



WARP PROJECT

WASTE AND RECYCLING PRACTICES FOR DUAL
TRANSITION IN VOCATIONAL EDUCATION

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1 Introduction

This report documents the process and outcomes of evaluating and validating the case studies developed within the WARP project. The objective of this deliverable is to ensure that each case study accurately reflects current industry practices, environmental regulations, and pedagogical principles in the field of sustainable waste management and recycling. The design process was designed to confirm the relevance, accuracy, and applicability of the selected case studies as effective learning tools for addressing identified skills gaps and training needs in the vocational education and training (VET) sector.

The evaluation involved a structured methodology that combined expert review, stakeholder feedback, and pedagogical analysis. Contributions were collected from industry representatives, VET trainers, and academic professionals to ensure a comprehensive perspective on content accuracy, industry alignment, and educational effectiveness. Particular attention was given to the case studies' capacity to engage learners, promote critical thinking, and facilitate the transfer of knowledge to real-world professional contexts.

This report provides evidence that the materials used in the WARP programme are both credible and pedagogically sound. The outcomes of this process form a foundation for the subsequent design of tailored capacity-building interventions for VET teachers, ensuring that future training activities are grounded in relevant, high-quality learning resources.



2 Case Study 1: Milton Keynes

2.1 Executive Summary

The United Kingdom (UK) has made significant strides in waste management and recycling, with an overall recycling rate of 47.9% for household materials in 2022. Wales, in particular, outperformed the rest of the nation, achieving a recycling rate of 56.9%. In 2022, there was a 0.4 tonne reduction of landfill waste compared to 2021. Meanwhile, packaging waste recycling saw a notable increase of 2.4% from 2022 to 2023, indicating progress in reducing packaging waste across the country.

England alone generated 63.0 million tonnes of construction and demolition waste in 2022, of which 59.4 million tonnes were recovered, showcasing a significant recovery rate for this type of waste. The UK generated 191.2 million tonnes of total waste in 2020, with England responsible for 85% (162.8 million tonnes) of the UK total.

Milton Keynes, a city in Buckinghamshire, England, has emerged as a leader in recycling, with a rate of 65% in 2024, far surpassing the national average of 43.4%. The city's recycling efforts date back to 1992, when it became the first in the UK to introduce curbside recycling collection. The recycling rates have experienced an increase of more than a third, propelling Milton Keynes up the ranks of cities that recycle the most across England. Through the implementation of colour-coded recycling bins and weekly collection schedules, Milton Keynes continues to improve its waste diversion practices.

Overall, the UK and Milton Keynes demonstrate positive trends in waste management and recycling, as shown in Figure 1, with significant reductions in landfill waste and a growing recovery rate, particularly in construction and demolition waste. However, challenges remain in achieving higher recycling rates and meeting future environmental targets.



Figure 1. Evolution of landfill use and plastic recycling rate in the UK.

This case study explores the ongoing efforts of the United Kingdom, particularly Milton Keynes, to enhance recycling and waste management strategies, with an emphasis on the crucial role of vocational education and training (VET) in this process. The research highlights key trends in waste reduction, recycling practices, and packaging waste management in the UK. Milton Keynes' recycling rate has risen to 65% in 2024, positioning it as a leading city in sustainable waste management, thanks in part to community involvement and effective training programs. The case study emphasises how VET can provide the skills needed to support these initiatives, focusing on the development of technical and managerial competencies in the recycling and waste management industry.

In a time of increasing environmental concerns and tightening regulations, VET programs can play a significant role in improving waste management practices. The integration of sustainability and circular economy principles into VET curricula ensures that future professionals are well-prepared to take on the challenges and opportunities in the recycling sector.

2.2 Background and Context

In 2022, England generated 63.0 million tonnes of construction and demolition waste, of which 59.4 million tonnes were recovered. This demonstrates the country's ongoing commitment to diverting waste from landfills and recovering valuable materials. Additionally, the UK as a whole

generated 191.2 million tonnes of total waste in 2020, with England responsible for 85% (162.8 million tonnes) of the UK total. The UK generated 191.2 million tonnes of total waste in 2020, with England responsible for 85% (162.8 million tonnes) of the UK total. The standard landfill rate per tonne has risen by £23 from 2023 to 2025, reaching £126.15 per tonne, further incentivising waste diversion efforts.

Approximately 65% of waste is recycled in Milton Keynes, whereas the English average is 43.4%. The introduction of colour-coded recycling bins for different materials and a structured collection system, such as separate bins for plastic, metal, glass, and paper, has significantly increased recycling rates. Local waste management programs, such as weekly collection of green and black bins and alternate-week collection of blue and red bins, further facilitate efficient recycling practices.

Together, the UK's national efforts and Milton Keynes' local initiatives provide an insight into the evolving landscape of recycling, illustrating both the challenges and progress in waste management systems across the country. The ongoing rise in recycling rates and recovery efforts showcases the potential for continued improvements in environmental sustainability.

In the context of the VET sector, the UK's growing focus on waste management and recycling presents significant opportunities for education and training providers. The UK generated 191.2 million tonnes of waste in 2020, with England responsible for 85% of this total. This underscores the critical need for a skilled workforce to address the growing challenges of waste reduction, recycling, and sustainable resource management.

Cities like Milton Keynes have been at the forefront of recycling innovations, with Milton Keynes achieving a 65% recycling rate in 2024, significantly higher than the national average. As industry evolves and demand for recycling professionals increases, VET institutions are positioned to train a new generation of workers skilled in modern recycling techniques, waste minimisation strategies, and environmental policy implementation. The VET sector plays an essential role in creating a workforce equipped to implement the latest advancements in recycling and waste management technologies.

2.3 Problem Statement

Despite significant strides in waste management and recycling efforts, the UK continues to face challenges in achieving optimal waste diversion and recycling rates. While some regions, like Wales and Milton Keynes, have made notable progress, the national recycling average remains below desired targets. The recycling rate in England is particularly concerning, as it lags behind the more ambitious benchmarks set by other regions.

The increasing volume of waste, particularly construction and demolition waste, adds to the complexity of achieving higher recycling rates across the UK. This demonstrates that while recovery efforts are being made, substantial quantities of waste still end up in landfills or other non-recyclable waste streams. Furthermore, with the UK generating 191.2 million tonnes of total waste in 2020—85% of which came from England—effective management of waste continues to be a pressing concern.

In addition to waste generation, the increasing costs associated with landfill use further complicate the issue. The standard landfill rate per tonne has increased from 2023 to 2025 by £23 and is currently at £126.15 per tonne. This rise in landfill rates serves as a financial disincentive, yet the overall effectiveness of landfill diversion remains insufficient to meet national and international waste reduction targets.

Given these challenges, it is crucial to explore and implement innovative solutions, improve public awareness, and enhance recycling infrastructure to boost the UK's overall recycling rates. Both the national strategy and local initiatives, such as those seen in Milton Keynes, provide valuable models, yet there remains much work to be done to create a truly circular economy in the UK.

The problem within the context of VET is twofold: First, there is a growing demand for qualified professionals in the recycling and waste management sectors, but many educational programs still lack the hands-on, industry-relevant training required to meet this demand. Second, as the UK seeks to meet its recycling goals, it faces significant barriers related to waste segregation, consumer participation, and evolving technological requirements.

VET institutions must address these gaps by offering comprehensive, practical training that equips students with the necessary skills to meet the evolving challenges of the recycling sector. Without the integration of such focused training, the industry risks falling short of national recycling goals and sustainability targets.

2.4 Objectives of the Case

The primary objectives of this case are to explore the current state of recycling and waste management in the UK, identify key challenges, and highlight the potential for improvement at both the national and local levels. The specific objectives of this case are as follows.

Firstly, to evaluate the current recycling rates and trends. This case aims to provide an in-depth assessment of the recycling rates in the UK, with a particular focus on household recycling and the performance of different regions, including Milton Keynes. Analysing these rates will help identify gaps and areas that require further investment and attention.

In addition, to examine the impact of local initiatives on recycling performance. This case will evaluate the success of local initiatives such as those implemented in Milton Keynes. These local success stories can offer valuable insights into best practices and strategies that other cities and regions can adopt to enhance their recycling efforts.

Furthermore, assessing the Challenges in Waste Management and Recycling is crucial for the ongoing challenges facing the UK to increase recycling rates and reduce landfill usage to be explored. Despite this, the UK still generates substantial amounts of waste, indicating a need for improved recycling and waste recovery strategies.

The Analysis of the economic and environmental implications of landfill waste will address the economic impact of increasing landfill rates. This will highlight the growing financial burden of landfill use and the need for more sustainable waste management practices. Additionally, the environmental cost of landfill waste, including its impact on greenhouse gas emissions and

resource depletion, will be explored.

One of the key objectives is to identify opportunities for improving recycling infrastructure and engaging the public in more sustainable waste practices. This includes examining how cities like Milton Keynes have enhanced recycling participation through measures like the introduction of red and blue recycling bins and wheelie bins for better waste separation.

The final objective is to propose strategic recommendations for enhancing the UK's circular economy by increasing recycling rates, improving waste management systems, and fostering a more sustainable approach to resource use. The case will provide actionable insights that can guide policymakers, local authorities, and businesses in developing effective strategies to reduce waste and increase the recovery of valuable materials.

The objective of this case study is to explore the potential for Vocational Education and Training (VET) programs to drive improvements in recycling and waste management practices in the UK. By examining successful initiatives such as Milton Keynes in 2024, the case aims to highlight how VET programs can support:

- Skills development in waste segregation, recycling technologies, and waste management practices.
- Public engagement in sustainability efforts through effective educational programs.
- Collaborations between VET providers and industry to ensure that training aligns with current and future market needs in the recycling sector.
- Innovation in waste reduction strategies, including the use of new recycling technologies and sustainable practices.

2.5 Challenges and Solutions

The recycling and waste management sector in the UK faces several challenges, despite ongoing efforts to improve sustainability. These challenges affect not only the national waste management strategies but also the local efforts in cities like Milton Keynes. This section outlines the key challenges in recycling and proposes potential solutions to address them.

The overall recycling rate in the UK remains low compared to its potential. This is significantly below the targets needed to achieve sustainability goals. While some regions, such as Wales, have achieved better results (56.9%), the national average is still far from where it needs to be.

The UK continues to generate significant amounts of waste each year. This large volume of waste, particularly in sectors like construction and demolition, presents a major challenge in terms of both reducing waste production and increasing recycling and recovery rates.

Although there has been some reduction in landfill waste, the UK's continued reliance on landfill disposal remains a major issue. The increase in landfill fees highlights the growing financial and environmental costs of waste disposal. The use of landfills also contributes to environmental degradation, including the release of greenhouse gases.

Effective recycling depends on the proper segregation of waste, which often presents a challenge.



In many parts of the UK, waste is not adequately separated, which results in contamination of recyclable materials and reduces the effectiveness of recycling programs. Additionally, public engagement in recycling initiatives is sometimes low, and people may not always be aware of proper waste sorting practices.

Furthermore, certain types of waste, such as construction and demolition waste, are difficult to recycle efficiently. However, despite high recovery rates in this sector, there remains a lack of infrastructure and specialised facilities for processing this type of waste, making it challenging to recover all valuable materials.

Consequently, solving these challenges poses a significant challenge all by itself, considering that it is a multi-factor problem. Some of the proposed solutions are presented in the following segment.

One of the most effective solutions to improve recycling rates is increasing public awareness and education about the importance of waste segregation. This can include government-led campaigns, community workshops, and school programs aimed at teaching citizens the correct way to separate recyclable materials. Local authorities, like those in Milton Keynes, can continue to leverage tools like red and blue recycling bins to make it easier for the public to sort their waste correctly.

To address contamination in recyclables, investing in more advanced sorting technologies could improve the efficiency of recycling systems. Technologies such as automated sorting systems, optical sorters, and AI-powered waste management could help separate recyclables more accurately and reduce contamination rates. This would ensure that more materials are recycled rather than sent to landfills.

In addition, adopting circular economy models would help reduce overall waste generation and promote the reuse of materials. In the construction and demolition sectors, for instance, policies encouraging the reuse and recycling of building materials can be promoted, reducing the need for raw material extraction and minimising waste. Further, incentivising businesses to design products with recycling in mind will help create a market for recycled materials.

A key solution lies in enhancing the infrastructure for recycling and waste collection across the country. Expanding the availability of specialised bins for different types of recyclable materials, as demonstrated in Milton Keynes with blue and red bins, could help streamline waste collection. Additionally, providing more recycling collection points, particularly in remote or rural areas, would ensure greater accessibility and participation in recycling programs.

To tackle the increasing landfill costs, policies that penalise landfill use and incentivise recycling should be expanded. A model similar to the £126.15 per ton landfill charge could be adjusted to further discourage landfill usage, while offering rebates or tax breaks to businesses and local councils that exceed recycling targets. This financial motivation would make it economically attractive to invest in recycling infrastructure and reduce landfill reliance.

An investment in new recycling technologies and research could help address the technical challenges associated with recycling specific materials, such as plastic and construction waste. By supporting innovation in recycling processes, such as developing new methods for recycling

complex materials or creating better sorting machinery, the UK can improve its recycling efficiency and capacity.

By addressing these challenges with targeted solutions, the UK can make significant progress towards its sustainability goals, ensuring a cleaner environment and a more efficient use of resources.

The recycling and waste management sectors face several challenges, many of which can be addressed through VET-focused solutions. For example, many areas of the recycling industry struggle to find qualified professionals with the necessary expertise in emerging technologies and waste management practices. VET programs, which is also the main target for the WARP project, can bridge this gap by incorporating technical training and practical experience in the latest recycling methods, such as plastics and electronic waste processing. Also, the inconsistent participation of the public in recycling programs remains a serious challenge. VET programs can contribute by training workers who specialise in community outreach and education, helping to foster greater awareness and engagement with recycling efforts. Regarding the integration from the VET sector, as recycling technologies advance, there is a need for a skilled workforce capable of operating and maintaining modern waste management systems. VET institutions could focus on training students in the latest recycling technologies, such as automated sorting systems and waste-to-energy technologies.

Last but not least, the increasing cost of landfill waste disposal, which has risen by £23 per tonne from 2023 to 2025, highlights the financial incentives for more sustainable waste management. VET can help by preparing individuals for sustainable waste practices and innovative recycling methods that reduce reliance on landfills.

2.6 Recycling Plan

The recycling plan outlines strategies for improving recycling rates, reducing waste, and promoting sustainable practices within the UK. By focusing on improving infrastructure, increasing public engagement, and enhancing the effectiveness of recycling processes, the UK can work towards meeting its environmental goals. This plan focuses on both national initiatives and localised efforts, such as those demonstrated in Milton Keynes, to ensure that recycling is more accessible and effective for all residents.

The priority is to continue expanding and enhancing the existing waste management and recycling infrastructure across the UK. Efforts should focus on both technical and social matters, such as better separation of the municipal solid waste and raising awareness regarding the waste reduction activities across the UK. Some examples of these proposed efforts are highlighted in the following segment.

Regarding the existing distribution of recycling bins, local authorities should ensure the availability of clearly marked, colour-coded recycling bins in every neighbourhood, as seen in Milton Keynes, where blue and red bins have been introduced for easy segregation of recyclables. This simple yet effective system can be replicated across other regions to promote better waste sorting.

In addition to residential recycling, more public recycling points should be made available in shopping centres, parks, and transportation hubs. For areas with limited waste management resources, such as rural regions, mobile recycling services or shared community bins can ensure greater participation.

Expansion of specialised recycling facilities for materials like electronics, construction waste, and certain plastics is needed. To further improve recycling in this area, local councils should partner with specialised facilities or privately owned companies and set up clear guidelines for how construction companies can recycle more effectively.

A. Educating the public is crucial for achieving higher recycling rates. The key actions will include:

- Awareness Campaigns: Launch national and regional campaigns that focus on educating residents about the importance of recycling, proper waste segregation, and the impact of contamination on the recycling process. These campaigns can leverage local media, social media, and community events to reach a wide audience.
- School and Community Programs: Schools should introduce environmental education programs that include hands-on recycling practices. In addition, local councils could organize community-based workshops that guide citizens on the proper disposal and recycling of various materials.
- Incentives for Participation: Programs that reward households or neighborhoods for high recycling rates, such as small financial incentives or recognition awards, can motivate residents to recycle more effectively. Examples of these programs can be modeled after successful initiatives in areas like Milton Keynes, where the public shows significant participation.

B. Promoting Circular Economy Models. Shifting from a linear economy to a circular economy is an essential part of reducing waste and increasing recycling. The steps to achieve this include:

- Product Design for Recyclability: Encourage businesses to design products with the end of their life cycle in mind, making them easier to recycle. This includes using fewer mixed materials, eliminating toxic substances, and promoting the use of recyclable materials. Policies that incentivize circular design could be implemented to ensure that recycling becomes a natural step in the product lifecycle.
- Extended Producer Responsibility (EPR): Implement or strengthen EPR schemes that hold manufacturers accountable for the entire life cycle of their products, including take-back and recycling. This would encourage companies to minimise waste and use recyclable materials in their production processes.
- Material Recovery and Reuse: Encourage industries, particularly the construction sector, to adopt practices for reusing and recycling construction materials. Providing incentives for recycling materials such as metals, glass, and plastics would help reduce the overall environmental footprint of production processes.

C. Financial Incentives and Regulatory Measures. The government should create policies that financially incentivize recycling and penalize wasteful practices. Key strategies include:

- Increased Landfill Taxes: The rate should be progressively increased to make landfill disposal less economically attractive. The revenue generated can be reinvested in recycling

programs, technology, and infrastructure development.

- **Subsidies for Recycling Infrastructure:** Local councils and businesses that invest in recycling infrastructure should receive financial incentives or subsidies. This can include grants for the purchase of advanced sorting equipment or investments in waste-to-energy plants that convert unrecyclable waste into energy.
- **Tax Incentives for Recycled Content:** Encourage the use of recycled content in manufacturing by offering tax breaks or subsidies to companies that use recycled materials in their production processes. This would create a stable demand for recycled materials, helping to close the recycling loop.

D. Advancing Recycling Technologies

Innovation in recycling technologies will be crucial for addressing more challenging waste streams. Key areas for improvement include:

- **Investing in Sorting Technologies:** Automation and AI can improve the accuracy and efficiency of sorting recyclables. This could drastically reduce contamination and increase the quality of recyclables, making it easier for facilities to process them and reduce the volume of waste sent to landfills.
- **Developing Advanced Recycling Techniques:** Research and investment into new recycling methods, especially for complex materials like plastics and electronics, should be prioritized. This includes chemical recycling technologies that can break down plastic into its basic components for reuse in manufacturing.
- **Expanding Waste-to-Energy Projects:** For waste that cannot be recycled, waste-to-energy projects could be expanded to generate power while reducing the environmental impact of landfill use. These initiatives can turn non-recyclable materials into renewable energy, contributing to both waste reduction and energy production.

D. Measuring and Tracking Progress. To ensure that recycling efforts are effective, continuous monitoring and evaluation are essential:

- **Setting National and Local Recycling Targets:** The UK should set ambitious recycling targets in line with the best international practices. These targets should be updated regularly to reflect changes in technology, infrastructure, and public participation rates.
- **Tracking Recycling Rates and Waste Diversion:** Councils should track recycling rates and waste diversion rates regularly, using this data to improve waste management programs. Public dashboards and reports can help create transparency and accountability, showing citizens and policymakers where improvements are needed.

By adopting a comprehensive recycling plan that emphasizes infrastructure, public engagement, circular economy principles, financial incentives, technological innovation, and strong regulatory measures, the UK can significantly increase its recycling rates and reduce its environmental footprint. Local initiatives, such as those already implemented in Milton Keynes, demonstrate the potential for achieving significant improvements in recycling when community involvement and effective systems are in place. Through these efforts, the UK can move closer to a sustainable, waste-free future.

For the VET sector, the recycling plan should focus on the development of curriculum and

training programs that reflect the best practices observed in cities like Milton Keynes. Therefore, training should include:

- **Waste Segregation:** Educating students on the importance of proper waste separation and providing hands-on experience in recycling operations.
- **Advanced Recycling Technologies:** Incorporating training on the latest recycling technologies, such as automated sorting systems and waste-to-energy innovations.
- **Waste Minimization:** Teaching strategies to reduce waste generation at the source and promoting the circular economy model.
- **Policy and Regulation Compliance:** Ensuring that students are aware of environmental policies, regulations, and best practices in waste management.

2.7 Teaching Methodologies and Best Practices for Environmental and Waste Education

Effective environmental and waste education plays a critical role in encouraging responsible behaviour toward recycling and waste management. The key to success in teaching environmental sustainability lies in using diverse, engaging, and practical methods that resonate with learners of all ages and backgrounds. Below are some of the most effective teaching methodologies and best practices that can be adopted to foster a greater understanding of environmental issues, specifically related to waste reduction and recycling.

A. Experiential Learning

Experiential learning is a hands-on approach that encourages learners to engage directly with environmental and waste-related issues. By experiencing real-world situations, students not only gain theoretical knowledge but also practical skills that can be applied in everyday life. Some best practices include:

- **Field Trips and Site Visits:** Organizing visits to recycling centers, landfills, composting facilities, or waste-to-energy plants provide students with first-hand exposure to how waste is managed and recycled. This helps bring abstract concepts to life and reinforces the importance of recycling.
- **Waste Audits:** Involving students in a waste audit at school or at home, where they track the types and amounts of waste produced can be an eye-opening experience. By sorting waste into recyclables, compostables, and non-recyclables, students learn about the challenges and opportunities for waste reduction.
- **Recycling Workshops and Demonstrations:** Practical workshops where students learn how to recycle different materials, or how to upcycle everyday items, encourage a deeper understanding of the recycling process.

B. Inquiry-Based Learning

Inquiry-based learning encourages students to ask questions and seek answers through investigation and problem-solving. This method not only helps students understand environmental and waste management concepts but also encourages critical thinking and

curiosity. Some best practices for implementing inquiry-based learning include:

- **Research Projects on Waste Topics:** Assign students projects where they must investigate topics such as the lifecycle of products, the impact of plastic on the environment, or the economics of recycling. Encouraging students to present their findings fosters independent learning and enhances their understanding of key concepts.
- **Problem Solving Challenges:** Present students with environmental problems—such as how to reduce waste in their community or how to design a more efficient recycling system—and ask them to come up with solutions. This hands-on approach to problem-solving builds practical knowledge and decision-making skills.

C. Collaborative Learning

Environmental education can be enhanced when students work together to solve common challenges. Collaborative learning fosters teamwork, communication, and collective problem-solving. Best practices include:

- **Group Projects:** Students can work in groups to design a community recycling initiative or develop a waste reduction campaign. This promotes a sense of responsibility and ownership of the project, encouraging students to take action.
- **Peer-to-Peer Education:** Older students can educate younger students about the importance of recycling, composting, and reducing waste, thus reinforcing their own learning while educating others. This "teach-back" method helps solidify concepts for both the teacher and the learner.
- **Collaborative Workshops with Local Communities:** Organizing workshops in partnership with local organizations, such as municipal waste departments or recycling centers, gives students real-world exposure to environmental practices. These partnerships help students connect classroom learning with community-based solutions.

D. Digital and Multimedia Tools

In today's digital age, utilising technology in environmental education allows for interactive and engaging learning experiences. Best practices include:

- **Interactive Online Platforms and Games:** There are various apps and online games that simulate recycling processes, waste sorting, or eco-friendly lifestyle choices. These interactive platforms engage students in learning by providing real-time feedback and challenges.
- **Educational Videos and Documentaries:** Multimedia tools like educational documentaries on waste management and environmental issues can visually demonstrate the effects of pollution and the importance of recycling. These materials can supplement classroom instruction and offer diverse perspectives on environmental challenges.
- **Virtual Field Trips:** For schools that cannot take physical field trips, virtual tours of recycling facilities, landfill sites, and eco-friendly businesses can be organized. This provides a valuable learning experience without leaving the classroom.

E. Thematic and Interdisciplinary Approaches

Environmental education should not be confined to just one subject area; it can be integrated

across different subjects, helping students see the broader implications of waste management on society and the planet. Best practices for a thematic approach include:

- **Integrating Waste Education Across Subjects:** In science classes, students can learn about the biological processes involved in decomposition, while in geography they can study the global impact of waste and pollution. Art classes can focus on upcycling materials into creative projects, while mathematics lessons can involve calculating the costs of waste and recycling.
- **Cross-Curricular Projects:** Encourage students to work on projects that connect environmental education with subjects such as economics, politics, or history. For example, studying the economics of recycling or researching historical changes in waste management policies can provide students with a holistic understanding of the topic.

F. Community and Family Engagement

Environmental education extends beyond the classroom. Involving families and communities is an essential component of effective waste education, as it encourages behavior change across all levels of society. Best practices include:

- **Community-Wide Waste Reduction Campaigns:** Organise local campaigns that involve schools, families, and local organisations to reduce waste and increase recycling. These campaigns could include educational outreach, recycling competitions, or waste reduction challenges.
- **Home-Based Assignments:** Encourage students to apply what they learn about waste reduction and recycling at home. For instance, students can monitor their family's waste production, help set up a recycling system or educate their parents on sustainable practices.
- **Partnerships with Local Organizations:** Collaborating with local environmental NGOs, waste management companies, and municipal authorities can provide students with expert insights and create opportunities for hands-on learning.

G. Positive Reinforcement and Rewards

To ensure long-term behavior change, it is essential to create a system of rewards and positive reinforcement for recycling efforts and environmental education. Best practices include:

- **Reward Systems for Recycling Participation:** Schools and communities can establish incentive programs that reward students and families for their recycling efforts. This might include offering certificates, hosting events, or awarding small prizes to those who meet recycling goals.
- **Recognition of Efforts:** Publicly acknowledging the efforts of individuals or groups who make significant contributions to waste reduction and recycling can motivate others to follow suit. Regular recognition also creates a culture of environmental responsibility within communities.

Effective environmental and waste education relies on dynamic, engaging, and inclusive teaching methodologies that foster not only knowledge but also action. By integrating hands-on experiences, collaborative learning, and community engagement, educators can inspire a new

generation of environmentally conscious individuals committed to making a positive impact on the planet. Whether through field trips, digital tools, or cross-curricular initiatives, the goal is to make recycling and waste management not just an educational topic but a lifelong practice.

In the VET context, it is important to focus on hands-on learning and real-world application of recycling and waste management techniques. The best practices include:

- **Project-Based Learning:** Providing students with practical, real-world projects that simulate actual waste management scenarios. This can involve community outreach programs or waste audits.
- **Industry Collaboration:** Partnering with local recycling firms, municipalities, and government agencies to offer apprenticeships and internships that allow students to gain first-hand experience.
- **Workshops and Seminars:** Offering training in emerging waste management technologies, waste reduction strategies, and sustainable practices.
- **Use of Technology:** Integrating virtual simulations and software tools used in the recycling industry, helping students become proficient in managing waste using modern digital platforms.

2.8 Conclusions

The role of Vocational Education and Training (VET) in promoting sustainability and advancing recycling initiatives is crucial. As demonstrated by initiatives in Milton Keynes and across the UK, successful waste management and recycling strategies are not only driven by local government and community engagement but also by the skills and expertise developed through education and training. Milton Keynes exemplifies the positive outcomes of combined efforts from local councils, the public, and well-trained professionals in the waste management and recycling sectors.

For the VET sector, it is important to highlight the role it plays in equipping future generations with the necessary skills to meet environmental challenges. Teaching methodologies such as hands-on, inquiry-based learning, and community-driven projects are essential in training individuals who will contribute to sustainable waste management practices. Through programs that incorporate waste audits, recycling workshops, and sustainability-focused projects, VET institutions can foster a deep understanding of the importance of waste reduction and recycling at all levels of society.

The integration of practical, industry-aligned skills training within VET programs can directly contribute to the growing demand for qualified professionals in the recycling and waste management sectors. This aligns with the ongoing changes in the waste management landscape and the need for innovative solutions to deal with landfill waste and recycling technologies. VET programs should place a stronger emphasis on these skills to ensure that students are prepared for the evolving demands of the environmental and waste management industries.

Challenges such as the high costs associated with landfill waste, the need for improved public education, and the continuous growth of packaging waste are areas where VET can have a significant impact. By training professionals who are skilled in cutting-edge waste management

practices and new technologies, the VET sector can contribute to the reduction of environmental impacts and the promotion of sustainable development.

In conclusion, VET plays a pivotal role in advancing the future of waste management and environmental sustainability. By fostering skills development in waste segregation, recycling technologies, and sustainable waste practices, VET institutions can help drive the change needed to reduce waste, enhance recycling, and contribute to a more sustainable future for all. The example of Milton Keynes shows that with the right education, training, and community engagement, substantial progress in recycling and waste management is not just an aspiration but an achievable reality.

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3 Case Study 2: Cyprus Region

3.1 Executive Summary

Cyprus (CY) faces significant challenges in aligning its waste management practices with European Union (EU) targets, particularly concerning municipal waste recycling and landfill reduction. In 2023, the country generated approximately 653 kg of municipal waste per capita, ranking it among the highest in the EU [3].

Despite efforts to improve waste management, Cyprus's municipal waste recycling rate has remained low over the past few years. In 2022, only 15% of municipal waste was prepared for reuse or recycled, while 59% was disposed of in landfills. This over-reliance on landfilling poses a significant barrier to achieving the EU's 2025 target of a 55% recycling rate for municipal waste [1].

Conversely, Cyprus has made notable progress in packaging waste recycling. In 2019, the recycling rate for all packaging waste reached 66.8%, surpassing the EU's 2025 target of 65%, with a significant portion of this recycled packaging waste being processed abroad, while only around 12% recycled domestically. [2,4,5,6].

Moreover, this positive trend in the recycling rate of packaging is expected to continue and rise even further, thus forcing the overall recycling rate to rise, through the installation and implementation of an innovative recycling initiative designed by the National Technical University of Athens, named the Green Kiosk.

Undoubtedly, the continuous improvements in recycling and waste management in Cyprus are resulting from a series of strong policies and initiatives at both the national and regional levels. Through programs that emphasise the circular economy and sustainability, Cyprus is steadily advancing towards a more sustainable waste management model.

This case study examines Cyprus's efforts to enhance recycling in terms of packaging waste, particularly in the mountainous areas, where there is no recycling infrastructure, through the introduction of the Green Kiosk system, with a special focus on the role of Vocational Education and Training (VET) in supporting these initiatives as a complementary key element.

Cyprus has achieved commendable progress in packaging waste recycling; however, significant efforts are needed to enhance municipal waste recycling and reduce landfill dependency. Investments in sorting-at-source infrastructure, public awareness campaigns, and vocational training are critical to advancing Cyprus's waste management practices and meeting EU targets.

3.2 Background and Context

Cyprus is characterised by an intense geomorphological relief, due to the mountainous formations that constitute its continental part. Due to the emergence of the mountainous element in a region, the fragmentation of the available territories is a factor which inevitably leads to the dispersion of local communities living in these areas. The main morphological features found in such areas are generally limited territorial area, the lack of adequate road network and limited accessibility as well as the absence of adequate infrastructure or existing waste management systems. In addition, since in many cases they are areas of tourist interest and attract seasonal population, there is always a significant variation in waste production both qualitatively and quantitatively.

The management of waste as a process presents significant challenges in modern urban environments due to the requirements arising from the accumulation of populations in single urban tissues, even if the most modern means and appropriate infrastructure are available. However, at the level of waste management in remote areas, the dispersion itself, in terms of population density and distribution, combined with further variables that appear in the mountainous regions concerned, makes the management of waste in these areas a constant challenge. Due to the access restrictions, as well as the necessary distances that the means of waste collection have to travel to collect and then transport the cargo to central waste management units, which are usually located either within or near the major urban centres, the cost of collection, transport and finally disposal is increasing dramatically.

Apart from the geomorphological constraints and the limited natural resources that characterise these areas, at the level of the administrative hierarchy, the remote areas remain mostly, if not entirely, dependent on larger administrative areas. As a result, the isolated areas are constantly marginalised and, as they are already vulnerable and in many cases, closed ecosystems, any effort to implement effective and sustainable solid waste management practices is significantly hampered.

As a result of the aforementioned, Cyprus faces significant challenges in aligning its waste management practices with European Union (EU) targets, particularly concerning municipal waste recycling and landfill reduction. In 2023, the country generated approximately 653 kg of municipal waste per capita, ranking it among the highest in the EU [3]. Moreover, Cyprus's municipal waste recycling rate has remained low over the past few years. In 2022, only 15% of municipal waste was prepared for reuse or recycled, while 59% was disposed of in landfills. This over-reliance on landfilling poses a significant barrier to achieving the EU's 2025 target of a 55% recycling rate for municipal waste [1]. The lack of infrastructure in separate collection in mountainous areas hampers the country's ability to improve its overall recycling rates, even though Cyprus has made notable progress in packaging waste recycling. In 2019, the recycling rate for all packaging waste reached 66.8%, surpassing the EU's 2025 target of 65%, with a significant portion of this recycled packaging waste being processed abroad, while only around 12% recycled domestically. [4,5,6].

To tackle this lack of infrastructure, in terms of source separation on dry recyclables, as well as on a plethora of waste streams, Cyprus, through the implementation of LIFE-IP CYzero Waste programme [7], aspires to acquire the proper means to boost its recycling rates, and more specifically, through the materialisation of the "Green Kiosks" initiative.

These kiosks serve as small centres for sorting recyclable materials, aiming to facilitate citizens' access to recycling, especially in remote and mountainous areas not served by other collection systems. The Green Kiosks accept a variety of materials, including paper, plastic, glass, metal, small electrical and electronic devices, batteries, light bulbs, cooking oil, and other items for reuse. Citizens separate their recyclable materials into reusable bags and deliver them to the kiosk operators for further management, such as compression and bailing.

In the context of the VET sector, Cyprus's growing focus on waste management and recycling presents an opportunity of salient significance for education and training providers. The Vocational Education and Training (VET) sector can play a pivotal role in enhancing the success and sustainability of the Green Kiosk Scheme in Cyprus, as well as the enhancement of similar endeavours concerning recycling schemes and practices. Similarly, the Green Kiosk scheme can offer valuable real-world opportunities to strengthen the VET sector's relevance and impact. As

such, it becomes apparent a critical need for a skilled workforce to address the growing challenges of waste reduction, recycling, and sustainable resource management. As industry evolves and demand for recycling professionals increases, VET institutions are set to train a new generation of workers skilled in modern recycling techniques, waste minimisation strategies, and environmental policy implementation. The VET sector is bound to play a pivotal role in creating a workforce equipped to implement the latest advancements in recycling and waste management technologies.

3.3 Problem Statement

Cyprus's waste management system has made considerable progress in recent years, particularly in urban centres, but faces significant challenges in ensuring effective recycling solutions in remote and mountainous areas. The need for sustainable practices demands innovative approaches and strategic support to overcome infrastructural, logistical, and social barriers. Addressing these challenges is crucial to promoting a circular economy and achieving national and EU-wide recycling targets.

Cyprus's waste management sector is confronted with several key issues, such as the following.

- **Limited Recycling Infrastructure in Mountainous Areas:** The geographic and demographic characteristics of Cyprus's mountainous regions hinder the development and accessibility of recycling infrastructure. Sparse populations and challenging terrain make it economically and logistically difficult to establish recycling collection points and transport systems, leaving these areas underserved compared to urban centres. Consequently, dry recyclables such as paper, plastic, and aluminium are often either not collected or improperly managed, leading to their disposal in landfills, which contradicts sustainability goals.
- **Logistical and Transportation Challenges:** The transportation of recyclables from remote, mountainous areas to central recycling facilities poses logistical challenges. High transportation costs and environmental concerns related to fuel usage reduce the overall efficiency and sustainability of recycling efforts in these regions. Additionally, the absence of localized processing units or storage facilities exacerbates the issue, resulting in delays and inefficiencies in recycling dry waste.
- **Insufficient Public Awareness and Engagement:** Mountainous communities often lack sufficient education and awareness regarding the importance of recycling and proper waste separation. Behavioural barriers, including misconceptions about recycling processes and a lack of trust in the system's efficacy, discourage active participation in recycling programs. Educational outreach programs targeting these communities remain limited, hindering efforts to foster a culture of sustainability.
- **Lack of Skilled Personnel in Recycling Operations:** Addressing the unique challenges of mountainous waste management requires a workforce with specialised skills in logistics, waste separation technologies, and community engagement. Currently, the Vocational Education and Training (VET) sector in Cyprus offers limited programs tailored to the specific needs of recycling operations in remote areas. The gap in specialised training results in inefficiencies in managing recycling schemes and limits the ability of municipalities to implement innovative waste management solutions.

- **Regional Disparities in Recycling Performance:** While urban and coastal regions in Cyprus benefit from better recycling infrastructure and higher participation rates, mountainous areas lag behind. This disparity undermines national waste management goals and highlights the need for targeted interventions to address regional inequities. Efforts to integrate mountainous communities into broader waste management strategies are often constrained by resource limitations and competing priorities.
- **Challenges in Promoting Circular Economy Practices:** The adoption of circular economy principles remains nascent in Cyprus, particularly in remote regions. Incorporating these principles into recycling systems requires systemic changes, including local processing of materials, community involvement, and incentives for sustainable behaviors. The lack of a coordinated approach to implementing circular economy practices limits opportunities to reduce waste and enhance material recovery in mountainous areas.

3.4 Objectives of the Case

The objective of this case study is to investigate the role of Vocational Education and Training (VET) in supporting Cyprus's recycling and waste management efforts, with a particular emphasis on the Green Kiosk Scheme, which promotes recycling mainly in mountainous areas, and the installation of circular economy principles. The case aims to:

- **Examine the Current State of Waste Management in Cyprus:** Briefly investigate Cyprus's waste generation patterns, recycling rates, and specific challenges related to the collection and processing of dry recyclables in remote and mountainous regions, while analyzing national trends in waste management, focusing on the implementation of the Green Kiosk Scheme and its effectiveness in increasing recycling rates.
- **Understanding the Role of VET in the Recycling and Waste Management Sector:** Assess how VET institutions in Cyprus can adapt their programs to address the unique challenges of waste management in mountainous areas and support the expansion of the Green Kiosk Scheme. Identify skills gaps in the workforce and explore how VET can contribute to improving the technical and operational capabilities required for effective recycling initiatives. The case will explore how VET programs can equip students with the technical and managerial skills necessary to implement innovative recycling practices.
- **Evaluate the Impact of VET on Recycling Innovation and Public Participation:** Analysing the potential of VET to enhance the practical implementation of recycling programs, including the deployment of technologies for waste segregation, optimisation of collection logistics, and fostering community participation in recycling initiatives. Pivotal role shall play, how the Green Kiosk Scheme can serve as a training and innovation hub for VET programs to develop professionals skilled in sustainable waste management practices.
- **Propose Recommendations for Strengthening VET Programs and Policies:** Provide targeted recommendations to improve VET curricula and align them with Cyprus's waste management and recycling goals.
- **Highlight the Role of Local and Regional Initiatives:** Explore how local initiatives like the Green Kiosk Scheme can be scaled up to address regional disparities in waste management performance. Investigate the potential for collaboration between municipalities, VET institutions, and private stakeholders in driving the adoption of best practices in recycling and sustainability.

- **Incorporate Data-Driven Insights into Waste Management Performance:** Extracting data on waste management and recycling performance in remote areas is of salient importance, should the respective authorities want to contextualise the challenges and opportunities for improvement. Through the Green Kiosk scheme, in correlation with proper skills acquired through VET, the properly trained personnel of the waste management sector could make a difference in highlighting the disparities in recycling rates between urban and mountainous areas.

By addressing the abovementioned objectives, the case study strives to underscore the importance of Vocational Education and Training in transforming Cyprus's waste management sector. Through strategic alignment with national goals, VET can play a pivotal role in fostering a skilled workforce, supporting the Green Kiosk Scheme, and advancing sustainable practices across the country.

3.5 Challenges and Solutions

In the context of Cyprus's waste management efforts, significant challenges exist, particularly in the recycling process as a whole, as well as the recycling of dry recyclables such as plastics, paper, and metals in mountainous and remote regions. These challenges are amplified by the island's unique geographical and socioeconomic factors, necessitating tailored solutions. Below is a series of primary challenges and proposed solutions, emphasizing the role of Vocational Education and Training (VET), in conjunction with the Green Kiosk Scheme in progress:

A. Limited Accessibility and Logistics in Mountainous Areas

Challenge: Mountainous regions in Cyprus face logistical barriers to effective waste collection and recycling due to limited infrastructure, low population density, and difficult terrain. These challenges result in reduced access to recycling facilities, leading to lower participation rates and contamination of recyclable materials. As Zero Waste Europe [8] notes, small island states often face unique barriers due to limited transportation infrastructure.

Solution:

- VET programs can foster specialized training modules for professionals working in mountainous regions, focusing on decentralized waste management systems and mobile recycling solutions.
- Trainees can be equipped with skills to operate, adaptable infrastructure tailored to the unique needs of remote communities, such as the Green Kiosks.
- Green Kiosks in these regions can act as hubs for recyclable material drop-off, supported by VET-trained personnel skilled in community engagement and material sorting and processing.
- Collaboration with local municipalities to create regional recycling networks can ensure efficient transportation of collected recyclables to the Green Kiosks and from the onwards to processing facilities.

B. Low Public Awareness and Participation in Recycling

Challenge: Public participation in recycling remains a significant challenge in Cyprus, with awareness of proper recycling practices particularly low in rural and remote areas. This leads to contamination of recyclables, reducing the effectiveness of waste management strategies, as well as to decreased recycling rates.

Solution:

- Incorporate behavioral science and community engagement strategies into VET curriculums to train professionals in fostering public participation.
- Professionals trained through VET curriculum can lead localized education campaigns targeting specific demographic groups, promoting the importance of sorting and recycling, especially in remote regions, as well as addressing common recycling mistakes.
- Green Kiosks, staffed with VET-trained personnel, can serve as education and collection centers, offering workshops, materials, and demonstrations to improve public understanding of recycling practices.

C. Underdeveloped Recycling Infrastructure

Challenge: Cyprus lacks sufficient infrastructure for the recycling of dry recyclables, particularly in rural and remote areas. The absence of nearby facilities in remote regions increases transportation costs and carbon emissions, making recycling less economically viable.

Solution:

- VET programs should emphasize technical training in the development and operation of decentralized recycling facilities, such as small-scale sorting plants that constitute the Green Kiosks.
- General training in innovative waste-to-resource technologies, such as advanced material recovery and upcycling, can enable professionals to optimize recycling in remote areas.
- Advocate for policies incentivising private-public partnerships to establish local recycling hubs. Green Kiosks can act as collection points feeding into these hubs, with trained personnel managing operations. It is foreseen that by 2026, 50 Green Kiosks shall be established throughout the Cyprus region.

D. Inefficient Recycling of Packaging Waste

Challenge: In 2020, Cyprus generated approximately 104,000 tonnes of packaging waste, with recycling rates for specific materials like plastics and metals at 19% and 57%, respectively [9]. Recycling of packaging waste in mountainous areas is particularly challenging due to material diversity and lack of specialized sorting facilities, as the reliance on centralized recycling facilities increases the difficulty of effectively managing diverse packaging materials.

Solution:

- Introduce focused training on managing packaging waste streams, including innovative sorting and processing technologies for multi-material and lightweight packaging.
- Equip professionals with the expertise to integrate circular design principles into packaging recycling efforts, enhancing reusability and recyclability.
- Expanding even further the Green Kiosk Scheme, to act as collection centres for sorted packaging waste, with trained staff ensuring proper sorting and storage to minimise contamination. Investments in decentralised recycling systems could bridge the accessibility gap, especially for mountainous and rural regions [10]. To this end, VET programs can train professionals in the management of localised recycling facilities,

enabling better collection and processing of packaging waste.

E. Lack of Integration with Circular Economy Principles

Challenge: While Cyprus has made strides in recycling, the integration of circular economy principles remains inconsistent. The Ellen MacArthur Foundation [11] emphasizes that transitioning to a circular economy requires systemic changes in policy, industry practices, and consumer behaviour.

Solution:

- Incorporating circular economy principles into VET curricula, including modules on product lifecycle management, eco-design, and innovative recycling solutions can empower professionals to design and implement systems that prioritize reuse, repair, and recycling.
- Fostering collaborations between VET institutions, universities, and industry to develop sustainable business models aligned with circular economy goals.
- The kiosks can showcase circular economy practices by providing reuse and repair advice, alongside recycling, supported by trained personnel skilled in circular resources management.

3.6 Recycling Plan

Cyprus, with its diverse geography and distinct challenges in waste management, including the limited accessibility of its mountainous regions, presents an opportunity to implement a comprehensive Recycling Plan. This plan focuses on enhancing the recycling of dry recyclables, addressing infrastructure gaps, and leveraging the Green Kiosk Scheme as a scalable solution, while emphasising the critical role of Vocational Education and Training (VET). By targeting these areas, Cyprus can improve its recycling rates, tackle waste management challenges, and support the transition to a circular economy.

Firstly, it is of great importance to describe the system of the Green Kiosk as a unit and as a scheme. The Green Kiosk constitutes an innovative initiative developed by the Unit of Environmental Science and Technology (School of Chemical Engineering - National Technical University of Athens), which encourages detailed waste separation at source. Green Kiosk aims to facilitate the implementation of European and national legislation on sustainable waste management, enabling local and regional authorities to improve their performance on recycling, paving the way for a more efficient use of resources. The system separates and processes various types of recyclable materials, resulting in the recovery of high-quality secondary products, and achieves interpersonal communication between the system operator and the citizens, in a way that allows awareness raising and education on improving waste separation.

The main objectives of the Green Kiosk are:

- To establish an integrated, replicable system for source separation and treatment of municipal waste for remote areas.
- To treat municipal recyclable waste at source, thus avoiding waste collection, transportation and treatment in central recovery facilities.

- To recover the maximum possible resources, while contributing to the diversion of waste from landfill.
- To eliminate landfilling practices currently in use in some remote areas.
- To facilitate recycling of the material and improve the quality of materials recovered through better waste separation and processing methods.
- Make waste recycling an economically attractive option in remote areas
- where transport costs are predominant.
- To inform and train citizens on how to sort different types of recyclable material through the setup of innovative prototype systems.

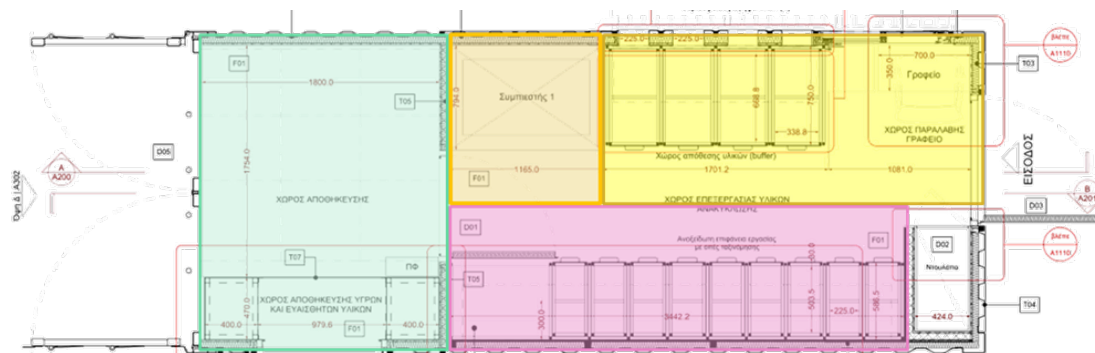
Modelled based on Circular Economy, the Green Kiosk comprises a small Recycling Sorting Centre suitably adapted into an upcycled modified container (6m x 2.4m x 2.6) which:

- Receives 5 streams of pre-sorted materials (paper, plastic, clothes, metal, special waste).
- Records the material streams collected.
- Informs and educates the residents if deemed necessary.
- Further divides the materials into at least 12 sub-categories.
- Compresses and bales the materials, achieving a reduction of initial volume by 70-90%.
- Temporarily stores the final packages.

Below, a series of actual photos of the technology applied, namely the Green Kiosk (Figures 2 - 5), is presented, as well as an overview of the Green Kiosk Scheme as a whole (Figure 6):



Figure 2 Transportation & installation of Green Kiosks



YELLOW	Reception area for presorted materials
PURPLE	Separation area of materials into sub-categories
ORANGE	Material processing area (compressing and baling)
GREEN	Storage area for baled materials

Figure 3 Layout of the interior of the Green Kiosk



Figure 4 Reception and further separation area, photos 4-6 Storage means & area, as well as the equipment of the operator



Figure 5 Compressing and bailing of the material

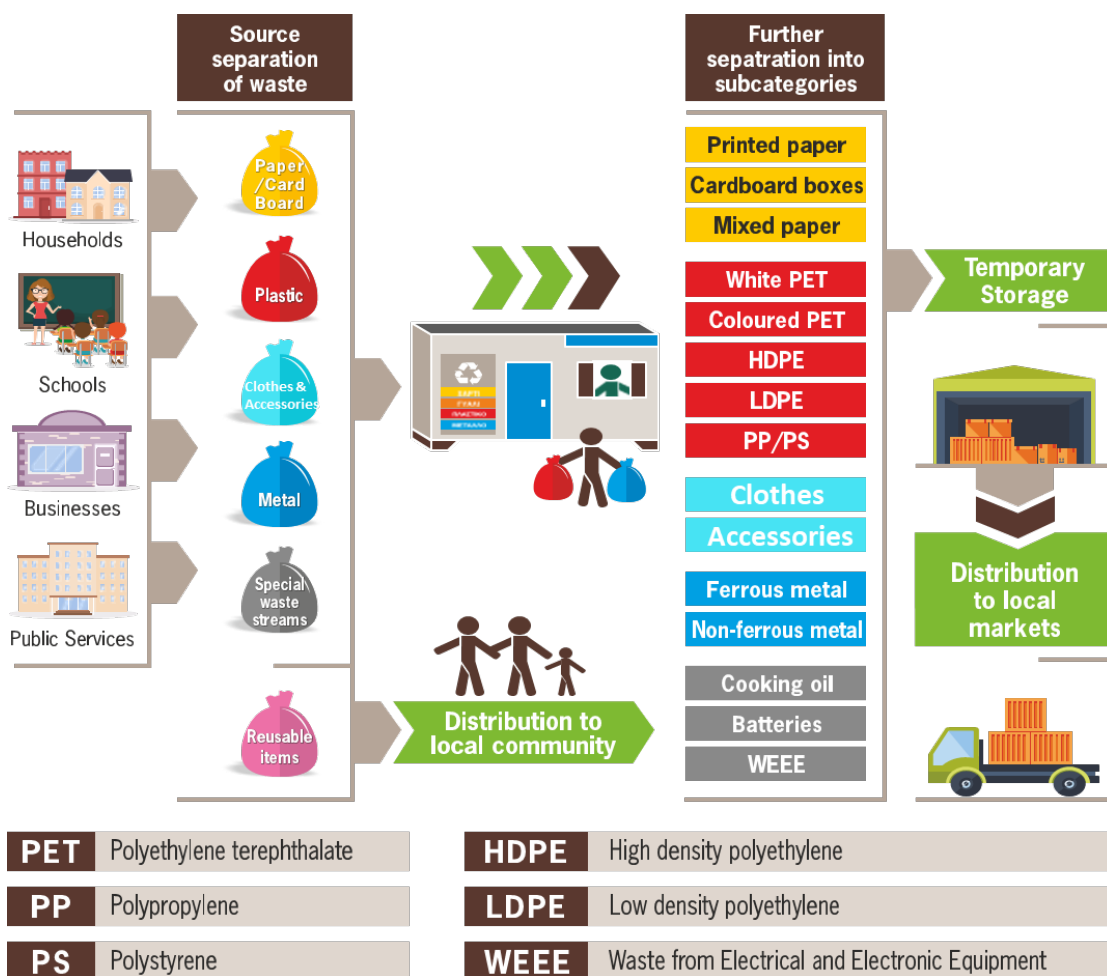


Figure 6 Overview of the Green Kiosk Scheme. Citizens have to drop their pre-sorted material. Afterwards the operator checks them for impurities and further separates them into more than 12 categories, so as to be compressed and be bailed before temporarily being stored within the Green Kiosk. Lastly, the distribution of the material to local markets and any interested parties, follows.

Taking into consideration the aforementioned overview of the Green Kiosk, while bearing in mind the role that VET may play in strengthening recycling practices, an actual outline of a recycling plan for Cyprus would include actions such as:

A. Enhancing Public Awareness and Engagement

Objective: Foster a culture of recycling by increasing awareness and participation across all communities, including remote areas.

Strategy:

- Community Education: Implement targeted awareness campaigns focusing on waste separation and recycling, emphasising the role of Green Kiosks in mountainous areas.

- School Programs: Integrate recycling education into school curriculums, utilizing VET-trained educators to teach proper waste separation at source.
- Outreach in Mountainous Regions: Conduct on-the-ground workshops and seminars in less accessible areas to ensure participation and engagement.
- Train professionals to lead educational programs that inform communities about the benefits and practicalities of recycling.
- Develop public communication skills within VET curricula to prepare graduates for community engagement roles.
- Distribute multilingual recycling guides tailored to local needs.
- Launch campaigns led by VET-trained facilitators, using multimedia tools to reach diverse audiences.

B. Expanding Recycling Infrastructure with Green Kiosks

Objective: Enhance accessibility to recycling facilities, particularly in remote mountainous regions, through the strategic implementation of the Green Kiosk Scheme.

Strategy:

- Deployment of Green Kiosks: Install recycling stations in key locations to collect dry recyclables like plastics, glass, metals, and paper.
- Technology Integration: Equip kiosks with advanced waste-sorting mechanisms and digital monitoring for better efficiency.
- Public-Private Partnerships: Collaborate with local businesses & communities to fund and maintain Green Kiosks.
- Train technicians in the maintenance and operation of Green Kiosk systems, including sorting and monitoring technologies.
- Provide specialized courses on kiosk deployment strategies and regional waste logistics.
- Develop a Green Kiosk maintenance manual, created by VET students and professionals.

C. Introducing Advanced Recycling Technologies

Objective: Increase the efficiency of recycling processes through the adoption of modern recycling technologies.

Strategy:

- Innovation Hubs: Establish centers for technological innovation in waste management at VET institutions.
- Recycling Technology Training: Offer VET courses on advanced methods like chemical recycling and high-tech sorting systems.
- Partner with technology providers to give students hands-on training with cutting-edge recycling equipment.
- Incorporate field projects in the VET curriculum to test and adapt new technologies.

- Organize training workshops on advanced recycling for VET students.
- Set up a recycling innovation lab at a leading VET institute in Cyprus.

D. Addressing Challenges in Packaging Waste Management

Objective: Tackle the growing issue of packaging waste, particularly in remote areas, by promoting sustainable packaging solutions.

Strategy:

- Sustainable Packaging Design: Collaborate with businesses to redesign packaging for easier recycling.
- Policy Incentives: Advocate for Extended Producer Responsibility (EPR) to ensure manufacturers participate in waste management.
- Develop courses on sustainable packaging design and EPR implementation.
- Train VET graduates to conduct packaging audits and suggest improvements.
- Work with packaging firms to introduce eco-friendly alternatives.
- Deploy VET-led teams to conduct workshops for small businesses in rural areas.

E. Promoting Circular Economy Principles

Objective: Transition from a linear to a circular economy by emphasizing resource efficiency and waste reduction.

Strategy:

- Reuse and Repurposing Programs: Encourage communities to repair and repurpose items, reducing waste generation.
- Material Recovery Facilities: Develop facilities that process recyclable materials into reusable resources.
- Train VET students in designing and managing circular economy projects.
- Develop certification programs in circular economy practices.
- Host repair workshops led by VET graduates to teach communities how to repurpose materials.
- Collaborate with local councils to establish material recovery units.

F. Monitoring and Evaluating Recycling Performance

Objective: Track progress and refine strategies based on recycling performance metrics.

Strategy:

- Data-Driven Insights: Use digital tools to collect and analyze data on waste collection and recycling rates.
- Transparent Reporting: Publish regular performance updates to build community trust and engagement.

- Train professionals in waste analytics and performance monitoring.
- Develop digital tools for waste tracking, created by VET students in collaboration with industry experts.
- Launch a national waste tracking system to improve data accuracy.
- Organize annual VET-led audits to assess Green Kiosk performance.

The above delineated Recycling Plan for Cyprus addresses critical challenges in waste management, including the recycling of dry recyclables and packaging waste, especially in mountainous areas. By focusing on the implementation and scaling of the Green Kiosk Scheme, integrating advanced recycling technologies, and promoting circular economy principles, Cyprus can significantly improve its recycling rates and waste management efficiency. Vocational Education and Training (VET) plays a central role in this transformation, equipping the workforce with the skills needed to design, implement, and manage innovative waste management solutions.

3.7 Teaching Methodologies and Best Practices for Environmental and Waste Education

Effective environmental and waste education is crucial for addressing Cyprus's waste management challenges, including low recycling rates and high landfill dependency. The integration of Vocational Education and Training (VET) with innovative initiatives like the Green Kiosk scheme can empower communities and professionals to adopt sustainable practices. This section outlines methodologies and best practices for enhancing environmental education in Cyprus, with a focus on leveraging VET and the Green Kiosk scheme, so as to achieve impactful waste management outcomes that would build a robust knowledge base and promote sustainability as a key skill in modern learning and adapting to contemporary needs.

A. Problem-Based Learning (PBL)

Problem-Based Learning (PBL) immerses students in real-world challenges, fostering collaboration, critical thinking, and practical problem-solving. This methodology is highly effective in addressing specific waste management issues in Cyprus, such as improving recycling rates and optimising the Green Kiosk operations:

- Real-Life Case Studies: Use the Green Kiosk initiative as a case study, challenging students to identify ways to optimise its impact, such as increasing public participation or expanding the range of materials collected.
- Collaborative Solutions: Engage VET students in designing strategies for deploying more Green Kiosks across municipalities, improving their accessibility and operational efficiency.
- Assign projects where students evaluate the performance of existing Green Kiosks and propose actionable recommendations for scaling the system.
- Organize community workshops led by VET trainees to educate the public on the Green Kiosk's benefits and proper recycling techniques.

B. Experiential Learning



Experiential learning connects theoretical knowledge with practical experience, enabling students to actively engage with waste management systems and initiatives like the Green Kiosks:

- **Field Trips and Site Visits:** Arrange visits to Green Kiosks and recycling facilities to provide firsthand insight into their operations. Students can observe live waste sorting processes and interact with the operators.
- **Hands-On Projects:** Task students with designing mini Green Kiosk prototypes for schools or community centers, promoting localized waste segregation and recycling.
- **Partner with municipalities and environmental organizations** to offer internships where VET students can assist in managing Green Kiosks and recycling programs.
- **Encourage VET students to develop recycling plans** for specific communities, integrating Green Kiosks as central elements.

C. Collaborative Learning and Peer Education

Collaborative learning fosters teamwork and shared knowledge, while peer education empowers students to teach one another, reinforcing learning and promoting widespread understanding of waste management practices:

- **Group Projects:** Organise group tasks where students develop public education campaigns centred on the Green Kiosks, targeting common misconceptions about recycling.
- **Peer Teaching:** Equip students to conduct workshops for peers and local residents on using Green Kiosks effectively and responsibly.
- **Establish mentorship programs** linking VET students with professionals managing Green Kiosks to exchange expertise and practical insights.
- **Facilitate interactive peer-led sessions** where students share innovative ideas for enhancing the Green Kiosk system's efficiency.

D. Blended Learning

Blended learning combines traditional classroom instruction with online resources and tools, creating a flexible and dynamic learning environment.

- **Online Resources:** Provide digital modules on waste management policies, circular economy principles, and Green Kiosk operations.
- **Virtual Simulations:** Develop online simulations where students manage a virtual Green Kiosk network, solving challenges like optimizing logistics and encouraging participation.
- **Use interactive quizzes and assignments** to reinforce students' understanding of Cyprus' recycling goals and Green Kiosk functionalities.
- **Share success stories of Green Kiosks** through videos and webinars to inspire students and highlight best practices.

E. Interdisciplinary Teaching

Interdisciplinary teaching integrates knowledge from various fields, fostering a holistic understanding of waste management challenges and solutions:



- **Cross-Disciplinary Projects:** Collaborate with business and engineering departments to teach students how to design sustainable Green Kiosks and develop business models for their operation.
- **Sustainability Focus:** Emphasise the interconnectedness of environmental, economic, and social aspects of the Green Kiosk initiative.
- **Host workshops on policy development,** exploring how legislative measures like Extended Producer Responsibility (EPR) can support the Green Kiosk system.
- **Encourage discussions on the economic and environmental benefits of expanding the Green Kiosk initiative,** highlighting the role of VET professionals.

F. Digital Tools and Data Literacy

Incorporating digital tools enhances waste education by providing students with the means to analyse data, track waste flows, and optimise waste management strategies.

- **Waste Tracking Apps:** Introduce students to tools that track recycling rates and monitor Green Kiosk usage, enabling data-driven decision-making.
- **Data Analytics:** Train students to analyse waste data from Green Kiosks to identify trends and inefficiencies, proposing improvements based on their findings.
- **Develop digital literacy programs that teach students how to use analytics tools for waste tracking and recycling performance evaluation.**
- **Encourage participation in citizen science projects to gather and analyze data on waste and recycling patterns in their communities.**

G. Integration of the Green Kiosk System with VET

The Green Kiosk initiative, a network of recycling kiosks across Cyprus, is a pivotal tool for improving waste management. These kiosks collect a variety of recyclable materials, including plastics, paper, and metals, making recycling accessible to the public. VET can play a crucial role in optimising this system and promoting its replication:

- **Operator Training:** Design VET programs that train individuals to manage Green Kiosk operations, ensuring efficiency and sustainability.
- **Public Engagement:** Equip VET students to lead community campaigns that encourage public participation in the Green Kiosk system.
- **Expansion Planning:** Train students to assess potential locations for new kiosks, considering accessibility, population density, and recycling needs.
- **Collaborate with local authorities to expand the Green Kiosk network,** using insights from VET-trained professionals.
- **Involve VET students in designing scalable models for Green Kiosks,** enabling their replication in other municipalities or regions.

By integrating VET into the environmental education strategy of Cyprus, particularly through combining initiatives like the Green Kiosk system, the country can build a skilled workforce capable

of driving sustainable waste management practices. Through active learning methodologies such as Problem-Based Learning, experiential projects, and interdisciplinary teaching, VET programs can empower students to address real-world waste challenges, optimise recycling systems, and advocate for a circular economy.

The Green Kiosk initiative, supported by VET, offers a replicable and impactful solution to the waste management challenges of Cyprus, paving the way for a more sustainable future. Together, these efforts will not only enhance recycling rates but also promote environmental responsibility across communities.

3.8 Conclusions

The Green Kiosk initiative in Cyprus, alongside other efforts to enhance sustainability and recycling, underscores the country's growing commitment to addressing environmental challenges. As a pioneering project in Cyprus's waste management strategy, it represents a critical step in reducing landfill dependence and fostering a circular economy. The Green Kiosk initiative's success in engaging communities, advancing recycling, and promoting waste minimisation provides a replicable framework for other communities aspiring to improve their waste management systems. Key takeaways from the integration of Vocational Education and Training (VET) with the Green Kiosk initiative highlight the importance of a holistic approach to confronting the complexities of waste management.

More specifically, Vocational Education and Training (VET) programs play a pivotal role in equipping the workforce with the knowledge and skills necessary to address waste management challenges effectively. By integrating sustainability and circular economy principles into VET curricula, Cyprus can cultivate professionals capable of driving innovation in waste reduction, recycling, and resource efficiency. This alignment between education and practice strengthens the foundation of the Green Kiosk initiative and ensures the availability of qualified practitioners to sustain its growth.

The transition from a linear to a circular economy remains essential for minimizing waste and maximizing material reuse. The Green Kiosk serves as a practical example of how localised recycling infrastructure, combined with strong community engagement and education, can significantly reduce waste sent to landfills.

Technology and innovation are critical enablers in this process. Through the application of digital waste tracking, smart recycling systems, and data-driven management approaches, VET-trained professionals can enhance operational efficiency and ensure that recycling practices remain adaptable to technological advancements.

Community participation remains a cornerstone of success. Awareness-raising campaigns and educational outreach—facilitated by VET graduates—foster responsible waste segregation and recycling behaviors, embedding a culture of environmental stewardship within local communities.

Effective collaboration across sectors is equally vital. The Green Kiosk initiative demonstrates the

potential of VET institutions to act as catalysts that bridge government bodies, private enterprises, and the public, fostering integrated and actionable waste management strategies.

Nonetheless, persistent challenges remain in achieving higher levels of waste segregation, improving recycling infrastructure, and encouraging sustained consumer engagement. Continuous adaptation of VET programs is necessary to prepare graduates to address emerging trends and technologies in waste management.

In conclusion, the Green Kiosk initiative exemplifies how education-driven, community-based approaches can transform local waste management systems. By maintaining strong synergies between VET and circular economy initiatives, Cyprus is well-positioned to lead in sustainable innovation. Continued collaboration, technological integration, and educational refinement will be key to overcoming future challenges and ensuring the long-term success of such initiatives.

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4 Case Study 3: INCA Ltd.

4.1 Executive summary

INCA Ltd. is one of the four core companies within AZ Group, a vertically integrated industrial group headquartered in Albania, with operations expanding throughout the Western Balkans. Founded in 2008 in Lezha, INCA specialises in the production of high-quality natural casings for the meat processing industry and has established a strong export presence in over 12 EU countries.

Beyond its core business, INCA is deeply embedded in AZ Group's innovative circular economy model, which transforms traditional linear production processes into closed-loop systems. INCA's operations are designed not only to deliver quality products but also to minimise environmental impact by ensuring that every part of the raw material is utilised. Through strategic collaboration with its sister companies — including AZ Rendering, which processes animal by-products, and AZ Bioenergy, which converts organic waste into renewable energy — INCA contributes to a holistic industrial ecosystem where waste is not discarded but transformed into valuable inputs for other sectors.

This systemic approach allows AZ Group to link sectors such as agriculture, pet food production, animal by-product recovery, and pharmaceutical raw materials into a cohesive, regenerative framework. INCA's role in this ecosystem is central, demonstrating how specialised manufacturing can drive sustainability, resource efficiency, and economic value simultaneously.

Through its work, INCA showcases how circular economy principles can be successfully integrated into export-oriented manufacturing, reinforcing the Group's reputation as a regional leader in sustainable industrial innovation.

Together, the four companies within AZ Group offer a diversified product and service portfolio for clients in the food, pet food, agricultural, bio-energy, and pharmaceutical industries. Their operations are guided by a shared business model rooted in circularity, innovation, and environmental responsibility.

This case study is part of an EU vocational training initiative aimed at illustrating how companies like AZ Group create practical opportunities for green skills development and workforce transformation. By tackling systemic industry challenges and aligning production processes with sustainability goals, AZ Group offers both a roadmap and a real-world training platform for future professionals in the circular economy.

4.2 Background and Context

AZ Group is a multi-company business based in Albania, operating across Albania, Kosovo, and Montenegro. Founded as a family enterprise in 2008, the group has grown through a combination of entrepreneurial foresight, engineering expertise, and a deep understanding of regional market dynamics. Today, it stands as one of the most advanced industrial groups in the Western Balkans, recognised for its commitment to a fully circular economy model.

The group comprises four core companies—INCA Ltd., PetEat Ltd., AZ Rendering Ltd., and a pharmaceutical division—that work in close synergy under a waste-to-value philosophy. Each division specialises in a distinct sector but contributes to a unified system where by-products from one process are transformed into inputs for another.

INCA Ltd., also known as I.N.C.A. NORD FISH Sh.p.k, was the group's first company and remains the only producer of natural casings in Albania. Based in Lezha and founded in 2008, INCA has undergone continuous modernisation and now exports its products to over 12 European countries, including Germany, Austria, France, Italy, and Portugal. Its clients include major meat processing companies both domestically and abroad. INCA is also a registered member of the International Natural Casings Association (INSCA) and holds an EU export license (No. 25 AL PP).

Founded in 2018, PetEat Ltd. focuses on the production of natural dog chews and pet treats. Its products are distributed across Europe and locally in Albania under the brand names "Cheer Chews" and "PetEat." The company sources raw materials internally and ensures a fully traceable, natural supply chain.

AZ Rendering Ltd. is the group's dedicated facility for processing animal by-products. It produces agricultural and livestock inputs such as animal protein and fat, which are used in livestock feed, fertilizers, and biofuels like biodiesel. In 2023, AZ Rendering launched the Western Balkans' first high-performance industrial organic fertilizer under the brand name "AZ Fert." In 2024, the company introduced Albania's first organic plant bio-stimulant, sold under the name "NUTRIVIVE."

The fourth company in the group operates in the pharmaceutical sector, producing raw materials used as precursors in the synthesis of active pharmaceutical ingredients (APIs) for human medicine. This expansion reflects AZ Group's strategy of diversifying into high-value and research-intensive markets.

AZ Group's entire operational model is based on the principles of the circular economy, underpinned by the "3P" framework: People, Planet, and Profit. The group transforms animal by-products from slaughterhouses into new, value-added products such as fertilisers, pet treats, and pharmaceutical inputs. It redirects internal waste into other business units, ensuring that nothing goes unused. Furthermore, 80% of its production is powered by solar energy, significantly reducing its carbon footprint.

As one of the only industrial groups in Albania operating with a zero-waste and negative-emissions model, AZ Group has set a new regional benchmark for sustainable production. Its leadership has inspired other businesses in the Western Balkans to reconsider how waste is managed and how circularity can be integrated into diverse sectors. Through ongoing investments in infrastructure, technology, and human capital, AZ Group continues to serve as a practical anchor for circular economy efforts throughout the region

4.3 Problem Statement

The transition toward a circular economy is a key strategic objective of the European Union and many national governments. However, the implementation of circular economy principles in Albania and the wider Western Balkans remains significantly hindered by systemic, regulatory, and social challenges.

One of the most pressing issues is the ineffective management of waste, which continues to impact environmental quality, public health, and economic sustainability. Improper waste disposal leads to soil, air, and water pollution, especially in rural and peri-urban areas where solid waste is frequently mixed and deposited in uncontrolled landfills. Open burning of waste further contributes to greenhouse gas emissions and environmental degradation. According to the European Environment Agency, achieving ambitious recycling and landfill reduction targets across

the EU could reduce greenhouse gas emissions by hundreds of millions of tons, illustrating the vast potential of effective waste management to support climate goals.

In Albania, despite policy efforts such as the National Integrated Waste Management Strategy, the system suffers from significant shortcomings. These include inadequate infrastructure, lack of source separation, insufficient investment in recycling technologies, and poor inter-institutional coordination. Moreover, enforcement of existing environmental regulations is weak, and public awareness of sustainable practices remains low. Although some local pilot projects in community-based recycling have shown promising results, they have not been scaled up to the national level.

The food and processing industries in Albania, including those handling animal by-products, face additional sector-specific challenges. These include outdated production technology, regulatory hurdles that limit exports—particularly of sensitive products like casings—and a lack of supportive policies that promote the reuse and recycling of by-products. Many businesses also lack the technical knowledge or financial means to shift toward more eco-friendly processes.

AZ Group has positioned itself as a practical response to these widespread challenges. By adopting a comprehensive circular economy model, the group demonstrates how integrated planning, technological investment, and cross-sector collaboration can overcome structural barriers. Rather than treating waste as a problem, AZ Group transforms it into a valuable input across its operations—from pet food and fertiliser to pharmaceutical raw materials—setting a benchmark for other companies in the region.

This case study highlights how AZ Group's experience serves as a counterpoint to fragmented and inefficient waste practices. It illustrates what can be achieved when circular economy goals are supported by vision, long-term commitment, and operational discipline.

4.4 Objectives of the Case

This case study has been developed to highlight the practical application of circular economy principles within the food processing and animal by-products industries, using AZ Group and its subsidiary companies as a real-world example. It aims to demonstrate that a fully circular business model is not only achievable, but also highly beneficial—even in environments with limited regulatory support or institutional infrastructure.

One key objective is to present a tangible and replicable model of how circular economy concepts can be integrated into traditional sectors such as meat processing and agricultural production. Through its internal recycling systems, AZ Group showcases how materials of animal origin can be reused and transformed into new, high-value products such as fertilisers, pet treats, and pharmaceutical raw materials.

Another important goal is to explore how companies can increase operational efficiency, reduce costs, and open new revenue streams through the adoption of sustainable practices. By converting waste into inputs for other production processes, AZ Group demonstrates that environmental responsibility and business profitability can go hand in hand.

The case study also emphasises the critical role of vocational education and training (VET) in building the next generation of circular economy professionals. It seeks to educate VET students on both the challenges and opportunities involved in developing and managing green businesses, particularly within the context of low- and middle-income economies.

Finally, the study aims to inspire vocational training institutions, educators, and policymakers to embed circular economy thinking into their curricula and capacity-building initiatives. By doing so, they can support the broader transformation of industry and society towards more sustainable and resource-efficient models of development.

4.5 Challenges and Solutions

In its journey toward becoming a leader in circular economy practices, AZ Group has encountered and overcome a range of operational, structural, and cultural challenges. These experiences not only illustrate the complexity of transforming traditional industries but also offer valuable insights into how such challenges can be addressed through targeted strategies.

One major challenge was ensuring safe and hygienic processing of animal by-products, particularly in Albanian slaughterhouses where hygiene standards and handling protocols were inconsistent or lacking. To address this, AZ Group implemented long-term supplier training programs, introduced quality control procedures, and maintained continuous communication through site visits, checklists, and feedback loops. It took nearly two years of sustained effort to establish reliable, food-grade standards across the supply chain.

Another challenge involved the collection and reuse of raw materials for pet food production within the PetEat division. The supply of suitable materials was initially unstable, and processing methods varied in quality. In response, AZ Group conducted a six-month operational audit, restructured its supplier partnerships, and optimised internal techniques to ensure higher yield, hygiene, and consistency in production.

The group also faced the broader systemic issue of integrated animal waste recovery, a concept largely unfamiliar in the Albanian context. With no national model in place, AZ Rendering had to establish its own structured collection system. Although compliance with waste regulations among partners remains only partially successful—estimated at 50–60%—the company has taken on an educational and leadership role by promoting best practices and demonstrating the feasibility of waste-to-value conversion.

Another significant barrier has been the general lack of awareness regarding circular economy principles, both at the institutional and community levels. Many citizens and businesses are unfamiliar with sustainability strategies or sceptical about their practical application. AZ Group has countered this through internal awareness campaigns, community education initiatives, and collaboration with vocational training institutions.

Finally, the group has had to navigate stringent European export standards, particularly for sensitive animal-derived products like casings. Meeting these standards required substantial investments in modern technology, quality assurance systems, and research and development. These efforts have enabled AZ Group—especially through INCA Ltd.—to gain access to key EU markets and to establish itself as a trusted international supplier.

4.6 Recycling/Re-using Plan

AZ Group operates a comprehensive and highly integrated recycling system that exemplifies the principles of industrial symbiosis and circular economy. Rather than treating waste as a by-product to be discarded, the group views it as a valuable resource that can be reintegrated into various production cycles across its business divisions.

At the core of this system is the processing of animal intestines and by-products by INCA Ltd., which transforms them into natural casings for the meat processing industry. The remaining organic materials, which would otherwise be considered waste, are passed on to AZ Rendering. Here, they are processed into organic fertilisers, animal protein, fat, and bio-stimulants, which are then used in agriculture, livestock feed, and the energy sector—most notably for the production of biodiesel.

This closed-loop model ensures that nearly all residual materials are converted into new products, thereby minimising the group's environmental footprint. Internal reuse between divisions is systematic: for example, by-products from INCA's operations serve as raw inputs for AZ Rendering, while PetEat utilises select organic residues to produce natural pet chews. In the pharmaceutical division, select high-purity materials are further refined for use in the production of active pharmaceutical ingredients.

To reduce its reliance on non-renewable energy sources, AZ Group powers approximately 80% of its operations with solar energy. Additionally, investments in process optimisation and energy-efficient machinery further reduce emissions and resource consumption across all sites.

What distinguishes AZ Group's recycling plan from conventional approaches is its systemic integration and long-term scalability. Rather than relying on traditional recycling channels or municipal systems, the company has built an in-house infrastructure that not only reduces waste but also generates new streams of revenue. This model highlights the viability of circular economy principles even in resource-constrained environments and provides a compelling blueprint for sustainable industrial development.

4.7 Teaching Methodologies and Best Practices

The case of AZ Group offers a valuable real-world foundation for vocational education and training (VET) in the fields of sustainability, waste management, and green entrepreneurship. It provides concrete examples of how circular economy principles can be applied in traditional industries and presents a unique opportunity to link classroom learning with practical, industry-based experiences.

To maximise the educational potential of this case, VET institutions are encouraged to integrate a variety of innovative teaching methodologies. Case study analysis serves as a central method, allowing students to explore the full life cycle of animal-based products and understand how AZ Group reduces waste and transforms by-products into new resources. Discussions can focus on specific processes such as the transformation of animal intestines into casings or the conversion of organic residues into fertilisers and biofuels.

Simulations are used to actively involve students by assigning them roles such as sustainability managers or production planners. Within these scenarios, students can design their own zero-waste strategies for a fictional company inspired by AZ Group's structure and operations. This encourages problem-solving, critical thinking, and collaborative decision-making.

In addition, structured debates stimulate reflection and inquiry. For example, students may be asked to evaluate whether the AZ Group model is transferable to other sectors or regions, thereby deepening their understanding of the economic, regulatory, and cultural conditions necessary for circularity to succeed.

Problem-based learning is another effective approach. Educators present students with real

challenges faced by AZ Group—such as ensuring compliance with hygiene standards in supply chains or building awareness among reluctant partners—and invite them to develop practical solutions. This method connects theoretical knowledge with actual business practices and constraints.

Hands-on activities like Green Lab simulations and waste mapping projects provide further learning opportunities. In Green Labs, students model production flows, analyse resource use, and test strategies for internal reuse. Waste mapping projects train students to assess the environmental impact of local industries and identify potential for resource recovery.

Moreover, blended learning models that combine classroom instruction with site visits, online modules, and industry engagement ensure a well-rounded educational experience. Through internships or job shadowing placements with companies like AZ Group, students gain direct exposure to circular business operations and build skills that align with the evolving needs of the green economy.

By implementing these diverse teaching practices, VET providers can prepare students not only to understand sustainability as a concept but also to apply it as a practical strategy in their future careers.

4.8 Conclusions

The case of AZ Group demonstrates that circular economy principles can be effectively applied even in structurally challenging environments with underdeveloped regulatory systems, infrastructure, and public awareness. By converting a traditionally resource-intensive sector into a sustainability-oriented industrial model, the company highlights that economic development and environmental responsibility can be mutually reinforcing.

Through its integrated operations—which include food processing, animal by-product utilisation, pet food production, organic agriculture, and pharmaceutical ingredient manufacturing—AZ Group has established a fully circular and scalable business framework. It systematically transforms waste into high-value resources, relies heavily on renewable energy, and applies efficiency measures across all production stages.

In addition to its economic and environmental contributions, AZ Group also plays a key role in vocational education. Its operational environment offers applied learning opportunities for students and trainees preparing for employment in sectors affected by the green transition. By providing access to real-life processes through case studies, internships, and simulations, the company functions as a practical learning hub for future professionals in the field of sustainable industry.

Overall, the example of AZ Group and INCA Ltd. illustrates that circularity is not only feasible but can also serve as a strategic advantage. The group represents a reference point for other enterprises in the Western Balkans and comparable regions, showing that with coordinated planning and investment, circular business models can be implemented successfully—even in settings with limited external support.

5 Case Study 4: Circular Economy Park in Albania

5.1 Executive summary

The Circular Economy Park in Albania, initiated by RecycAl, represents a transformative model for sustainable waste management, vocational education, and social inclusion in the Western Balkans. Strategically located near Tirana, the Park integrates recycling, reuse, education, and business innovation under one roof. RecycAl, founded in 2022 by waste management expert Lulzim Baumann, is Albania's only company with an integrated approach that combines collection, repair-resale, and environmental education. The Park's core pillars include a Recycling Yard, a Second-Hand Shop with Repair Hub, an Eco-Education Center, and a Circular Economy Showroom.

Since mid-2023, the Park has trained over 600 student multipliers and engaged 6,000+ students in 20 schools, with expansion plans for 40 more schools. RecycAl collaborates with government bodies, municipalities, NGOs, research institutions, and private companies across Albania and the Western Balkans. With over 100,000 kg of recyclable waste prepared annually, the Park is a replicable model supporting Albania's EU integration goals and the OECD Circular Economy Roadmap.

RecycAl's partnerships include institutions such as the Fraunhofer Institute (Germany), the Albanian Ministries of Environment and Infrastructure, and key recycling firms. Inclusive practices support Roma communities and low-income groups, while 80 MSMEs benefit from new circular services. The Park is co-funded by DBU and Heidehof Foundation, with future sustainability secured through recyclable material sales, refurbished goods, consultancy, and CE product promotion.

This case study highlights RecycAl's Circular Economy Park as a best-practice example of circularity in action—combining local impact, regional collaboration, and alignment with EU waste and climate directives.

5.2 Background and Context

RecycAl is an ecologically and socially oriented company founded in Albania in 2022 by Lulzim Baumann, a seasoned waste management expert with over a decade of experience in Albania and Kosovo. Mr Baumann has previously served as an advisor to the Minister of Environment of Kosovo, a GIZ Diaspora Expert, and a consultant on various EU-funded waste management projects. RecycAl is fully Albanian-owned and is a member of the German Federal Ministry for Economic Cooperation and Development's (BMZ) International Waste Alliance – PREVENT.

As the first of its kind in Albania, RecycAl's Circular Economy Park represents an integrated approach to sustainable development. The park brings together large-scale recyclable material collection and aggregation, repair and resale of used goods, and practice-oriented education on circular economy principles. This concept is operationalised through several core components: an Eco Education Centre, a Second-Hand Shop with an attached Repair Hub, a Circular Economy Showroom, a Recycling Yard handling materials like glass, plastic, metal, and paper, and open-air spaces for community events, training, and sustainability demonstrations. Strategically located just ten minutes from Tirana International Airport and easily accessible from Tirana, Kamza, Vora, and Fushe-Kruje, the park serves as a central hub for municipalities, businesses, and educational institutions alike.

Since launching educational activities in June 2023, RecycAl has trained 600 student multipliers and reached more than 6,000 students in 20 schools through visual materials and interactive events. These efforts led to a functional school-based waste separation system. Although the cooperation with Kamza Municipality was later discontinued, RecycAl aims to expand its outreach by engaging with 40 additional schools by 2025 to continue integrating circular economy education across Albania's public education system.

RecycAl's partnership model is extensive and inclusive, covering a wide array of stakeholders. On the government level, the company maintains active communication with Deputy Ministers and the newly founded Circular Economy Agency, which recognises the Park as a national pilot project for circular economy implementation, including its role in Extended Producer Responsibility (EPR) systems. At the municipal level, RecycAl has signed cooperation agreements with Kamza and actively operates in Kukes and Vora, including waste collection from public institutions and involvement in clean-up efforts such as that at Fierza Lake.

In the private sector, RecycAl collaborates with key players like AGELS ALBANIA, which processes plastics into granulates, and maintains an active exchange with the Albanian Recyclers Association. Academic cooperation is ongoing with institutions like Polis University, the University of Donja Gorica in Montenegro, and the European University of Tirana, with future collaboration planned with Germany's Fraunhofer Institute. The informal waste sector is also an important partner, particularly 150–200 Roma collectors who are being integrated through fair pricing schemes, safety equipment, and training, based on models from Emmaus Valona and The Ideas Partnership.

Cooperation with Albanian civil society is facilitated through partnerships with NGOs such as EDEN, Milieukontakt, Co-PLAN, and ETMI, with joint initiatives spanning research, awareness campaigns, and project implementation. The Park maintains a strong presence in both traditional and digital media, with over 1,800 LinkedIn followers and widespread media coverage on channels like Top Channel and Report TV. International donors, including GIZ, EU4Innovation, SIDA, JICA, AFD, and the World Bank, have recognised RecycAl's credibility and potential, ensuring continuous dialogue and collaboration.

RecycAl's work targets multiple social groups. Over 100 Roma waste collectors and their 500 family members are benefiting from formalised opportunities, training, and access to safe and dignified employment. Simultaneously, more than 40,000 low-income residents (70% of whom are rural) benefit from access to affordable second-hand goods and improved environmental conditions. Moreover, 80 micro and small enterprises (MSMEs) have begun receiving waste collection services and are being linked into sustainable value chains enabled by the park.

The environmental impact of the Circular Economy Park is equally significant. By 2025, RecycAl aims to prepare at least 100,000 kg of waste for recycling annually, with a five-year target of reaching 1,000,000 kg. This drastically reduces illegal dumping and environmental degradation, especially around the Ishmi River Basin. The initiative also helps meet Albania's biodiversity and climate targets while aligning with EU accession requirements.

The project's regional significance is reflected in the growing interest from UNDP and Helvetas in Kosovo, the Danish Refugee Council for disaster relief logistics, and other Western Balkan initiatives. The Park's replicable model has positioned it as a regional reference point for circular economy advancement.

Financial support for the project has come from a mix of donors and private contributions. The

German DBU and the Heidehof Foundation are funding the educational components, while RecycAl itself is investing in the Recycling Yard and Second-Hand Shop. Future funding from the Albanian Government is expected for education activities. The park's physical infrastructure comprises a 240 m² Recycling Yard, a 240 m² Reuse Centre, and a 170 m² Education Centre, forming the operational foundation of this transformative initiative.

5.3 Problem Statement and the Opportunity

Albania faces serious challenges in waste management and recycling. According to INSTAT (2022), only 18.9% of the country's waste is recycled, well below the targets set by both national and EU frameworks. The EU Waste Framework Directive requires that 60% of total waste be recovered by 2030, a standard Albania must meet as part of its EU accession path.

The consequences of poor waste management are visible in the environment. For instance, Europe's most polluted river, the Ishmi, carries over 500 tons of plastic waste into the Adriatic Sea annually. This pollution originates primarily from the municipalities in the region where the RecycAl Circular Economy Park operates.

The most important policy guiding waste management in Albania is the Strategic Policy Document for Integrated Waste Management and Action Plan (2020–2035). Aligned with the EU Circular Economy Action Plan, it sets out national goals to improve waste collection, promote recycling, and reduce landfill dependency. Key requirements include:

- Source separation through three-bin systems.
- Development of Extended Producer Responsibility (EPR).
- Bans on single-use plastic bags (adopted in 2022).
- Strict recycling targets across material categories.

A. Circular Economy Roadmap (OECD 2024)

RecycAl contributed to the development of the OECD Roadmap towards Circular Economy of Albania (2024), which outlines several critical actions for the private sector, including:

- Investing in infrastructure that complements municipal systems.
- Integrating recyclables into economic value chains.
- Enhancing collaboration between public and private stakeholders.

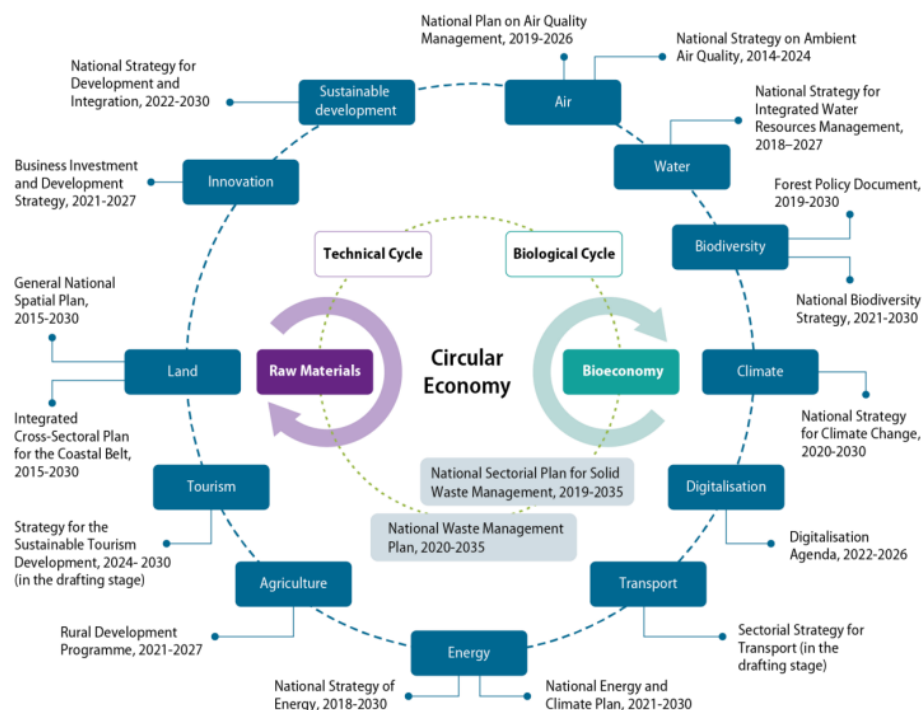


Figure 7: Overview of the Albanian policy landscape relevant to the circular economy

B. Circular Economy Road Map_2023

Legal and Institutional Framework for Circular Economy in Albania- Law on Integrated Waste Management (2011)

The law, aligned with EU directives, outlines the responsibilities of waste generators, municipalities, and private operators. Its core goals are waste prevention, reuse, recycling, and energy recovery. Key provisions include:

- Differentiated collection and source separation
- Recovery and recycling of materials
- Reuse and waste prevention strategies
- Regeneration of used oils
- Best Available Techniques (BAT) in operations

Terms such as by-product and end-of-waste are not yet legally defined, creating uncertainties for circular businesses. However, the law does regulate hazardous waste imports and exports, in line with the Basel Convention.

A forthcoming EPR law (expected in 2026) will make producers responsible for managing the end-of-life of their products, including take-back schemes for packaging, electronics, and batteries.

While Albania has progressive legal frameworks, enforcement and infrastructure lag behind. Municipalities struggle with (Figure 8):

- Lack of infrastructure for sorting and recycling.
- High transportation and landfill costs (eg, €29/ton plus transport).
- Few private operators capable of separation and recovery.
- Over-reliance on landfilling and informal sector activities.

Municipal tenders for waste collection rarely attract circular economy companies, as they often focus solely on transport logistics. No major public recycling infrastructure exists in most municipalities.

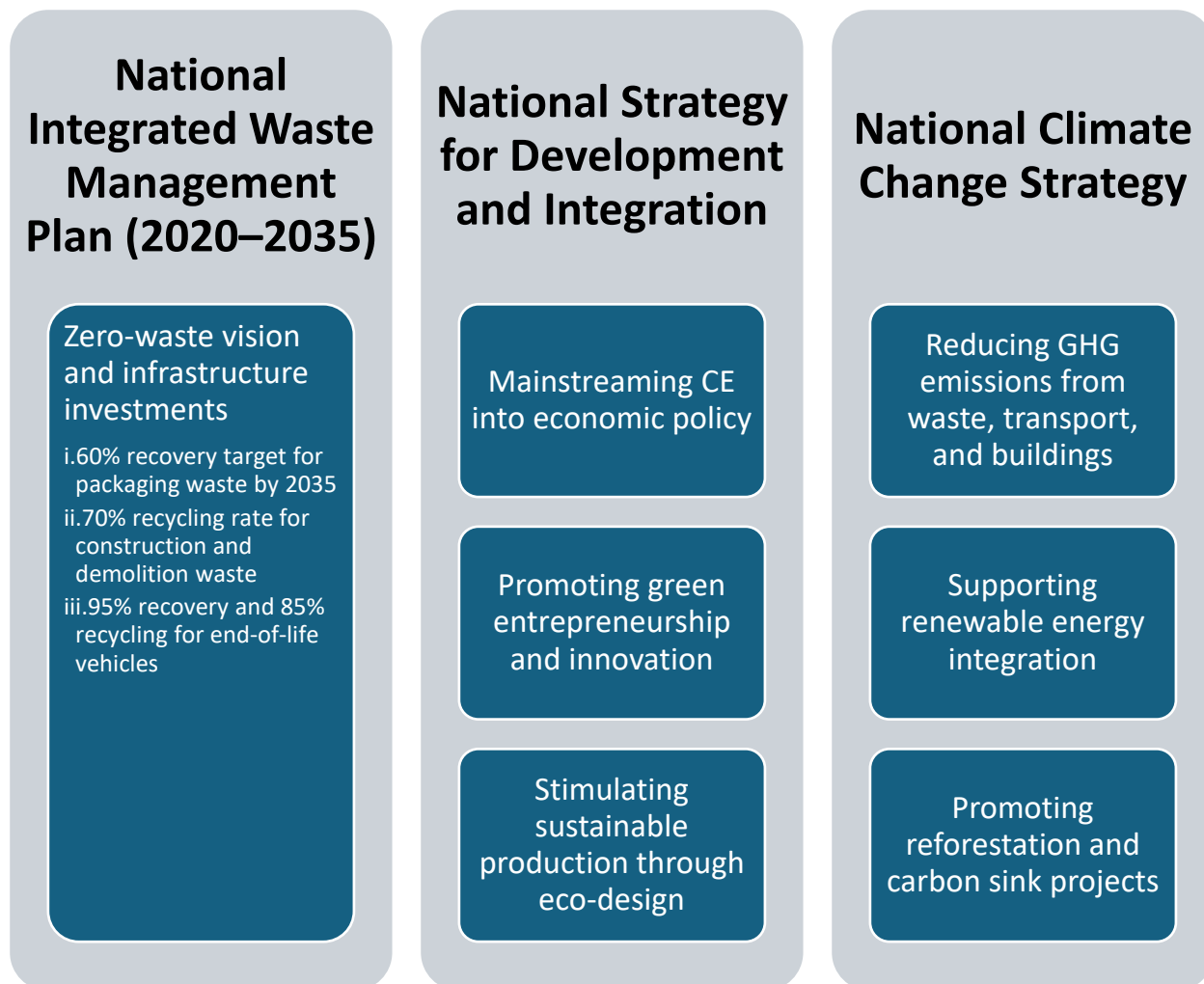


Figure 8: National Strategies supporting Circular Economy

5.4 Objectives of the Case Study

This case study has been developed with the primary aim of supporting VET providers, professional schools, and vocational educators in understanding and applying circular economy principles in practical, real-life contexts. Through the experience of RecycAl's Circular Economy Park, the case provides an engaging and replicable example of how waste management, green entrepreneurship, and social inclusion can be integrated into VET programs. The key objectives are:

- **Demonstrate Practical Application of Circular Economy Principles**
Showcase how waste streams such as plastics, glass, paper, textiles, and used goods can be reused, recycled, and upcycled into new products. The Park offers real-world examples of sustainable processing, small-scale production, and eco-innovation.
- **Support Curriculum Development and Teaching Innovation**
Provide VET trainers with an accessible, Albanian-based reference model that can be integrated into teaching materials, project-based learning, and student engagement activities.
- **Enhance Green and Entrepreneurial Competencies**
Promote green skills, digital competencies, and entrepreneurial mindsets among students and teachers. The project encourages learners to co-design solutions, engage in hands-on learning, and understand business models in the green economy.
- **Strengthen School-Business Cooperation**
Highlight how vocational schools can collaborate with local CE actors like RecycAl for internships, dual training, and applied learning modules.
- **Promote Replicable Models for Regional Development**
Serve as a best-practice model not only for Albania but also for VET systems in the Western Balkans. The RecycAl park demonstrates a scalable and socially inclusive circular model linked to local job creation.
- **Raise Awareness on Environmental Responsibility**
Foster environmental literacy and personal responsibility in younger generations by linking education with community action and sustainability goals.

This case study is designed to be used in classroom discussions, VET school projects, and teacher training programs. It aligns with the EU Green Deal, the 2020 Council Recommendation on VET, and Albania's own Circular Economy Roadmap.

5.5 Challenges and Solutions

The implementation of RecycAl's Circular Economy Park faces several risks that are common in emerging economies working to establish sustainable waste management systems. The following outlines the main challenges identified at the outset of the project and the strategic solutions adopted to mitigate them:

A. Volatility in Global Commodity Markets for Recyclables

A sudden downturn in global commodity prices, especially for plastics, could significantly reduce RecycAl's income from material sales, impacting financial sustainability and staff employment. The plastic market is particularly volatile, and disruptions could block sales for extended periods.

Solution:

- **Material Diversification:** RecycAl expands its focus beyond plastics to include more stable materials like metals and paper, reducing market risk.
- **Revenue Diversification:** Income is also generated through the sale of used goods, circular products, educational services, and consultancy in waste management.
- **Long-Term Contracts:** Establishing multi-year supply and sales agreements helps buffer against short-term price shocks.

B. Limited Municipal Cooperation Due to Mistrust or Corruption

Certain municipalities might refuse to collaborate due to political reasons, low environmental awareness, or perceived mistrust, reducing material inflow and weakening local impact.

Solution:

- **High-Level Government Support:** RecycAl has established strong ties with the Albanian Ministry of Environment, the National Circular Economy Agency, and the Department of Waste of Tirana Municipality. It also enjoys open support from mayors in Kruja, Vora, and Kukës.
- **Public Engagement & Reputation:** RecycAl is widely seen as a responsible and trusted socio-ecological actor. This reputation is maintained through continued awareness-raising and communication campaigns.
- **International Trust:** Cooperation with cyclos GmbH (Germany) and co-funding from DBU (German Environmental Foundation) has increased credibility. ADA's support adds further institutional trust.
- **Focus on Schools:** RecycAl's educational work with schools is welcomed by municipalities and reinforces engagement, even when political cooperation is uncertain.

C. Risk of Project Underperformance

Objectives—such as quantities of recyclables collected or circular products created—may not be achieved if initial assumptions prove incorrect or management falls short.

Solution:

- **Realistic Planning:** All objectives have been carefully calibrated based on field experience and data.
- **Multiple Partners:** Each objective is backed by several partners, ensuring redundancy in case one withdraws.
- **Monitoring System:** Progress is reviewed every 4–6 weeks in internal meetings, allowing early detection and adjustment. Backup options are defined for critical outputs.

D. Delays in Permits and Licensing

Acquiring necessary building, environmental, and waste management licenses can be time-consuming, risking implementation delays.

Solution:

- **Early Action:** The building permit is already secured, and construction is nearing completion.

- **Efficient Planning:** Preparations for the Environmental Permission (Type B) and License III.2.B were initiated well in advance and are expected to conclude within four months of project start.
- **Expert Support:** RecycAl has contracted Eko Studio LLC, a specialized Albanian company, to manage permit acquisition efficiently.
- **Political Backing:** Strong support from national and local government ensures streamlined procedures and reduces risks of bureaucratic or corrupt delays.

5.6 Recycling Plan

Our long-term strategy and this project application directly serve the implementation of the EU-aligned Albanian Policy Framework and the OECD Circular Economy Roadmap (2024) recommendations:

- We will significantly reduce the amount of plastics that would otherwise end up as marine litter and aim at reintegrating these plastics into Circular Economy business models. RecycAl will collect plastics from the six Albanian municipalities that are the main sources of plastic waste entering the Adriatic Sea.
- We will enable the provision of critical infrastructure for a future Extended Producer Responsibility (EPR) system, as RecycAl's plant will be the only certified and holistic collection point in the region. This infrastructure will support municipalities and serve as a reference point for EPR implementation.
- RecycAl will establish and strengthen multi-stakeholder cooperation across value chains by creating a platform for collaboration — matching collected resources with CE innovations, investors, and entrepreneurs from Albania and EU-standard countries.

RecycAl's role begins with setting up much-needed waste management infrastructure — including collection, aggregation, and sale for recycling. The initiative addresses the current fragmented recycling landscape by providing a comprehensive system.

The Circular Economy Park, located in Kruja Municipality, will serve surrounding municipalities: Vora, Kamza, Tirana, and Kukës. Key objectives include:

- Preparing over 100,000 kg of waste annually for recycling by 2026, growing to 1,000,000 kg by 2031.
- Collecting and refurbishing used products from four municipalities.
- Establishing 20 partnerships for Circular Economy solutions.

Moreover, RecycAl aims to collect over 100,000 kg of recyclable waste annually. The breakdown is:

- From 80 private partner companies (cafés, restaurants, supermarkets):
 - Plastics: ~37,500 kg/year
 - Cans: ~30,000 kg/year
 - Paper: ~22,500 kg/year

Total: ~90,000 kg/year

- From 20 public schools:
 - Plastics: ~1,200 kg/year
 - Cans: ~60 kg/year
 - Paper: ~4,800 kg/year

Total: ~6,060 kg/year

- From clean-up actions with NGOs and municipalities:
 - Plastics: ~4,000 kg/year
 - Cans/Metals: ~100 kg/year

Total: ~4,100 kg/year

- From 150 informal collectors and 500 households near the park:
 - Plastics: ~1,800 kg/year
 - Cans/Metals: ~2,400 kg/year
 - Paper: ~1,200 kg/year

Total: ~5,400 kg/year

Total Estimated Annual Collection: ~105,560 kg

The waste is currently collected separately by partners and transported using one truck, one car, and one full-time employee. This currently results in only ~1,800 kg/month, but scaling will occur as soon as co-financing is secured, increasing capacity to over 6,950 kg/month.

Construction of the recycling hall will finish by September–October 2024. Once co-financing is secured, RecycAl will:

- Furnish the center
- Purchase machinery (forklift, compactor)
- Finalize the waste license
- Hire additional staff

In this context, the Municipalities in the region lack recycling plans and pay high landfill costs (€29/ton + transport). Waste is not separated and all goes to Tirana landfill.

RecycAl's solution:

- Create Albania's first source-separated recycling yard
- Demonstrate replicable models for public or private scaling
- Enable future partnerships with EU waste management companies

Expected Outcomes by 2026

- Prevent 200,000 kg of waste from reaching dumpsites/rivers
- Offer affordable second-hand goods to 40,000+ locals

- Create new value chains in the EU and Western Balkans
- Educate 18,000 students, municipal staff, and SMEs

This project directly supports the objectives of the Albanian Strategic Waste Policy (2020–2035) and the OECD Circular Economy Roadmap (2024) by promoting large-scale collection, reuse, and recycling of key material streams, including plastics, metals, paper, glass, textiles, and used goods, across six municipalities in Albania. The initiative is designed to operationalize circular economy principles at the local level through the establishment of efficient collection systems, repair and resale infrastructure, and capacity-building actions that create both environmental and socio-economic value.

The recyclables collected through this system will be processed and sold to identified clients, who will also benefit from advisory and matchmaking services aimed at supporting the development and improvement of circular business models and enhancing integration into local and regional value chains. This comprehensive approach ensures that the initiative not only diverts significant volumes of waste from landfills but also stimulates sustainable market activity and job creation in the recycling and reuse sectors.

Over the implementation period, the project will progressively scale its operations to achieve the collection and recycling of more than 100,000 kilograms of materials per year by the fourth quarter of 2025. Complementing this, a repair and resale operation will be established to process goods sourced from four municipalities, supported by a 200 square metre indoor warehouse and 500 square metres of outdoor space, fully operational by the third quarter of 2025.

To ensure structural and operational capacity, several dedicated facilities will be developed. A Recycling Yard, comprising 200 square metres of indoor space and 500 square metres of outdoor space, will be completed by the fourth quarter of 2024, furnished by the first quarter of 2025, and fully licensed by the third quarter of 2025. A Reused Goods Mall and Repair Centre of similar dimensions will also be completed and equipped by early 2025, providing a dedicated venue for refurbishment and resale activities. In parallel, a Multifunctional Centre, including a public showroom of 170 square metres, will be built and furnished within the same timeframe. This centre will host awareness-raising activities, business matchmaking events, and the promotion of circular economy partnerships between European Union and Western Balkan stakeholders.

By the end of 2025, the project aims to have established at least 20 cross-regional circular economy partnerships, promoted both through the physical showroom and a digital platform, ensuring the visibility and replication of best practices.

Through the implementation of this initiative, it is expected that at least 200,000 kilograms of waste will be diverted from disposal and redirected toward reuse and recycling streams. The project will contribute to the creation of green jobs, the provision of affordable reused goods to approximately 40,000 beneficiaries, and the establishment of 20 long-term partnerships advancing the circular economy in the region.

In addition, the project will deliver extensive educational and engagement outcomes, reaching 18,000 students, 80 small and medium-sized enterprises, and four municipalities through dedicated awareness campaigns, training activities, and collaborative programs. Equal access and gender inclusion are embedded within the project design to ensure that benefits are distributed across diverse social groups.

A critical outcome of the initiative will be the establishment of a sustainable RecycAl business

model, which will serve as a replicable example of circular entrepreneurship. The project aims to ensure financial self-sufficiency, maintaining a baseline monthly operational cost of approximately €1,200 and generating revenues between €1,800 and €2,000, with projected growth through enhanced collaboration with institutional and private-sector partners. The initiative will leverage a strong and diverse partnership network, including the Fraunhofer Institute, Everwave, Agels, Edipack, and other regional actors engaged in sustainable innovation.

Long-term financial sustainability will be achieved through a diversified revenue structure that balances operational efficiency with community and market engagement. The sale of recyclable materials—including plastics, metals, glass, and paper—collected from four municipalities, 20 schools, and 28 businesses will form a primary income stream. Additional revenue will be generated through second-hand retail operations, offering refurbished goods sourced from donations, partner contributions, and household collections.

The project will also derive income from rental and collaboration activities, utilizing the multifunctional centre and conference facilities for events, workshops, and professional gatherings that promote circular economy practices. Further revenue will come from consultancy and brokerage services, supporting European companies interested in exploring sustainable investment opportunities in Albania and the Western Balkans. Finally, the showroom component will serve both an educational and commercial function, promoting sustainable products—such as those developed by PLASTIKA and Kosovo Glass Recycling—and showcasing innovative solutions in eco-construction and resource efficiency.

Collectively, these measures will establish a financially viable and socially inclusive circular economy model that advances national policy goals, supports local employment, and strengthens Albania's alignment with European environmental and sustainability standards.

5.7 Teaching Methodologies and Best Practices for Environmental and Waste Education

RecycAl's Circular Economy Park offers a unique learning environment that integrates environmental education with real-life waste management practices, enabling vocational students, teachers, and the wider public to engage in transformative sustainability learning. Its core teaching methodologies refer to:

- Experiential

Learning

Learners engage in hands-on activities such as sorting recyclables, refurbishing goods, and operating waste equipment. This approach allows students to apply theoretical knowledge in real-world contexts, enhancing retention and skill development.
- Project-Based

Learning (PBL)

Students undertake specific challenges or projects, such as designing an upcycled product or analyzing local waste streams. This encourages critical thinking, teamwork, and innovation while addressing real environmental problems.
- Peer-to-Peer

Learning

Multiplier training within schools enables trained students to educate their peers on

circular practices, increasing awareness and promoting a student-led culture of sustainability.

- **Site Visits and Demonstrations**
School groups visit the Circular Economy Park to see the operations of a recycling yard, second-hand shop, and eco-education center. Demonstrations and guided tours are tailored to different age groups and professional backgrounds.
- **Blended Learning**
RecycAl is developing digital materials, short videos, and interactive infographics to complement in-person trainings. These resources support distance learning and allow schools to integrate CE topics into their curricula more easily.
- **Interdisciplinary Approach**
The training program connects environmental issues with economics, design, engineering, and social inclusion. This holistic view helps learners understand the broader implications of their actions and the systemic nature of sustainability.
- **Local Context and Cultural Relevance**
Educational content is adapted to the Albanian and Western Balkan context, using local examples, challenges, and success stories. This ensures better relevance, motivation, and potential for community engagement.
- **Training-of-Trainers Model**
RecycAl has successfully trained school staff and selected student multipliers, enabling long-term impact through internal capacity building.
- **Partnership with Municipalities and Schools**
Institutional partnerships ensure that trainings are well-integrated and that separated waste is properly collected after awareness efforts.
- **Use of Visual Tools**
Posters, signage, color-coded bins, and infographics are displayed throughout the park and in partner schools, reinforcing behavioral change through visibility.
- **Focus on Inclusion**
Programs are accessible to students from diverse backgrounds, including Roma communities, and emphasize social equality and fair employment in waste-related sectors.
- **Feedback-Driven Improvement**
Regular assessments and feedback loops from teachers, students, and municipal partners help RecycAl adjust and improve its training content and delivery style.

These educational methodologies form a strong foundation for raising environmental awareness, equipping young people with green and entrepreneurial skills, and supporting the long-term transition toward a circular economy in Albania and the Western Balkans.

5.8 Conclusions

The Circular Economy Park established by RecycAl in Albania represents a pioneering, integrated approach to waste management, social inclusion, and vocational education in the Western Balkans. It is not just a recycling facility—it is a multifunctional, community-based solution addressing multiple socio-environmental challenges simultaneously.



Through its pillars—the Recycling Yard, Reused Goods Mall, Eco-Education Center, and Circular Showroom—the Park creates a circular ecosystem that connects waste management operations, education, employment, and green entrepreneurship. This synergy has already demonstrated measurable impacts in schools, municipalities, and businesses.

By collecting over 100,000 kg of recyclables annually, supporting 80 SMEs, engaging 60 schools, and involving vulnerable communities such as Roma informal collectors, the Park is a scalable and replicable model. The project's alignment with the EU Waste Framework Directive, Albania's Strategic Policy Document for Integrated Waste Management, and the OECD Roadmap (2024) positions it as a key contributor to national and EU-level environmental goals.

Moreover, its strong educational component—rooted in practice-oriented VET training—ensures sustainability through knowledge transfer, capacity building, and youth empowerment. The project bridges the gap between policy and practice, theory and action, vision and implementation.

As Albania prepares to align with EU standards and accelerate its circular transition, the Circular Economy Park offers a blueprint for how integrated, inclusive, and innovation-driven solutions can catalyze systemic change in the waste and resource sector.

This case study not only informs policy and VET development but also inspires the replication of successful models throughout Albania, Kosovo, and beyond.

6 Case Study 5: Greening the VET Campus: A Sustainable Waste Management Initiative at a Technical School in Pristina

6.1 Executive Summary

In 2022, a technical vocational education and training (VET) school in Pristina, Kosovo, initiated a campus-wide waste management project aimed at reducing its environmental footprint and embedding sustainability in student learning. Through a structured recycling plan, integrated educational methodologies, and collaboration with local institutions, the school transformed from a high-waste generator into a green learning hub. This case study outlines how student-led initiatives, low-cost infrastructure changes, and curriculum reform contributed to a 50% reduction in waste and lasting behavioral changes.

6.2 Background and Context

The VET school “Mehmet Akif” in Pristina serves over 600 students specializing in electrical engineering, construction, and computer maintenance. Kosovo’s capital faces growing urban waste issues, with limited public recycling infrastructure and low rates of environmental literacy. Despite government efforts, schools have struggled to meaningfully integrate environmental sustainability into education. This project was funded through a small municipal grant and supported by a local NGO, GreenKosova.

6.3 Problem Statement

The school produced large volumes of waste—especially plastic bottles, packaging, electronic waste (e-waste), and hazardous workshop by-products. Without recycling infrastructure or environmental modules in the curriculum, students and staff lacked awareness and means to reduce waste, contributing to landfill overflow and public health risks.

6.4 Objectives of the Case

- Introduce a waste management system across the school.
- Build student knowledge and responsibility in environmental stewardship.
- Promote teacher development in environmental education.
- Connect theory and practice in sustainable resource use.

6.5 Challenges and Solutions

The implementation of sustainable waste management practices within the partner school highlighted several key challenges that required targeted and coordinated interventions. Initially, the absence of adequate infrastructure significantly hindered progress. The school lacked appropriate waste collection facilities, including bins, signage, and logistical arrangements for regular disposal. This limitation made it difficult for students and staff to engage in systematic

recycling or segregation of materials. To address this gap, color-coded recycling bins were installed in all classrooms and workshops, enabling the separation of plastics, paper, metals, and general waste. Furthermore, a formal partnership was established with a local waste management company to ensure the consistent, weekly collection and environmentally responsible processing of the sorted materials.

A second challenge related to student engagement and attitudes toward environmental practices. At the start of the initiative, many students displayed apathy and resistance to behavioural change, showing limited interest in sustainability-related topics. To stimulate participation and ownership, the project introduced peer-led awareness activities. These included classroom competitions rewarding the highest recycling rates and the formation of student “green patrols” responsible for promoting good practices among their peers. This approach proved effective in fostering motivation, strengthening environmental awareness, and embedding a culture of responsibility within the school community.

The third major challenge concerned the limited capacity of teachers to integrate sustainability and circular economy principles into their lessons. Most educators had not received formal training in these areas, which restricted their ability to convey relevant knowledge and skills to students. In response, the project team, in collaboration with GreenKosova, organized a series of capacity-building workshops for teachers. These sessions focused on practical strategies for embedding waste management and sustainability topics within STEM and vocational education. Teachers were provided with concrete examples, teaching resources, and methodologies to support the incorporation of environmental themes into their classroom practice.

Through these combined interventions, the school achieved measurable improvements in its waste management performance and established a more sustainable learning environment. The coordinated enhancement of infrastructure, student engagement, and teacher capacity created a replicable model for integrating environmental education into everyday school operations. This experience demonstrates that behavioural change and sustainability awareness in educational institutions are most effectively achieved when physical improvements are complemented by active participation and targeted professional development.

6.6 Recycling Plan

The implementation plan focused on establishing an integrated and participatory waste management system within the school, combining material segregation, student engagement, and data-driven monitoring. The process began with the introduction of a structured material separation system covering multiple waste streams, including paper, plastic, aluminium, electronic waste, and workshop chemicals. Clearly labelled collection points were installed throughout the school premises to ensure safe and efficient sorting at the source.

A key feature of the initiative was the active involvement of students in daily waste management practices. Each week, classroom teams were assigned to monitor the correct use of recycling bins and record data on the quantities collected. This peer-led monitoring approach encouraged responsibility, collaboration, and environmental awareness among students, transforming waste segregation into a regular part of school culture.



In parallel, a secure storage area was established for the safe collection and temporary storage of electronic waste and used batteries. This measure ensured compliance with environmental safety standards and prevented potential contamination from hazardous materials. The introduction of safe e-waste handling procedures also served as an educational tool, illustrating the importance of responsible management of electronic materials.

Data collection and analysis played a central role in sustaining motivation and tracking progress. The student monitoring teams produced monthly reports summarizing the types and quantities of materials recycled. These reports were reviewed by teachers and project coordinators and used both to evaluate performance and to highlight achievements during school assemblies and awareness events.

By the end of the first year of implementation, the school successfully diverted approximately 3.2 tons of waste from landfill, representing a significant step towards institutionalizing sustainable waste management practices. The combination of clear operational planning, active student participation, and consistent data use proved highly effective in reinforcing behavioural change and establishing a replicable model for environmental education and circularity within the school setting.

6.7 Teaching Methodologies and Best Practices

The educational component of the initiative was structured around active, interdisciplinary, and experience-based learning, designed to embed sustainability and circular economy concepts within the school curriculum. A Project-Based Learning (PBL) approach was adopted to engage students in practical environmental problem-solving. As part of this framework, learners conducted waste audits to assess consumption patterns and identify areas for reduction, while also developing and implementing awareness campaigns aimed at improving recycling behaviour within the school community.

A cross-disciplinary teaching approach further enhanced the integration of sustainability topics across various subjects. In mathematics, students applied data analysis techniques to interpret waste audit results and track recycling performance over time. In ICT classes, they created digital posters and awareness materials, combining technological and creative skills to communicate environmental messages effectively. Engineering and vocational lessons incorporated eco-design challenges, encouraging students to prototype solutions that reduce waste or promote resource efficiency. This approach not only reinforced technical learning outcomes but also demonstrated the relevance of circular economy principles across disciplines.

The initiative also emphasized student leadership and ownership of sustainability activities. A Green Committee composed of student representatives was established to oversee communication, coordinate logistics, and propose innovative actions related to waste management and environmental awareness. The committee played a key role in maintaining momentum, ensuring that activities were student-driven and aligned with the broader objectives of the program.

Finally, to strengthen the link between classroom learning and real-world application, the project integrated field-based collaboration and experiential learning opportunities. Students participated in excursions to landfill sites, recycling centres, and environmental NGOs, gaining



firsthand understanding of waste management processes and the environmental impact of consumption and disposal practices. These visits complemented classroom learning by providing tangible insights into the challenges and opportunities associated with sustainable resource management.

Overall, the combination of project-based learning, cross-disciplinary integration, student leadership, and real-world engagement fostered a holistic educational experience that not only deepened students' knowledge but also cultivated practical skills and environmental responsibility.

6.8 Conclusions

The initiative reduced campus waste by 50% and cultivated a culture of sustainability. Students reported increased awareness and personal responsibility, and teachers became more confident in delivering environmental education. The model was presented to the Ministry of Education for national scaling and continues as a student-run program.



7 Case Study 6: “From Wood Waste to Workbench: Circular Economy Skills in a VET Carpentry Program in Gjakova”

7.1 Executive Summary

This case study presents a successful circular economy initiative implemented at a carpentry and woodcraft VET school in Gjakova, Kosovo. Faced with high material waste and outdated teaching approaches, the school launched a practical upcycling and sustainability module. Through workshops, partnerships with local furniture businesses, and student-led product innovation, learners gained hands-on experience in green entrepreneurship. The project created a pathway to employment while cutting school wood waste by over 60%.

7.2 Background and Context

“Skenderbeu” VET School in Gjakova has over 200 students enrolled in woodworking, design, and mechanical courses. Despite Kosovo’s growing furniture industry, few VET programs equip learners with skills in sustainable design or circular economy practices. With limited budgets, the school often relied on donor material, producing high levels of offcuts and unused pieces. Unused scrap often went to landfill or burned.

In 2023, the school secured support from a Swiss-funded skills development program to pilot a green innovation lab.

7.3 Problem Statement

Woodworking activities generated excess wood waste, and students lacked exposure to sustainability concepts or innovation in carpentry. Employment outcomes were stagnant, and school-community links were weak.

7.4 Objectives of the Case

The primary objective of this case was to reduce wood and material waste generated within the school’s workshops through upcycling and reuse practices. By promoting the transformation of discarded materials into new, functional, or artistic products, the initiative sought to minimize resource wastage while demonstrating the tangible value of circular design principles in vocational education.

A key goal was to develop student competencies in circular economy principles, ensuring that learners not only understood theoretical sustainability concepts but were also able to apply them in practical, workshop-based contexts. Through hands-on activities, students explored material life cycles, sustainable production methods, and innovative approaches to extending product value and lifespan.



The case also aimed to foster eco-entrepreneurial thinking and product innovation, encouraging students to approach waste materials as opportunities for creative design and small-scale business ventures. This entrepreneurial dimension supported the development of critical skills such as problem-solving, creativity, and resource management, all essential for future green careers.

Finally, the initiative sought to engage the local business community to strengthen the connection between education and the labour market. Collaboration with local enterprises provided students with exposure to real-world sustainability challenges, mentorship opportunities, and insights into emerging trends in the circular economy. This engagement ensured that the learning process remained grounded in practical relevance and contributed to building stronger community ties around sustainability-driven innovation.

7.5 Challenges and Solutions

The implementation of the case study encountered several challenges that required strategic and collaborative solutions to ensure successful outcomes and long-term sustainability.

The first major challenge concerned the low perceived value of recycled products. Many stakeholders, including educators and community members, initially expressed concern that students' upcycled creations would be of limited quality or commercial appeal. To address this perception, the project engaged expert mentors from the design and craft sectors to guide students in improving the aesthetic and functional quality of their work. Additionally, a series of community exhibitions were organized to publicly showcase the finished products. These events helped shift attitudes by demonstrating the creative potential and market viability of recycled materials, reinforcing the message that sustainability and quality can coexist.

A second challenge related to limited resources and outdated workshop facilities. The lack of appropriate tools and equipment constrained students' ability to experiment with advanced upcycling techniques. This limitation was mitigated through collaborative partnerships with local businesses and the Swiss development program, which provided essential tool donations and technical support. These contributions enabled the school to modernize its facilities and offer a more comprehensive, hands-on learning experience.

The third challenge involved curriculum inflexibility, as sustainability topics were not formally integrated into the existing national woodworking curriculum. To overcome this barrier, the project team developed a flexible elective module on circular economy and sustainable design, which was piloted with approval from the Ministry of Education. This adaptive approach allowed students to gain exposure to contemporary environmental practices without requiring immediate structural curriculum reform, while also creating a model that could be scaled or replicated in other vocational institutions.

Through these targeted interventions, the project successfully addressed key operational, perceptual, and institutional barriers, setting a strong foundation for the broader integration of circular economy principles into vocational training frameworks.

7.6 Recycling Plan

The recycling plan for this case focused on transforming waste materials from local sources into functional and marketable products while providing students with practical experience in circular economy practices. The primary input materials included furniture offcuts, wood pallets, and discarded household furniture sourced from local businesses. Students were actively involved in the entire process, which began with cleaning and sorting the materials to ensure they were suitable for reuse. They then applied upcycling techniques to repurpose these materials into finished products, including stools, decorative panels, and plant holders.

The output of this process was both tangible and impactful. By the end of the project cycle, students had created over 80 unique items, which were showcased and sold at the Green Makers' Fair. The proceeds generated from these sales were strategically reinvested into purchasing additional tools and providing scholarships for participating students, thereby reinforcing the sustainability and educational value of the initiative. This recycling plan not only reduced material waste but also cultivated entrepreneurial skills, creativity, and practical knowledge of circular economy principles among the students, providing a replicable model for integrating environmental responsibility into vocational education.

7.7 Teaching Methodologies and Best Practices

The educational approach adopted in this case emphasized active, student-centered learning, combining practical skills development with the cultivation of sustainability literacy. A **Design Thinking approach** was employed to encourage students to identify real community needs and collaboratively co-create innovative solutions, fostering both creativity and problem-solving capabilities.

To develop entrepreneurial and management competencies, the project incorporated **enterprise simulations**, in which small student groups operated as mini-companies responsible for product design, budgeting, and marketing. This experiential method allowed learners to understand the practical implications of decision-making within a circular economy context, while also promoting teamwork and strategic thinking.

The initiative further leveraged **partnership-driven learning**, with workshops co-led by local craftspeople and representatives from recycling companies. These collaborations provided students with access to expert knowledge, technical guidance, and industry best practices, ensuring that learning was directly connected to real-world applications and professional standards.

In addition, the program integrated a focus on **sustainability literacy**, including structured sessions on forest management, carbon footprint assessment, and lifecycle thinking. These lessons reinforced the broader environmental and societal context of students' practical activities, helping them to link hands-on upcycling and product design with systemic understanding of resource efficiency and circular economy principles.

Through the combination of design thinking, enterprise simulations, partnership-driven workshops, and sustainability-focused education, the project established a set of **best practices** that are both replicable and scalable, demonstrating an effective model for integrating circular

economy education into vocational training.

7.8 Conclusions

The project successfully established a robust model for integrating green skills and circular economy principles into vocational woodcraft education. Over the course of implementation, the initiative achieved significant outcomes, including a 60% reduction in material waste, the support and mentorship of five (5) students in launching eco-entrepreneurial ventures, and the institutionalization of a permanent sustainability elective within the school curriculum.

Beyond these immediate results, the project has created broader systemic impact by positioning the school as a member of a national working group tasked with exploring strategies for embedding circular economy modules across vocational education and training (VET) programs in Kosovo. This engagement ensures that the lessons learned and best practices developed through the initiative will inform future curriculum development and contribute to the wider adoption of sustainable and resource-efficient practices within the national VET system.

