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CIRCULAR ECONOMY – A CONCEPTUAL REVIEW AND ANALYSIS OF IMPLICATIONS FOR SWEDISH DEVELOPMENT COOPERATION

Daniel Slunge, Ida Andersson, Petter Wikström, Thomas Sterner

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Daniel Slunge, Ida Andersson, Petter Wikström
and Thomas Sterner

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Daniel Slunge, PhD, is a researcher in environmental economics at the Environment for Development Initiative, University of Gothenburg. His research focuses on policy instrument design, risk perceptions and economic valuation.

Ida Andersson, MSc, is a research assistant in chemical risk management and environmental economics at the FRAM Centre for Future chemical Risk Assessment and Management, University of Gothenburg.

Petter Wikström, MSc, is a research assistant in environmental economics at the University of Gothenburg.

Thomas Sterner is a Professor of environmental economics at the University of Gothenburg. His research and teaching focuses on policy instrument design.

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Foreword by EBA

The concept of "circular economy" has over the last few years become what Evert Vedung coined as a "semantic magnet", an ever present and positively loaded concept – but with a less than precise meaning. Today, at the centre of public policies on green transition and sustainable development, there is need for a thorough understanding of the concept.

In this working paper, the authors review the concept and analyse its potential implications for Swedish development cooperation. They point both at its "policy momentum" and to the fact that it is influencing (rather than being affected by) development cooperation. The authors show that much of what Sweden is already doing under other nametags (such as "green economy") is relevant to the circular economy agenda, and argue that Sida and the MFA will be a long way along just by understanding better how circular economy relates to ongoing activities.

The authors illustrate how the fact that most of both production and consumption today is global means that circular ambitions in Sweden, the EU or elsewhere will affect developing countries. In addition to discussing opportunities, the authors emphasise the importance of understanding the risks for populations in developing countries. Circular ambitions in the global north should not be supported at the expense of the health and life of informal waste workers in partner countries.

It is our hope that this this working paper will be of use not only to us here at the EBA, but also to colleagues at Sida and the MFA who are interested in the concept of circular economy and its potential importance in development cooperation.

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Stockholm, May 2021

Jan Pettersson, Managing Director

Sammanfattning

Under senare år har begreppet cirkulär ekonomi fått en ökad användning och betydelse inom svensk och europeisk politik. Den här rapporten ger en översikt över begreppet cirkulär ekonomi och dess användning inom internationellt och svenskt utvecklingssamarbete.

Trots begreppets popularitet saknas det fortfarande en vedertagen definition för cirkulär ekonomi. Tidigare sågs begreppet främst som en strategi för att minska uppkomsten av avfall men idag används det betydligt bredare. Ett exempel är den europeiska kommissionens handlingsplan för cirkulär ekonomi från 2020, där den cirkulära ekonomin ses som

> ”avgörande för att uppnå klimatneutralitet senast 2050 och för att frikoppla ekonomisk tillväxt från resursanvändning, samtidigt som man säkerställer EU:s långsiktiga konkurrenskraft och ser till att ingen lämnas utanför”.

Den svenska handlingsplanen för cirkulär ekonomi från 2021 omfattar också en bred agenda, inklusive produktdesign, hållbar konsumtion, giftfria och cirkulära kretslopp samt främjandet av innovation och cirkulära affärsmodeller.

Resurseffektivitet, återvinning, hållbar konsumtion och produktion samt andra centrala frågor inom cirkulär ekonomi är långt ifrån nya. I stället för att uppmärksamma helt nya frågor sammankopplar agendan för cirkulär ekonomi den växande klimat- och miljökrisen med innovation, sysselsättning och ekonomisk tillväxt.

Den snabbt växande litteraturen om cirkulär ekonomi är till stor del inriktad på tekniska lösningar, system och affärsmodeller. De flesta av de förvånansvärt optimistiska prognoser och antaganden om effekter av en omställning till en mer cirkulär ekonomi på tillväxt och sysselsättning bygger på konsultstudier. Större studier om sociala, politiska och andra kontextuella faktorer som skapar incitament och hinder för en mer cirkulär ekonomi saknas.

Relativt få studier belyser de särskilda utmaningar och möjligheter som en omställning till en mer cirkulär ekonomi kan medföra för låg- och medelinkomstländer. Länder med låga arbetskraftskostnader kan ha en konkurrensfördel vid demontering, reparationer och återvinning, processer som är svåra att automatisera, på den växande internationella marknaden för sekundära varor och material. Inom jordbruk, bostäder och transporter visar nya studier att det kan finnas stora potentiella fördelar med mer cirkulära tillvägagångssätt i utvecklingsländer. Men omfattande studier av dessa potentiella fördelar saknas och uppskattningar baseras ofta på mindre fallstudier.

Dessa potentiella positiva effekter riskerar dock att överskuggas av de betydande negativa hälso- och miljöeffekter som kan uppstå i samband med återvinning och avfallshantering. Aktiviteter som i utvecklingsländer ofta utförs av fattiga män och kvinnor i informella anställningar och nätverk utan möjligheter att skydda sig från farliga kemikalier i begagnade produkter och avfall. Om inte försiktighetsåtgärder vidtas, riskerar en omställning till en cirkulär ekonomi i Europa att leda till export av sekundära material och produkter som endast kan återvinnas till höga miljömässiga och sociala kostnader till länder med bristfällig miljölagstiftning och teknisk kapacitet. Den stora olagliga transporten av elektroniskt avfall och plastavfall som innehåller farliga kemikalier utgör oroande exempel.

En annan risk kopplad till en omställning till en cirkulär ekonomi är att många olika nya produktstandarder för hållbarhet, återvinningsbarhet och spårbarhet kan utgöra nya handelshinder för fattiga länder med begränsad anpassningskapacitet. Följaktligen spelar både handelspolitiken och Baselkonventionen om gränsöverskridande transporter av avfall en viktig roll i diskussionen om cirkulär ekonomi. En nyckelfråga är utvecklingen av harmoniserade standarder och procedurer för att kontrollera kvaliteten på sekundära material och vad som skiljer sådana material från att klassificeras som avfall. Utan sådana standarder och procedurer blir det svårt att skala upp en laglig internationell handel med sekundära material.

Cirkulär ekonomi spelar även en allt större roll inom det internationella utvecklingssamarbetet och är ett prioriterat tema i den nya europeiska biståndsstrategin för perioden 2021–2027. Då det europeiska biståndet koordineras inom ”Team Europe” har prioriteringarna i den europeiska

strategin och det nya instrumentet för finansiering (NDICI) betydelse för Sveriges och andra medlemsländer. De policydialoger kring cirkulär ekonomi som EU-kommissionen för med den Afrikanska unionen, Sydafrika, Kina, Indien, Colombia och andra länder kan också vara viktiga för medlemsländernas utvecklingssamarbete. Även den ökade användningen av begreppet cirkulär ekonomi inom OECD, de multilaterala utvecklingsbankerna och flera av FN-organisationerna talar för att cirkulär ekonomi kommer vara en viktig ram för delar av biståndsarbetet under de kommande åren.

Cirkulär ekonomi och ett antal närliggande begrepp är inkluderade i flera styrande dokument för det svenska biståndet. I ”Policyramverk för svenskt utvecklingssamarbete och humanitärt bistånd” – under ”Fri och rättvis handel och hållbara investeringar” – slås det fast att:

> ”Utvecklingssamarbetet ska bidra till en omställning till en fossilfri ekonomisk utveckling, byggd på resurseffektiv, cirkulär och biobaserad ekonomi med giftfria kretslopp”

En genomgång av Sidas vägledande dokument och insatser visar att svenskstödda initiativ inom detta område har många namn och former. Hittills har grön ekonomi, snarare än cirkulär eller biobaserad ekonomi, varit den bredare term som Sida använt i dialoger och insatser som kopplar samman miljö och ekonomiska frågor. En portföljanalys visar att termen cirkulär ekonomi endast i ett fåtal tillfällen finns med i titeln eller beskrivningen av insatser finansierade med svenskt bistånd. Men Sverige stödjer många insatser med hög relevans för en mer cirkulär ekonomi och en grön omställning i bred bemärkelse. Sverige är bland annat en viktig finansiär av flera internationella organisationer och nätverk som påverkar den globala diskussionen om cirkulär och grön ekonomi.

Den framväxande internationella agendan för cirkulär ekonomi har potential att engagera en bred uppsättning aktörer i en dialog om hållbar ekonomisk utveckling. Införandet av nya begrepp innebär dock även kostnader för givare och partnerländer för studier, utbildningar, utveckling av handlingsplaner o.s.v. Det finns en risk att alltför mycket resurser ägnas åt att diskutera de visionära aspekterna av en cirkulär ekonomi på bekostnad av faktiska insatser för att åtgärda faktiska hälso- och

miljöproblemen som orsakas av industriell förorening och bristande avfallshantering.

Ett sätt att operationalisera cirkulär ekonomi i svenskt utvecklingssamarbete kan vara att identifiera ett antal prioriterade frågor. Det bör vara inom områden där det finns en gedigen erfarenhet och kunskap inom den svenska resursbasen och där det finns en stark efterfrågan i partnerländerna kring samarbete. Med utgångspunkt i denna kunskapsöversikt har följande områden identifierats:

- Styrmedel för resurseffektivitet och förebyggande av föroreningar.
- Giftfria material flöden genom proaktiv kemikaliehantering.
- Social inkludering och en rättvis övergång till en cirkulär ekonomi.
- Cirkulära affärsmodeller i specifika värdekedjor.
- En samordnad politik för cirkulär ekonomi, miljö, handel och bistånd.

Ovanstående förslag är inte nya områden för svenskt bistånd. Inom samtliga områden finns många intressanta och relevanta befintliga insatser. Tanken med dessa förslag är snarare att visa på områden där svenska bidrag kan skapa mervärde och berikas av agendan för cirkulär ekonomi.

Summary

Circular economy is increasingly discussed in Swedish, European and international public policy making. This report provides a review of the circular economy concept and discusses its potential implications for Swedish development cooperation.

There is no standard definition of a circular economy. While it was originally perceived as primarily a strategy for reducing waste, the use of the circular economy concept is considerably broader today. An indicative example is the European circular economy action plan from 2020, which is envisioned to make a

> "decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the EU and leaving no one behind".

The Swedish action plan on circular economy from 2021 also covers a broad agenda, including product design, sustainable consumption, non-toxic and circular flows, innovation and circular business models.

Resource efficiency, recycling, changes in consumption patterns and other key circular economy issues have been discussed extensively for a long time. Rather than bringing attention to entirely new issues, the circular economy agenda connects the growing climate and environmental crisis with innovation, employment and economic growth.

The booming literature on circular economy is largely technically and business oriented. Most of the surprisingly optimistic macro-economic prognoses on the growth and employment creation potential of the implementation of circular economy policies are based on consultancy studies. Larger studies on social, political and other contextual factors shaping the incentives and obstacles to a more circular economy are lacking.

There are relatively few studies on the challenges and opportunities that a transition to a more circular economy may bring about for low and middle-income countries. But as most supply chains are highly international, the implementation of circularity policies in EU and other

large economies will have global implications. Countries with low labour cost can have a competitive advantage in disassembly, repairs and remanufacturing on the growing international market for secondary goods and materials. In agriculture, housing and transports, recent studies indicate that there may be large potential benefits from more circular approaches in developing countries. However, there are no comprehensive studies of these potential benefits and estimates are often based on smaller case studies.

These potential benefits risk being outweighed by the significant health and environmental impacts associated with recycling and waste management. Such activities are often performed by poor men and women in informal employment and networks without possibilities to protect themselves from hazardous substances in used electronics and other used products and waste categories. If not managed carefully, European circular economy policies can incentivize export of secondary materials and products, which can only be recycled at high environmental and social costs to countries with less stringent environmental standards and technological capacity. The large illegal shipping of e-waste and plastic waste containing hazardous substances are worrying examples.

Another risk is that a proliferation of new product standards for durability, recyclability and traceability will become trade barriers for countries with a limited capacity to adapt. Consequently, the role of trade policy and the Basel Convention on transboundary movements of hazardous wastes in relation to circular economy policies is increasingly discussed. A key issue is the development of harmonised standards and procedures to verify the quality of secondary materials and what distinguishes such materials from being classified as waste. Without such standards and procedures, it will be difficult to scale up a legal international trade in secondary materials.

Circular economy also plays an increasingly important role in development cooperation. Especially the focus on circular economy in the new EU development cooperation strategy for 2021–2027, and priorities in the new NDICI instrument, will be important for Sweden and other member states as a coordinated "Team Europe" approach is promoted. Policy dialogues on circular economy pursued by the Commission with the African Union, South Africa, China, India, Colombia and other countries can also be important for the development cooperation of EU member

states. The increasing use of the circular economy concept by several UN organisations, OECD and the Multilateral Development Banks also indicate that circular economy will play an important role in development cooperation policy during the coming years.

Circular economy and closely related concepts are included in several of the key policy documents for Swedish development cooperation. The policy framework concludes that Sweden should contribute to

> "…a transformation to a resource-efficient, non-toxic, circular and bio-based economy with low emissions of greenhouse gases".

A review of Sida's guiding documents and contributions show that Swedish supported initiatives in this area have many names and forms. So far green economy, rather than circular or biobased economy, has been the broader term used by Sida in dialogues and contributions linking environment and economic issues. Through an analysis of the Swedish development cooperation portfolio, the study finds that few contributions have been explicitly labelled as circular economy initiatives, but that many existing Swedish contributions are highly relevant for addressing real "circular economy issues" and a broader green transition. Notably, Sweden is an important financier of several international organisations and networks influencing global policy discussion on green and circular economy.

While the emerging circular economy agenda has the potential to engage a broad set of actors in a dialogue on sustainable economic development, introducing new concepts also involves costs for donors and partner countries for studies, trainings, the development of action plans etc. There is a risk that too much effort is devoted to discussing the visionary aspects of a circular economy at the expense of addressing the very real health and environmental problems caused by industrial pollution and improper waste management.

A way to operationalise circular economy in Swedish development cooperation would be to identify a set of priority circular economy issues. Ideally, these should be issues where there is a solid experience and knowledge among the Swedish resource base and where there is a strong

demand in partner countries for collaboration. Based on the review, the following issues are proposed:

- Policy instruments for pollution prevention and resource efficiency.
- Non-toxic material cycles through proactive chemical management.
- Social inclusion and just transition to a circular economy.
- Circular business models in specific value chains.
- Policy coherence on circular economy, including environment, trade, and development cooperation policy.

The proposed priority issues are not new to Swedish development cooperation as there are many interesting and relevant contributions in the existing portfolio. The idea is rather to outline potential priority issues where Swedish contributions can add value to, and benefit from, the circular economy agenda.

1 Introduction

The circular economy is increasingly discussed in Swedish, European and international public policy making. The concept has also gained considerable traction in the private sector as a new way to capture value and move from linear to circular flows of energy and materials. The "Circular economy action plan for a cleaner and more competitive Europe", launched be the European Commission in 2020 is envisioned to make a

> "decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the EU and leaving no one behind" (European Commission, 2020a).

Swedish policies on resource efficiency, extended producer responsibility and other key circular economy issues have a long history. However, it was first in 2020/21 that a Swedish national strategy and action plan on circular economy were presented.

As most supply chains are highly international, circularity goals in Europe and Sweden cannot be met without large-scale changes also taking place in low and middle-income countries (European Commission, 2020d). Circular economy is hence also becoming an important focus area in the development cooperation policy and external relations of the European Union and its member states.

The booming literature on circular economy has so far paid relatively little attention to low and middle-income countries and development cooperation policy. However, during recent years several interesting studies have been published, such as Preston (2019) outlining priority circular economy issues in developing countries; Rademaekers et al. (2020) analysing implications of circular economy policies in Africa-EU cooperation; and Kettunen et al. (2019) and Yamaguchi (2021) identifying linkages between circular economy and trade policy. The present report adds to this literature by providing a review of the circular economy concept and discussing potential implication for Swedish development cooperation.

The report was commissioned by the Swedish Expert Group for Aid studies (EBA) which is a government committee with a mandate to independently evaluate and analyse Sweden's international development assistance. The report is based on a review of published and grey literature as well as interviews and participation in seminars on the topic (appendix 1). The analysis of how the circular economy concept, and the related concepts green economy and biobased economy, have been operationalised in the Swedish development cooperation portfolio is based on a search in the Open Aid database with open government data of Swedish aid (section 6.3).

The report is organised as follows.

Chapter 2 provides and overview of the circular economy concept, how it relates to similar concepts such as green economy and biobased economy, and how it is used in academic research.

Chapter 3 reviews policies on circular economy in the European Union, Sweden, China, different UN organisations, OECD and the private sector.

Chapter 4 discusses issues of special interest when it comes to circular economy in low and middle-income countries. This includes the large informal recycling and waste management sector, risks and opportunities related to the growing trade in secondary materials and potential new trade barriers posed by circularity related product standards.

Chapter 5 provides an overview of circular economy in development cooperation policy of the European Union and selected member states. Also, the use of circular economy in the Multilateral Development Banks is reviewed.

Chapter 6 contains an analysis of circular economy in Swedish development cooperation policy and its operationalisation. The chapter also includes an analysis of circular economy, green economy and biobased economy related contributions in the Swedish development cooperation portfolio (see also appendix 2).

Chapter 7 contains a concluding discussion on the risks and opportunities of circular economy in development cooperation. The chapter also highlights how governance factors and price signals reflecting environmental and social costs are of crucial importance for a circular

transition. Finally, potential priority circular economy issues for Swedish development cooperation are proposed.

2 Circular economy – a conceptual overview

This chapter provides an overview of the circular economy concept, how it relates to similar concepts such as green economy and biobased economy, and how it is used in academic research.

2.1 A new sustainability paradigm?

While circular economy was originally perceived as primarily a strategy for waste management and recycling, many actors now advocate a much broader interpretation. Increasingly, the term circular economy is broadened and framed as a new sustainability paradigm involving large economic opportunities and as a strategy for climate change mitigation and reduced environmental degradation (Preston et al., 2019). For example, the European Commission (2020d, p. 3) states that

> "the worldwide transformation to a circular economy entails moving from linear, highly resource depleting systems with high emissions, waste generation, and high impacts on ecosystems and natural capital, towards circular, less wasteful systems that use resources more efficiently and sustainably, while providing work opportunities and a high quality of life."

There is no standard definition of a circular economy, as made clear by for example (Kirchherr et al., 2017) who reviewed over 100 different definitions of a circular economy. It is hence challenging to tease out what precisely the circular economy concept does and does not entail. Rather than an academically well-defined concept, circular economy may be seen as a visionary policy concept of a more resource efficient and sustainable economic development. It is perhaps best understood by what it is not: circularity is defined in contrast to the "linear" economy in which products start in a mine and end up in landfills as waste.

Importantly, circular economy is not seen only, maybe not even primarily, as an agenda for waste reduction and environmental improvements but

also as an agenda for innovation, economic growth and job creation. The Swedish public inquiry on a circular economy (SOU 2017:22) even refers to potential economic gains from a circular economy transition in Europe in the same magnitude as gains once projected before the creation of the common European market!

Besides the importance of skilled policy entrepreneurs in framing the circular economy concept, there are important drivers behind the appearance of the concept on the international policy agenda.

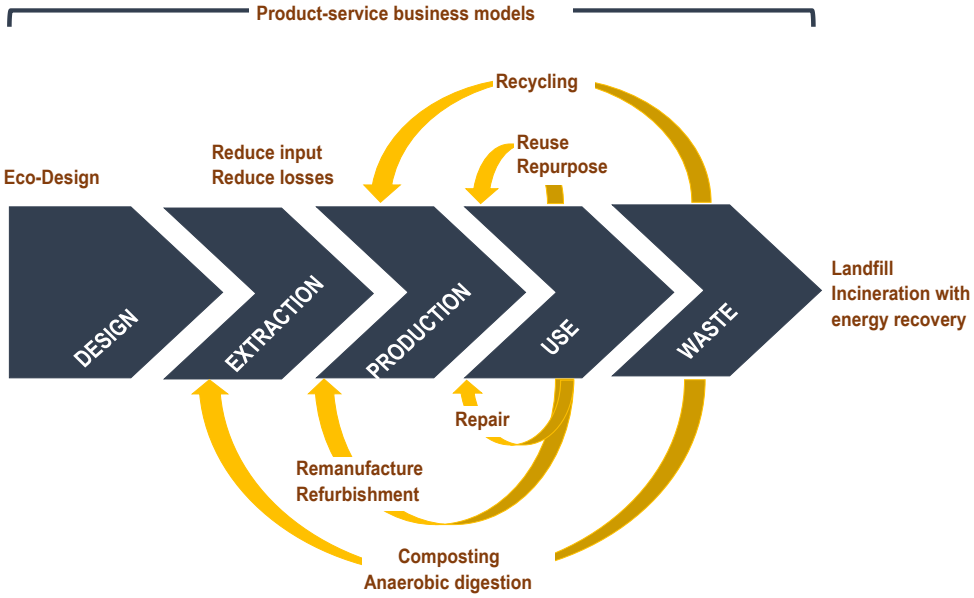
1. *Growth in population and income per capita:* This mega trend has resulted in increasing flows of materials in society which need to be managed. As an illustrative example, a study in Nature shows that man-made mass now exceeds all living biomass on Earth (Elhacham et al., 2020). With current trends, global material extraction is projected to more than double in 2060 compared to 2017's levels, from 92 billion tons to 190 billion tons. The global population is predicted to grow from 7.3 billion in 2015 to 10.2 billion in 2060 (UNEP, 2019).
2. *Escalating climate and environmental crisis:* Besides generating increasing amounts of waste, the growing material flows are intrinsically linked to the escalating climate and environmental crisis, as summarized for example in a series of articles on the Anthropocene and Planetary Boundaries (Rockström et al., 2009; Steffen et al., 2015). Notably, this crisis is more linked to pollution than resource scarcity.
3. *Rapid technological development:* In particular the decreasing cost of renewable energy and the evolving information technology, create new opportunities for a transition to a more circular economy (SOU 2017:22).

2.2 From linear to circular flows

In its simplest form, the term circular economy refers to an economy which is more "circular" than today's "linear" economy. The "linearity" of an economy means that materials flow in one direction: from extraction, production, use and final waste disposition. The circular economy instead implies that resources flow in a circular way – instead of being disposed as waste, resources are put back into the material flows through different loops and thus, enters several life cycles. For example

Geissdoerfer et al. (2017) define circular economy as "a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops." Viewing waste as a resource constitutes a central part in the circular economy. Figure 1 illustrates how material flows can become more circular through different measures.

Figure 1: Circular economy measures in a product's life cycle



Source: Authors.

- *Measures in the design phase:* by redesigning products, they can become more resource efficient and durable and thus enable additional use cycles. Eco-design can further affect material use by changing material composition.
- *Measures in the extraction phase:* by reducing the need for inputs or energy requirements and reduce losses, the extraction phase can be optimised.
- *Measures in the production phase:* by reducing inputs or energy requirements and reduce losses, the need for virgin materials can be minimised. One way of increasing the utilization of virgin materials for organizations is to apply industrial symbiosis. For instance, industrial symbiosis can mean that one company's waste is another company's input, or that several companies share an energy source.

- *Measures in the use phase:* measures to extend the lifetime of products includes creating different loops, such as repair, reuse, repurpose, remanufacture and refurbish. These loops enables products to enter second life cycles and thus products and resources are put back into the material flow instead of reaching the end-of life phase prematurely. Through innovative business models and product-as-service models, products can further be used more efficiently and thus increase the utilization patterns of products and services (this includes for instance sharing schemes such as car-sharing pools or renting services).
- *Measures in the end-of-life phase:* measures to close the loop includes recycling (or for biodegradable materials composting and anaerobic digestion). If recycling is not possible nor desired, materials can still be used for incineration with energy recovery.

The different "R-imperatives" (all measures with the re-prefix) constitute a core element of the circular economy concept, and work as operationalisation principles (Kirchherr et al., 2017). The circular economy concept has over the years developed from a waste related concept restricted to closed geographical entities, to a much broader term including a system perspective where a combined thinking of business models, resources and products is applied and targets global value chains (Reike et al., 2018).

The circular economy concept is often discussed in relation to specific material flows or supply chains such as plastics, textiles, electronics, food or construction materials. Box 1 summarizes challenges with today's linear flows and circular opportunities in relation to electronics, plastics and textiles.

Box 1: Circular economy opportunities for electronics, plastics and textiles according to the Platform for Accelerating the Circular Economy (PACE)

Electronics: Today's consumer electronics market is fast growing and estimated to be worth over 1 trillion USD. This development is driven by digitalisation and electronics becoming more affordable but is also very dependent on virgin materials and characterised by low recycling rates and prematurely discarded products. Electronics have further become the world's fastest growing waste stream. In 2019, 54 million metric tonnes of e-waste were generated, where only 17.4% of global waste was officially documented as recycled. As electronic products contain increasingly more materials, resource security has become a core business issue. Circular measures, such as recycling and remanufacturing, could therefore be a vital contributor in acquiring raw materials and harbour a large economic potential, as the value of raw materials lost in global e-waste amounts to 57 billion USD. Reuse and higher utilisation rates can further reduce the need for virgin materials and thus the environmental impact posed by production and extraction. Furthermore, products can be designed according with circular principles, for instance designing for reparability, which could potentially create new product-as-service based business models and jobs related to remanufacture and repair.

Plastics: is a large, linear material stream, which has globally increased twentyfold in the last 50 years. At current rates, plastic packaging volumes (representing 40% of plastic use) are expected to increase by a factor four to 318 million metric tonnes per year in 2050, and only 14% of this plastic is collected for recycling. The sector is further characterised by requiring virgin fossil resources, potentially toxic additives and creating environmental and social impacts. Closing the loops through increasing recycling rates and recycled or renewable material inputs have the potential of unlocking economic value, as it is estimated that 95% of the value of plastic packaging is lost annually, which corresponds to some 105 billion EUR. Recycling and other circular measures such as reducing unnecessary and problematic plastics, can further entail large environmental benefits such as reducing marine plastic pollution and the presence of micro plastics. Compared

to virgin production, greenhouse gas emissions are estimated to be around 25% lower per tonne of recycled plastics.

Textiles: have long been an economically important industry and is globally valued at 1.3 trillion USD, employing more than 300 million people. The industry is characterised by being resource intense, polluting the water system with chemicals, detergents and microfibers, low recycling rates and a significant water footprint. The sector is estimated to consume some 215 trillion liters of water each year and 87% of textile materials end up in landfills or are incinerated. The sector is furthermore largely dependent on consumer trends such as the "fast Fashion" which creates large quantities of low-quality garments, which is often becoming waste prematurely. With shorter trend-cycles and low prices, overconsumption is thus "encouraged". New business models, such as renting or leasing services, and change in consumer behavior, could reduce overconsumption and keep products in use for longer. Repair services and reuse of collected garments (through e.g. second hand) could additionally play a vital part in increasing the utilization rates. It is estimated that a 44% reduction of greenhouse gas emissions could be generated if the average number of times a garment is worn was doubled. Closed loops within the sector can further be achieved by recycling of textile material. Recycling can further reduce the need for virgin material, save water and decrease the overall environmental impacts as well as the need for chemical input.

Source: (PACE, 2021a, 2021b, 2021c), summarized by Authors

2.3 Green, biobased or circular economy?

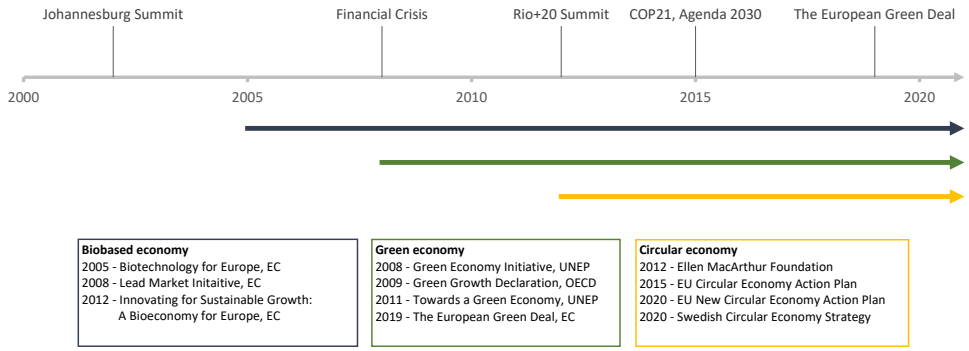
There are several policy concepts overlapping the concept of a circular economy. Most notably, "green economy", "green growth", "bioeconomy/biobased economy" and "sustainable production and consumption" also relate to a green transition and to a more sustainable (economic) development.

The green economy concept was popularized internationally by UNEP in 2011, recognizing that "achieving sustainability rests almost entirely on getting the economy right" (UNEP, 2011, p. 9). UNEP defined green economy as an economy that "results in human well-being and social

equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2011, p. 9). Around the same time, the World Bank and OECD published similar flag-ship reports, but with a focus on green growth (OECD, 2011a, 2011b; World Bank, 2012). The OECD defined green growth as a strategy: "fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD, 2011b, p. 9).

In a biobased economy, industrial inputs should be derived from renewable biological resources. Non-renewable materials, chemicals and energy should be replaced by biobased substitutes from primarily the forest and agricultural sector. The concept is also strongly linked to life sciences and biotechnology (D'Amato et al., 2017). The European action plan Innovating for Sustainable Growth: A Bioeconomy for Europe for a biobased economy was launched in 2012 (European Commission, 2012). Figure 2 displays a schematic timeline on when the different concepts gained momentum on the international policy agenda.

Figure 2: Timeline of sustainability concepts showing when concepts were popularised in the policy sphere



Note: While these concepts have longer historical roots than shown in the figure, the timeline aims to depict when these concepts gained foothold and became "mainstream". The figure contains a non-comprehensive list of examples of key reports and policies. Source: Authors, based on (D'Amato et al., 2017; Geissdoerfer et al., 2017; Georgeson et al., 2017; Loiseau et al., 2016; McCormick & Kautto, 2013; Merino-Saum et al., 2020).

Table 1 includes the most common topics in the scientific literature on circular economy, green economy and biobased economy respectively, as identified in a comparative review by D'Amato et al. (2017).

Table 1: Main topics emerging in circular economy, green economy and biobased economy concepts

Topic	Circular economy	Green economy	Biobased economy
1	Sustainable development in industrialisation and urbanisation	Sustainable development	Biomass and renewables in energy production
2	Recycling in products life cycle for waste reduction	Green investments, especially in urban context	Rural policies esp. in Europe
3	Industrial symbiosis, especially in EU	Tourism, business, education, employment	Biotechnology applications in health science
4	Efficiency evaluation techniques in logistics/ supply chain management systems	Biomass and renewables in energy production	Biotechnology applications in materials science
5	Carbon emission and energy in production plants	Recycling, re-use, reduction in products life cycle	Biomass supply/demand, especially wood
6	Greening the supply chain	Conservation and land use	Biosecurity

Source: (D'Amato et al., 2017).

The authors conclude that green economy is the most inclusive concept as it encompasses some ideas from both circular economy and biobased economy, and note that:

- "…*circular economy* focuses on industrial urban processes for decoupling resource use and economic output;
- *biobased economy* focuses on biological resource-based innovation and land use practices in the context of rural development; and
- *green economy* envelops an umbrella perspective for a balanced social-environmental development…" (bullets and italics added).

All three concepts relate to the broader sustainable development agenda - Agenda 2030 – and are often portrayed as "way of achieving sustainable development". Among the sustainable development goals, circular economy is perhaps most clearly related to Goal 8 Decent work and

Economic growth [1] and Goal 12 Sustainable Production and Consumption.[2] UNEP further relate circular economy to goal 3 good health and well-being, 5 gender equality, 6 clear water and sanitation, 7 affordable and clean energy, 11 sustainable cities and communities, and 13 climate action.[3]

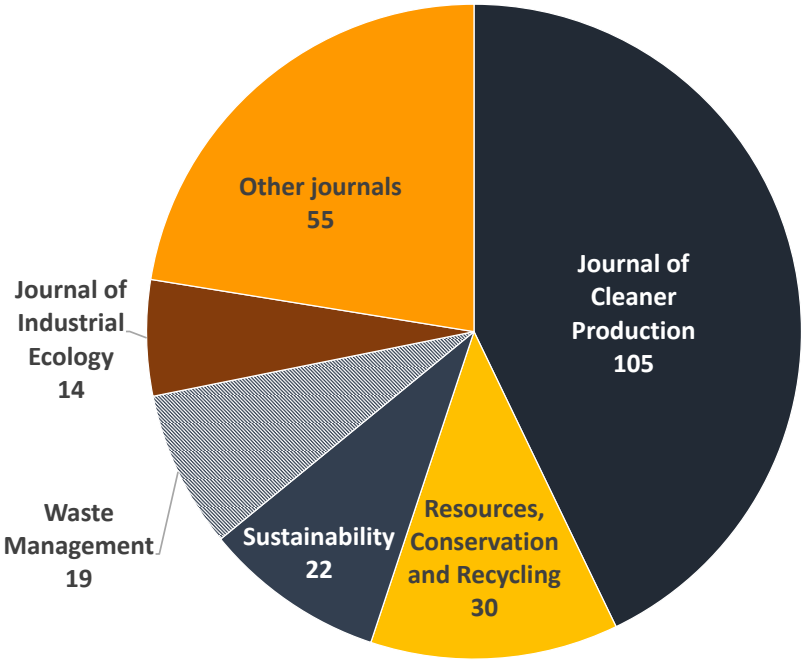
2.4 Circular economy in academic research

The term circular economy is relatively new in academic research. The number of articles with circular economy as a topic published per year in peer reviewed journals has increased from very low numbers in the early 2000's, to more than 100 articles per year in 2016 (Geissdoerfer et al., 2017). By mid-2017, 80% of articles on the topic had been published in the 5 previous years (Merli et al., 2018). See the Handbook of the Circular Economy (Brandão et al., 2020) for a recent overview.

Almost 20 percent of the articles on circular economy were published in The Journal of Cleaner Production. Other popular journals for the literature on circular economy are Resource conservation and recycling, Sustainability, Waste management and Journal of industrial ecology (figure 3) (Merli et al., 2018).

[1] E.g. Target 8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead.
[2] E.g. Target 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.
[3] See https://buildingcircularity.org/; https://www.unep.org/circularity

Figure 3: Number of publications on circular economy in different journals 2004–2017



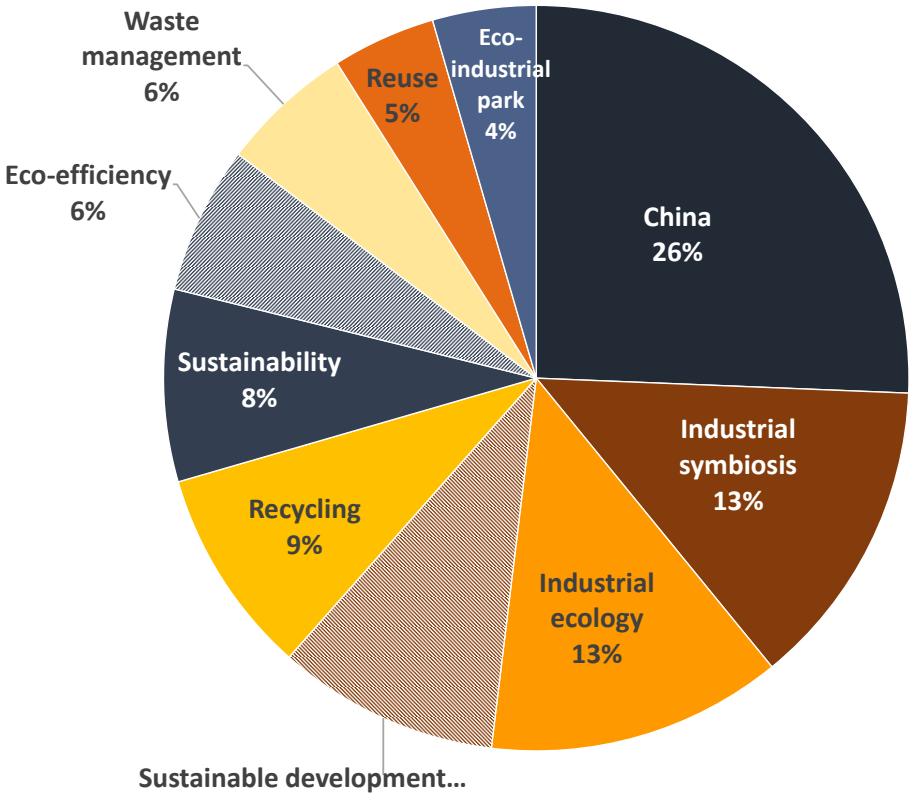
Source: Authors, based on (Merli et al., 2018).

The large focus on technical issues in this literature is also visualised in a review of the most frequent occurring keywords in published articles on the circular economy (figure 4). Industrial symbiosis and ecology, recycling, eco-efficiency and waste management are the most common technical terms. D'Amato et al. (2017, p. 9) notes that the

> "literature on circular economy almost monolithically revolves around resource-efficiency, increasing resource productivity and decoupling resource utilization from economic growth. Circular economy is embedded in the context of industrial systems and does not account sufficiently for social and local dynamics."

There are also a number of conceptual articles on the relationship between circular economy and broader sustainability issues (Geissdoerfer et al., 2017). A review of keywords also shows that researchers from China have contributed frequently to the literature on circular economy (see section 4.3 on circular economy in China).

Figure 4: The most frequent occurring keywords in reviews and articles on circular economy



Source: Authors, based on (Geissdoerfer et al., 2017). Note: The analysis by Geissdoerfer et al (2017) includes 250 publications in English published 1950 to January 2016.

The most common methods used in the published articles on circular economy are case studies and modelling studies, theoretical and conceptual, review pieces, and surveys. Many articles focus on tools for decision-making such as life-cycle analysis and topics such as closed loop value- and supply chains, circular business models, and circular product design (Geissdoerfer et al., 2017; Merli et al., 2018).

Notable is that the circular economy concept, aside from some articles in Ecological Economics, is barely appearing at all in peer-reviewed economics journals. This is surprising as economists have for decades dealt with issues critical for a transition to a more circular economy. This includes analyses of incentives and policy instruments for environmental and natural resources management (see for example Sterner and Coria (2012)

for an overview). Moreover, the transition from an open (linear) to a closed (circular) economy was discussed already in 1966 by the economist Kenneth E. Boulding in his classical article The Economics of the Coming Spaceship Earth. Also, the economists Pearce and Turner discussed already in 1990 how a switch from the linear to a circular system was a logical consequence of the law of thermodynamics (Pearce & Turner, 1990).

Hence, there is very large academic literature, including in economics, on critical issues for a circular economy such as resource efficiency, decoupling, waste management and pollution prevention. But, generally this literature is not framed as having circularity as its goal. The goal is instead increased welfare or minimizing the consequences of pollution. The result can in many cases be quite similar.

Notable is also that there is very little academic "circular economy research" on the effects on employment and economic growth related to a transition to a more circular society. Most of the optimistic macro-economic prognoses on the growth and employment creation potential used in circular economic policy making are based on consultancy studies. See National Institute of Economic Research (2016) for a critical review.

3 Policies on circular economy

As most supply chains are highly international, the implementation of circularity policies in EU and other large economies as well as in private sector organisations will have implications for low and middle-income countries. By influencing the global policy development in areas such as trade, environment and development cooperation, circular economy initiatives and policies implemented by international organisations can also have important implications for low and middle-income countries.

This section reviews policies on circular economy in the European Union, Sweden, China, different UN organisations, OECD and the private sector.

3.1 European Union

The European Commission launched the first European Circular economy action plan in 2015 (European Commission, 2015). The second "Circular Economy Action Plan: for a Cleaner and more Competitive Europe" from 2020 (European Commission, 2020a) forms an important part of the EU Green Deal, the new growth strategy for EU, which aims to

> "transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use." (European Commission, 2019, p. 2).

A transition of European industry to a cleaner and more circular industry is a key element of the Green deal, which is implemented through several specific strategies. The chemicals strategy for sustainability addresses a toxic-free environment and aims to protect citizens and the environment from hazardous chemicals. The Industry strategy and the new Circular economy action plan jointly address how to transform the European

industry into a climate neutral, circular and digital industry (European Commission, 2019).[4]

The Circular economy action plan includes policy measures for making products more sustainable, i.e. durable, energy efficient and recyclable. Improving the traceability of product components, for instance by introducing digital passports, as well as expanding the existing Eco-design directive, are essential elements of the sustainable product policy. Key value chains in focus are electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, and food, water and nutrients (European Commission, 2020a). The Action plan also contains demand side elements to empower consumers and public buyers through for example better access to information on product content. Furthermore, the Action plan includes measures to reduce waste and enhance secondary raw material markets. The Commission highlights the importance of toxic-free material flows to assure well-functioning secondary markets. Despite existing chemical regulation (e.g. REACH), harmful substances are still present in many products on the European market. Traceability of product content is hence vital to identify potential harmful substances and enable safe recycling. The requirement to report substances of concerns in products on the European market to the SCIP-database from January 2021 is a step in this direction.[5] The Action Plan also includes measures to reduce export of waste to third countries (see section 5.1).

[4] Other strategies in the Green Deal include, e.g., the Farm to Fork strategy, which aims to design a fair, healthy and environmentally friendly food system; the Biodiversity strategy for 2030, with global targets to protect biodiversity and address the main causes for biodiversity loss within EU; and the European strategy for Plastics in a Circular Economy, which aims to transform plastics in accordance with circular principles such as recyclability and reparability and promote and develop more sustainable materials.

[5] Over five million notifications of Substances of Concern in articles or products had been reported to the SCIP-database early 2021. The database on Substances of Concern In articles as such or in complex objects (Products) was established under the Waste Framework Directive. https://echa.europa.eu/sv/scip

3.2 Sweden

Swedish policies on resource efficiency, extended producer responsibility and other key circular economy issues have a long history. An important milestone was the government bill on "Circular resource flows" (Government of Sweden, 1993), presented after the UN Conference on Environment and Development 1992, containing many of the principles and policies which today constitute core elements of the circular economy agenda.

However, it was first when a Swedish public inquiry on circular economy was initiated in 2016 that the term was picked up in Swedish public policy making. The inquiry (SOU 2017:22), discussed opportunities for a broader green tax reform and proposed specific instruments aiming to increase utilisation and reuse of consumer products, such as car-sharing rules and tax deductions for repair services. Following a proposal from the Inquiry, a Swedish Circular Economy Delegation was initiated in 2018.[6]

A National Strategy on Circular Economy was published in July 2020 (Swedish Ministry of the Environment, 2020) and followed by an Action Plan in January 2021 (Swedish Ministry of the Environment, 2021). The circular economy strategy shall contribute to reaching the national environmental and climate targets as well as the global targets in Agenda 2030. The vision is to achieve a society where resources are used effectively in non-toxic, circular flows. The circular economy strategy and action plan is structured in four areas (i) products and product design, (ii) consumption and use, (iii) non-toxic and circular flows, and (iv) innovation and circular business models. Six material flows are prioritised: plastics, textile, food, renewable and biobased raw materials, construction sector, and critical metals and minerals for innovation. Table 2 includes examples of measures in the circular economy action plan under each of the four focus areas.

While there is a clear focus on national measures in the Swedish action plan for circular economy, it should also contribute to "the development of circular economy within EU and globally". For instance, within the chemical area, Sweden is active in developing a new global framework for

[6] https://www.delegationcirkularekonomi.se/

chemicals and waste after 2020, where one goal is to ensure that information about chemical content is developed for products that reaches the EU market. Other examples include promoting a textile strategy for EU that encompasses the global value chain, as well as promoting a global plastic agreement.

Table 2: Focus areas and examples of measures in the Swedish Action Plan on Circular Economy

Focus area	Examples of measures
Sustainable production and product design	Recycled, non-toxic material in products Requirements of a minimum share of recycled material in certain product categories , e.g. 30% in PET bottles Product standards on durability and recyclability Product information – e.g. product digital passports, climate declarations for buildings Green tax reform
Sustainable consumption and use of materials, products and services	Sharing services – e.g. car sharing pools Enable repair and reuse of products – e.g. reduced VAT on repair services Public procurement
Non-toxic and circular material cycles	Waste prevention and management – e.g. tax on plastic bags, investigate refund system for small electronics such as phones Producer responsibility – e.g. textiles Upstream chemicals management Global framework on chemicals and waste
Innovation and circular business models	Policy instruments contributing to circular business models – e.g. green bonds and green investment guarantees Policy instruments to stimulate supply and demand for circular products/services and materials – e.g. reduced VAT on green investments such as solar cells Research & innovation – e.g. national platform for sustainable textiles.

Source: Authors, based on (Swedish Ministry of the Environment, 2021).

3.3 China

Besides Europe, China is the other major economy actively using the circular economy concept as a frame for environmental and industrial policy. The cleaner production promotion law was presented in 2002 and is often referred to as the start for circular economy policies in China (Su et al., 2013). Another milestone is the Circular economy promotion law from 2009, which aims at "facilitating circular economy, increase resource utilization rate, protect and improve environment and realizing sustainable development" (Ministry of Ecology and Environment of the People's Republic of China [MEE], 2008). Circular economy has further been incorporated as a focus area in several of China's five-year plans for national social and economic development.

Implementation of circular economy practises in China is mainly made at three levels. At the micro level, enterprises are encouraged or required to adopt cleaner production and eco-design. For enterprises in heavily polluting industries, such as chemical-, food process-, and pulp and paper industries, cleaner production measures are required. At the meso level, examples of circular measures include the development of eco-industrial parks with industrial symbiosis in focus. In these parks, enterprises share infrastructure systems, such as water, electricity and waste treatment, and develop an eco-industrial chain where industrial by-products are traded within the park. At the macro level, more extensive networks between industries and industrial parks from several sectors at regional level, are developed. Circularity is promoted through redesign of a city's infrastructure and industrial layout, as well as phase-out of heavy polluting enterprises. In the area of waste management, urban symbiosis, which is an extension of industrial symbiosis, is a priority. Typical activities include utilization of recycled waste, materials, green technologies and products as well as environmental-friendly products (Su et al., 2013).

Aligned with the Chinese circular economy work, the Chinese authorities launched a foreign waste import ban in 2018, targeting 24 types of waste including plastics, scrap paper, textiles, and vanadium slags (Qu et al., 2019), which has put pressure on other states to take responsibility for their own waste (see also section 4.4).

In 2018, China and EU signed a joint Memorandum of understanding on circular economy cooperation (Ellen MacArthur Foundation, 2018).

3.4 OECD

Circular economy is a key topic within the focus area of environment for the Organisation for Economic Co-operation and Development (OECD). Within the circular economy field, OECD drives the Re-Circle project, which provides policy guidance on resource efficiency and the transition to circular economy. The project focuses on interlinkages between material use and for example climate change, digital innovation, food security and international trade (OECD, n.d.; Yamaguchi, 2021).

3.5 United Nations

UN-organisations use a broad range of terms related to circular economy, including green economy, sustainable production and consumption, just transition, cleaner production and biobased economy. There is an increasing use of the circular economy concept to frame different initiatives. This section exemplifies how this is done in UNIDO, UNEP, UNDP, ILO and FAO.

UNIDO

United Nations industrial development organisation, UNIDO, has identified circular economy as a cross-cutting service and several publications describe how the work of different UNIDO divisions supports circular economy. [7] Existing projects focus on resource efficiency, extending products' lifetime and waste management. For instance, UNIDO, together with UNEP, supports development of local knowledge in resource efficient and cleaner production methodologies, in a network with over 70 members. Several ongoing projects focus on recycling of electronic and electric waste in countries such as Cambodia, Ethiopia and Uganda (UNIDO, 2017).

[7]See https://www.unido.org/our-focus-cross-cutting-services/circular-economy

UNEP

United Nations environment programme, UNEP, mainly frames economy-oriented work as green economy, resource efficiency and sustainable consumption and production rather than as circular economy. Sustainable consumption and production activities are built around three main objectives; decoupling environmental degradation from economic growth, applying life-cycle thinking, and sizing opportunities with new markets and jobs that a green transition can bring for developing countries.

UNEP's economy division has recently begun to frame some of their work as "circularity" and has launched a web based "circularity platform" focusing on plastics, textiles and electronics. It contains various publications and promotional material. Circular approaches are also referred to in UNEP's new environmental and social sustainability framework (UNEP, 2020).

UNDP

In similarity with UNEP, the United Nations development programme, UNDP, has only recently begun to frame some programmes and projects in circular economy terms. The most notable example is perhaps the publication "A 1.5°C World Requires a Circular and Low Carbon Economy" published jointly with UNEP in 2020 (UNDP, 2020). The organisations strongly recommend countries to use circular economy approaches to reduce greenhouse gas emissions and to include this when elaborating their national determined contributions under the Paris Agreement. There are also examples of UNDP supported circular economy projects in several developing countries such as Ghana8 and Lao PDR.[9]

ILO

The International labour organization, ILO, is a leading advocate for the importance of creating a just transition when society transforms to a more

[8] https://www.africa.undp.org/content/rba/en/home/presscenter/articles/2020/transitioning-to-a-circular-economy-with-a-multi-stakeholder-pla.html

[9] https://www.undp.org/content/undp/en/home/librarypage/climate-and-disaster-resilience-/circular-economy-strategies-for-lao-pdr.html

sustainable economy. ILO's Guidelines for a just transition towards environmentally sustainable economies and societies for all was published in 2015 (ILO, 2015).

As a green transition involves large structural changes of production and consumption patterns, there will inevitably be winners and losers. In order to create a just green transition with decent jobs, ILO advocates for, e.g., social protection programmes, ex ante assessments of macro-economic and sector policies and social dialogues. In reaching the aim of creating a just transition, the ILO provides training programmes, where one is "opportunities for decent work in circular economies".

FAO

The Food and agriculture organization (FAO) has recently begun to use the concept "circular bioeconomy" and is leading the international work on sustainable and circular biobased economy through the International Sustainable Bioeconomy Working Group. It also produces tools to monitor and evaluate the transition and supports countries with policy guidance and technical assistance in their development of sustainable and circular biobased economy strategies. (FAO, n.d.-a, n.d.-b, n.d.-c).

3.6 Private sector organisations

Circular economy is a popular concept among many private sector organisations. Growing resource scarcity, consumer demands and new business opportunities are some of the drivers. In Sweden, H&M[10] and IKEA[11] are often used as examples of companies leading their sector towards circularity. On a global scale, Apple[12] and Philips[13] are examples of leading companies in terms of profiling and marketing their circular economy strategies.

In addition to efforts made by specific enterprises, several alliances and organisations related to circular economy have emerged. A leading actor

[10] https://hmgroup.com/sustainability/circular-and-climate-positive/circularity-and-our-value-chain/

[11] https://about.ikea.com/en/sustainability/a-world-without-waste/circular-services

[12] https://www.apple.com/se/environment/

[13] https://www.philips.com/a-w/about/sustainability/circular-economy.html

is the Platform for Accelerating the Circular Economy (PACE), founded at the World Economic Forum in 2018 and hosted by the World Resources Institute (WRI). PACE partners drive projects mainly within four areas: electronics, plastics, food and textile (PACE, n.d.-b). For example, one active project is on circular management of electronics in Nigeria, aiming at providing a model for other African countries.[14] Another example project is reducing food loss in Kenya, which aims at eliminating food loss in a fruit and vegetable chain for the domestic market.[15]

Another leading organisation within the circular economy field is the Ellen MacArthur Foundation, formed in 2010. The organisation has become well known for a number of circular economy reports and initiatives involving the private sector. The organisation works with several partners, such as the H&M Group, IKEA and Google (Ellen MacArthur Foundation, 2017).

[14] https://pacecircular.org/circular-economy-approaches-electronics-nigeria
[15] https://pacecircular.org/foodflow

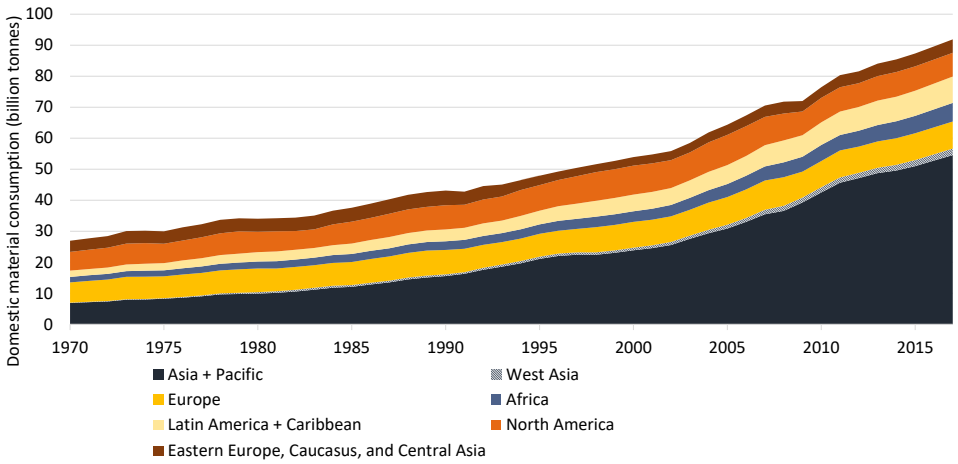
4 Critical circular economy issues in low and middle-income countries

As most supply chains are highly international, circularity goals in Europe cannot be met without large-scale changes also taking place in low and middle-income countries. This section discusses selected circular economy issues of special importance to low and middle-income countries.

4.1 Rapid growth in material use and waste streams

The global population has approximately doubled and global GDP has grown fourfold since 1970 (UNEP, 2019). This has resulted in a rapid growth also in material consumption and waste. As illustrated in figure 5, this growth has been especially high in Asia. The developments in China, and a limited number of other upper middle-income countries, with large investments in new infrastructure in combination with material and energy intensive industrialisation (partly outsourced from high income countries) explain most of the rapid increase in material consumption in Asia (UNEP, 2019).

Figure 5: Domestic material consumption 1970–2017



Note: Domestic material consumption = Domestic material extraction + material imports – material exports. Source: (International Resource Panel [IRP], 2017).

With rapid population growth, high urbanisation rate and expected income growth, Africa is projected to experience the highest increase in material use during the coming decades. While global material use is predicted to more than double between 2011 and 2060, OECD prognoses that material use will increase more than 4 times during the same period in the Africa and Middle East region (OECD, 2019). However, this increase starts from very low levels. In 2017, the domestic material consumption per capita in Africa was 83% lower than the average per capita consumption in North America (Rademaekers et al., 2020).

The foreseen growth in flows of materials and waste involves significant environmental and social challenges, not least to African countries with poor infrastructure and governance frameworks to manage hazardous waste and where recycling activities are largely handled in the informal sector (UNEP, 2018a).

Besides improving capacity for recycling and waste management and creating jobs in the recycling and remanufacturing industry, recent reviews discuss other opportunities that circular economy policies could have for low and middle-income countries. Agriculture, housing and transports are examples of sectors discussed where there could be large potential benefits from more circular approaches. However, comprehensive studies of these potential benefits are scant and estimates are often based on smaller case studies (Preston et al., 2019).

In one of few studies, the "Circular economy in Africa-EU cooperation", Rademaekers et al. (2020) use a macroeconomic model to estimate impacts from the implementation of a first set of circular measures in a limited set of priority sectors on the African economy. The study predicts a 2% higher GDP and 3% higher employment rate by 2030 in a circular economy scenario compared to a business-as-usual scenario. This corresponds to approximately 11 million additional jobs in the circular economy scenario.

4.2 Circularity in the agri-food sector

There has been relatively little attention paid to the potential role circular approaches can play in the agriculture sector where most people in low-income countries are employed (Preston et al., 2019; van Bodegom et al.,

2019). This may seem a bit odd since nutrient recycling is perhaps the most fundamental of circular flows. Beside its economic importance, agriculture is estimated to contribute to a quarter of worldwide greenhouse gas emissions and an important driver behind deforestation, biodiversity loss and water pollution (van Bodegom et al., 2019).

In contrast, the EU Farm to fork strategy (European Commission, 2020b) is closely linked to the circular economy action plan, and in for example the Netherlands, which is a frontrunner in industrialised agriculture and circular economy, there is a very vivid discussion on resource efficiency and circularity in agriculture (Bianchi et al., 2020; Muscio & Sisto, 2020).

There are numerous existing concepts in the discussion on how to make agriculture more sustainable. The increased importance of circular economy has potentially brought with it a focus on whole food systems and supply chains. Circularity is also increasingly used in combination with the bio-economy concept to ensure that the biobased production (including agriculture, forestry, aquaculture, fisheries and other marine biomass) moves from linear to circular. Illustrative is the use of the term "circular bioeconomy" by the Food and agricultural organisation (FAO) (FAO, n.d.-c).

Circular economy issues for the agricultural sector include optimal use of inputs (e.g. organic fertilizer), land (e.g. vertical farming, closed loop aquaculture), minimisation of food waste during production and use, re-use of food, by-products and waste (e.g. biogas, or new products) and recycling and reduction in leakage of nutrients (carbon, nitrogen, phosphorous, water) (Preston et al., 2019).

A common application is the re-circulation of waste to produce fertilizer and other products. For example, a Ghanaian company uses urine, food market organic waste, and slaughterhouse waste to produce organic fertilizer, irrigation water, biogas and electricity. In a review of case studies on circular economy case studies in low and middle-income countries, van Bodegom et al. (2019) show that circular approaches can be applied at different levels: At the individual farm, as exemplified by a Chinese pig farm that circulates its own pig manure to create biogas and fertilizer. At the regional level, where a Tanzanian company creates insect protein from organic waste from Dar Es Salaam. At an international level where a

company buys animal and vegetable waste and creates organic fertilizer which is sold to 65 countries (van Bodegom et al., 2019).

4.3 Large informal sector in recycling and waste management

A large share the working population in low-income countries has an informal employment, and waste management is among the principal activities in the informal sector (Desmond & Asamba, 2019; Preston et al., 2019). This is an occupation where poor people search through garbage heaps, dump sites and junkyards in search of material they can use or sell. Informal recycling activities often form part of elaborate networks specialising in specific materials. In, for example, Brazil more than 380 thousand waste pickers are organised in around 1200 cooperatives and associations and form an integral part of recycling and waste management activities (Gutberlet et al., 2020). Hence, policies, concerning waste management and recycling in low- and middle-income countries are important from a livelihood perspective. An important consideration is how to include the large informal work force into a transition to a more formalized waste management and recycling sector (Gutberlet et al., 2017; Preston & Lehne, 2017).

4.4 Environment and health risks

Recycling and management of the growing flows of secondary materials and increasingly complex waste pose severe risks to ecosystems and human health in low and middle-income countries with comparatively low environmental standards and technological capacity. Illegal waste shipping and dumping as well as lack of transparency about the content of waste flows make effective governance difficult.

A large share of global e-waste is already exported to developing countries often illegally or falsely labelled as intended for e.g. reuse (Forti, Baldé, Kuehr, & Bel, 2020). The health and environmental risks associated with imports and processing of e-waste have been analysed in several studies. When recycling e-waste, informal workers use unsafe methods such as burning off metal wire insulation, grilling circuity boards, and acid leaching

(Asampong et al., 2015; Preston et al., 2019). These techniques expose both the workers and the environment to a number of toxic substances, including carbon monoxide, heavy metals, dioxins, brominated flame retardants and polychlorinated biphenyls (PCB's) (Forti et al., 2020; Perkins et al., 2014; Preston et al., 2019; UNEP, 2018b). Observed negative health effects include cancer, adverse effects on birth outcomes and the functioning of heart, lung, and immune system, as well as impaired learning and altered neurodevelopment (Forti et al., 2020). In regions near recycling sites, toxic substances contaminate food, indoor dust, air, soil, sediment, and water (Grant et al., 2013; Perkins et al., 2014). Substances can bioaccumulate and persist for long periods in the environment and constitute long-term health and environmental risks (Perkins et al., 2014).

The environmental effects from plastic pollution have received global attention during the last years (Lau et al., 2020). Lately there is also growing attention to the health effects associated with the many different hazardous substances in plastics (Groh et al., 2019) which can find their way into food chains. Also, the incineration of plastics with suboptimal technology in low- and middle-income countries is an area of growing concern (Preston et al., 2019).

China, together with Hong Kong, imported around 70% of global cumulative plastic waste since the early 1990's (Brooks et al., 2018). In 2018, China banned import of most plastic waste in order to reduce the inflow of contaminated plastics and difficult to recycle plastics (Katz, 2019). This lead to a major change in the large trade flows of plastic waste in which Southeast Asian countries like Malaysia replaced China as the world's leading importers (Wang et al., 2019). Malaysia, however, has recently stopped imports of plastic waste as the country, according to the Environment minister, does not want to "become the garbage dump of the world" (BBC, 2020).

Recently, the EU banned exports of plastics that are difficult to recycle (European Commission, 2020c) and the Basel Convention decided in 2019 to introduce unrecyclable, mixed and contaminated plastic waste into their regime that requires the consent of importing countries before waste exports can proceed (Basel Action Network [BAN], 2019).

4.5 Trade opportunities and barriers related to circularity

With increased implementation of circularity policies in EU and other large economies, the demand for disassembly, repairs and remanufacturing services will rise and growing trade flows of waste and scrap, secondary raw materials and second-hand goods is expected (Yamaguchi, 2021).[16] This entails both benefits and costs for low and middle-income countries, but the magnitude is difficult to assess due to poor data of these trade flows (Rademaekers et al., 2020).

Due to low labour costs, there can be a competitive advantage in disassembly, repairs and remanufacturing which are still difficult to automate (Preston & Lehne, 2017). Imported functioning or repairable second-hand products can also be an affordable way to improve access to technology for low-income countries (Amankwah-Amoah, 2016). In Ghana, for example, repair and reuse of electronic products have been important in meeting the demand for laptops among students, and there have been similar effects for mobile phones. Another important example is refurbished healthcare equipment that could be purchased for up to 60 percent less than new equipment (Preston et al., 2019).

However, trade in second hand products, such as used cars or electronics, also prolongs the lifetime of products with poor environmental standards. Such trade has also been used to disguise illegal shipment of waste as it can be difficult to control the functionality of traded goods (Rademaekers et al., 2020).

The implementation of national or regional circular economy policies, including, new product standards for durability and traceability also risk creating new trade barriers for low and middle-income countries (Preston et al., 2019; Rademaekers et al., 2020; Yamaguchi, 2021).

Achieving more circular flows of materials is dependent on improved transparency and standardized classifications throughout international supply chains to enable effective and safe use of secondary materials. New

[16] See the OECD "Re-circle" study "International Trade and the Transition to a Circular Economy" (OECD, n.d.)

digital technologies, such as electronic tags and digital passports, can enable materials, products, product components and chemical contents to be tracked and mapped throughout supply chains (ChemSec, 2021). This technological development is essential to the implementation of the EU circular economy action plan (see chapter 4 below).

Stronger requirements on transparency and traceability can however pose challenges for low and middle-income countries. One major challenge for traceability is lack of data. Even though the general material (plastic, wood, textiles) might easily be known, creating safe circular material flows will require specific knowledge about material and chemical content. Such data is however extensively missing and the spread of such data between different actors within the supply chain is a further challenge (ChemSec, 2021). Low and middle-income countries generally have less developed systems in place to generate the required data and documentation related to product contents, and even more so if recycled materials are used.

Consequently, there is growing discussion on the role of trade policies and international environmental agreements to better manage the considerable opportunities and risks associated with more circular material flows (Kettunen, 2019; Yamaguchi, 2021). One of the central issues is the development of harmonised standards and procedures to verify the quality of secondary materials and what distinguishes such materials from being classified as waste. Without such standards and definitions, it will be difficult to scale up a legal international trade in secondary materials.

4.6 Institutional capacity constraints

Taking into account that the growth in materials use and waste is projected to be especially high in Africa and some Asian countries, there are relatively few studies on the particular challenges and opportunities a circular transition may bring about for low and middle-income countries (other than China). While many examples of circular projects and activities exist, few developing countries have dedicated circular economy strategies (Preston et al., 2019).

Surprisingly few developing countries have implemented regulation on extended producer responsibility, which is one fundamental policy to incentivize more circular resource flows (Slunge & Alpizar, 2019).

As circular economy approaches span across many different sectors and levels of governments, governing a circular transition may prove particularly challenging in low and middle-income countries. Weak institutional capacity was also the most frequently stated constraint to scaling up circular economy approaches, in a recent survey on circular economy priorities in developing countries, carried out by UNIDO and Chatham house. Access to finance and technology were the second and third key constraints identified in the study (Preston et al., 2019).

5 Circular economy in development cooperation

This section briefly reviews circular economy policies in EU development cooperation policy and in three EU member states, which have a particular circular economy focus in their development cooperation. The use of the circular economy concept by the multilateral development banks is also reviewed.

5.1 EU

The European Commission has supported several global circular and green economy policy initiatives during the last years. This includes the UN policy action on green economy (PAGE), The EU Switch to Green Flagship Initiative and the External Investment Plan Guarantees linked to sustainable cities.

Directorate-General International Partnerships (DG INTPA) foresee that in the new EU development cooperation strategy for 2021-2027 a much larger focus will be on promoting circular economy in partner countries, in collaboration with EU member states ("Team Europe"). The newly established Neighbourhood, Development and International Cooperation Instrument (NDICI) – which merges ten existing financing instruments and the European Development Fund – will be the main vehicle for coordination with member states and partner countries.

Discussions on the role that circular economy issues will play in NDICI programmes are ongoing. Draft programmes and Team Europe Initiatives (TEIs) include circular economy contributions at country and regional levels. At country level, TEIs on circular economy are foreseen to include the development of enabling frameworks, engagement with the private sector and value chain development, trade facilitation, investment mobilisation and action at city level (e.g. waste governance and infrastructure). At the regional level, draft initiatives include regional standards, value chain development and trade facilitation. One example is the EU-ASEAN strategic partnership and action on circular economy and other Green deal priorities. It will combine policy dialogue and a mix of

grants, loans, guarantees, technical assistance, and collaboration with research agencies and civil society[17].

The Commission is also actively using the circular economy concept in policy dialogues on the global, regional and national levels. It is for example promoting a global agreement on plastics, explores the possibility of defining "safe operating spaces" for use of natural resources as well as an international agreement on natural resources management. Policy dialogues on circular economy have been undertaken with the African Union, South Africa, China, India, Colombia and other countries. In some cases, for example with China and India, specific partnership agreements on circular economy have been reached.

According to the Commission, African leaders show a strong commitment to scale up and use circular economy approaches in the African green transition efforts. Circular economy is increasingly viewed as contributing to reduced natural resource dependency and pollution while at the same time contributing to economic growth and job creation. The Commission explicitly mentions that EU could consider membership in the newly formed African Circular Economy Alliance (ACEN), a platform for circular economy engagement in Africa (European Commission, 2020d).

5.2 EU member states

A few member states explicitly push for a circular economy in their development cooperation and foreign policy.

Netherlands

In 2016, the Dutch government launched a broad programme for a circular Dutch economy by 2050. Among the goals are a 50% reduction in primary resources use by 2030 and to be a waste-free economy, completely running on reusable materials by 2050 (Government of the Netherlands, n.d.). While there is no specific circular economy strategy for Dutch development cooperation, the Dutch policy document on foreign trade and development cooperation explicitly mentions circular economy

[17] Presentation by Thibaut Portevin, DG INTPA, Member States meeting on development and international cooperation on Circular Economy, 31 March 2021.

as an important way to reach the sustainability goals in developing countries.

There are also several initiatives and guiding documents. The initiatives for a circular economy (I4CE) is a collection of existing private sector development tools that embassies may use to stimulate circular thinking. The I4CE serves as a guide and inspiration for embassies in the development of circular initiatives (Bindels et al., 2020). Example of programmes include: (i) the Holland circular hotspot programme, where national knowledge and expertise within circular economy supports development countries, and (ii) the Dutch fund for climate projects, which possesses expertise in water security, sustainable farming, sustainable energy or circular economy, that invests in developing countries projects (Government of the Netherlands, 2018).

Finland

The Finnish government views a circular economy transition as crucial in reaching the national goal of carbon neutrality by 2035. Finland also aspires to become a global leader in circular economy by 2025. The Finnish innovation fund, SITRA, plays a leading role on circular economy in Finland. Among other things, SITRA has initiated the World Circular Economy Forum, WCEF, which now run big yearly global conferences.

Developing countries, especially in Africa, are supported in developing "Circular Economy Roadmaps" and integrating these with their national strategies on environment and climate. As part of this work, Finland joined the African circular economy alliance in 2019. Examples of projects include the "African circular economy project, ALUE" which is a collaboration between Finland, the African development bank and SITRA, supporting circular economy solutions in African countries (Ministry for Foreign Affairs of Finland, 2020). Finland is further working on a new Africa strategy, where circular economy is to be included as one of the key thematic areas. Furthermore, Finland supports partnerships that co-create new enterprises based on circular economy concepts in developing countries, through special funds and platforms, such as the energy and environment partnership fund (EEP Africa,) and Finnfund (Finnfund, n.d.).

Germany

Germany has for almost a decade framed waste management in circular economy terms. The "Circular Economy Act" from 2012 has the purpose to

> "promote circular economy in order to conserve natural resources and to ensure the protection of human health and the environment in the generation and management of waste" (German Bundestag, 2012, p. 4).

This focus is also strong in German development cooperation where "circular economy and waste management" is listed as one of the Federal Ministry for Economic Cooperation and Development's (BMZ) key issues.

BMZ promotes improved waste management systems in partner countries and works to raise awareness of the waste problem. Work on circular economy in development cooperation is a mean to achieve climate mitigation and protect natural resources through development cooperation (BMZ, 2017).

German development cooperation is additionally carried out by GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), which implements projects for different donors such as the BMZ, the EU, private companies or different multi-actor partnerships. GIZ has implemented several circular economy projects focusing for example on waste management in Kosovo, plastic waste in India and recycling in Jordan and Colombia (GIZ, 2020a, 2020b, n.d.-a, n.d.-b).

5.3 Multilateral Development Banks

Circular economy is increasingly discussed and promoted, but not yet integrated into the major policy frameworks or large financial portfolios of the Multilateral Development Banks (MDBs).

The Asian development bank (ADB) has incorporated circular economy into their latest strategy 2030 where one priority area is "tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability". Efficient use of resources and designing out

waste is a specific focus area, and circular economy is mentioned within several areas such as infrastructure and water management (ADB, 2019b). ADB for example support the people's republic of China to develop policy and capacity, technical guidance and design of pilots to further advance green, circular, zero waste cities (ADB, 2020). Another project is promoting actions on plastic pollution in Asia and the Pacific. In this project, member countries will be assisted with

> "forming policy and regulations to encourage a circular economy" and "prepare investments in integrated solid waste management and circular economy systems" (ADB, 2019a).

The African development bank (AfDB), is involved in the African circular economy alliance (PACE, n.d.-a) and the initiative **"**Development of a Green Growth Investment Program in Africa focused on waste management and the circular economy," which aims to minimise waste and maximise the value of resources, recovered and regenerated from their end of lives (AfDB, 2020). The AfDB will further set up the African circular economy facility (ACEF) together with the Finnish Ministry for Foreign Affairs, SITRA and the Nordic Development Fund, during 2021. The ACEF is a circular economy multi-donor fund, which will support African countries in design and implement cross-sectorial circular economy road maps and fund projects that promote entrepreneurship and job creation[18].

The Inter-American development bank (IDB) has not included circular economy in its institutional strategy (IDB, 2019) but has several related projects in place. One project in Bolivia targets for instance a model for e-waste management based on a circular economy approach. Another project is expansion and modernization of recycling and circular business of tires in Panama (IDB, n.d.).

The World Bank is increasingly using the circular economy concept, primarily in relation to private sector development. Several news, publications and learning initiatives on the World Bank webpage relate to the topic. The World Bank hosts a learning series on circular economy and

[18] Presentation by Marleena Ahonen, Finnish Innovation Fund, Sitra, Member States meeting on development and international cooperation on Circular Economy, 31 March 2021.

private sector development, where leading experts are brought together to consider and provide evidence-based responses to challenges related to a circular economy transition.[19] Circular business models, public-private sector dialogues and other ways to engage with market actors are central elements in the circular economy approach used by World Bank private sector specialists.

5.4 Integration of trade, environment and development cooperation policy

The large focus on circular economy by the European Commission will most certainly also have implications for the development cooperation activities of EU member states. The increasing use of the circular economy concept among the Multilateral Development Banks and several UN organisations also indicate that circular economy will play an increasingly important role in development cooperation policy during the coming years.

Since the circular economy agenda includes global supply chains, it highlights the need to connect policy making at national, regional and global levels. Consequently, the coherence between development-, environment-, trade and other policy areas becomes important. It is also likely that there will be an increasing integration between the climate change mitigation and circular economy agendas (ECDPM, 2020).

The brief review in this chapter indicate that the circular economy concept is increasingly used in development cooperation policies, in particular in relation to private sector development initiatives. A recent synthesis note on "the Circular Economy for Donors" published by the Donor Committee for Enterprise Development (DCED, 2021), show that initiatives are heterogeneous and span many sectors and issues.

[19] https://www.worldbank.org/en/events/2020/09/21/circular-economy-and-private-sector-development-learning-series#2

6 Circular economy in Swedish development cooperation

This section reviews how circular economy is included in policy documents guiding Swedish development cooperation and how the concept has been operationalised into guidelines and contributions by the Swedish international development cooperation agency (Sida), the main implementing agency of Swedish development cooperation.

6.1 Circular economy in Swedish development cooperation policy

Circular economy and closely related concepts are included in several of the key policy documents steering Swedish development cooperation. Environment and climate change is one of the five "perspectives" in the Policy framework for Swedish development cooperation and humanitarian assistance. In the thematic priority "Inclusive Economic Development" it is stated that Sweden shall "… support sustainable, responsible and productive investments and a transition to a resource-efficient, circular and biobased economy." The policy framework identifies

> "economic instruments and new business models, education and information, as well as sustainable public procurement" as important tools (Government of Sweden, 2016).

Among the 13 thematic strategies guiding Swedish development cooperation, circular economy is only referred to in the strategy for Sweden's global development cooperation in sustainable economic development. The strategy states that activities should contribute to

> "…inclusive sustainable economic development and a transformation to a resource-efficient, non-toxic, circular and bio-based economy with low emissions of greenhouse gases" (Swedish Ministry of Foreign Affairs, 2018b, p. 4).

The circularity perspective is further highlighted in relation to resource management; "*Activities are to contribute to a positive business climate with sustainable use of natural resources*." (Swedish Ministry of Foreign Affairs, 2018b, p. 5).

The "Strategy for Sweden's global development cooperation in the areas of environmental sustainability, sustainable climate and oceans, and sustainable use of natural resources 2018–2022", does not explicitly mention circularity, but states that "operations with a link to sustainable production and consumption should be based on a lifecycle perspective, the precautionary principle and the polluter pays principle" (Swedish Ministry of Foreign Affairs, 2018a, p. 5). The strategy further states that

> "analyses based on a lifecycle perspective are important to highlight the way in which people who live in poverty are affected by chemicals, waste and other environmental impact and to be able to propose relevant measures." (Swedish Ministry of Foreign Affairs, 2018a, p. 3).

Circular economy is also referred to in recent Swedish development cooperation strategies targeting specific countries. The strategy for partnership with Kenya (2021–2025) states that Swedish development cooperation "…will promote a circular economy which reduces climate impact, improves the environment; the competitiveness, the economic growth and creates green jobs" (Swedish Ministry of Foreign Affairs, 2020, p. 5). The strategy for partnership with Bangladesh states that development cooperation

> "… may contribute to a transition to a circular economy as well as a socially and environmentally sustainable textile production with reduced water use and emissions of hazardous substances." (Swedish Ministry of Foreign Affairs, 2020, p. 5).

In the latest budget bill, the Swedish Government has further described that "development cooperation shall support a transition to a fossil-free economic development, built on a resource-efficient, circular and bio-based economy with non-toxic flows" (Government of Sweden, 2020, p. 43). Similar statements can further be found in the budget bills for 2018

and 2020 (Government of Sweden, 2017, 2019). Circular economy is not mentioned in the yearly government instructions to Sida.

6.2 Circular economy in Sida's guiding documents and toolbox

Sida's environment policy states that environmental aspects should be integrated in all operations and sectors to ensure a transformation to an environmentally sustainable development. One out of four "directions" to achieve this is

> "promotion of a circular economy, through economic instruments, incentives and technical solutions that in a transformative manner contribute to a resilient, climate neutral and resource efficient development." (Sida, 2018).

Sida's "Green Toolbox" contains guidelines and tools for Sida staff and partners to integrate environment and climate change perspectives into their activities. There is a special information brief as well as a dialogue and assessment tool on green economy, but the toolbox does not contain information on the circular economy or biobased economy concepts.[20]

There has so far been no structured effort, such as studies, concept notes, seminar series or staff training, to operationalise and mainstream the circular economy concept at Sida. In this respect, the broader green economy concept has been in focus.

6.3 Circular economy in the Swedish development cooperation portfolio

In order to get an overview of how the references to circular economy and related terms in policies guiding Swedish development cooperation have been operationalised into specific program and project supports ("contributions", in the following text) a search was conducted in the

[20] https://www.sida.se/en/for-partners/methods-materials/green-toolbox

database with open government data of Swedish aid (www.openaid.se). Due to limitations in the registration and labelling – and hence searchability – of contributions in Open Aid, this analysis should not be seen as a complete review of the full portfolio of Swedish contributions. It is rather indicative and exemplifies how circular economy and related terms in policy documents have been translated into contributions.

In Open aid, contributions were found by searching for the terms "circular economy", "green economy" and "biobased/bio economy" in both English and Swedish. The search was limited to contributions starting 2015 or later. An additional search using the same terms and years was conducted in d-portal, a database for development activities and budgets published to the International Aid Transparency Initiative. The search results were divided into four categories, based on how contributions were labelled in the project titles, or if the specific search terms were included in the project description. The four categories were:

- Circular economy – contributions with "circular economy/circular" in the project title or description.
- Green economy – contributions with "green economy/green" in the project title or description.
- Biobased economy – contributions with "biobased/bio economy/bio" in the project title or description.
- Other contributions of relevance for "a transition to a resource efficient, circular and biobased economy"[21]

The search in the databases identified 52 contributions with only one explicitly mentioning the circular economy. Based on a dialogue with Sida program officers, 16 additional examples of contributions were identified. Contributions addressing central elements in the circular economy agenda were added to the group of circular economy related contributions. This included contributions addressing chemicals and waste management, recycling, resource efficiency, greening specific supply chains, enterprise development with circular economy linkages, and decent work initiatives

[21] In Open Aid, these contributions were identified in the search using "circular economy". "green economy" or "biobased economy" as key words, although these words were not included in the project title or description.

related to the informal sector and recycling. Contributions in the area of blue economy, climate economy, green growth and environmental economics were added to the green economy category.

Table 3 summarises the identified contributions in relation to the four categories (see Appendix 2. Portfolio analysis) for a list of the identified contributions).

Table 3: Summary of contributions in portfolio analysis

Category	No. of identified contributions	Total annual budget in SEK**	Budget share of portfolio
Circular economy	7	30 000 000	5%
Green economy	27	205 000 000	34%
Biobased economy	6	23 000 000	4%
Other contributions*	28	340 000 000	57%
Total portfolio contributions	68	598 000 000	100%

Note: See appendix 2 for a list of the contributions included in the portfolio analysis. * Other contributions of relevance for a transition to a resource efficient, circular and biobased economy. ** Annual budget is calculated with the assumption of equal distribution per year, over time period. Source: Authors

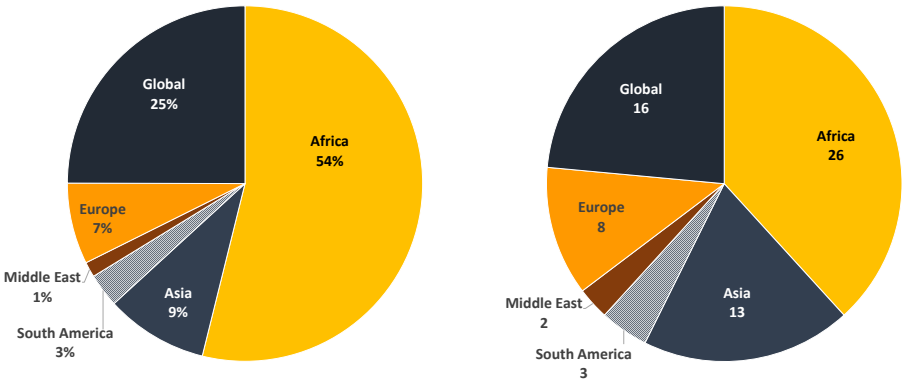
The portfolio analysis illustrates that there are few Swedish contributions today that directly relate to circular economy activities. Of the 68 identified contributions, only 7, were categorised as circular economy contributions. This corresponds to 5 percent of the total budget in the portfolio analysis. 27 contributions (34% of the budget) were categorized as green economy contributions, 6 contributions (4% of the budget) were categorized as biobased economy contributions and 28 contributions (57%) were placed in the fourth category "Other contributions".

Figure 6 illustrates that almost half of the contributions are for programmes or projects in Africa. Global programmes constitute around 25% of the analysed portfolio. The geographical focus on Africa as well as the channelling of large aid funds through global programmes largely corresponds to that of Swedish development cooperation in general.[22]

[22]https://publikationer.sida.se/contentassets/0ddf84f6b9f6455bbaa6a6929274c7ff/sida_arsredovisning_2020.pdf

The portfolio analysis additionally shows that contributions related to circular, green or biobased economy lie mainly within the sector category "general environmental protection".[23] The portfolio analysis includes 21 contributions related to this category. Additional key sector categories present in the portfolio analysis are energy generation, distribution and efficiency (7 contributions), industry (7), water supply and sanitation (6) and agriculture (5).

Figure 6: Share of budget and number of contributions in the portfolio



Note: The left circle illustrates share of budget in the portfolio. The right circle illustrates number of contributions per region in the portfolio. Source: Authors.

The portfolio analysis should however be interpreted with caution. The 68 contributions included in the portfolio analysis, with a total annual budget of 598 million SEK, only constitute approximately 1.4 percent of the total Swedish development cooperation portfolio, which amounted to over 42 billion SEK in 2020.[24] Also, the analysis only includes contributions which appeared during the search using the specified terms. Contributions in this area that are labelled in a different way are not included. Thirdly, some of the contributions mentioned in conversation with Sida, could not be found as contributions in Openaid, and were not included in the analysis.[25]

[23] In OpenAid, contributions are linked to a sector and sector category, which describes the thematic area in which the contribution will be performed. OpenAid is based on the OECD/DAC sector code standard, also used by IATI.

[24] https://publikationer.sida.se/contentassets/0ddf84f6b9f6455bbaa6a6929274c7ff/sida_arsredovisning_2020.pdf

[25] For instance, the Better Cotton Initiative, BCI, and related contributions to the project.

6.4 Swedish support to a green transition has many names and forms

The review of Sida's guiding documents and contributions as well as the dialogue with Sida staff show that Swedish development cooperation contains a large variety of contributions to a green transition, and that these supports have many names and shapes. So far, green economy, rather than circular economy or biobased economy, has been the broader term used by Sida for dialogues and contributions linking environment and economic issues. This may at a first glance be surprising as "green" is one of the few words not mentioned in policy documents guiding development cooperation. However, the use of green economy follows the popularity the concept gained a decade ago among UNEP, OECD, the World Bank and other international organisations. Sida has also been an important financier of early NGO and UN initiatives on green economy such as the Green Economy coalition and the Partnership for Action on Green Economy.

Even though few programmes or projects have been explicitly labelled as circular economy initiatives, many existing Swedish contributions are highly relevant for addressing real "circular economy issues". Notably, Sweden is an important financier of several international organisations influencing global policy discussion. This includes UNEP's work on sustainable production and consumption and ILO's work on a just transition. Sida is also increasingly engaged with the private sector and international NGOs in various initiatives to stimulate a green transition. Examples include the core funding to the World Resources Institute, which chairs PACE and the Science based targets initiative, and the support to the Market Transformation Initiative led by the World Wildlife Fund (WWF). Other examples include collaborations with Swedish large companies in Swedish Investors for Sustainable Development, Swedish Leadership for Sustainable Development and Sweden Textile Water Initiative.

The extent to which Swedish "global contributions" lead to concrete action in poor countries could not be assessed as part of this review, but merit further attention. Similarly, the level of priority and integration of green, circular and biobased economy issues in bilateral development

cooperation programmes merit further attention. A strategic approach to a green transition requires buy-in of partner country governments and involvement of strong ministries in charge of areas such as finance, planning, agriculture and infrastructure. When such buy in is lacking, there is a risk that support to a green transition will be diluted and take the form of many not so strategic projects (Slunge & César, 2012).

7 Concluding discussion and recommendations

This chapter concludes the review with a discussion of critical issues in moving forward with the circular economy agenda in Swedish development cooperation. To stimulate further discussion, potential priority circular economy issues for Swedish development cooperation are identified in the last section.

7.1 Benefits and costs of introducing the circular economy concept in development cooperation

Circular economy has rapidly emerged on the international policy agenda as a visionary boundary concept connecting issues such as environmental pollution, climate change, private sector development, job creation and economic growth. Most issues on the circular economy agenda – e.g. resource efficiency, decoupling of economic growth from environmental impacts and recycling – have been discussed extensively before. As such, circular economy can be seen as old wine in new bottles.

However, the circular economy concept seems to be benefitting from a critical window of opportunity to connect the growing environmental crisis with existing and emerging solutions in an agenda for change.[26] The benefits of the concept should primarily be seen in its apparent ability to engage a broad set of actors in a dialogue on sustainable economic development. Addressing environmental challenges requires collaboration and action by many different actors, why concepts opening doors to important actors such as ministries of Industry and Finance and private sector organisations should be welcomed.

Still, introducing new concepts involves both costs and certain risks. In development cooperation, the introduction and roll-out of new concepts often involves studies, trainings, dialogues etc. As new concepts are often

[26] See the seminal book on agenda setting by Kingdon (2003).

followed by funding, many developing country administrations rapidly adjust to new items on the development cooperation agenda and develop policy documents, action plans and projects that can get funding. For example, several developing countries are now beginning to develop national circular economy action plans, involving consultancy report and dialogues. One example is Kenya, where a consultant has been commissioned to develop a circular economy toolkit to be used by different sector administrations and county governments. To motivate the cost of such exercises they must add considerable value, and not be merely a rebranding of existing green economy action plans.

There is a risk that much effort is devoted to discussing the visionary aspects of a circular economy at the expense of addressing the very real health and environmental problems caused by industrial pollution and improper waste management. Another risk is that companies try to greenwash by introducing some circular projects in a largely polluting business. When moving forward on circular economy in development cooperation, besides all the dialogues it may create with new actors, care should hence be taken to make sure that real problems are in focus and that the potential strategic behaviour of private sector actors is carefully considered.

7.2 Circular, biobased or green economy – a pragmatic approach?

Besides "circular", "sustainable, biobased, resource-efficient, fossil free and non-toxic" are concepts used to describe the sort of economic development that Swedish development contribution should contribute to. As concepts overlap and there is a tendency to expand concepts to be all inclusive, it can be challenging to know when and how to use circular economy and other concepts. A recent evaluation illustrates this dilemma by noting that Swedish policy and instruction to Sida is "extensive, complex and in some respects unclear" (p. 6) and that "the number of goals and themes per strategy should be reduced and be formulated at an overall level and as similarly as possible when they are about the same thing." (p. 8) (Swedish National Financial Management Authority [ESV], 2020).

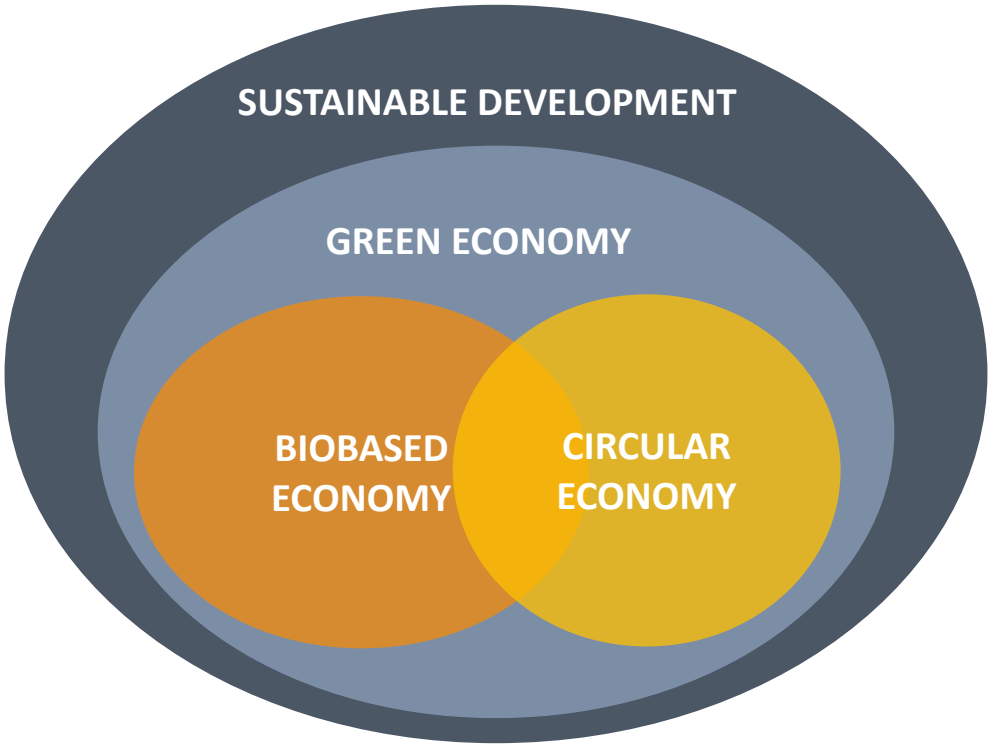
In the dialogue with Sida staff it was also clear that they prefer that the different concepts are seen as forming part of a larger green transition, and that detailed reporting on how each specific concept is implemented is avoided. A pragmatic approach to the use and operationalisation of the different concepts is preferred, where country and regional contextual factors and priorities, as well as the possibilities to achieve positive impacts on poverty reduction and environmental improvements, are considered.

The "Team Europe" approach used in EU's development cooperation, where member states coordinate their activities in a particular country or region, adds an additional layer of complexity to the use of different concepts. As circular economy is becoming a priority concept in EU development cooperation, Swedish actors will need to adapt and align.

In order to use different concepts in a pragmatic, but at the same time conceptually meaningful, way, development cooperation staff need to have a good understanding of different concepts and in what circumstances it is preferable to use each concept. Sida could develop its existing toolbox, staff guidance and training with a typology of different concepts and their preferred use. This would be one important step to further operationalise the policy guidance on circular economy in development cooperation.

Figure 7 and table 4 include a rudimentary typology based on the present review. In figure 7, circular economy and biobased economy are identified as subsets of the broader green economy concept (see section 2.3), which in turn is a subset of the broader sustainable development agenda. As many of the concepts lack clear definitions and overlap each other, developing this type of conceptual typology entails some rather subjective distinctions. It is also likely that the circular economy concept will expand in policy circles and possibly replace some of the discourse and strategies developed under the green economy umbrella during the last decade.

Figure 7: A visualization of the connections and overlap of different sustainability concepts



Source: Authors.

Table 4 identifies key principles and issues linked to the same four concepts as in figure 7 as well as "fossil free "and "non-toxic" which appear in Swedish development policy documents related to a green transition.

Table 4: Sustainability concepts – key principles and issues

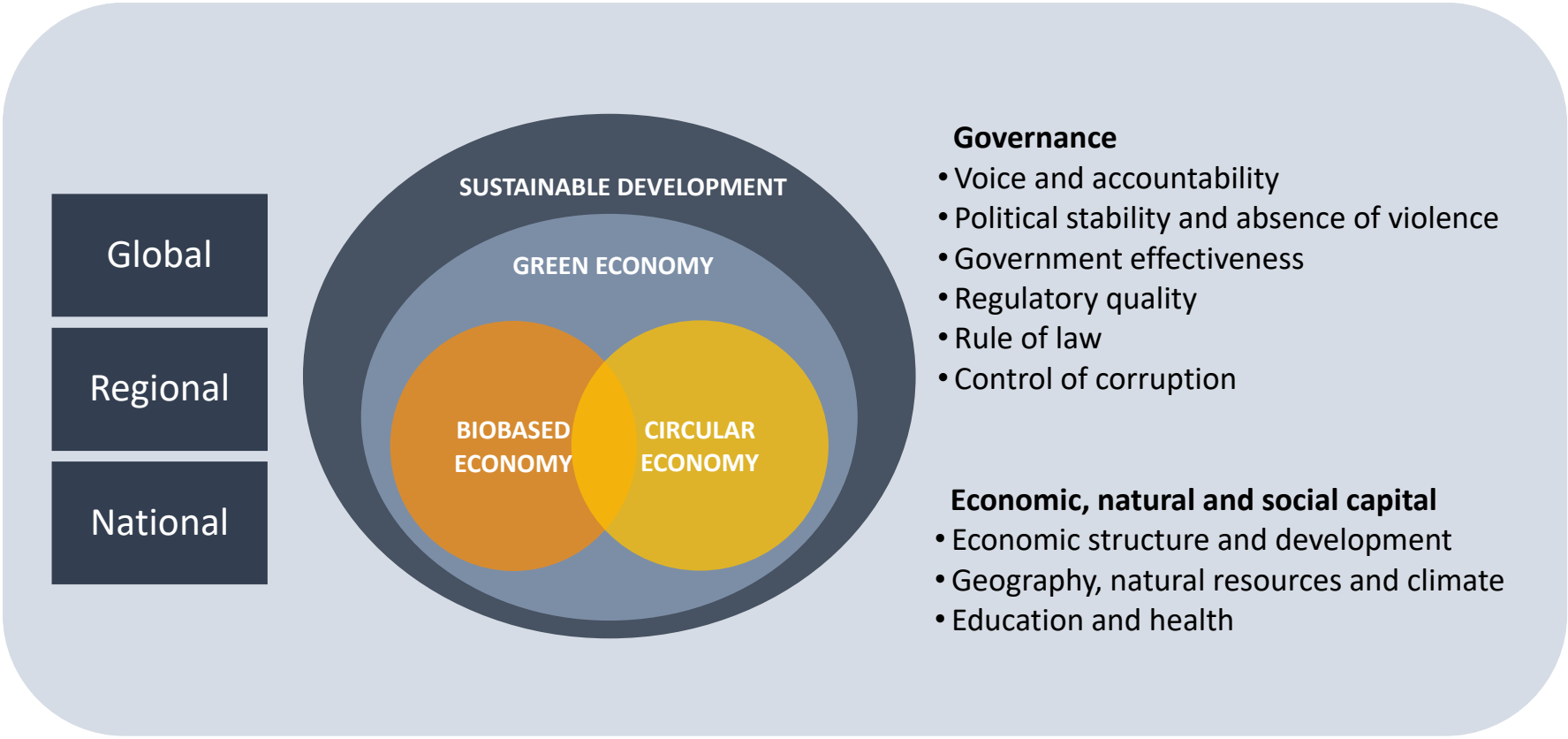
Concept	Principle	Key issues
Sustainable economic development	• Can be sustained over time • Socially, environmentally and economically	• Measuring income • Genuine savings • Trade-offs
Green economy	• Incentives for a green economic transition • Green and blue natural resources	• Economy wide incentives • Valuation and management of ecosystem services and biodiversity
Circular economy	• Extended lifetime • Minimal mining and use of new raw materials • Reuse, recycling, waste minimisation	• New business models • Supply chain initiatives • Resource efficiency
Biobased economy	• Increased use of biological materials	• Forestry, agriculture, aquaculture
Fossil free	• Renewable energy	• Climate change
Non-toxic	• Avoidance and safe management of hazardous chemicals • Green chemistry	• Chemicals and waste • Traceability • Supply chain initiatives

Source: Authors.

7.3 Significant governance challenges to a green and circular transition

Much of the literature on circular economy has a technical and business oriented focus. It is also within the field of private sector development that the circular economy has received most attention within development cooperation (DCED, 2021). While new business models, technology and financing are important, additional attention need to be paid to the contextual factors and governance challenges at global, regional and national levels shaping the incentives for a green and circular attention (figure 8).

Figure 8: Contextual factors for a green and circular transition



Source: Authors.

Such factors include specific policy instruments, such as regulations on extended producer responsibility, but also broader governance issues such as voice and accountability and rule of law. Also, the economic and social situation in a particular country context matters greatly for the possibilities for development cooperation to contribute to a green transition. For example, the COVID-19 pandemic has drastically reduced economic growth in many low and middle-income countries which may make it more difficult to invest in a green transition and implement certain policies.

Our review indicates that it is primarily in the implementation of the two thematic strategies for Swedish development cooperation on Sustainable economic development and Environment and Climate where contributions directly focusing on green, circular or biobased economy are found. However, contributions under other strategic priorities, such as human rights, democracy and rule of law, can also be important in providing an enabling environment for the realisation of a circular economy and a broader green transition.

There are also important interlinkages between governance as well as development cooperation support at the global, regional and national levels. International rules governing trade of primary and secondary raw materials and goods are of increasing importance to a green transition. Hence, a coherent Swedish approach to circular economy in low and middle-income countries should involve environment, trade and development cooperation policy.

7.4 The crucial role of prices in the circular economy

So far, the literature on circular economy has not paid sufficient attention to the crucial role that prices play in the circular economy. A transition to more circular resource flows involves changes in the behaviour of millions of producers and consumers in an internationally interconnected economy. Market prices of different materials and products represent key signals for product design, extraction of raw materials, production and consumption. If environmental and social costs are not internalized in these prices, there will be an incentive to design products that use more

energy or materials during the life-cycle than if the prices reflected the true costs (Wingqvist & Slunge, 2013).

Prices are also important to understand the challenges in recycling and waste management. There is a common misunderstanding that there is a need to recycle more because "waste is in reality so valuable". However, materials with high prices (value) are automatically recycled. There are no piles of gold lying around and recycling rates of certain metal are very high compared with for example plastics. Waste is, in fact, defined by lacking economic value, i.e. the value of the collected material is lower than the collection cost. Rather than having a high hidden value, waste can often have a high negative value, by polluting for instance water at high social and environmental costs.

Consequently, in any circular transition it is crucial to "get the prices right", by identifying and addressing situations where the market fails to allocate resources efficiently in society. Space is here insufficient to describe all the market failures or how to design appropriate policy instruments (see e.g. Sterner and Coria (2012)). Important examples of market failures in the context of a circular economy include situations where:

- Property rights are not assigned properly or fully;
- There are environmental externalities – (pollution) costs that the polluters do not pay;
- There are important public goods at stake (including innovation) leading to underinvestment or overuse;
- Economic actors do not have access to full information or information is asymmetrically distributed.

In the presence of (serious) market failures, policy measures are generally beneficial (if the measures themselves cost less than the distortion caused by the market failure). However, designing and implementing policy instruments that address these market failures is extremely challenging (Sterner et al., 2019). An additional challenge in the quest for a circular economy is that prices of materials relative to income tend to decrease in growing economies leading to increases in use of materials and waste. Increases in resource efficiency of specific products or processes can be

counteracted by increases in demand. This rebound effect makes it important to analyse general equilibrium effects of circular economy policies (National Institute of Economic Research [NIER], 2016).

7.5 Circular economy priority issues in Swedish development cooperation

There is a risk of devoting too much attention to conceptual discussions on circular economy and how it differs in relation to green economy or other concepts used by development partners. One way to operationalise circular economy in Swedish development cooperation would be to identify a set of priority areas or issues. Ideally, these should be issues where there is a solid experience and knowledge among the Swedish resource base and where there is a strong demand in partner countries to solve important issues. Most of the issues outlined below are not new, Sida already has many interesting and relevant contributions in its current portfolio (not all are covered in this review). The idea is rather to outline examples of potential priority issues that can be framed as Swedish contributions to a circular economy.

Table 5 display an overview of five suggested priority issues and exemplifies actors involved and aid modalities. Each of these priority issues are further detailed below.

Table 5: Five suggested circular economy priority issues in Swedish development cooperation

Priority issue	Actors	Aid modality
Incentives for pollution prevention and resource efficiency	• MoFinance/Environment/Sector ministries	• High level dialogue • International training programmes • Sector support • Twinning
Supporting non-toxic material cycles through proactive chemical management	• MoTrade and Industry • MoEnvironment • Trade associations	• Technical support • Training
Social inclusion and just transition to a circular economy	• ILO and labour unions • Trade associations • Government ministries and agencies • Civil society organisations • Media/journalists	• Multi sector dialogues • Watch-dog and other accountability initiatives
Circular business models in specific value chains	• MoTrade and Industry • Trade associations • Academia • CSO networks	• Public-Private Partnerships • Challenge funds
Policy coherence on circular economy–trade, aid and environmental agreements	• Swedish MoForeign Affairs, Trade, Environment; EU coordination etc.	• Aid policy • Trade policy • Agriculture policy

Source: Authors.

7.5.1 Creating incentives for pollution prevention and resource efficiency

A circular economy transition requires behavioural changes by billions of producers and consumers. Creating the right incentives for this transition is of obvious importance. Producers and consumers need to bear the full cost, including the cost of pollution, recycling and waste management, of their activities. This cannot be achieved through specific technical (recycling) projects, but requires an upstream approach using policy instruments spanning whole sectors or the whole economy. Important incentives are also shaped by international trade rules.

Sweden has a large experience from using a variety of policy instruments (regulatory, price based, information) at national and local levels that can generate incentives for pollution prevention and circular material flows (Swedish Environmental Protection Agency [SEPA], 2020). Examples of such instruments include regulations on extended producer responsibility, deposit-refund systems and pollution taxes. One of the lessons of the Swedish experience is that it is very difficult to find appropriate policy instruments.

Swedish development cooperation could provide knowledge and experience on the use of such policy instruments through a dialogue with partner country governments and administrations. Finance and Environment ministries as well as sector ministries would be important partners. Besides high-level dialogues, different types of training programmes, twinning agreements and secondments are possible instruments. Support to research capacity in this area in Swedish partner countries would also be important.

7.5.2 Supporting non-toxic material cycles through proactive chemical management

While circularity has an intuitive appeal, it is sometimes questionable as a goal in itself. The low knowledge about the chemical content in products and material flows constitute a serious and not sufficiently highlighted obstacle to the creation of more circular material flows. Hundreds of hazardous chemicals have been identified in recycled materials and the

concentration can increase over the recycling cycles. The presence of toxic chemicals, such as lead, mercury, phthalates, brominated, chlorinated or fluorinated substances, also constitute severe threats to health and local environments (ChemSec, 2021).

Sweden plays a leading role in pushing for more proactive chemical management at the EU, global level (SAICM) and through smaller development cooperation projects. The circular economy agenda may provide opportunities for expanding this work in collaboration with environmental and industrial agencies in partner countries. This can take the form of technical support to develop national chemical regulation but may also include new initiatives on access to information and improvement of the traceability of chemical content in products and production processes. As a consequence of the European sustainable product policy, with requirements on product content information and traceability, the demand for technical support from partner government, e.g. Ministries of Trade or Industry, on these issues may increase. Existing Swedish support to civil society networks and environmental journalists that inform about health and environmental concerns related to toxic material flows are very relevant in this context as they can generate demand for more proactive approaches.

7.5.3 Social inclusion and just transition to a circular economy

Swedish experiences in the field of democracy, human rights and social inclusion could make important contributions to the often technically focused circular economy agenda. Initiatives can for example aim to strengthen transparency and access to information involving journalists, lawyers, and civil society watch groups, or support ombudsmen or other pro-accountability initiatives (Blair, 2008).

Through the existing core support to ILO and collaboration with Swedish trade unions, context specific linkages to circular economy issues could be explored. Critical social and environmental circular economy issues could be highlighted in the Global Deal initiative, launched by the Swedish

government in collaboration with ILO and OECD.[27] A key challenge is that waste collection and recycling activities are largely informal activities performed by poor men and women. Attention should be paid to how to include rather than exclude the people performing these informal activities in circular economy initiatives (Wingqvist & Slunge, 2013). The right to health among workers in the waste and recycling sector is another issue of particular concern. There are numerous anecdotal examples of cases where a strategy that superficially looks good from a "circular" viewpoint – like increased rates of recycling – may actually imply sending waste to people in low-income countries who are ill equipped and uninformed about the risks.

7.5.4 Circular business models in specific value chains

The circular economy agenda is most prominent in private sector development initiatives where circularity challenges and business models related to particular material or product categories are in focus (DCED, 2021). There are for example existing Swedish contributions linked to the textile value chain, involving networks of private and public actors. Contributions in this area can for example involve support to research and innovation, access to technology and leveraging investments in a circular transition. Influencing criteria for financing provided by the Multilateral Development Banks can be a way to shape incentives for a green and circular transition. For example, the exclusion policies on coal and specific areas of oil and gas, has resulted in a significant reduction of financing from the MDBs to fossil fuel related projects during the last years (IISD, 2021). Supporting capacity to comply with new international standards on traceability, circularity and durability is another important focus for development cooperation in this area.

A challenge for development cooperation in this area is to avoid financing activities that private actors should pay for in accordance with the polluter pays principle. Development cooperation in this area should hence be guided by an analysis of what particular market failure contributions aim to address (see section 7.4). The public good nature of innovation

[27] https://www.theglobaldeal.com/

(typically leading to under investments) could for example motivate support to research and innovation. Poor or asymmetric information could motivate support to labelling or other information disclosure initiatives. See for example Gardner et al. (2019) for a review of initiatives aiming at increasing the transparency of global commodity supply chains.

7.5.5 Policy coherence on circular economy – trade, aid and environmental agreements

The Swedish policy for global development stresses the importance of policy coherence. In relation to circular economy, Swedish initiatives in the areas of trade, product standards and environmental agreements may be at least as important to developing countries as Swedish development cooperation. During the coming years, new international agreements on chemicals and waste (replacing SAICM), plastics and standards for trade/exports of secondary materials will be discussed. Through EU, Sweden will also form part of new trade agreements including product standards and other issues linked to a circular economy. Swedish development cooperation policy on circular economy should be discussed in this broader context.

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Appendix 1. Interviews and seminars

Interviews

December 14th 2020, Thibaut Portevin, Policy Officer Green Economy, DG International Cooperation and Development.

December 14th 2020, Etienne Raffi Kechichian, Senior Private Sector Development Specialist, The World Bank.

December 15th 2020, Ulrika Åkesson, Thematic lead Environment and Climate Change, Sida.

January 13th 2021, Ingela Juthberg, Advisor Sustainable Economic Development, Sida.

January 22nd 2021, Ola Alterå, Head of secretariat of the Swedish Climate Policy Council, and Chair of government inquiry on Circular Economy (SOU 2017:22).

Seminars/Webinars

December 4th 2020, EU Commission and Member States meeting on development and international cooperation on Circular Economy.

December 14th 2020, Online seminar on Green Growth and Circular Economy Toolkit for Policy Makers in Kenya.

January 28th 2021, Seminar on draft report with programme officers at Sida.

February 4th 2021, Webinar with the Platform for Accelerating the Circular Economy, PACE, hosted by World Resources Institute, on Time to Act: The Circular Economy Action Agenda.

March 25th 2021, OECD Webinar on International Trade and the Circular Economy.

Appendix 2. Portfolio analysis

In order to get an overview of how the references to circular economy and related terms in policies guiding Swedish development cooperation have been operationalised into specific program and project supports, a search in the database with open government data of Swedish aid (www.openaid.se) was conducted in December 2020. This search was complemented by interviews with Sida staff as well as a seminar with Sida staff.

Table A1 contains the names and a short description of the 68 identified projects.

Table A1: Identified contributions.

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
CATEGORY 1: Circular economy (contributions addressing chemicals and waste management, recycling, resource efficiency, greening specific supply chains, enterprise development with CE linkages, decent work and initiatives related to the informal sector and recycling)								
Solid waste management Bolivia-zero waste 2019-2022	SE-0-SE-6-13471A0101-BOL-14050 SE-0-SE-6-13471A0102-BOL-14050	Helvetas Swiss Intercooperation	Programme "0 waste in Bolivia", which contributes to management of solid waste.	Bolivia	2019-2023	34 155 000	6 831 000	Water supply and sanitation
SEA Circular	SE-0-SE-6-5102017601-ASI-41010	UNEP	The project's overall purpose is to "reduce spillage of plastic to waterways and to coastal areas in South East Asia by reducing plastic that enters waste streams".	Asia	2018-2023	55 000 000	9 166 667	General environmental protection
Circular Economy through sustainable waste management and employment	SE-0-SE-6-11797A0101-KEN-14050	Hanns-Siedel Foundation	Contributes to a shift towards a circular economy in the solid waste management sector in Kenya.	Kenya	2018-2021	2 939 462	734 866	Water supply and sanitation

[28] Annual budget is calculated with the assumption of equal distribution per year, over time period.

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
Keep Georgia Tidy	SE-0-SE-6-13312A0101-GEO-41081 SE-0-SE-6-13312A0102-GEO-41081 SE-0-SE-6-13312A0103-GEO-41081 SE-0-SE-6-13312A0104-GEO-41081 SE-0-SE-6-13312A0105-GEO-41081	Keep Georgia Tidy (KGT)	The programme aims to reduce greenhouse gas emissions and pollution of environment by 2023 through environmental sustainable education and promotion of circular economy in Georgia.	Georgia	2019-2023	35 124 760	7 024 952	General environmental protection
Projects for goal 12, agenda 2030	SE-0-SE-24-2019-31-218-15150	Swedish Institute	Collaboration focusing on circular economy in the textile industry.	South Africa	2019	100 605	100 605	Government and civil society
Kemi Technical Assistance to ZEMA on Pesticide Management	SE-0-SE-6-13038A0101-ZMB-41010 SE-0-SE-6-13038A0102-ZMB-41010	Kemikalie-inspektionen	Aims to reduce the risks to human and animal health and the environment from the use of pesticides in Zambia.	Zambia	2020-2024	13 300 000	2 660 000	General environmental protection
COVID-19 UNDP Environmental Programme 2019-2020	SE-0-SE-6-12252A0101-KHM-41010	UNDP	The programme aims to contribute to Cambodia being able to attain the Sustainable Development Goals related to 1) natural resources management & biodiversity conservation, 2) clean, affordable and sustainable energy and 3) circular economy.	Cambodia	2018-2022	16 500 000	3 300 000	General environmental protection
CATEGORY 2: Green Economy (contributions focusing on blue economy, climate economy, green growth and environmental economics)								
New climate economy	SE-0-SE-11-90601A0101-GGG-41010	International NGO	The project New Climate Economy	Global	2020	3 000 000	3 000 000	General environmental protection
New Climate Economy and The Coalition for Urban Transition	SE-0-SE-11-90292A0101-GGG-41010	International NGO	Participation in project "New Climate Economy" and "Coalition for Urban Transition".	Global	2019	3 500 000	3 500 000	General environmental protection

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
Partnership for Action on Green Economy	SE-0-SE-6-11740A0101-GGG-32110	UNDP	PAGE Capacity Development Programme	Global	2018-2023	40 000 000	6 666 667	Industry
PAGE Partnership for Action on Green Economy	SE-0-SE-11-12285A0101-GGG-41010 SE-0-SE-11-11181A0101-GGG-41010	UNDP	Support developing countries to converse to a green economy.	Global	2017-2018	6 400 000	3 200 000	General environmental protection
UNEP partnership for Action on Green Economy	SE-0-SE-11-9999116101-GGG-41030 SE-0-SE-11-10152A0101-GGG-41010	UNEP	Contributions to UNEP for contribution to partnership for action on green economy.	Global	2015-2017	3 010 399	1 003 466	General environmental protection
Supporting A Green/Blue Economy: Liberia Blue Ocean Program	SE-0-SE-6-13068A0101-LBR-14050 SE-0-SE-6-13068A0102-LBR-14050	Conservation International (CI)	Aims to promote sustainable management of Liberia's coastal and marine ecosystems.	Liberia	2019-2024	20 000 000	3 333 333	Water supply and sanitation
Green Economy: Sustainable Mountain Tourism and Organic Agriculture (GRETA)	SE-0-SE-6-12700A0101-GEO-32130	Austrian Development Agency (ADA)	The intervention "Green Economy: Sustainable Mountain Tourism and Organic Agriculture (GRETA)", aims at facilitating an improvement of the business environment and the creation of new income opportunities.	Georgia	2018-2023	30 500 000	6 100 000	Industry
Green Economic Development II Phase	SE-0-SE-6-11303A0101-BIH-23183 SE-0-SE-6-11303A0102-BIH-23183 SE-0-SE-6-11303A0103-BIH-23183	UNDP	The intervention aims at improving and scale up of energy efficiency.	Bosnia and Herzegovina	2018-2020	62 900 000	20 966 667	Energy generation, distribution and efficiency
Environment for Development (EfD) Initiative	SE-0-SE-6-6105040201-GGG-41010	University of Gothenburg	Capacity building in environmental economics.	Global	2021-2024	160 000 000	40 000 000	General environmental protection

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
UNICEF Green Innovations Hub	SE-0-SE-6-10962A0101-ZWE-41081 SE-0-SE-6-10962A0102-ZWE-41081	UNICEF	Implementation of the program "Green Innovation Hubs", encourage young entrepreneurs to find innovative solutions to environmental- and energy related challenges in Zimbabwe.	Zimbabwe	2017-2020	7 000 000	1 750 000	General environmental protection
Gothenburg University Inclusive Green Economy	SE-0-SE-6-14368A0101-GGG-41010	University of Gothenburg	International training programme - Inclusive Green Economy in Practice.	East Africa	2020-2022	18 500 000	6 166 667	General environmental protection
IFC Moldova Business Investment Climate Phase III	SE-0-SE-6-13823A0101-MDA-32130 SE-0-SE-6-12688A0101-MDA-32130	IBRD / International Bank for Reconstruction and Development / The World Bank	Implementation third phase of Moldova Investment Climate Reform Project 2019-2023, inception and implementation phase.	Moldova	2019-2023	28 000 000	5 600 000	Industry
The Green Fund – UNHCR	SE-0-SE-6-13602A0101-RSS-23210	United Nations Office of the United Nations High Commissioner for Refugees	Enable the phase out of fossil fuels within UNHCR through the development of method, processes and preparation of procurement documents, contract-templates for private energy suppliers.	South of Sahara	2019	40 000 000	40 000 000	Energy generation, distribution and efficiency
We effect green enterprise business dev	SE-0-SE-6-12065A0101-ZWE-31120 SE-0-SE-6-12065A0103-ZWE-31120	Donor country-based NGO	Implementation of a Green Enterprise Business Development Programme (EBDP) in 9 districts of Zimbabwe in partnership with three local implementing partners.	Zimbabwe	2018-2021	36 210 000	9 052 500	Agriculture
IFC BGTAP - Green bonds technical assistance program	SE-0-SE-6-12304A0101-GGG-24030 SE-0-SE-6-12304A0102-GGG-24030	International Bank for Reconstruction and Development	The fund of Green Bonds – Emerging Green One, will mobilize USD2 billion issued in emerging markets. IFC have also built the Green Bond Technical	Global	2018-2022	53 500 000	10 700 000	Banking and financial services

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
			Assistance Programme, which will e.g. build local capacity on green bond markets.					
JPO ILO 2018 South Africa, Green jobs & PAGE	SE-0-SE-6-11958A0101-GGG-16020 SE-0-SE-6-11266A0102-ZWE-43040 SE-0-SE-6-11958A0102-ZAF-41010	ILO	Contribution of implementing Agenda 2030 in developing countries.	Global	2018-2020	3 334 285	1 111 428	Other social infrastructure
Red & green rods: Swedish - Collaboration on visual ecology of amphibians	SE-0-SE-29-2014-4325-425-43082	University of Lund	Collaboration aiming to better understand the visual ecology of amphibians.	Argentina	2015-2017	748 000	249 333	Other multisector
COVID-19 Practical Action green economic development 2017-2020	SE-0-SE-6-11266A0101-ZWE-43040 SE-0-SE-6-11266A0103-ZWE-43040	International NGO: Practical Action	Contribute to sustainable green economic growth in Zimbabwe by enhancing agricultural productivity with renewable energy and water efficient technologies.	Zimbabwe	2017-2020	24 300 000	6 075 000	Other multisector
ILO Entrepreneurship & Skills development through green enterprize 2017-2020	SE-0-SE-6-11283A0101-ZWE-32130 SE-0-SE-6-11283A0102-ZWE-32130	ILO	The programme "ILO Green enterPRIZE Innovation & Development in Zimbabwe" aims to 'contribute to SMEs growing and creating more & better jobs for women and men through gender equal skills development and sustainable Enterprises'.	Zimbabwe	2017-2020	26 500 000	6 625 000	Industry
Financing of temporary appointment for Swedish director of	SE-0-SE-2-t61-CRS2015-61-UF2014-81005-UD-MU-998-91010	Donor Government	Financing of temporary appointment for Swedish director of Green Climate Fund 2015.	Global	2015	270 530	270 530	Administrative costs

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
Green climate fund 2015	SE-0-SE-2-t60-CRS2015-60-UF2014-81005-UD-MU-998-91010							
Green banking for environmentally sustainable investments	SE-0-SE-6-5217001601-BGD-25012	Other financial corporations	Aims to increase the awareness of the private sector on CSR and promote their opportunities to access green funds for investment in environmentally and climatically sustainable activities.	Bangladesh	2015-2016	262 148	131 074	Business and other services
Forum syd green ownership 2017-2019	SE-0-SE-6-10321A0101-KHM-41010	Donor country–based NGO	The programme Go! Green Ownership 2017-2019, aims to strengthen local organisations to engage poor and vulnerable groups, including women, to manage the root causes to inequalities related to access to, use of and control over natural resources.	Cambodia	2017-2019	49 300 000	16 433 333	General environmental protection
Green communication in multi-relay wireless networks	SE-0-SE-29-2014-4044-540-43082	Chalmers University of Technology	Aims to improve the power efficiency, increase the portion of renewable energy in the wireless networks and develop carbon-reducing systems.	Iran	2015-2017	750 000	250 000	Other multisector
GF PAO support 2019-2022	SE-0-SE-6-13044A0101-GGG-15152	Donor country–based NGO	Green Forum (GF) implements 'Green Political Organisations Programme' (GPOP) in Latin America, Africa (regional) and Europe. The program involves capacity strengthening- and networking activities for strengthening political parties' knowledge and exchange.	Global	2019-2020	20 170 000	10 085 000	Government and civil society

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
Development of green nanotechnologies for catalytic pyrolysis of biomass	SE-0-SE-29-2014-4250-85-43082	University of Stockholm	Aims to obtain the fundamental understanding of physical and chemical phenomena relevant to nanocatalytic pyrolysis technologies for production of second generation biofuels from renewable biomass.	Ukraine	2015-2017	750 000	250 000	Other multisector
Mechanisms of charge transfer dynamics in materials for green energy	SE-0-SE-29-2017-05447-645-23182	University of Uppsala	Aims to study the dynamics of carriers (electrons and holes) by a novel hybrid quantum-classical method combining time dependent density functional theory and non-adiabatic molecular dynamics simulations.	India	2018-2020	1 125 000	375 000	Energy generation, distribution and efficiency
Swedish Leadership for Sustainable Development (SLSD) 2019	SE-0-SE-6-13337A0101-GGG-25040 SE-0-SE-6-13337A0102-GGG-91010 SE-0-SE-6-13337A0103-GGG-25040	Central government in donor country	SLSD 2.0 is a network with Swedish companies, aims to transform to a climate-neutral society, through action, inspiration and influence.	Global	2019-2020	4 081 611	2 040 806	Business and other services
CATEGORY 3: Biobased economy/Bioeconomy								
Biobased Scaffold, membranes and hydrogels for improved wound healing and bone regeneration (BIOHEAL)	SE-0-SE-29-2016-05709-645-12182	University of Stockholm	Aims to establish a collaboration and exchange of knowledge between Swedish and Indian material scientists and medical team to develop polymer based bioglass scaffold, cellulose nanocomposite membranes and hydrogels for wound and dental care.	India	2017-2019	1 170 000	390 000	Health

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
BIO-INNOVATE Phase II, recruitment and office	SE-0-SE-6-5100019901-AFR-32182	International Centre of Insect Physiology and Ecology	Recruitment of project management for BIO-INNOVATE Phase II, and costs for office space (equipment from Phase I).	Africa	2016	300 000	300 000	Industry
BIO-INNOVATE Phase II, 2016-2021	SE-0-SE-6-5105007601-AFR-32182	International Centre of Insect Physiology and Ecology	BIO-INNOVATE is a multidisciplinary research and innovation competitive funding mechanism for biosciences and product oriented innovation activities in Kenya, Uganda, Tanzania, Rwanda, Burundi and Ethiopia. Focus on applications of bio-resources innovations to support sustainable growth and adaptability to climate.	Africa	2016-2021	120 700 000	20 116 667	Industry
UNDP climate smart bio-waste management challenge	SE-0-SE-6-13547A0101-SRB-43032	UNDP	The project aims at promoting innovative projects and business solutions for climate-smart management of biodegradable waste (bio-waste).	Serbia	2019-2022	4 950 495	1 237 624	Other multisector
Development of bio-inspired catalysts for oxidative degradation of organic pollutants in wastewater	SE-0-SE-29-2015-05936-645-41082	University, College or Other Teaching Institution, Research Institute or Think–Tank	This project is devoted to the development of new molecular transition metal catalysts for the oxidation of persistent pollutants, with the aim of developing applications of the catalysts to wastewater treatment.	India	2016-2018	1 170 000	390 000	General environmental protection
Autonomous Visual Detection of Bio-hazards Locations with Aerial Drones	SE-0-SE-29-2018-05024-640-12250	University, College or Other Teaching Institution, Research Institute or Think–Tank	The project aims to use drones to reduce and control breeding grounds for mosquitoes where arboviral viruses Dengue and Zika can spread, to contain the spread of the diseases.	Sri Lanka	2019-2020	787 500	393 750	Health

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
CATEGORY 4: Examples of programmes contributing to "a transition to a resource efficient, circular and biobased economy"								
Sustainable Natural Resource Management for Climate Resilience	SE-0-SE-6-12013A0101-KEN-31220	World Vision Kenya, Northern Rangelands Trust and Stockholm Environmental Institute	This intervention aims at increasing the resilience of marginalized households to climate-change-related shocks through diversified livelihoods and improved natural resource management and use.	Kenya	2018-2021	79 900 000	19 975 000	Forestry
Coffee & Climate and strengthening coffee based livelihoods	SE-0-SE-6-13490A0101-GGG-31120 SE-0-SE-6-13490A0102-GGG-31120	International NGO	Increasing capacity among coffee farmers to adapt to, and mitigate climate change and improve the livelihoods.	Latin America, Africa, Asia	2020-2023	40 000 000	10 000 000	Agriculture
SEI Water Programme Bolivia 2018-2021	SE-0-SE-6-11972A0101-BOL-14020	Stockholm Environment Institute (SEI)	Support the programme Wash thinking connected to Hydrology (WATCH) - improves Bolivian watersheds by sustainably and resiliently managing water resources and sanitation systems.	Bolivia	2018-2021	45 000 000	11 250 000	Water supply and sanitation
Strategic Collaborative Fund Phase 2, 2018-2022	SE-0-SE-6-10833A0101-ASI-41010 SE-0-SE-6-10833A0201-ASI-41010	SEI, Stockholm Environment Institute	Aims to support strategic events, builds capacity of regional actors and enables learning for increased collaboration on key environmental issues.	Asia	2018-2023	48 375 000	8 062 500	General environmental protection
SMHI 2017-2020: WACCA-Ethiopia: WATER AND CLIMATE CHANGE SERVICES FOR AFRICA	SE-0-SE-6-10823A0101-ETH-14081 SE-0-SE-6-10823A0102-ETH-14081	SMHI	Initiative to development of climate and water information and early warning services.	Ethiopia	2017-2020	22 000 000	5 500 000	Water supply and sanitation
SIWI 2018 Jan-Dec Preparation Africa Water Revolution -	SE-0-SE-6-11994A0101-RSS-14015	Stockholm International	The contribution support SIWI to pave the way for the initiative "Call for an African Water	South of Sahara	2017	4 340 500	4 340 500	Water supply and sanitation

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
Preparation Africa Water Revolution		Water Institute (SIWI)	Revolution" that aims to improve the water resource management on the continent in a sustainable, climate smart and innovative manner.					
Ukrainian Parliament 'Green Caucus' Secretariat Support with UNDP	SE-0-SE-6-12053A0101-UKR-41010	UNDP	Aims at strengthening the work of the Parliament of Ukraine on environmental and energy issues.	Ukraine	2018-2020	5 000 000	1 666 667	General environmental protection
RSS/NERC - MENA Region Initiative - a NEXUS Approach & Renewable Energy Tech	SE-0-SE-6-5203030001-AME-41010 SE-0-SE-6-5203030002-AME-41010	Royal Scientific Society/National Energy Research Centre. Ernst & Young	Aims to enhance the capacity of MENA Municipalities as local authorities to promote needed reforms and innovations in the field of Sustainable Development and Green Economy.	Middle East	2016-2021	48 274 609	8 045 768	General environmental protection
Beyond the Grid Fund for Africa	SE-0-SE-6-12534A0101-ZMB-23210 SE-0-SE-6-12534A0102-MOZ-23210 SE-0-SE-6-12534A0103-LBR-23210 SE-0-SE-6-12534A0104-BFA-23210 SE-0-SE-6-12534A0105-UGA-23210 SE-0-SE-6-12534A0107-LBR-23210	NEFCO/Nordic Environment Finance Corporation	Encourage private sector to provide affordable, efficient, high quality, renewable energy services to underserved people in off-grid rural and peri-urban areas that builds on experience of the Beyond the Grid Fund for Zambia.	Zambia, Mozam-bique, Burkina Faso, Liberia, Uganda.	2019-2026	630 000 000	78 750 000	Energy generation, distribution, and efficiency
MUSIKA Phase 3	SE-0-SE-6-11097A0101-ZMB-31120 SE-0-SE-6-11097A0102-ZMB-31120 SE-0-SE-6-11097A0103-ZMB-31120	Musika Development Initiatives	The intervention aims to improve access to new markets that present the opportunity for both inclusive economic growth, environmental protection and climate change mitigation.	Zambia	2018-2021	161 332 962	40 333 241	Agriculture

Title	Activity ID	Contract writing partner	Description	Geographic coverage	Time period	Total budget [SEK]	Annual budget [SEK][28]	Sector category
Promoting decent work in Rwanda's informal economy	SE-0-SE-6-5116012201-RWA-16020	ILO	The overall objective is to promote decent work in Rwanda's informal economy.	Rwanda	2017-2020	27 185 000	6 796 250	Other social infrastructure
KGRTC ILO Skills and Enterprise Development in the Energy Sector	SE-0-SE-6-12727A0101-ZMB-23210 SE-0-SE-6-12727A0101-ZMB-23183	ILO/International Labour Organization	The pilot intervention aims at developing a training programme driven by market needs and with strong engagement of the private renewable energy sector.	Zambia	2019-2020	7 500 000	3 750 000	Energy generation, distribution and efficiency
Beyond the Grid Fund for Zambia (BGFZ)- Energy Service Provider	PLANIt ID: 11155. Archive case No UM 2017/23330	Vitalite	BGFZ is an initiative for investments in renewable energy outside the national grid in Zambia. BGFZ targets a new segment of development-promoting energy services aimed at poor consumers.	Zambia	2018-2022	22 050 000	4 410 000	
Clean and Energy efficient cooking / fuel switch	SE-0-SE-6-12898A0101-ZMB-32174	NEFCO/Nordic Environment Finance Corporation	Aims to scan and test the market for clean cooking solutions in urban Zambia.	Zambia	2020-2021	5 000 000	2 500 000	Industry
FARM AFRICA 2016-2023: Integrated approach , G4F and N4D	SE-0-SE-6-10407A0101-ETH-41081	FARM Africa	Implementation of the programme "Integrated approach to improving rural livelihoods, empowering communities and partner", through a more efficient and sustainable way.	Ethiopia	2016-2023	53 000 000	6 625 000	General environmental protection
SAFE - Mercy Corps/ADRA Sudan	SE-0-SE-6-13260A0101-SDN-31120 SE-0-SE-6-13260A0102-SDN-31120	Mercy crops	Implementation of the programme "Strengthening Agricultural Markets and Food Security (SAFE)", aims to improve agriculture in a more sustainable way and improve agriculture markets.	Sudan	2018-2022	123 250 000	24 650 000	Agriculture

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Decent Work in the Supply Chains of the Garment Sector in Regional Asia	SE-0-SE-6-10660A0101-ASI-16070	ILO	This component develops Regional knowledge on eco-innovation and greener production in the garment industry and identifies gaps and weaknesses among environmental policies regulating the industry.	Asia	2019-2021	36 600 000	12 200 000	Other social infrastructure
SNV INCREASE Climate Smart Agriculture and Biogas	SE-0-SE-6-12923A0101-ZMB-31120 SE-0-SE-6-12923A0102-ZMB-31120	SNV Netherlands Development Organisation	Aims to increase the social, economic and environmental resilience and equity in agricultural and energy systems.	Zambia	2020-2023	79 200 000	19 800 000	Agriculture
ILO Partnership Programme 4, 2018-2021	SE-0-SE-6-6105900001-GGG-16020 SE-0-SE-6-6105900002-GGG-16020	ILO	Sida's global support to the ILO. One cross cutting work of ILO is Just Transition and Environmental Sustainability.	Global	2018-2021	189 000 000	47 250 000	Other social infrastructure
Economics Training 2017-20202	SE-0-SE-6-5504026701-CUB-24081	University, College or Other Teaching Institution, Research Institute or Think–Tank	Education/training in economics for civil servants and university teachers.	Cuba	2017-2019	9 500 000	3 166 667	Banking and financial services
Coal-based economies in developing countries	SE-0-SE-29-2020-03605-666-41010	Linköping University	An environmental, health and cost evaluation around mega thermal power plants, which establish the causality between TPP emissions, health risks, and cost-benefit analyses.	Bangladesh	2021-2023	4 500 000	1 500 000	General environmental protection
Driving a sustainable ocean economy	SE-0-SE-11-90616A0101-GGG-41010	OECD Development Centre	Support to the OCED project "Driving a sustainable ocean economy".	Global	2020	3 000 000	3 000 000	General environmental protection
UNCDF Financing Inclusive Digital Economy in Zambia	SE-0-SE-6-13733A0101-ZMB-24040	UNCDF, United Nations Capital	Aims to increase access to finance for service providers using digital payments through	Zambia	2020	6 000 000	6 000 000	Banking and financial services

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		Development Fund	developing a loan guarantee facility with banks and financial institutions, for loans to companies offering services that can improve poor people's livelihoods, through digital payment methods and at affordable costs.					
Power Africa	SE-0-SE-6-5101000601-AFR-23210 SE-0-SE-6-5101000602-AFR-23210 SE-0-SE-6-5101000603-GGG-23210 SE-0-SE-6-5101000604-AFR-23210 SE-0-SE-6-5101000605-GGG-23210 SE-0-SE-6-5101000606-GGG-23210 SE-0-SE-6-5101000607-AFR-23210 SE-0-SE-6-5101000608-AFR-23210		Expansion of renewable energy production and access in the sub-Saharan Africa region, and phasing out of non-renewable energy sources.	Africa	2015-2025	18 270 346	1 660 941	Energy generation, distribution and efficiency
Core support EcoVisio - EcoVisio Waste Management Area	SE-0-SE-6-12042A0101-MDA-15150 SE-0-SE-6-12042A0102-MDA-15150	Asociatia Obsteasca Ecovisio	Funding to strengthen the work by EcoVisio and their core activities.	Moldova	2018-2021	5 351 583	1 337 896	Government and civil society
Sustainable ocean economy in the ASEAN region	SE-0-SE-11-90319A0101-GGG-41010	United Nations Educational, Scientific and Cultural Organisation	Driving a sustainable ocean economy in the ASEAN region.	Global	2019	5 000 000	5 000 000	General environmental protection

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Next Generation Energy Materials for the Hydrogen Economy	SE-0-SE-29-2014-4324-764-23182	University, College or Other Teaching Institution, Research Institute or Think–Tank	Research on improvements of hydrogen economy.	Thailand	2015-2017	750 000	250 000	Energy generation, distribution and efficiency
World Resources Institute "New Climate Economy"	SE-0-SE-11-12345A0101-GGG-41010 SE-0-SE-11-11509A0101-GGG-41010 SE-0-SE-11-10149A0101-GGG-41010 SE-0-SE-11-90601A0101-GGG-41010 SE-0-SE-11-91029A0101-GGG-41010	WRI & International NGO	Participation for developing countries i Global Commission on the Economy and Climate.	Global	2016-2021	14 100 000	2 350 000	General environmental protection