CHAPTER 5

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CIRCULAR ECONOMY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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The main objective of this chapter is to analyze the circular economy in the context of sustainable development. The conceptual and contextual framework of the circular economy on a global scale is revealed through a review of documents of international organizations like UN, UNIDO, UNDP, OECD, EC as well as a survey of several case studies that highlight the key aspects of the circular economy. The authors argue how the circular economy practices integrate with services, which include the conversion of production facilities, product design, capacity building, new business models and policy advice. The authors give recommendations for overcoming the challenges of the circular economy in reaching the Sustainable Development Goals (SDGs). Particular attention is paid to the views on how to improve environmental sustainability and advance economic development.

1. INTRODUCTION

An increasingly popular concept gaining attention globally in the context of green economy and sustainable development is the circular economy. Circular economy differs from the linear economic model by a new global system whereby goods are made, used, reused, repaired, and then converted again into reusable secondary raw materials. The way in which products are designed and resources are consumed, concepts of ownership, modes of production and business models, are some of the areas in which change is needed for a sustainable future.

The circular economy is not a new concept. The notion of circularity has deep historical and philosophical origin. The idea of feedback, of cycles

in real world systems, is ancient and has echoes in various schools of philosophy. It enjoyed a revival in industrialized countries after World War II when the advent of computer-based studies of non-linear systems unambiguously revealed the complex, interrelated, and therefore unpredictable nature of the world we live in - more akin to a metabolism than a machine. With current advances, digital technology has the power to support the transition to a circular economy by radically increasing virtualization, de-materialization, transparency, and feedback-driven intelligence. According to Blomsma and Brennan (2017, pp.603-614), the circular economy is now facing its "validity challenge period" on its way to becoming a robust and consolidated concept, implying a radical shift in consumption and production patterns.

Nowadays, the circular economy represents a new socio-economic paradigm for policymakers and for managers in the corporate social responsibility strategies. The circular economy is about economics, innovation and competitiveness. As such, it goes beyond waste management and recycling and implies changes in production and consumption models, standardization, eco-design and integrated planning. Industry, universities and governments can spur innovation to deal with the consequences of the accumulated legacy waste.

2. MATERIALS AND METHODS

The chapter examines the circular economy in the context of sustainable development. The methodology is based on desk and field research. A thorough study of specialized literature, papers and documents of the UN, UNDP, UNIDO, OECD, WEF, EC, etc., as well as exploration of the current world trends has been made. Analysis and synthesis of books, papers, websites and scientific texts related to circular economy, sustainable development and the impact of the "greening" of the economy on a global level as well as the fulfilment of the Sustainable Development Goals (SDGs), have been applied. The analytical framework includes comparative analysis, induction and deduction which have been used in drawing conclusions.

In order to assess the drivers for the circular economy transition, the authors refer to a survey launched by OECD in April 2019. The survey was submitted to more than 100 cities from OECD countries, through various network channels of the Organization.

Targeted respondents were primarily authorities in local administrations in charge of the circular economy in cities and regions such as: dedicated circular economy managers, officers of innovation agencies and other relevant actors with a mandate on the circular economy or likely to have one in the future, but also environmental, economic, waste or urban planning departments, CEOs of utilities, etc.

Cities and regions were invited to respond to the survey regardless of the level of maturity of circular economy strategies, initiatives, plans and program. The authors also apply empirical research. Several case studies have been used to highlight the key aspects of the circular economy. The chapter also contains graphs that illustrate the main points of the discussion.

3. CONCEPTUAL FRAMEWORK OF THE CIRCULAR ECONOMY

Since the industrial revolution, humankind has been following a linear model of production and consumption. Raw materials have been transformed into goods that are afterward sold, used and turned into waste that has been many times unconsciously discarded and managed.

On the opposite, the circular economy is an industrial model that is regenerative by intention and design and aims to improve resources' performance and fight the volatility that climate change might bring to businesses. It has benefits that are operational as well as strategic and brings together a huge potential for value creation within the economical, business, environmental and societal spheres (Figure 1).

There are more than 100 different definitions of circular economy which are used in scientific literature and professional journals (OECD, 2020). The diversity of definitions makes it difficult to make circularity measurable. Although there are many concepts of the circular economy, they all describe a new way of creating value, and ultimately prosperity, through extending product lifetime and relocating waste from the end of the supply chain to the beginning - in effect, using resources more efficiently by using them more than once. Some researchers argue that social inclusiveness is also a necessary part of the circular economy (Korhonen, Honkasalo & Seppälä, 2018). Here are some of the most popular definitions:

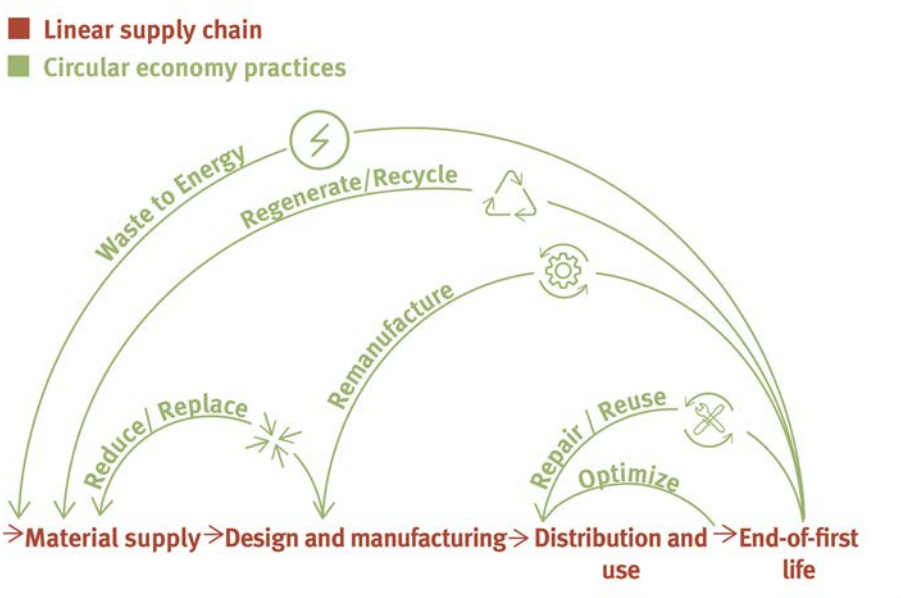

Figure 1. Circular economy practices
Source: https://www.unido.org/our-focus-cross-cutting-services/circular-economy

UNIDO defines circular economy as an industrial economy that routes materials, parts and products back into use several times and creates more value and less waste. It is an alternative in which value is maintained for as long as possible, products are designed to last, and the generation of waste is minimized (UNIDO, 2020).

According to the definition of the WEF (2017) "A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems, and business models."

The circular economy is restorative and regenerative by design. Relying on system-wide innovation, it aims to redefine products and services to design waste out while minimizing negative impacts. A circular economy is then an alternative to a traditional linear economy (make, use, dispose) (Ellen MacArthur Foundation, 2018).

An economic system that replaces the end-of-life concept, with reducing, alternatively using, recycling and recovering materials in production

/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (ecoindustrial parks) and macro level (city, region, nation and beyond), with the aim of accomplishing sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers (Kirchherr, Reike & Hekkert, 2017).

The circular economy is one that has low environmental impacts and makes good use of natural resources through high resource efficiency and waste prevention, especially in the manufacturing sector, and minimal end-of-life disposal of materials (Ekins et al., 2019). The circular economy is where the value of products, materials and resources is maintained in the economy for as long as possible by returning them into the product cycle at the end of their use, thus minimizing the generation of waste (EC, 2015).

The different definitions often focus on the use of raw materials or on system change. Definitions that put an emphasis on resource use often follow the 3-R approach: reduce (minimum use of raw materials), reuse (maximum reuse of products and components) and recycle (high quality reuse of raw materials).

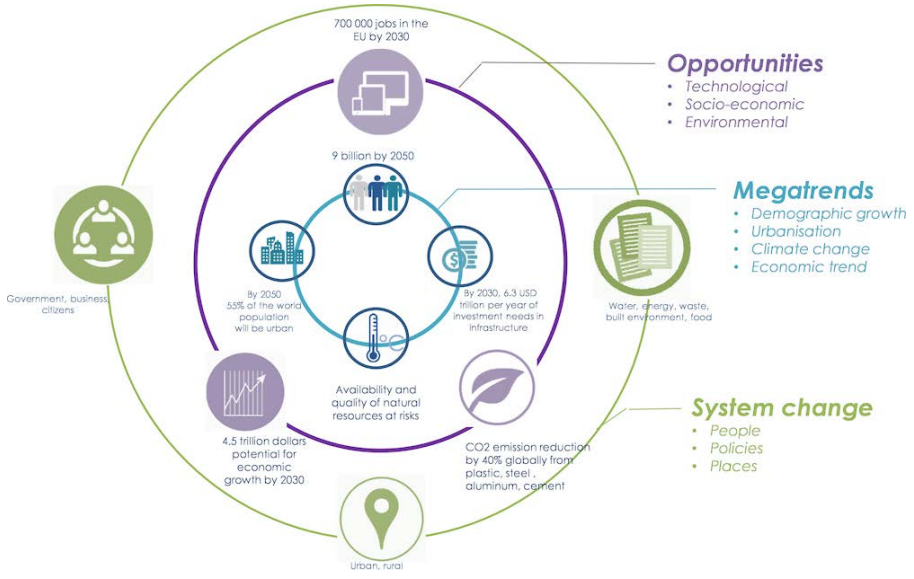

Figure 2. Analytical framework

Source: oecd-library.org

Also, there are three different layers of circularity, with increasingly broad coverage: closing resource loops, which is defined relative to a traditional economic system; slowing resource loops and materials flows; and narrowing resource loops, which implies a more efficient use of materials, natural resources and products within the linear system (OECD, 2019). According to Korhonen, Nuur, Feldmann and Birkie (2018, pp.37-46), definitions that focus on system change often emphasize three elements, which are further explained: closed cycles, renewable energy, systems thinking.

In the post-COVID-19 scenario, the circular economy can become the new normal. This unprecedented crisis highlighted the unsustainable nature of certain environmental and social trends and led to a reconsideration of current production and consumption patterns, including mobility, material use and food. The circular economy can help address unsustainable trends and find adequate solutions towards a green recovery (Vassileva at al., 2020). In particular, cities and regions have a role to play in closing the loops, reducing waste, reusing resources and restoring ecosystems alongside long-term recovery measures for more resilient, sustainable and thriving societies.
By reconfiguring material loops, the circular economy offers an example of resilience in the face of future crises. Human-centered cities could reduce private car use and regenerate green spaces. Organic waste could be transformed into high-quality fertilizer for local food production in rural areas.

Buildings, made of traceable and recyclable materials, could absorb carbon dioxide, treat wastewater, and produce energy (Raworth, 2020). This will require a combination of natural and technological loops, incentives to create projects and profitable investment, conducive regulations, and strong links with rural areas, in order to promote a cultural shift towards a more resourceful and less wasteful society (Romano, 2020).

The circular economy can help drive sustainable development (Figure 3). By promoting a rethinking of business models consisting in designing more durable and recyclable products, reusing materials in the production cycle and fostering a more responsible consumption, the circular economy approach is an interesting implementation vehicle to

Sustainable Development Goal (SDG) 12, pledging for more sustainable and responsible consumption and production patterns. Moreover, it is also equally relevant for the achievement of SDGs 2 (zero hunger), 6 (water), 7 (energy), 8 (decent work and economic growth), 9 (industry innovation and infrastructure), 11 (sustainable cities and communities), 13 (climate action), 14 (life below water) and 15 (life on land).

4. RESULTS AND DISCUSSION

4.1. OECD Survey on the Circular Economy in Cities and Regions

OECD made an interesting survey on the circular economy in cities and regions from which the drivers and the readiness for this process become evident. According to the results of the survey, climate change, global agendas and economic changes are major drivers for surveyed cities and regions to transition to a circular economy (OECD Survey, 2020). The study establishes that the most important drivers for transitioning to a circular economy are environmental (climate change, 73%), institutional (global agendas, 52%) and socio-economic (changing economic conditions, 51%).
Additionally, the circular transition is driven by job creation (47%), private sector initiatives (46%), new business models (43%), technical developments (43%) and research and development (R&D) (41%). The keywords respondents most associate with the circular economy in cities and regions were “climate change”, “zero waste” and “innovation”.

As per the outcome of the survey, climate change is a driver to the circular economy for 73% of surveyed cities and regions, as cities are both vulnerable to climate change impacts and contribute to climate risks. Cities contribute to 70% of GHG emissions (World Bank, 2010). In order to achieve the objectives of the Paris Agreement under the United Nations Framework Convention on Climate Change to limit global warming to less than 2˚C and 1.5°C by 2030, emissions would have to be 25% and 55% lower than in 2018 respectively (UNEP, 2019).

The EU, within the framework of the EU Green Deal, aims to achieve an economy with net-zero GHG emissions (climate neutrality) by 2050.
Obviously, global agendas are driving the transition to the circular economy for 52% of surveyed cities and regions. The circular economy

approach can contribute to the achievement of the 2030 Agenda for Sustainable Development. While it is strictly linked to SDG 12 on sustainable and responsible consumption and production patterns, other SDGs (e.g. 6, 7, 15) are also relevant for increasing sustainability in cities (SDG 11).

The circular economy can also support the Paris Agreement under the UN Framework Convention on Climate Change since practices of reusing, recycling, sharing, amongst others, reduce GHG emissions and simultaneously address issues linked natural resources extraction and exploitation. Finally, the circular economy can support the implementation of the New Urban Agenda (2016), the European Green Deal and G20 initiatives on resource efficiency.

Changing economic conditions represent a major driver towards the circular economy for 51% of respondents (OECD, 2020). The COVID-19 crisis has put the world on standby, unlike any other economic, social and climate crisis, resulting in a very significant GDP loss for 2020 (4.5%). Still, cities are engines of economic growth: projections show that a group of 600 cities will generate nearly 65% of the world's economic growth by 2025 and that cities tend to generate more income per capita as they increase in size. While pursuing economic growth, resource efficiency should be improved, as expressed by the concept of decoupling.

Another driver for 4% of surveyed cities and regions is job creation. Between 2012 and 2018, the number of jobs related to the circular economy in the EU increased by 5% to reach around 4 million (EC, 2020b). Circularity can be expected to have a positive net effect on job creation provided that workers acquire the skills required by the green transition (EC, 2020a).

Moving from fossil fuel to renewable energy, from landfill to reuse, remanufacturing and recycling, to clean mobility, amongst others, implies changes in the future of jobs, skills, social and economic models. Yet, the transition should be "just" by taking into account people's social well-being, quality of life and equity. It is estimated that by 2030, the number of additional jobs would exceed 75 000 in Finland, 100 000 in Sweden, 200 000 in the Netherlands, 400 000 in Spain and half a million in France. This is due to the fact that an economy favoring repair,

maintenance, upgrading, remanufacturing, reuse, recycling of materials and product-life extension, is more labor intensive than both mining and manufacturing of a linear economy (Wijkman & Skånberg, 2017).

New business models, technical developments and R&D represent a driver for more than 40% of surveyed cities and regions. New business models in cities are flourishing, from reverse logistics, reuse, leasing and sharing. Increasingly, cities are considering green infrastructure and decoupling alternatives, such as new electric vehicles, solar panels, smart grids, retrofitting of buildings, recycling facilities as part of their circular vision (Wijkman & Skånberg, 2016).
Another valuable result of the survey is the preparedness for the circular economy. Table 1 below provides information about the key data collected across cities and regions participating in the OECD Survey on the Circular Economy in Cities and Regions. Data are provided by 44 cities and 2 regions.

They refer to the corresponding administrative level to the city or region responding to the survey. Four dimensions are represented: level of GDP, population size, the share of recycled waste and CO_2 emissions. The table also reports on the existence or not of a circular economy strategy which is extremely important when doing business in the targeted regions.

Table1. Key data from surveyed cities and regions

Key data from surveyed cities and regions	Cities and regions	Country	GDP EUR	Popul-ation	Waste recycled of total waste generated by households	CO_2 emissions T CO_2/cap-ita/year	Circular economy strategy
More than 500	Dunedin	New Zealand	+	▲	-	+	NOT YET
kg inhabitant year	Barcelona Metropol. Area	Spain	++	▲▲ ▲▲	-	-	YES
	Prato	Italy	+	▲	+		YES
	Lisbon	Portugal	+	▲▲	-	+	NOT YET
	London	United Kingdom	+++	▲▲ ▲▲	-		YES
	Manresa	Spain	+	▲	+		NO
	Paris	France	+++	▲▲ ▲▲	-		YES
401-500	Santiago	Chile	+	▲▲	-		NOT YET
kg inhabitant year	Riga	Latvia	+	▲▲ ▲	-	-	NOT YET
	Quillota	Chile	+	▲	-	-	NOT YET
	Milan	Italy	++	▲▲ ▲▲	+	-	NOT YET
	Rotterdam	Netherlan.	++		-		YES
	Granada	Spain	+	▲			NOT YET
	Flanders	Belgium	++	▲▲ ▲▲	+	+	YES
	Umeå	Sweden	++	▲	-		NOT YET
	Scotland	United Kingdom	++	▲▲ ▲▲	+		YES
	Glasgow	United Kingdom	++	▲▲ ▲	-		NOT YET
	Antwerp	Belgium	++	▲▲ ▲	+	-	NOT YET
	Sabadell	Spain	+	▲	+	-	NOT YET
	Peñalolén	Chile	+	▲	-		NOT YET
	Nantes Metropol. Area	France	+	▲▲ ▲	-		YES

	Murcia	Spain	+	▲▲		-	NOT YET
	Maribor	Slovenia	+	▲		+	YES
	Munich	Germany	+++	▲▲ ▲▲	+	+	NOT YET
301-400	Greater Porto Area	Portugal	+	▲▲	-	-	NOT YET
kg inhabitant year	San Francisco	United States	+++	▲▲	+		NOT YET
	Temuco	Chile	+	▲▲	-	-	NO
	Groningen	Netherlan.	+	▲			NOT YET
	Lappeenranta	Finland	++	▲	+	-	NOT YET
	Tilburg	Netherlan.	++		+		YES
	Ljubljana	Slovenia	+	▲▲ ▲		+	NOT YET
	Valladolid	Spain	+	▲▲ ▲		-	YES
	Oslo	Norway	+++	▲▲ ▲	+		NOT YET
	Helsinki	Finland	+++	▲▲ ▲	+	-	YES
	Copenhagen	Denmark	+++	▲▲ ▲	+	-	YES
	Joensuu	Finland	+		+	+	NO
150-300	Austin	United States	+++		-		YES
kg inhabitant year	Toronto	Canada	++	▲▲ ▲▲	-		NOT YET
	Amsterdam	Netherlan.	+++		-	-	YES
	MRC des Sources	Canada	+	▲	-		YES
	Oulu	Finland	++	▲	+	+	NOT YET
	Medellin	Colombia	+	▲▲ ▲▲	-	-	NOT YET
	Malmö	Sweden	+++	▲▲	+	-	NO
	Melbourn	Australia	++	▲	-	+	YES
	Kitakyushu	Japan	++	▲▲ ▲	-	+	NO
	Tampere	Finland	++	▲		-	

Source: OECD (2020), OECD Survey on the Circular Economy in Cities and Regions, OECD, Paris.

LEGEND:

GDP:	Above EUR 50.000	EUR 50.000-30.000	Below EUR 30.000	
	+++	++	+	
Population:	Above 1 M	1.000.000-500.000	500.000-250.000	Below 250.000
	▲▲▲▲	▲▲▲	▲▲	▲
Waste recycled:	Above the average of 31.8% generated by households		Below the average (31.8%) generated by households	
	+		-	
CO_2 emission:	Above the average (5.9 T CO_2/capita/ year)		Below the average (5.9 T CO_2/capita/ year)	
	+		-	

4.2. Benefits and barriers of the circular economy

The application of the circular economy concept entails substantial changes within the economic subsystem (Vucović, at al., 2020). Achieving the balance between the social and economic impacts, as well as environmental impacts, is necessary to become a major task. According to Vucović, Riznić and Vuković "economic development must go hand in hand with minimal environmental damage, but also an attempt must be made to address or substantially reduce the adverse effects so far" (2020).

One of the goals of the circular economy is to have a positive effect on the planet's ecosystems and to fight the excessive exploitation of natural resources. The circular economy has the potential to reduce greenhouse gas emissions and the use of raw materials, optimize agricultural productivity and decrease the negative externalities brought by the linear model. When it comes to reducing greenhouse gases, a circular economy can be helpful due to the following reasons:

- Because it uses renewable energy that in the long run is less polluting than fossil fuels.
- Thanks to reusing and dematerializing, fewer materials and production processes are needed to provide good and functional products.
- Because residues are seen as valuable, and they are absorbed as much as possible in order to be reused in the process.
- Since the preferred choices will be energy-efficient and non-toxic materials and manufacturing and recycling processes will be selected.

The principles of the circular economy on the farming system ensure that important nutrients are returned to the soil through anaerobic processes or composting, which softens the exploitation of land and natural ecosystems. In this way, as "waste" is returned to the soil, besides having fewer residues to deal with, the soil gets healthier and more resilient, allowing a greater balance in the ecosystems that surround it. Following the circular economy's principles, negative externalities such as land use, soil, water and air pollution are better managed, as well as the emission of toxic substances and climate change (OECD, 2020).

Another obvious benefit is the increased potential for economic growth. It is important to decouple economic growth from resource consumption. The increase in revenues from new circular activities, together with a cheaper production by getting products and materials more functional and easily disassembled and reused, has the power to increase GDP and therefore economic growth. When compared with the raw material extraction that's common on the linear approach, the circular economy model has the potential to lead to a bigger amount of material savings. Considering that the total demand for materials will increase due the growth of the world population and middle classes, a circular economy leads to lower material needs, as it skips landfills and avoids recycling, focusing on making materials' cycles last longer. On the environmental side, it also avoids bigger pollution that extracting new materials would represent.

There is a correlation between the adequate implementation of the circular economy and the need to create green jobs (Radojčić & Arsić, 2020, p. 338). According to the WEF (2017), the development of a circular economy model, together with a new regulation (including taxation) and organization of the labor markets, can bring greater local employment in entry-level and semi-skilled jobs. Another study conducted by the Ellen MacArthur Foundation (2017) and McKinsey also concluded on the changes in employment growth in case of a shift to a circular economy model. The study says that these new jobs will be created through increases in:

- recycling and repairing practices, where one could add new designers and mechanical engineers to make lasting and easily disassembled products and materials at the transformation/production stages,

- an increase in new businesses (and niches) due to innovation processes and new business models and
- growth in consumption and spending by lower prices.

Lower input costs and in some cases create entirely new profit opportunities that can be achieved by businesses that move to the circular economy model. In this circular sphere, profit opportunities may come from playing in new markets, cutting costs off with waste and energy reductions and the assurance of continuity of supply.
Moving towards a circular economy model means reducing the number of raw materials used. Instead, more recycled (or even reusable or easily transformed) inputs that have a higher share of labor costs would be used, leaving companies less dependent on the volatility of the price of raw materials. This would also protect companies from geopolitical crises and safeguard them regarding their supply chains whose probability to be destroyed or damaged because of climate change events is increasing every day. In the end, the circular economy model would turn businesses more resilient, or in other words, make them more resistant and prepared to deal with unexpected changes.
According to Ellen McArthur's Foundation report (2018), a circular economy model has the potential to create demand for new services and new job opportunities such as:

- "collection and reverse logistics companies that support end of life products being reintroduced into the system,
- product marketers and sales platforms that facilitate longer lives or higher utilization of products and
- parts and component remanufacturing and product refurbishment offering specialized knowledge ".

Another illustration of the benefits of the circular economy is the fostering of business models where products are rented or leased by customers during different periods of time, depending on the type of products. This gives businesses the chance to learn about their customer's usage patterns and behaviors, as they get to interact more often with them. Ultimately, this new relationship might just improve customer satisfaction and loyalty and contribute as well for the development of products and services that suit clients better. In a market where suppliers remain responsible for the product supplied for a longer period, communicating well and understanding the clients' preferences and needs

is more important than ever (Bogetić et al., 2021, pp.66-68).
Objective analysis requires to point out some economic barriers to the implementation of a circular economy model, as follows:

- Social and environmental externalities are not considered in prices, privileging financial market signals instead of people and nature when economic decisions are made.
- Prices of raw materials are fickle and at low prices alternative, good quality secondary resources are not competitive.
- Circular economy business models are harder to develop, as most investors are still working under a linear economy logic and sometimes upfront investments are required.
- The demand for circular products and alternatives is still small.
- There are still not many qualified professionals with technical or 'information and communication technology' (ICT) knowledge.

When it comes to implementing and developing the circular economy, many different institutional barriers might need to be overcome. Some of them are worth mentioning:

- The fact that our current economic system is geared towards the demand of the linear economy and is not yet prepared to deal with circular economy entrepreneurs.
- New business models may be challenging to implement and develop because of laws and regulations that are not prepared for this kind of innovations.
- Plenty of businesses rely on old and/or strong alliances, making it harder to create new alliances and therefore to close loops.
- Many companies still have goals and appraisal systems that focus on short-term value creation, whereas the circular economy model is a long-term value creation model.
- The GDP index does not consider social and environmental externalities, discouraging the creation of value in both these areas.

There are also some broad perspectives to a circular economy model. A Swedish study conducted in 2017 that aimed to integrate different perspectives on this topic suggests that the main barriers to moving towards the circular economy model can be divided into financial, structural, operational, attitudinal and technological (OECD, 2020).
The first barrier has to do with the challenge of measuring the financial

benefits of CE and its profitability. The 'structural' barrier that follows has to do with being unclear of gets responsible for CE within companies. By their turn, 'operational' challenges represent the difficulty of dealing and staying in control of processes within the value chain. The fourth barrier, 'attitudinal', has mostly demonstrated the lack of knowledge about sustainability issues and also a big risk aversion - it shows that disruptive changes aren't the best way to develop circular strategies.
The last barrier to a circular has a technological origin and it has to do with the need for changing and redesigning products and production/ take-back systems. These needs end up creating concerns about the ability to do this and still being competitive and having quality products (OECD, 2020).

5. HOW IS THE CONCEPT OF CIRCULAR ECONOMY APPLIED?

Governments are encouraging and, in some cases, requiring the adoption of circular economy principles and practices that would lead to more resource efficiency and less waste. At a global level, the Sustainable Development Goals, adopted by the United Nations Member States in 2015, include many related ambitions. At the country and regional level, in 2008 China was among the first to adopt a circular economy law promoting the recovery of resources from waste. In that same year, the G8 environment ministers agreed on an action plan for the 3Rs: reduce, reuse and recycle. Following on that, the 2015 G7 Summit Leaders' Declaration underscored the need for "sustainable supply chains" that protect workers and the environment (UNIDO, 2017).
Governments around the world, from city to supranational, have provided various degrees and forms of public support for research, development and demonstration of new technologies, practices and business models for a circular economy, and encouraged their diffusion through financial, technical and training support (Prendeveille et al., 2018). However, tracking such activities to outcomes, and drawing clear, generalizable conclusions, is a highly difficult task, with many such activities - such as the actual level of public support for resource efficiency innovation - often not measured (OECD, 2016a). A common approach to support such innovation, however, has focused on industrial symbiosis, particularly through the creation of eco-industrial parks. In 2016, 250 eco-industrial parks existed around the world, with two-thirds in non-OECD countries,

particularly China (Kechichian & Jeong, 2016). Of those for which data was available, 45% engaged in industrial symbiosis, whilst 51% engaged in other waste management measures, and 35% in other resource efficiency activities, often generating substantial savings and efficiencies (OECD,2020, p.50).
UNCTAD's work on the circular economy started in 2015 with a collaboration with the Ellen MacArthur Foundation on resource-circularity potentials in large economies like India and China. Circularity is already part of many lines of work within UNCTAD, such as activities on tackling fossil fuel and fisheries subsidies. Resource circularity cannot be promoted in international value chains just by promoting and enacting national rules.

While companies have made strides in improving their social and environmental footprints, privatizing public policy through voluntary sustainability standards and Corporate Social Responsibility falls short from this task. In a world where most trade happens in parts and components in highly globalized value chains, promoting global resource circularity goes through international rules and cooperation, as well as individuals and consumers empowered with education (UNCTAD, 2020).

UNCTAD works on the circular economy by encouraging discussions and activities seeking to bring value out of waste streams, by stimulationg discussions around collaborative economy sectors, by the examination of innovate business models and encouragement of consumer awareness and behavioral shifts. In partnership with other international organizations, UNCTAD's work on the circular economy at the national and multilateral level brings this important theme to the service of the international community.

UNIDO is also one of the organizations that fully supports the adoption of circular economy principles that lead to higher resource efficiency and less waste and is one of the leading UN agencies in regard to implementing and monitoring Sustainable Development Goal (SDG) 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" (UNIDO, 2017; UNIDO, 2019). The Organization has thus implemented any projects and programs that address various building blocks of circular economy. Some projects support resource efficient and cleaner manufacturing of products, others help develop safe, easy-to-recycle products with longer lifetimes and still

others deal with the recovery or safe disposal of resources at the end of a product's life.

Recycling further aligns well to SDG 12 (Responsible consumption and production). In making this shift, it is important that the differing needs of developing and developed countries are taken into consideration. For example, a fall in demand for primary goods from developed countries could have a negative impact on poorer nations, in particular Least Developed Countries (LDCs), which rely heavily on exports. At the same time, LDCs and other developing economies may lack the knowledge and technology necessary to make the circular economy possible.

In this regard, UNIDO is working to ensure that the circular economy will benefit the global economic system, including developing economies. Building on decades of work helping developing countries to move to more resource-efficient, clean industrial products, processes and industrial standards, the Organization is positioning itself as a key provider of technical cooperation enabling the smooth transition to a circular economy approach.

In the field of environment, UNIDO's services include capacity-building for the industrial sector to improve resource productivity, reuse and recycling, as well as policy advice and training on the adoption of sustainable energy solutions, environmentally sound technologies and new business models and approaches for addressing environmental challenges, such as cleaner production chemical leasing and circular economy (UNIDO, 2019).
The Japanese concept of "mottainai" expresses that it is a shame for something to go to waste without having made use of its potential in full - something that happens with regularity in a linear economy. Japan also puts higher priority on using resources efficiently and recycling materials to reduce its dependence on imports. A conventional recycling business model in Japan is paper production, where wastepaper, particularly newspapers and magazines, are collected by small businesses and local governments to produce new paper. In 2013, 80.8 percent of wastepaper was collected and shared 63.9 percent to the total production of recycled paper. By recycling paper, import of virgin pulps is minimized and fluctuation of prices in the international commodity market is mitigated (Hongo, 2016, p.17-29).
In late 2015, the European Union adopted an ambitious Circular

Economy Package (CEP), including goals for food, water and plastics reuse. “The message is that while you are protecting the environment you can boost your economic development and provide new growth and new jobs,” said the then European Commissioner for Environment Janez Potočnik in support of the EU Circular Economy Package in 2014 (EC, 2015). The main regulatory requirements resulting from the CEP were binding targets on landfilling and recycling, introduced via the introduction and revision of various directives, which entered into force in July 2018. The targets included common requirements for 65% of municipal waste to be recycled by 2035, and 70% of packaging waste by 2030 (with sub-targets for specific packaging materials, from 30% for wood to 85% for paper and cardboard), with intermediate targets for both, and a maximum of 10% of municipal waste to be sent to landfill by 2035 (with waste suitable for recycling or other recovery prohibited from landfill by 2030. All 54 ‘actions’ proposed by the CEP have been delivered or are being implemented. However, it is difficult to determine whether these actions have been effective in delivering the overall objectives of the CEP. This is in part due to the short timeframes concerned, but also a result of the lack of any quantitative targets against which to measure their achievement (OECD, 2020, p.66)

The Circular Economy Action Plan (CEAP) 2020 is a cornerstone of the EU Green Deal. Key to the CEAP 2020 is its established agenda to promote sustainable growth, in alignment with the new EU Green Deal. The CEAP 2020 focuses on sustainable product design, waste, urban, rural and suburban areas, as well as unlocking support for businesses through cross-cutting actions that serve to enhance the goals of the EU Green Deal. Together, the EU Green Deal and CEAP 2020 envisage to achieve a cleaner and more competitive Europe in collaboration with businesses, consumers, citizens and civil society. The four core themes of the Circular Economy Action Plan 2020 are: make sustainable products the norm in the EU, empower consumers, focus on the lifetime of products through a sectoral lens and ensure less waste. The CEAP aims at accelerating the transformational change required by the European Green Deal, while building on circular economy actions implemented since 2015. This plan is targeted to ensure that the regulatory framework is streamlined and made fit for a sustainable future, that the new opportunities from the transition are maximized, while minimizing burdens on people and businesses (EC, 2020).

The plan presents a set of interrelated initiatives to establish a strong and coherent product policy framework whose aim is to make sustainable products, services and business models the norm and transform consumption patterns so that no waste is produced in the first place. This product policy framework will be progressively rolled out, while key product value chains will be addressed as a matter of priority. Further measures will be put in place to reduce waste and ensure that the EU has a well-functioning internal market for high quality secondary raw materials. The capacity of the EU to take responsibility for its waste will be also strengthened.

Europe is not expected to achieve transformative change by acting alone. The EU is continuing to lead the way to a circular economy at the global level and use its influence, expertise, and financial resources to implement the 2030 Sustainable Development Goals. This plan aims also at ensuring that the circular economy works for people, regions, and cities, fully contributes to climate neutrality, and harnesses the potential of research, innovation, and digitalization.

The implications of globalization for the companies do not include only diversification of the international business operations all over the world and boosting of new modes like e-business, but also other evolving views of the environment which take the form of “green business” and new attitude towards the renewable resources and alternative sources of energy (Vassileva, Talovic & Stojadinovic, 2018, p.76).

A study accomplished by Boeva, Vassileva, Pavlova, Stoychev and Zhivkova (2015, pp.5-20) examines the changes that occur in international business operations within the global efforts for environmental protection and argues that more and more companies take advantage of the circular economy.

In recent years, the idea of pushing environmental responsibility upstream to associated suppliers and vendors has gained favor as a strategy among environmentally conscious companies. In this way, buyer companies seek to ensure that the environmental standards they have adopted internally are consistently maintained by their suppliers, even without government regulation, this sort of inter-firm compliance regime offers advantages to supplying companies that adopt greener practices (Vassileva & Simić, 2021, pp.31-44).

6. BUSINESS CASES

According to the OECD (2019) typology of circular business models there are five models for special analysis: circular supply models, which replace traditional inputs with renewable, bio-based or recovered inputs; resource recovery models, which use waste streams to produce secondary materials; product-life extension, through making more durable products, or products which can be re-used, repaired, refurbished and remanufactured; sharing models, through which under-utilized consumer goods are used more intensively by being shared in use; and product-service systems (PSS), the business model that has had easily the most analysis in the literature, and sometimes is called 'services instead of products' (OECD, 2019, p.36).

The following case studies provide a snapshot of some of the projects, which form part of a much larger and growing portfolio of circular economy projects, as just one element of UNIDO's broader work on circular economy (UNIDO, 2019).

Case 1: Creating Value through Waste Management

Countries such as Armenia, Belarus, Kazakhstan and Ukraine rely heavily on refrigeration and air conditioning (RAC) equipment for economic growth. However, there is no proper end-of-life treatment of RAC equipment in the region and it is routinely sent to landfill where it creates problems for the environment. When these appliances are not disposed of correctly, they can emit gases that deplete the ozone layer and contribute to climate change. Additionally, all of the valuable materials in refrigerators and air-conditioning units like aluminum, copper, plastic and glass, which can be used as resources for production processes, are lost. Addressing this problem therefore has two key benefits: it reduces the environmental impact of landfilling and generates economic opportunities by transforming waste into raw materials.

Main Approach

UNIDO's regional project supports the development of a comprehensive waste management system for RAC appliances - from the moment they reach their end-of-life, until the greenhouse gases (GHGs) they contain are safely disposed of. UNIDO is also supporting the region in adapting legislation to minimize the environmental impact of waste disposal. Recycling centers, where ozone depleting substances (ODS) can safely

be extracted and valuable raw materials can be recycled from end-of-life refrigerators, freezers and air conditioning units, will also be established and training will be provided at all stages of the waste management system.

Expected Results and Impacts (SDGs 8,9 and 13 have been targeted)
With the recycling technology installed under the regional project, it is expected that it will be possible to recover approximately 95 per cent of the insulating foam contained in refrigerators and freezers. It is estimated that this will reduce typical refrigerator landfill waste by 85 per cent (by weight). ODS will be recovered and destroyed, preventing their release into the atmosphere, and mitigating environmental impact. This will save landfill space and reduce resource consumption. Valuable refrigerator materials, such as metal, copper, aluminum, and plastic will also be recovered and resold commercially on the recycling markets. By ensuring a high recovery rate for refrigerants, the new waste management systems will not only reduce emissions of ODS and greenhouse gases, but also help to establish new economic opportunities.

Case 2: Preparing a Move to Greener Services
The cold chain remains an important area for circular economy efforts. Refrigeration and air conditioning (RAC) systems must be properly serviced in order to ensure that the potential environmental benefits are optimized, and greenhouse gas leakages are safeguarded against. In Turkey, as in many other developing and middle-income countries, a legislative and regulatory framework is needed in order to strengthen the RAC service sector. With this in mind, a UNIDO project aimed to help prepare the country for the ratification and early implementation of the Kigali Amendment to the Montreal Protocol. Introduced in October 2016, the Amendment aims for the phase-down of environmentally harmful hydrofluorocarbons by cutting production and consumption.

Main Approach
Through the project, UNIDO brought together policymakers and national and international experts to come up with technical solutions and a legislative framework that will help to create an environment conducive to HFC reduction. The focus is on reducing the overall usage of HFC refrigerants and promoting the most sustainable models of RAC equipment. This form of policy support provides the basis for the adoption of climate-friendly alternatives and cost-effective solutions that successfully reduce HFC use and also meet consumer demand.

Expected Results and Impact (SDGs 8,12 and 13 have been targeted)
Facilitating a reduction in HFC refrigerant use in the service sector will foster best practices and circular economy practices, which, at the same time, address the demand for improved air conditioning maintenance and servicing. In this way, the policy and regulatory support provided will help to boost the RAC servicing sector in Turkey and position the country well for further future development and application of low climate-impact technologies.

Case 3: Brazil's First Climate-friendly Beer Cooler
At the design phase, hazardous substances can be avoided, resource use can be minimized, resource efficiency in the production process can be improved, serviceability can be enhanced, product lifetime can be extended, and recyclability can be optimized from the very outset. Given the harmful effects that refrigerants can have on their surroundings and the environment, UNIDO undertakes a large number of projects where refrigeration equipment is redesigned using low-impact, alternative refrigerants. In addition, the amount of refrigerant for each unit can be drastically reduced, and related resources can be saved.
As most beer coolers use ozone-depleting, high-impact climate gases like hydrochlorofluorocarbons (HCFCs) as refrigerants, part of the challenge is to adopt affordable green technology while making economic and environmental gains. At the same time, the most climate friendly alternative technology, propane, is flammable so it makes sense to reduce the amount of refrigerant within the closed system. Small and medium-sized enterprises (SMEs) are constantly looking for ways to be more energy efficient, reduce environmental impact and improve customer experience. Chopeiras CITTI, a small, locally owned manufacturer of beer coolers based in Ribeirão Preto, Brazil, is one such enterprise. A new design introduced under a UNIDO project reduced the amount of refrigerant needed by a factor of 11, from 1.2 kg to 0.09 kg for each unit; the climate impact of the refrigerant per unit was reduced by a factor of 1500.

Main Approach
UNIDO partnered with Chopeiras CITTI in a project aimed at developing a beer cooler capable of cooling at least 20 liters of beer per hour. Together with local consultants and mechanical engineers, a complete product redesign resulted in a far more energy efficient product. The provision of new equipment, safety training, and changes to existing

manufacturing equipment and facilities all enabled the company to safely use alternative, flammable refrigerants in a fully tested, climate-friendly solution.

Results and Impacts (SDGs 8,9,12,13 and 17 have been targeted)
The project demonstrates that SMEs can integrate circular economy practices that have both a positive environmental and economic impact. The beer cooler's improved, green design increased energy efficiency, decreased refrigerant leakage rates and reduced overall resource use (in this case refrigerant, electricity and raw materials). At the same time, the new design extended the lifetime of the product. By replacing HCFCs with a propane alternative, an environmentally harmful component was designed out, which not only resulted in greenhouse gas emissions reduction, but also substantially reduces the challenges involved with the recovery, storage and destruction of refrigerant once the beer cooler reaches the end of its useful life. In terms of economic impacts, the company experienced savings in labor costs due to the reduced assembly time, and savings in production costs due to the use of fewer raw materials. As a result of these improvements, the company requested UNIDO to continue the support, by implementing a full conversion of their manufacturing facilities with the aim of extending the same alternative technology to larger capacity beer coolers. At the same time, the benefits, in particular the cost reductions in manufacturing, and the decision by the manufacturer to convert their complete product line, encourage other SMEs in the sector to switch to more climate-friendly, economically profitable designs.

7. CONCLUSION

The circular economy is an industrial model that is regenerative by intention and design and aims to improve resources' performance and fight the volatility that climate change might bring to businesses. It has benefits that are operational as well as strategic and brings together a huge potential for value creation within the economical, business, environmental and societal spheres.
As the analysis shows the circular economy reduces resource dependency and resource use, including energy thereby reining in production costs, narrowing market exposure, and limiting costs stemming from resource extraction and generation. It additionally leads to the introduction of

economically viable methods of reducing pollution and separating harmful from reusable waste material. Beyond individual enterprises, these benefits further extend to entire industrial sectors, or even national economies, thus contributing to the achievement of the SDGs.

The circular economy encourages inter-company exchanges and synergy-building, leading to better economic, social, and environmental performance. This in turn helps raise the overall performance of national economies and opens up new markets and jobs. On an international level, the circular economy facilitates the exchange of goods across borders by introducing standards to secondary raw materials that were previously considered waste. Improved product characteristics such as extended lifetime, recyclability and serviceability further help ensure that products can be used and sold on the global market. By helping overcome international trade barriers in this way, the circular economy offers new possibilities by which countries can prosper.

For countries with an EU accession perspective such as the countries of the Western Balkans, emerging economies, and key supporters of green economy across the world, the new sustainable models will open up business and employment opportunities, while strengthening the ties with European economic partners. The transition to the circular economy requires an alignment and cooperation of stakeholders at all levels - local, national, regional and international.

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