 10 per cent (COE-R 2016). Demographic pressure and governance issues accentuate the risks posed by their economic vulnerability. Moreover, in many resource-rich / resource-dependent developing countries, revenues gained from resource extraction and trade help drive development and economic growth. These countries may view circularity with caution, seeing it as a possible threat to growth and development prospects rather than as an opportunity for diversification (Preston *et al.* 2019). At the same time, circularity will provide pressure for resource-rich countries to diversify their economies and generate economic transformation away from primary material production, which could create great opportunity for developing countries to move up the value chain.

A circular economy involves the substitution of primary raw materials by secondary raw materials. We can thus expect an increase in trade of secondary materials. As there exists no globally accepted definition of secondary raw materials, it is difficult to track the trade flows. However, a 2018 OECD report identified trends in trade in steel scrap by identifying the HS code, finding that over the last 25 years, global trade patterns in steel

6. A study by Dussaux and Glachant (2019) empirically tested whether increased domestic recycling of metals and minerals offset dependency on primary raw material imports. They found, among other things, that increased domestic recycling had no impact on the levels of imports of primary raw materials (cited in OECD forthcoming).
7. Countries that are most exposed are the Democratic Republic of the Congo, Guinea, Guyana, Liberia, Madagascar, Mauritania, Mozambique, Namibia, Niger, the Republic of the Congo, Sierra Leone, South Africa, and Suriname.

scrap have generally grown, with OECD countries mostly accounting for that growth (OECD 2018).

The OECD reported that global trade in waste and scrap in 2018 reached USD 95 billion, with metals accounting for the majority (82% of exports in value terms, followed by paper (12%) and plastics (3%) (OECD, Forthcoming). An increase in demand for waste and scrap provides developing countries with a comparative advantage in the sorting, recycling and remanufacturing of materials with additional economic opportunities. Since scrap importing countries are often also manufacturing hubs, developing a competitive scrap industry would not only have environmental benefits but could also make economic sense (van der Ven 2020). Waste becomes a tradeable product when countries decide not to, or do not have the capacity to, process waste for recycling domestically. According to OECD data, trade in waste and scrap increased significantly between 2003 and 2016: by 48 per cent in weight and 183 per cent in value (OECD 2018).

While increased trade in waste and scrap presents opportunities, it can also create significant challenges – including that it does not align with the proximity principle, according to which waste must be treated as closely as possible to where it was generated. Most waste is traded from developed countries to developing countries, which typically have underdeveloped waste management capacity, and/or have laxer environmental regulations in place. In these situations, increased trade in waste and scrap can result in "waste dumpting". This refers to increased import volumes of waste either of insufficient quality for recycling, that is hazardous, or for which a country lacks the capacity to recycle. As a result, the imported waste often ends up in landfills or is dumped in a manner that does not protect the environment, thereby contributing to a growing waste crisis.

Waste dumping is facilitated by a lack of international standards that categorize different types of waste, making it difficult for an importing country to differentiate between waste and recyclable and reusable waste (van der Ven 2020). In response to these challenges, a number of countries have started to impose trade restrictions on certain types of waste imports. For instance, in January 2018, China imposed import restrictions on various types of plastic and unsorted waste paper, while India banned solid plastic waste in 2019. In addition, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes (Basel Convention) sets out a framework to regulate transboundary movements of hazardous waste. For instance, the Basel Convention has imposed strict rules on trade in e-waste, allowing only for re-usable e-waste to be exported from OECD to non-OECD countries. In a recent amendment, which will become effective

in January 2021, the Basel Convention offers a distinction between hard- and easy-to-recycle plastic, with hard-to-recycle plastic requiring prior informed consent before it can be traded (Basel Convention Plastic Waste Amendment).

Increased imports of second-hand products into developing countries, which is also predicted to occur as the lifespan of products is expanded, has generated various concerns for these countries, including that second-hand imports will undermine a country's ability to develop competitive local industries. However, concerns also relate to low quality, illegal trade and lack of operational efficiency. For instance, second-hand motor vehicles are typically less energy efficient than newer vehicles. On the other hand, an increase in second-hand imports also creates employment opportunities, especially in industries such as clothing.

Standards for eco-design and recycling are also predicted to increase as a result of an increase in the uptake of circular economy measures. While labelling schemes relevant to the circular economy are in their early stages and uptake is limited, work is being done to develop either management or product standards, the latter of which can be upstream standards relevant for product design and production, and downstream standards related to secondary materials (Box 2) (OECD forthcoming). These standards play a key role in incentivizing circular business practices, and could have an impact on more efficient material resource extraction from developing countries. On the other hand, the standards could serve as non-tariff barriers for imported products from developing countries, as these countries may not have the capacity to meet more stringent environmental and other standards.

While numerous companies in developed countries have begun including plans to introduce circularity into their supply chains, this has been more challenging for companies in developing countries. One study focused on India identified 16 barriers to incorporating circular supply chain management (Mangla 2018). Many other developing countries will face similar challenges and limitations when moving towards circular supply chain management.

Finally, as different stages of the circular value chain depend directly on the delivery of services, an uptake of circular economy principles is predicted to lead to new trading opportunities in various services sectors. Specifically, such services include those used at the product design stage, through research and development or eco-design; the sourcing stage which relates to the collection and sorting of waste material and its transformation into secondary raw materials; and the production stage which refers to remanufacturing or refurbishing. Other,

more traditional services including installation, assembly, testing, or maintenance management are also key. (IISD 2020). The heightened importance of services in these areas could provide an opportunity for developing countries with a comparative advantage, or dormant comparative advantage, in these sectors.

Box 2. Product standards relevant to the circular economy

Circular economy product standards (upstream)

- International Material Data Systems
- EU Directive on the restriction of hazardous substances
- Extended producer responsibility schemes and modulated fees (France, Germany, Italy)
- CEN/CLC/JTC10 – General method for assessing the proportion of recycled material content in energy-related products (pending approval)
- CEN/CLC/JTC10 – General methods for assessing the recyclability and recoverability of energy-related products (Reference EN 45555:2019)
- CEN/CLC/JTC10 – General methods for the assessment of the ability to repair, reuse and upgrade energy-related products (Reference 45555:2019)
- Product 10Y reparability label
- Austria standard on recyclability (ONR 192102:2014)
- Global Organic Textile Standard
- Higg Material Sustainability Index

Circular economy product standards (downstream)

- Circular Economy Action Plan – quality standards for secondary raw materials (ongoing)
- British Standards Institute voluntary standard PAS141:2011 – reuse of used and waste electrical and electronic equipment
- American National Standards Institute "Specifications for the Process of Remanufacturing – RIC001.1-2016
- CEN/CLC/JTC 10 – General method for assessing the proportion of reused components in energy-related products (Reference EN 45556:2019).

Source: OECD forthcoming

3.3 Trade agreements and the circular economy

Key messages

- Trade agreements – both regional and multilateral trade agreements – can be used proactively to advance the circular economy and minimize the environmental impacts associated with resource extraction.
- The World Trade Organization could be a platform for Members to advance specific initiatives related to the circular economy and could focus on enhancing coherence and policy alignment between the environment and trade.
- With respect to regional trade agreements, developing countries must find ways to utilize these agreements more proactively and employ them as instruments to leverage the opportunities and minimize the challenges associated with a transition to a circular economy. This can be done, for instance, by aligning market access commitments and by including specific provisions on technical standards.
- It is also important to ensure that regional trade agreements do not undermine any commitments made relevant to the circular economy, including under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (the Basel Convention).
- Regional trade agreements can also be used to reduce demand for material resources and support the adoption of renewable energy, including by regulating fossil fuel subsidies and incentivizing trade in renewable energy products and services.

This section examines the linkages between resource extraction, trade agreements and the circular economy. First, it sets out how the World Trade Organization (WTO) delineates the policy space that countries have to adopt circular economy measures, thereby seeking to find a balance between enabling countries to adopt measures to protect the environment while ensuring non-discriminatory trade. It further discusses how the WTO as an institution can serve as a platform to advance the circular economy. Second, the section explores how trade agreements can be used proactively to facilitate a transition to a circular economy, both focusing on current practices and proposing new ideas. For instance, it is critical to ensure that trade agreements do not undermine countries' commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, or other international environmental agreements.

3.3.1 The WTO and the circular economy

The adoption of circular economy measures, such as extended producer responsibility schemes or standards, subsidies and taxes, will have effects on trade. As a result, they must comply with the requirements of multilateral trade rules set out in the WTO, in addition to any requirements that a country has agreed to through regional trade agreements. This section explains the key WTO rules that could be applicable to circular economy measures, and then focuses on ways that the WTO could contribute to the circular economy more generally.

The WTO's General Agreement on Tariffs and Trade (GATT) requires that measures applicable to goods must be non-discriminatory, meaning that members must treat products from other members no less favourably than domestic "like" products (National Treatment) and "like" products from other countries (Most Favoured Nation). In the context of the circular economy, it would be important that countries be able to adopt measures on the basis of circular characteristics. For instance, countries should be able to differentiate between products made from primary raw materials and recycled materials / secondary raw materials, or products that meet certain energy efficiency thresholds versus those that do not.

To date, there is no clear consensus on how these types of questions would be treated in the context of the non-discrimination provisions of the GATT (Preston *et al.* 2019). It remains an open question in the WTO jurisprudence as to whether products that differ on the basis of their processes or production methods – as opposed to physical characteristics – can be considered unlike for purposes of the discrimination provisions.

Should circular economy measures be considered discriminatory, however, such measures can still be justified under the general exceptions clause set out in Article XX of the GATT, if a party can demonstrate that the measure complies with some general requirements and is either "necessary to protect human, animal or plant life or health" or "relating to the conservation of exhaustible natural resources" (Box 3).

Box 3. Policy space to regulate retreaded and second-hand tires

In 2005, the European Union challenged Brazil's import ban on retreaded tires. Retreading tires is a process whereby tires are recycled and their life span is extended by 30-100 per cent. While this process advances the circular economy, it could also lead to higher levels of waste as the life span of retreaded tires is much shorter than for new tires. This creates a problem especially in tropical countries like Brazil, as tires disposed in landfills can fill with water and become breeding grounds for mosquitos and vectors for disease.

Brazil imposed a ban on the import of retreaded tires to minimize these challenges. It argued that the ban was justified under GATT Article XX, as the measures were taken to protect human, animal or plant life or health.

While the panel ultimately considered the ban to be WTO-inconsistent as it did not comply with the general conditions of Article XX, the Appellate Body confirmed that the measure was necessary to protect human life or health under Article XX(b). As such, this case is generally considered to be a ruling that advances environmental policies, with WTO expert Joost Pauwelyn noting that it turned Article XX into a "catch-all obligation to engage in sound and reasonable environmental policies".

Source: WTO 2020; International Centre for Trade and Sustainable Development 2010; van der Ven 2020.

Circular economy policies typically involve the adoption of standards to facilitate the transition to a circular economy. Such standards are subject to the requirements set out in the Agreement on Technical Barriers to Trade (TBT Agreement). This agreement requires that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade. Specifically, it requires that "technical regulations shall not be more trade restrictive than necessary to fulfil a legitimate objective", which it notes includes the protection of the environment.

Other provisions encourage that technical requirements and standards are harmonized/aligned with international standards, such as standards set by the International Organization for Standardization (ISO), wherever possible. These types of provisions ensure that standards and labels do not hinder market access that could be caused by the proliferation of schemes across jurisdictions that impose different requirements. It is therefore important that schemes align with international standards, such as the ISO standard for the circular economy, which is under development. In this sense, the framework that governs the adoption of technical standards in

the WTO could be leveraged to facilitate trade in products that meet circular standards.

Moreover, the WTO plays an important role in enhancing transparency and cooperation, which is relevant to the circular economy. For instance, the TBT Committee and the Committee on Trade and Environment both serve as platforms where Members can exchange information and best practices, including with respect to environmental regulations (Wijkstrom, 2015, cited in IISD 2020). Moreover, the WTO aims to enhance transparency. Indeed, a number of provisions require Members to notify, and to provide other Members an opportunity to comment on, new certain types of new regulations that are adopted. Specifically, transparency provisions are a key part of the WTO TBT Agreement, requiring Members to notify in advance technical regulations, including those with environmental objectives, to provide other Members with an opportunity to comment on these regulations before they go into effect. The combination of committee meetings and transparency provisions that are build into various WTO provisions relevant to the environment enhance transparency between Members vis-à-vis various regulations that are relevant to the circular economy. The WTO could build on these existing provisions and practices by enhancing transparency and cooperation between Members specifically related to measures at the intersection of trade and the environment, including the circular economy.

The WTO can play an important role in advancing circularity in other ways. It could include the circular economy – or sustainability more generally – as a priority area during the 12th Ministerial Conference in June 2021 by, for instance, adopting a statement or decision that sets out Members' intention to advance the circular economy through trade. A number of developing countries have shown support for adopting a circular economy agenda, including Ghana, Morocco, Namibia and Sri Lanka (Birkbeck 2019). Moreover, Members could use the WTO platform to advance specific initiatives relevant to the circular economy. For instance, China has been using the WTO to address issues in trade and plastic waste. Other initiatives could focus on enhancing coherence and policy alignment between the environment and trade, for example with a focus on the Basel Convention and the WTO.

Specifically with respect to developing countries, the WTO's Aid for Trade initiative, which helps developing countries overcome trade-related constraints, could provide targeted support to build capacity in emerging industries relevant to the circular economy, such as recycling and waste management, or help businesses in developing countries meet eco standards and labelling requirements.

3.3.2 Regional trade agreements as circular enablers

Regional trade agreements have proliferated over the last decade, in part in response to the slow pace of multilateral negotiations. Already, a variety of types of provisions are present in regional trade agreements to advance resource efficiency and circularity, and additional ways exist in which regional trade agreements could be used to help countries leverage the circular economy while mitigating any negative effects.

At present, no concluded free trade agreement contains a direct reference to the circular economy. Three EU agreements, the updated EU-Mexico Free Trade Agreement and the EU's free trade agreements with Australia and New Zealand that are under negotiation or awaiting ratification, do include a direct reference to the circular economy, aiming to enhance cooperation. The EU's Australia and New Zealand agreements include the following provision:

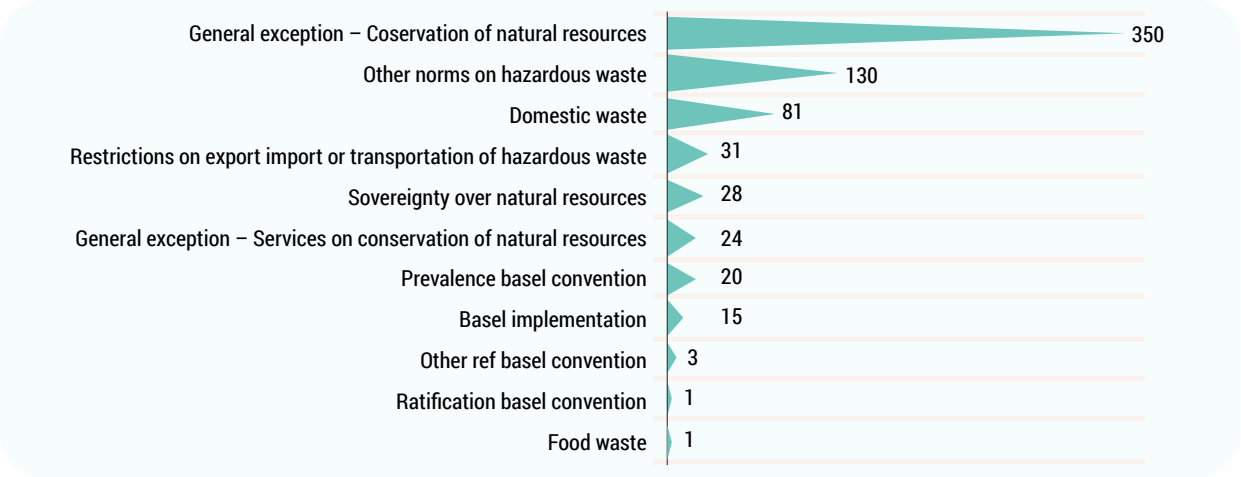
> The Parties shall work together to strengthen their cooperation on trade-related aspects of environmental policies and measures, bilaterally, regionally and in international fora, as appropriate, including in the UN High-level Political Forum for Sustainable Development, UN Environment, UNEA, MEAs,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

This language, however, is weak as it merely focuses on strengthening cooperation, including in areas related to the circular economy. A number of other ways exist in which regional trade agreements have incorporated, either in the main body or in side agreements, provisions that relate to natural resource management and waste management. The TREND Analytics database, a joint initiative of the German Development Institute and Laval University, found that 385 out of 730 trade agreements concluded between 1945 and 2018 contain provisions related to the environment.

These provisions, for the most part, are general exception provisions similar to GATT Article XX (Fig. 19). Other provisions regulate hazardous waste and domestic waste, govern sovereignty over natural resources, or make references to the Basel Convention – either strengthening each Party's capacity to implement and enforce obligations under the Convention, or requiring parties to "reaffirm their commitment to effectively implement in their laws and practices"[8] their commitments made under the Basel Convention.

8. This language is taken from the Colombia-Peru EU Free Trade Agreement (2012), Art. 270(2).

Figure 19. Circular economy-related provisions in regional trade agreements, 1945-2018



Source: OECD forthcoming

To make trade agreements a more effective tool to advance the circular economy and enhance resource efficiency, future regional trade agreements need to go one step further and address some of the challenges associated with a transition to circularity, especially for developing countries.

For instance, developing countries could leverage circular economy opportunities by strategically negotiating market access in both goods and services. Given the close interaction between goods and services in the context of the circular economy, an integrated approach to facilitating trade in goods and services affecting the circular economy would likely have the largest impact (IISD 2020).

Specifically, they could remove tariffs on goods required to develop a circular economy infrastructure, such as machinery for waste processing, waste containers, new materials needed for eco-design, etc. – which can be significant. With regard to services, developing countries could open up sectors that are relevant to optimizing resource use while minimizing waste, for instance sewage services (WTO Central Product Classification code 9401), refuse disposal services (9402), and sanitation and similar services (9403). Regional trade agreements could also be used to make commitments in services sectors that are relevant to the circular economy but are not currently covered in the Service Sectoral Classification W/120, such as waste recycling.

Moreover, the lack of harmonization of circular economy standards and/or regulation can operate as a market access barrier, especially for small and medium enterprises (SMEs) that are unable to navigate and comply with multiple different standards and regulations; and for exporting firms in developing countries facing less stringent requirements for products and services. Indeed, a IISD report found, based on surveys conducted with businesses that provide services relevant to the circular economy, that the most frequently cited market access barrier concerned diverging regulatory requirements in different jurisdictions, especially on secondary material or waste trade (IISD 2020).

From a developing country perspective, it is better to develop a uniform set of standards internationally than to be confronted with different standards in different export markets. Thus, developing countries should participate in the process of developing international standards under the ISO and the Basel Convention. International assistance will be important to help the private sector in these countries meet standards related to circularity. Alternatively, regional trade agreements could facilitate trade in circular products / renewable energy by establishing mutual recognition of the parties' respective circular standards, provided that they have the same effect.

More generally, there are a number of other substantive provisions typically contained in regional trade agreements that can advance the circular economy. For instance, agreements could include provisions that give market correcting subsidies (those that internalize environmental externalities) special treatment under subsidy disciplines. Government procurement is another area in which regional trade agreements could advance the circular discussion. For instance, agreements could contain provisions that confirm the right to discriminate on the basis of environmental criteria, including circular economy standards. (Crosbey, 2016). Moreover, regional trade agreements could ensure that provisions on investment do not hinder governments from adopting regulation to move towards a circular economy.

3.3.3 Aligning trade agreements and the Basel Convention

Trade and the environment are governed by different sets of rules. For trade agreements to advance circularity and resource efficiency, trade and environmental rules need to be aligned. The lack of alignment, especially between existing trade rules and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, can hinder the facilitation of trade and circularity.

A key challenge for developing countries in the context of trade and the circular economy is determining the quality of the secondary materials

that are being imported. This could help a developing country decide whether the material should be imported, or whether it is of such poor quality or so difficult to recycle that it is preferable to keep the product out of the country's economy.

Whether a product classifies as waste, scrap or secondary material is determined at a national level and could differ among countries. Moreover, the Harmonized System that is used to categorize traded products, which is maintained by the World Customs Organization, is based on parameters that are misaligned with the Basel Convention. For instance, a distinction between hazardous and non-hazardous waste is critical under the Basel Convention, as it prohibits trade in hazardous waste but allows for trade in non-hazardous waste. However, the Harmonized System codes that cover waste and scrap do not differentiate between these wastes, and customs officials must determine whether waste is hazardous or not on a case-by-case basis.

In situations where the Harmonized System code does differentiate between different types of secondary waste – as between used products and waste – enforcement is challenging due to a lack of visual differentials. These examples speak to a general misalignment between the Harmonized System codes, which are based on physical product descriptions and can easily be verified by customs officials, and the characteristics that enable differentiation between secondary products.

One way to overcome this misalignment would be to introduce differentiation of waste based on product characteristics such as recycling potential. A recent amendment to the Basel Convention – to enter into effect in January 2021 – offers a distinction between hard- and easy-to-recycle plastic, whereby hard-to-recycle plastic requires prior informed consent before it can be traded, and easy-to-recycle plastic is not subject to any obligations. These developments must also be reflected by creating different Harmonized System codes depending on the ease of recycling. Absent progress internationally, parties to a regional trade agreement can commit to do this under the agreement.

A related issue is ensuring that regional trade agreements do not undermine commitments that countries have made under the Basel Convention. In particular, asymmetrical regional trade agreements between a large economic player and a smaller developing country can create pressure to bypass Basel Convention commitments and/or countries' environmental regulations.

For instance, an industry group representing the world's largest chemical and fossil fuel companies is lobbying the United States to influence the ongoing US-Kenya Free Trade Agreement negotiations to reverse Kenya's strict limits on plastic and its limits on the import of foreign plastic garbage (Tabuchi *et al.* 2020). The group aims to use Kenya as a hub through which US-made

chemicals and plastics can be supplied to other African markets. If pushed through, the regional trade agreement would negate any progress made in the context of the Basel Convention. It is critical that countries are aware of this.

3.3.4 Using trade agreements to reduce energy resource extraction

There are additional ways in which trade agreements can be used to reduce the demand for material resources and incentivize the adoption of renewable energy. For instance, trade agreements could play a role in limiting the use of subsidies for the production and consumption of fossil fuels, which globally amount to over $500 billion a year. Subsidies make greenhouse gas-emitting fuels cheaper, thus creating an incentive to produce more. During the 2017 WTO Ministerial Conference (MC11), a sub-set of WTO Members adopted the Fossil Fuel Subsidies Reform Ministerial Statement, which called for further WTO action to discipline fossil fuel subsidies (Verkuijl *et al.* 2019). Given how the WTO Agreement on Subsidies and Countervailing Measures is structured, it is challenging to determine whether specific types of fossil fuel subsidies would be WTO consistent.

Some progress is being made at the regional level to discipline fossil fuel subsidies. For instance, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership prohibits specific subsidies for fisheries – including fuel subsidies – that would "negatively affect fish stocks that are in an overfished condition" or are caught through illegal, unreported and unregulated fishing.[9] Moreover, a regional trade agreement between the EU and Singapore, which is still awaiting ratification, includes a provision requiring that the parties recognize the need to reduce greenhouse gas emissions and limit the distortions of trade as much as possible when developing public support systems for fossil fuels. The agreement also contains a provision in which parties share the goal of progressively reducing fossil fuel subsidies (Verkuijl *et al.* 2019). Additionally, in September 2019, Costa Rica, Fiji, Iceland, New Zealand, Norway and Switzerland launched the Agreement on Climate Change, Trade and Sustainability (ACCTS), the scope of which is envisioned to include disciplines to eliminate harmful and socially regressive fossil fuel subsidies.[10]

For developing countries, including disciplines in regional trade agreements that prohibit harmful fossil fuel subsidies may be very challenging, especially given the vast consumer subsidies that governments such as India and Indonesia provide to ensure that these fuels are affordable for the poor. However, there are other, less drastic

9. Comprehensive and Progressive Agreement for Trans-Pacific Partnership, Art. 20.16.5 (21 February 2018).
10. New Zealand Foreign Affairs and Trade, "Agreement on Climate Change, Trade and Sustainability (ACCTS) negotiations", https://www.mfat.govt.nz/en/trade/free-trade-agreements/climate/agreement-on-climate-change-trade-and-sustainability-accts-negotiations.

ways in which international trade agreements could be leveraged towards reforming fossil fuel subsidies. This includes, as a first step, creating capacity-building and technical assistance to help countries get a better picture of energy subsidies, the environmental impact, and how it can be improved. This could also include sharing best practices on how fossil fuel reform could be improved while meeting a country's energy needs. Moreover, enhancing transparency could also be an important first step towards progressive fossil fuel subsidy reform. The WTO could play a leading role in enhancing fossil fuel transparency, for example by including it in Trade Policy Reviews (Verkuijl *et al.* 2019).

While trade agreements can be used to disincentivize fossil fuel subsidies, they could also be used to incentivize trade in renewable energy products and services. This can be done by alleviating barriers to trade and investment in environmental goods and services to incentivize the diffusion of environmental technologies. Steps could include removing tariffs on environmental goods, for example through an approach similar to the Environmental Goods Agreement and by making commitments for environmental services. Countries could also lower non-tariff barriers relevant to trade and investment in renewable energy generation.

The EU-Singapore Free Trade Agreement includes a chapter covering this, requiring parties to, among others, refrain from adopting local content requirements on renewables, refrain from adopting measures requiring the formation of partnerships with local companies (with certain exceptions), and ensure that rules concerning the authorisation, certification and licensing procedures are applied in an non-discriminatory manner.[11] It also includes provisions requiring the harmonization of standards for the generation of energy from renewable and sustainable non-fossil sources to relevant international standards, and specifications about the design of product requirements, including environmental performance.

Not all of these provisions will be relevant for developing countries that are negotiating regional trade agreements. It is important that developing countries have enough policy space to diversify their economies, adopt green industrial policies and build up renewable industries. However, this serves as an example of the different ways in which trade agreements can be used both as a tool to leverage renewable energy use, and as a tool to disincentivize certain types of material resource extraction such as harmful fossil fuels.

11. EU-Singapore Free Trade Agreement, Chapter 7, Non-tariff barriers to trade and investment in renewable energy generation, 14 November 2019, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22019A1114(01)&from=EN#page=26.

Credit: Vladimka production/shutterstock

4. Recommendations for Policymakers

Key messages

- A shift towards a circular economy can reduce the environmental impact associated with the extraction of primary raw materials.
- Trade agreements - including regional and multilateral trade agreements - can play a key role in advancing a transition towards a circular economy. Countries can demonstrate leadership by proactively linking trade agreements with the environmental agenda, including through circularity. In doing so, it is important to address challenges and leverage opportunities specific to developing countries and a transition to a circular economy.

The following policy measures related to trade and the environment will be key to reducing demand for extractive resources and driving the transition to an inclusive, green and more circular economy.

4.1. Enhance alignment between international trade and environmental legal frameworks

- Enhance the understanding of ways in which the circular economy can create viable inputs of resources for value chains and reduce the environmental impacts associated with resource extraction.
- Adopt a systems approach to trade and the environment. This requires better understanding the impact that transitioning to a circular economy will have on trade flows, especially with developing countries, in order to clarify how these countries can leverage opportunities and mitigate any challenges.

4.2. Align trade agreements with domestic environmental policies and priorities

- To leverage the opportunities and mitigate any challenges associated with the circular economy, developing countries should proactively study the impact and identify leverage points.

- Resource-dependent developing countries should be proactive about aligning trade agreements to economic diversification strategies that shift away from dependence on primary materials.

4.3. Ensure that trade agreements move towards a circular economy that is inclusive of developing countries

- Integrate support for circularity initiatives into development assistance, such as Aid for Trade. This could be harnessed to help countries transition to resource-efficient, more circular economies as well as adjust to the risks and opportunities posed by circular economy policies in the economies of major trading partners.
- Ensure that discussions about the circular economy at the World Trade Organization and other international fora take account of the interests and concerns of developing countries.
- Consult and share information with stakeholders about new circularity measures. Ensure that reasonable time is given to enable stakeholders to adjust, and that adequate assistance is provided to developing countries to support their adaptation.
- Enhance international dialogue and cooperation in an effort to better understand and respond to the distributional impacts of circular economy policies.

4.4. Proactively use regional trade agreements to advance circularity and reduce demand for primary raw materials

- Leverage trade and other international agreements to strengthen environmental management and governance of material resource extraction.
- Integrate meaningful provisions directly related to circularity in trade agreements and ex-ante trade impact assessments and ensure that these are fully implemented and the impacts monitored.

- Include provisions both within and outside environment/sustainable development chapters that promote resource efficiency. For instance, this could include provisions on technical standards, subsidies and market access.
- Ensure alignment of trade agreements and environmental commitments related to circularity. Specifically, ensure that commitments made under the Basel Convention are not undermined by trade agreements.
- Explore ways in which trade agreements can be used to disincentivize harmful fossil fuel subsidies, while incentivizing trade in renewable products.
- Leverage trade agreements to alleviate barriers to trade and investment in environmental goods and services to ensure diffusion of the best-available environmental technologies.
- Advance dialogue and research about additional creative ways to enhance the link between trade and the circular economy to minimize the environmental impact associated with the resource extraction of primary raw materials.

4.5. Advance the development of international standards for circularity

- Push for the harmonisation of definitions and classifications related to waste and treatment practices. Clarify when and following what processes waste becomes a secondary material. This will be crucial to enable especially developing countries to know what kind of material resources are being imported, and to prevent these countries from becoming the world's waste basket.
- Support the finalization of the ISO international standard for the circular economy, giving due consideration to the potential wider impacts of such a standard and indicators for monitoring. This is especially important for developing countries, as they wish to engage in the standard-development process.
- Adopt global recyclability and eco-labelling standards and set international and national resource efficiency targets.

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5. Conclusion

A transition to a circular economy can play a key role in reducing demand for material resources. Raising environmental standards for extraction and improving sustainable production and sourcing will minimize the environmental harm associated with resource extraction. However, such a transition, led by developed countries, will create both challenges and opportunities for resource-dependent developing countries. Some of these challenges relate to the disconnect between multilateral frameworks that govern the environment, and the multilateral trade rules; others relate to policy space and ensuring that developing countries do not cement their position as the world's waste basket. On the other hand, a transition to a circular economy presents opportunities for developing countries, including the chance to move away from resource dependence and to diversify their economies into emerging sectors such as recycling and renewables.

Trade agreements – both regional and multilateral trade agreements – can play a key part in facilitating the uptake of circularity while minimizing associated challenges. The WTO has a role to play in signalling the need to prioritize environmental considerations – including those related to resource extraction – in ongoing negotiations. The WTO could also be a platform for countries to share best practices on environmental issues, and could contribute to enhancing transparency relevant to environmental practices. Regional trade agreements could be used to alleviate barriers to trade and investment in environmental goods and services by harmonizing product standards that are relevant to circularity. They could also tailor market access commitments to industries such as services and waste management.

It is also critical to enhance alignment between the Basel Convention and regional trade agreements. Regional trade agreements could risk undermining commitments made under the Basel Convention – a situation that must be avoided.

Moving beyond circularity, trade agreements can play a key role in reducing energy material resource extraction. Discussions and initiatives are ongoing at both the multilateral and regional levels about how trade agreements can discourage or prohibit harmful fossil fuel subsidies. On the flip side, regional trade agreements are starting to include provisions that liberalize trade in renewable energy products and services, with the aim of facilitating the uptake of renewables.

Considerations for developing countries can be different than for high-income countries. More research is required to develop a more comprehensive and specific approach on how and where trade agreements can be leveraged to help developing countries reduce the environmental impact associated with resource extraction, while also mitigating any spill-overs resulting from a transition to a circular economy. At a minimum, this will require targeted capacity-building and development assistance.

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About UNEP's Environment and Trade Hub

The United Nations Environment Programme's Environment and Trade Hub enables countries to use trade and investment as vehicles for achieving the environmental dimension of the 2030 Sustainable Development Agenda. Launched in 2015, the Environment and Trade Hub serves as the overarching delivery mechanism for United Nations Environment Programme's (UNEP) work on trade. Through research, capacity building and policy advisory services, the Hub works with many partners across the globe to provide tailored support to countries seeking to make trade work for the environment, resilience and prosperity.

In focusing on the three planetary crisis – climate change, biodiversity loss and pollution – the Hub promotes mutually supportive trade and environment policies across four key areas: Trade in Environmentally Sound Technologies; Governance at Trade & Environment Nexus; Green Markets & Global Value Chains; and Reducing the Footprint of Trade and Greening the Brown.

The Hub develops analyses, tools and methodologies on the trade and environment nexus and offers advisory services according to countries' needs and priorities. By acting as a convener and facilitator for policymakers, civil society, the private sector and academia, the Hub also promotes national, regional and international cooperation between environment and trade communities and shapes the global agenda on environment and trade.

More information about the Hub can be found at:
Website: www.unenvironment.org
Twitter: @UNGreenEconomy
Facebook: @GreenEconomyUNEP
Contact: unenvironment-trade@un.org

About the International Resource Panel

The International Resource Panel was established to provide independent, coherent and authoritative scientific assessments on the use of natural resources and their environmental impacts over the full life cycle. The Panel aims to contribute to a better understanding of how to decouple economic growth from environmental degradation while enhancing well-being.

Benefiting from the broad support of governments and scientific communities, the Panel is constituted of eminent scientists and experts from all parts of the world, bringing their multidisciplinary expertise to address resource management issues. The information contained in the International Resource Panel's reports is intended to be evidence based and policy relevant, inform policy framing and development, and support evaluation and monitoring of policy effectiveness.

Since the International Resource Panel's launch in 2007, more than 30 assessments have been published. The assessments of the Panel to date demonstrate the numerous opportunities for governments, businesses and wider society to work together to create and implement policies that ultimately lead to sustainable resource management, including through better planning, technological innovation and strategic incentives and investments.

Following its establishment, the Panel first devoted much of its research to issues related to the use, stocks and scarcities of individual resources, as well as to the development and application of the perspective of 'decoupling' economic growth from natural resource use and environmental degradation. These reports include resource-specific studies on biofuels, water and the use and recycling of metal stocks in society.

Building upon this knowledge base, the Panel moved into examining systematic approaches to resource use. These include looking into the direct and indirect impacts of trade on natural resource use; issues of sustainable land and food system management; priority economic sectors and materials for sustainable resource management; benefits, risks and trade-offs of low-carbon technologies; city-level decoupling; and the untapped potential for decoupling resource use and related environmental impacts from economic growth.

In the forthcoming months, the International Resource Panel will focus on scenario modelling of natural resource use, the socioeconomic implications of resource efficiency and the circular economy, the role of resources in environmental displacement and migration, and the connections between finance and sustainable resource use, among others.

More information about the Panel and its research can be found at:
Website: www.resourcepanel.org
Twitter: https://twitter.com/UNEPIRP
LinkedIn: https://www.linkedin.com/company/resourcepanel
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UN environment programme

International Resource Panel

Sustainable Trade in Resources:
Global Material Flows, Circularity and Trade

Trade is responsible for much larger amounts of material extraction than direct trade flows indicate, when accounting for the additional materials, energy, water and land used in the extraction and production of traded goods but left behind as wastes and emissions in the exporting country.

In 2017, the material requirement for trade was three times the direct trade as more than 35 billion tons of material resources were extracted globally to produce 11 billion tons of directly traded goods. This means that one-third of the total 92 billion tons of material resources extracted in the global economy that year were destined to produce goods for trade.

Such analysis by the International Resource Panel of the materials embodied in trade reveals that resource-intensive processes have shifted from high-income importing countries to low-income exporting countries, with a corresponding shift in associated environmental burdens.

The extraction and processing of resources for export depletes natural assets, while increasing waste, emissions, loss of biodiversity, land degradation and water pollution. Appropriate policies are therefore needed to address the adverse environmental impacts of trade and ensure that trade helps drive the transition towards a fairer, more sustainable and circular economy.

Policy analysis by UNEPs Environment and Trade Hub shows how both multilateral trade rules and regional trade agreements can be used proactively to advance the circular economy and minimize the environmental impacts associated with resource extraction.

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