Green Transitions Guidance Note
Circular Economy

IBC Training Programme on Green Transitions

The United Nations Issue-based Coalition (IBC) on Environment and Climate Change for Europe and Central Asia

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Executive Summary

A circular economy can be defined as an economic system in which the value of products and raw materials contained in them are optimally preserved at the end of their use phase. This includes the recovery of raw materials, the extension of the use phase as well as the establishment of circular business models based on sharing and leasing. The concept of a "circular economy" offers an alternative to the current linear system in which products are basically produced, used and in the end disposed. This pattern of production and consumption has led to an enormous increase in waste generation, currently about 2 billion tons per year. The transformation towards a circular economy offers significant opportunities for the reduction of greenhouse gas emissions. Also from an economic point of view a more circular system could save billions of US Dollars and lead to the creation of new jobs. Despite these different potential benefits, the current level of circularity is absolutely insufficient.

There is no lack of good practice examples that prove the technical feasibility of a circular economy – for specific materials, for products or increasingly also on the level of whole cities[1]. The challenge is to scale them up and to get them out of the market niches in which most of them still operate. There are some conclusions that can be drawn from the frontrunners and especially from failed attempts: The need to increase the transparency of material flows and related costs, the use of digitalization as key enabler of circularity, improved standardization of circular processes, increased investments and the importance of ambitious policy strategies.

The development and implementation of circular economy approaches and strategies in developing and emerging countries has to face specific challenges. Typical reasons are a lack of financial resources for necessary investments, a different status quo of technical infrastructures, for example regarding logistics and the lack of trained and experienced staff to implement certain regulations in practice. On the other hand, it should also be taken into account that developing and emerging countries can build upon "traditional practices" that are now re-discovered as major building blocks of a circular economy.

Circular economy in the context of Green Transitions

The concept of a "circular economy" offers an alternative to the current linear system in which products are basically produced, used and in the end disposed of. This pattern of production and consumption has led to an enormous increase in waste generation. According to the World Bank, the total amount of waste is already at 2 billion tons per year and will increase to 3,4 billion tons in 2050[2]. Most countries around the globe lack the technical infrastructure to properly dispose such amounts of waste, inter alia leading to 13 million tons of plastic waste leaking into rivers and oceans per year.

The production of all these products that are disposed after often very short use phases (e.g. plastic bags) requires even greater amounts of natural resources. In 2021 the global extraction of natural

[1] European Investment Bank (2021).
[2] Kaza et al. (2018).

resources from different ecosystems (ores, biomass, sand and gravel etc.) has for the first time exceeded 100 billion tons of material. According to UNEP´s International Resource Panel, this massively unsustainable overconsumption of resources is responsible for 50 % of all greenhouse gas emissions and for over 90 % of the current, unprecedent loss of biodiversity.

From an environmental point of view, the linear system is thus seen as a dead end, eventually putting the long-term survival of mankind at risk by exceeding various of important global boundaries that would ensure a "safe operating space"[3]. But also from an economic point of view, many countries have started to look into options of increased circularity in order to reduce reliance on raw material imports, to increase the overall resilience of supply chains in their industries and to create new job opportunities, for example, in the recycling, repair and reuse sector (the European Commission expects 700,000 new jobs by implementing the measures included in its Circular Economy Action Plan[4]).

Figure 1 highlights key characteristics of such a circular system of value creation. The major challenge is to increase the level of coordination between different steps of the value chain, specifically to already consider aspects like repairability or recyclability in the design phase of products as well as to develop business models that are based on preserving the value of products at the end of the use phase instead of simply maximizing the throughput of products. It should be noted that various diverging definitions exist how exactly a circular economy differs from our current linear system, for example, on which spatial levels material loops should be closed or how exactly to define a level of sustainable resource use[5].

[3] Rockström et al. (2009).
[4] European Commission (2020a)
[5] Kirchherr et al. (2017).

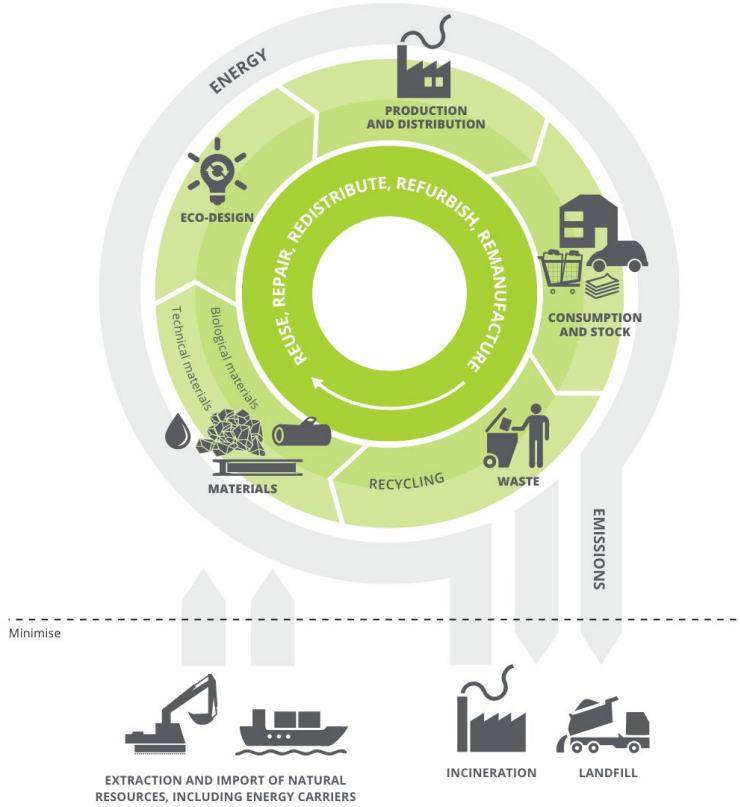

Figure 1: A simplified model of the circular economy (Source: EEA, 2017).

Status of circularity

Despite the different potential benefits outlined above, the current level of circularity is absolutely insufficient. Even in frontrunner countries like the Netherlands the share of recycled materials in industry is just 31 %; meaning more than two thirds of the materials used are still virgin materials and thus far away from really closed material loops. On a global scale the Circularity Gap Report states that circularity is just 8.6 % and even has decreased over the last years[6].

This low level of circularity is in clear contrast to the various reports that highlight the economic opportunities of a circular economy, for example, the Ellen MacArthur Foundation in cooperation with McKinsey has estimated the annual net (!) cost saving potentials of a fully circular system at around 700 billion US Dollars. Against this background the key challenge will be to get from theory to practice and to identify concrete intervention points to implement a circular system. The so-called 9R framework offers a differentiated approach to what kind of specific measures this could include – from

[6] Haigh et al. (2021).

basic diversion from landfilling to systemic transformations towards circularity (reduce, rethink and refuse)[7].

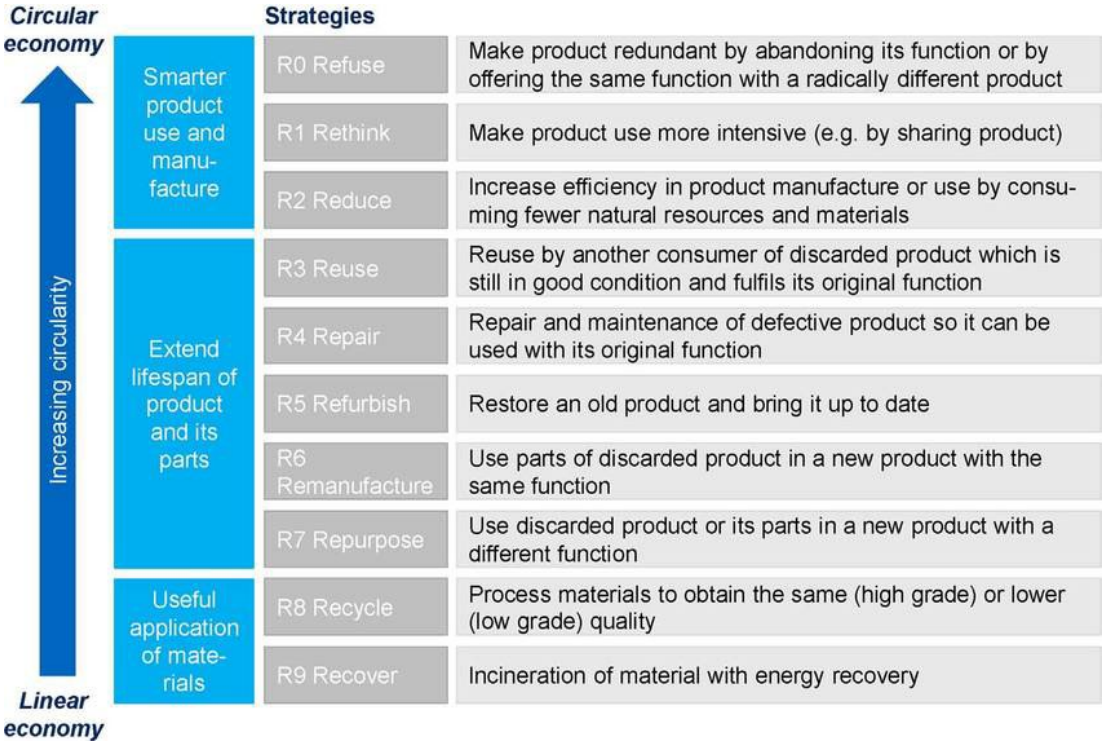

Figure 2: Overview of the 9R framework (Source: Potting et al., 2017).

Compared to, for example, mitigating the climate catastrophe, the regulatory framework for a circular economy is still in an early stage of development with often weak objectives, lacking monitoring approaches and especially without clear consequences for those missing such targets. The recently initiated process to develop a legally binding agreement to end plastic pollution could be a starting point to develop a more stringent policy framework. In contrast to comprehensive circular economy concepts, clear and strict regulations exist for the end of use phase of products, i.e. the waste management sector (e.g. mandatory recycling quota or waste shipment regulations).

In the context of the 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, circular economy contributes to several of the 17 SDGs, specifically SDG 12 on Responsible Consumption and Production with targets on waste prevention (12.5), improved resource efficiency (12.2) and the quantified target to halve food waste/ losses by 2030. The European Commission has positioned itself as frontrunner on circular economy; its Circular Economy Action Plan has set the target to achieve a circular material use rate of 25 % by 2030.

[7] Potting et al. (2017).

In addition to policy regulations, various industry initiatives have emerged, for example the Alliance to End Plastic Waste or the New Plastics Economy Global Commitment, launched by the Ellen MacArthur Foundation and UNEP. Some NGOs have raised criticism that the targets set by such industry activities are either not ambitious enough or will not be met given the insufficient level of investment by the private sector.

Circular economy in concrete sectors and value chains

Concrete circular solutions as well as policies to support them clearly differ between different value chains and economic sectors. Extremely globalized value chains like textiles or the automotive sector require different approaches than, for example, circular construction. Although overall concepts like increasing efficiency and consistency of resource use in some ways apply to all sectors, they differ in terms of already achieved circularity, technical opportunities or potential circular business models. There are no one size fits all solutions and every value chain and every specific market will require carefully designed policy mixes.

In the past the public attention has often been on the recyclability of consumer products, while on the other hand industrial processes offer significant opportunities for circular approaches. Concepts of industrial symbiosis focus on by-products of production processes that can be used in others as valuable input instead of becoming waste[8]. A famous example is the industrial park at Kalundborg in which companies annually save 24 million US Dollars and more than 600,000 tons of CO_2 emissions. Figure 3 shows some of the exchange structures between the different companies. The example highlights how circular economy goes beyond improving the efficiency of isolated processes; circularity always requires coordination between partners upstream or downstream the value chain.

[8] European Union (n. d.).

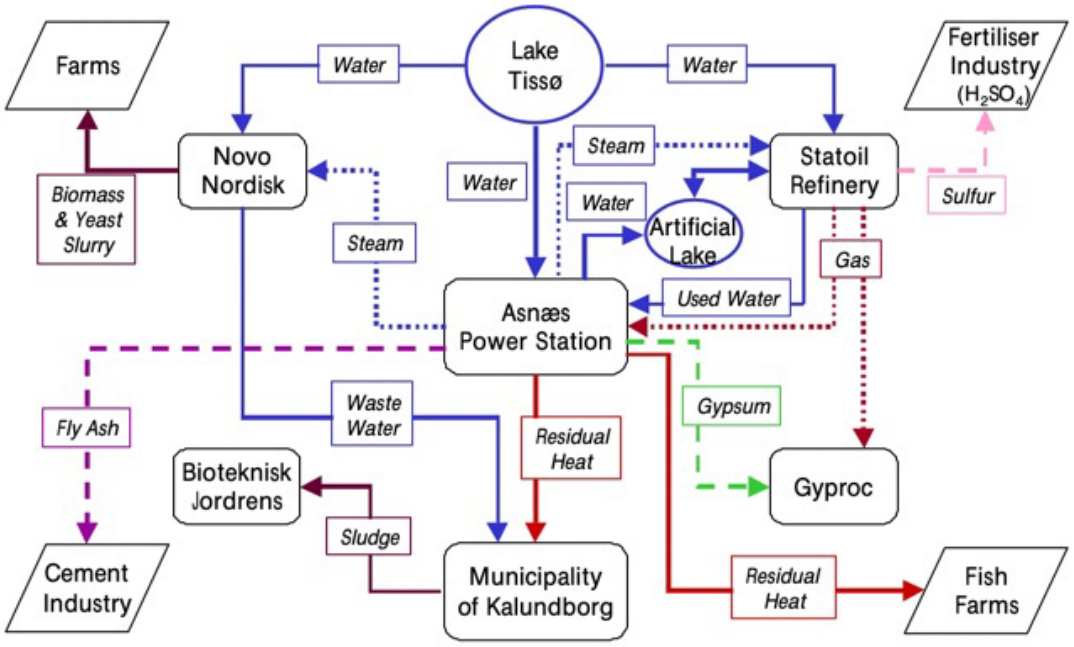

Figure 3: The industrial symbiosis of Kalundborg, Denmark (Source: UNEP Environmental Management for Industrial Estates, n. d.).

The construction sector is one of the most resource intensive sectors, causing the single biggest waste stream. Circular construction includes the reuse of building elements like for example doors or windows, the use of recycled concrete that has a significantly lower GHG intensity or the use of construction techniques that would allow a destruction-free disassembly. In order to turn such approaches into a viable business model, building information models (BIMs) have been developed to systematically record information about raw materials included in buildings, their specific location as well as market value. The availability of such information then allows to recover materials at high quality and to increase the share of recycled materials also in new buildings.

For the agricultural sector circular economy can be seen as important contribution to the reduction of food losses alongside the value chain. According to the FAO, the global percentage of food lost after harvesting at the farm, transport, storage, wholesale and processing levels is estimated at 13.3 % in 2020[9] – causing an enormous wastage of natural resources. On the other hand, a reduction of food losses could offer interesting business cases. According to estimates, investments in measures to reduce losses and waste in food can give a 14-fold return[10]. For this purpose, the United Nations Economic Commission for Europe (UNECE) has elaborated a Code of Good Practice in order to provide guidance to the sector on how to reduce losses and waste in the sector. Inter alia this focusses on quality specifications. Specifications for retailers (including quality requirements, correct maturity for

[9] FAO (n. d.).
[10] UNECE (2021).

the intended purpose and labelling) should be clarified in advance and in dialogue and/ or purchase agreements with producers to avoid unnecessary losses/ wastes. Retailers' quality specifications should conform as much as possible to the market standards developed for trading fresh fruits and vegetables, for example[11].

Success factors of successful circular economy strategies

As outlined above there is no lack of good practice examples that prove the technical feasibility of a circular economy – for specific materials, for products or increasingly also on the level of whole cities[12]. The challenge is to scale them up and to get them out of the market niches in which most of them still operate. There are some conclusions that can be drawn from the frontrunners and especially from failed attempts.

Increasing transparency of material flows and related costs

Most companies and public administrations or other stakeholders involved in production processes are often surprisingly unaware of the material flows that their products, services etc. are based on. According to the German Statistical Agency almost 40 % of costs in producing companies are linked to raw materials and only 3 % to direct energy consumption. A systematic inventory of material flows and stocks as well as accounting the costs linked to them are often the first step to incentivizing circularity.

Digitalization as key enabler of circularity

Improving availability of such data to the right stakeholders is closely linked to digitalization and industry 4.0 applications[13]. The 4th industrial revolution offers a broad range of opportunities to make circular processes more competitive against traditional linear approaches. The use of sensors could provide real-time data on the available supply of secondary raw materials, blockchain based tools could securely link supply and demand for them, digital twins could allow to optimize production processes also with regard to the recovery potentials of the waste streams they generate. Nevertheless, the opportunities of Circular Economy 4.0 are still to a large extent unexploited and will require systemic support.

[11] UNECE (2021).
[12] European Investment Bank (2021).
[13] Industry 4.0 is based on cyber-physical systems (e.g., 'smart machines') that use modern control systems, have embedded software systems and dispose of an Internet address to connect and be addressed via the Internet of Things (IoT). This way, products and means of production get networked and can 'communicate', enabling new ways of production, value creation, and real-time optimization, see https://www.i-scoop.eu/industry-4-0/

Standardization of circular processes

Another key barrier for circular solutions is often a lack of standards and norms alongside circular production processes. Initiating the development of industry-wide accepted standards can significantly reduce transaction costs linked to, for example, defining quality standards of recovery processes. Norms can especially help to develop so called "end-of-waste" criteria that would precisely define under which conditions a waste again becomes a regular product that can be shipped, used and sold as a virgin material. The German Institute for Standardization has coordinated a roadmap process that – based on the involvement of more than 1.000 stakeholders – identified hundreds of concrete needs for new or updated regulations in order to support a circular economy[14].

Steering investments into circular economy

The transformation from a linear system to a circular economy is a long-term process that eventually will depend on steering investments away from linear technologies and processes into circular alternatives. Such circular investments are often characterized by on the one hand high return-on-investments, on the other hand longer amortization periods and increased complexity. Against this background it is of crucial importance to develop reliable regulatory framework conditions so that companies take strategic decisions to focus on future circular market opportunities. The European Commission is currently setting up criteria for circular investments that will then be used to obligate banks and investors to report on the circularity of their investment portfolios[15]. Another important field of action is to mobilize more venture capital for circular start-ups and strategic investments into R&D for circular technologies as well as for setting up ecosystems in which such technologies can thrive.

Developing ambitious policy strategies

Circular investment policies should be embedded into comprehensive, consistent and coherent circular economy policy strategies. In many cases the responsibility for circular economy policies lies with waste management departments – which lack influence on design decisions, on industrial policies or on necessary taxation policies that would support instead of hindering circular business models. Circular economy has to be understood as a cross-cutting policy issue to which a broad range of policy fields have to contribute, for example, labour policies for the development of necessary circular skill sets or even foreign policies with regard to negotiating global systems of extended producer responsibility[16]. Such a broad range of involved stakeholders then requires the development of very clear responsibilities based on robust targets and monitoring schemes. The development of such

[14] DIN e. V. (n. d.).
[15] European Commission (2020).
[16] Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals, see https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm

circular economy strategies cannot be achieved without a broad participation of stakeholders in industry, civil society organizations and academia – the preparation of such processes is often of crucial importance for the actual speed of circular transformations.

Circular economy transitions in developing and emerging countries

The development and implementation of circular economy approaches and strategies in developing and emerging countries has to face specific challenges[17]. On the one hand, a simple "copy & paste" approach of solutions that have been successful in, for example, OECD countries often fails. Typical reasons are a lack of financial resources for necessary investments, a different status quo of technical infrastructures, for example regarding logistics and the lack of trained and experienced staff to implement certain regulations in practice.

Against this background it is important to be realistic about what circular economy can deliver and not to oversell the concept as a potential solution for complex challenges like structural unemployment or undeveloped economic growth. As outlined above, even frontrunner countries like the Netherlands still depend mainly on primary raw materials (67 % of all raw materials used in the Dutch economy are primary raw materials) – against this background setting realistic objectives and a thoughtful prioritization of steps is crucial.

On the other hand, it should also be taken into account that developing and emerging countries can build upon "traditional practices" that are now re-discovered as major building blocks of a circular economy. Reuse, repair and repurposing of products at the end of their first use phase are already well-established routines in many low- and upper-middle income countries. In many cases they would benefit from further support, for example, in standardization, the improved use of ICT or continuous training. This nevertheless shows that the discussion on circular economy should not be narrowed down to large-scale recycling infrastructures. Here countries can learn from failures of countries like Germany where uncoordinated investments in waste incineration infrastructure led to significant over-capacities at the beginning of the century – with negative impacts on the economic viability of waste sorting and recycling[18]. In clear contrast especially community-based and informal circular practices offer great potentials for circular value creation – in a way leapfrogging technical end-of-pipe solutions as they had been in the focus of waste management policies in Western Europe[19].

Nevertheless, it is important to emphasize that circular economy is not a substitute for sustainability. Improving the circularity of material flows directly and indirectly contributes to various Sustainable Development Goals (directly to SDG 12, and indirectly to climate protection, the fight against poverty and sustainable cities, for example) – it does not allow ever-increasing consumption and still requires

[17] Bengtsson et al. (2021)
[18] Wilts & von Gries (2015).
[19] Wilts (2016).

the recognition of ecological boundaries. A circular economy can be a very powerful tool – especially when bringing together the right people to drive meaningful change; it is definitely not an end in itself but has to be integrated in a comprehensive transformation approach towards sustainability.

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