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La Scuola in Campo

Environmental Sustainability Education

A Comprehensive Manual and Course Guidelines

Project: La scuola in campo

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ISTITUTO D'ISTRUZIONE SUPERIORE "STANGA"

This document will be assisted as a comprehensive manual integrated into the Environmental Sustainability Education course and will be implemented as a pilot project in secondary schools.

IAgroCert, under the supervision of the Project Manager from the Municipality of Pandino and with assistance from two higher education institutes from Italy and Slovenia, elaborated on the training concepts and created the manual.

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CONTENTS

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ABOUT THE PROJECT

The project aims to structure an educational course on environmental sustainability for young people in agricultural VET schools. It will be carried out by expert trainers together with the teachers involved, responding to all the necessary needs to prepare students to realise sustainable development. Teachers and educators will then be formed to look at the future of education by considering the labor market and green sustainability.

The project includes project management activities, a training activity for educators together with two experts, the development of a manual on a course to be implemented, a testing phase with 2 classes in the last year, and finally the publication of the manual and dissemination of results.

The general objective of the project, in addition to the direct experimental application on the territory and linked to the needs of the proponents, is the creation of a "model" that can be exported to other contexts and can be adapted according to their specific needs.

The project will therefore have a benefit not only on the actors involved (primarily educators and students), but also on the associations, bodies and territories involved.

CONSORTIUM

- **Comune di Pandino – Italy - Coordinator**
- **Grm Novo mesto - center biotehnike in turizma- Slovenia**
- **INSTITOUTO PROOTHISIS KAI PISTOPOIISIS PROIONTON AGRODIATROFIS -Greece**
- **Istituto di Istruzione Superiore "Stanga"- Italy**

ABOUT THE MANUAL

The Environmental Sustainability Education manual is designed to guide the implementation of a comprehensive course targeting secondary schools. Developed in collaboration with iAgroCert, under the supervision of the Municipality of Pandino's Project Manager and two higher education institutes, the manual encompasses seven key chapters addressing critical environmental topics.

The primary **target groups** involved in this initiative include:

1. Experts: Two experts will oversee the course's development, focusing on content, learning dynamics, and instructional methods.
2. Teachers: Four teachers (two per school) will receive specialised training and contribute their expertise to the manual, drawing from their daily practices.
3. Students: Two classes of fourth-year students will actively participate as testers, offering valuable feedback and shaping the course content.
4. Municipality of Pandino: The project manager and municipal staff will monitor progress, providing essential institutional support and bridging educational efforts with the labour market.

The manual comprises **seven** chapters, each addressing a critical aspect of environmental sustainability:

1. Biodiversity: Understanding and conserving the diverse life forms on Earth.
2. Pollution: Identifying, mitigating, and preventing various forms of pollution.
3. Ecoremediations and Revitalisations: Exploring methods to restore and rejuvenate ecosystems.
4. Sustainable Use of Energy and Raw Materials: Promoting efficient use of energy, renewable resources, and responsible material management.
5. Sustainable Management: Implementing sustainable practices across various sectors.

6. Circular Economy: Adopting a model that minimises waste and maximises resource efficiency.
7. Zero Waste: Emphasising waste reduction, recycling, and reuse strategies.

The manual will undergo a pilot phase in two selected institutes. Teachers will implement the methodologies outlined in the manual and provide regular feedback every two months via video conferences to monitor progress and refine the course content.

The initiative aims to achieve both tangible and intangible outcomes:

Enhanced role identity for stakeholders, fostering a mindset of ongoing change and innovation.

A comprehensive manual, refined based on feedback, will be disseminated to dairy schools, teaching staff, and public entities. The manual will be freely available for download on the project's communication channels, serving as a practical tool for promoting environmental education and sustainable practices.

The manual represents a significant step towards promoting environmental education, fostering sustainable practices, and preparing students for a green future in alignment with European policies. It will encourage schools to prioritise environmental education and sustainability, equipping students with the knowledge and skills needed for a more sustainable and responsible future.

Chapter 1

Understanding Sustainable Education

1. Introduction

1.1 Circular Economy in Education

In this introductory chapter, we will learn about the essential principles of sustainable education, with an emphasis on the Circular Economy, Sustainable Development Goals (SDGs), and the Green Deal. Understanding these pillars is critical for educators who seek to include sustainability into their teaching techniques and develop in their students a feeling of environmental responsibility. The Circular Economy demonstrates an evolutionary change in our approach to resources, emphasising sustainability and waste reduction. We will focus on how organisations, governments, and communities may implement circular practices to improve sustainability and economic resilience.

1.2 Integrating the SDGs into the Curriculum

This section allows educators to incorporate the SDGs into lesson plans, highlighting their importance in solving global concerns. We examine practical ways to make learning about the SDGs more interesting, motivating students to become active participants in creating a more sustainable future. The United Nations' Sustainable Development Goals serve as an international call to action to solve global concerns. We look at how the Circular Economy connects with and helps to achieve key SDGs, promoting a comprehensive and integrated approach to sustainable development.

1.3 The Green Deal's Educational Implications

As the European Green Deal defines the continent's future, we look at the educational consequences. Teachers will learn how to integrate their teaching methods with the Green Deal, raising environmental awareness and equipping students to be educated citizens in a sustainable society. The Green Deal, the

European Union's flagship effort, is a comprehensive road map for ensuring the EU's economic sustainability. We will explain the Green Deal's fundamental elements and how they link to the Circular Economy, providing a plan for a greener, more resilient future.

1.4 Creating a Foundation for Sustainable Education

This section offers practical recommendations and techniques for establishing a sustainable education foundation in classroom contexts. Educators will learn how to inspire students to become responsible global citizens by developing an environmental awareness culture and integrating sustainability across disciplines.

By the conclusion of this chapter, instructors will have a thorough knowledge of the main ideas behind sustainable education, setting the foundation for the next chapters, which will dig further into practical applications and creative teaching approaches.

2. Embracing the Circular Economy in Educational Practice

Welcome to the chapter of our complete manual for educators who want to incorporate circular economy ideas into their classroom activities. In this section, we will look at the fundamentals of the circular economy and how they apply to education. As we continue, consider how these ideas might be effectively integrated into the framework of your teaching techniques, resulting in an engaging and long-lasting learning experience for your students.

2.1 Understanding the Circular Economy

Let us begin by clarifying the concept of a circular economy. Consider a learning environment in which waste is reduced, resources are used effectively, and students actively engage in sustainable activities. The circular economy, with its emphasis on reuse, recycling, and regeneration, offers a framework for doing precisely that. In this handbook, we will look at practical ways and exercises for implementing these ideas in the classroom.

The European Union produces more than 2.2 billion tonnes of waste every year. It is currently updating its legislation on waste management to promote a shift to a more sustainable model known as the circular economy.

The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended. In practice, it implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible thanks to recycling. These can be productively used again and again, thereby creating further value. This is a departure from the traditional, linear economic model, which is based on a take-make-consume-throw away pattern. This model relies on large quantities of cheap, easily accessible materials and energy.

Also, part of this model is planned obsolescence when a product has been designed to have a limited lifespan to encourage consumers to buy it again. The European Parliament has called for measures to tackle this practice.

At the core of circular economy concepts is the idea of creating things with long-term in mind. This includes creating objects that are not only solid but also easy to fix, resulting in longer lifecycles and minimising the need for frequent replacements. This idea represents a shift away from the conventional 'throwaway' mentality and toward a more sustainable approach to product creation. Another important consideration is the emphasis on reuse and regeneration. The circular economy advocates for items and resources to be reused, repaired, or regenerated whenever feasible. This strategy helps to conserve important resources and reduces the environmental effect of new product manufacture. Recycling and upcycling are essential elements of circular economy strategies. Recycling techniques are fine-tuned to recover the most value from materials, removing them from landfills and reintroducing them into the manufacturing cycle. Simultaneously, upcycling entails repurposing garbage into higher-quality or more valuable items, demonstrating circular thinking's inventive potential. Resource efficiency is at the heart of circular economy principles. By reducing waste via effective resource usage, this strategy promotes a more sustainable connection with our world. It entails improving processes to ensure that materials are used to their full capacity, reducing environmental damage, and encouraging responsible consumption. Essentially, these essential ideas constitute the cornerstone of circular economic activities, stressing sustainability, resource conservation, and a transition towards a more responsible and regenerative economic model.

2.1.2 Statistics

Statistics underscore the pressing need for a transition to a circular economy. According to the Global Material Flows Database, the global economy consumed a staggering 89.4 billion tons of materials in 2019. This sheer volume highlights the urgency of adopting more sustainable consumption models to alleviate the strain on Earth's resources. The challenge of electronic waste, or e-waste, is particularly significant. The Global E-waste Monitor reveals that in 2019 alone, the world generated a massive 53.6 million metric tons of electronic waste. Alarmingly, only 17.4% of this e-waste was formally collected and recycled. Circular economy principles offer a promising solution to address this challenge, providing a framework for responsible handling and repurposing of electronic products.

Beyond the environmental benefits, embracing circular economy principles can lead to substantial economic opportunities. A report by the Ellen MacArthur Foundation suggests that by fully integrating these principles, we could unlock economic benefits, potentially generating an additional $4.5 trillion in economic output by 2030. This statistic underscores the potential for circular economy practices not only to contribute to environmental sustainability but also to drive economic growth and innovation.

2.1.3 Benefits

Circular economy strategies provide several benefits, ranging from environmental protection to economic and corporate advantages. Circular economy techniques prioritise environmental conservation as a key advantage. Circular economy concepts contribute significantly to lowering total raw material demand by designing goods for lifespan and stressing reuse, regeneration, and effective recycling. This, in turn, contributes to natural resource conservation, lowers greenhouse gas emissions, and reduces environmental pollution. Transitioning to a circular economy may create jobs while simultaneously benefiting the environment. This transition generates job possibilities in a variety of industries, including recycling, refurbishing, and sustainable product design. As circular practices become more common, the demand for qualified people in these industries is likely to increase, contributing to a stronger labour market.

Circular business models promote both innovation and resilience. Companies that embrace circular economy ideas are encouraged to develop innovative and

efficient solutions for waste reduction, resource optimisation, and sustainable practices. This drive to innovation not only improves the environment, but it also increases overall corporate resilience. Businesses in a circular economy are better prepared to respond to changing market conditions and consumer preferences. Individuals and organisations may help to create a more sustainable and resilient future by learning about and implementing circular economy principles. The advantages go beyond environmental protection, positively benefiting economies and cultivating a culture of innovation and accountability.

2.1.4 Global initiatives

The European Union's Green Deal is a game-changing initiative in global environmental efforts. The Green Deal aims to turn Europe into the world's first climate-neutral continent by 2050, using circular economy concepts at its foundation. The EU strives to set the standard for climate change mitigation and environmental preservation by encouraging innovation, resource efficiency, and sustainable practices.

Circular economy concepts line up with UN Sustainable Development Goals (SDGs). Notably, SDG 12 focuses on responsible consumption and production, highlighting the importance of sustainable resource management and waste reduction. Circular economy techniques also help to achieve SDGs 13 (climate action) and 14 and 15 (life on land and below water), demonstrating circularity's connectivity with larger global sustainability goals.

Finally, the global impetus toward a circular economy extends beyond individual countries, with significant efforts such as the European Green Deal and China's Circular Economy Promotion Law paving the way. When governments and corporations connect their strategy with circular concepts, they not only contribute to environmental preservation but also build the groundwork for a resilient and sustainable global economy. Embracing circularity is not just a choice; it's a strategic imperative for fostering balance and harmony in our coexistence with the planet.

3. Understanding the Sustainable Development Goals (SDGs)

3.1 Introduction

The Sustainable Development Goals (SDGs) represent a global commitment to address pressing challenges and achieve a sustainable future for all. Adopted by all United Nations Member States in 2015, the SDGs comprise 17 interconnected goals that encompass a wide range of economic, social, and environmental objectives. Rooted in the principle of leaving no one behind, the SDGs provide a shared blueprint for peace and prosperity, emphasising the need for collaboration on a global scale.

Origins and Significance

The origins of the SDGs can be traced back to the Millennium Development Goals (MDGs), which were in place from 2000 to 2015. While the MDGs made significant strides in poverty reduction and access to education and healthcare, they fell short in addressing the root causes of global challenges. The SDGs emerged as a response to this gap, offering a more comprehensive and integrated framework for sustainable development.

The 17 SDGs:

The SDGs cover a broad spectrum of issues, ranging from eradicating poverty and hunger to ensuring environmental sustainability and promoting inclusive societies. Each goal is interconnected, recognizing the complex and interdependent nature of global challenges. The 17 SDGs are as follows:

- Goal 1- No Poverty: End poverty in all its forms everywhere.
- Goal 2- Zero Hunger: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
- Goal 3- Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

- Goal 4- Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Goal 5- Gender Equality: Achieve gender equality and empower all women and girls.
- Goal 6- Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all.
- Goal 7- Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable, and modern energy for all.
- Goal 8- Decent Work and Economic Growth: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.
- Goal 9- Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
- Goal 10- Reduced Inequality: Reduce inequality within and among countries.
- Goal 11- Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.
- Goal 12- Responsible Consumption and Production: Ensure sustainable consumption and production patterns.
- Goal 13- Climate Action: Take urgent action to combat climate change and its impacts.
- Goal 14- Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
- Goal 15- Life on Land: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

- Goal 16- Peace, Justice, and Strong Institutions: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
- Goal 17- Partnerships for the Goals: Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development.

Interconnectedness and Integration

A defining feature of the SDGs is their interconnectedness. The goals recognize that addressing one challenge often requires addressing multiple issues simultaneously. For instance, ending poverty (Goal 1) is closely linked to achieving good health and well-being (Goal 3) and ensuring quality education (Goal 4). This interconnected approach acknowledges the complexity of global issues and encourages integrated solutions.

Global Targets and Indicators

Each SDG is accompanied by specific targets and indicators designed to measure progress. These targets provide a roadmap for countries and organizations to set priorities and allocate resources effectively. Regular monitoring and reporting on these indicators enable stakeholders to assess advancements, identify gaps, and recalibrate strategies to stay on course.

Participation and Inclusivity

One of the key principles underlying the SDGs is the principle of inclusivity. The goals emphasise the importance of engaging all stakeholders, including governments, businesses, civil society, and individuals, in the pursuit of sustainable development. This inclusive approach recognizes that addressing complex challenges requires collaborative efforts on a global scale.

Challenges and Opportunities

While the SDGs represent a bold and ambitious vision for the future, challenges persist. These challenges include disparities in implementation progress among different regions, the impact of global crises (such as the COVID-19 pandemic), and the need for increased financial resources to support sustainable development initiatives. However, the SDGs also present immense opportunities for innovation, collaboration, and positive change.

SDGs and the Private Sector

The private sector plays a crucial role in the achievement of the SDGs. Businesses and industries are called upon to align their operations with sustainable practices, contribute to poverty alleviation, and actively engage in environmental conservation. Companies embracing social responsibility and ethical business practices can make substantial contributions to the global agenda.

As a comprehensive framework for addressing the world's most pressing challenges, the SDGs embody the collective commitment of nations to build a sustainable and equitable future. While progress is being made, the journey towards achieving the SDGs is ongoing, requiring sustained effort, collaboration, and innovation. The SDGs serve as a compass guiding humanity toward a world where prosperity is shared, and the well-being of people and the planet are safeguarded for generations to come.

SDGs in education

Step 1: Understanding the SDGs

The module begins with an exploration of the 17 SDGs, each addressing critical global challenges. Through engaging lessons, students gain a comprehensive understanding of the goals, their origins, and the interconnectedness that forms the backbone of sustainable development.

Step 2: The Classroom as a Global Stage

Transforming classrooms into global stages, students delve into real-world issues aligned with the SDGs. Collaborative projects and discussions empower them to see beyond textbooks and understand the practical implications of the goals in their local and global communities.

Step 3: Curricular Integration

Discover how the SDGs seamlessly integrate into existing curricula. From science to literature, mathematics to social studies, educators find innovative ways to infuse SDG-related content, making lessons not only informative but also inspiring.

Step 4: Hands-On Learning and Experiences

Learning by doing is the essence of this chapter. Students actively engage in hands-on projects, field trips, and community initiatives that bring the SDGs to life. Whether planting trees, organising awareness campaigns, or creating sustainable solutions, students experience firsthand the impact of their actions.

Step 5: Digital Tools and Resources

Explore the vast array of digital tools and resources designed to enhance SDG education. From interactive apps to virtual field trips, technology becomes an ally in making SDG-related content accessible, engaging, and adaptable to diverse learning styles.

Step 6: Assessing Impact and Progress

Assessment takes a new form as educators measure not just academic performance but also the impact of students' actions in line with the SDGs. Portfolios, reflections, and collaborative evaluations become valuable tools in assessing progress towards a sustainable future.

Step 7: Fostering Global Citizenship

The ultimate goal is to nurture global citizens who understand their role in creating a better world. Lessons on empathy, cultural understanding, and responsible citizenship instil values that go beyond the classroom, shaping students into compassionate leaders of tomorrow.

As we conclude, it becomes evident that integrating the SDGs into school education is not just an academic exercise – it's a pathway to nurturing compassionate, informed, and proactive individuals. Students emerge not only with knowledge but with the power to contribute meaningfully to a world where everyone thrives.

4. Analysing the European Green Deal: A Vision for Sustainable Transformation

The European Green Deal stands as a groundbreaking and ambitious initiative by the European Union (EU), aiming to propel the continent into a new era of sustainability and climate resilience. Launched in 2019, this comprehensive analysis explores the overarching aims, key components, and potential implications of the Green Deal in the context of global efforts toward environmental conservation and a circular economy.

- ❖ Understanding the Aims

At its core, the European Green Deal is a strategic response to the escalating climate crisis and environmental degradation. The primary objective is to achieve climate neutrality by 2050, making the EU the first climate-neutral continent. This transformative vision encompasses a multifaceted approach, integrating policies and initiatives across various sectors, including energy, transport, agriculture, and biodiversity.

- ❖ Key Components and Pillars

The Green Deal unfolds through a series of interconnected pillars, each addressing a critical aspect of sustainability. These pillars include climate action, clean energy, sustainable mobility, biodiversity, and the circular economy. Analysing these components reveals a thorough strategy that recognizes the interdependence of environmental, economic, and social factors in fostering a resilient and sustainable future.

- ❖ Policy Instruments and Legislative Framework

An in-depth examination of the Green Deal necessitates an exploration of the policy instruments and legislative framework driving its implementation. The European Climate Law, the Farm to Fork Strategy, and the Renovation Wave Strategy are among the pivotal policies shaping the transition. This section delves into the intricacies of these regulations and their potential impact on industries, communities, and individual citizens.

- ❖ Localising the Green Deal

While the Green Deal is a global vision, its success depends on local actions and engagement. Analysing how communities and businesses can contribute to its objectives highlights the significance of a bottom-up approach. Local case studies

and initiatives demonstrate the real-world impact of the Green Deal, fostering a sense of ownership and responsibility among citizens.

- ❖ Innovation and Technology

A critical facet of the Green Deal is its reliance on innovation and green technologies to drive sustainable practices. This section analyses the role of technological advancements in achieving the Green Deal's goals, emphasising the importance of research, development, and the adoption of eco-friendly solutions. Exploring the potential challenges and opportunities associated with technological innovation offers a nuanced perspective.

- ❖ Progress Monitoring and Impact Assessment

The effectiveness of the Green Deal relies on robust mechanisms for monitoring progress and assessing its impact. This section scrutinises key performance indicators, monitoring systems, and evaluation tools employed to measure the success of green initiatives. Understanding the complexities of impact assessment is crucial for stakeholders, policymakers, and citizens alike.

- ❖ Global Implications and Collaborations

While the Green Deal is a European initiative, its global implications are significant. Analysing the EU's collaboration with international partners underscores the interconnectedness of environmental challenges. Evaluating the diplomatic and cooperative aspects of global environmental efforts provides insights into the potential for collective action on a planetary scale.

As we conclude this analysis, it becomes evident that the European Green Deal is not merely a policy framework; it is a transformative vision for a sustainable and resilient future. The success of the Green Deal hinges on collective efforts, innovative solutions, and a shared commitment to environmental stewardship. In embracing the Green Deal, the EU sets a precedent for nations worldwide, inspiring a generation to advocate for and contribute to a more sustainable world.

4.1 Green Deal: A Comprehensive Guide to Sustainability

The European Green Deal, unveiled by the European Union, stands as a groundbreaking initiative with the aim of transforming Europe into the world's first climate-neutral continent by 2050. This comprehensive guide delves into the

multifaceted dimensions of the Green Deal, exploring its origins, objectives, and the far-reaching implications for sustainable development.

Step 1: Unveiling the Green Deal

The European Green Deal emerged as a holistic response to the urgent climate challenges faced by the global community. Originating in 2019, it serves as the EU's roadmap to decarbonize the economy, promoting a circular and sustainable future. Students embark on a journey to uncover the core principles and aspirations embedded in this transformative initiative.

Step 2: Pillars of the Green Deal

At the heart of the Green Deal lie key pillars that guide its implementation. From climate neutrality and clean energy to sustainable mobility and biodiversity, students explore the interconnected goals that constitute the foundation of this ambitious agenda. Engaging activities and discussions enable a deeper understanding of how each pillar contributes to a greener and more resilient Europe.

Step 3: Policy Instruments and Legislation

Understanding the legislative framework and policy instruments that underpin the Green Deal is crucial. This chapter provides insights into regulations such as the European Climate Law and the Farm to Fork Strategy. Students grasp the significance of policy measures in driving the transition towards a sustainable and equitable future.

Step 4: Localising the Green Deal

While the Green Deal is a grand vision for Europe, its success relies on local actions. Students explore how communities, businesses, and individuals can contribute to the Green Deal's objectives. Case studies and interactive projects encourage students to envision practical ways to implement green practices in their own communities.

Step 5: Innovation and Green Technologies

Innovation plays a pivotal role in achieving the Green Deal's objectives. Students delve into the world of green technologies, from renewable energy sources to sustainable agriculture practices. The chapter explores how technological advancements can propel the transition towards a green and digital future.

Step 6: Assessing Progress and Impact

A critical aspect of the Green Deal's success is the ability to measure progress and impact. Students learn about key performance indicators, monitoring systems, and assessment tools employed to gauge the effectiveness of green initiatives. Engaging in simulated assessments, students gain insights into the complexities of evaluating sustainability on a macro scale.

Step 7: The Global Impact

While the Green Deal is a European initiative, its impact extends globally. Students examine how the EU collaborates with international partners to address shared environmental challenges. Discussions explore the role of diplomacy, cooperation, and solidarity in achieving a sustainable future for the entire planet.

As students conclude their exploration of the European Green Deal, they emerge not only with a profound understanding of a transformative policy but also with a sense of responsibility. The Green Deal becomes a catalyst for nurturing eco-citizens – individuals equipped with the knowledge and motivation to contribute actively to a sustainable and resilient world.

Chapter 2

Biodiversity

According to National Geographic, biodiversity is a term used to describe the enormous variety of life on Earth. It can be used more specifically to refer to all the species in one region or ecosystem. Biodiversity refers to every living thing, including plants, bacteria, animals, and humans.[1]

According to WWF, biodiversity is all the different kinds of life you'll find in one area—the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world. Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life. Biodiversity supports everything in nature that we need to survive food, clean water, medicine, and shelter.[2]

As humans continue to intensify their exploitation of the Earth's resources, we are jeopardising the delicate balance of ecosystems and causing a significant loss of biodiversity. According to WWF's 2022 Living Planet Report, there has been an alarming 69% average decline in global populations of mammals, fish, birds, reptiles, and amphibians since 1970. Additionally, the 2019 Global Assessment Report by the Intergovernmental Platform on Biodiversity and Ecosystem Services revealed that a staggering 1 million animal and plant species are currently at risk of extinction—the highest number ever recorded in human history. Significant portions of both terrestrial and marine environments have undergone substantial changes, with three-quarters of land areas and approximately 66% of ocean areas being altered. Moreover, more than a third of the Earth's land surface and nearly 75% of its freshwater resources are now used for agriculture or livestock farming. The impacts of climate change exacerbate the detrimental effects of other environmental stressors on both nature and human well-being. Overfishing, deforestation, water pollution, and the escalating climate crisis are all contributing to the loss of biodiversity worldwide, affecting ecosystems from remote wilderness areas to our local communities.

[1] *National Geographic Society. (2024, June 21). Biodiversity. Retrieved from* https://education.nationalgeographic.org/resource/biodiversity/

[2] *Hancock, L. What is biodiversity? Why it's under threat and why it matters. World Wildlife Fund. Retrieved from* https://www.worldwildlife.org/pages/what-is-biodiversity

Biodiversity is vital to the health and balance of our planet's ecosystems, encompassing the variety of life forms from microorganisms to large animals, and including genetic, species, and ecosystem diversity. It plays a crucial role in providing essential ecological services that sustain life, such as pollination, seed dispersal, climate regulation, water purification, nutrient cycling, and pest control. Additionally, biodiversity is the foundation of many natural resources, including food, fuel, shelter, and medicine, supporting key industries like agriculture, forestry, fisheries, and tourism. Beyond its tangible benefits, biodiversity holds cultural, spiritual, and aesthetic value, enriching our lives and connecting us to the natural world through traditions, beliefs, and practices. It also has intrinsic value, emphasising the inherent right of all living organisms to exist and flourish, independent of their usefulness to humans. Moreover, biodiversity contributes to our social well-being by promoting a sense of connection, responsibility, and stewardship towards the environment, fostering sustainable behaviours and practices. Recognizing the diverse benefits of biodiversity is essential for guiding conservation efforts and informing decision-making to ensure a sustainable future for both humanity and the planet.

Biodiversity refers to the wide range of life forms on Earth and is vital for the health and stability of ecosystems. It creates diverse habitats that accommodate various species, encompassing ecosystems of different kinds, rare environments, and connecting pathways between habitats. Numerous experts argue that biodiversity, embodying the entirety of life on our planet, offers essential advantages that humans obtain from the natural world. [3]

Biodiversity is indispensable for delivering ecosystem services that support our food sources, clean air, water resources, and a range of other invaluable natural benefits. Human activities can have detrimental effects on biodiversity through various stressors and drivers of change. The Eco-Wheel illustrates the intricate relationship between natural resources, the benefits derived from biodiversity, and the factors influencing its conservation. The expansion of the human population and subsequent land development pose significant threats to biodiversity, as land conversion and habitat loss can jeopardise the stability and survival of species. Habitat destruction is a universal challenge, with humans transforming natural habitats into alternative land uses. Overharvesting for activities such as commercial fishing and recreational hunting can lead to a drastic

[3] *American Museum of Natural History. What Is Biodiversity? Retrieved from* https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity

decline in species populations, pushing some to the brink of extinction. For instance, a significant reduction was observed in U.S. Atlantic cod stocks due to overexploitation and depletion. According to the Food and Agriculture Organization (FAO), approximately 32% of fish stocks were overexploited, depleted, or recovering in 2008. Disrupting the viability of a single species can have far-reaching impacts on the balance of entire ecosystems. Moreover, human activities, including overuse and recreation, can exert pressure on environments and species, leading to detrimental effects. While outdoor activities can be beneficial for human health, excessive visitors can harm plant life, distress local animal populations, and introduce invasive species. Invasive species, such as kudzu and the Emerald Ash Borer Beetle in the U.S., can outcompete native species and significantly alter ecosystems, further impacting overall biodiversity. Additionally, pollution in its various forms, including chemical contamination and nutrient overload, poses severe threats to both aquatic and terrestrial species, emphasising the need for conservation efforts to protect and preserve biodiversity.

Conserving biodiversity offers numerous benefits, including supporting food security and ensuring sustained livelihoods through genetic diversity. Genes play a crucial role in regulating biological processes and enhancing organisms' resilience to environmental stressors. Maintaining genetic diversity is vital for preserving a wide variety of crops capable of resisting diseases and producing valuable biochemicals used in healthcare. It also ensures the availability of species for essential ecosystem services like pollination and pest control. A reduction in genetic diversity can diminish organisms' ability to adapt and may result in the loss of valuable biological information. Biodiversity has significantly contributed to advancements in modern medicine and human health research. Many pharmaceuticals are derived from plant species, such as the anti-tumor agent Taxol from the Pacific yew tree, the antimalarial artemisinin from sweet wormwood, and the cardiac drug digoxin from the digitalis plant. Additionally, pharmaceuticals can originate from non-plant species, like the pain-relieving drug ziconotide derived from the venom of predatory cone snails. Without these species, treatments for diseases like malaria, tuberculosis, cancer, and heart failure might not have been developed. The ongoing conversion of habitats and loss of biodiversity could lead to the disappearance of potential cures for some of the world's most challenging diseases. Beyond medicinal benefits, spending time

in outdoor environments has been linked to improved life satisfaction, happiness, reduced blood pressure, anxiety, and symptoms of cardiovascular disease.[4]

Conserving biodiversity ensures the preservation of its many benefits for all species. Diverse environments, such as Yellowstone National Park, support a multitude of species while also serving as beautiful, educational, and engaging recreational areas. Biodiversity conservation is crucial for maintaining functioning ecosystems, ensuring a stable food supply, and providing additional benefits.

The Convention on Biological Diversity (CBD) serves as the international legal framework dedicated to "the conservation of biological diversity, the sustainable utilisation of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources." This treaty has been ratified by 196 nations worldwide. The primary goal of the CBD is to promote actions that foster a sustainable future, addressing the collective global concern for biodiversity conservation. It encompasses biodiversity at various levels, including ecosystems, species, and genetic resources, and extends its scope to biotechnology through the Cartagena Protocol on Biosafety. The convention touches upon diverse sectors directly or indirectly linked to biodiversity and its role in development, spanning areas like science, politics, education, agriculture, business, culture, and more. The Conference of the Parties (COP) serves as the governing body of the CBD. Comprising all governments or Parties that have ratified the treaty, the COP convenes biennially to assess progress, establish priorities, and formulate work plans.

Based in Montreal, Canada, the Secretariat of the Convention on Biological Diversity (SCBD) plays a pivotal role in supporting governments in the CBD's implementation and its work programs. The Secretariat's responsibilities include organising meetings, drafting documents, coordinating with other international organisations, and disseminating information. The Executive Secretary heads the Secretariat, overseeing its operations and facilitating collaboration among member nations and stakeholders to advance biodiversity conservation efforts globally.

Education plays a pivotal role in promoting the sustainable and equitable utilisation of biodiversity and its conservation. It is instrumental in integrating biodiversity into mainstream discussions and practices. The diminishing

[4] *U.S. Environmental Protection Agency. (n.d.). EnviroAtlas Benefit Category: Biodiversity Conservation. Retrieved from* https://www.epa.gov/enviroatlas/enviroatlas-benefit-category-biodiversity-conservation

indigenous and local knowledge, along with the decline in sustainable traditional land use, poses threats to biodiversity, ecosystem services, and the achievement of Sustainable Development Goal 4 (quality education for all). Hence, there is an urgent need to incorporate biodiversity into educational curricula and learning initiatives. A widespread lack of awareness regarding biodiversity and its significance exists, with some viewing biodiversity merely as a resource for exploitation, leading to unsustainable practices like deforestation and wildlife poaching. Effective communication about biodiversity is essential for realising the objectives of the Sustainable Development Goals (SDGs) and the Convention on Biological Diversity (CBD). The preservation of biodiversity relies on collective global action by an informed society that values and understands biodiversity. This involves efforts to elevate local and indigenous knowledge about biodiversity. Adopting an inclusive approach that engages everyone is crucial for biodiversity conservation. Communication strategies on biodiversity should be tailored to resonate with various age groups and communities, ensuring broader understanding and participation in conservation efforts.[5]

In educational discussions, the instruction on biodiversity stands as a vital educational topic that enables students to gain a profound comprehension of the relationships between organisms and their surroundings. Environmental education plays a crucial role in raising awareness about the importance of biodiversity. Biodiversity refers to the variety of life on Earth, including the different species of plants, animals, and microorganisms, the genetic diversity within these species, and the ecosystems they form. Here are some key points to include when educating about biodiversity:

- Importance of Biodiversity
- Threats to Biodiversity
- Conservation of Biodiversity
- Role of Individuals in Biodiversity Conservation

Incorporating hands-on activities, field trips, and interactive learning experiences can make environmental education about biodiversity more engaging and impactful. Encourage students to explore local ecosystems, identify different species, and understand their ecological roles to foster a deeper connection with nature and inspire conservation actions.

[5] *United Nations. (n.d.). Convention on Biological Diversity. Retrieved from https://www.un.org/en/observances/biological-diversity-day/convention*

GOOD PRACTICES ON BIODIVERSITY

Understanding and conserving the diverse life forms on Earth

«Production of cheese using hay from stable meadows»

Regarding the relative good practices, we have focused on the activities that take place in the cheese factory of our school.

What is stable meadow?

It is a lawn that is not plowed or tilled for a long time, for a minimum period of at least ten years, but can last for centuries. It is left to spontaneous cultivation, does not weed and no pesticides are used. The only agricultural practices to which it is subjected are mowing, irrigation and organic fertilisation with manure. It is characterised by the presence of several herbaceous species and for this reason it is also called a polyphyte meadow. No chemical intervention, no artificial seeding: the propagation of species occurs naturally.

Stable meadows play an important role as a refuge area for plant and animal biodiversity: plant biodiversity is predominantly characterised by spontaneous flora consisting of gramineae, leguminous and composite to obtain a balanced and complete forage for the feeding of dairy cows that will produce a special milk, both organoleptically and nutritionally, and that will affect the subsequent dairy production. They also host interesting animal species, supporting a rich wildlife community with many species of butterflies, subsoil invertebrates and small mammals. Grass seeds and insects provide an important food source for birds. The presence of insects and small mammals supports nocturnal and diurnal birds of prey such as barn owls, buzzards and kestrels.

Stable meadows are also an example of sustainable agriculture: their cultivation does not require the use of pesticides and herbicides, and manure is used for fertilisation. This results in a marked reduction in pollution (of the atmosphere, water and soil) and, by promoting the capture and retention of carbon underground (carbon storage), an increase in organic matter (humus) and the

fertility of agrarian soil. Moreover, the plants themselves, by decomposing, give rise to organic matter that promotes the biochemical processes occurring in the soil. Stable meadows can therefore be considered true stores of carbon dioxide, which is thus removed from the atmosphere where it causes the greenhouse effect and are therefore now generally recognized as irreplaceable factors in the fight against climate change.

That is why, with Regional Law No. 14 of July 25, 2022, the Lombardy Region provides, within the Rural Development Plan, specific measures aimed at the enhancement, maintenance, preservation and establishment of new stable meadows in the regional territory.

Even the Municipality of Pandino, which has always strived to safeguard the environment through urban planning and territorial protection, could not fail to pay attention to the great environmental richness constituted by the grassy expanses known as Stable Meadows of Pandinasco, setting as the basis of its strategic choices the preservation of these natural specificities that characterise the territory.

How it was Implemented:

As part of the La Scuola in Campo project, the Scuola Casearia di Pandino intends to make a new cheese produced with milk from cows in the area, fed with hay from the Stable Meadows of Pandinasco, and flavored with hay or aged in hay from the same meadows. Since both flavoring and refining require the use of certified hay, which is not available at the moment, two prototype cheeses were made, produced with milk from the area, but for which certified hay purchased on the market was used. They are:

- a fresh Primo Sale cheese, ready for immediate consumption after cheesemaking, flavored with freeze-dried meadow hay added during processing;

- a cheese, Canestrella type, semi-hard, aged on a bed of hay.

Both cheeses were made, in the School's cheese factory, by students participating in the project.

Cheese production was the concluding part of the project, after the students deepened, including through site visits and the study of maps of the area, their knowledge regarding stable meadows and their agronomic and environmental importance. Stable meadows are a cultural heritage because they are linked to

pastoral culture and its heritage of knowledge and, last but not least, they are filled with beauty, so they are important for preserving landscapes as an important part of the culture and identity of local communities.

Results/Impact:

Through this activity, students' awareness was raised of how agriculture plays a key role in combating climate change and, as a result, can provide better lifestyles for people and future generations in terms of livelihood and health.

Chapter 3

Pollution

According to National Geographic, pollution is the introduction of harmful materials into the environment. These harmful materials are called pollutants. Pollutants can be natural, such as volcanic ash. They can also be created by human activity, such as trash or runoff produced by factories. Pollutants damage the quality of air, water, and land.[6]

Based on Brittanica, pollution occurs when an amount of any substance or any form of energy is put into the environment at a rate faster than it can be dispersed or safely stored. The term pollution can refer to both artificial and natural materials that are created, consumed, and discarded in an unsustainable manner[7].

Air pollution, water pollution, and land pollution stand out as the primary types of environmental contamination. Pollution can extend to include overactivity by humans, like light and noise pollution, or focus on particular contaminants like plastics or radioactive substances. Delve deeper into this topic with our infographic.

Air pollution plays a significant role in driving climate change. Activities like burning fossil fuels and extensive deforestation result in higher levels of carbon dioxide in the atmosphere. This excess CO2 acts as a greenhouse gas, trapping heat and leading to a warming effect known as the greenhouse effect. Consequently, this alters global climate patterns and contributes to rising sea levels worldwide. Pollution can be mitigated through practices like recycling, effective wastewater treatment, and proper disposal of hazardous waste. Additionally, reducing corporate fossil fuel extraction can help combat air pollution. A 2017 Carbon Majors Report by the Carbon Disclosure Project revealed that over 70% of greenhouse gas emissions are generated by just 100 companies, highlighting the significant impact of corporate activities on environmental pollution. The history of pollution traces back to the early days of human settlements. Pollution, categorised by its impact on air, water, and land, has evolved over time with modern society also grappling with newer forms such

[6] National Geographic Society. (2024, March 6). *Pollution*. Retrieved from https://education.nationalgeographic.org/resource/pollution/

[7] Nathanson, J. A. (2024, July 5). *Pollution*. In Editors of Encyclopaedia Britannica (Eds.). Encyclopaedia Britannica.

as noise, thermal, light, and plastic pollution. Historically, while environmental pollution could arise from natural events like forest fires or volcanic eruptions, the term usually points to contaminants stemming from human activities. As populations grew and settled in permanent locations, pollution emerged as a significant concern. Ancient cities were often plagued by unsanitary conditions due to human waste and debris. The use of coal as fuel from around 1000 CE and the subsequent conversion to coke for iron smelting in the 17th century exacerbated air pollution. In Europe, from the Middle Ages through the early modern era, these conditions led to disease outbreaks like plague, cholera, and typhoid fever. With the onset of industrialization and unprecedented population growth in the 19th century, pollution transformed into a widespread issue. Awareness of the need for environmental protection gained momentum in the mid-20th century. Rachel Carson's 1962 book "Silent Spring" highlighted the dangers of pesticides like DDT and their adverse effects on ecosystems. In response to growing environmental concerns, countries worldwide implemented significant environmental legislation, including the Clean Air Act (1970) and the Clean Water Act (1972) in the United States. The Intergovernmental Panel on Climate Change (IPCC), established in 1988, further emphasised the role of human activities in global warming. A 2018 IPCC report highlighted that human actions, particularly the burning of fossil fuels, have contributed to a global temperature increase between 0.8 and 1.2 °C since preindustrial times, underscoring the urgent need for environmental stewardship and sustainable practices.

Absolutely, education plays a pivotal role in shaping behaviours and attitudes towards the environment. A lack of awareness and understanding often leads to unsustainable practices that exacerbate environmental pollution. By integrating comprehensive environmental education into school curriculums and community programs, we can empower individuals to make informed decisions and adopt eco-friendly habits. Promoting the importance of recycling, reusing, and reducing waste can significantly mitigate the adverse effects of pollution. Furthermore, educating people on proper waste management practices, such as segregating recyclables, composting organic waste, and safely disposing of hazardous materials, can prevent soil and water contamination. Transportation is another significant contributor to pollution. Educating the public about the environmental impacts of vehicle emissions and promoting alternative modes of transportation like public transit, carpooling, and cycling can help reduce carbon emissions and improve air quality. Governments, NGOs, and educational institutions must collaborate to develop and implement effective environmental education

programs. These initiatives should emphasise the interconnectedness of human activities and environmental health, fostering a sense of responsibility and stewardship towards our planet. In conclusion, addressing environmental pollution requires a multifaceted approach that includes not only policy interventions and technological advancements but also a concerted effort to educate and raise awareness among the public. By investing in environmental education and promoting sustainable practices, we can pave the way for a greener, healthier future for all.

Addressing pollution through educational methods is essential for fostering awareness and promoting sustainable practices. Integrating environmental education into school curriculums can instil a sense of responsibility from a young age, while hands-on learning experiences like field trips and nature projects offer practical insights into environmental issues. Interactive workshops, seminars, and digital platforms can engage a broader audience, providing valuable information on pollution sources, impacts, and prevention strategies. Public awareness campaigns and community engagement initiatives further amplify the message, encouraging active participation in environmental stewardship. Collaborative projects involving schools, government agencies, and environmental organisations leverage collective expertise to address complex challenges. By empowering individuals and communities through education, we can inspire meaningful action, advocacy, and policy changes to combat pollution and promote a healthier, more sustainable future for all.[8]

[8] Denarius. (2023, March 1). *The Importance of Education in Preventing Environmental Pollution*. Medium. Retrieved from https://medium.com/@denariusdenr/the-importance-of-education-in-preventing-environmental-pollution-11e5423cd9b5

GOOD PRACTICES ON POLLUTION

"From a T-shirt to a Wreath"

Read the story titled From a T-shirt to a Wreath.

In the Kingdom of T-shirts, where waste shirts were alive and full of life, there lived a T-shirt named Lacosta. She was a creative and innovative T-shirt who dreamed of adventures outside her realm. One day, Lacosta found a box full of worn-out T-shirts that had been discarded due to stains and holes. She decided to join forces with these waste shirts and breathe new life into them in a different way - by making a wreath. With scissors in hand, an abundance of imagination, and considering that the entrance door to the Kingdom of T-shirts measures 90 cm wide and 220 cm high, Lacosta began to cut and knit, creating beautiful wreaths from recycled T-shirts. So every shirt got a new role, it became part of the wreath. Some t-shirts became colorful ornaments, others formed the basis of the wreath, and all were combined into a festive symphony of colors. Lacosta and her friends began to create fairy-tale wreaths. One day, when the first snow bleached the Kingdom of T-shirts, it was noticed that some T-shirts were losing their original color. Together, they investigated why this was happening and found that it was due to a lack of festive spirit. They decided to start making Advent wreaths and spread the joy of Christmas among the people. This is how Lacoste's wreath workshop was created, where people could bring their old t-shirts and turn them into festive wreaths. Wreaths could be shared with those who needed a little Advent charm. T-shirts have come to life again, now as part of the festive decorations, and the community has become even more united in the spirit of festive joy. Lacosta was lucky to be able to create not only wreaths, but also a festive atmosphere that warmed the hearts of all inhabitants of the Kingdom of T-shirts.

Based on what you read, answer the questions and write down the answers.

• Who were the heroes of the story?
• Where did the story take place?
• What was the problem with the Kingdom of T-shirts?
• How did the Kingdom of T-shirts deal with the problem?

0. In the left column of the table, write down the stages needed to make a wreath, and in the right, draw sketches of the individual stages of making a wreath.

0. When making a wreath, keep in mind that it should occupy no more than one third of the width of the door. At the appropriate stage of making the wreath, it is important to also observe the rule of the golden ratio, since the width of the perimeter against the size of the opening should be in a ratio of 1:1.6.

a) Calculate the diameter of the perimeter and the diameter of the finished wreath for the dimension of the door from the story.

b) Note the calculations in the table below. Note the calculated diameters on the corresponding sketch in the table from task 3.

c) Now that you have calculated the size of the wreath and made it, measure the wreath with a meter and compare the measurements with the calculated values. Write down the results in the table below. Do your calculations match the measurements?

	Calculated (cm)	Measured (cm)
Diameter of the wreath		
Circumference Diameter		
My findings:		

Continue the story in a way that incorporates the techniques you learned while making the wreath. You can write a story, draw a comic, make a presentation (using ICT tools) or a paper sticker, or record a short video story of making the wreath itself. The choice is yours.

How it was Implemented:

Photos of the activities carried out (the source of all is Grm Novo mesto – Centre of Biotechnology and Tourism).

Results/Impact: Advantages (strong points) of the activities carried out:

The activity is suitable for students of different ages. If students work in groups, collaborative learning and the development of teamwork skills are encouraged.

The use of recycled T-shirts to make wreaths promotes environmental awareness and educates about the possibilities of reusing materials.

The assignment develops reading and understanding of the text, as students had to read the story carefully in order to be able to answer questions and understand the course of events.

The assignment encourages creative thinking as students continue the story in a way that suits them best. Students can show their artistic side by drawing sketches of making a wreath or creating art products related to the story.

By making the wreath itself, motor skills are developed (e. g. cutting, knitting and creating are activities that can improve the motor skills of students).

It is important to plan and allocate time to complete all tasks.

Floriculture was associated with other subjects. With mathematics in mathematical calculations, where we included the principles of geometry, the golden ratio, measurement, etc. , with environmental protection in the reuse of waste T-shirts.

Measuring the actual wreath with a measuring tape allows students to gain experience by actually measuring and comparing the results with the calculated values.

Students can combine theoretical knowledge of the golden ratio rule with actual creation of a wreath, which strengthens the connection between theory and practice.

By selling wreaths at the charity bazaar, students became involved in the local environment/community.

Difficulties (weak points) of the activities carried out:

Limited time. Additional hours would be required to complete some phases.

Problems with mathematical calculations - students had to cope with the comprehension of the text and the recall of the mathematical knowledge needed to solve the tasks.

Recommendations:

Students could create sketches of their wreaths using a computer program, thus including ICT content.

After completing the assignment, students could be encouraged to think more about what they have learned and how they can use this knowledge in the future.

Chapter 4

Ecoremediations and revitalisations

Ecoremediation and revitalization are crucial strategies for restoring and improving degraded ecosystems, addressing environmental pollution, and promoting biodiversity conservation. Ecoremediation refers to the use of biological, chemical, or physical processes to remove or neutralise pollutants from soil, water, and air. Examples include phytoremediation, where plants are used to absorb and accumulate contaminants from soil and water, and bioremediation, which employs microorganisms to break down pollutants into less harmful substances. These eco-friendly techniques offer cost-effective and sustainable solutions for cleaning up polluted sites and restoring environmental quality. ERM methods may reduce and eliminate the consequences of natural disasters (floods, droughts, landslides, etc.), nonpoint pollution (agriculture, tourism, transport, industry, landfills and dispersed settlement). High efficiency may be achieved in the protection of the living environment, water resources, streams, rivers, lakes, groundwater and the sea. The basic functions of ERM involve great buffer, self-cleaning and habitat creation capacities. The purpose of the introduction of ERM is to recreate the conditions specific to natural systems, the diversity of biotopes and preservation of ecosystem balance.

Revitalization focuses on restoring and enhancing the ecological health and functionality of degraded ecosystems. This may involve reforestation efforts to combat deforestation, habitat restoration projects to support native flora and fauna, and the creation of green spaces to improve urban biodiversity and ecosystem services. Revitalization efforts often engage local communities, fostering environmental awareness, and promoting stewardship of natural resources. Together, ecoremediation and revitalization initiatives play a vital role in mitigating the impacts of pollution, conserving biodiversity, and fostering resilient, healthy ecosystems. By integrating these approaches into environmental management strategies, we can contribute to a more sustainable and harmonious relationship between humans and the natural world.

ERM (Eco-Restoration Management) is a versatile approach that promotes water retention, enhancing groundwater stability and habitat enrichment, boosting biodiversity, biomass growth, and improving landscape self-cleaning capabilities.

Additionally, ERM supports energy conservation and even energy generation. The key advantages of ERM methods include:

Cost-effectiveness and Environmental Friendliness: ERM methods require minimal financial investment and are environmentally sustainable, both functionally and aesthetically.

Multi-functional Benefits: They offer diverse benefits such as water retention, pollution reduction, ecosystem restoration, and increased biological diversity.

Simplicity and Acceptability: ERM procedures are straightforward, easily understandable, and environmentally sound.

Complementary to Existing Systems: They complement existing pollution prevention systems, like tertiary treatment in agriculture, food processing, and wastewater management.

Water Treatment and Recycling: ERM enables drinking water treatment and water recycling for irrigation purposes.

Prevention of Rapid Drainage: They help prevent quick drainage, aiding in water conservation.

Creation of Buffer Zones: ERM establishes mitigation areas, serving as air barriers.

Incorporation of Vegetation and Wetlands: They integrate vegetation zones and wetlands before water discharge into standing bodies of water.

Furthermore, ERM plays a vital educational role by fostering understanding of natural systems, environmental processes, and monitoring techniques like water treatment and heavy metal retention. Education is crucial for society's future, encouraging a shift in perspectives towards understanding nature's functioning. ERM provides an ideal learning environment for observing natural processes, benefiting both educational institutions and the public.

In practice, ERM can manifest in various forms such as constructed wetlands, sustainable landfill remediation, coastal vegetation zones, river diversions, artificial wetlands, noise and dust barriers, phytoremediation of contaminated sediments, soil treatment, drinking water purification, tertiary wastewater treatment, hazardous wastewater treatment, and watercourse revitalization.

The ecoremediation educational polygon is a specialised learning environment designed to educate and engage people in the principles and practices of

ecoremediation. The ecoremediation educational polygon serves as a classroom in nature,offering a unique learning environment that combines environmental education with hands-on experiences in ecosystem restoration and pollution control. This educational space utilises ecoremediation techniques to address environmental challenges while providing valuable insights into natural systems and processes. In the ecoremediation educational polygon, students and visitors can explore various ecoremediation methods, such as constructed wetlands, phytoremediation, and soil treatment, firsthand. They can witness how these techniques help in water retention, pollution abatement, and habitat restoration, contributing to biodiversity conservation and landscape enhancement. The polygon offers interactive learning opportunities, where participants can engage in practical activities like planting native vegetation, monitoring water quality, and observing wildlife. These experiences foster a deeper understanding of ecological principles, environmental stewardship, and the importance of sustainable practices. Moreover, the ecoremediation educational polygon emphasises the multi-functional benefits of ecoremediation, including energy conservation, water treatment, and the creation of buffer zones and mitigation areas. It showcases how these practices can be integrated into existing infrastructure and everyday life to promote environmental sustainability. By serving as a "classroom in nature," the ecoremediation educational polygon encourages active learning, critical thinking, and problem-solving skills. It inspires individuals to become responsible environmental citizens, capable of making informed decisions and taking action to protect and restore our planet's natural resources.

Key Features of the Ecoremediation Educational Polygon:

Interactive Demonstrations: The polygon features interactive displays and demonstrations of various ecoremediation techniques, such as constructed wetlands, phytoremediation, and soil treatment. Visitors can observe these methods in action and learn how they contribute to pollution control, habitat restoration, and biodiversity conservation.

Practical Workshops: Regular workshops and training sessions are conducted to provide participants with practical skills and knowledge in ecoremediation practices. These sessions may cover topics like water quality monitoring, native plant propagation, and ecosystem management.

Educational Signage: Informative signage and educational materials are strategically placed throughout the polygon to explain the science behind ecoremediation, its environmental benefits, and its applications in different contexts.

Research Opportunities: The polygon may also serve as a research facility, allowing scientists and students to conduct experiments, monitor environmental parameters, and evaluate the effectiveness of various ecoremediation techniques.

Community Engagement: Community members are encouraged to participate in volunteer programs, clean-up events, and citizen science projects hosted at the polygon. This fosters a sense of environmental stewardship and encourages local engagement in sustainability initiatives.

Environmental Monitoring: Advanced monitoring systems may be installed to track the progress of ecoremediation efforts, measure water quality, and assess the health of local ecosystems over time.

Collaborative Partnerships: The polygon may collaborate with educational institutions, government agencies, environmental organisations, and industry stakeholders to promote research, innovation, and best practices in ecoremediation.[9]

[9] Korže, A. V. (2013). *Ecoremediation (ERM) as a Sustainable Approach to Environmental Protection*. In *Proceeding the Economic Dimension of Land Degradation, Desertification and Increasing the Resilience of Affected Areas in the Region of Central and Eastern Europe (EDLDIR-2013)*. Mendel University in Brno Press. ISBN 978-80-7375-715-1.

GOOD PRACTICES

Eco-remediation training ground

As part of the Sustainable Development of Southeastern Slovenia with Ecoremediation project, a training ground was established educational center for the sustainable solution of environmental problems in Southeastern Slovenia with ecoremediation. Polygon is on the estate Grm Novo mesto – Center for Biotechnology and Tourism. Pilot training courses are set up at the training ground objects that enable recognition of the operation of ecoremediation systems. In addition to the built systems, they are on the training ground also natural cleaning systems. With the aim of recognizing the workings of nature and the possibilities that nature offers for preserving a healthy environment, a summer school is organised with a focus on the Grm Novo mesto training ground and on the existing training ground for ecoremediation in Modraže, in the municipality of Poljčane. The ERM workbook contains descriptions of ecoremediation systems prepared by Limnos d.o.o. as part of the Sustainable Development of Southeastern Slovenia project with ecoremediation.

How it was Implemented:

An eco-remediation training ground is being prepared at the institute Grm Novo mesto - Center for Biotechnology and Tourism on an area of 3 ha in the immediate vicinity of educational institutions (schools and a student dormitory). It is supposed to present ERM facilities in a real environment, which contribute to the solution of concrete environmental problems in south-eastern Slovenia.

The eco-remediation learning path will demonstrate the functioning of nature - its functions, such as regulating the amount of water and its purification, obtaining biomass and thus carbon dioxide sink, and increasing biodiversity.

The test site will have seven teaching observatories located in different natural habitats - in a coniferous forest, a scrubland, on a meadow, and more specific eco-remediation facilities will also be erected, such as an anti-dust barrier, an ERM ditch on agricultural land, an ERM arrangement of water accumulation and a plant cleaning device.

The sequence of learning observatories for the recognition of ecoremediation is as follows:

1. natural ecoremediation – coniferous forest
2. natural ecoremediation – scrubland
3. natural ecoremediation – meadow
4. vegetation belts – dust barrier
5. ERM trench on agricultural land
6. ERM regulation of water accumulation
7. plant treatment plant

Results/Impact: Advantages (strong points) of the activities carried out:

The programs for practical training at the training ground for ecoremediation in Grom Novo mesto are aimed at gaining experience and knowledge while working in the field of ecoremediation (ERM). ERM systems have already been established on the Grm Novo mesto property, namely on the water reservoir (cascade and floating island), dust barrier and ERM trench. A plant treatment plant has also been built on Trška gora, but no additional work will be carried out on it. ERMs in nature are evidence of the functioning of nature, so in many places they can only be transferred to the anthropogenic environment. At the training ground for ERM Grm Novo mesto, the forest, forest edge and meadow are three natural systems that have already been changed by man. That is why they must be arranged and equipped for educational purposes at the Grm Novo mesto training ground. The programs are linked to the new arrangements at the training ground for ERM Grm Novo mesto with the aim that the participants of individual programs will gain insight and practical experience of establishing ERM in nature. With practical knowledge, they will be able to solve problems in their own municipalities or at home. To spread interest in ERM, to give practical experience and to train people (especially young people) to know how to work ERM-systems is the goal of practical education programs. Through practical training, participants acquire:

– the ability to plan ERM arrangements on specific cases;

- the ability to connect causes and consequences in finding solutions for concrete problems in the environment;

– understanding ERM as natural cleaning systems with which we achieve self-cleaning abilities of nature and transfer them to the environment where it is man intervened and changed the functioning of nature;

– self-confidence, ability, ability to take one's own action at degradations in the environment using ERM knowledge (use of vegetation systems, natural materials and consideration of natural laws).

Chapter 5

Sustainable use of energy and raw materials

Sustainable use of energy and raw materials is vital for ensuring a harmonious balance between human activities and the natural environment, promoting long-term ecological resilience, and supporting socio-economic development. Adopting sustainable practices in energy consumption and resource management can help mitigate environmental degradation, reduce carbon emissions, and conserve valuable natural resources for future generations.

The escalating utilisation of natural resources has led to significant environmental repercussions, accounting for approximately half of the greenhouse gas emissions and contributing to 90% of biodiversity loss and water scarcity. While the global economy has expanded twofold since 1970, and extreme poverty rates have declined, the consumption of both renewable and non-renewable natural resources has tripled. This pattern has not only exacerbated environmental degradation but has also widened economic disparities, with the benefits of resource utilisation disproportionately accruing to a minority. Addressing this complex challenge necessitates a multifaceted approach involving political decision-makers, businesses, local governments, organisations, and citizens committed to fostering sustainable practices. Recognizing nature as a vital asset underscores the imperative for a holistic approach to resource management that ensures well-being for people, animals, plants, and the stability of our political and economic systems.

Strategies for Sustainable Resource Utilization

Technological and Social Innovations: Leveraging technological advancements and social innovations can enhance resource efficiency, foster sustainable business models, and promote quality of life over consumption-driven growth.

Policy Frameworks: Political leaders and policymakers play a pivotal role in shaping sustainable resource management through legislation and regulations that set environmental standards and incentivize companies to exceed them.

Consumer Influence: Citizens and consumers wield considerable influence through their purchasing choices, demanding sustainably produced goods and services and supporting companies that prioritise environmental stewardship.

Resource Efficiency and Recycling: Improving resource efficiency, combating climate change, protecting biodiversity, and promoting sustainable consumption are essential strategies for achieving a more sustainable resource use paradigm. Recycling and circular economy principles can significantly reduce the demand for virgin raw materials.

Critical Considerations for Sustainable Resource Management

Resource Allocation: Assessing the optimal utilisation of critical raw materials across sectors such as transport, energy production, and electronics requires careful consideration of trade-offs and long-term impacts.

Compensatory Measures: Addressing material shortages resulting from increased recycling efforts or utilising edible materials for fuel necessitates innovative solutions to balance competing needs and ensure food security.

Material Life Cycle: Determining the primary use of raw materials for textiles, packaging, or electronics and developing effective recycling systems to minimise reliance on virgin resources is crucial.

Holistic Assessment and Collaboration

Life Cycle Analysis: Adopting a life cycle approach to evaluate the environmental impacts of resource utilisation helps identify the most effective and sustainable solutions.

Collaborative Decision-making: Engaging multiple stakeholders in decision-making processes ensures that the burden is not merely shifted from one sector to another but leads to solutions beneficial to all parties involved.

In conclusion, transitioning towards sustainable resource utilisation requires concerted efforts, innovative solutions, and collaborative partnerships across

sectors. By adopting a holistic approach that balances economic development with environmental stewardship and social equity, we can create a more resilient and sustainable future for all.

Raw materials play an indispensable role in achieving the Sustainable Development Goals (SDGs). The SDGs, established by the United Nations, are a universal call to action to end poverty, protect the planet, and ensure prosperity for all by 2030. Raw materials are the basic substances that are used to produce goods and services, and they are essential for various industries such as manufacturing, construction, energy, and technology.

Role of Raw Materials in Achieving the SDGs

-Economic Growth and Innovation (SDG 8): Raw materials are fundamental to various industries, driving economic growth, fostering innovation, and creating employment opportunities.

-Energy Transition (SDG 13 & 7): Essential raw materials like lithium and cobalt are crucial for renewable energy technologies, facilitating the shift towards a low-carbon economy and ensuring affordable and clean energy for all.

-Responsible Consumption and Production (SDG 12): Sustainable sourcing and recycling of raw materials promote responsible consumption patterns, minimise waste, and contribute to a circular economy.

-Healthcare and Technology (SDG 3 & 9): Raw materials underpin advancements in healthcare and technological innovation, supporting breakthroughs in medical treatments and technological solutions.

-Biodiversity and Ecosystem Preservation (SDG 15): Responsible extraction practices and reforestation efforts are vital for preserving biodiversity and protecting ecosystems.

-Infrastructure Development (SDG 9): Raw materials are essential for building robust infrastructure, including roads, bridges, and communication networks, promoting industrialization and innovation.

-Clean Water and Sanitation (SDG 6): Raw materials play a role in water treatment processes, ensuring access to clean and safe water for communities.

Raw materials play a critical role in the pursuit of sustainable development, underpinning the achievement of multiple Sustainable Development Goals (SDGs) such as economic growth, energy transition, and responsible

consumption. However, their extraction, production, and consumption must be managed responsibly to balance economic prosperity with environmental and social considerations. To achieve this balance, empowering rural communities through education and skill development can ensure equitable sharing of benefits from raw material extraction, aligning with SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth). Strengthening global partnerships and collaborations (SDG 17) can foster knowledge exchange and best practices in sustainable resource management, while prioritising social equity and justice (SDG 10) through ethical sourcing and fair labour practices is essential for promoting inclusive growth. Additionally, ensuring disaster resilience (SDG 11), promoting sustainable agriculture (SDG 2), and advancing gender equality (SDG 5) are vital components of holistic raw material management. Through collaborative efforts, innovation, and ethical practices, we can harness the potential of raw materials to build a sustainable and equitable future, aligning with the vision of the Sustainable Development Goals by 2030.

The use of natural resources and raw materials in education is a multifaceted topic that encompasses various aspects of environmental sustainability, curriculum development, and experiential learning. Integrating the concept of natural resource utilisation into educational settings can provide students with valuable insights into the importance of responsible resource management, environmental conservation, and sustainable development. Natural resources and raw materials can be incorporated into education in multiple ways.[10]

- Experiential Learning and Outdoor Education: Utilising natural materials in outdoor education programs can offer students hands-on experiences with the environment. Activities such as nature walks, gardening, and forestry projects can help students develop a deeper appreciation for nature, understand ecological systems, and learn about sustainable land management practices.
- Technology and Innovation: Integrating technology and innovation in education can highlight the importance of raw materials in technological advancements. Students can explore the lifecycle of products, from raw material extraction to manufacturing and recycling, gaining insights into the environmental and social impacts of consumerism.
- Critical Thinking and Problem-Solving: Engaging students in discussions and activities that address complex environmental issues related to natural

[10] Finnish Environment Institute (Syke). (2023, May 4). *Use of natural resources and raw materials*. Updated 2024, June 25. Retrieved from https://www.ymparisto.fi/en/sustainable-circular-and-bioeconomy/use-natural-resources-and-raw-materials

resource depletion, climate change, and biodiversity loss can foster critical thinking and problem-solving skills. Encouraging students to analyse, evaluate, and propose solutions to these challenges prepares them to be informed and responsible global citizens.

- Cultural and Ethical Perspectives: Exploring the cultural, ethical, and indigenous perspectives on natural resource use and conservation can broaden students' understanding of the interconnectedness of human societies and the environment. Recognizing and respecting diverse cultural practices and values related to natural resources can foster empathy, respect, and appreciation for cultural diversity.

In conclusion, incorporating natural resources and raw materials into education offers a holistic approach to learning that emphasises environmental stewardship, sustainability, and global citizenship. By providing students with opportunities to explore, engage, and reflect on the complexities of natural resource utilisation, educational institutions can empower them to make informed decisions and contribute positively to creating a more sustainable and equitable future.

Here are some engaging activities that incorporate the use of natural resources and raw materials in education across different subjects and age groups:

Science and Ecology Activities:

Nature Walk and Observation: Take students on a nature walk to observe different ecosystems, plants, and wildlife. Discuss the importance of biodiversity, habitat conservation, and the role of natural resources in supporting life.

Recycling Sorting Game: Organise a recycling sorting game where students learn to categorise different materials into recyclable, compostable, and landfill categories. Discuss the environmental benefits of recycling and waste reduction.

Water Quality Testing: Conduct water quality testing activities using simple kits to analyse the pH, turbidity, and pollution levels of local water sources. Discuss the importance of clean water and conservation.

Social Studies and Geography Activities:

Resource Mapping: Have students create maps that identify and locate natural resources in their region, such as forests, rivers, minerals, and agricultural lands. Discuss the economic, social, and environmental significance of these resources.

Case Studies: Analyse case studies of countries or communities that have implemented sustainable resource management practices. Discuss the challenges, successes, and lessons learned.

Cultural Exploration: Explore the cultural significance of natural resources in different societies. Discuss indigenous knowledge, traditional practices, and ethical considerations related to resource use.

Mathematics and Technology Activities:

Carbon Footprint Calculation: Use online calculators or worksheets to help students calculate their carbon footprint based on their daily activities and consumption patterns. Discuss ways to reduce carbon emissions and promote sustainability.

Data Analysis: Analyse data related to resource consumption, waste generation, and environmental impacts using graphs, charts, and spreadsheets. Discuss trends, patterns, and potential solutions.

Technology Showcase: Research and present innovative technologies that utilize natural resources sustainably, such as renewable energy systems, green building materials, and water-saving technologies.

Arts and Crafts Activities:

Natural Artwork: Encourage students to create artwork using natural materials like leaves, twigs, and stones. Discuss the beauty of nature and the importance of preserving it.

Upcycling Projects: Organise upcycling projects where students repurpose discarded materials to create useful items or art pieces. Discuss the concept of waste reduction and creative reuse.

Community Engagement and Service Learning:

Community Garden Project: Collaborate with local communities to establish a school or community garden. Involve students in planting, maintaining, and harvesting organic produce while learning about sustainable agriculture and food systems.

Environmental Cleanup: Organise environmental cleanup events in local parks, beaches, or waterways. Engage students in hands-on activities to collect litter, remove invasive species, and restore natural habitats.

Awareness Campaigns: Plan and implement environmental awareness campaigns or workshops in the school or community to educate others about the importance of sustainable resource management and conservation.

These activities can be adapted and modified to suit different educational settings, age groups, and learning objectives. By incorporating hands-on experiences, critical thinking exercises, and collaborative projects, these activities can help students develop a deeper understanding of natural resources, environmental sustainability, and their role as responsible global citizens.

Good practices on sustainable use of energy and raw materials

Energy saving and “zero km” milk in the school’s cheese factory

Regarding good practices for the sustainable use of energy and raw materials, we focused on activities that take place in our school dairy factory.

How it was Implemented:

1.The use of milk from local cowsheds for educational activities has been increased. For the cheeses that the school sells in its shop, the milk is delivered in bins from a supplier located a few metres from the school, or it comes directly from farmers who deliver their milk for processing. In this case, the products are then collected from the deliverers for direct sale in their shops or farmers' markets, without transport to areas far from the farm. In previous years, milk was purchased from a large milk centre and the products sold to traders who then distributed them in their shops. This change of policy reduces the amount of fuel needed to transport milk and processed products over long distances and focuses on the environmental sustainability of consumer products.

2.New equipment for washing moulds and tools has been installed at the school’s cheese factory, which allows a judicious use of water and detergent. In this way, for washing the material used during teaching exercises, water consumption is very low. Electricity consumption is also lower as the washing cycles are very short. Previously, materials were washed by hand, which consumed a lot of water, energy to produce steam for its heating and detergent.

3.Also in a logic of raw material recovery, a special nozzle has been installed on all the rubber hoses of the water used for cleaning in the dairy, which reduces the

flow and consumption of water. This saves a considerable amount of water that would otherwise be wasted in the sewerage system.

4.To reduce water consumption during cheese production, a pump was introduced to recover the ice-cold water that is used to cool the milk after pasteurisation. With this new system, the water is recovered and recirculated with 100% recovery, as it remains in a closed circuit. Previously, disposable water was used.

5.In order to disseminate these good practices to customers, a QRcode will be produced for each product of the dairy, which will link to a sheet describing not only the characteristics of the cheese, but also information on the supply of zero-mile milk and on water and energy consumption.

Results/Impact:

The first important result of these activities was to raise the students' awareness of the importance of saving energy and raw materials. In this way, they will be able to participate in a new way of dealing with these issues in their future work as well. Secondly, these actions have led to an important reduction in water and electricity consumption, which at the moment it has not yet been possible to quantify, but which can be done in the future with a specific consumption analysis. Last but not least, attention was drawn to the topic of 'zero-mile”' products and the issue of correct consumer information.

EXAMPLES OF GOOD PRACTICES

Chapter 6

Sustainable management

From the perspective of history, the concept of sustainability was formulated at the first United Nations Conference on the Environment in 1972, but it has only really taken shape since 1987, when the Brundtland Report ("Our Common Future") clarified the objectives of sustainable development. The same study proposed the three pillars or concepts of environmental, social, and economic sustainability, sometimes referred to as ESG. The transition to sustainable development is largely based on a set of international agreements and goals, which are subsequently implemented at the individual state and community levels. Some of the most well-known are: The United Nations Framework Convention on Climate Change and related protocols aim to limit greenhouse gas emissions.[11]

Sustainability management has progressed greatly from its inception in the 1970s, when it was largely seen as a regulatory need to comply with environmental legislation. During this period, many industry executives saw environmental protection as a danger to their profits rather as an essential component of their economic strategy.

A 1974 Conference Board poll confirmed this viewpoint, finding that environmental management was mostly viewed as a necessary evil rather than a value-adding project. However, by the 1980s, there was a gradual shift in perspective as some forward-thinking businesses began to view environmental stewardship as a social obligation, albeit one that was frequently ranked low on the list of organisational objectives.

The turning point came in 1995 when Harvard professor Michael Porter argued in the Harvard Business Review that environmental conservation may provide corporations with a competitive edge. This viewpoint shook old thinking and ushered in a new age of sustainable corporate operations. Since Porter's groundbreaking paper, several studies have confirmed the benefits

[11] University of Central Lancashire. (2022, October 10). *What is sustainable management?* Retrieved from https://onlinestudy.uclan.ac.uk/resources/what-is-sustainable-management-and-why-is-it-important

of sustainability management, indicating that organisations that embrace environmental and social responsibility frequently have lower utility costs, more customer loyalty, and more investor backing. Today, sustainability management is the new normal, with many organisations, communities, and enterprises incorporating sustainable practices into their basic strategy and operations. Sustainability is becoming increasingly important as a vital engine of innovation, resilience, and long-term success.

Sustainable management integrates environmental, social, and economic considerations into business strategies to create a balanced and resilient business model that benefits current and future generations. This approach emphasises environmental stewardship by reducing resource consumption and promoting renewable energy, while also focusing on social responsibility through fair labour practices and community engagement. Economically, sustainable management aims to balance profitability with ethical considerations, driving long-term value creation through innovation and responsible supply chain management. By fostering transparency, accountability, and stakeholder engagement, businesses can mitigate risks, achieve cost savings, gain competitive advantage, and enhance their reputation. Through strategic planning, employee engagement, performance measurement, collaboration, and continuous improvement, sustainable management enables organisations to adapt to changing market dynamics, regulatory landscapes, and societal expectations, positioning them for long-term success in a rapidly evolving global landscape.

A. Environmental Considerations: Sustainable management prioritises environmental sustainability by implementing practices that reduce carbon footprint, minimise waste, conserve resources, and promote the use of renewable energy. This proactive approach not only mitigates environmental risks but also positions businesses to adapt to regulatory changes and consumer demands for eco-friendly products and services.

A1. Resource Management: Efficient use and conservation of natural resources, including water, energy, and raw materials, are critical components of sustainable management. Adopting circular economy principles, where resources are reused, recycled, or repurposed, can significantly reduce environmental impact.

A2. Carbon Footprint: Businesses can minimise their carbon footprint by transitioning to renewable energy sources, improving energy efficiency, and implementing carbon offsetting initiatives. This not only reduces greenhouse gas emissions but also positions companies as leaders in combating climate change.

A3. Waste Reduction: Implementing waste reduction and recycling programs can help businesses minimise landfill waste and promote a more sustainable approach to resource management. This can result in cost savings and demonstrate a commitment to environmental responsibility.

B. Social Responsibility: Social aspects of sustainable management encompass fair labour practices, diversity and inclusion, employee well-being, and community engagement. By investing in their workforce and local communities, businesses can enhance their reputation, foster employee loyalty, and build stronger relationships with stakeholders, leading to long-term success and resilience.

B1. Fair Labor Practices: Ensuring fair wages, safe working conditions, and equal opportunities for all employees are essential aspects of social responsibility. Businesses that prioritise these practices can attract and retain talent, foster employee satisfaction, and enhance their reputation.

B2. Diversity and Inclusion: Promoting diversity and inclusion within the workforce can drive innovation, improve decision-making, and create a more equitable workplace. By embracing diversity, businesses can better reflect the communities they serve and strengthen their competitive edge.

B3. Community Engagement: Engaging with local communities through philanthropic initiatives, volunteering, and partnerships can build trust, enhance brand reputation, and create positive social impact. Businesses that actively contribute to community development can foster goodwill and long-term loyalty among stakeholders.

C. Economic Viability: From an economic perspective, sustainable management aims to balance profitability with ethical considerations. By integrating sustainability into business strategies, companies can identify cost-saving opportunities, drive innovation, and gain a competitive advantage in the marketplace. Moreover, responsible supply chain management ensures transparency, accountability, and resilience against supply chain disruptions, safeguarding business continuity and profitability.

C1. Cost Savings: Sustainable management practices, such as energy efficiency improvements and waste reduction initiatives, can lead to significant cost savings over time. By optimising resource use and reducing operational inefficiencies, businesses can improve their bottom line while minimising environmental impact.

C2. Innovation: Embracing sustainability can drive innovation by encouraging the development of new products, services, and business models that meet environmental and social needs. Companies that innovate sustainably can differentiate themselves in the market and capture new opportunities for growth.

C3. Responsible Supply Chain Management: Ensuring ethical sourcing, transparency, and accountability throughout the supply chain can mitigate risks associated with environmental, social, and governance (ESG) factors. Responsible supply chain management can enhance resilience, safeguard brand reputation, and meet evolving consumer expectations for responsible business practices.

D. Strategic Integration: Sustainable management requires a strategic approach that integrates environmental, social, and economic goals into core business operations and decision-making processes. This holistic approach fosters collaboration across departments, encourages cross-functional innovation, and aligns business objectives with global sustainability frameworks.

D1. Cross-functional Collaboration: Sustainable management requires collaboration across various departments, including operations, marketing, finance, and human resources. By integrating sustainability into strategic planning and decision-making processes, businesses can align organisational goals and drive collective action towards sustainability objectives.

D2. Alignment with Global Frameworks: Aligning business strategies with global sustainability frameworks, such as the Sustainable Development Goals (SDGs) and the Paris Agreement, can provide a roadmap for action and ensure that companies' efforts contribute to broader societal and environmental goals.

E. Stakeholder Engagement: Effective sustainable management involves engaging with a diverse range of stakeholders, including employees, customers, investors, regulators, and communities. By fostering open communication and collaboration, businesses can gain valuable insights, build trust, and co-create solutions that address shared challenges and create shared value.

E1. Open Communication: Building transparent and open communication channels with stakeholders, including employees, customers, investors, and regulators, is crucial for understanding their expectations, concerns, and priorities related to sustainability.

E2. Collaboration and Partnership: Engaging stakeholders in collaborative initiatives and partnerships can facilitate knowledge sharing, co-creation of solutions, and collective action to address shared challenges and opportunities.

E3. Feedback and Continuous Improvement: Actively seeking feedback from stakeholders and incorporating their insights into decision-making processes can help businesses identify areas for improvement, refine sustainability strategies, and demonstrate a commitment to stakeholder engagement and accountability.

Each consideration of sustainable management plays a vital role in creating a balanced and resilient business model that integrates environmental stewardship, social responsibility, and economic viability. By analyzing and addressing these considerations effectively, businesses can mitigate risks, seize opportunities, and contribute to building a sustainable future for all stakeholders.

Sustainable development is built around three core pillars: economic growth, social equity, and environmental protection. To experience economic growth, a business must also take social equity and its effect on the environment into consideration. The World Business Council for Sustainable Development (WBCSD) champions the principles of sustainable management by aligning businesses with the core tenets of economic growth, social equity, and environmental protection. Through initiatives like Vision 2050: Time to Transform, the WBCSD provides a strategic framework that guides businesses along nine transformation pathways, ranging from energy to food systems. This comprehensive approach mirrors the evolution of sustainable management, emphasizing collaboration, innovation, and stakeholder engagement. By aligning with global goals such as the Sustainable Development Goals (SDGs) and the Paris Agreement targets, the WBCSD ensures that businesses' sustainability efforts contribute to broader societal and environmental objectives. In doing so, the council paves the way for businesses to drive transformative change, creating a resilient and sustainable future where all people can thrive within planetary boundaries by 2050. The circular economy is an economic model that aims to design out waste and keep products and materials in use for as long as possible. Unlike the traditional linear economy, which follows a "take-make-dispose" pattern, the circular economy focuses on reducing resource consumption, reusing products and materials, and recycling waste to create a closed-loop system.

Don’t waste food

We invite you to join the food waste monitoring and find out if food waste is a problem in your institution. Encourage children, pupils, students, employees and parents to think about social, environmental and economic problems related to wasted food.

The food we throw away represents wasted water, energy and natural wealth. That's why we need to find solutions to reduce waste as much as possible - also in the field of food.

OBJECTIVES:

Reduce and prevent food waste at home and at school.

Encourage the practical use of unused food and show the correct way of storing food products (a master chef is not one who cooks well and creates a lot of waste, but one who thoughtfully buys and uses all the ingredients).

Properly recycle and dispose of food scraps (composting and separate disposal in a biological waste container).

Increase awareness of responsible food handling.

Educate about responsible handling of food and food waste

How it was Implemented:

By implementing various activities (food waste diary, recycled food recipes, art-graphic and literary prize competition) on the topic of reducing wasted food, step by step you will arrive at useful solutions at the system and awareness level.

Results/Impact:

The most valuable results are cooking books, available on following links:

https://ekosola.si/wp-content/uploads/2023/04/Reciklirana-kuharija-2023.pdf

https://ekosola.si/wp-content/uploads/2022/06/Reciklirana-kuharija-2022.pdf

https://ekosola.si/wp-content/uploads/2021/06/reciklirana-kuharija-2021-FINAL-E-verzija.pdf

https://ekosola.si/wp-content/uploads/2020/07/Knji%C5%BEica-Reciklirana-kuharija-2020.pdf

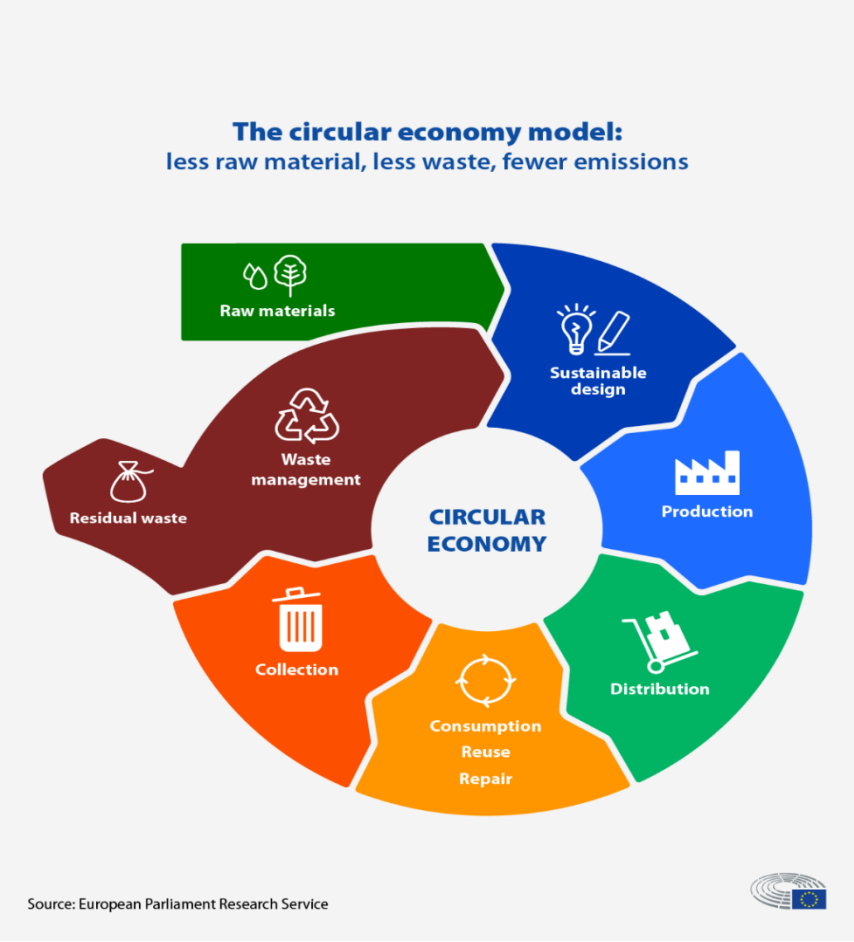
https://ekosola.si/wp-content/uploads/2019/09/Knjizica-Receptov-2019.pdf

Chapter 7

Circular economy and zero waste

The circular economy requires a system change.

The circular economy is an economic model that aims to design out waste and keep products and materials in use for as long as possible. Unlike the traditional linear economy, which follows a "take-make-dispose" pattern, the circular economy focuses on reducing resource consumption, reusing products and materials, and recycling waste to create a closed-loop system.



Key Principles of Circular Economy

Design for Longevity and Reusability: Products are designed to last longer, be easily repaired, and eventually recycled or repurposed. This extends the lifespan of products and reduces the need for new resources.

Resource Efficiency: Maximizing the use of resources through efficient production processes, waste reduction, and recycling helps minimize environmental impact and conserve natural resources.

Waste Prevention and Valorization: Emphasizing waste prevention strategies and transforming waste into valuable resources through recycling, upcycling, and composting contributes to a more sustainable and resource-efficient economy.

Closed-Loop Systems: Creating closed-loop systems where materials are continuously reused and recycled within the production cycle reduces the reliance on virgin resources and minimizes waste generation.[12][13]

Benefits of Circular Economy

Environmental Sustainability: By reducing resource consumption, minimizing waste, and promoting recycling, the circular economy helps mitigate environmental degradation, conserve natural resources, and combat climate change. Utilizing reusing and recycling practices can decelerate the depletion of natural resources, minimize disturbances to landscapes and habitats, and mitigate the loss of biodiversity.

The circular economy also offers the advantage of reducing annual greenhouse gas emissions. As per the European Environment Agency, industrial activities and product usage contribute to 9.10% of greenhouse gas emissions in the EU, while waste management accounts for 3.32%. Developing more efficient and sustainable products from inception can decrease energy and resource utilization. It's estimated that over 80% of a product's environmental impact is established during its design stage. Transitioning to more durable products that can be reused, updated, and repaired can diminish waste generation. Packaging presents a

[12] **European Parliament - Circular Economy: Definition, Importance, and Benefits:** European Parliament. (2020). *Circular Economy: Definition, Importance, and Benefits*. Retrieved from European Parliament.
[13] **Circular Economy Action Plan (2020) - EU:** European Commission. (2020). *Circular Economy Action Plan*. COM(2020) 98 final. Retrieved from EUR-Lex

growing concern, with the average European generating nearly 180 kilos of packaging waste annually. The goal is to address excessive packaging and enhance its design to encourage reuse and recycling.

Economic Growth: The circular economy can stimulate economic growth by creating new business opportunities, driving innovation, and fostering job creation in sectors such as recycling, remanufacturing, and waste management.

As the global population expands, so does the demand for essential raw materials. However, the availability of these critical resources is finite. The limited availability of raw materials also leads to dependency for some EU countries, as indicated by Eurostat, with approximately half of the raw materials consumed in the EU being imported. The trade value of raw materials between the EU and the rest of the world has nearly tripled since 2002, with exports outpacing imports in growth. Nevertheless, the EU continues to have a trade deficit, amounting to €35.5 billion in 2021. Recycling raw materials helps mitigate supply-related risks, such as price fluctuations, availability issues, and reliance on imports. This is particularly relevant for critical raw materials essential for manufacturing technologies pivotal to achieving climate objectives, like batteries and electric engines.

Transitioning to a circular economy has the potential to enhance competitiveness, foster innovation, spur economic growth, and generate employment opportunities. It's projected that the shift could create around 700,000 jobs in the EU by 2030. Redesigning materials and products with circularity in mind can catalyze innovation across various sectors of the economy, driving sustainable practices and solutions. Furthermore, consumers stand to benefit from more durable and innovative products. These products not only improve quality of life but also offer long-term cost savings, making sustainable choices more appealing and accessible.

Social Equity: Promoting inclusivity, fair labor practices, and community engagement within the circular economy framework can contribute to social equity, improve livelihoods, and enhance quality of life for communities.

Resilience and Security: Building a resilient and diversified supply chain through circular economy principles can reduce dependency on finite resources, mitigate supply chain risks, and enhance business continuity and security.

Challenges and Considerations

The transition to a circular economy faces numerous barriers across institutional, cultural, financial, regulatory, and technological domains. Addressing these challenges requires comprehensive policy interventions and collaborative efforts across various sectors and stakeholders. Some of the key barriers include:

Transitioning from Linear to Circular: Shifting from a linear to a circular economy requires significant changes in business practices, consumer behavior, and regulatory frameworks. It necessitates collaboration across sectors and stakeholders to overcome barriers and facilitate the transition. A transition from a linear economy to a circular economy is essential to alleviate environmental pressures and enhance the security of primary raw material supply. In this new paradigm, guided by the principles of "reduce, reuse, and recycle," the extraction of primary resources is minimized by extending the lifespan of existing resources and materials. This shift towards circularity not only conserves valuable resources but also promotes sustainable practices that benefit both the environment and the economy.

Externalities and Resource Pricing: The lack of internalization of externalities and resource pricing hampers the efficient use of resources and discourages the transition to a circular economy.

Skills and Investment: Insufficient investment in circular product design and production, as well as a lack of skills in circular practices, hinder the adoption of reuse, repair, remanufacturing, and recycling.

Enablers for Cross-Cycle Performance: Limited alignment of power and incentives across value chains impedes collaboration and innovation in circular practices.

Consumer and Business Acceptance: Resistance to new consumption models such as leasing and performance-based payment models, as well as a lack of awareness about the circular economy among consumers and businesses, pose significant barriers.: Educating consumers about the benefits of the circular economy and encouraging sustainable consumption patterns are essential to drive demand for circular products and services.

Know-How and Economic Incentives: Lack of economic incentives for repair and reuse, as well as insufficient consumer information on product origins and perishability, contribute to low adoption of circular practices.

Waste Separation and Sustainable Procurement: Inadequate waste separation infrastructure and limited sustainable procurement incentives by public authorities hinder progress towards a circular economy.

Investment in Recycling Infrastructure: Insufficient investment and innovation in recycling and recovery infrastructure and technologies, along with the lock-in of existing technologies, impede circularity. Investing in research, development, and innovation is crucial to developing sustainable technologies, processes, and business models that support the circular economy transition.

Transport Flow Harmonization: Lack of harmonization of transport flows within and between municipalities leads to logistical challenges and confusion among shippers and transporters.

Policy Coherence and Finance: Weak policy coherence, challenges in obtaining suitable finance for circular economy business models, and widespread planned obsolescence within product chains further complicate the transition. Implementing supportive policies, regulations, and incentives can accelerate the adoption of circular economy principles and create an enabling environment for businesses to innovate and invest in sustainable solutions.

The European Union has been proactive in advancing the transition to a circular economy through various policy initiatives and legislative actions. Here's a summary of the key developments:

Circular Economy Action Plan (March 2020)

The European Commission introduced the Circular Economy Action Plan to promote sustainable product design, reduce waste, and empower consumers. The plan focuses on resource-intensive sectors like electronics and ICT, plastics, textiles, and construction. One of the notable measures is the "right to repair," which aims to extend the lifespan of products and reduce electronic waste.

The European Commission's new action plan for the circular economy outlines ambitious objectives aimed at transforming the EU's economy into a more sustainable and circular model. The key objectives include:

Making Sustainable Products the Norm: The action plan aims to promote the adoption of sustainable products across various sectors, making eco-friendly options more accessible and prevalent in the EU market.

Empowering Consumers and Public Buyers: The plan seeks to empower consumers and public buyers by providing them with information, tools, and incentives to make informed and sustainable choices.

Targeting Resource-Intensive Sectors: The action plan focuses on sectors that use significant resources and have high potential for circularity, such as electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water, and nutrients.

Reducing Waste: One of the primary objectives is to minimize waste generation by promoting reuse, repair, remanufacturing, and recycling across all stages of the product lifecycle.

Promoting Circularity for People, Regions, and Cities: The plan aims to ensure that the benefits of the circular economy are realized at the individual, regional, and urban levels, fostering inclusive and sustainable development.

Leading Global Efforts on Circular Economy: The EU intends to take a leadership role in global efforts to advance the circular economy, setting standards, and promoting best practices internationally.

Actions to Be Implemented

The European Commission has committed to implementing all 35 actions listed in the new action plan. These actions encompass a wide range of initiatives, including regulatory measures, financial incentives, research and innovation support, consumer awareness campaigns, and public procurement strategies.

By pursuing these objectives and actions, the EU aims to accelerate the transition to a circular economy, reduce environmental impact, create new job opportunities, foster innovation, and improve resource efficiency across the continent. The successful implementation of the action plan will be crucial in achieving the EU's long-term sustainability goals and positioning the EU as a global leader in the circular economy.

Parliament Resolution (February 2021)

The European Parliament adopted a resolution supporting the Circular Economy Action Plan and calling for additional measures to achieve a carbon-neutral, environmentally sustainable, toxic-free, and fully circular economy by 2050. The resolution emphasizes tighter recycling rules and sets binding targets for materials use and consumption by 2030.

First Package of Measures (March 2022)

The European Commission released the first package of measures to accelerate the transition towards a circular economy, in line with the Circular Economy Action Plan. The proposals include initiatives to boost sustainable products, empower consumers for the green transition, review construction product regulations, and develop a strategy on sustainable textiles.

EU-wide Rules on Packaging (November 2022)

In November 2022, the Commission proposed new EU-wide rules on packaging to reduce packaging waste and improve packaging design. The rules advocate for clear labeling to promote reuse and recycling and call for a transition to bio-based, biodegradable, and compostable plastics.

These policy initiatives demonstrate the EU's commitment to advancing the circular economy, reducing environmental impact, and promoting sustainable consumption and production practices. By implementing these measures, the EU aims to create a more resilient, resource-efficient, and environmentally friendly economy that benefits both people and the planet.

The circular economy offers a promising alternative to the traditional linear economy by promoting resource efficiency, waste reduction, and sustainable consumption and production practices. Embracing circular economy principles can lead to environmental sustainability, economic growth, social equity, and resilience. However, transitioning to a circular economy requires concerted efforts from businesses, governments, and consumers to overcome challenges, drive innovation, and create a more sustainable and inclusive future for all.[14]

ZERO WASTE

Waste is often a manifestation of broader systemic issues related to consumption patterns, production processes, economic models, and cultural norms. The zero waste philosophy goes beyond just managing waste; it seeks to address the root causes of wastefulness by promoting a fundamental shift in how we think about resources, consumption, and sustainability. Zero waste is a philosophy and a set of principles aimed at reducing the amount of waste produced by individuals, businesses, and communities. The goal of zero waste is to minimize the generation of waste, maximize recycling, composting, and reuse, and ensure that

[14] **Drivers and Barriers in the Transition from a Linear Economy to a Circular Economy:** Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2021). Drivers and barriers in the transition from a linear economy to a circular economy. *ResearchGate*. Retrieved from ResearchGate.

products are designed to be reused or recycled at the end of their lifecycle. Here's a closer look at the concept of zero waste and its key principles:

Key Principles of Zero Waste

- Reduce: The first step in achieving zero waste is to minimize the generation of waste by reducing consumption, opting for durable and long-lasting products, and avoiding single-use items.
- Reuse: Reusing products and materials is essential in a zero waste approach. This includes repairing, refurbishing, and repurposing items to extend their lifespan and reduce the need for new products.
- Recycle: Recycling is the process of converting waste materials into new products. In a zero waste system, recycling plays a crucial role in diverting waste from landfills and reducing the demand for raw materials.
- Compost: Composting organic waste, such as food scraps and yard waste, turns it into nutrient-rich compost that can be used to enrich soil and reduce the need for chemical fertilizers.
- Redesign: Redesigning products and packaging to be more durable, repairable, and recyclable is essential in achieving zero waste. This involves adopting circular design principles that consider the entire lifecycle of products.

The Zero Waste International Alliance (ZWIA) plays a crucial role in promoting and defining the concept of Zero Waste globally. Establishing internationally accepted standards and definitions is essential for ensuring consistency and clarity in the implementation of Zero Waste practices across different regions and communities. The adoption of the first peer-reviewed definition of Zero Waste by the Planning Group of ZWIA in 2004 marked a significant milestone in the Zero Waste movement. This definition serves as a guiding framework for organizations, businesses, and individuals striving to minimize waste generation, maximize recycling, and reduce the overall environmental impact of our consumption patterns.

The Zero Waste International Alliance:

- initiates and facilitates research and information sharing for the promotion of Zero Waste
- builds capacity to effectively implement Zero Waste
- sets standards for evaluating the achievement of Zero WasteThe commitment of ZWIA to advancing Zero Waste principles is commendable, and their efforts continue to inspire and drive positive change towards a more sustainable and circular economy worldwide.[15][16]

Benefits of Zero Waste

Waste initiatives not only protect the environment but also stimulate economic growth, create jobs, and foster community engagement:

- Environmental Protection

Zero waste practices reduce the environmental impact of waste disposal by minimizing pollution, conserving natural resources, and mitigating climate change. By embracing a circular economy approach, where resources are reused, recycled, and regenerated, communities can significantly reduce their carbon footprint and environmental degradation.

- Economic Savings

By reducing waste and maximizing resource efficiency, businesses and communities can realize substantial cost savings. These savings come from reduced disposal costs, increased recycling revenue, and operational efficiencies.

- Job Creation

Zero Waste programs that prioritize reuse, repair, recycling, and composting create more jobs than traditional waste management methods. Recycling creates an average of nine times more jobs than landfilling, composting generates at least twice as many jobs as landfills and four times as many as incineration facilities, and reuse can create as many as 30 times more jobs than landfills. This equates to 1.17 jobs for every 1,000 tons of materials recycled, contributing to the creation

[15] **Zero Waste Europe - Why a Zero Waste Vision?** Zero Waste Europe. (n.d.). Why a Zero Waste Vision? Retrieved from Zero Waste Europe.

[16] **Eco-Cycle - Jobs and Economic Benefits** Eco-Cycle. (n.d.). Jobs and Economic Benefits. Retrieved from Eco-Cycle.

of new job opportunities in recycling, composting, waste reduction, and sustainable product design and manufacturing.

- Community Engagement

Zero Waste initiatives encourage community participation, education, and awareness, fostering a culture of sustainability and collective action. By engaging citizens, businesses, and local organizations in Zero Waste programs, communities can build resilience, strengthen social bonds, and create a shared vision for a sustainable future.

- Strengthening the Local Economy

Zero Waste programs keep dollars and materials circulating through the local economy, supporting local businesses, creating jobs, and stimulating economic development. By prioritizing local recycling and composting facilities, encouraging sustainable procurement practices, and promoting green entrepreneurship, communities can build a resilient and thriving local economy.

https://www.torontoenvironment.org/zerowaste_benefits

Challenges and Considerations

While the zero waste concept offers numerous benefits, implementing zero waste practices can pose challenges due to existing infrastructure, consumer behavior,

regulatory frameworks, and economic considerations. Addressing these challenges requires collaborative efforts, innovative solutions, policy support, and public engagement to drive the transition towards a zero waste society.

Achieving zero waste requires collective action, collaboration across sectors, policy support, innovation, and community engagement. By embracing the zero waste philosophy, we can unroot the causes of wastage, transform our relationship with resources, and pave the way for a more sustainable and harmonious coexistence with our planet. In essence, zero waste is not just about reducing waste; it's about reimagining our relationship with the planet and each other, fostering a culture of mindfulness, responsibility, and stewardship for future generations.[17]

GOOD PRACTICES ON CIRCULAR ECONOMY AND ZERO WASTE

Reduce, Recycle & Composting

The topic of the circular economy was treated in class as part of the school curriculum, with particular emphasis on the issues and objectives set by the European Parliament. In our school, some actions have already been in place for years (such as separate waste collection). Thanks to this project, however, the students wanted to emphasise certain aspects such as packaging reduction, plastic recycling and composting.

How it was Implemented:

1. REDUCE

[17] Zero Waste International Alliance. (n.d.). About ZWIA. Retrieved from ZWIA.

Since last year, the school shop has been using biodegradable bags instead of the old plastic ones; now the use of paper bags is increasing and customers are offered the purchase of cloth bags that can be reused for a long time

2. RECYCLE

In the municipality of Pandino, separate waste collection has reached a good level of around 73% in recent years, but there is obviously room for improvement, as there are municipalities similar to ours with separate waste collection levels of around 80%. For this reason, we have decided to create an incentive for the correct collection of plastic waste in order to send it to a proper recycling system,

by encouraging our shop customers to bring back their yoghurt and cottage cheese containers in exchange for free products.

3. COMPOSTING

Organic waste accounts for more than 30% of household waste production: being able to recover it through composting can help reduce waste management costs and, in landfills, prevent the emission of greenhouse gases into the atmosphere and leachate into groundwater. Home composting is therefore not only one of the practices of good and correct waste management, but also a choice of collective participation in the solution of the "waste problem", which, with the contribution of all of us, is transformed into a great resource.

Compost is the result of biochemical and biological processes that take place on waste and can be used to recover organic waste produced by human activities. Thanks to the activity of micro-organisms, fungi and insects, compost is obtained, an organic fertiliser that is useful for nourishing the soil. In addition to the amount of nutrients it contains, compost is important in providing the soil with unique compounds that make it soft, porous, easier to work and with a greater capacity to retain water. In essence, it is the solution to many of the problems faced by the professional or amateur farmer whose aim is to produce healthy and abundant crops without wasting water, fertiliser and energy on tillage.

Among the activities proposed by the class for the correct recycling of materials in the context of a circular economy, the recycling of vegetable waste from the school canteen and cuttings from the boarding school garden by composting will be implemented next school year to produce a natural fertiliser (compost).

In this way, the organic waste produced can be reduced and turned into a resource.

A compost bin has been requested from the waste management company to collect these materials and the compost will be used as a natural fertiliser in the school garden.

Results/Impact:

An important result of these good practices has already been achieved: the students in the class have been sensitised to think about and propose some practical activities that can be of interest to them and that can have a significant impact on the environment.

The real results of these activities will have to be evaluated in the coming years, but they are certainly an important step towards raising awareness of what each of us can do for the environment around us, but also towards improving the economy of our own territory and country in terms of circularity and sustainability.

Some links:

- https://multimedia.europarl.europa.eu/it/video/x_V007-0034
- https://www.europarl.europa.eu/topics/it/article/20151201STO05603/economia-circolare-definizione-importanza-e-vantaggi
- https://www.riciclaviadana.it/informazioni/il-compostaggio-domestico/10.html

CONCLUSION

The Environmental Sustainability Education manual, developed through this project, is anticipated to have a significant and multifaceted impact on various stakeholders, educational practices, and broader community goals. It will enrich the curriculum of agricultural VET schools by integrating comprehensive environmental sustainability topics, ensuring students receive a well-rounded education that includes critical ecological concepts and practices. By focusing on practical skills and real-world applications, the manual will prepare students for careers in the green economy and enable them to tackle environmental challenges effectively. It will empower educators with the knowledge and tools necessary to teach complex environmental subjects confidently, enhancing their teaching capabilities and broadening their subject expertise. The manual will introduce innovative pedagogical approaches, enabling teachers to engage students more effectively and foster a deeper understanding of sustainability issues. Significantly, the manual will raise awareness among students about environmental issues, the importance of sustainability, and their role in promoting a green future. Through hands-on activities, projects, and interactive learning methods, it will encourage active student participation, making learning more dynamic and impactful, and promoting critical thinking and problem-solving skills. The manual will inspire local initiatives that contribute to community resilience and environmental health, as students equipped with sustainability knowledge drive local projects that benefit their communities. Additionally, it will highlight the economic benefits of sustainability, such as job creation in the green economy and cost savings from efficient resource use, leading to the development of new economic opportunities within communities. The success and practicality of the manual will make it a valuable model that can be replicated in other educational institutions, adaptable to meet the specific needs and contexts of different schools and regions. By making the manual freely available, the project will facilitate its dissemination to a wide audience, promoting environmental education on a larger scale and reaching a broader demographic of students and educators. It will align with European policies and sustainability goals, such as the European Green Deal and the Circular Economy Action Plan, ensuring the educational content supports broader regional and international sustainability objectives. Meeting educational standards will ensure its credibility

and acceptance within formal education systems, supporting its integration into existing curricula.