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CRCLEcon Project

Andrey Zahariev

Petko Angelov — **Margarita Mihaylova**
Alexandru – Lucian Manole — **Catalin Deatcu**
Virginia Cucu — **Ghenadie Ciobanu**
Veronica Vasile — **Ahmed Munir Gokmen**
Yasemin Saraci — **Saban Onur Viga**
Ekrem Erdinc Gulbas — **Maja Ivanovic-Djukic**
Marija Radosavljevic — **Suzana Stefanovic**
Bojan Krstic — **Miljana Talic**

Repertory on Circular Economy for Students

Developed within the project:
"Trifold approach to circular economy: perspectives of academia, business and wider society"

2022-1-BG01-KA220-HED-000085464

This publication is prepared within the scope of the project "Trifold approach to circular economy: perspectives of academia, business and wider society" 2022-1-BG01-KA220-HED-000085464, which has been co-financed by the Erasmus+ Programme of the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Commission.

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

The publication is a collaborative work of the partner organizations to the project. The names of the organizations partnering in the project which contributed to this publication are as follows: D. A. Tsenov Academy of Economics – Bulgaria, Artifex University of Bucharest, Istanbul Esenyurt University and University of Nish.

ISBN 978-954-23-2479-9
DOI 10.13140/RG.2.2.28495.91044

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Project number: 2022-1-BG01-KA220-HED-000085464
"Trifold approach to circular economy: perspectives of academia, business and wider society"

Programme Erasmus+, Cooperation for innovation and the exchange of good practices, Strategic Partnerships for Higher Education, Development of Innovation

Tsenov Academic Publishing House
Svishtov, 2024

This edition is developed as part of Work Package Two within project number 2022-1-BG01-KA220-HED-000085464 “Trifold approach to circular economy: perspectives of academia, business and wider society”. Specifically, it focuses on achieving the second specific objective, which involves exploring the components of circular economy from students’ perspective.

Repertory on Circular Economy for Students
Textbook, first edition

Prof. D-r Andrey Zahariev, author, Svishtov, 2024
Head Assist. Prof. D-r Petko Angelov, author, Svishtov, 2024
Sen. Lecturer D-r Margarita Mihaylova, author, Svishtov, 2024
Prof. D-r Alexandru – Lucian Manole, author, Bucharest, 2024
Assoc. Prof. Conf. univ. D-r Catalin Deatcu, author, Bucharest, 2024
Assoc. Prof. D-r Virginia Cucu, author, Bucharest, 2024
Lecturer D-r Ghenadie Ciobanu, author, Bucharest, 2024
Lecturer D-r Veronica Vasile, author, Bucharest, 2024
Head Assist. Prof. D-r Ahmed Munir Gokmen, author, Istanbul, 2024
Head Assist. Prof. D-r Yasemin Saraci, author, Istanbul, 2024
Head Assist. Prof. D-r Saban Onur Viga, author, Istanbul, 2024
Head Assist. Prof. D-r Ekrem Erdinc Gulbas, author, Istanbul, 2024
Prof. D-r Maja Ivanovic Djukic, author, Nis, 2024
Prof. D-r Marija Radosavljevic, author, Nis, 2024
Prof. D-r Suzana Stefanovic, author, Nis, 2024
Prof. D-r Bojan Krstić, author, Nis, 2024
Research Assistant Miljana Talic, author, Nis, 2024
Prof. D-r Stoyan Prodanov, reviewer, Svishtov, 2024
Prof. D-r Tadija Djukic, reviewer, Nis, 2024
Sen. Lecturer D-r Margarita Mihaylova, proofreader, Svishtov, 2024

The textbook is part of the output from project number 2022-1-BG01-KA220-HED-000085464 “Trifold approach to circular economy: perspectives of academia, business and wider society”, Programme Erasmus+, Cooperation for innovation and the exchange of good practices, Strategic Partnerships for Higher Education, Development of Innovation. The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Content

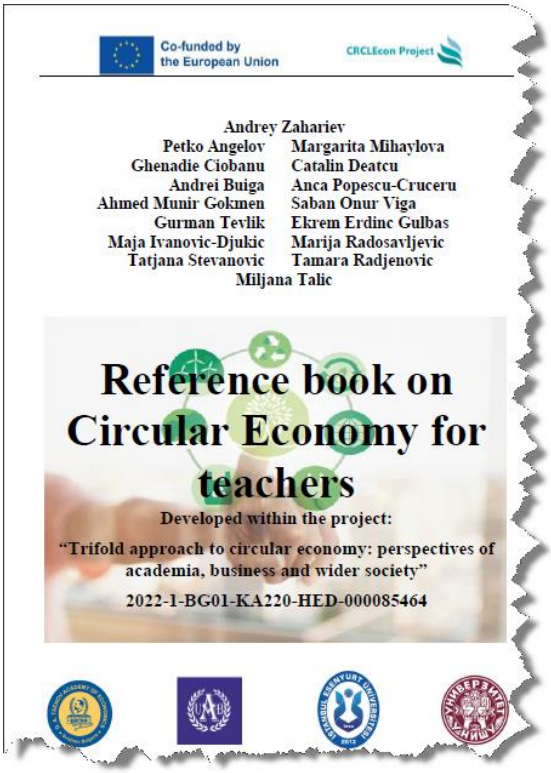
This book shall be cited in APA style as follows:

Zahariev, A., Angelov, P., Mihaylova, M., Manole, A.–L., Deatcu, C., Cucu, V., Ciobanu, G., Vasile, V., Gokmen, A.M., Saraci, V., Viga, S.O., Gulbas, E.E., Ivanovic-Djukic, M., Radosavljevic, M., Stefanovic, S., Krstic, B., Talic, M. (2024) *Repertory on Circular Economy for Students*. Tsenov Academic Publishing House, Svishtov, 168 pages, ISBN 978-954-23-2479-9, DOI: https://www.doi.org/10.13140/RG.2.2.28495.91044

INTRODUCTION

Dear readers,

After publishing the first book (**Zahariev, A., Angelov, P., Mihaylova, M., Gokmen, A.M., Viga, S.O., Tevlik, G., Gulbas, E.E., Ciobanu, G., Deatcu, C., Buiga, A., Popescu-Cruceru, A. Ivanovic-Djukic, M., Radosavljevic, M., Stevanovic, T., Radjenovic, T., Talic, M. (2023)** ***Reference book on Circular Economy for teachers*****. Tsenov Academic Publishing House, 157 pages, ISBN 978-954-23-2435-5, DOI: www.doi.org/10.13140/RG.2.2.34487.91046**) within



the scope of the Erasmus+ project 2022-1-BG01-KA220-HED-000085464 "**Trifold approach to circular economy: perspectives of academia, business and wider society**" the team of partners from four universities across four Balkan countries has begun intensive development on our next intellectual product, titled "**Repertory on Circular Economy for Students**". As a result, there is our vision to introduce the circle economy ideas among our students. As we noted earlier the circular economy is a viable and promising alternative to the currently prevailing linear economic system. The fact of having a world with finite resources involves the need to adopt a sustainable economic system where sustainable processes must be prioritized. Therefore, in this context of finite resources, Circular Economy seeks economic growth only if achieved in a sustainable way by keeping resources within closed cycles as long as possible.


AGENDA

of the First workshop on applicable methodology in teaching circular economy of Erasmus+ KA220-HED project

"Trifold approach to circular economy: perspectives of academia, business and wider society"

Project number: 2022-1-BG01-KA220-HED-000085464

30.04. – 02.05.2023
Chiflik, Troyan municipality, Bulgaria

AGENDA

Second workshop on Branch specifics in circular economy of Erasmus+ KA220-HED project

"Trifold approach to circular economy: perspectives of academia, business and wider society"

Project number: 2022-1-BG01-KA220-HED-000085464

18.05. – 20.05.2023, Bucharest, Romania

In this regard, the project aimed to explore the aspects of circular economy in details and in various aspects – students, academic staff, businesspeople and society activists. The project will offer visualized summary brochures on the main identified challenges. Work Package Two of the project was supported with two initial workshops aimed at enriching the teaching on circular economy. The first workshop focused on content development, while the second centred around piloting with students. Simultaneously, the first workshop delved into the nature and challenges of the circular economy, while the second workshop addressed the vital competence set required for effective engagement in circular economy practices.

The overarching objective of the project is to elucidate the implications of circular economy challenges and introduce solutions in an adaptable manner that brings together students from diverse social backgrounds, with particular attention to those who are discouraged or lagging behind their peers. This will be accomplished through the provision of training materials and the organization of a series of coordinated activities and collaborative workshops. The specific objectives of the project are: investigating the components of circular economy from teachers' perspective; examining the components of circular economy from students' perspective; exploring circular economy challenges to business and wider society.
Work Package Three (WP3) of the project aims to develop training content for students and assess its feasibility for future utilization within universities and for self-learning purposes. This intellectual output endeavours to address the challenges and introduce solutions pertaining to circular economy in an adaptable manner, with a focus on fostering collaboration among students from diverse social backgrounds, particularly those who may feel discouraged or fall behind their peers. WP3 specifically delves into the components of circular economy from the perspective of students. Notably, the third workshop on the nature and challenges of circular economy took place in Nis, Serbia, from September 21st to September 23rd, 2023.


AGENDA

of the Third Workshop on the nature and challenges of circular economy of Erasmus+ KA220-HED project

"Trifold approach to circular economy: perspectives of academia, business and wider society"

Project number: 2022-1-BG01-KA220-HED-000085464

21.09. – 23.09.2023, Nis, Serbia

Work Package Three (WP3) of the project proposes training content to students and evaluates its feasibility for further use both within universities as well as for self-learning purposes. This intellectual output aims to present the challenges and introduce solutions related to the circular economy in an adapted manner, with a focus on fostering collaboration among students from diverse social categories, particularly those who may feel discouraged or lag behind their peers. WP3 explores the components of circular economy from students' perspective.

In addition to the activities provided in the agenda of the third workshop, and in line with the "green" focus of the project, a visit to the "E-Recycling" company in Niš was organized, where the process of recycling of electrical devices, plastic and paper was explained and demonstrated to the project participants.

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The final for the package fourth workshop on competence set vital for circular economy was held in Istanbul, Turkyie (11-13 January 2024).


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CRCLEcon Project
Trifold approach to circular economy: Perspectives of academia, business and wider society
2022-1-BG01-KA220-HED-000085464
Project outputs:
Reference book on Circular Economy for teachers
Repertory on Circular Economy for students
Handbook on Circular Economy Challenges to business and society
Support activities:
Piloting of the developed content at joint workshops
Meetings with business experts
Joint partner events
circlecon.eu
Workshop on competence set vital for circular economy of Erasmus+ KA220-HED project
11.01. - 13.01.2024, Istanbul, Turkiye

During social programme of the fourth workshop in Istanbul, at the initiative of the project team at "D. A. Tsenov" Academy of Economics and with the assistance of Archimandrite of the Ecumenical Throne Charalampos Nichev, who serves the Bulgarian-speaking Orthodox community in Constantinople, alumni of the Svishtov Academy of Economics, a meeting with His All-Holiness Ecumenical Patriarch Bartholomew on January 13 was organized and conducted.

The Ecumenical Patriarch blessed the visiting scholars and their Balkan university partners involved in the CRCLEcon project. With its ecological focus, the CRCLEcon project fully supports the initiatives of His All-Holiness Patriarch Bartholomew to organize numerous international symposiums and seminars on environmental issues, for which he is also known as the "Green Patriarch."

The meeting also included a visit to the renovated Iron Church "St. Stephen" in Istanbul.

After publishing the Repertory for Circular Economy for Students the project workflow, will proceed with two workshops, two concluding conferences, and two meetings of the project administration teams.

The specified dates and periods are in the months of May, June, September, and October 2024, and includes:

First. Regarding project management and reporting the final two project administration meetings will be held as follow: Third transnational partner meeting on project administration (23-25.05.2024, Bucharest); Fourth transnational partner meeting on project administration (17-19.10.2024, Nis).

Second. Within work package four "Circular Economy, Business and Society" the last two workshops will be held as follow: Workshop 5 on main challenges to business and society (Târgu Jiu, Romania, 9-11.05.2024); Workshop 6 on competitive advantages to business and benefits to society (Nis, Serbia, 24-26.06.2024).

Third. The joint final conferences will be held in Istanbul and Svishtov as follows: First joint final conference on 20.09.2024 in Svishtov hosted by D. A. Tsenov Academy of Economics (19-21.09.2024); Second joint final conference on 04.10.2024 in Istanbul, hosted by Istanbul Esenyurt University (03-05.10.2024).

Prof. D-r Andrey Zahariev, Project manager on behalf of
D. A. Tsenov Academy of Economics, institutional project contractor

CHAPTER ONE. CHALLENGES OF THE CIRCULAR ECONOMY

Introduction to chapter one[1]

The first chapter of this book „Challenges of the circular economy" is focused on the following main problem areas:

- knowledge of the general elements regarding the circular economy and the differences from the linear economic model;
- knowledge of the specific principles of the circular economy;
- developing skills to identify and manage practical ways in which we can move from the linear economic model of production and consumption to the circular model;
- redesigning the value chain by adopting circular economy mechanisms and discovering how it can contribute to making economic activities more profitable;
- introducing circularity as an element to increase economic competitiveness;
- identifying the characteristic elements of different circular business models;
- enveloping circular behaviour, both in terms of production and consumption, as a prerequisite for sustainable and durable economic development.

In this chapter, you will acquire knowledge and skills how to:

- knowledge of concepts specific to the circular economy and its characteristic mechanisms;

[1] Note. This chapter was written by researchers from Artifex University of Bucharest, as follows: Professor Alexandru Lucian Manole PhD (Subchapters 1.2 and Vocabulary); Associate Professor Cătălin Deatcu PhD (Introduction, Subchapter 1.1), Associate Professor Virginia Cucu (Subchapter 1.3), Lecturer Ghenadie Ciobanu Phd (Subchapter 1.4) and Lecturer Veronica Vasile (Subchapter 1.5).The student training section (Question for self - assessment) was written jointly by Professor Alexandru Lucian Manole PhD and Associate Professor Cătălin Deatcu PhD.

- identify the differences between the classical, linear economic model and the circular economy model;
- manage the changes needed to move from the linear model of production to the circular economy;
- the practical use of mechanisms and tools specific to the circular economy to redesign the value chain and identify new profit centres that may arise from the implementation of this new economic model;
- the use of specific circular economy tools in the work of economic operators and non-profit organizations to ensure a sustainable increase in their competitiveness;
- identify the particularities of circular production and consumption behaviour and develop new ways of stimulating this type of behaviour, including all actors (state bodies, economic agents, non-profit organisations, the population) in the specific circuit of the green economy.

The chapter includes the following subchapters:

1.1. General overview of the topic

1.2. Changes in production and consumption patterns

1.3. Redesigning the value chain

1.4. Synchronising circularity with competitive business models

1.5. Developing circular behaviour.

1.1. General overview of the topic

The circular economy has become an increasingly debated topic nowadays, as the whole world is becoming increasingly aware that the future of human activities must enable sustainability and sustainability goals to be achieved. Thus, we can see that national and international policymakers have reached a consensus, at least relatively, on the importance of building a modern economic system based on real

protection of the natural environment, a truly green economy, in which economic agents are taught and stimulated to see beyond the limits of economic efficiency and give priority to better use of resources. On the other hand, economic and non-profit organisations, as well as a large part of the world's population, are becoming increasingly aware of their role in building a new economic system and are starting to give due importance to activities such as reusing, remanufacturing or recycling goods.

The transition from an economic system based largely on the intensive use of natural and energy resources to a "green" economy is the real challenge of the first half of the 21st century. Humanity has reached an inflection point that could determine its future. We can choose to continue the chaotic exploitation of the Earth's available resources, taking on board the devastating effects that such a policy can have, culminating in a possible situation where life on this planet could no longer be sustainable, or we can make a swift transition to a more nature- and people-friendly economic system, an economic system in which we place the idea that the natural environment is our long-term partner in our journey on this planet, an economic system in which each of us individually and all of us together work to bring back into the economic system products or parts of products that we no longer use and in which we are less interested in buying goods that we don't need just to be fashionable. The shift from a culture based on self-image to one based on the common interest of protecting the environment is certainly not an easy process to achieve, but it is an opportunity, a chance that we all welcome in our quest to leave our descendants a truly important legacy - a clean planet that allows them to live in optimal conditions and carry on our civilization. So, the transition to the circular economy is not just an economic requirement, but an opportunity we can give to future generations.

As always when we talk about changes in human behaviour and advancement of civilization, it is very important to understand that education plays a fundamental

role in providing the necessary framework for this transition. The transition from an economy that constantly "abuses" the environment to one based on environmentally friendly technologies requires a real effort in raising awareness and educating new generations about the particularities of this new economic and social model. We cannot expect the younger generation to be happy if we don't work to make them aware of the benefits the green economy can have for their future. Nor can we expect young people to adopt the new system if we do not present them frankly and openly with the advantages and disadvantages of this new economic model, how it works, and how it can affect each of our lives. It is therefore time to go beyond abstract definitions and present to young people, as frankly as possible, the perspective that this new economic model offers.

Because of the above, education becomes a point of reference in the evolution of the circular economy, it must act as an effective tool for the training of specialists who have all the necessary knowledge to implement the new model, but who also find themselves in its specific values. It is not enough to give young people information about the green economy, it is necessary to make them believe in it, identify with it, and see it as an opportunity for a better future for themselves and for the generations to come.

Based on the above-mentioned elements, we wanted this chapter to be, both by the actual elements that are analysed in it and by the way they are presented, a tool facilitating the genuine connections between young people, as beneficiaries of the educational process, and the specific concepts of the circular economy. The aim of this approach is to make young people fully aware that they are the main actors in what will prove to be a very difficult process, but one that cannot be avoided if we want to ensure sustainable development of the world economy and protect the environment, thus creating the conditions for a better, greener future for generations to come. Moreover, by reading these pages, we want young people to discover the specific realities of the circular economy and develop a series of skills and abilities

that will help them adapt to the requirements of this new economic and social model.

The chapter concludes with a series of practical exercises designed to further consolidate the concepts explained in these pages and to make young readers think about the importance of the circular economy for our common future.

1.2. Changes in production and consumption patterns

The lessons learnt from recent centuries demonstrate that an economy based almost exclusively on the intensive use of natural resources to ensure consumption that is often chaotic is not a viable and sustainable alternative for mankind. In reality, we are increasingly talking about the depletion of certain categories of raw materials, environmental pollution, problems in managing huge quantities of waste, all of which are real problems and should be solved as soon as possible. On the brink of imminent environmental disaster, mankind must identify development solutions that can be effective not only in economic terms but also in terms of ensuring medium and long-term sustainability.

From the outset, it is important to identify the starting point of the transition to a circular economy. Thus, after the first industrial revolution (1760), mankind embarked on a continuous struggle to increase economic profitability and ensure the highest possible returns, without paying any attention to the costs involved.

Throughout this period, a linear economic system based on the principle of "take - make - consume - dispose" was imposed and developed worldwide (DS Smith, 2024). Companies take raw material resources, transform them into products or services which they then pass on to consumption, and then immediately after they are used, they become practically waste and are thrown away. This is a very short economic cycle, in which the path from the exploitation of natural resources to the transformation of finished products into waste is a very fast one, far exceeding our planet's capacity to regenerate itself.

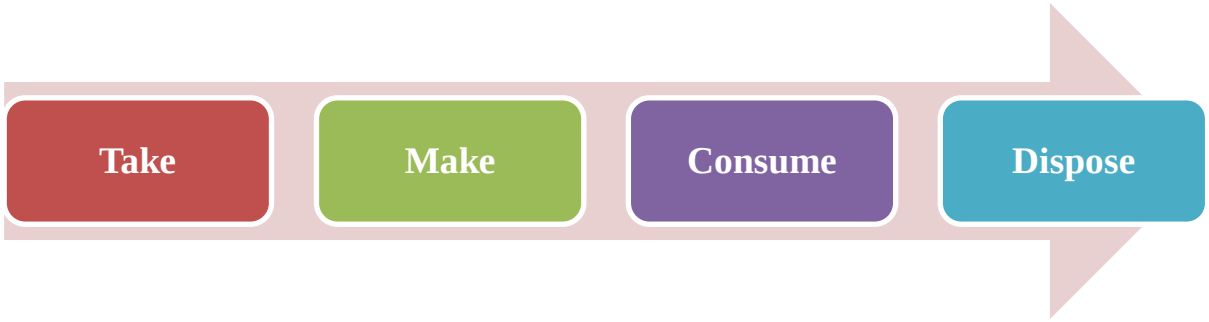

Figure 1-1. The linear economy model

If we were to look honestly at the implications that this economic model has had on human society, we could see that, for almost 300 years, we have been "madly" exploiting the natural resources of this planet, making certain categories extinct or on the verge of extinction, and we have produced mountains of waste that affect the quality of life all over the world, but especially in underdeveloped or developing countries.

Global studies show that the gap between supply and demand for commodities will reach a record 8 billion tonnes in 2030 and 29 billion tonnes in 2050 at current rates. Our planet's natural resources cannot cope with this rate of exploitation and there will be a real problem in managing them in the medium to long term (Bank of America, 2022). In total, we are currently estimated to be consuming 75% more natural resources than this planet can sustain in the long term.

Also, according to the same document, global waste generation currently stands at around 11 billion tonnes per year, a huge amount with less than a quarter being recycled, while around 75% is either landfilled or incinerated, resulting in a substantial carbon footprint. In the traditional economic model, waste of various kinds (such as plastic waste, textile waste, food waste, e-waste, or construction waste) represents the endpoint of the product life cycle, posing significant harm to the environment. If this endpoint of the product life cycle were not enough, it should also be mentioned that during the transformations that occur in the production process and during transport to the point of sale, all products or services contribute

to the release of greenhouse gases (carbon, methane) into the atmosphere.

In this context, it is obvious that mankind is obliged to identify clear and viable solutions to limit the consumption of natural resources and waste management, and it is mandatory to reintroduce them into the economic circuit for as long as possible.

In response to this challenge, the concept of the circular economy has emerged. It is by no means a new concept, first mentioned in the seventh decade of the last century, but it has only come to be seen as a real alternative in recent years as the devastating environmental effects of the traditional economic model have become increasingly evident and powerful.

In this context, it is important to know how the circular economy can be defined, and perhaps the most eloquent definition is the one formulated by the Ellen MacArthur Foundation, according to which "the circular economy is an umbrella term for an economy designed to be able to regenerate itself. In a circular economy, material flows are of two types: biological, capable of being reintegrated into the biosphere, and technical, intended to be reused without entering the biosphere" (Ellen MacArthur Foundation, 2024).

In other words, we could consider that the circular economy is an economic system planned for the reuse of materials in subsequent production cycles (Gribincea, 2021), which aims to minimize waste products and waste and better protect the natural environment.

The circular economy can be defined as a model of production and consumption in which a product must be used, borrowed, properly repaired as much as possible, and at the end of its operating life, recycled. That means that products will be utilized to their fullest extent, and when they reach true obsolescence, they can be dismantled into parts, which helps preserve the planet's natural resources.

The circular economy has an extraordinary beneficial potential for all categories of actors involved in its implementation. A vast portion of the population,

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as well as economic entities and non-governmental organizations, whether at local or national levels, stand to benefit from this approach.

Figure 1-2. The circular economy model

To understand what the circular economy is and why it is a sustainable alternative for human society, we first need to look at what its real objectives are. Thus, the implementation of this new economic system is intended to limit the consumption of primary natural resources, in parallel with a transition to the use of

renewable energy and a reduction in the quantities of waste, to ensure real environmental protection.

To achieve these goals, the life cycle of all categories of products and services needs to be extended, with the circular economy relying on specific activities such as recycling, reuse, repair, and remanufacturing, but also on a range of alternative regenerative resources or innovative techniques such as regenerative design.

Repair can be defined as an operation designed to extend the life cycle of products by addressing any deficiencies in their functionality. This is advantageous both for the manufacturer (who reduces the cost of creating a new product) and for the purchaser (who can save a large part of the amount that would have been spent on a new product).

Reconditioning is a more "in-depth" repair activity aimed at restoring products with severely impaired functionality to their optimal conditions of use. This is a win-win situation for product buyers, who can spend less on such an operation, and for manufacturers, who can turn this type of activity into an important source of revenue.

Remanufacturing (reconditioning) applies to products that can no longer be repaired or reconditioned and involves rebuilding the product by preserving its components that are still functional and replacing all those that are severely damaged. The advantages of this method are similar to those mentioned above and are aimed at both manufacturers and buyers.

Reuse involves using parts of the original damaged product to make another category of goods. The defective product becomes a source of raw materials for other products with a completely different functionality and usefulness.

Recycling is the final option for recovering parts of products that have completed their full life cycle and is an important source of raw materials and materials that could be used in future economic activities.

The principles underlying the new circular economic model can be

summarised as follows:

Figure 1-3. Principles of the circular economy

Principle 1 - Keep products and materials in use (Ellen MacArthur Foundation, 2024).

The main benefits of the circular economy relate to the preservation of added value through better use of material and energy resources and labour. In this respect, there is a pressing need to ensure that products, their components, and materials remain in circulation for as long as possible and that their life cycle can be extended through a rigorous design and focus on durability, re-use, repair, remanufacturing, and recycling.

Principle 2 - Elimination of waste and pollution

Implementing the green economy aims to reduce the negative effects of productive activities on human health and the natural environment. Thus, through its specific mechanisms, the circular economy aims to reduce the consumption of natural resources, reduce the release of greenhouse gases and other categories of hazardous products as waste products in production processes, and minimize air, soil, and water pollution through a significant waste reduction.

Principle 3 - Regeneration and renewal of natural systems

Implementing the circular economy will lead to a reduction in the use of non-renewable natural resources and better conservation of renewable ones. For example, the recycling of household waste can yield nutrients with a high potential for soil regeneration, which will provide the framework for sustainable and durable agriculture. A similar process can be found in the use of alternative energy sources, which have little or no impact on the environment compared to the traditional system of using fossil fuels.

Following these specific principles of the circular economy will lead to substantial benefits in the medium and long term, including:

- reducing pressure on natural resources by reducing unnecessary consumption;
- reducing the quantities of waste and waste products by returning them to the productive economic circuit;
- improving the supply of raw materials by including in the production process those materials that have been recovered in the recycling process;
- increasing the competitiveness of economic entities by identifying and implementing new profit centres as a result of repair and remanufacturing activities for certain product categories;
- stimulating innovation as a tool to create new, sustainable, and reusable categories of products and services;
- stimulating sustainable economic growth by implementing new types of businesses and redesigning global economic circuits to minimize costs and impact on the natural environment.

1.3. Redesigning the value chain

When we talk about introducing a new economic system, we need to be able to make a real and relevant comparative analysis of the costs and benefits it brings. Such an approach is all the more necessary now, at the time of the transition to a

green economy, because we are faced with the real problem of rejection of the new concept because of the widespread belief that any process or technology that falls into the environmentally friendly category is much more expensive and harder to assimilate. Many managers are now reluctant to change the global economic paradigm, believing that it is risky to move from a system that has proven its economic viability to an entirely new mechanism with its own set of challenges.

From the point of view of economic entities, the circular economy comes with some difficulties in terms of implementing its specific mechanisms, but also with many significant advantages such as reducing costs (especially raw material costs) and identifying new profit centres, all of which lead to a reduction in the risks associated with the activities provided. By implementing the mechanisms specific to this new economic system, economic operators also benefit from a major boost in terms of developing research and innovation processes identifying new ways of differentiating themselves on the market and building customer loyalty.

As part of the process of implementing the circular economy, companies need to provide the framework for designing and realizing new categories of products and services that are long life cycle, sustainable, modular, and recyclable. This will certainly not be a straightforward process for the vast majority of economic entities, but it can be seen as a key to success in the years to come. Companies that can adapt to the demands of the new economic and social system will have the best chance of establishing themselves on the market shortly.

Redesigning the value chain as part of the transition to the circular economy also involves optimizing the relationships that economic entities have with suppliers and customers. In this respect communication is a real way to ensure that the actors involved in the various segments of this chain are aligned with the overall objectives of ensuring sustainable and sustainable development.

And yet, in a world that turns conceptual models into monetary expressions, it is necessary to make it clear why a firm will be interested in introducing circular

economy mechanisms as obvious ways of making an economic profit. Schematically, the advantages that a company can have by implementing the new economic model can be presented as follows:

- economic entities that opt for this type of business model have a real opportunity to reduce production costs by using recycled raw materials and materials, the cost of which is substantially reduced compared to their traditional variant;
- organizations adopting the circular economy model will be those that develop their research and innovation capabilities, which will allow them to increase their profits as a result of marketing new, innovative products that will differentiate them from existing traditional competitors;
- through repair, refurbishment, remanufacturing, re-use or recycling activities, circular economic operators have the opportunity to earn significant amounts of money, turning these activities into profit centres;
- reducing landfill costs is a feasible way to minimize costs and increase profitability.

Based on all the elements mentioned above, we can show what a functioning circular economy model could look like, ensuring an increase in the economic potential of companies and a minimization of environmental impact (See Fig. 1-4).

Last but not least, the main opportunities that the circular economy brings to the global economic and social system should be mentioned. These can be summarised as follows (Andronova-Cincelette, Liverani, & Behrens, 2023):

- the circular economy can achieve the twin goals of achieving sustainable growth and creating more jobs;
- the green agenda must ensure youth involvement and jobs for young people;
- including jobs in the circular agenda can highlight opportunities to reduce existing inequalities while addressing unintended welfare risks;

- circular economy initiatives should take into account the impact on developing countries.

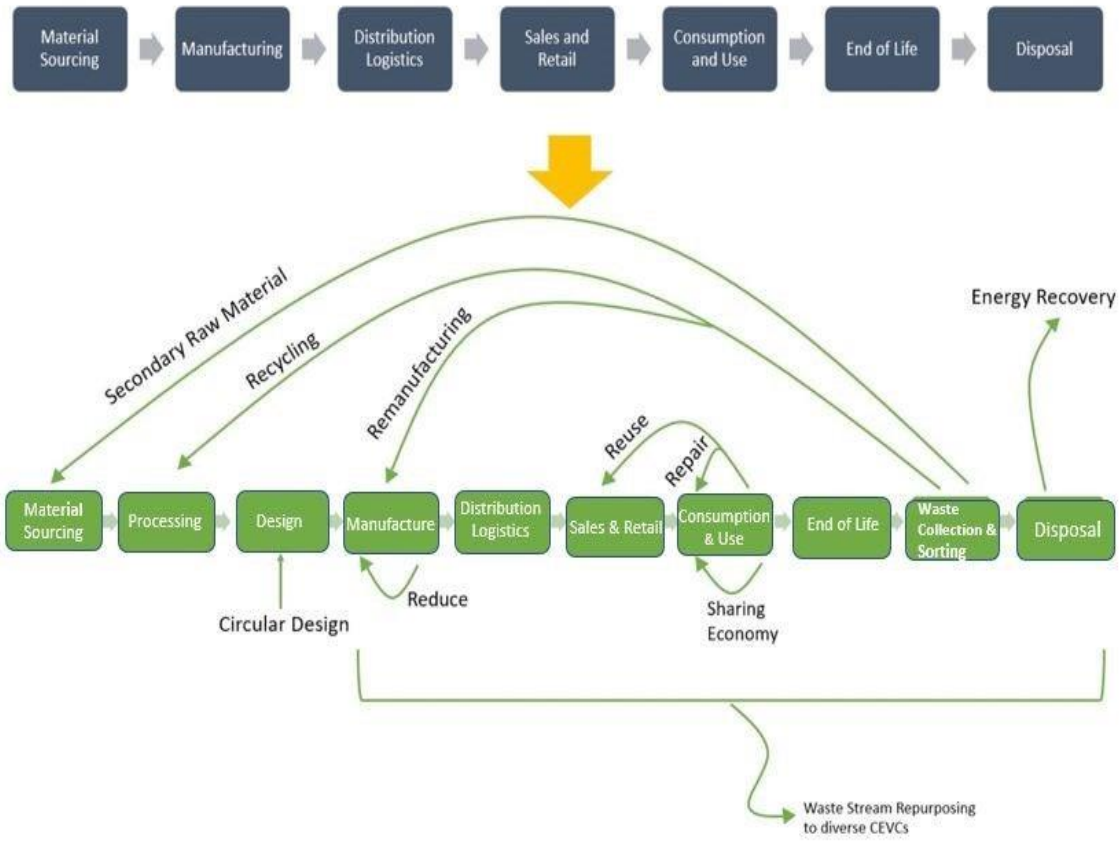

Figure 1-4. The circular economy value chain

1.4. Synchronising circularity with competitive business models

The introduction of the circular economy on a large global scale can be seen as the fourth major industrial revolution and will lead to the emergence and development of new categories of economic entities based on circularity and sustainability. At the same time, business models specific to the circular economy are the key to extending the lifespan of many national and multinational companies, the only condition being that they align with the requirements of the new system.

In the new economic and social context of today's world, organizations need to adjust their business models to integrate the principles of circularity into all

components of the supply and distribution chain. Based on these new realities, companies have the opportunity to maximize the benefits of products and services marketed by extending their life cycle, followed by recovery and regeneration after the end of the cycle.

In practice, moving from the linear to the circular model of production implies implementing sustainable business strategies (Economic Research Institute, 2022), in which category the following can be included:

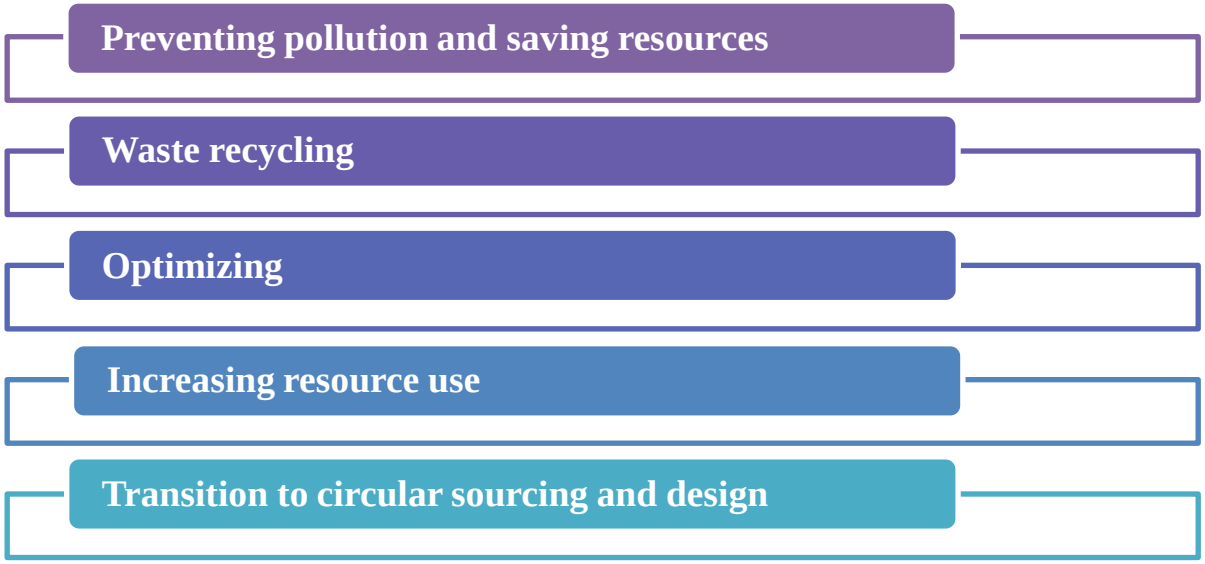

Figure 1-5. Sustainable business strategies

When analysed from the producers' point of view, the value of goods and services can be retained as long as they can be used within optimal parameters and/or they can be reused over several life cycles. From an organisational point of view, maintaining the value of a product and service at a high value for a longer period is a real challenge and involves major changes at managerial, organisational, political, and, not least, individual and collective levels. It also requires increased high-level coordination along the entire value chain of circular products and services traded. All these elements are sources of expense for companies starting the transition to the circular economy, but they are also real opportunities as the adaptation process is completed.

For consumers, circular businesses, through circular products and services, are an optimal solution to satisfy personal needs, offering a new kind of experience and individual satisfaction over an extended period of use. As long as the actual functionality of the product is not affected, the consumer will certainly be satisfied that they can use it for a longer period without incurring unwanted additional costs.

Considering the above, it is obvious that a circular business model is an opportunity for contemporary economic entities and a sustainable source of supply for today's consumers. It is thus necessary to establish what is conceptually a circular business model. In this sense, we can use the definitions formulated by Bas Mentink (Bas Mentink, 2014), on the one hand, and Marcus Linder and Mats Williander (Marcus Linder; Mars Williander, 2015), on the other hand:

- "The circular business model is the rationale for how an organization creates, delivers and captures value with and in closed material loops" (Bas Mentink);
- "The circular business model is a business model in which the conceptual rationale for value creation is based on using the economic value retained in products after use to produce new offerings" (Marcus Linder; Mars Williander).

The transition from classical to circular economic models requires major organizational changes in all its components, thus (Institute for Economic Research, 2022):

- In terms of the value creation component, moving to the circular model requires that products are made in specific processes, with recycled materials and special resources. To this end, companies need to create production capacities specific to the circular economy, set up appropriate logistics systems, and prioritize communication and maintenance of relationships with customers and business partners;
- in the valorization component, circular products must have the necessary characteristics so that they can be reused or recycled;

- the value proposition component implies that the sale of circular products or services should aim at changing the behaviour of customers by encouraging them to adopt circular consumption behaviour or, in extreme cases, even changing traditional customers to ones that have already aligned with circularity standards;
- in the value capture component, economic entities have the option to choose to market those products or services that are charged according to their use.

Regarding the typology of circular business models, we can note that in the literature there are several delimitations and classifications. In this chapter, we will refer to two of them, namely those set out by the Forum of the Future and the Organisation for Economic Co-operation and Development (OECD).

Thus, according to the "Circular Business Models" report produced by the Forum of the Future project (Forum of the Future, 2020), ten circular business models are mentioned, as follows:

- loop recycling model - involves using waste as raw material to create new products;
- the product-to-service model;
- the product and service customization model;
- the downcycling model - assumes that the value of the recycled product is less than the value of the original product;
- the upcycling model - assumes that the value of the recycled product is higher than the value of the original product;
- consumer loyalty model - involves encouraging repeat use of a product or service;
- modular design model - involves creating products from smaller parts, called models, so that it is possible to replace a single module, rather than the whole product, if necessary;

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- the industrial symbiosis model - involves the sharing of services, utilities, and secondary resources between different economic entities to ensure a significant reduction in consumption;
- the local production model - involves reorienting the production process according to availability in the regional supply chain;
- waste collection model.

If we look at the classification proposed by the Organisation for Economic Co-operation and Development (Organisation for Economic Co-operation and Development, 2020), we can identify five major types of circular business as follows:

- Resource recovery model;
- Circular suppliers / circular supplies models;
- Product life extension model;
- Sharing platform/Sharing Economy model;
- Products as a service model.

In practice, the most successful circular business models are considered to be (Economic Research Institute, 2022):

- The circular suppliers/circular supplies model involves replacing traditional raw materials, especially rare ones, with renewable, recyclable, or biodegradable variants. Underpinning this business model is a specific philosophy called 'Cradle to Cradle' (C2C).
- The industrial symbiosis model involves the association of economic entities to share utilities and certain categories of resources. A more special model can be included in this category of models, i.e. one based on the principle of interlinkage, where waste from one company's activity becomes, in practice, raw material for another economic entity.
- The circular business model based on resource recovery involves the recovery of secondary raw materials used in the waste activity and waste processing.

- The circular business model based on product lifecycle extension involves making products and services with an extended lifecycle, based either on innovative technologies or using modular design.
- The product-to-service model involves moving from the actual marketing of products to the sale of complex packages of services associated with the initial product (maintenance, repair, remanufacturing). A separate model within this category is the one where the actual sale of the product is abandoned and this process of transferring ownership to the buyer is replaced by a process of leasing the product on a long-term basis.

1.5. Developing circular behaviour

Implementing the circular economy and a new type of production and consumption behaviour is no easy task. To change an economic system from the ground up, it is necessary to bring about a real and profound change in mentalities and culture at both community and, above all, individual levels.

There is also a need for all those involved to acquire the knowledge and skills appropriate to the transition to a green economy, which requires a redesign of the entire global education system. There is no doubt that lifelong learning and vocational training, concepts so often used in today's education, must become real tools for training specialists in all areas of the circular economy, who will be able to ensure success in a global market undergoing profound and accelerating change.

The simplest question we should all answer is "What can we do" to make the circular economy a reality? In this respect, we can mention some actions that are as simple as they are relevant to environmental protection and the redesign of new global production and consumption behaviour (DS Smith, What you can do to support the Circular Economy, 2024):

- Let's recycle more, but also better. For each of us, recycling must become an important part of our lives. We need to realize that household and industrial

waste, whatever its nature, can be treated as a future resource for use in economic activities and stop using the verb "to throw away" as an endpoint in the life of certain categories of products and services. The vast majority of these goods can be re-used, at least in part, and can add value in the future. To achieve this goal, everyone must give due importance to recycling, which must be a quantitative as well as a qualitative process. For recycling to be truly effective, it is necessary for each of us to respect the rules governing this process and to separate the various categories of waste products correctly.

- Reducing the contribution to carbon dioxide emissions using those products and services that are "environmentally friendly" in current consumption.
- Careful choice of electronic and household products, considering environmental criteria such as water and electricity consumption, real possibilities for repair and remanufacturing of products, proportion of recyclable materials in the product structure, etc.
- Limiting water consumption. There are several simple actions that each of us can take, such as turning off a tap while brushing our teeth, which will lead to a significant reduction in consumption globally.
- Reducing hydrocarbon consumption by rigorous use of cars in local transport. While this may seem like a topic for everyone's convenience, it is important to know that personal car transport has come to consume 13% of all natural resources used globally each year. Replacing personal transport with public transport, or even switching to more environmentally friendly options such as cycling, will lead to a substantial reduction in unnecessary consumption of liquid fuels and thus reduce the global carbon footprint.
- Replacing conventional petrol and diesel cars with electric ones. This will substantially reduce pollution in large urban areas, which will lead to an increase in the quality of life in these areas. It should be noted, however, that

this type of vehicle also has an environmental impact, even if this is still under-researched, namely that of storing batteries after they are exhausted.

- Recycling food waste and using it, after processing and composting, as a fertilizer in agriculture, replacing conventional fertilizers and pesticides that are highly damaging to the environment.
- Recycling plastic packaging is one of the main sources of water and soil pollution worldwide. Plastic is one of the materials that has a very long decomposition time, making it a real enemy of the environment. Add to this the statistic that over the last 70 years we have recycled only about 10% of the total amount of plastics produced, and it is easy to see the impact of this type of pollution and the importance of sorting and recycling this category of products.
- Use glass or porcelain dishes instead of disposable ones. Such a personal approach can have a major global impact. For example, it is important to know that by the end of 2022, around 7.5 million disposable coffee cups will be used annually in the UK alone, the vast majority of which are made of hard-to-decompose plastics. The vast majority of these cups end up in landfill sites or are incinerated after use, with a significant environmental impact.
- Protect forests, green spaces, and make reforestation permanent. This can be achieved through the widespread use of products made from recycled fibres rather than those involving massive deforestation and processing of raw wood. It is also important that we all contribute to planting new trees and maintaining green spaces, especially in urban areas, as they play a key role in absorbing pollutant gases.
- Transmission of information. This is the easiest thing we can do. It costs us nothing to convey to everyone we come into contact with how important it is to protect the environment by adopting circular consumption behavior, and

thus having the power to influence the standard of living of generations to come.

Moving beyond these theoretical elements, we can focus our attention on some seemingly insignificant changes that can occur in the behaviour of each of us, but which, when added up globally, can have colossal effects on improving the quality of life of each of us.

- We all want to be fashionable and buy the latest phone, tablet, or laptop. But is it really necessary for us to do so? The answer is certainly no, and the impact of implementing sensible consumer behaviour in this area is not to be underestimated. In light of the realities of the new circular economic model, we should all be looking to repair or refurbish these categories of devices, thereby extending their life cycle, and also to recycle them when they become completely inoperable. In this way, we will each contribute to reducing our consumption of raw materials and protecting the environment.
- Is it necessary to ask for disposable tableware every time we order food? The answer will surely be ‘no’ this time too. We are well aware that we have the option of having a set of ordinary crockery on hand, even at work, which can be washed after use. In this way, we can all say that we have contributed to reducing the amount of plastic polluting our soil and water, thus protecting various species of flora and fauna.
- Is it difficult to sort waste correctly and recycle it separately? It is certainly not that hard, it's just convenience that stops us from doing it. In many parts of the world, national or local authorities have started projects in recent years to collect household waste correctly, and it is desirable that we also adopt correct circular behaviour in this area.

Adopting consumption behaviour that is appropriate to the requirements of the circular economy is certainly not so difficult. It is only through education, in and out of school, through well-constructed public information campaigns, and by

encouraging the transmission of information from person to person that we can bring about a real change in the mentality and concepts that govern our daily lives. Such a change is, in fact, the key to establishing the circular economy as a fundamental component of the sustainable development of human society.

STUDENTS TRAINING SECTION

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Keyword list with vocabulary

The linear economy is an economic system based on the principle of "take - make - consume - dispose", in which raw materials are taken, transformed into products or services, transmitted to the consumer and subsequently thrown away, in the form of waste.

The circular economy is a generic term to define an economy designed to be able to regenerate itself. In a circular economy, material flows are of two types: biological ones, capable of being reintegrated into the biosphere, and technical ones, intended to be re-evaluated without entering the biosphere.

The circular economy represents an economic system planned for the reuse of materials in subsequent production cycles, which aims to minimize residual products and waste and better protect the natural environment.

Repair can be defined as an operation designed to ensure the extension of the life cycle of the products by remedying the deficiencies arising in their operation.

Refurbishment involves a “deeper” repair activity, aimed at ensuring the return of products with severely impaired functionality to optimal conditions of use.

Remanufacturing (remanufacturing; remanufacturing) is an operation applied to products that can no longer be repaired or reconditioned and involves the restoration of the product by keeping its components that are still functional and the total replacement of seriously damaged ones.

Reuse involves the use of parts of the original damaged product to make another category of goods. Basically, the defective product becomes a source of raw materials for other products with a completely different functionality and utility.

Recycling represents the final option for recovering parts of products that have completed their entire life cycle and is an important source of raw materials and materials that could be used in future economic activities.

The value chain is a tool that links the activities of a company with its functional parts and tries to make an assessment of the contributions that each part brings to the added value of the organization.

The circular business model is the rationale for how an organization creates, delivers and captures value with and in closed material loops.

The circular business model is a business model in which the conceptual logic for value creation is based on using the economic value retained in products after use in producing new offerings.

Circular behaviour is that model of production and consumption behavior that develops within a circular economic system.

Sustainability represents the quality of an anthropic activity to be carried out without exhausting the available resources and without destroying the environment, so without compromising the possibilities of meeting the needs of future generations.

Sustainable development refers to creating a balance between contemporary lifestyle and continued economic growth, on the one hand, and environmental protection and finding alternative resources, on the other.

Questions for self-evaluation and discussion

1. Which type of economy is specific to the "take-make-consume-dispose" model?

a) circular economy;
b) private economy;
c) linear economy;
d) centralized economy.

2. The circular economy represents:

a) an economic system planned for the reuse of materials in subsequent production cycles, which aims to minimize residual products and waste and better protection of the natural environment;
b) an economic system in which raw materials are taken, transformed into products or services, transmitted to the consumer and subsequently thrown away, in the form of waste;
c) an economic system planned for the reuse of materials in subsequent production cycles, which aims to maximize residual products and waste and better protection of the natural environment;
d) an abstract concept, without immediate practical applicability.

3. The concept of circular economy appeared:

a) in the 2000s;
b) in the last decade;
c) in the 1970s;
d) in the 17th century.

4. The concept of sustainable development refers to:

a) creating a balance between the contemporary lifestyle and the continuation of economic growth, on the one hand, and environmental protection and finding alternative resources, on the other;
b) the quality of an anthropic activity to be carried out without exhausting the available resources and without destroying the environment, so without compromising the possibilities of meeting the needs of future generations;
c) creating a balance between the contemporary lifestyle and the continuation of economic growth, using intensively the existing natural resources;
d) the elimination of fossil fuels from the economic circuit in order to better protect the environment.

5. Repair, as an activity specific to the circular economy, represents:

a) a "deeper" repair activity, aimed at ensuring the return of products with severely impaired functionality to optimal conditions of use;
b) an operation intended to ensure the extension of the life cycle of the products by remedying the deficiencies arising in their operation;
c) an operation that applies to products that can no longer be repaired or refurbished and involves the restoration of the product by keeping its components that are still functional and the total replacement of those seriously affected;
d) an activity specific to the linear economy, not the circular one.

6. The category of activities specific to the circular economy does not include:

a) repair;
b) restoration;
c) reuse;
d) recycling.

7. The circular business model implies:

a) creating attractive products for potential buyers;
b) creating added value by using the economic value retained in products even after their initial use;
c) creation of round-shaped products in order to increase their aerodynamics;
d) creating products through the intensive use of raw materials and materials.

8. The business model in which the actual sale of the product is abandoned and this process of transferring ownership to the buyer is replaced by a long-term product rental process is a model of the type:

a) from product to service;
b) cradle to cradle;
c) circular suppliers / circular consumables;
d) activity based on industrial symbiosis.

9. Reducing the contribution to the emission of carbon dioxide through the use in current consumption of those "friendly" products and services with the environment is a component of:

a) creating a circular business environment;
b) rational behaviour;
c) circular behaviour;
d) linear behaviour.

10. Currently the annual global waste production is:

a) 11 billion tons, of which only 25% is recycled;
b) 11 billion tons, of which 75% is recycled;
c) 110 billion tons;
d) 1.1 billion tons.

11. What type of heavy metals are recovered by recycling incandescent bulbs and how does this operation contribute to protecting the environment?

12. Describe an action, a component of circular behavior, through which people can contribute directly to protecting the environment and try to identify the effects it has in the medium and long term on ensuring the sustainable development of human society.

13. Place the following activities in the correct order, depending on the time of their appearance in the circular economic model:

- reconditioning;
- restoration;
- recycling;
- repair;
- reuse.

14. Fill in the missing principle specific to the circular economy in the diagram below:

15. What do you think is the correct order of placing the following categories of waste, according to their decomposition period:

- paper and food waste;
- plastic bags;
- cigarette butts;
- cans;
- glass bottles;
- aluminum cans;
- cans;
- plastic bottles (PETs)

Summary

These first two decades of the 21st century are marked by a redefinition of the rules by which the global economic system is intended to function. Thus, more and more frequently, the need to transition from a linear economy, based on the consumption of raw materials and energy, to a circular, green, environmentally friendly economy is insisted upon.

In this context, it is being discussed more and more frequently about ensuring a sustainable development worldwide, respectively about ensuring a balance

between the contemporary lifestyle and the continuation of economic growth in all countries of the world, on the one hand and the protection of the environment and the identification of alternative resources, preferably renewable, on the other hand.

The concept of circular economy, which appeared in the 70s of the last century and was rediscovered and implemented at the beginning of the 21st century, is a generic term that appeared to define an economy capable of self-regeneration. The circular economy can be defined as a model of production and consumption in which a product must be used, borrowed, properly repaired as much as possible, and at the end of its operating life, recycled.

In an overall view, the circular economy can be considered to be a model that ensures an obvious gain for all parties involved in the implementation process. Beyond the obvious advantage represented by the improvement of living conditions by ensuring a real protection of the environment, by switching to this new system:

- the population will benefit from access to new, innovative products with a longer lifespan, made from environmentally friendly materials, but also to a series of support services such as repair, reconditioning, restoration or reuse;
- economic agents will be able to benefit from raw materials and materials from recycling, with significantly lower costs compared to those from mining activity. Also, companies have the opportunity to profit from activities specific to the circular economy, which aim to extend the life cycle of a product;
- local and national organizations will have an obvious gain from this process as a result of the reduction of factors that negatively impact the environment, thus making it possible to reduce the amounts allocated for its restoration.

Businesses designed according to the circular model represent the future of the world economy. Thus, companies that identify with the specific requirements of the new economic system will have the opportunity to capture added value along all the specific stages of a prolonged product life cycle.

By implementing circular business models such as the circular suppliers - circular consumables model, the product-to-service model, the model based on industrial symbiosis, the model based on resource recovery or the one based on extending the life of products, companies that adapt to the requirements of the green economy identifies and exploits the economic opportunities that the new system offers by reducing some categories of expenses (expenses with raw materials or waste storage) and creating new profit centres through the activities of repair, reconditioning, reuse, etc.

From the end consumer's point of view, adopting a circular behaviour requires an effort to understand the mechanisms specific to this new economic model. But, once we get used to this new type of behaviour, each of us will have significant advantages, first of all through access to a new category of products, with increased performance and extended life cycle.

Training example 1-1

We all know that incandescent light bulbs are still widely used for lighting. However, there are very few people who are really aware of how important it is that this type of light bulbs is recycled, immediately after the end of their life cycle.

Thus, it should be noted that this type of bulbs contains 3-5 milligrams of mercury, a highly toxic chemical element that causes serious environmental problems. Heavy metal poisoning, a category to which mercury also belongs, has very serious long-term effects, affecting the human body and, in particular, fat tissue and the bone system. Bulbs that are not properly recycled and end up in landfills break and contaminate the soil, water and air, and can also end up in the food we eat.

Recycling a light bulb will make it possible to collect several categories of raw materials that can later be reused, such as: glass (88% of the original volume of the light bulb), metal (5%), plastic (4%), fluorescent dust (3%) and mercury

(0.005%).

In this context, we must also mention the fact that, in recent years, attempts have been made worldwide to replace incandescent bulbs on a large scale with new types of lighting fixtures (economical or LED bulbs).

Training example 1-2

One of the most famous companies operating worldwide, Apple, has implemented mechanisms specific to the circular economy at all levels of its activity.

Thus, the company eliminated the plastic packaging in which the phone cases were packed, replaced the glass foils glued to the screen of its terminals with ones made of paper, and switched to making the strips on the sides of its devices from recycled glass.

Apple only uses recycled rare metals in its devices, including the gold used to make motherboards.

Training example 1-3

In order to have a clearer picture of how the business environment perceives the transition to the circular economy, we will briefly present the results of a study carried out in Romania by the start-up Flip (a company that implements the principles of the circular economy in the field of refurbishing phones and tablets). The main conclusions that can be drawn from this study can be summarized as follows:

- *50% of Romanian companies believe that it is relatively affordable for them to apply at least one of the principles specific to the circular economy;*
- *41% of Romanian companies believe that the main problem that arises in the implementation of the circular economy is precisely the reduced availability of products and services in this category;*

- *30% of economic entities in Romania believe that there is a real problem in terms of resistance to change, this targeting all actors involved in the implementation of the new economic model (political and administrative decision-makers, companies, population);*
- *33% of large Romanian companies believe that financial reasons (higher costs of sustainable raw materials, longer investment amortization period) constitute a problem in the process of implementing the circular economy.*

CHAPTER TWO. SOLUTIONS FOR TRANSITION TOWARDS CIRCULAR ECONOMY

Introduction to chapter two[2]

The chapter "Solutions for transition towards circular economy" is focused on the following main problem areas:

- Sectoral diversification and resource unification in the circular economy
- Regulatory certificates for the circular economy
- Universal chemical agents in the circular economy
- Ecological analysis of chemical production methods in the circular economy using the example of caustic soda
- Advantages and disadvantages of plastics
- Key challenges in managing plastic waste in the context of the circular economy
- Ensuring the collection and recycling of waste through a municipal fee for household waste
- Collection and transportation of household waste
- Disposal of household waste
- Ensuring sanitation of the spatial-development areas of settlements assigned for public use
- Methodological calculations for determining municipal household waste fees by components.

[2] Note. This chapter was written by researchers from D. A. Tsenov Academy of Economics, as follows: Professor Dr. Andrey Zahariev (the Introduction, Subchapters 2.2 and 2.4, as well as Training example 2-2); Head Assistant Professor Dr. Petko Angelov (Subchapter 2.1), Senior Lecturer Dr. Margarita Mihaylova (Subchapter 2.3 as well as Training example 2-1). The student training section was written jointly by the three authors.

In this chapter, you will acquire knowledge and skills how to:

- Group industrial sectors for the purpose of unified processing into the 4 main categories of recyclable waste in the circular economy;
- Comment on regulatory certificates for the circular economy using the example of the implemented EU legislation in Bulgaria;
- Investigate the impact of chemical reagents for activities such as water purification, fly ash, contaminated soils, etc.;
- Compare technological specifics for the production of caustic soda as a universal chemical agent;
- Examine the plastic recycling sector and its key challenges;
- Analyse a cost estimate for activities related to the collection and landfilling of household waste;
- Calculate the components of a municipal fee for household waste.

The chapter includes the following subchapters:

2.1. Industry

2.2. Chemicals

2.3. Plastics

2.4. Waste and recycling

2.1. Industry

2.1.1. Sectoral diversification and resource unification in the circular economy

The world and the Bulgarian industries are undergoing a transformation process from linear to circular economy. In the process of the "green transformation", emphasis is placed on industrial symbiosis and the transformation of waste from one sector into a usable resource for another. The terms "circular economy" and "green economy" are often used interchangeably. However, it is

important to note that the circular economy is a consequence and part of the green economy, focusing on the industrial cycle. In Bulgaria, the industry focuses on eight key sectors:

1. Metallurgy and steel production: An important sector with considerable production of metals and steel.
2. Chemical industry: Recycling products through chemical processes to transform organic and inorganic raw materials.
3. Mechanical engineering and automotive manufacturing: Production of machinery, equipment, and automotive components.
4. Textile industry: Production of textile products and clothing.
5. Power engineering: Production of electric power and the development of renewable energy sources.
6. Food and beverage industry: Production of food and beverages.
7. Information technology and services: Development of software technologies and provision of IT services.
8. Construction and real estate: Development of construction and infrastructure projects.

The above mentioned eight sectors comprise the four unified groups of waste materials that can have circular (secondary) usage: glass, plastic, paper, and metal. Each of the sectors can adapt to the circular economy in one of the following aspects: recycling, optimization of production processes, use of secondary raw materials, material innovations, development of closed cycles. According to Bulgarian legislation and strategic provisions, this is entirely possible and achievable. The industry's focus on the circular economy is highlighted in the Partnership Agreement with Bulgaria for 2022-2027, the National Recovery and Resilience Plan, the National Strategy for Small and Medium-Sized Enterprises for 2022-2027, the National Waste Management Plan for 2022-2028, and others.

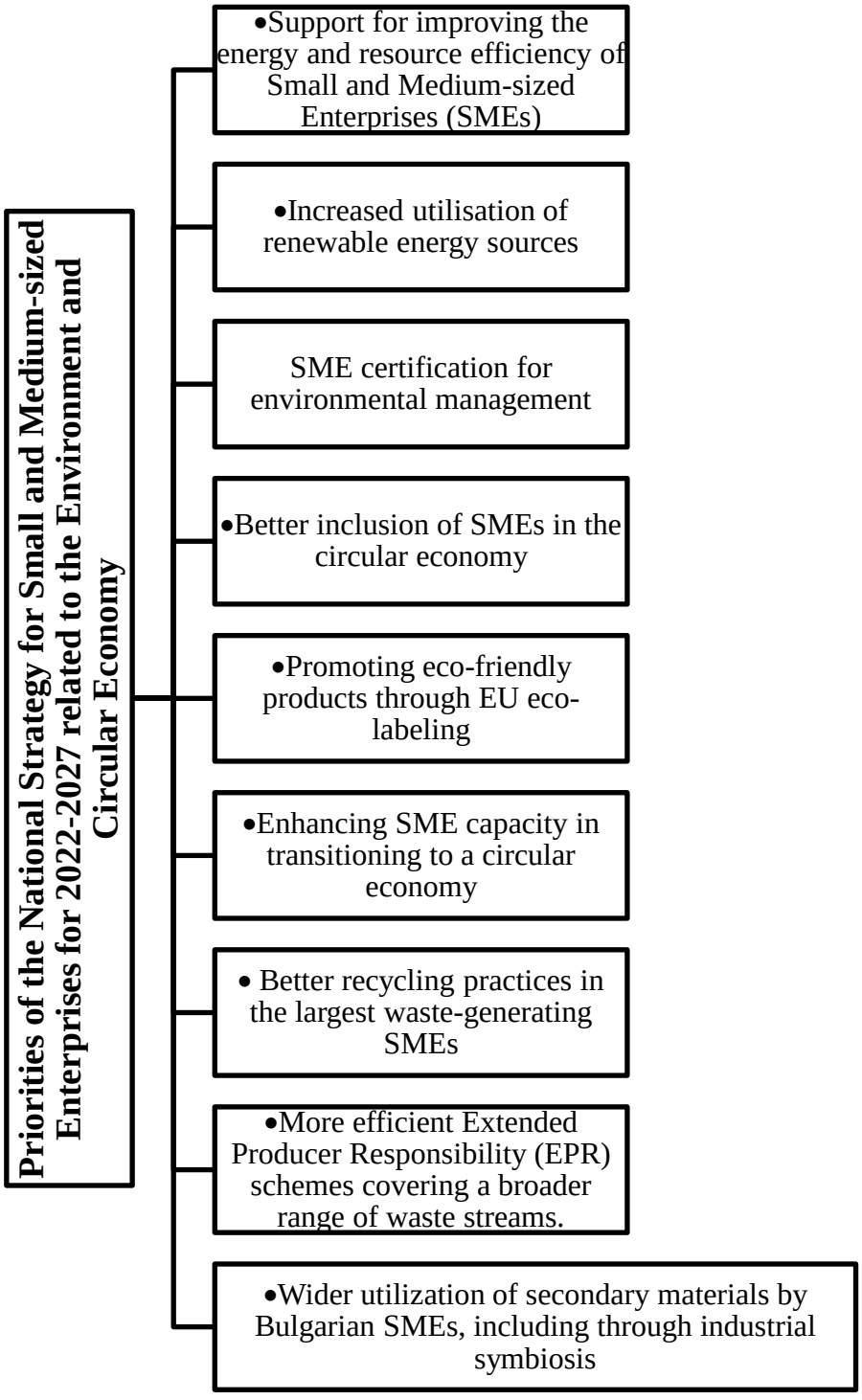

Figure 2-1. Priorities of the National Strategy for Small and Medium-sized Enterprises for 2022-2027 related to the Environment and Circular Economy

Source: Developed by the author based on the National Strategy for Small and Medium-sized Enterprises for 2022-2027.

The Partnership Agreement with Bulgaria outlines the main directions of investments with a focus on the circular economy, aimed at innovative and intelligent economic transition, clean and fair energy transition, green and blue investments, and circular economy.

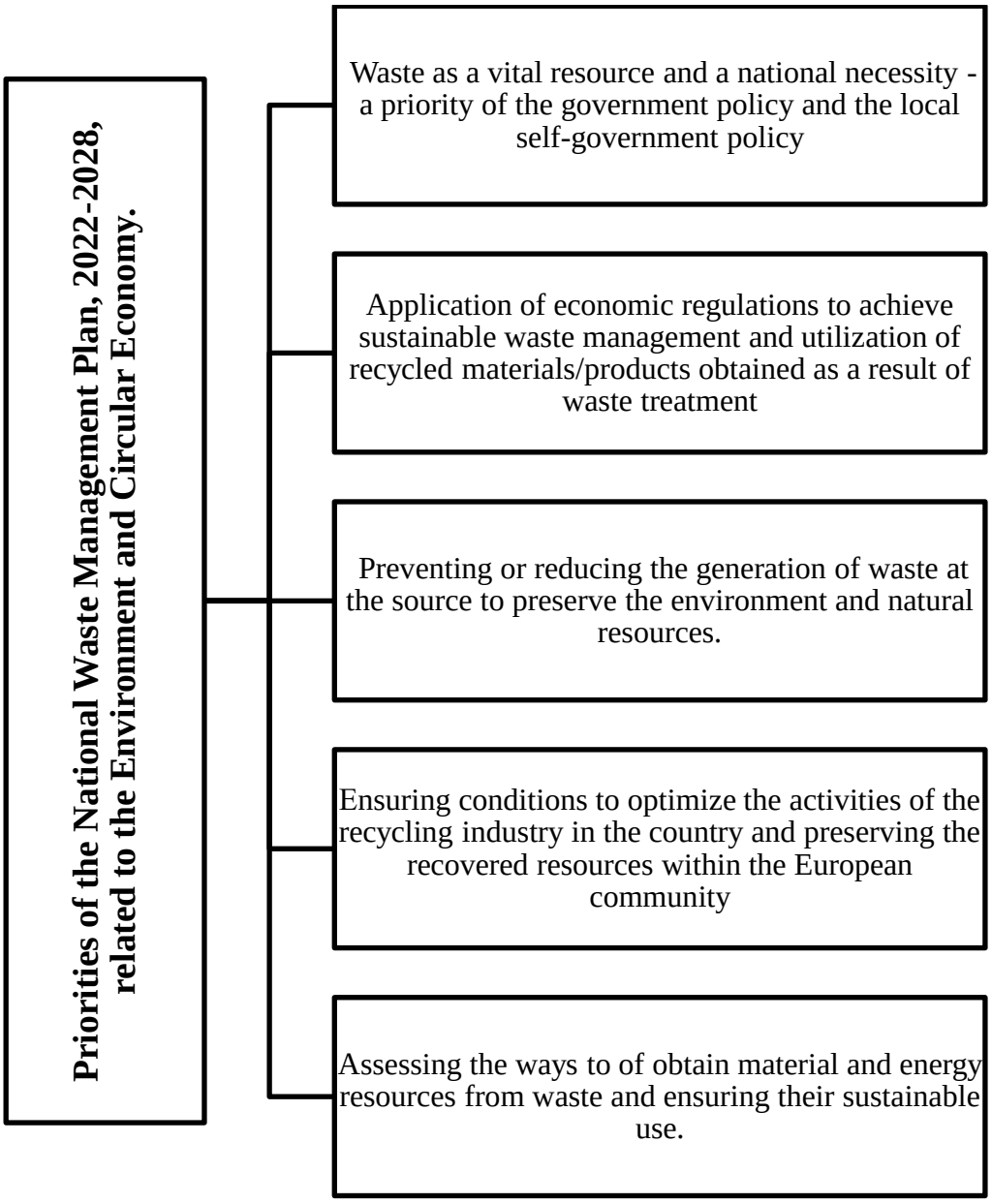

Figure 2-2. Priorities of the National Waste Management Plan, 2022-2028, related to the Environment and Circular Economy

Source: Developed by the author based on the National Waste Management Plan for 2022-2028.

The National Recovery and Resilience Plan not only aims at economic and social recovery in the country after COVID-19 but also lays the groundwork for green and digital transformation in the context of the "green goals" of the European Green Deal. Key strategic documents directed towards the transition to the circular economy in the Bulgarian industry include the National Strategy for Small and Medium-sized Enterprises for 2022-2027 and the National Waste Management Plan for 2022-2028, which outline the following priority goals, visually represented in Figure 2-1 and Figure 2-2.

The recycling industry is of crucial importance in this process. In practice, without its elaboration, achieving a circular cycle in the economy would not be possible. In Bulgaria, significant funding is allocated for the implementation of circular economy principles, and the recycling industry shows good potential. The circular economy is increasingly making its way into various industrial sectors in Bulgaria.

Among the most significant companies practicing circular economy principles are the Bulgarian Recycling Association, the Bulgarian Water Association, the Bulgarian Construction Chamber, the Automotive Cluster Bulgaria, CleanTech Foundation, Association RES Cluster, the Union of Green Energy Producers, the Earth and Man National Museum, companies, municipalities, etc.

2.1.2. Evidence of circular economy in the industry of Bulgaria

In this line of thinking, every industrial sector in Bulgaria has specific recycling characteristics and represents an important part of the transformation process from a linear to a circular economy. Examples of the implementation of the circular economy in Bulgaria in various sectors include:

The metallurgical sector is one of the sectors that use resources with a practically infinite cycle. The new EU policies for high resource efficiency through the circular economy are a path for its improvement but have not yet found

widespread application in Bulgaria. Due to sustainable development in mining and metallurgy in our country, the goals of the circular economy must become a national priority. This approach aims to reduce dependence on imports from third countries, achieve lower energy consumption, and enhance economic efficiency and competitiveness. Bulgarian companies working in this direction include Auruca Metal AD, Refran EOOD., KCM AD Plovdiv, Monbat Recycling EAD, and others.

Chemical industry: BASF which operates in the Bulgarian market, is focused on the circular economy. This includes managing long-term political decisions such as the European Green Deal, overcoming the consequences of current geopolitical conflicts like the war in Ukraine, and advancing towards digitalisation. BASF develops chemistry for a sustainable future. More than 111,000 employees in the BASF Group contributing to the success of businesses in almost every sector and almost every country worldwide.

Mechanical Engineering and Automotive Manufacturing: Although mechanical engineering and automotive manufacturing are not major industrial sectors in the country, in recent years, the implementation of the circular economy has been observed in the foreign companies operating in Bulgaria. Specifically, as materials such as iron, steel, copper, or tungsten are reused in industrial processes in many European countries, this practice is applied in several German and Austrian companies. The "Green" steel and the recycling of used construction materials are just a couple of examples of diverse circular economy practices. Tech Industry Bulgaria is one of the suppliers of industrial products systematically transporting and regenerating hazardous waste from solvents sold in the market. They specialize in industrial cleaning and treatment of details and surfaces, mainly in the field of metal processing. Key clients include manufacturing sectors such as mechanical engineering, automotive manufacturing, plastic, and food and beverage industries. As all processes of cleaning and treatment are associated with industrial chemicals, if their use is not within closed lines, machinery, and facilities, these chemicals will

have an extremely negative impact on the environment and workplaces.

Textile Industry: To give textile waste a second life, it must be collected separately in specialized containers. Then, an assessment should be made to determine the best way to extend the life of each specific item. In Bulgaria, a positive trend can be observed with the increasing interest and use of containers for separate collection of textiles in the country, thanks to the company Texcycle. Additionally, global leaders like H&M and Adidas, operating in both the global and Bulgarian markets, are implementing design strategies for recyclability. This involves increasing the volume of collected and resold clothing and increasing the share of clothing made from recycled textile fibres. They also incorporate the use of organic cotton, grown without harmful chemicals and without disrupting ecosystems. According to the Report on Environmental Savings from Implementing a Circular Economy in the Textile Sector in Bulgaria, prepared by the Bulgarian Association Circular Textile (BACT) for the period 2019-2021, 96,170 tons of textiles were processed, with 72,829 tons exported to other countries for reuse. This resulted in saving 1.7 million tons of carbon emissions from the production of new textiles and clothing, equivalent to the annual emissions of 2 million cars. It also prevented the disposal of 35,000 tons of natural fabrics and the associated emissions from decomposition, equivalent to the amount of household waste generated by 80,000 Bulgarians in a whole year.

Power engineering: The Bulgarian industrial group "Aurubis" is a leading global supplier of non-ferrous metals and one of the largest copper processing companies in the world. It is directly linked to the green transition even before it became a common goal in the EU. The company is based on three main pillars: increasing energy efficiency, diversifying energy sources, including through its own production, and ensuring secure and predictable supplies from abroad. An example of this is the process of replacing energy-intensive motors with more efficient ones. Simultaneously, at the company's plant near Pirdop and Zlatitsa, a turbine utilizing

waste heat from the sulfuric acid production facilities operates. By capturing some of this heat, steam is produced.

The turbine generates energy used in production. In practice, it is an on-site power plant that operates with renewable energy. The effect is not only cheaper energy but also a zero-carbon footprint.

Figure 2-3. Efficient circular economy in "Aurubis Bulgaria", at 80 km from the capital Sofia in the region of the Balkan Mountain Range and Sredna Gora

Source: https://www.aurubis.com/en/bulgaria/about--aurubis-bulgaria/location

Food and beverage industry: In terms of circular economy, this sector can be illustrated by the examples of agroecology, conservation agriculture, and agroforestry (growing trees around or within crops or pastures). (Bulgaria Plastics Pact, 2022). Bulgaria is among the top ten countries with a carbon footprint in the food sector. Producers of non-alcoholic beverages and bottled water in Bulgaria use packaging that is 100% recyclable. Gradual progress is observed in various sub-sectors of the industry, with the need for greater awareness among representatives of small and medium-sized businesses.

Information technologies and services: In the field of information technology (IT), some companies actively apply the principles of the circular economy. For example, Apple, the manufacturer of iPhone and Mac products, emphasizes material recycling and the recovery of old devices. Google uses

renewable energy sources for its data centers and supports sustainability projects. Dell, a computer product manufacturer, focuses on designing products that facilitate component recycling. Microsoft is moving towards a circular economy by supporting sustainability and energy efficiency.

Construction and real estate: "Glavbolgarstroy" has been developing a construction waste processing installation that is mobile, usable on-site during construction, even in urban areas, and saves a significant portion of the harmful emissions generated by the sector.

2.2. Chemicals

2.2.1. Sodium Hydroxide as a Universal Chemical Agent in the Circular Economy

Sodium hydroxide (NaOH), also known as 'lye' or 'caustic soda,' is a colourless basic hydroxide with an ionic crystal structure. It is an extremely hygroscopic compound – it is highly soluble in water and attracts moisture from the air. The solutions of sodium hydroxide and saturated solutions of inorganic compounds is particularly important for preserving air purity in pollution from coal-fired power plants. The thermal energy industry is one of the largest waste generators. According to current data for Bulgaria in the period 2020-2023, 45% of the country's electricity is generated in coal-fired power plants. Coal consists of two parts – organic and mineral. During combustion in power plants, the organic part burns, and the larger part of the mineral part remains as waste in the form of fly ash, boiler slag, bottom ash, and solid particles from gas cleaning. Coal-fired power plants annually generate significant amounts of flue gases. They contain fly ashes obtained from the combustion of the mineral part of coal and represent about 60% of the total ash quantity.

An efficient and environmentally friendly method for utilizing fly ashes is their hydrothermal treatment with inorganic bases, which gives various types of

zeolites, where the zeolite zone forms like egg white, covering the central core of fly ash particles. By merging with sodium hydroxide, most of the fly ash particles are converted into sodium salts such as silicate and aluminate, leading to the formation of sodium zeolite in the hydrothermal reaction. Sodium hydroxide is used to produce the valuable raw material sodium zeolite, effectively reducing the release of harmful fly ashes into the environment.

The classical technology for sodium hydroxide production is through the chemical causticization method (also known as the "lime method") – the interaction of sodium carbonate (also known as "calcined soda") with calcium hydroxide (also known as "slaked lime" or "milk of lime"): $Na2CO3 + Ca(OH)2 \leftrightarrow 2NaOH + CaCO3$. The essence of the method lies in treating a 10-12.5% solution of calcined soda with slaked lime with constant stirring and heating. In the soda solution, milk of lime is "quenched" and turns into calcium hydroxide, which reacts with sodium carbonate to form sodium hydroxide lye, after which the lye is concentrated through evaporation and fusion to obtain the final product. The chemical production follows the Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) by the European Chemicals Agency.

The demand for caustic soda spans the entire spectrum of the chemical industry. Sodium hydroxide can successfully find applications in the 'circular economy' model not only for the needs of the energy sector (capturing fly ash in coal-burning power plants, softening and neutralizing process waters) but also in the following industries and productions:

- Construction (production of lime solutions for masonry and plaster)
- Petrochemical (production of oils and oil additives) and mining-enrichment industries (flotation and treatment of wastewater)
- Agriculture (for applying the "liming" method to acidic soils)
- Livestock farming (for disinfection of premises)

- Sugar industry (for technologically extracting sugar in sugar production)
- Water treatment plants for drinking and wastewater (for antibacterial treatment of drinking and wastewater)
- Production of household-hygiene products, including preparing lime water, manufacturing antifungal and antibacterial preservatives).

2.2.2. Ecological analysis of caustic soda production methods as a universal chemical agent in the circular economy

Engineering analysis identifies the membrane method as the most economically advantageous in sodium hydroxide production. Scientific studies demonstrate the possibility of obtaining NaOH from a coal seam gas (CSG) saline solution through membrane electrolysis. In a 2014 study (Simon, Fujioka, Price, & Nghiem, 2014), a cation exchange membrane (Selemion CMF, AGC Engineering Ltd, Tokyo, Japan) was used, characterized by high durability for electrolysis applications. The membrane has a thickness of 440 μm and very low electrical resistance (2.5 Ω/cm2 at 0.5 M NaCl and 25 ^{O}C). The transport number of Na+ (defined as the current carried by the specified or total current of the CMF membrane) is above 0.95.Salt solutions (Simon, Fujioka, Price, & Nghiem, 2014) are prepared by dissolving analytical NaCl, NaHCO3, and Na2CO3 in Milli-Q water. NaHCO3 and Na2CO3 are the two most common salts in coal seam gas (CSG) water, as reported in the literature. In a pilot study using a combination of RO and MED, 95% water recovery is achieved. The concentrations of Na+, HCO3- and Cl- in the remaining salt solution are 17.0, 19.7, and 2.2 g/L, respectively.

The lower energy intensity of the chlor-alkali process and the energy obtained from sunlight are a good recommendation for the process. Experimental demonstrations have been conducted using solar electrolytic asbestos and non-asbestos membrane cells (see Figure 2-4) for caustic soda production.

Table 2-1.

Salts	Molecular weight (g/mol)	Solubility at 25 ○C (g/L)	Conductivity of 10% (wt/wt) brine at 25 ^{O}C (mS/cm)
NaCl	58.44	362	130
$NaHCO_3$	84.00	105	55
Na_2CO_3	106.00	307	79

Source: (Simon, Fujioka, Price, & Nghiem, 2014)

A study from 2015 explores the possibility to base the electrolysis method on solar cells which produce electricity. Among various strategies aimed at meeting energy demand, efficient energy use, and storage prove to be the most cost-effective option.

$$2\,NaCl\,(aq) + 2\,H_2O \xrightarrow[\text{Electrical energy}]{} \underset{\text{Anode}}{Cl_2(gas)} + \underset{\text{Cathode}}{H_2(gas) + 2NaOH\,(aq)}$$

Based on the results obtained from the cell operations, it can be reasonably concluded that the membrane cell with solar energy can produce caustic soda with specifications close to those produced by conventionally powered diaphragm cells (See Figure 2-5) on a similar scale. The condition is that solar panels should be able to generate sufficient voltage to overcome the resistance of the cell and the circuit, placing them in a suitable location, installing them correctly, and completing the circuit according to requirements. The advantages of such a method are that the cells can operate without using conventional electrical energy since the only necessary energy comes directly from the sun.

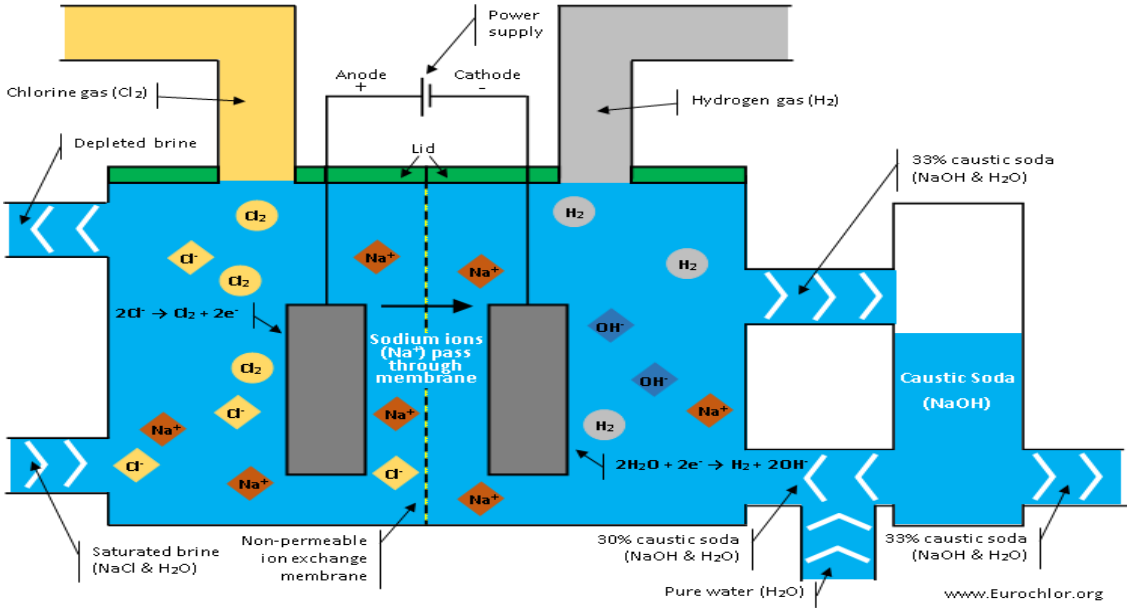

Figure 2-4. Manufacturing process of caustic soda by membrane cell

Source: (OXY, 2018, p. 7)

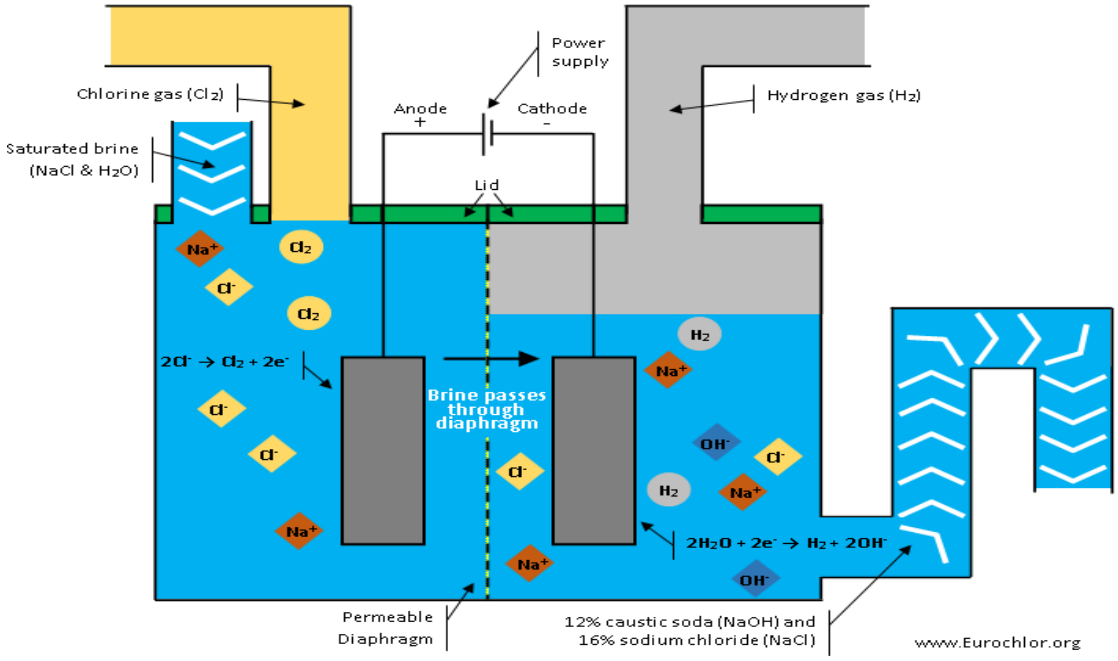

Figure 2-5. Manufacturing process of caustic soda by diaphragm cell

Source: (OXY, 2018, p. 9)

Also, the operation can be a very compact process that fits into a small area or can be scaled to the required size depending on the production capacity. The

process is considered much more economical and flexible in terms of expansion.

The operation is environmentally friendly since the only required form of energy is solar. When comparing the types of membranes used, the non-asbestos diaphragm is preferred, as its performance is relatively better than that of the asbestos diaphragm (Ahmad, Sudan, & Abdelmaged, 2015). Technologically, the production process can be organized through a membrane cell or through a diaphragm cell shown sequentially.

As a result of engineering solutions, the NaOH is produced with a wide range of applications, according to global market demand, distributed by shares: direct application with a share of 54%, mainly as a neutralizing agent; in organic chemicals, with a share of 35 percent; for inorganic chemicals, with a share of 11 percent. The global distribution of caustic soda demand gives a leading role to the Asia-Pacific region for the period 2022-2027 (See Figure 2-6).

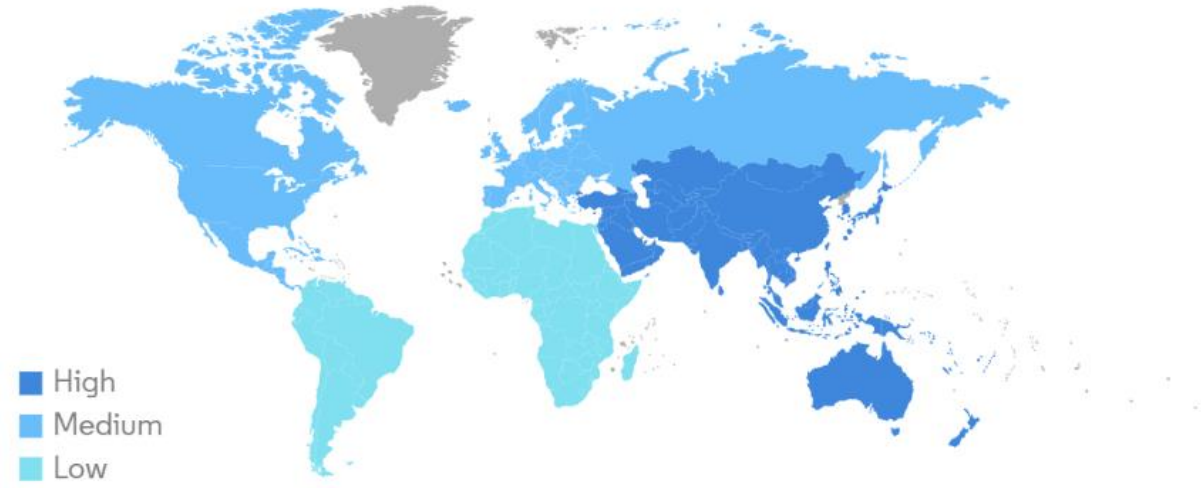

Figure 2-6. Global caustic soda market according to expected growth by regions, 2022-2027

Source: (Mordor Intelligence, 2024)

As a solid substance, sodium hydroxide is most sold in the form of flakes, granules, or solid blocks.

2.3. Plastics.

2.3.1. Advantages and disadvantages of plastics.

Plastics is a widely used synthetic material, that has revolutionised almost any industry and has brought convenience to our lives. In some aspects the use and production of plastics has a number of *advantages* – it is a cheap, versatile, and sterile material which can be used in various applications, including construction, medical instruments, and food packaging. It is also durable, lightweight and it is not easy to break. So, it is quite understandable why ever since plastic was invented in the 20th century, plastic production and use has increased exponentially. According to the statistics from the United Nations Environmental Programme (UNEP), the world has produced more than 9.2 billion tones since 1950, half of which in the last decade only. Moreover, by 2060 if no actions are taken, plastics use is projected to triple from its 2019 levels (OECD, 2022).

However, apart from the numerous advantages, the increased use and respectively production of plastic also comes with significant *drawbacks*. First, the production of plastics involves the use of non-renewable resources such as crude-oil and energy-intensive processes (Marczak, 2022). Refining crude oil into plastic resin, the production of plastic components, and the transportation of finished products all consume large amounts of energy. This contributes to the *depletion of energy resources* and increases carbon emissions, further exacerbating environmental issues.

Then, most consumer plastics are designed for single use, their recycling is limited (in fact less than 10% of plastic products are recycled), which further contributes to *environmental pollution*. The improper disposal of plastics, including littering and inadequate recycling, leads to accumulation in landfills, water bodies, and natural environments (Kumar, et al., 2021). And the prospects are not optimistic – as per the projected trends described in a recent OECD report if no “ambitious, coordinated and global policy actions” are taken, the leakage of plastics to rivers and

oceans would grow further by one-third from 6 million tonnes in 2020 to more than 9 million tonnes in 2040 (OECD, 2023). Moreover, In the long run, this is likely to have devastating effects on human health and the global climate.

2.3.2. Key circular economy challenges

The transition to a circular economy for plastics faces specific challenges that hinder the effective management of plastic waste and the promotion of sustainable practices. In this paragraph of Chapter Two the key circular economy challenges are discussed by identifying and addressing five gap areas which are to be bridged for the successful transition to a more sustainable and circular economy for plastics. These gap areas are related to the funding, information, awareness, technical solutions, and collaboration in the field of plastic waste management.

A) Funding gap

Although the circular economy can contribute to achieving the SDGs, research indicates that it is significantly underfunded (Schröder & Raes, 2021). Financial support is limited mainly to waste management and recycling projects, and even in this area the medium and low-income countries are lagging. There are a number of reasons for this including lack of standardized and comparable data and metrics, low awareness and expertise on CE among financial institutions, not sufficient financing for higher-value circular economy opportunities across value chains and in support of the scaling of circular business models and other. In terms of plastics two solutions are worth mentioning: *the EPR (Extended Producer Responsibility) scheme*, which holds producers responsible for managing the costs and end-of-life of products they place on the market and the *Plastic Credits schemes*.

Extended Producer Responsibility (EPR) is a concept where manufacturers and importers of products bear financial and sometimes physical responsibility for the environmental impacts of their products throughout the product life cycle. In

practice, ERP involves producers taking responsibility for the management of products after becoming waste, including collection; pre-treatment (e.g., sorting, dismantling or de-pollution); preparation for reuse; and recovery (e.g., recycling and energy recovery) or final disposal (World Bank, 2022). *Plastic credits* are a form of tradable credits that can be bought and sold by companies to offset their plastic waste. The idea is to create a financial incentive for companies to reduce their plastic use and increase the use of more sustainable alternatives.

B) Information gap

Understanding the leaks of plastic waste into the environment and the effects of waste management on the greenhouse gas emissions is key to developing effective measures to tackle plastic pollution and create a circular economy. However, there is little reliable information and data to make informed decisions (Hsu, Domenech, & McDowall, 2022). There still is no *universally accepted framework for corporate plastic waste disclosures* which makes comparing data extremely difficult (PREVENT Waste Alliance, 2023). The development of such a framework will be crucial to ensure comparability of metrics and to effectively integrate corporate insights into holistic action plans that systematically stop plastic pollution. It will also contribute to improving transparency, corporate accountability and eventually, a circular economy for plastics. On the tool side, the development of various measuring tools such as the Lifecycle Assessment Calculator (LCA calculator)[3] and the Greenhouse Gas Calculator (GHG calculator) contribute to the more comprehensive understanding of the environmental impacts and costs of different solutions and provide an informative basis for decision-making of policy makers.

[3] Note: The lifecycle assessment calculator is a tool for measuring the lifecycle environmental impacts of alternative solutions versus single-use plastics which can be found at https://www.pxp-sustainability.com/suplcacalculator. The Greenhouse Gas Calculator (GHG calculator) is an excel tool for calculating greenhouse gases in solid-waste management. It can be found at https://shorturl.at/tIT58.

C) Awareness gap

As environmental challenges are largely behavioural challenges, the development of *a structured behaviour-centred design approach* can help many environmental projects achieve more impact (MacDonald, Allen, Williams, Flowers, & Walker, 2023). In addition, *various awareness raising campaigns* and other communication activities can be used to create understanding, acceptance or even the demand for the introduction of circular economy solutions within society. Last, but not least of high importance is the *building of capacity both at academic and at the organisational and business levels*. At the academic levels this can be done through the development of comprehensive and up-to-date programmes in waste management and circular economy. In addition, the development of various tailored mentoring programmes, that include the designing of business plans and options for increasing recycling streams, as well as the identification of the required technical equipment, skills and operating procedures can largely contribute to enhancing awareness and employment through recycling (Stojic & Salhofer, 2022).

D) Technical gap

The technical gap in plastics waste management can be characterized by a lack of comprehensive and efficient *solutions at both upstream and downstream stages of the plastic lifecycle. Upstream challenges* include *the need for innovative materials, better design practices, and extended producer responsibility*. Innovative materials in the realm of plastics aim to address environmental concerns associated with traditional plastics. These materials often offer enhanced sustainability, biodegradability, or recyclability. For example, biodegradable plastics, such as PLA (Polyactic acid), PHA (Polyhydroxyalkanoates) and PBS (Polybutylene succinate) can break down naturally into harmless by-products under specific conditions; bio-based plastics are derived from renewable resources such as plants or microorganisms, reducing reliance on fossil fuels; there are recyclable variants of

traditional plastics, like PET (Polyethylene Terephthalate) used in beverage bottles and other. Some other smart innovative solutions are the various types of edible packaging, mushroom-based packaging and other.

Downstream challenges in plastics waste management primarily relate to the handling, collection, recycling, and disposal of plastic waste after it has been used by consumers. Some key downstream technical challenges include: inadequate collection systems, limited recycling infrastructure, contamination of recyclables (due to mixing of different types of plastics or non-recyclable materials with recyclables), lack of market demand for recycled plastics and other. Addressing these downstream challenges requires a multi-faceted approach, including improved waste collection infrastructure, investment in recycling technologies, public awareness campaigns, and policies that incentivize sustainable waste management practices.

E) Collaboration gap

The collaboration gap in the context of plastics refers to the challenges and shortcomings in fostering effective cooperation and coordination among various stakeholders involved in addressing plastic pollution and waste management. Some key aspects of the collaboration gap are: lack of collaboration between sectors such as government, industry, non-governmental organizations (NGOs), academia, and local communities; limited international collaboration and harmonization of policies and standards related to plastics; lack of active collaboration in some industries in adopting sustainable practices, including the development of eco-friendly packaging or participating in extended producer responsibility (EPR) programs; insufficient sharing of data and information among stakeholders, including governments, industries, and researchers; limited collaboration between researchers, innovators, and the industry to develop and implement new technologies for plastic alternatives and recycling and other.

Addressing the collaboration gap in plastics waste management requires fostering partnerships, encouraging knowledge exchange, promoting transparency, and creating a shared vision among diverse stakeholders. Collaborative efforts should aim to integrate environmental, economic, and social considerations for comprehensive and sustainable solutions to the plastic pollution challenge.

2.4. Waste and recycling

2.4.1. Provision for the collection and recycling of waste through a household waste fee

In the Republic of Bulgaria, the collection and recycling of waste are organized at the municipal level. The Law on Local Taxes and Fees defines a fee for household waste payable by individuals and legal entities. The amount of this fee for each obliged person is determined for the calendar year while adhering to two complementary principles:

1) the polluter-pays-principle; or
2) the final-holder-pays principle.

Annually, the municipal council adopts a financial plan to ensure the service of waste collection, disposal, and recycling. The financial plan includes all relevant costs for the calendar year incurred by the municipality in providing the services for which the household waste fee is paid for each service and by funding sources. The services covered by the household waste fee are three:

- collection of household waste in specialized receptacles for unseparated and/or temporarily separated storage of household waste (including activities related to collecting waste deposited by individuals and legal entities in the respective receptacles containers, loading it into specialized transport vehicles, and subsequently transporting it to facilities and installations for safe disposal thereof)

- safe disposal (including activities related to treating household waste in licensed facilities and installations);
- sanitation of the spatial-development areas of settlements assigned for public use.

2.4.2. Collection and transportation of household waste

The first component forming the fee is for "collection and transportation of household waste to facilities and installations for safe disposal thereof." It includes the following activities:

a) provision of receptacles for storage of household waste, excluding waste falling within the scope of the management of ordinary waste under the Waste Management Act.
b) transportation of household waste to facilities and installations for safe disposal thereof, excluding waste falling within the scope of the management of ordinary waste under the Waste Management Act.

To financially secure this first component, the corresponding cost estimate includes analytical positions for:

- the expenses for the provision of household waste receptacles (the receptacles can be for separate or general collection);
- the expenses for the maintenance of the household waste receptacles;
- costs for provision or use specialized transport vehicles for transporting household waste, including garbage collection machines.
- costs for maintenance of specialized transport vehicles for transporting household waste, including garbage collection machines.
- scheduled collection of household waste, including separately collected waste, excluding waste falling under the management of ordinary waste.
- transportation of household waste, excluding waste falling under the management of ordinary waste.

- providing information to the public about collection, including separate collection, and transportation of household waste.
- control of activities related to waste generation, collection, storage, and transportation, including the use of the Global Positioning System (GPS), Geographic Information Systems (GIS), and other technological solutions.
- taxes, fees, and insurance for vehicles, including garbage collection machines, in case the activity is carried out by the municipality and is not contracted as a concession service.
- other costs for providing the service, arising from a regulatory act.
- other costs for providing the service, arising from a decision of the municipal council.

2.4.3. Safe disposal of household waste

The second component forming the household waste fee is for the "treatment of household waste in facilities and installations." It includes the following activities:

a) treatment of household waste not covered by ordinary waste management.
b) survey, design, construction, maintenance, operation, closure, and monitoring of landfills for household waste and/or other facilities or installations for the utilization and/or disposal of household waste.

For the purposes of financial provision for this second component, the corresponding cost estimate includes analytical positions for:

- expenses for the treatment (disposal and utilization) of household waste not covered by ordinary waste management.
- expenses for activities such as analysis, inspections, and samples of waste.
- surveys, including pre-investment, financial and economic analyses, and design of landfills for household waste, as well as facilities and installations for the treatment of household waste and/or sites for the free transfer of separately collected household waste, including bulky waste.

- expenses for the construction of landfills for household waste, as well as facilities and installations for the treatment of household waste and/or the provision of sites for the free transfer of separately collected household waste, including bulky waste.
- expenses for the maintenance and operation of landfills for household waste, as well as facilities and installations for the treatment of household waste and/or sites for the free transfer of separately collected household waste, including bulky waste.
- expenses for the closure and post-exploitation care of the landfill site.
- monitoring.
- expenses for securities, where and when necessary.
- purchase of land for the construction of landfills for household waste.
- expenses for participation in the activities of the regional association for waste management.
- provision of information to the public about waste management activities in the territory of the municipality.
- expenses for the development of waste management programs.
- expenses for the implementation of control activities for the treatment of household waste.
- other expenses for the provision of the service, arising from a regulatory act.
- other expenses for the provision of the service, as decided by the municipal council.

At the transition between the first and second components, waste recycling can be carried out through three temporal methods: ex ante, in medias, and/or ex post. From an efficiency standpoint, a combination of these three temporal methods is applied to separate from the total amount of household waste the four basic raw material categories subject to recycling: glass, plastic, paper, and metal.

2.4.4. Sanitation of the spatial-development areas of settlements assigned for public use

The third component forming the household waste fee is for "sanitation of the spatial-development areas of settlements assigned for public use." It includes activities to keep clean the streets, squares, sidewalks, alleys, parks, and other areas in towns and settlements intended for public use. The expenses for these activities are included in the cost estimate as follows:

- cleaning household waste from streets, squares, sidewalks, alleys, parks, inter-block spaces, children's playgrounds, cemetery parks, and other areas for public use in towns and settlements. This involves sweeping, washing, collecting, and transportation of household waste, including waste from channels, shafts, underpasses, overpasses, riverbeds, and ditches within town limits.
  - provision of containers for collecting household waste from public areas in towns and settlements.
  - maintenance of the containers for collecting household waste from public areas in towns and settlements.
  - purchase or hiring of vehicles for collecting and transporting household waste from public areas in towns and settlements.
  - maintenance of equipment for collecting and transportation of household waste from public areas in towns and settlements, in case such expenses are not included in other positions.
  - control of activities related to preventing the disposal of household waste in unauthorized locations and/or the creation of illegal dumps, as well as organizing their cleanup.
  - providing information to the public about maintaining the cleanliness in public areas.

- taxes, fees, and insurance on equipment for collecting and transporting household waste from public areas in towns and settlements, in case the activity is carried out by the municipality.
- other expenses for providing the service, arising from regulatory acts.
- other expenses for providing the service as decided by the municipal council.

The cost estimate position "other expenses for providing the service as decided by the municipal council" is to include a detailed breakdown of the expenses associated with rendering the respective household waste management service. Their reasoning is to be described in the Municipal Council decision to approve the cost estimate.

2.4.5. Methodological calculations and cost estimate for determining the components of the municipal household waste fee (HWF)

Local taxes envisage the provision of services by the municipal administration. Determining the specific amount of fees is subject to the cost-covering principle. The specific services for which fees are collected are specified in regulatory acts, including an active debate in municipal councils to determine the annual amount of the household waste fee and its associated components in the respective cost estimate for financing this activity. Table 2-2 presents a methodology for determining the "household waste" fee (**HWF**) to provide a municipality financing for three interconnected activities with a total budget of 2 million euros: component "1" - with a share of 50%, for waste collection and disposal; component "2" - with a share of 30%, for landfilling and treatment of solid household waste; component "3" - with a share of 20%, for cleaning public areas. The coverage of the expenses is to be shared by the registered legal entities (LE) and natural persons (NP) on the territory of the municipality in a proportion of 55:45. Additionally, available data on the tax base for assets owned by LE forms the amount of 200 million euros, and for assets owned by NP - of 150 million euros. Under these

circumstances, the specific rates (synthetically) and by components are presented in Table 2-2.

Table 2-2. Calculation of components of the municipal household waste fee

	In EUR	Component 1	Component 2	Component 3
LE	200000000	50%	30%	20%
NP	150000000	50%	30%	20%
Total expense (€)	2 000 000	1 000 000	600 000	400 000
LE total expense (€) (with share 55%)	1 100 000	550 000	330 000	220 000
NP total expense (€) (with share 45%)	900 000	450 000	270 000	180 000
HWF in %	**Total HWE**	**Fee 1 in %**	**Fee 2 in %**	**Fee 3 in %**
HWF / LE	0,550%	0,275%	0,165%	0,110%
HWF / NP	0,600%	0,300%	0,180%	0,120%
HWF in ‰	**Total HWF**	**Fee 1 in ‰**	**Fee 2 in ‰**	**Fee 3 in ‰**
HWF /LE	5,50‰	2,75‰	1,65‰	1,10‰
HWF / NP	6,00‰	3,00‰	1,80‰	1,20‰

Thus, for every Euro value of long-term tangible assets from the respective category, recorded and accounted for in the balance sheet of legal entities, they will pay an annual HWF in the amount of 5.50‰. For the category of individuals, the fee will be 6.00‰.

The activity-based valuation method determines individual fees for the different types of activities. When determining the size of the fees for activities and users, it is recommended to observe the following basic assumptions:

- The fee is calculated based on the quantity of disposed and processed household waste, with the price determined per cubic meter and based on the tax

assessment of residential and non-residential properties of legal entities and natural persons.

- The fee for non-residential properties of natural persons is equal to the fee for non-residential properties of legal entities.
- The fee for residential properties of legal entities is equal to the fee for residential properties of natural persons.

Legal entities and individuals in settlements and districts with organized waste collection and disposal pay the full fee, while others pay only the fee for disposal and processing of household waste and for sanitation of the spatial-development areas of settlements assigned for public use. The calculation of the household waste fee requires not only determining the proportion for joint financing between natural persons and legal entities but also taking into account the collection rate effect for both categories of obligated persons.

STUDENTS TRAINING SECTION

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Keyword list with vocabulary

Circular Economy - a model of production and consumption that minimizes waste.

Industrial sector - the secondary economic sector, including those economic sectors that produce finished, usable products.

Hazardous emissions - a major source of air pollution.

Carbon footprint - the total amount of greenhouse gas emissions caused by an individual, organization, product, or a process.

Economic efficiency - a part of overall efficiency which can be defined as the optimal use of resources and production capacity.

Innovative economic transition - an economic transition based on innovations that underlies the transition to a green and digital economy.

Clean and just energy transition - a mechanism for a fair transition that is a key

instrument for achieving a climate-neutral economy in a fair manner.

Caustic soda (sodium hydroxide) - a caustic chemical used in industrial processes such as soap and paper production, and in powerful cleaning substances. The chemical is an inorganic compound with the formula NaOH. It is a white solid ionic compound consisting of sodium cations Na^+ and hydroxide anions OH^-.

Membrane cell for soda caustic manufacturing – Membrane cell is the cheapest sodium hydroxide production method, considering energy and capital cost. What makes these kinds of cells important is that they do not cause environmental concerns. Membrane technology uses brine and electricity with a proton exchange membrane separator between electrodes to produce chlorine, caustic soda and hydrogen.

Diaphragm cell for soda caustic manufacturing – Diaphragm Cell process utilizes asbestos or alternate substitutes to asbestos, to separate the co-products Sodium Hydroxide (Caustic Soda) and Chlorine. In the diaphragm cell process, the anode area is separated from the cathode area by a permeable diaphragm. The brine is introduced into the anode compartment and flows through the diaphragm into the cathode compartment. Diluted caustic brine then leaves the cell.

Solid sodium hydroxide – it is most commonly sold as flakes, prills, and cast blocks.

Single-use plastics - disposable plastic items designed for one-time or short-term use before being discarded.

Microplastics - small pieces of plastic, less than 5 mm (0.2 inch) in length, that occur in the environment as a consequence of plastic pollution.

Mechanical recycling - the processing of plastic materials without altering their chemical structure.

Chemical recycling - a set of technologies that aim to break down complex plastic polymers into their original monomers or other valuable chemicals.

Upcycling - repurposing discarded or unwanted materials to create new products of

higher quality or value than the original items.

Downcycling - breaking down materials into simpler forms or lower-grade products.

Household waste – The waste generated from human activities in homes, yards, administrative, social, and other public buildings. It also includes waste from commercial establishments, craft activities, enterprises, recreational facilities, and entertainment venues, provided it is not hazardous waste, and its quantity or composition does not hinder its treatment together with household waste.

Household waste fee – The household waste fee is paid for the services of the municipality for: collection and transportation of household waste to facilities for treatment; treatment of household waste in facilities; sanitation of the public areas in settlements and villages within the municipality. The amount of the household waste fee for each obligated person is the sum of the fees for each service and is determined by allocating the expenses for the household waste fee for the current year from the cost estimate. For each service, the allocation is made by applying the respective calculation method depending on the bases adopted by the municipal council.

The polluter-pays principle - The "polluter pays" principle is one of the fundamental principles of the European Union's environmental policy. Its application means that polluters bear the costs associated with pollution, including the costs of measures taken for the prevention, control, and elimination of pollution, as well as the costs imposed on society by the pollution. The costs of eliminating pollution are covered by the polluter, not the taxpayer.

The final-holder-pays principle – Any holder of household waste in the respective municipality can be rendered the service against payment for activities related to the recycling and/or disposal of waste, including pretreatment before recycling and/or disposal, by a legal entity holding a permit to carry out activities related to waste collection, transportation, recycling, or disposal, according to the prescribed procedure.

Household waste cost estimate - All related expenses for the calendar year made by the municipality for providing the services covered by the household waste fee. These costs are included in the cost estimate in total and for each service, based on the estimated size and indication the sources of financing.

Questions for self-evaluation and discussion

1. What are the priorities of Bulgaria as an EU member in terms of the environment protection and circular economy as described in the National Strategy for Small and Medium-Sized Enterprises 2022-2027?
2. In which industrial sectors we can find the greatest commitment to the implementation of the principles of the circular economy?
3. In your opinion, how can the process of transitioning from a linear to a circular economy be facilitated?
4. What are the most popular names for the chemical product NaOH?
5. Name at least five main areas of market demand for caustic soda as a universal chemical agent in the circular economy.
6. Outline the primary technological methods for the production of caustic soda.
7. Besides neutralizing fly ashes in coal-fired power plants, where else is caustic soda primarily applied, according to the goals of environmental preservation?
8. In what form is solid sodium hydroxide usually sold?
9. Summarise the main advantages and disadvantages of using plastics.
10. What is Extended Producer Responsibility (EPR)?
11. Based on the learning content in paragraph 2.3. outline the main problems and the respective possible solutions for plastics waste management using the table below.

Gap area	*Problem statement*	*Solution*

12. Discuss the benefits and limitations of recycling in the broader context of waste management and resource conservation.
13. Specify the main advantages and disadvantages of determining municipal household waste fee (HWF) fee based on the method of tax assessment of properties owned by natural persons (NP).
14. Highlight the key advantages and disadvantages of determining municipal household waste fee (HWF) based on the method of tax assessment of properties owned by legal entities (LE).
15. Based on the methodological example from point 4.4, calculate the amount of municipal household waste fee (HWF) for each of the three components and the total for legal entities (LE) if the costs are equally shared between natural persons (NP) and legal entities (LE) in the cost estimate.
16. Based on the methodological example from point 4.4, calculate the amount of household waste fee (HWF) for each of the three components and the total for natural persons (NP) if the costs are shared as follows: NP=40% and LE=60%.

Summary

In the process of "green transformation," emphasis is placed on industrial symbiosis and the transformation of the waste from one industry into a usable resource for another. The main economic sectors generate four standardized groups of waste that can be circularly (secondarily) used: glass, plastic, paper, and metal. At the national level, the countries, member states of the EU develop and adopt

national plans for waste management related to the environment and circular economy. In the circular economy, the chemical production of chlorine and sodium hydroxide plays a significant role. The markets for sodium hydroxide are more in number but typically smaller in scale than those for chlorine. Among other characteristics, caustic soda is highly valued as a neutralizing agent, for pH control, as a dehydrochlorination agent, and as an absorbent in the scrubbing of flue gases. In the circular economy, caustic soda is a universal chemical agent for reducing air pollution from coal-fired power plants and purifying wastewater. Various economic efficiency parameters are considered in the production of caustic soda through electrolysis and membrane methods. Both electrolysis process methods are highly power-intensive. By providing power for the electrolysis process with solar panels, the cost of producing caustic soda as a universal chemical agent for circular economy needs can be significantly reduced. The global distribution of caustic soda demand highlights the leading role of the Asia-Pacific region for the period 2022-2027.

In terms of production and use of plastics, undoubtedly a future without plastics is neither realistic, nor desirable. Plastics is a very versatile and cheap to produce material of many applications that considerably ease our everyday lives. However, overproduction and respectively pollution with plastics is one of the gravest threats for our planet. Although downstream strategies to curb plastic pollution exist, they are ineffective in the face of current plastic production and waste generation which is still outpacing existing regulations. It is necessary to address the plastic pollution crisis by adopting a more comprehensive and integrated approach that includes both upstream and downstream strategies.

Pursuant to the European Charter of Local Self-Government, municipalities should have sufficient own resources to freely dispose of when exercising their powers, and at least part of the financial resources should come from local taxes and duties, the rates of which they have the right to determine within the framework of the law. Among these taxes is the household waste fee, which has the primary

purpose of ensuring the collection, transportation, and disposal of household waste, as well as the sanitation of the in urbanized areas. To financially support the functioning of the waste collection and disposal system, municipal councils annually adopt a cost estimate for the household waste fee. It adheres to certain cost-covering principles and follows the concept of financial decentralization. This concept aims to provide public services in terms of quantity, quality, and prices that meet the needs of citizens and are in line with the capabilities of municipalities, based on sustainable and long-term balancing of the associated costs with stable revenue sources and effective civic control.

Training example 2-1.

Kia Corp (Kia) formerly known as Kia Motors Corp is an automobile manufacturer which manufactures and markets wide variety of motor vehicles (https://www.globaldata.com/company-profile/kia-corp). Having launched in 2022 a seven-year partnership with Dutch non-profit organization The Ocean Cleanup (https://theoceancleanup.com) (TOC) the company has joined the growing number of companies forming strategic partnerships to secure a reliable supply chain for ocean plastic.

Through the partnership, Kia will support TOC as an official "Global Partner" via financial contributions and in-kind supplies to initiate ocean and river cleanup projects; support construction of TOC's various river-cleaning devices; and create a resource-circulation system that will integrate harvested plastics into Kia's production and value chain process. The company will also supply four electric vehicles to the organization's headquarters in the Netherlands in exchange for usable portions of the collected by TOC plastic and research results and relevant data on reducing plastic pollution with Kia.

Adapted from: New Kia-Ocean Cleanup Partnership the Latest in Ongoing Effort to Rein in Our

Global Plastic Footprint, https://sustainablebrands.com/read/waste-not/new-kia-ocean-cleanup-partnership-the-latest-in-ongoing-effort-to-rein-in-our-global-plastic-footprint

Training example 2-2.

*As the director of the Finance and Budget Directorate, your main task is to develop a forecast for the municipal revenues from the household waste fee. It is known that the tax bases for determining the household waste fee (HWF) amount to 5**K** million euros for properties owned by legal entities (LE) and 4**M** million euros for properties owned by natural persons (NP).*

*You are required to determine the size of **the three components of the household waste fee** (for collection and transportation, for disposal, and for sanitation of public areas) for the two groups of taxpayers in per mil (‰) per euro of the property tax assessment, assuming that:*

*1. The planned **expense** for the quality provision of the service by the municipality amounts to 1,**MK** million euros.*

*2. It is envisaged that **the fee** of LE will cover 6**K**% of the costs of providing the service, and the remaining portion will be collected from the fee paid by NP.*

*Note: To personalise the task, two parameters, "**K**" and "**M**" are used as follows:*

*"**K**" is the second digit of the month when the student was born (e.g., 01 is January, and K=1; 12 is December, and K=2).*

*"**M**" is the second digit of the day of the month when the student was born (e.g., if born on 1, 11, 21, or 31, then M=1, and so on).*

*All else being equal (ceteris paribus), the solution can be developed with parameters "**K"=0** and "**M"=0.***

Table 2.3. Distribution of expenses financed through the "household waste fee" (HWF) by components, legal entities, and natural persons for their respective properties.

Obligated persons	Tax bases (€)	Component 1	Component 2	Component 3
LE	5**K**000000	4**K**%	2**M**%	…%
NP	4**M**000000	4**K**%	2**M**%	…%
Total expense	1**MK0**000			
LE total expense (6**K**%)				
NP total expense (….%)				

Table 2.4. Planning the revenues from fees in euros and pro mil (‰) for the taxation of legal entities and natural persons for their respective properties

Total „HWF“ (€)				
Total „HWF“ in ‰		Fee 1 in ‰	Fee 2 in ‰	Fee 3 in ‰
HWF - LE				
HWF - NP				

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CHAPTER THREE. IMPLICATION OF CIRCULAR ECONOMY TO DISADVANTAGED AND DISCOURAGED STUDENTS

Introduction to chapter three[4]

The chapter "Implication of Circular Economy to Disadvantaged and Discouraged Students" is focused on the following main problem areas:

3.1. Circular Economy and a poor person's problem

3.2. Complexity of circular skills

3.3. The case of replacing study with work

3.4. Digitalization trends and inclusiveness

The concept of a Circular Economy has gained significant traction in recent years as societies around the globe grapple with the challenges posed by environmental degradation and resource depletion. In pursuing sustainable practices, the Circular Economy promotes the idea of closing the loop on product life cycles, minimizing waste, and maximizing the efficient use of resources. However, successfully implementing Circular Economy principles necessitates a fundamental shift in the skills and competencies required across various sectors. This chapter delves into the intricacies of circular skills, exploring the multifaceted nature of these competencies and the challenges and opportunities they present in a Circular Economy (Mondal et al., 2023).

[4] Note. This chapter was written by researchers from Istanbul Esenyurt University, as follows Dr. Ahmet Münir Gökmen (Editor and Subchapter 3.4), Dr. Yasemin Sarici (Subchapter 3.1), Dr. Onur Viga (Subchapter 3.2 and Training Examples 3.1) , Dr. Ekrem Erdinç Gülbaş (Subchapter 3.3, and Training examples 3.2); The rest was written jointly by the four authors.

The Circular Economy represents a paradigm shift in how societies produce, consume, and dispose of goods and services. It challenges the linear "take, make, dispose" model, aiming to create a closed-loop system where resources are continually reused, recycled, and regenerated. As we navigate this transition, the demand for a new set of skills has emerged. Circular skills encompass a diverse range of competencies, spanning industries and disciplines. This essay aims to unravel the complexity of these circular skills and their pivotal role in driving the success of the Circular Economy (Garcia-Saravia Ortiz-de-Montellano et al., 2023).

The transition towards a Circular Economy necessitates a profound transformation in the skills and competencies required across various domains. This chapter delves into the intricacies of circular skills, highlighting key aspects such as adaptability, interdisciplinary competence, continuous learning, and technological agility. These dimensions are essential for individuals and organizations seeking to thrive in a circular paradigm. The chapter explores specific skills within these dimensions, including innovation and problem-solving, career resilience, and global collaboration, emphasizing their pivotal role in fostering sustainable practices and contributing to the success of the Circular Economy (Munaro & Tavares, 2023).

At the beginning of the topic" The case of replacing study with work", it would be appropriate to point out the differences between studying and working. The main purpose of studying is to gain knowledge, skills, and understanding about a particular subject or field. The main purpose of the work is to use one's knowledge and skills to fulfill some duties and responsibilities in return for a value or results.

In the fast-evolving landscape of the 21st century, the concept of circular skills has emerged as a critical paradigm for navigating the complexities of our interconnected world. Unlike traditional linear skill sets that follow a straightforward trajectory, circular skills recognize today's challenges' dynamic and ever-changing nature. This exploration delves into the multifaceted dimensions of circular skills, examining their significance in a world where adaptability, versatility, and continuous learning

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are paramount. These requirements are to be delivered first of all by the employees related to the new business models (Straub et al. 2023).

3.1 Circular economy and a poor person's problem

3.1.1 Socioeconomic implications for impoverished communities

The Circular Economy (CE) paradigm, heralded for its sustainable resource management, raises pertinent questions concerning its implications for impoverished populations. This sub-chapter examines the nuanced relationship between CE principles and the socioeconomic challenges individuals in poverty-stricken communities face.

The Circular Economy, as elucidated by (Geissdoerfer, et al., 2017), champions regenerative practices, emphasizing resource efficiency, waste reduction, and closed-loop systems. Its potential for mitigating environmental degradation and fostering sustainable growth is well-documented. Contradiction to the linear economy, a circular economy aims to frustrate waste generation and diminish environmental influences throughout the life cycle of a product.

However, poverty-stricken communities face multifaceted challenges, including limited access to resources, inadequate infrastructure, and socio-economic marginalization. This is highlighted in various studies, including (Smith and Khan, 2018) and (Gupta, 2020), which underscore the complexities of poverty beyond financial scarcity, encompassing social, health, and environmental disparities. Furthermore, challenges for poverty-stricken communities should be examined in two different environmental conditions: urban and rural areas. Although rural life conditions naturally forced people toward using closed loop systems to increase usage of tools and product's life cycle, intentionally rural communities should be supported in case of circular economy. The exurban population is still significant in Central and Eastern Europe, with values close or above 40% in Slovakia, Romania,

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Serbia, and Poland, and 30–24% in Ukraine and Bulgaria, according to the World Bank (2020).

Rural settlements face various threats associated with climate change, natural hazards, environmental pollution, food security, economic barriers, and urban expansion, which indicate rural lands have poor prospects of achieving the SDGs (Sustainable Development Goals, United Nations) by 2030.

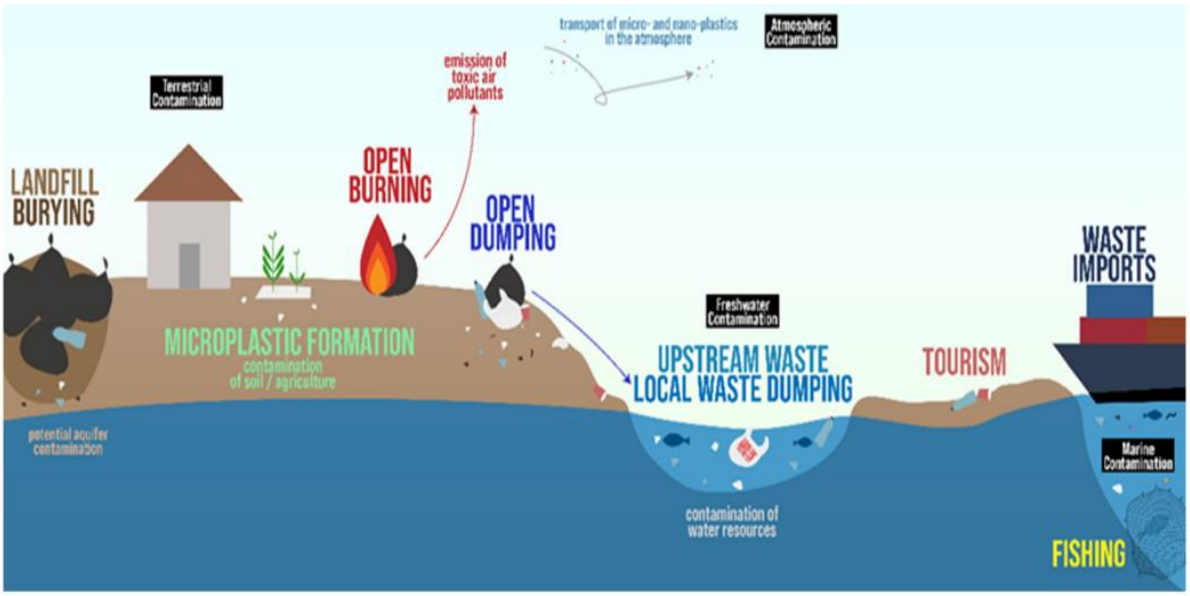

Figure 3-1. Overview of rural plastic pollution contamination in the terrestrial, atmospheric, freshwater, and marine environments

Figure 3-1 gives the most plastic contamination defilement courses nourished by household squander, tourism, agrarian application, angling, and squander imports. These courses are related with uncontrolled transfer alternatives in the setting of immature rustic squander administration framework (open burning, burying, open dumps) that contaminate the soil–air–water nexus (Mihai F-C, Gündoğdu S.et al, 2022).

Furthermore (Mihai, 2022), the part of country squander administration division is highlighted as a key factor to decrease residential plastic contamination

sources at the downstream level. This arrange incorporates major geological ranges with a specific centre on low- and middle-income nations from Latin America, Africa, Asia, Balkan and Eastern Europe, and island communities. In such regions, country populaces are not completely secured by squander collection administrations and/or waste management frameworks are destitute, and the collection capture of residential plastic squander stream is low. Furthermore, these locales are uncovered to unlawful activity of unsafe squander, counting plastic materials from high-income nations.

The implementation of CE practices may inadvertently exacerbate disparities in impoverished communities. Research by (Martinez-Fernandez, et al., 2018), illuminates how the upfront costs and technological requirements for CE adoption may widen the socioeconomic gap, limiting access for marginalized groups.

While CE principles offer potential benefits such as job creation, resource optimization, and environmental conservation, their translation into tangible benefits for impoverished populations remains uncertain. This dilemma is highlighted by (Tan, et al., 2019), emphasizing the need for inclusive policies and equitable distribution mechanisms.

Efforts towards an inclusive CE must prioritize strategies that address the specific needs of impoverished communities. This involves tailoring policies and interventions to ensure accessibility, affordability, and relevance. Gupta (Gupta, 2020) advocates for participatory approaches, involving local stakeholders in CE initiatives to promote ownership and inclusivity.

The intersection of the Circular Economy and poverty poses intricate challenges and opportunities. Effective integration of CE principles in impoverished communities demands a nuanced approach that accounts for socioeconomic disparities, ensuring equitable access and meaningful participation to harness its potential for sustainable development. Although exurban areas are struggling to achieve the United Nations' Sustainable Development Goals (SDGs) in line with

Agenda 2030 deals with the problems of severe environmental pollution issues fed by industrial and agricultural activities combined with poor waste and sanitation management practices (Mihai F-C, Gündoğdu S.et al,2022).

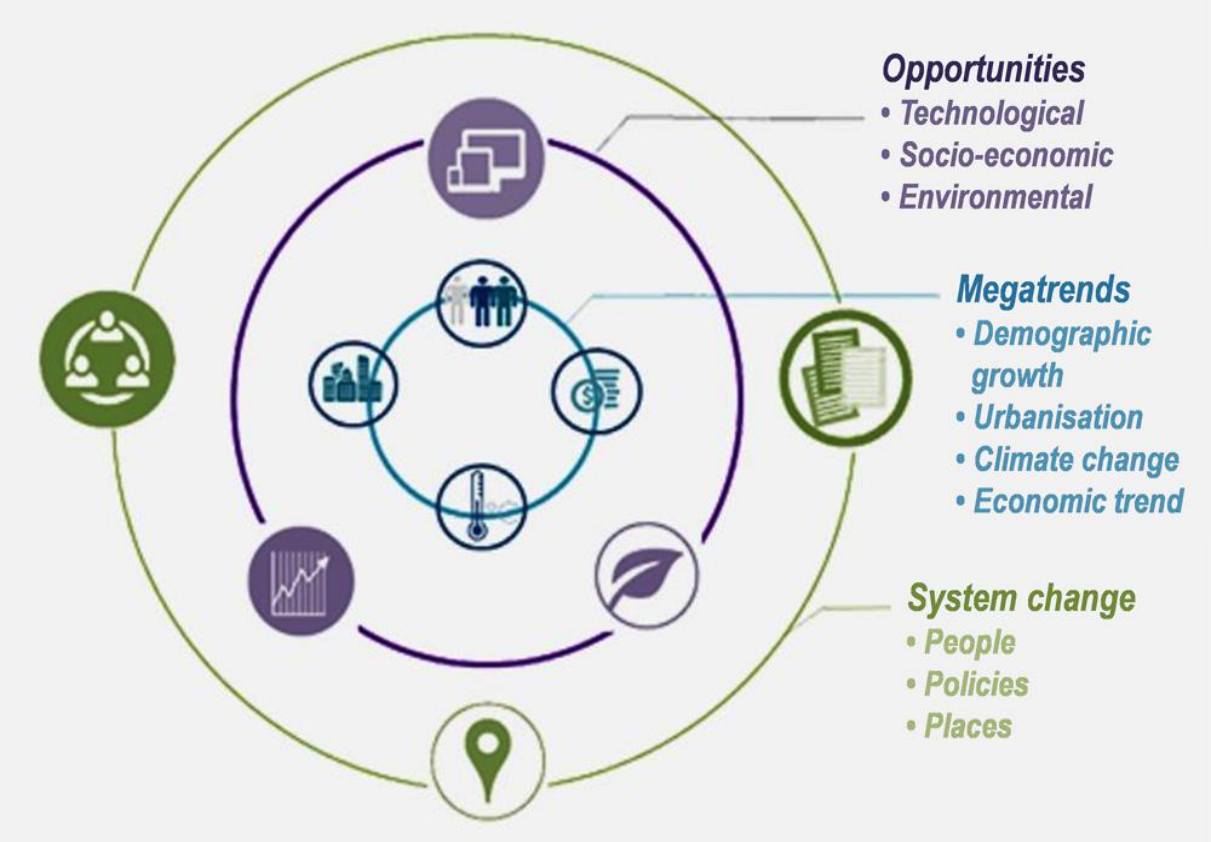

Figure 3-2. The circular economy framework for cities and regions

Figure 3-2 summarizes the circular economy basic points and indicates to us the importance of 3P (people, policies, and places). Circular consumptions habits definitely replace with linear consumer behaviours. People can influence production through contemporary expanding models. Policies, such as environmental, regional development, agricultural and industrial, should present complementary approaches to enhance planning, e.g., for the use of water and energy in the built environment or the re-use of food waste for agriculture purposes. Places, whereas interconnected to each other as urban and rural areas, spaces for inflows and outflows of materials, resources, and products, in connection with surrounding areas and beyond. As a

result, 3P has an important role in changing the dynamics of systemic changes (OECD 2020).

This sub-chapter explores the interface between the Circular Economy and poverty, acknowledging the challenges and proposing avenues for inclusive implementation. It underscores the necessity for tailored strategies that bridge socioeconomic gaps to ensure the equitable distribution of the Circular Economy's benefits.

3.2. Complexity of circular skills

3.2.1 Understanding circular economy

Before delving into the intricacies of circular skills, it is essential to establish a foundational understanding of the Circular Economy. This section explores the principles and frameworks that underpin this concept, emphasizing the need for a holistic and integrated approach to resource management. The Circular Economy represents a departure from traditional linear models of production and consumption, calling for a shift towards regenerative and sustainable practices. In navigating this transition, the complexity of circular skills becomes evident. This essay aims to shed light on the critical dimensions of adaptability, interdisciplinary competence, continuous learning, and technological agility, examining their significance in the context of circular skills (Maher et al., 2023).

The rapid evolution of environmental challenges and market dynamics requires individuals and organizations to be adaptable and resilient. This section explores the importance of adaptability in the Circular Economy, emphasizing the need for a proactive approach to change. Case studies and examples illustrate how adaptability fosters innovation and ensures sustainability in the face of uncertainty (Evans, 2023).

3.2.2 Circular Skills in Design and Innovation

One of the key pillars of the Circular Economy is the integration of sustainable design and innovation. This section explores the skills required to design products and services that prioritize durability, recyclability, and minimal environmental impact. It also examines the role of creativity and interdisciplinary collaboration in fostering circular thinking among designers and innovators (Marey et al., 2024).

3.2.3 Continuous Learning

The Circular Economy is a dynamic and evolving concept, demanding a commitment to continuous learning. This section discusses the importance of a learning mindset, the role of education and training programs, and the need for ongoing skill development. Real-world examples illustrate how organizations and individuals can embrace continuous learning to stay at the forefront of circular innovation (Morseletto, 2023).

3.2.4 Supply Chain Management in the Circular Economy

The shift towards a Circular Economy necessitates a re-evaluation of traditional supply chain practices. Circular skills in supply chain management involve optimizing material flows, implementing reverse logistics, and fostering collaboration among stakeholders. This section explores the challenges and opportunities in building circular competencies within supply chain professionals (Trevisan et al., 2023).

Circular challenges are inherently complex, requiring collaboration across diverse disciplines. Interdisciplinary competence is a key circular skill that bridges gaps between different fields of knowledge. This section explores the benefits of interdisciplinary collaboration in circular initiatives and outlines the skills needed to facilitate effective communication and cooperation among experts from various backgrounds (Kumar et al., 2023).

3.2.5 Circular Skills in Manufacturing and Production

Manufacturing processes play a pivotal role in determining the sustainability of products. Circular skills in manufacturing encompass resource efficiency, waste reduction, and the adoption of circular production techniques. This section investigates the role of circular skills in reshaping manufacturing practices and ensuring a more sustainable industrial landscape (Valls-Val et al., 2023).

3.2.6 Circular Skills in Resource Management

Efficient resource management is at the heart of the Circular Economy. Circular skills in resource management involve effective waste reduction, recycling strategies, and the adoption of circular business models. This section examines the challenges faced by organizations in implementing circular resource management practices and the skills needed to overcome these hurdles (Mauss et al., 2023).

3.2.7 The Role of Technology in Circular Skills

In the digital age, technology plays a crucial role in driving the Circular Economy forward. This section explores the intersection of technology and circular skills, focusing on digital innovations such as block chain, artificial intelligence, and the Internet of Things. It also discusses the need for digital literacy and technology integration in developing circular competencies (Sánchez-García et al., 2024).

Technology plays a pivotal role in driving the Circular Economy forward. This section explores the significance of technological agility, focusing on the ability to adapt and leverage emerging technologies to enhance circular practices. Case studies highlight how technological advancements contribute to resource efficiency, waste reduction, and sustainable production methods (Tauseef Hassan et al., 2023).

3.2.8 Circular Skills in Policy and Advocacy

The successful implementation of Circular Economy principles requires supportive policies and advocacy efforts. Circular skills in policy development involve a deep understanding of environmental regulations, economic incentives, and stakeholder engagement. This section analyzes the role of policymakers and advocates in creating an enabling environment for circular practices (Riggs et al., 2024).

3.2.9 Challenges and Barriers to Developing Circular Skills

Despite the growing recognition of the importance of circular skills, numerous challenges and barriers are hindering their widespread adoption. This section identifies and examines these challenges, ranging from educational gaps to organizational resistance, and discusses potential strategies to overcome them (Borms et al., 2023).

While the dimensions of adaptability, interdisciplinary competence, continuous learning, and technological agility are critical, there are challenges in developing and integrating these circular skills. This section addresses common obstacles and proposes strategies to overcome them, emphasizing the importance of a holistic and collaborative approach (Oghazi et al., 2024).

Skills within the Dimensions of Circular Economy are (Voukkali et al., 2023):

a. Innovation and Problem-Solving:
   i. Design Thinking in Circular Innovation
   ii. Problem-Solving in Circular Supply Chains
   iii. Entrepreneurship and Circular Business Models
b. Career Resilience:
   i. Lifelong Learning and Skill Adaptation
   ii. Flexibility in Career Paths within Circular Industries
   iii. Resilience in the Face of Economic Shifts

c. Global Collaboration:

i. Cross-Cultural Communication in Circular Initiatives

ii. International Partnerships for Circular Solutions

iii. Collaborative Platforms for Global Circular Networks

3.3 The case of replacing study with work

3.3.1 Definition of Study and Work

After the 1990s, a significant problem was encountered in the field of education in the world and in developed countries. Most of the families of students studying in public schools fell into the low-income category. The challenge of educating low-income children has become a central challenge for educators. Research has revealed that the score gap between students in low-income groups and students in high-income groups has not closed in the last 20 years; on the contrary, the gap has gradually increased. Although governments and non-profit organizations have made efforts to change the overall performance of low-income, disadvantaged students, this has not significantly changed outcomes. Debates on closing these gaps can be resolved beyond the efforts of politicians and philanthropists, by educators and experts working with children living with difficulties, searching for and finding new methods (Tough, 2016).

One of the important problems in education is that students are divided according to their age groups and different education models are applied for different age groups. Not enough attention is paid to the fact that education is a continuous process from birth to business life.

In the classical education approach, while trying to teach cognitive qualities such as reading, writing, calculating and analyzing to children and young people in schools, the development and teaching of qualities that are defined as non-cognitive skills such as courage, curiosity, self-control, optimism and conscientiousness are ignored.

An example of how to overcome this mistake is the work of Elizabeth Spiegel, a chess instructor at Intermediate School 318, a school for low-income colored students in Brooklyn. In her studies, Spiegel conveyed to her students a sense of belonging, self-confidence, and purpose rather than chess knowledge. Students persisted in challenging tasks and passed important milestones. They faced disappointment, loss, and failure with confidence and resilience. They are committed to long-term goals. Spiegel did not use words like courage, character, or self-control in her lectures. She only talked to her students about chess, analyzed their games, gave clear and detailed information about the mistakes they made, and helped them see what and how they could do differently. She paid careful and close attention to her students' work. As a result, school 318 students achieved great success in the matches they played with the teams of much higher-income private school students and won the national championship (Tough, 2013).

3.3.2 Benefits of Work

In addition, working has various benefits for students. Working serves as a guide for students in the process of discovering future career paths. Working primarily helps an individual gain insight into the daily activities and responsibilities associated with a profession by gaining practical experience in a particular field. Secondly, working in specific industries provides the opportunity to network and develop relationships. Working students have the opportunity to connect with experts where they work who can provide them with guidance, advice, and potential job opportunities. Working provides students with the opportunity to develop their skills by giving them real-world experience. Hands-on experience is important not only for personal development but also to increase the marketability of the workforce to potential employers. Working also helps students build a strong resume. Employees have a more competitive structure in the job market, knowing that they have industry-specific skills and experience. Working provides the opportunity to

experience different career options and choose the appropriate one. As individuals work in a particular industry, they can better evaluate whether a particular career is interesting and aligned with their long-term goals. Experience also shows that students who work during their student years transition to full-time employment more quickly and easily. Some companies use working students as a means of identifying and hiring future full-time employees. This makes working a strategic step in the education process.

As stated above, it can be argued that working is the most important factor, especially for disadvantaged or discouraged students, because that will determine the success or failure of students in their career development and subsequent business lives. However, sending students to the working environment without adequately preparing their competencies and without providing them with the necessary cognitive and non-cognitive skills will have negative consequences in the short term. It is extremely important to prepare students for working life through various methods during the education process, before asking them to take their place in working life. Some of the main methods are lecturing, discussion-based learning, group work and collaboration, case studies, hands-on activities, role-playing and simulations, problem-based learning, flipped classroom, peer teaching, technology integration, assessment and feedback, project-based learning, Socratic method and mind mapping and visual aids. These methods will prepare disadvantaged students to work instead of studying in the process of preparation for life. It would be appropriate to explain these methods by associating them with circular economy and give examples of what students have to do related to circular economy.

3.3.3 Learning by Working

In the traditional education system, a lecture involves the educators presenting information orally to students. In the new system where students will work actively, lectures will be used to convey theoretical concepts, learn technical terms, and get

to know the subject. However, the process here will be conducted by students, not educators. In lecturing, students should define the concept of a circular economy, contrast it with the traditional linear economy model, and explain the goals and principles of circular economy. Then define the basic technical terms and concepts of circular economy such as Closed-Loop System, Cradle to Cradle (C2C), Product Life Extension, Remanufacturing, Recycling, Upcycling, Biomimicry, Resource Efficiency, Reverse Logistics, Eco-design and Material Passport, Waste Reduction, Resource Efficiency, Product Life Extension and Maintenance by using written or verbal resources such as newspapers, magazines, YouTube videos or internet graphics.

Using the discussion-based learning method when teaching circular economy can help students better understand the concepts and engage effectively in the subject. There are steps to consider when applying this method. In this method, the focus of the discussion is first determined. Students can choose specific topics such as "Circular economy and sustainability" or "Waste management and recycling". Students form small groups. Each group will share their views and listen to each other's thoughts during the discussion. Students do research on basic concepts before the discussion. They prepare questions to ask students in other groups. For example, “What are the benefits of circular economy?” or “How can waste be managed effectively?” During the time given to the groups, students first share their thoughts on the subject and then ask each other questions to emphasize their different perspectives. This creates a rich environment for discussion. It is crucial that all students actively participate during the discussion.

Group work and cooperation methods enable students to increase their interaction with each other, gain team spirit, and achieve success by creating synergy for those who have differences and deficiencies on an individual scale. In this method, it is important to create groups in heterogeneous structures. Groups consisting of different demographic characteristics such as gender, ethnicity,

religious belief, and social class enable the group to gain different perspectives. The group is asked to prepare a project on circular economy. The group embodies one of the circular economy problems in their project and offers their own solutions to them. Everyone in the group is given certain responsibilities. Materials such as opinions of experts, books, articles, and videos that the group can reach are shared by the group and evaluated together. The group project is presented in the classroom and other settings. This presentation encourages students to share information, develop communication skills, and learn student - centered learning. After the presentation, both individual and group success is evaluated. Through this method, group members and instructors provide feedback to students and show them in which aspects they have improved themselves and in which aspects they can improve and how.

Case analysis is the evaluation of events that occurred in the real world. This method can be an effective way to learn and understand circular economy concepts of industry in a concrete, real-life context. Students should first be divided into groups; each group should choose one of the various cases and examine it in detail. Students explain the case to other groups in the form of a presentation, considering circular economy principles. They ask each other questions about the case. These questions enable deeper thinking and understanding of the subject. An important feature of the case analysis method is that students contact the institution where the case took place, visit this institution, and/or invite institution officials to the case analysis presentation. These stages enable students to establish close contacts with the business world in which they want to take part in the future. This initiative among students is an important opportunity for discouraged and disabled students.

Participating in hands-on activities while learning circular economy is an effective method to both reinforce learning circular economy concepts and establish close relationships with the business world, which is of great importance in the student's future. In this method, students form a group and choose a topic related to

a particular aspect or concept of the circular economy. For example, recycling processes, circular economy in product design or waste reduction strategies. Students develop an application scenario taken or created from real life. This scenario should show students in practice how the circular economy works. Students need various materials and resources to implement this scenario. These materials can be recyclable waste or self-made product design models. After the scenario application is completed, students make a presentation explaining their experience and the results they obtained. The purpose of this is to allow students to share the experiences they have gained from different applications with each other and to allow interaction between groups. During the presentation, students are asked questions about their experiences and the results of the application. The discussion and analysis environment allows students to evaluate themselves, understand what concepts they understand, what they have learned, and how they can improve their areas of improvement in the future. Hands-on activities provide students with more realistic and applicable knowledge about how circular economy concepts are perceived in the real business world, how they are applied, and how they can be improved.

In the role-playing and simulation method, students prepare a scenario inspired by real life. For example, by monitoring the life cycle of a product, they create a scenario that shows how the product reaches the recycling stage. Students take different roles in this scenario. For example, one student plays the role of the manufacturer of a product, another student plays the role of the consumer of that product, and another student plays the role of the representative of the recycling facility of that product. With these roles, different elements of the circular economy are represented. A simulation is made according to this scenario, in which the production, consumption, and recycling stages of the product are imitated. Before the simulation, students contact the manufacturers, consumers, and recycling facility representatives of that product and try to learn their attitudes and behaviours towards

the product, the recycling stage, and the circular economy. They practice their roles just like actors who work on the characters they will play. They determine how they should behave in this scenario according to the role they take. Once the preparations are completed, the simulation is performed. With the roles they play in simulation, they can transform abstract concepts into concrete experiences. After the simulation, students make evaluations. They discuss what challenges they have faced, what they have learned, and how they can contribute this knowledge to the circular economy. This gives students a chance to interact with each other and understand different points of view of industry. In this process, interactions with the manufacturers and recycling facility representatives enable students to establish networks that are very important for their post-school work life.

3.4 Digital Trends and Inclusiveness

3.4.1 Understanding Circular Skills

Circular skills represent a departure from the conventional understanding of skills as static, job-specific competencies. Instead, they embody a continuous learning and adaptability mindset that allows individuals to navigate diverse and evolving professional landscapes. At the core of circular skills is the idea that learning is a lifelong process, and individuals must develop the ability to acquire, refine, and adapt their skills throughout their careers (Quendler and Lamb 2016). The start-ups are also basic platforms for this(Anon n.d.).

A. Adaptability and Resilience

Circular skills emphasize adaptability as a cornerstone attribute. In a rapidly changing world, professionals need to be agile and resilient, ready to pivot in response to technological advancements, economic shifts, and societal changes. The ability to adapt is not limited to mastering new tools or technologies; it extends to cultivating a mindset that embraces change and uncertainty as opportunities for growth(Martin 2012).

B. Interdisciplinary Competence

The complexity of modern challenges often requires a multidisciplinary approach. Circular skills encourage individuals to develop competencies across various disciplines, enabling them to draw on a diverse set of knowledge and perspectives. Interdisciplinary competence fosters creativity and problem-solving abilities, empowering individuals to address complex issues that transcend the boundaries of traditional job roles (Braßler and Dettmers 2017).

C. Continuous Learning

Circular skills promote a culture of continuous learning, acknowledging that knowledge and expertise are fluid and ever-expanding. This involves not only staying abreast of industry trends but actively seeking out opportunities for personal and professional development. Lifelong learners are better equipped to thrive in environments where the pace of change is rapid, and the demand for up-to-date skills is constant (Maltoni and Lomonaco 2019).

D. Technological Agility

In an era where technology is a driving force across industries, circular skills emphasize technological agility. This goes beyond proficiency in specific tools and platforms; it involves the ability to understand, adopt, and leverage emerging technologies. Professionals with technological agility can navigate the evolving digital landscape, ensuring that they remain relevant and effective in their roles(Ra et al. 2019).

3.4.2 Challenges and Opportunities

While the concept of circular skills offers a dynamic and holistic approach to professional development, implementing and embracing these skills pose challenges. Resistance to change, traditional educational structures, and a reluctance to venture beyond established comfort zones are hurdles that individuals and

organizations must overcome. However, the opportunities presented by circular skills are immense:

A. Innovation and Problem-Solving

Circular skills foster an environment conducive to innovation. Professionals, who possess the ability to integrate diverse knowledge, think critically, and approach problems from different angles are better positioned to contribute creative solutions to complex challenges(Griffin and Guez 2014).

B. Career Resilience

Embracing circular skills enhances career resilience. Individuals who continuously update their skill sets and adapt to evolving demands are more likely to thrive in dynamic industries. Career resilience becomes a valuable asset in a world where job roles are subject to rapid change and automation (Schwabe and Castellacci 2020).

C. Global Collaboration

Circular skills enable individuals to collaborate across borders and cultural divides. The interconnectedness of the global economy demands a workforce capable of navigating diverse perspectives and working collaboratively on an international scale.

Digitalization Trends: A Transformative Force

The ongoing digital revolution has witnessed a myriad of technological advancements that are redefining the way businesses operate, governments function, and individuals interact. Cloud computing, artificial intelligence, the Internet of Things (IoT), and blockchain are among the key drivers propelling digitalization forward. These technologies are not only streamlining processes and increasing efficiency but are also creating new opportunities for innovation across various sectors.

One notable trend is the proliferation of data-driven decision-making.

Organizations are harnessing the power of big data analytics to gain valuable insights, optimize operations, and enhance customer experiences. This data-centric approach is not only limited to businesses; governments are also leveraging data to improve public services, healthcare, and urban planning. However, with this abundance of data comes the responsibility to address privacy concerns and ensure that the benefits are equitably distributed.

Furthermore, the rise of artificial intelligence and automation is transforming the nature of work. While these technologies bring unprecedented efficiency and productivity gains, they also raise questions about job displacement and the need for upskilling the workforce. It is imperative to foster an inclusive environment where individuals are equipped with the skills necessary to thrive in the digital era, bridging the digital divide that could otherwise lead to societal disparities.

3.4.3. Inclusiveness in the Digital Age: Bridging the Divide

Inclusiveness in the digital age encompasses not only access to technology but also the equitable distribution of its benefits. Several key aspects contribute to achieving a more inclusive digital society:

A. Digital Literacy

Promoting digital literacy is fundamental to ensuring that everyone can participate in the digital landscape. This involves providing education and training programs to individuals of all ages, focusing on basic digital skills, cybersecurity awareness, and the ability to navigate digital platforms. Initiatives that bridge the digital literacy gap contribute significantly to creating a more inclusive society(Tinmaz et al. 2022).

B. Access to Technology

While the world has witnessed significant strides in expanding internet access, there are still regions and communities facing digital exclusion. Efforts to bridge this gap involve infrastructure development, affordable access to devices, and initiatives

that bring connectivity to underserved areas. Closing the digital access divide is crucial for ensuring that no one is left behind in the digital transformation(Aghdam et al. 2022).

C. Diverse and Inclusive Design

As digital products and services become ubiquitous, it is essential to adopt a design philosophy that considers the diverse needs and experiences of users. Inclusive design focuses on creating technology that is accessible to people of all abilities, backgrounds, and ages. By prioritizing inclusivity in the design process, we can develop products that cater to a broad spectrum of users, fostering a sense of belonging and usability for everyone(Hosking, Waller, and Clarkson 2010).

D. Ethical Considerations

In the pursuit of digitalization, ethical considerations play a pivotal role in shaping the impact on society. Issues such as data privacy, algorithmic bias, and the ethical use of artificial intelligence require careful attention. Striking a balance between technological innovation and ethical principles ensures that the benefits of digitalization are distributed equitably without compromising fundamental values(Jurkiewicz 2018).

STUDENTS TRAINING SECTION

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Keyword list with vocabulary

Circular Economy: A model of economic development that promotes regenerative practices, emphasizing resource efficiency, waste reduction, and closed-loop systems. It aims to minimize environmental impact throughout the life cycle of a product.

Closed-Loop Systems: Systems that aim to eliminate waste by reusing and recycling materials within a continuous cycle, reducing the need for new resource extraction.

Equitable Distribution: Fair and just allocation of resources, benefits, and

opportunities among different individuals and groups, with the aim of reducing disparities.

Inclusive Policies: Policies designed to ensure that all individuals and communities, including marginalized groups, have fair and equitable access to resources, opportunities, and benefits.

Resource Optimization: Efficient use and management of resources to maximize benefits and minimize negative impacts on the environment.

Socioeconomic Disparities: Differences in economic and social conditions among individuals and communities, often leading to inequality.

Sustainable Development Goals (SDGs): A set of global goals adopted by the United Nations to address various challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice, with a target to achieve them by 2030.

Waste Reduction: The systematic effort to minimize the generation of waste, emphasizing the importance of recycling, reusing, and repurposing materials.

Supply Chain: A supply chain refers to the entire process of producing, distributing, and delivering goods or services from the point of origin to the final consumer. It encompasses all the stages involved in bringing a product or service to market, including procurement of raw materials, manufacturing, transportation, storage, and distribution.

Interdisciplinary Competences: Interdisciplinary competences refer to the skills and abilities that enable individuals to integrate and apply knowledge, methods, and perspectives from multiple disciplines to solve complex problems or address challenges that cannot be effectively tackled within the confines of a single discipline. Interdisciplinary competence involves the capacity to bridge gaps between different fields of study, collaborate with experts from diverse backgrounds, and synthesize insights from various disciplines to gain a more comprehensive understanding of a given issue.

Skill Adaptation: Skill adaptation refers to the ability of individuals to adjust, learn, and apply new skills in response to changes in their environment, job requirements, or the evolving demands of their profession. This concept is closely related to adaptability, as individuals need to continuously update and expand their skill sets to remain relevant and effective in a rapidly changing world.

Economic Shifts: Economic shifts refer to significant changes in the structure, behaviour, or performance of an economy over a period. These shifts can result from various factors, including technological advancements, changes in government policies, shifts in consumer preferences, global economic events, and more. Economic shifts can impact different sectors of the economy, influencing production, consumption, investment, and overall economic growth.

Group work: Collaborative learning in teams.

Hands-on activities: Practical learning experiences.

Low-income: Families with limited financial resources.

Non-cognitive skills: Qualities like resilience, curiosity, and self-control.

Studying: Acquiring knowledge and skills through education.

Tacit knowledge: Implicit knowledge based on experience and intuition.

Working: Applying knowledge and skills in exchange for value.

Digital Trends: The identification of new techniques and trends that use the digital ecosystem and the internet to carry out marketing promotions using new techniques and formats.

Inclusiveness: The quality of including many different types of people and treating them all fairly and equally: The Department embraces inclusiveness and diversity.

Adaptability and Resilience: Adaptability implies a sense of personal choice, of purposefully navigating—rather than being driven by—changing circumstances. Resilience is the capacity to recover quickly from difficulties. Resilience gives you the ability to bounce forward with new insights and learning you can carry into the future.

Interdisciplinary Competence: The ability to integrate knowledge and perspectives from two or more disciplines to identify, analyze, and solve complex problems that cannot be solved effectively or adequately and in an ethically responsible manner using mono-disciplinary approaches alone.

Continuous Learning: The process of learning new skills and knowledge on an on-going basis. This can come in many forms, from formal course taking to casual social learning. It involves self-initiative and taking on challenges.

Resource Efficiency: The optimal use of available resources to achieve maximum output while minimizing waste, in line with the principles of sustainability.

Technological Agility: The ability to quickly and smoothly adapt to or integrate current technologies with newer, different, disruptive, expansive or convergent technologies.

Questions for self-evaluation and discussion

1. How do rural and urban areas differ in their approach to closed-loop systems and circular economy practices?
2. What challenges and opportunities arise at the intersection of the Circular Economy and poverty, and how can they be effectively addressed?
3. How do circular consumption habits differ from linear consumer behaviours, and how can people influence production through expanding models?
4. Considering the multidimensional nature of circular economy practices, discuss the interplay between technical skills, such as product redesign and life cycle analysis, and soft skills, such as collaboration and adaptability. How does the integration of both types of skills contribute to the complexity of implementing circular initiatives within organizations?
5. Explore the challenges associated with developing circular skills in a rapidly evolving technological landscape. How do emerging technologies both facilitate and complicate the acquisition of circular skills, and what strategies can

individuals and organizations employ to navigate the complexity of staying relevant in the context of circular economy practices?

6. In what ways can the traditional education system be adapted to better prepare students for the continuous process of learning from birth to business life, especially focusing on the development of cognitive and non-cognitive skills?
7. How might the integration of hands-on activities, group work, and simulations enhance the understanding and application of circular economy concepts among students, fostering practical knowledge and connections with the real business world?
8. In what manner can the utilization of the role-playing and simulation method contribute to students' understanding of abstract concepts, such as the life cycle of a product in the context of circular economy, and how can these experiences be translated into practical insights for their future careers?
9. What are circular skills?
10. What are the challenges and opportunities of circular skills?
11. What is transformative force perspective in digital trends?
12. Please inform us about elements regarding inclusiveness in digital age.

Summary

The concept of a Circular Economy has gained momentum as societies address environmental challenges, advocating for closing product life cycles, reducing waste, and optimizing resource use. Implementing Circular Economy principles requires a shift in skills. Circular skills encompass diverse competencies crucial for success. They include adaptability, interdisciplinary competence, continuous learning, and technological agility. These skills are vital in fostering sustainable practices and supporting Circular Economy success. Additionally, circular skills acknowledge the dynamic nature of contemporary challenges, emphasizing adaptability and continuous learning.

The chapter discusses the rising importance of circular skills in the context of transitioning towards a Circular Economy. It highlights the need for a fundamental shift in skills and competencies across various sectors to effectively implement Circular Economy principles. Circular skills encompass adaptability, interdisciplinary competence, continuous learning, and technological agility. These skills are crucial for individuals and organizations to thrive in a circular paradigm and contribute to sustainability. Additionally, the chapter emphasizes the dynamic nature of contemporary challenges, underscoring the importance of adaptability and continuous learning in navigating complex interconnected issues.

Training example 3-1. Interactive Activities of Circular Economy for Students

Interactive activities play a crucial role in engaging university students and helping them grasp the concepts of circular economy more effectively. Here are some detailed examples of interactive activities for teaching circular economy:

1. Circular Design Workshop:

Organize a workshop where students work in groups to redesign a product using circular design principles. This could involve considering factors such as material selection, product lifespan, ease of disassembly, and recyclability.

2. Waste Audit and Analysis:

Conduct a waste audit on campus or in the local community. Students can participate in collecting, sorting, and analyzing waste to understand the types and quantities of materials discarded. This hands-on experience helps them appreciate the impact of waste and explore opportunities for improvement.

3. Circular Business Model Simulation:

Have students participate in a simulation where they develop circular business models. They can explore how businesses can generate value through

product-as-a-service, sharing platforms, remanufacturing, and other circular approaches.

4. Upcycling Challenge:

Encourage students to participate in an upcycling challenge where they transform discarded materials or products into new, useful items. This activity promotes creativity and demonstrates how waste can be repurposed.

5. Product Life Cycle Analysis:

Assign students a project to conduct a life cycle analysis of a specific product. They can investigate the environmental impact at each stage, from raw material extraction to disposal, and propose strategies to reduce the overall environmental footprint.

6. Circular Economy Game:

Develop or use existing board games or online simulations that simulate the complexities of a circular economy. Games can provide a dynamic and engaging way for students to understand the interconnectedness of various elements within the system.

7. Community Engagement Project:

Encourage students to collaborate with local businesses or organizations to implement circular economy initiatives. This could involve suggesting improvements to waste management, promoting recycling programs, or supporting businesses in adopting more sustainable practices.

8. Guest Speaker Panels:

Organize panel discussions with guest speakers who have experience in circular economy initiatives. Students can interact with professionals, ask questions, and gain insights into real-world applications and challenges.

9. Circular Economy Debate:

Arrange a debate where students discuss the pros and cons of circular economy adoption. This activity encourages critical thinking and helps students

explore different perspectives on the feasibility and potential drawbacks of circular practices.

10. Field Trips to Circular Economy Facilities:

Take students on field trips to facilities that exemplify circular economy principles, such as recycling centres, remanufacturing plants, or sustainable product design studios. This provides a tangible experience of how circular concepts are applied in practice.

These interactive activities aim to immerse students in the practical aspects of circular economy principles, fostering a deeper understanding of the subject and encouraging them to think critically about sustainable practices.

Training example 3-2.1

Make an exercise in which you will use the hands-on method in the process of learning the circular economy.

Exercise Title: Waste Reduction Strategies in a Local Community

Define objective. Identify needs. Design your group formation and scenario. Determine implementation steps. Make presentation, then discussion and finally evaluation.

Training example 3-2.2

Make an exercise in which you will use the hands-on method in the process of learning the circular economy.

Exercise Title: Innovative design solutions for specific products or industries.

Define objective. Identify needs. Assign roles and develop scenarios. Simulate roles. Evaluate results.

CHAPTER FOUR. CIRCULAR ECONOMY FUTURE SPECIALISTS

Introduction to chapter four[5]

The chapter "Circular economy future specialists" is focused on the following main problem areas:

- Development of circular business models
- Evolvement into a Circular Economic Business Model at the personal, corporate, institutional, and societal levels
- Circular business models and their sub-models
- Application of circular business models in the value chain
- Green job definitions and job typology
- Up-and-coming green-economy professions
- New professional skills in certain fields that will drive the Circular Economy

In this chapter, you will acquire knowledge and skills how to:

- Classify circular business models and their sub-models
- Examine the application of circular business models in the value chain
- Use the Canvas template to design a circular economy model
- Recognize new green jobs and the skills they require
- Develop skills through education programs to encourage circular employment

The chapter includes the following subchapters:

4.1. Evolvement into a Circular Economic Business Model at the personal,

[5] Note. This chapter was written by researchers from University of Niš, as follows: Prof. Dr Maja Ivanović-Đukić (Introduction and students training section), Prof. Dr Marija Radosavljević (Students training section), Prof. Dr Suzana Stefanović (Subchapter 4.1. and Training example 4-1.), Prof. Dr Bojan Krstić (Subchapter 4.2. and Training examples 4-2., and 4-3.), Research assistant Miljana Talić (Introduction and students training section).

corporate, institutional, and societal levels

4.2. Up-and-coming green-economy professions and jobs

In recent years, the circular economy has attracted considerable attention both among researchers and professionals. The basic premise of the circular economy is a transformation in the way resources are used, from traditional linear systems, in which resources are used in the production of finished products that become waste after their use, to circular systems in which resources are reused and remain in a continuous loop of production and consumption (Urbinati et al., 2017). In the beginning, the focus of circular economy research, in light of the general concern about the increasing environmental pollution, greenhouse effect and climate change, was more focused on the efficient use of resources, waste generation and recycling. Today, the focus of researchers, in order to effectively apply the principles of the circular economy, increasingly shifts to fundamental changes in the supply chain itself, existing business strategies, as well as in business models (Rosa et al., 2019).

4.1. Evolvement into a Circular Economic Business Model at the personal, corporate, institutional, and societal levels

4.1.1. The concept of circular business models

Business models attract a lot of attention from researchers, so there are numerous definitions and typologies of them in the scientific literature. In essence, it is pointed out that the business model explains how the firm creates, captures and delivers value (Osterwalder & Pigneur, 2010, p. 14). Researchers point out that a business model consists of three broad and interconnected dimensions: value proposition, value creation and value capture (Teece, 2010; Bocken et al., 2016), the combination of which defines a business model. The value proposition includes the products and services that make up the firm's offering and how they solve the problems of target customers. The dimension of value creation answers the question

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of how the firm creates that value proposition using its internal and external resources and capabilities, technological infrastructure and processes, while the dimension of value capture answers the question of how the firm earns in the context of the costs of value creation, on the one hand, and sources and ways of generating income based on the value proposition for customers, on the other hand (Baden-Fuller & Haefliger, 2013).

The shift towards a circular economy requires a systematic change in the way companies create and deliver value to customers (value proposition and creation), as well as how they generate and capture value (the value capture dimension) (Bocken et al., 2016). Therefore, Bocken et al. (2016) point out that the business model in the context of the circular economy represents a framework for understanding how companies propose, create and capture value by applying the principles and practices of the circular economy. In addition to this useful and simple definition, numerous authors have provided much more substantial definitions of circular business models. For example, Geissdoerfer et al. (2020, p. 7) gives a comprehensive definition according to which circular business models are "business models that are cycling, extending, intensifying, and/or dematerialising material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organisational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying), and the substitution of products by service and software solutions (dematerialising)."

The ability to rapidly and successfully innovate and introduce new business models not only leads to greater returns from product and process innovation but can become a source of a company's "renewable" competitive advantage (Ibid.). There are not many definitions of business model innovation in the context of the circular economy. Most of these definitions focus on the transition from a linear to a more circular business model. A somewhat more complex definition is given by Geissdoerfer et al. (2020, p. 8), who point out that circular business model

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innovation can be defined "as the conceptualisation and implementation of circular business models, which comprises the creation of circular start-ups, the diversification into circular business models, the acquisition of circular business models, or the transformation of a business model into a circular one. This can affect the entire business model or one or more of its elements, the interrelations between the elements, and the value network."

Given the importance of creating innovative circular business models, we will focus to the implications that the development of these models has not only on the company level, but also on the personal, institutional and societal level.

4.1.2. Development of circular business models at the company and personal level

Bearing in mind the significant political and social pressures caused by increasing environmental pollution and climate change, it is believed that the circular economy will become dominant in the 2030s. Gartner's predictions are highlighted, for example, which indicate that by 2029, supply chains will no longer be allowed to generate waste as in a linear economy, since both the governments of numerous countries and consumers themselves consider it unacceptable (WEF, 2022). Companies, therefore, must focus on changes in linear supply chains and invest in circular business models (CBM). Companies that do not undertake this will be pushed out from the market by new industry leaders - the so-called "born circular" companies. Therefore, established companies, with more traditional business models, must introduce elements of circularity into their models, undertake some pilot initiatives in terms of new CBMs, as well as create a transition strategy for moving to a circular business model (Ibid.).

Although economic growth has led to a higher quality of life in numerous countries, the reckless exploitation of resources in traditional business models has its price (Ying, 2020), which is reflected in the depletion of natural resources, the growth of gas emissions, and climate change that leads to the destruction of

biodiversity. It is stated that from the total extraction of resources, from biomass to minerals, only 8.6% of those resources are returned to the system, while 91.4% of all extracted resources are opportunity costs, i.e. loss when we operate in a linear economic system (Ibid.). In response to these problems, the changes occur in the way of thinking and behaviour, from policy makers, companies, and even customers.

Regarding certain doubts as to whether there is a willingness of buyers on the market to accept the new CBMs, it is indicated that consumers are also worried, especially the younger generation. In 2015, Nielsen research showed that 73% of millennials globally are willing to pay more for sustainable products, and research in the US showed that even 90% of the same generation is willing to pay more for products that contain sustainable and ecological materials. Moreover, Chinese consumers are also following these trends, so for example the largest e-commerce company in China recorded a 71% increase in sales of green products on its platform in 2017 compared to the previous year (Ibid.). The evolution of consumption patterns leads to increasing pressure in many countries towards the development of CBMs, which will lead to the reduction of gas and waste emissions, create new economic opportunities based on sustainable business models, promote innovation and create new jobs in the green sector.

Increased consumer awareness, especially in the sphere of environmental protection (due to global warming, plastic pollution, biodiversity loss) leads to new sources of reputational risk for existing companies with linear business models and creates new incentives for the adoption of green and more circular business models by companies (OECD, 2019). Also, the demands and expectations of individuals are growing, especially among the younger generations, towards greater transparency in company operations, honesty, but also interaction and greater involvement of customers (Ying, 2020). This requires a change in the way companies create and deliver value to customers and how they capture the value created, i.e. in bringing their business models closer to the requirements of greater circularity.

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The growing interest of the scholars and professionals on circular business models has also led to the emergence of various typologies of CBM available to companies, which differ from each other depending on the classification approach (Accenture, 2015; Achtenberg et al., 2016; Bocken et al., 2016; Lewandowski, 2016; Rosa et al., 2019).

The typology of circular business models that we will present is based on research by the consulting firm Accenture (2015), which analysed 120 companies that generate a significant improvement in resource productivity and in innovative ways reduce costs, increase revenues and value for customers, and achieve differentiation. Five basic circular business models have been developed: 1) circular supply chain model (based on replacing traditional material inputs with renewable, recovered, bio-based ones), 2) resource recovery model (based on obtaining materials from waste), 3) product life extension model (based on extending product life), 4) sharing model (based on increasing utilization of existing products and assets), and 5) production service system model (based on providing services to customers rather than products). Although some models have been known for a long time (for example, obtaining secondary raw materials by recycling waste, or extending the life of the product through repairs during the warranty period), they have evolved and developed into numerous sub-models, the basic characteristics of which are shown in table 4.1. (Accenture, 2015; Achterberg et al., 2016; OECD, 2019; WEF, 2022; Sitra, 2022; Nordic Innovation, 2021).

Table 4.1. Circular business models and their sub-models

Circular business models	**Sub-models**	**Basic characteristics**
Circular supply chain	"Build to last"	It includes the design of modular products that are more durable and easy to repair and upgrade.

	Circular supply	Procurement of materials that can be recycled, i.e. renewable and bio-based materials and energy.
Resource recovery	Downcycling	Like classic recycling, it includes the transformation of waste into secondary raw materials. The key difference is that the recovered materials are of lower quality and can only be used as input in a limited number of applications.
	Upcycling	It involves the transformation of waste into secondary raw materials and their subsequent use in relatively higher value applications (for example, getting bags from seat belts or tarps for cars).
	Industrial symbiosis	Closed-loop recycling that involves using one firm's by-products as production inputs for another.
Product life extension	Classic long life	It is achieved by designing products in a way that increases their durability. The economic implications are reflected in the fact that the manufacturer can charge a premium price for products of higher quality and durability.
	Direct reuse	It involves the redistribution and reuse of products that would otherwise end their life before expected useful life.
	Repair	By replacing defective parts or repairing it, it is possible for the products to reach their full lifespan, and by extending the care of the

		product after the sale itself, the manufacturer ensures customer loyalty.
	Refurbishment / Remanufacture	Products are given a "new life" returning them to their original functional condition. Although they are sold at lower prices than new products, they can bring significant profits to the manufacturer due to significant savings in material.
Sharing platform	Co-ownership	It involves the lending of physical goods, usually of higher value (e.g. home sharing like in case of Airbnb platform, or sharing home appliances and tools, like on Peerby platform).
	Co-access	It enables other people to participate in an activity that would have taken place anyway (for example the online platform Blablacar, which connects drivers who have unfilled seats in their vehicle during the trip with potential passengers who would use the ride for a fee).
Product service system	Product-oriented	The value proposition includes a number of pre- and post-sales services (e.g. extended product warranty or the possibility of returns during or after the end of the product's life).
	User-oriented	Customers pay for temporary access to a particular product, usually through a short-term or long-term rental agreement, while the service provider retains full ownership of the

		product (for example, leasing office equipment).
	Result-oriented	Instead of selling products in the traditional way, the services or results that those products provide are marketed (e.g. a company from the energy sector sells the result of heating - maintaining a certain temperature level in the building, instead of basic heating equipment or invested energy).

The application of all these models makes the value chain more circular compared to the traditional linear chain, and each of the models and sub-models can be used in multiple stages (activities) of the value chain, as shown in Figure 4.1.

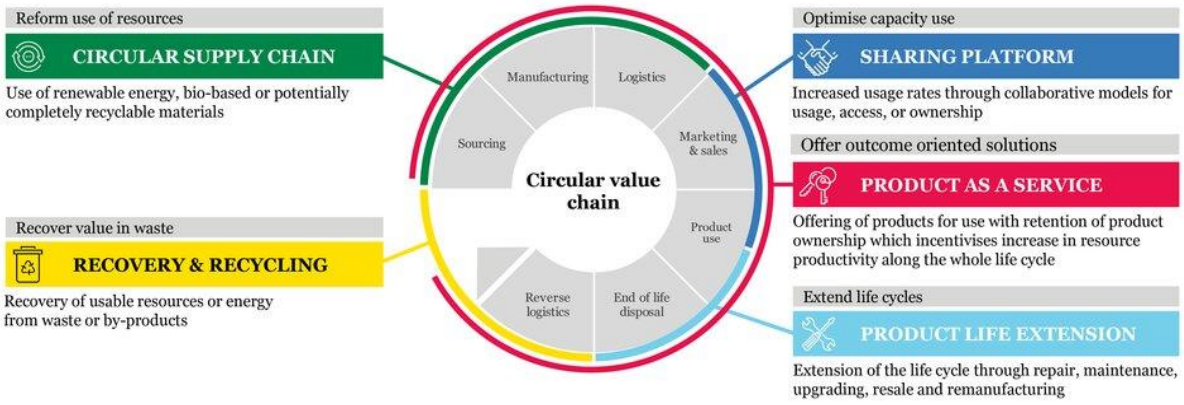

Figure 4.1. Application of circular business models in the value chain

Source: Ataly A., Dumas, C., Van Wassenhove, L. (2021) The Circular Business Model, Hardvard Business Review, July-August, pp. 11-34.

It should be noted that one company can use several circular business models, i.e. sub-models simultaneously. Also, some companies have recognized CBM as their core, while in others they are complementary to their core business (Muhović,

2023), which is more linear by its nature.

The application of new CBMs by companies interacts with changes in the behaviour of individuals. For example, a shift in the behaviour patterns of individuals from "use and throw " to the use of products made according to the "build to last" model, can reduce the generation of waste and, therefore, the mindless depletion of resources and pollution of the environment. The increasing orientation of individuals towards recycling, repairing of products, reusing of products, as well as upgrading and refurbishment, which affect the extension of the life of products, then towards renting instead of owning certain products (in accordance with the sharing economy model), will lead to an increase of sustainable businesses and growth in the number of new jobs in the green sector (World Green Economy Organization, n.d.). Changes in consumer behaviour are also reflected in the increasing transition towards business models related to servitization, i.e. providing services rather than simply selling products to customers, in accordance with the product-as-a-service model. This change leads to a greater connection between consumers and companies and contributes to the increase of consumer loyalty towards certain brands (Ibid.).

In circular business models, special attention is paid to closing the loop with consumers, which enables real interaction with users and enables co-creation of products and services. The difference of this approach compared to the traditional approach of "good relations with consumers" is in the level of involvement of customers. Instead of simply collecting data about consumers, in order to develop products and services that will meet their needs, today consumers are involved in the co-development and co-production of products and services, which can affect the future directions of companies' growth (Ying, 2020), in terms of greater orientation towards platform models. In this type of business model, the boundary between users and employees is blurring since both groups can be found "on the same side". Namely, online users in the digital platform model are, in fact, producers

of various contents as well as service providers (hence the name "prosumers" – user-producer) (Susan & Acs, 2017), who as an external and flexible workforce significantly reduce costs in the sharing platform model versus traditional industries (Stefanović, 2021). However, not all sharing economy platforms are in line with the principles of the circular economy, nor do they contribute to sustainability. It can be said that the expansion of the sharing economy over the last decade, as well as the economic benefits of sharing-based platforms, has resulted in environmental, local community and wider social benefits being largely nullified. For example, the expansive growth of businesses based on home sharing (as in the case of AirBnb, for example) had negative effects in terms of increased traffic and congestion of some tourist destinations (so-called overtourism) and endangerment of the local population in cities with pollution by tons of waste after "invasion" of a huge number of tourists. Or, ride sharing (as in the case of Uber) leads to an increase in traffic jams in big cities, rather than a decrease in the number of passengers and in that way increases pollution (Stefanović, 2021). Therefore, only platform-based models that lead to the sharing of underutilized assets, thereby reducing resource use and pollution, can be considered circular sharing economy platform models.

There are some other barriers at the personal level that make it difficult or impossible to implement CBM (Muhović, 2023). Some of them are related to deep-rooted cultural and social norms, such as when consumers prefer to be the first owner of a product (avoiding the purchase of second-hand products), or when they prefer ownership over sharing products, or when they want to own heating equipment instead of the use of a home heating service as in the product-as-a-service model. Also, continuous and intensive work must be done to raise the awareness of individuals about the importance of sorting waste for its recycling and changing habits to buy new products instead of repairing old ones, in accordance with the circular model of product life extension. Therefore, promoting pro-environmental behaviour of individuals is crucial for the further development of circular business

models.

4.1.3. Circular business models development at the institutional and societal level

The link between CE policies and practices in companies, as well as changes in individual behaviour patterns, is represented by institutions that regulate activities within and between organizations, and also between individuals. Stating the definition of institutions as "the rules of the game in society", Hjaltadóttir and Hilda (2021) focus on regulation, as a form of formal institutions, which influence informal institutions, such as value systems, culture, ways of working and other social practices.

When it comes to regulation, as a form of formal institutions, it is particularly reflected in the harmonization of the legislative framework of a country as well as its strategic documents with the corresponding regulation in the EU. In this sense, the basic regulation in the EU on the application of CE was established by the adoption of An EU Action Plan for the Circular Economy (2015-2019), and A New Circular Economy Action Plan for Cleaner and More Competitive Europe (2020-2025), as a part of the European Green Deal, which identified the circular economy as the main tool for achieving the goal of making the EU carbon neutral by 2050. In this sense, the Green Deal, as a new EU growth strategy and road map, represents a set of political initiatives to achieve the sustainability of the European economy. All EU countries, as well as countries throughout Europe, are obliged to harmonize their legislation with EU legislation, in order to achieve sustainable and competitive businesses across Europe.

EU member states have generally achieved harmonization in terms of main strategic documents, action plans and partial policies. For example, from the partners in this project, Romania and Bulgaria, as EU members, have already adopted strategic documents: in September 2022, the Romanian government adopted The Romanian Strategy for the Circular Economy, which is a road map for

accelerating Romania's transition from a linear to a circular economy model. The implementation of the Action Plan (the deadline for adoption of which was September 2023) should provide a framework for that transition (circulareconomy.europa.eu, n.d.). As a time frame, the National Recovery and Resilience Plan envisages the adoption of the Strategy for the CE and Action Plan by 2023 to ensure Romania's transition to CE by 2030 (ETC CE, 2022a). Romania adopted a Regulation in August 2022 regarding the adjustment of some financial measures by establishing a "de minimis" aid scheme for the transition to CE. The purpose of this financial support mechanism is the development of new industrial sectors, the revaluation of existing resources and the reduction of waste, which pollutes the entire country. The mechanism stipulates that the maximum amount of grants from the state budget in a period of 16 months is 200,000 euros in lei, and the minimum amount is 15,000 euros from the state budget, while the remaining 15% would be the beneficiaries' own sources. The main areas to be financed are: companies performing technology transfer activities for the consolidation of CE; development of research and innovation activities, ecological design of products and services that promote the principles of CE; establishing and/or equipping centers for product repair and renovation; development of waste recycling activities, etc. (Ibid., p. 7).

Also, in Bulgaria, in October 2022, the Council of Ministers adopted the Strategy and Action Plan for the transition to a circular economy for the period 2022-2027. The strategy formulates three strategic goals: 1) a green and competitive economy; 2) less waste and more resources; 3) an economy that benefits consumers. Concrete measures are planned in order to achieve the goals formulated as concrete activities in the Action Plan that accompanies the strategy (BTA, 2022). The Action Plan includes three types of activities: short-term, medium-term (for the period 2024-2027) and permanent (for the entire duration of the Action Plan) (ETC CE, 2022b, p. 6). Some of the medium-term measures include funding of resource-

efficient technologies focused on encouraging SMEs from the process industry to implement innovations, activities and technologies that enable the transition to CE. These include, among other things, reducing plastic in packaging, introducing environmental standards, labelling, transitioning to a bioeconomy, shortening supply chains, increasing the durability of products and the possibility of repair and reuse, as well as improving waste management in companies. Then, the measures include the establishment of Centres for product reuse, which would encourage the reuse of used products and the repair of appliances, bicycles and the like. It also includes training and the acquisition of professional qualifications related to repair work, for example for members of vulnerable groups. Permanent measures would include, among other things, activities for prevention, separate collection, reuse, recycling and recovery of waste, application of new technologies related to separation and use of waste, strengthening of control regarding waste disposal, as well as encouraging companies to engage in repair and creating Centres for product reuse, etc. (Ibid.).

Also, the Ministry of Economy of Bulgaria has prepared a draft of the program Competitiveness and Innovation in Enterprises (CIE), as one of the programs for the use of EU funds in Bulgaria for the program period 2021-2027 (Ibid., p. 8). The program is structured in two priorities: Priority 1 "Innovation and growth" and Priority 2 "Circular economy". Priority 2 "Circular Economy" includes two specific objectives aimed at preparing companies for the challenges of the green transition and achieving climate neutrality. Interventions within the first specific goal of promoting energy efficiency and reducing greenhouse gas emissions, for which 6.87% of the CIE budget, i.e. about 1493 million euros, have been allocated, aim to improve energy efficiency in companies through targeted actions, including the implementation and certification of systems for energy management and systems for monitoring and controlling energy consumption. Another specific goal, Promoting the transition to a resource-efficient circular economy, for which 30.75% of the CIE budget has been allocated, refers to the implementation of activities of SMEs in the

area of product design, production processes and waste management in order to achieve more resource-efficient production without waste, oriented to the principles of CE (Ibid).

When it comes to partner countries in the project, which are not EU members, i.e. Turkey and Serbia, the situation is quite different. In Turkey, although there are numerous and comprehensive laws and policy documents that direct sectoral policies towards sustainable and climate-resilient development, the primary legal and policy documents, such as the Long-term low emission development strategy, the Climate Law or A Circular Economy Strategy and Action Plan, are still under preparation (UNFCCC, n.d.). For example, it is planned that A National Circular Economy Action Plan and Roadmap will be adopted by the end of the fourth quarter of 2023.

When it comes to Serbia, policy makers in the Republic of Serbia are working on creating an adequate strategic and regulatory framework, in order to facilitate the transition to a circular economy. However, although the government has adopted specific laws and strategies, which represent a regulatory framework related to energy and environmental protection (e.g. the Law on Climate Change from 2021, and the Energy Sector Development Strategy for the period until 2025), the regulatory framework is incomplete, since some of the legal documents are in the draft stage and have not yet been adopted (e.g. Energy Development Strategy until 2040 and Low Carbon Development Strategy), while other are outdated and require revision (National Renewable Energy Action Plan 2020) (Uvalić, 2023).

Harmonization of Serbian legislation regarding the circular economy takes place under the framework of the implementation of the Western Balkans Green Agenda adopted at the Summit of the Western Balkan countries in Sofia in November 2020, since Serbia belongs to this regional group of countries. The countries of the Western Balkans have accepted the obligation to implement measures that will ensure alignment with the European Green Deal and the Action

Plan in five areas, including the transition to a circular economy (Uvalić, 2023; Muhović, 2023). Although in 2020 the Green Agenda was supported by the European Commission's Economic and Investment Plan for the Western Balkans, which foresees grants of 9 million euros over seven years, access to the EU market, as well as EU financial assistance, will primarily depend on the progress achieved in the transition of these countries to green economy (Uvalić, 2023). The existing policies and regulatory framework are not sufficient to move to circular business models and value chains but are only a starting point for their further development. Some of the changes in regulations in the countries of the Western Balkans, which would stimulate the transition to circular business models, could be: an increase in the minimum legal warranty period in order to extend the life of the product; reducing the use of disposable products when there are circular alternatives; defining compensations for the purchase of primary (raw) materials; determination of qualitative criteria for recycling to prevent deterioration of product quality; developing a rolebook on circular activities and business models; defining targets for product reuse and refurbishment of product, etc. (Muhović, 2023, p. 42).

The lack of a legal framework can prevent the necessary flexibility for carrying out the activities of certain business models: e.g. sharing economy platforms, such as AirBnb and Uber, which face difficulties due to the lack of appropriate tax laws (Nordic Innovation, 2021), as well as laws in the field of labour and wages (Stefanović, 2021). Also, the existing regulation may favour linear business models which slows down the application of circular models (for example the existing classification of materials as "secondary" in relation to "waste") (Nordic Innovation, 2021).

When it comes to fiscal and financial incentives, as institutional solutions for the implementation of the new CBMs, they can refer to taxation, subsidized financing, internalization of costs, etc. Linking market instruments with tax reforms,

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for example by reducing labour taxation in the green economy, or introducing an environmental tax, could affect the improvement of environmental quality, stimulate economic growth and increase employment (OECD, 2017). When it comes to fiscal measures, they mainly refer to the introduction of additional taxes for business operations that do not comply with the requirements of the circular economy and have a negative impact on the environment (Muhović, 2023). Revenues collected by this reform, i.e. environmental tax or the sale of permits for carrying out activities that affect pollution, enable governments to either reduce taxation on the labour market that is detrimental to green businesses, or to finance specific education and training programs from areas of circular economy. Although the primary goal of environmental taxation is to improve the quality of the environment, it simultaneously contributes to improving the health and well-being of all citizens and provides the government with budgetary flexibility in an effort to reduce harmful taxation on the labour market, in order to improve the overall efficiency of the economy. Environmental taxation can thus potentially have multiple benefits for society (OECD, 2017, p. 6). On the other hand, reforms in the tax system may refer to certain incentives to promote the application of green technologies. Sweden, for example, already introduced numerous green incentives in 2008/2009 to support the development of biofuels, electric cars, biogas, solar cells and energy efficiency measures (Ibid, p. 8). This can significantly influence the increase of investments in green sectors and CBMs and the increase of employment in them.

When it comes to other financial incentives, they can refer to: 1) financial assistance from the state for the transition to circular activities; 2) provision of guarantee funds and replenishment of investments for companies that switch to CBM; 3) encouraging banks to introduce credit lines with subsidized interest rates for companies switching to CE models, as well as enabling a longer grace period for loans; 4) provision of alternative sources of financing; or 5) establishing a fund to support the introduction of circular business operations, etc. (Muhović, 2023, p. 43).

When it comes to commercial financing, some of the ways of financing by banks are particularly suitable for certain CBMs. In addition to subsidized loans as well as bank guarantees, leasing and factoring, for example, can be used as convenient ways of financing the business model of production services system. Also, modern financing models such as crowdfunding or grants and the so-called impact investors are suitable for financing ideas and pilot projects in the area of circular economy (Nordic Innovation, 2021).

In general, the interaction between social (value attitudes, perceptions, lifestyle, etc.), institutional (regional regulatory context) and market components (networking and cooperation between companies), has the ability to connect resources and local actors, enabling the transfer of information and the coordination of agents in specific region (Tapia et al., 2021). Temporary loss of jobs (although permanent, in some sectors) will occur in the process of transferring employees from existing "brown" to "green" sectors and developing new necessary skills and knowledge, as an integral part of the growth of new business models associated with the green economy. World Green Economy Organization cites data from the International Labor Organization from 2018, where it is predicted that around 6 million new jobs will be created as a result of growth of the circular economy businesses. Ideally, the loss of jobs in the "brown" sectors goes "hand in hand" with the chances of a transition to "decent" jobs in the green sector. This, bearing in mind that some jobs, even in green sectors, may not necessarily be decent and fair. Some inequalities in access to decent jobs may exist due to gender, age, urban or rural status of individuals or belonging to a particular nation and country. As a rule, green jobs are not decent without ensuring appropriate quality and fairness in employment. For example, the construction of the green buildings as well as recycling will create jobs in the circular and green economy, but may not necessarily ensure safe working conditions, adequate wages, social protection or equal rights for employees in these sectors. Without the aforementioned qualities, these jobs do not meet the criteria to

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be fully considered green economy jobs (World Green Economy Organization, n.d.).

Public participation through social dialogue can serve as a platform for ensuring a balance between environmental requirements, equality and economic needs to develop national policies that enable the transition to a green economy (Ibid.). The mechanism of social dialogue, including tripartism and collective bargaining, serve as an effective tool for policymaking at all levels, and can contribute to the realization of a just transition (Castillo, 2023). Castillo (2023, p. 23) sees a just transition as promoting a green economy in a way that is as fair and inclusive as possible for all involved – employees, businesses and society – creating decent work opportunities and leaving no one behind. A just transition entails maximizing the social and economic opportunities associated with climate and environmental activities, while minimizing and carefully managing the challenges through effective social dialogue and the involvement of all stakeholders and respecting the fundamental principles and the right of everyone to work (ILO, 2023, p. 12, cited in: Castillo, 2023).

Equity is an essential element in defining decent green jobs, in terms of improving human well-being and social equality. The relative ratio of wages, working hours, working environment and safety at work are important factors in determining whether this equity is achieved in different countries. Building the concept of decent work at the level of governments, societal partners and other stakeholders is essential for the transition to a green economy. In order to ensure the achievement of social justice, equality must be ensured in terms of gender equality in participation, equal access to education and training for the necessary skills and promotion at work, as well as rewarding based on skills and capabilities, as well as achieved results (World Green Economy Organization, n.d.). Again, social dialogue and collective bargaining are emphasized as important instruments in achieving these goals. In providing the opportunity to achieve the goals of social inclusion and equality, an important place belongs to the model of social enterprises, which, in

addition to economic ones, also have social and ecological motives in their basis (Stefanović & Talić, 2022). Through the development of the business model of social enterprises, the goals of employment of marginal groups (women, disabled, minorities) in the green sector can be achieved and their right to decent work can be ensured, which is the basis of a fair transition towards a circular and green economy model.

4.2. Up-and-coming green-economy professions and jobs

4.2.1. Circular or Green job definitions and job typology

A circular/green job is "any occupation that directly involves or indirectly supports one of the strategies of the circular economy" (Circle Economy, 2021). Circular/green jobs are the "activities that produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems" (ILO, 2018, p. 1). The International Labour Organisation (ILO) and United Nations Environmental Program (UNEP) describes that circular/green jobs must fit within the Decent Work Agenda (ILO, 2018a; UNEP, 2020). Circular/green jobs are "workplaces in agricultural, manufacturing, research and development, administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid the generation of all forms of waste and pollution" (UNEP, 2008).

Three types of green/circular jobs, as well as their roles and functions, are presented in Table 4-1, 4-2 and 4-3 (UNEP, 2021).

Table 4-1. The roles and functions of core circular/green jobs

Definition	***Core circular/green jobs are all jobs that ensure the closure of raw material cycles, including jobs in repair, renewable energy, waste and resource management.***
The roles and functions	***Description***
PRIORITISE REGENERATIVE RESOURCES	*Ensure renewable, reusable, non-toxic resources are utilized as materials and energy in an efficient way.* *Example:* Agronomic advisors support healthy soil nourishment with organic fertilizer from composted manure and crop remnants. They combine strong interpersonal skills with ecological knowledge.
STRETCH THE LIFETIME	*While resources are in-use, maintain, repair, and upgrade them to maximize their lifetime and give them a second life through take-back strategies when applicable.* *Example:* Repair technicians repair appliances, machines, or vehicles. They possess strong technical and manual skills which can be acquired through formal and informal education and training.
USE WASTE AS A RESOURCE	*Utilize waste streams as a source of secondary resources and recover waste for reuse and recycling.* *Example:* Process operators sort waste for sellable products, for example, to produce livestock feed made from waste flows. Although classed as practical-skill work, knowledge of the quality of incoming raw materials is crucial.

Source: Authors' presentation according to UNEP (2021)

Table 4-2. The roles and functions of enabling circular/green jobs

Definition	***Enabling circular/green jobs are jobs that remove barriers for and enable the acceleration and upscaling of core circular activities, including jobs that arise in leasing, education, design, and digital technology. They form the supporting shell of the circular economy.***
The roles and functions	***Description***
DESIGN FOR THE FUTURE	Adopt a systemic perspective during the design process, to employ the right materials for appropriate lifetime and extended future use. *Example:* Circular equipment engineers design products to enable parts and resource recovery after the product's use phase. They excel in complex problem solving on a technical level designs for the future.
RETHINK THE BUSINESS MODEL	Consider opportunities to create greater value and align incentives through business models that build on the interaction between products and services. *Example:* Demand planners oversee supply and demand to make refurbishment a profitable business model. This role requires logical thinking and reasoning.
INCORPORATE DIGITAL TECHNOLOGY	Track and optimize resource use and strengthen connections between supply-chain actors through digital, online platforms and technologies. *Example:* Building information managers maintain data on construction components to keep track of these physical assets. They understand how to integrate and interpret virtual

	information management systems.
TEAM UP TO CREATE JOINT VALUE	Work together throughout the supply chain, internally within the organization and with the public sector to increase transparency and create shared value. *Example:* Procurement professionals stimulate the demand for secondary materials and discern and connect new suppliers to do so. This profile points to the need for entrepreneurial, interpersonal skills.
STRENGTHEN AND ADVANCE KNOWLEDGE	Develop research, structure knowledge, encourage innovation networks, and disseminate findings with integrity. *Example:* Teachers transfer knowledge and skills to the current and future workforce to equip workers with skills for circular economy strategies.

Source: Authors' presentation according to UNEP (2021)

Table 4-3. The roles and functions of indirectly circular/green jobs

Definition	***Indirectly circular/green jobs are the jobs that indirectly uphold the circular economy. These jobs occur in other sectors that do not play a direct role in furthering the transition to the circular economy but can still adopt circular strategies. They include jobs that provide services to core circular strategies, including jobs in information services, logistics, and the public sector.***
The roles and functions	***Description***
INDIRECTLY UPHOLD THE CIRCULAR	These jobs exist in sectors not directly contributing to advancing the circular economy, yet they can incorporate circular strategies. This category encompasses roles in service provision to primary circular strategies, encompassing positions in information

ECONOMY	services, logistics, and the public sector. *Examples*: - The courier, who uses and maintains a fleet of second-hand bikes to bring packages to and from consumers as part of a reverse logistics scheme; - The bank, which uses repair services to maintain the electrical equipment used in its day-to-day operations; - The farmer, who utilizes renewable energy in the production of their agricultural products.

Source: Authors' presentation according to UNEP (2021)

The labour force plays a crucial role in driving the transition toward the circular/green economy. Questions such as which jobs are already integrated into the circular economy, their locations, how they are distributed across sectors, and their connection to circular strategies are essential. The Circular Jobs Monitor (*CJM*) (www.circular-jobs.world), a product of "Circle Economy", addresses these questions. Developed through a collaborative effort between "Circle Economy" and the *UNEP*, the *CJM* gathers and presents data about jobs within the circular economy. This tool serves as a valuable resource for individuals and organizations, offering insights into the correlation between circular economy activities in various industries and the labour market.

4.2.2. The up-and-coming green-economy professions and new jobs

The shift to a circular/green economy will have an impact on labour markets in many places throughout the world. New green occupations will arise while some existing or traditional jobs will change or die. Innovative combinations of human knowledge, competencies, capacities, and skills will be needed for these new vocations. To become responsive, accountable, and effective in ever-changing work

contexts, managers and other employees in enterprises will need to adopt new mentalities and develop new skills. Green skills represent the abilities needed to support a sustainable business environment (Crippa & Drąsutė, 2022).

The ILO predicts that the circular economy will generate 24 million jobs globally by the year 2030. Additionally, calculations by the EU for the same timeframe indicate an annual employment growth rate of 0.3% in the circular economy sector, resulting in approximately 700,000 new jobs (https://bit.ly/43CfnnA). This emerging workforce of professionals will operate under a paradigm that diverges from the disposable culture, advocating for the transformation of waste rather than its disposal.

The current state of labour markets is closely tied to the linear economy, characterized by a take-make-waste approach. However, a shift is anticipated as organizations embrace circular business models and strategies. The circular economy revolves around practices and services that emphasize the reuse of materials and the closure of material cycles. These processes are inherently more labour and skill-intensive compared to many activities in the traditional one-directional linear economy. Activities such as recovering parts for reuse or providing products through a leasing service, for instance, require specialized tasks like reverse logistics, resource sorting, and component cleaning.

The implementation of the circular economy necessitates both manual and practical labour, alongside the requirement for highly skilled work in designing and engineering innovative solutions. When effectively managed, the circular economy holds the potential to generate opportunities for workers across various skill levels.

Acknowledging that the circular economy will reshape the landscape of employment, we are presented with a unique chance. This opportunity extends beyond reconsidering how we handle material flows; it encompasses a re-evaluation of the treatment of people within this framework. There is a chance to restructure labour markets in ways that enhance the quality of work, foster inclusive workplaces,

and offer continuous learning and upskilling opportunities for workers. This proactive approach enables them to adapt to the evolving demands associated with new business practices, innovations in business, and business models.

The educational landscape is witnessing a rise in the number of programs offered by schools and universities focusing on the new cross-disciplinary, sustainable production model. This trend is indicative of a growing demand for professionals with expertise in this field across various sectors. As industries increasingly recognize the importance of sustainability, the need for individuals possessing knowledge in this domain is on the rise (https://bit.ly/3U77bcd). Many new professionals entering this field have backgrounds in ***s***cience, ***t***echnology, ***e***ngineering, and ***m***athematics (shortly, *STEM*). A notable trend is the increasing professionals in large corporations especially for tasks like measuring environmental footprints. These experts provide valuable advice on adhering to waste management and recycling regulations, aligning with initiatives like the *European Green Deal* (program for combating climate change).

For employers to effectively integrate employee skills into a circular system, a continuous "skill and reskill" approach for the workforce is essential. This entails incorporating education and training into your lifelong self-improvement journey. The objective is to pursue careers in circularity that facilitate the ongoing development of worker skills, replacing traditional career-focused training. Knowledge sharing and knowledge updating are crucial for staying employable in the circular economy.

4.2.3. New professional skills that will drive the Circular Economy

The demand for professionals well-versed in circular economy principles is on a steady rise. Driven by the imperative to address climate change, both companies and governments are intensifying their environmental commitments. The circular economy becomes integral to meeting these obligations as it extends across various

requirements. The multifaceted nature of this challenge emphasizes its broad impact across sectors and organizational levels. Key aspects include the strategic use of renewable raw materials through practices like reuse, repair, and recycling, influencing diverse aspects of businesses, including digitalization, logistics, and management. The circular economy, therefore, represents a comprehensive approach that permeates various dimensions of societal and corporate responsibility.

Certain jobs are driving the green/circular/regenerative economy direction. The "take-make-waste" model induces changes in the labour market which are green jobs (Sulich & Sołoducho-Pelc, 2022). Among these career opportunities or newly influential occupations are (*https://netimpact.org/blog/Circularity-Careers-are-the-Future*): 1. *Product and packaging design manager* with the mission of protecting the environment in a green economy; 2. *Circular investment manager* which requires understanding the characteristics of companies likely to be successful in the new economic model; 3. *Manager for new customer service*, such as leasing instead of purchasing and buying; 4. *Reverse logistic manager* with the function of better and more efficient recycle, repurpose and reuse; 5. *Product lifecycle manager* with the duty to examine product handling across the board.

The report *"Employment in sustainability and the environment: 10 professions with a future"* by the *International University of La Rioja* (UNIR) and the *INFOEMPLEO* listed ten positions as some of the careers in sustainability with the brightest future (Table 4)

Table 4-4. Ten positions as some of the careers in sustainability with the brightest future according to the UNIR and INFOMPLEO

Position	***Description***
Sustainable technological solutions and projects analyst	Analyses the activities that could be harmful to a company and alters them to be more sustainable solutions.

Occupational risk, quality, environment, and corporate responsibility technician	Advises companies on how to manage the implementation of regulations or standards for risk prevention, the implementation of quality systems, environmental impact reduction, and corporate social responsibility.
Sustainable logistics consultant	Performs tasks relating to labeling or packaging, product costs (types of contracts and transportation), controlling the company's contamination levels, and selecting a less polluting means of transportation.
Eco-designer	Includes environmental criteria in the product design and development phase, trying to take preventive measures to lessen the environmental impact.
Circular economy specialist	Works to ensure that the products that companies put on the market are produced taking sustainability criteria into account.
Environmental education specialist	Teaches about environmental, economic, and cultural processes through the acquisition of skills such as critical thinking and a systemic approach.
Environmental sustainability expert	Manages a company's resources sustainably, both for the production and distribution of its goods and services.
Cultural manager specializing in sustainability	Preserves the sustainability of the management and development of cultural and artistic projects.
Renewable energies expert	Manages a company's resources sustainably, both for the production and distribution of its goods and services.
Environmental engineer	Assesses, prevents, and seeks technical solutions for the environmental problems that a company's production processes may cause.

Source: Authors presentation according to the UNIR and INFOMPLEO
https://www.repsol.com/en/energy-and-the-future/future-of-the-world/circular-economy-professionals-wanted/index.cshtml

Harum Tasci published in July 2023 the top 10 in demand sustainability jobs which are presented in Table 4-5.

Table 4-5. Top 10 green jobs according to Tasci

Green jobs	***Description***
Sustainability manager	Helps organizations meet regulatory requirements, attract environmentally conscious consumers, and enhance their reputations. Identifies areas for improvement and spearhead initiatives that promote environmental, social and economic wellness. Develops and implements green strategies, ensuring businesses minimize their ecological footprints while maximizing positive social impact.
Renewable energy engineer	Designs, develops and implements renewable energy infrastructure and solar, wind, or geothermal power systems, with the aims of reducing dependence on fossil fuels, driving the adoption of sustainable energy solutions in both residential and commercial settings, and mitigating environmental change.
Green building architect	Designs energy-efficient and environmentally sustainable buildings, implementation of green building materials, as well as innovative design techniques and efficient systems to create structures that minimize environmental impact and promote occupant well-being.
Environmental consultant	Assesses and minimizes company's environmental impact, providing advice in such areas as pollution prevention, resource conservation, and regulatory compliance. Develops sustainability plans and helps companies adopt sustainable practices, including identifying the areas of improvement, such as reducing water consumption, implementing recycling programs, and adopting

	cleaner production methods. Enables businesses to navigate regulations and develop strategies that align with sustainability goals.
Sustainable supply chain manager	Optimizes supply chains to ensure sustainable sourcing, reduce waste, promote ethical practices, and drive sustainability initiatives across procurement, logistics, and distribution processes. Implements sustainable procurement practices, reducing emissions, and promoting circular economy principles that support organizations in achieving their sustainability objectives while driving positive social and environmental change.
Enter climate change analyst	Assesses the impact of environmental change on various sectors, analyzes data, and develops strategies to mitigate risks and adapt to changing conditions. Identifies the risks and opportunities associated with environmental change, providing valuable insights to governments, organizations, and communities, and helping them prepare for and respond effectively to climate-related challenges.
Waste management specialist	Develops waste reduction and recycling programs, focusing on minimizing waste generation and promoting sustainable waste management practices. Optimizes waste disposal processes, promotes recycling initiatives, and implements innovative waste-to-energy solutions, contributing to the circular economy by minimizing landfill waste and maximizing resource recovery.
Water resource manager	Develops sustainable water management plans, promotes water conservation, improves water efficiency, addresses water pollution issues, and ensures water quality through monitoring and remediation efforts.

Corporate social responsibility manager	Drives sustainable business practices and manages stakeholder relationships. Ensures that businesses operate ethically and contribute positively to society and the environment. Develops and implements strategies that align with sustainable practices, promote social equity, and enhance the overall reputation of the organization.
Sustainable agriculture specialist	Assists farmers in transitioning to sustainable farming practices, improving soil quality, and reducing environmental impacts. Implements organic farming methods, permaculture principles, and regenerative agriculture techniques, to enhance soil health, minimize chemical inputs, conserve water resources, promote biodiversity, and transform the agricultural sector into a more sustainable system.

Source: Authors' presentation according to Harum Tasci, https://bit.ly/49g8eus

Organizations dedicated to embracing circular practices will acknowledge every member of their workforce as valuable and innovative human capital, deserving of respectful treatment.

STUDENTS TRAINING SECTION

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Keyword list with vocabulary

Circular Business Model - business models that are cycling, extending, intensifying, and/or dematerialising material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organisational system.

Circular Business Model Innovation - conceptualisation and implementation of circular business models, which comprises the creation of circular start-ups, the diversification into circular business models, the acquisition of circular business models, or the transformation of a business model into a circular one.

Circular supply chain - use of renewable energy, bio-based or potentially completely recyclable materials.

Resource recovery - recovery of usable resources or energy from waste or by-products.

Product life extension - Extension of the life cycle through repair, maintance, upgrading, resale and remanufacturing.

Sharing platform - collaborative models for usage access or ownership.

Product service system - pre- and post-sales services.

Circular or green jobs - jobs that help protect ecosystems and biodiversity.

Green skills - the abilities needed to support a sustainable business environment.

Core circular/green jobs - jobs that ensure the closure of raw material cycles, including jobs in repair, renewable energy, waste and resource management.

Enabling circular/green jobs - jobs that remove barriers for and enable the acceleration and upscaling of core circular activities, including jobs that arise in leasing, education, design, and digital technology.

Indirectly circular/green jobs - jobs that occur in other sectors that do not play a direct role in furthering the transition to the circular economy but can still adopt circular strategies.

Questions for self-evaluation and discussion:

1) What is a business model?
2) How can you evolve business model into a Circular Economy?
3) What are the five basic circular business models?
4) How can Circular Business Models and sub-models be used in the value chain?
5) What barriers make CBM implementation difficult or impossible?
6) What are the differences among Business Models at the personal, corporate, institutional, and societal levels?
7) What are up-and-coming green-economy professions?
8) What are the three types of green/circular jobs?
9) What professional skills are desirable for green-economy professions that will drive the Circular Economy?
10) What impact does the transition to a circular/green economy have on labor markets?

Summary

The total extraction of resources is only 8.6% in the traditional linear economic model, while 91.4% of all extracted resources are opportunity costs, i.e. loss. A circular economy was developed in order not to protect natural resources. The application of circular economy at the company level implies the development of circular business models. Circular business models that are cycling, extending, intensifying, and/or dematerialising material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organisational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying), and the substitution of products by service and software solutions (dematerialising).

The circular business model also includes circular jobs (jobs in agriculture, production, research and development, administrative and service activities that

significantly contribute to preserving or restoring the quality of the environment). These include jobs that help protect ecosystems and biodiversity; reduce energy, material and water consumption through highly efficient strategies; contribute to the decarbonization of the economy; and minimize or completely avoid the creation of all forms of waste and pollution. Green jobs also include new professional skills, such as: analytical abilities related to assessing the damage that a company can create to the environment, abilities to design green products, the ability to develop green products, abilities related to the use of green technologies, the ability to promote the advantages of green products, the ability to implement energy efficiency, etc.

Training example 4-1. Methodological considerations of the elements for designing the Canvas business model of the circular economy

The great interest of scientists and practitioners in the development of business models is also reflected in the fact that a large number of tools have been developed for the design and innovation (reconfiguration) of existing models. Nevertheless, the CANVAS business model (Business Model Canvas - BMC), developed by Osterwalder and Pigneur (2010), is one of the earliest and most widely used tools, which has been successfully applied in various industries. CANVAS is a management tool in the form of a visual diagram that represents a template for reconfiguring existing and/or developing new business models. It includes nine building blocks, that is, elements on which every business model should be based, which are, in fact, areas that need to be connected and balanced. These are the following elements: value proposition, key partners, key resources, key activities, customer segment, client/customer relationships, channels, cost structure and revenue streams (Ibid.). Within each of these elements, that is, areas, several key questions should be answered. The elements of BMC and the key questions to be answered in relation to each element are given in the following schematic

representation.

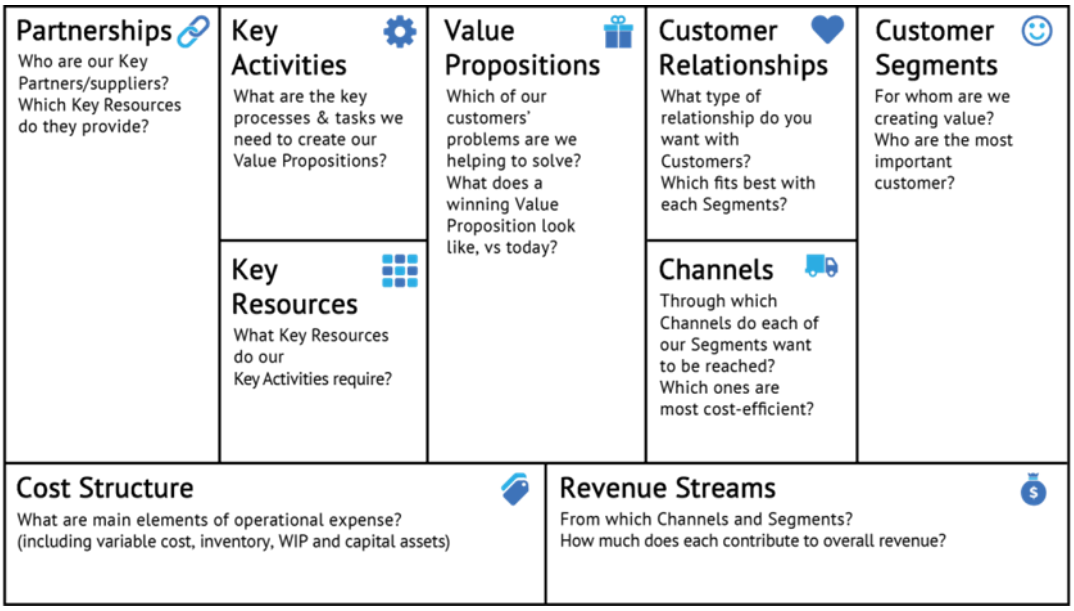

Figure 4-2. Canvas business model according to Osterwalder and Pigneur (2010)

Retrieved from: https://www.pliohub.com/create-a-business-model-canvas/

Although there have been attempts by some authors to develop special frameworks, i.e., Canvas templates for the needs of circular economy business models, it is considered that the BMC developed by Osterwalder and Pigneur represents a good basis that, with certain adjustments of the elements that make it up, can be successfully used for designing circular economy business models, which we talked about in chapter 4. Each of the models and sub-models of the circular economy can be described by a characteristic combination of key elements of the business model that provide the corresponding outcomes of the circular economy. The focus is on essential elements and issues related to individual elements that make each circular economy business model recognizable.

Some of the essential questions related to certain elements of the CE Canvas business model can be answered as follows:

Table 4-6. Elements for designing the Business Model CE Canvas

<table>
<tr><td colspan="2">Value Proposition Elements
Lower costs (over the life of the product): lower product costs or reduced cost of ownership for the end customer.
Performance: provide results and a level of performance consistent with the customer's job-to-be-done solution, such as a product-as-a-service model.
Access: convenience in accessing products/services on-demand, flexibility, breadth of choice as, for example, in platform-based models, leasing, renting.
Sustainability: provide results based on sustainability, which customers value (environmental, social and similar).
Shared value: provide value for customers outside the main value chain.</td></tr>
<tr><td>Customer relations
Long-term or recurring relationships: for example, subscriptions, long-term services, etc.
Transactional: one sale/transaction.</td><td>Customer segments
New customer segments: selling products/services to different customer segments.
"Vertical" customers: customers outside the main product value chain.</td></tr>
<tr><td>Channels
Resale channels: using distinctive sales channels.
Resale Channels: Resale of products at the end of life.
Secondary materials markets: the market for the sale of recovered (recycled) materials.</td><td>Income streams
Income from the sale of products: sale of products, components, materials.
Revenue from the sale of services: applies only to services that do not include ownership.
Revenues from the sale of product-service packages: the sale of "packages" of products and services.
Income from the sale of waste: income from the sale of waste, i.e., products that are reused instead of landfilled.</td></tr>
<tr><td>Key activities
Product design: product design that enables repair, maintenance, disassembly, remanufacturing, recycling, replacement of parts and materials, etc.
Reverse logistics: refers to reverse logistics that is performed in the company itself.
Provision of services: services according to the "product-as-a-service" model, or value-added services (for example, preventive maintenance, equipment diagnostics, etc.).</td><td>Key partners
Suppliers: suppliers of circular materials.
Reverse logistics: refers to reverse logistics performed by another company.
Technology: partners providing key technologies.</td></tr>
<tr><td>Key resources
Property management platform: platforms for booking, monitoring, payment, etc.
Specialized manufacturing processes: specialized processes and facilities (e.g., for remanufacturing, 3D manufacturing, etc.).
Assets: equipment or products that can be</td><td>Cost structure
Financial incentives: for example, to return products after use or products at the end of their life cycle.
Labor: labor costs.
Material: material costs (including material recycling).</td></tr>
</table>

provided as a service.	• *Finance costs:* customer financing costs. • Waste disposal: costs of waste disposal. •

Source: Osterwalder, A., & Pigneur, Y. (2010) Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons, pp. 173-175

The above considerations of individual elements were used by Aleyn (2018) to describe how these elements combine to describe some of the relevant circular business models through the Canvas template. For example, the elements relevant to the resource recovery circular business model in the Canvas template can be displayed as follows:

Table 4-7. Canvas template for designing a circular economy business model Resource recovery

<table>
<tr><td rowspan="2">Key Partners

Reverse Logistics: Partners in the reverse-logistics chain - e.g., waste management municipalities; etc.</td><td>Key Activities

Reverse Logistics: Recovery of materials at end-of-life.</td><td rowspan="2">Value Propositions
Sustainability: Environmental sustainability of recovered material.

Lower cost: May be priced at a discount to virgin materials on secondary markets.</td><td>Customer Relationships
Generally transactional relationships.</td><td rowspan="2">Customer Segments
Vertical Customer: Customers may be in different ‘vertical' segments, or secondary material commodity companies. May include internal Procurement customer in a Tully closed-loop model.</td></tr>
<tr><td>Key Resources
Plant and equipment for recovery processes, where relevant. This may be outsourced to a key partner.</td><td>Channels
Secondary material Market: Markets for sale of recovered materials (scrap, recycled, etc.)</td></tr>
<tr><td colspan="3">Cost Structure

Waste Disposal: Reduction/elimination of own disposal costs which organisation may have to otherwise incur.</td><td colspan="2">Revenue Streams

Waste-as-value: Sale of recovered maternal direct to customer (may be internal Procurement customer if fully closed-loop) or to secondary material markets.</td></tr>
</table>

Source: Osterwalder, A., & Pigneur, Y. (2010) Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons., pp. 176-177

Some other Canvas templates could include elements of other circular business models or their sub-models. So, for example, it is possible to create a Canvas template for the needs of developing a circular business model, Circular Supply. Based on the discussion of the essential elements of this circular business model, complete the template below.

Table 4-8. Canvas template for designing a circular economy model Circular supply

<table>
<tr><td rowspan="2">Key Partners</td><td>Key Activities</td><td rowspan="2">Value Propositions</td><td>Customer Relationships</td><td rowspan="2">Customer Segments</td></tr>
<tr><td>Key Resources</td><td>Channels</td></tr>
<tr><td colspan="3">Cost Structure</td><td colspan="2">Revenue Streams</td></tr>
</table>

***Training example 4-2. Illustration of core and enabling circular jobs and skills in Amsterdam in the Netherlands*[6]**

Amsterdam Metropolitan Area (AMA) comprises the broader region around Amsterdam and inhabits well over 2.4 million people across 33 municipalities. AMA has committed to becoming fully circular by 2050. Of the total ~1.3 million jobs within the AMA in 2016, 11% are circular. This corresponds to approximately 140,000 circular jobs in the AMA, 63,500 of which are located within the City of Amsterdam itself. Both government and business are responsible for circular skills development. Governmental organizations play a key role in the development of the right competencies for the circular economy. Yet, to more effectively develop the

[6] Source: Circle Economy. (2018). Final-Circular-Jobs-and-Skills-in-the-Amsterdam-Metropolitan-Area.pdf

necessary skills to for circular economy, greater alignment of education programmes and business is needed. In this way, skills developed through education programmes can better match the practical talents demanded by companies.

Four action perspectives for boosting circular employment are the following:

A. *Develop necessary skills in practical experience and training through public private partnerships (between education and business);*
B. *Ensure the necessary cross-sectoral collaboration and interdisciplinary thinking in the circular economy, and especially is important to focus on early cooperation between different (professional) training courses;*
C. *Integrate circular economy principles into University programmes and schools to enable graduates from all disciplines to contribute towards the circular economy;*
D. *Capitalize on the competitive advantage and defining character of a city to further maximize the potential of the circular economy, as illustrated by the AMA's focus on digital technology, circular design, and preserve and extend the lifespan of products.*

Table 4-9. Core and enabling circular jobs and skills in AMA region

Core circular jobs/skills	Enabling circular jobs/skills
Jobs in ***Prioritize regenerative resources*** enable to the creation of renewable energy and operation of new decentralized energy systems. In the AMA more than 2% of circular jobs (2.500 jobs) are in this strategy. The three most important professions are in the repair and maintenance, architecture and engineering, and administration sectors. Circular skills: Problem-solving, Resource Management, Systems, Technical	Jobs in ***Collaborate to create joint value promote cooperation within value chains***, within organizations and with the public sector. This strategy provides 1% (20) circular jobs in the AMA. Most jobs are located in business and financial services, personal services, and management sector. Circular skills: Problem-solving, Resource Management, Systems, Technical
Jobs in ***Preserve and extend*** relate to the repair and lifetime extension of products	Jobs in ***Design*** for the future ensure that materials and assembly techniques that extend the life of

and materials. This strategy represents more than 13% (18,500) circular jobs in the AMA. Most jobs are located in the maintenance and respiration, transportation, and manufacturing sectors. Circular skills: Resource Management, Systems	products and enable the repair and dismantling of products are adopted. In the AMA, circular design makes up 8% (10,700) of circular jobs. These jobs are mainly found in art, design and media, and manufacturing sectors. Circular skills: Problem-solving, Resource Management, Systems, Social, Technic
Jobs in Use waste as a resource relates to the valuation of residual and waste streams for new purposes. This strategy represents more than 4% (5,800) of circular jobs in AMA. Most jobs are located in the construction, transportation and management sectors. Circular skills: Technical	Jobs in ***Incorporate digital technology*** serve to map material use and optimise value chains through digital platforms and technologies. This strategy provides 29% (41,000) circular jobs in the AMA. Jobs occur mainly within the ICT, business and financial services, and sales and marketing sectors. Circular skills: Basic, Resource Management, Systems, Social
Jobs in Rethink the business model relates to new revenue models to accelerate the circular economy through, for example, sharing platforms and product-service systems. In the AMA, this strategy represents 5% (7,000) circular jobs. Most jobs are located in the retail, logistics, and management sectors. Circular skills: Resource management, Technical	

Training example 4-3. Deposit & Return system for recycling drinks cans and bottles in Denmark generates new circular/green jobs[7]

In July 2021, the EU directive on single-use plastics lays out a number of measures aimed at reducing the amount of single-use plastics and increasing the share of plastic that is recycled that must be met by 2030. In addition to recycling targets and extended producer responsibility, a key requirement is that member states must collect 90% of all plastic bottles by 2029. In Denmark, a key solution for

[7] Source: https://bit.ly/43EzKAL and https://stateofgreen.com/en/news/10-examples-of-circular-economy-solutions/

reaching the 90% collection goal may be to emulate the return and deposit system for disposable bottles and cans containing beverages (alcohol, soft drinks, juice, mineral water etc.). A privately owned, non-profit organization known as the Danish Return System (DRS) was established by the breweries in Denmark and approved by the Danish Ministry of Environment to operate the deposit and return system. It is the DRS that bears responsibility for collecting, processing, and returning the empty bottles and cans to producers to be recycled. When sending beverages to shops, the producers send a corresponding deposit to DRS. Shops and supermarkets refund deposits to the consumers and then receive the corresponding amount from DRS in return once the empty bottles and cans are collected and counted. Essentially, the deposit money flows continuously throughout the system. Unclaimed deposit money, however, is kept by DRS, which is used to finance and develop the system. At larger supermarkets, special machines scan the cans and bottles, separate them, compress them, and then the packaging is collected by the DRS to be prepared for recycling at the two sorting plants DRS operates, so that they can then be transformed into new cans and bottles. Smaller shops and kiosks without these kinds of facilities return the cans and bottles whole. For producers, it can be cheaper to produce new cans and bottles from old ones. The DRS occupies a special place in the heart. Many a child or teenager has gone around their neighbourhoods collecting empty cans and bottles to return at the machines installed in supermarkets and kiosks in return for coins, which they often will use to buy treats such as sweeties or ice-cream, or even new soft drinks. The system is so important to Danish culture. The DRS represents a closed loop production system, where the high value of glass, metal and plastic is preserved. Refillable bottles that are sold and deposited in Denmark are reused up to 30 times, while the cans and single use plastic bottles and glass bottles are melted and used to produce new ones. The 'bottle to bottle' and 'can to can' loop preserves the value of the materials, saves virgin resources and emits less CO2. In 2021, the return percentage of disposable packaging in Denmark

reached 93%. Namely, 1.9 billion bottles and cans were deposited for reuse, which amounts to an overall return rate of 93%. The figure differs slightly according to whether glass, plastic, or aluminum is used. Recycling the 1.9 billion bottles in 2021 also saved 210,000 tons of CO2 being emitted. The deposit and return system create circular economy benefits. Producing cans from recycled materials uses 95% less energy than it would if they were produced using virgin materials. Furthermore, the cooperation between producers, consumers and DRS is effective, which results in a high rate of return.