

Sustainability

New Approaches for a *Wicked Problem*

This publication is a deliverable of the project entitled “Green Hive”, a Cooperation Partnership in the Vocational Education and Training field co-funded by the European Union’s Erasmus+ Programme under Grant Agreement No. 2022-2-IE01-KA220-VET-000097215.

Deliverable Title:

Sustainability: New Approaches for a Wicked Problem

Deliverable Version: 1.0 - October 2025

Deliverable Lead: Lascò Srl

Author: Angela Mangiullo

DOI: 10.5281/zenodo.17709782

Contributors:

- Acomi Nicoleta (TEAM4Excellence)
- Acomi Ovidiu (TEAM4Excellence)
- Cleary Elaine (Technological University of the Shannon - Midlands Midwest)
- Lanzetta Miriam (Lascò Srl)
- Lopez Cruz Maria del Carmen (Femxa)
- Melissinou Raina (KEAN)
- Taylor Marie (Technological University of the Shannon - Midlands Midwest)
- Tsekouras Vasilis (KEAN)

Disclaimer: Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority. Neither the European Union nor the granting authority can be held responsible for them.



The reuse of this document is authorised under the Creative Commons Attribution-Noncommercial 4.0 International (CC BY-NC 4.0) licence (<https://creativecommons.org/licenses/by-nc/4.0/deed.en>). This means that you are free to copy, share, adapt and use the material for non-commercial purposes, as long as you give appropriate credit, provide a link to the licence, and indicate if changes were made.

TABLE OF CONTENTS

Introduction	3
1. The Green Hive Project	5
2. Sustainability: Why a wicked problem?	6
3. A system approach to sustainability education	8
3.1 Preparing learners for the circular economy	8
3.2 Skills, knowledge, and attitudes for green competences	9
4. A European Challenge for Green Combs	11
5. Winning solution	12
5.1 The Winning Team: Liceul Tehnologic “Lazăr Edeleanu” Năvodari	12
5.2 Impact and transferability	13
6. Other promising initiatives	14
6.1 Greece	14
6.2 Romania	16
6.3 Spain	19
6.4 Ireland	21
6.5 Italy	23
7. Ways Forward	26
Bibliography	28

Introduction

Sustainability is one of the defining challenges of our time. Climate change, biodiversity loss, resource scarcity, and social inequalities intertwine in ways that defy simple solutions. ***Wicked problems***, as defined by Rittel and Webber (1973), are issues that are difficult to define, have no single solution, and require constant negotiation among diverse stakeholders. Unlike “tame” problems, wicked problems resist linear or technical fixes; they demand systemic approaches, creativity, and collaboration across sectors (Levin et al., 2012).

The **Green Hive project**, a Cooperation partnership in the Vocational Education and Training (VET) field co-funded by the Erasmus+ Programme of the European Union, was designed as a response to this demand by five entities: the [Technological University of the Shannon Midlands Midwest](#) (Ireland), the companies [Lascò](#) (Italy) and [Femxa](#) (Spain), and the non-profit and non-governmental organisations [KEAN](#) (Greece) and [TEAM4Excellence](#) (Romania). Bringing together VET providers, teachers, students, and stakeholders from across Europe, the project created spaces for co-creation and experimentation. Within their local Hubs, participants worked side by side to design and test innovative solutions for sustainability, with a particular focus on equipping learners with the competences required for the green transition and circular economy.

This publication, “*Sustainability: New Approaches for a Wicked Problem*”, brings together the insights, practices, and results of this collaborative journey. It offers both a theoretical lens, framing sustainability as a wicked problem, and practical examples of how education and training can contribute to addressing it. From the winning Hub’s solution to other promising

initiatives, it highlights the creativity and commitment of young people, educators, and communities engaged in shaping a more sustainable future.

Rather than offering final answers, **this e-publication seeks to inspire dialogue, experimentation and shared learning.** It is an invitation to reflect on what has been achieved through Green Hive and to imagine how such approaches can be scaled and adapted to meet the challenges ahead.

1. The Green Hive Project

The concept of the Green Hive ecosystem was born within an ambitious European project designed to revolutionise sustainability education through a dynamic network of localised Sustainability Education Hubs, known as 'Green Combs,' and a knowledge platform to connect them, promoting the sharing of information, documents, guides, resources, and knowledge between members of the various communities.

The Green Hive project was conceived as a strategic response to the urgent need to integrate sustainability competences within vocational education and training. At its core, the project aims to equip VET providers with the tools and methodologies to prepare learners for the demands of the green transition and the challenges of the circular economy (European Commission, 2020). To achieve this, Green Hive has developed a network of local hubs, referred to as *Green Combs*, that convene educators, learners, businesses, NGOs, and public authorities in collaborative ecosystems. These hubs are tied through the Green Hive digital platform, which functions as both a repository and a co-creation space, enabling the sharing of resources, practices, and innovative pedagogical solutions aligned with the European Sustainability Competence Framework (*GreenComp*) (Bianchi et al., 2022). In this way, the project bridges the gap between policy frameworks and classroom practice, providing teachers and trainers with methodological guidelines, toolkits, and digital instruments to foster transversal competences essential for sustainability, such as critical thinking, systems understanding, and collaborative problem-solving (Voogt & Pareja Roblin, 2012; Rieckmann, 2018). By promoting cross-sector collaboration and embedding digital innovation in VET, Green Hive positions itself not merely as a project but as a model for reimagining education's role in addressing sustainability issues.

2. Sustainability: Why a wicked problem?

Sustainability issues, in particular climate change, environmental degradation, and social inequalities, embody what scholars define as *wicked problems*: phenomena that resist simple, linear solutions due to their inherent complexity, uncertainty, and the web of interconnections among ecological, economic, social, and political dimensions. As *Climate change as a 'wicked problem'* (Stang & Ujvari, 2015) points out, climate change has proven “slow, uneven, and politically divisive,” demonstrating how ambitious goals clash with divergent interests, varying capacities, and unpredictable feedback loops. In wicked problems, what seems to be a solution in one domain may trigger unintended consequences in another; the lack of consensus on problem definitions and the multiplicity of stakeholders multiply this challenge.

This complexity is particularly visible in the sustainability field, where tensions arise between economic growth and environmental protection, technological innovation and social inclusion, or short-term benefits and long-term resilience. The European Environment Agency (EEA, 2023) has warned that Europe is not on track to meet several of its 2030 sustainability targets, underscoring the insufficiency of fragmented, incremental interventions. Addressing wicked problems requires systemic thinking, participatory governance, and transformative change. It also calls for resilience: the capacity of societies, institutions, and learners to adapt and innovate in the face of intertwined ecological, economic, and political crises.

Education plays a central role in this context. Yet, as the OECD (2024) notes, sustainability education is often confined to science curricula, even though wicked problems demand cross-disciplinary, place-based, and experiential approaches. Recent scholarship

emphasises the importance of *transformative education*, which engages learners not only in acquiring knowledge but also in co-creating solutions, developing agency, and navigating uncertainty (Voogt & Pareja Roblin, 2012; Rieckmann, 2018). However, these approaches face obstacles such as limited resources, gaps in teacher training, and conflicts of interest in curriculum design that dilute ambition and accountability (Sund & Öhman, 2025).

Key Characteristics of sustainability as a wicked problem

- Multiple interconnected systems (environmental, economic, social)
- Diverse stakeholders with conflicting interests
- Long-term consequences spanning generations
- Uncertainty in outcomes and unintended consequences
- No opportunity for trial-and-error learning.

Recognising sustainability as a wicked problem thus reshapes how we imagine the role of VET and education more broadly. It is not about delivering fixed answers but about equipping learners with the competences to manage complexity, negotiate diverse perspectives, and collaboratively design adaptive responses. This orientation resonates strongly with the philosophy of the Green Hive project, which embraces uncertainty, fosters co-creation, and builds ecosystems of learning that prepare the next generation for the profound challenges of the green transition.

3. A system approach to sustainability education

Sustainability education cannot be confined to isolated disciplines or short-term initiatives; evidence increasingly shows that a systemic approach is needed, one that acknowledges the interconnections between ecological, economic, and social dimensions, as well as the links between local and global contexts and among diverse stakeholders. Such an approach implies that education must prepare individuals not only to understand environmental challenges but also to act within complex systems, anticipate unintended consequences, and develop transformative capacities (Sterling, 2010). In Vocational Education and Training (VET), this means equipping learners not only with technical skills but also with critical, reflective, and collaborative competences that enable them to navigate the green transition in a resilient and proactive manner.

3.1 Preparing learners for the circular economy

The transition toward a circular economy is at the base of European sustainability policies, requiring not only technological changes but also cultural and educational shifts. According to Kirchherr, Reike, and Hekkert (2017), clearly defining the circular economy would help design educational models that incorporate lifecycle thinking, material reuse, waste management as an opportunity, and consideration of environmental and social impacts. The study *Setting Up an Educational Ecosystem for Enabling Sustainability Competences Development*¹ further emphasises that developing sustainability competences requires a

¹ Acomi, N., Lanzetta, M., Acomi, O., & Abbruzzese, G.(2025).Setting up an educational ecosystem for enabling sustainability competences development.Revista Românească pentru Educație Multidimensională,17(1),159-179. <https://doi.org/10.18662/rrem/17.1/945>

local educational ecosystem connecting schools, communities, businesses, and other stakeholders to co-design learning experiences that reflect real-world contexts.

3.2 Skills, knowledge, and attitudes for green competences

The European Sustainability Competence Framework (*GreenComp*) (Bianchi et al., 2022) offers a comprehensive structure for identifying the skills, knowledge, and attitudes required for sustainability. It identifies key competences such as systems thinking, critical thinking, futures literacy, collective action, and responsibility. These competences demand pedagogical approaches that foster collaboration, reflexivity, and ethical engagement. For instance, developing systems thinking involves helping learners map interactions and feedback loops across ecological and socio-economic systems, while futures literacy competence requires the capacity to imagine and critically assess alternative scenarios. Importantly, these competences are not abstract: they translate into the ability to innovate in professional practice, participate in democratic decision-making, and adopt sustainable lifestyles.

Core Principles of New Approaches

The new paradigm for addressing sustainability challenges is built on several foundational principles that distinguish it from traditional approaches. These include systems thinking that recognises interconnections, adaptive management that allows for learning and adjustment, participatory processes that engage diverse stakeholders, and technological innovation that enables unprecedented solutions.

A system approach to sustainability education thus positions learning as both personal and collective transformation. It empowers individuals to recognise their agency within complex systems and to collaborate with others in building solutions.

This philosophy aligns closely with the Green Hive Project, which promotes co-creation, digital innovation, and cross-sector collaboration as tools for preparing learners to address the uncertainties and challenges of the green transition.

4. A European Challenge for Green Combs

The European Challenge for Green Combs represents a practical and collaborative application of the systemic approach to sustainability education promoted by the Green Hive project. Designed and implemented by the project consortium in 2025 as a Europe-wide competition, it brought together VET providers, learners, and local stakeholders in co-creation processes aimed at addressing real-world sustainability challenges. Each participating hub, or *Green Comb*, functions as a microcosm of an educational ecosystem, linking teachers, students, businesses, and community organisations to foster collaborative problem-solving and innovation. Participants are encouraged to use the Green Hive platform, the GreenComp competence framework, and pedagogical resources developed throughout the project to design interventions that are contextually relevant, impactful, and transferable across European contexts.

The challenge emphasises the integration of knowledge, skills, and attitudes, enabling learners not only to propose innovative solutions but also to assess their environmental, social and economic implications critically. By fostering active engagement and cross-sectoral collaboration, the European Challenge experimented with the principles outlined in the systemic approach to sustainability education: experiential learning, co-creation, reflection, and iterative improvement. Beyond the competitive dimension, it facilitates networking among Green Combs across Europe, promoting the exchange of best practices, the dissemination of innovative methodologies, and the scaling of solutions that demonstrate both pedagogical and environmental effectiveness. In this way, the European Challenge consolidates the Green Hive's vision of sustainability education as a collaborative,

dynamic, and transformative endeavour, equipping learners and educators to navigate the complexities of wicked problems collectively.

5. Winning solution

5.1 The Winning Team: Liceul Tehnologic “Lazăr Edeleanu” Năvodari



Liceul Tehnologic “Lazăr Edeleanu” Năvodari

The project ***Fighting for Wellness***, developed by **Liceul Tehnologic “Lazăr Edeleanu” Năvodari**, tackles the intertwined challenges of sustainability, inclusion, and student engagement by transforming the school’s unused courtyard into a lively, multifunctional learning and community space. The initiative is designed not only to improve active learning and student participation but also to align with the principles of the New European Bauhaus by combining sustainability, aesthetics, and inclusivity. The envisioned space integrates gazebos for outdoor classes, green areas with benches, tables, and chairs, a stage for events and presentations, a dedicated reading zone, a projection area for film screenings, and a school garden that could evolve into a community garden. To bring this vision to life, the project relies on a participatory approach: students, teachers, and parents volunteer to reduce costs, while partnerships with the municipality of Năvodari and local companies (Midia, Rompetrol, Argenta) secure financial and material support. Additional resources are mobilised through the parents’ association and crowdfunding campaigns, ensuring both ownership and sustainability of the initiative. The step-by-step implementation plan includes

presenting the idea to the Student Council, establishing volunteer groups, engaging the school management, seeking sponsorships, and disseminating the project through social media.

5.2 Impact and transferability

The project's impact is multifaceted, encompassing educational, social and environmental dimensions. By creating a shared green learning environment, *Fighting for Wellness* can foster creativity, critical thinking, collaboration, communication and citizenship among students, while also providing educators with innovative teaching opportunities. It fosters environmental awareness and sustainable behaviour, contributing to both academic success and emotional well-being. The involvement of local stakeholders strengthens community ties and offers students authentic experiences of collaboration and civic responsibility. Importantly, the solution is highly transferable: the methodology of combining co-creation, stakeholder engagement, and resource mobilisation can be adapted by other schools across Europe, particularly those seeking to repurpose unused spaces for educational and community benefit. The project exemplifies how systemic thinking, inclusivity, and cross-sectoral collaboration can address wicked problems in education and sustainability, positioning students as active changemakers in their learning environments and beyond.

6. Other promising initiatives

6.1 Greece

The involvement of Greek schools in the Green Hive Contest highlighted how students can transform local concerns into meaningful environmental action. Their projects addressed a variety of issues that resonate strongly with their communities, such as the preservation of natural resources, the promotion of sustainable lifestyles, and the importance of collective responsibility. By combining awareness-raising activities with practical solutions, the Greek participants demonstrated how education, creativity, and civic engagement can come together to foster a greener and more resilient future.

First Vocational High School of Servia, Kozani

Students at the First Vocational High School of Servia, Kozani, turned their attention to the persistent problem of waste and its environmental consequences. Recognising the need to move from passive awareness to active engagement, they launched a series of initiatives centred on recycling and composting. By collecting small electronic devices, headphones, batteries, and even unwanted notebooks, they highlighted the importance of reducing electronic and paper waste. Beyond collection, they demonstrated creativity by repurposing old materials—such as dismantling a computer to create a storage box and building a recycling container from notebook covers—thereby showing that reuse is both feasible and impactful. Complementing these actions, their composting activities taught peers how organic waste could be transformed into valuable fertiliser, cutting reliance on chemical products and improving soil quality. Together, these initiatives not only addressed waste

management but also fostered a culture of responsibility and innovation within the school community.

1st EPAL of Artas

In Artas, the focus shifted to the deterioration of water quality, a problem with direct consequences for both the environment and local communities. Pollution in the Aegean Sea, particularly near harbours, had long been attributed to old oil boats, but students at the 1st EPAL of Artas revealed that industrial waste, untreated sewage, pesticides, and fertilisers were the real drivers of ecological decline. Their project framed water pollution as a multifaceted issue that threatened biodiversity, public health, and the livelihoods of local fishermen. In response, they developed a strong advocacy campaign promoting the reduction of pesticide use, the improvement of wastewater treatment systems, and stricter enforcement of environmental regulations. Community engagement was a cornerstone of their approach: they encouraged clean-up activities, recycling, and awareness campaigns, ensuring that responsibility for protecting water resources was shared by all. Through this holistic vision, the school linked environmental protection to social and economic well-being, inspiring collective responsibility for safeguarding one of life's most vital resources.

2nd Evening Vocational School of Nea Ionia

The 2nd Evening Vocational School of Nea Ionia addressed the urgent issue of rising energy consumption and its environmental impact. Their project underscored the importance of energy efficiency in smart buildings, presenting it not as an option but as a necessity for the future. By implementing Energy Management Systems (EMS) powered by IoT sensors, they were able to monitor energy consumption in real time, detect inefficiencies, and adjust

systems such as heating, ventilation, and lighting to reduce waste. At the same time, the school explored renewable energy solutions, integrating solar panels, geothermal heat pumps, and energy storage systems to reduce dependence on fossil fuels. This dual approach not only decreased carbon emissions but also cut operational costs, showing how environmental and economic goals could be pursued together. By merging technology, sustainability, and education, the students demonstrated how local initiatives can contribute to broader climate objectives while fostering awareness of responsible energy use among peers and the wider community.

6.2 Romania

The participation of Romanian schools in the Green Hive Contest demonstrated both creativity and commitment in addressing some of the most urgent environmental challenges. Each school engaged with issues that directly affect their communities—ranging from waste management and energy efficiency to fast fashion, transport, and marine pollution—while also developing solutions that are practical, innovative, and replicable. Their projects reflect not only a growing awareness among young people of the global climate crisis, but also their determination to take responsibility and to inspire change within their schools and local environments.

Carol I Commercial College

At the **Carol I Commercial College**, students highlighted the lack of green spaces and practical sustainability education in schools. To respond to this issue, they created the *Echos Sprout Initiative*, an action plan that combines school gardens, recycling programs, and digital “echo challenges.” Through these activities, students not only reduce waste and promote greener practices on campus but also inspire their peers to adopt climate-friendly

habits. Their vision is to expand the initiative to other schools by providing resources, workshops, and networks of eco-clubs.

Liceul Tehnologic Ioan N Roman Constanța

The students from **Liceul Tehnologic Ioan N Roman Constanța** decided to focus on the fast fashion industry, which is currently the world's second-largest polluter. They identified a series of problems caused by this sector, such as excessive water waste, the use of toxic chemicals, high CO₂ emissions, and a growing crisis of discarded clothes. Their solution has been to promote what they call “smart fashion”: donating, swapping, and repurposing clothes, while also encouraging a general reduction in consumption. Their message is powerful in its simplicity: “We don’t need more stuff.”

Another group from the same school, **Liceul Tehnologic Ioan N Roman Constanța**, turned their attention to the issue of transport in Romania. They noted how the country still relies heavily on fossil fuels, resulting in pollution, inequity between urban and rural areas, and unsafe conditions for those who wish to cycle. Their proposal emphasises the importance of investing in cycling infrastructure, improving public transportation systems, offering shuttle services to rural communities, and changing the public mindset towards greener choices. Their vision is of cleaner air, safe cycling paths, efficient transport, and people-first cities.

Liceul Tehnologic Nicolae Dumitrescu Cumpăna

At **Liceul Tehnologic Nicolae Dumitrescu Cumpăna**, students explored the ongoing waste crisis, with particular attention to the problems of landfills, school lunch waste, and inadequate recycling. They responded with the idea of a “Campus Green Cycle,” a closed-loop system that transforms organic waste into compost, which is then used to maintain student-run gardens producing vegetables, herbs, and flowers for school use. The

project goes beyond waste management, since it also rewards students with eco-leader certificates, encourages classrooms to adopt plants, and creates small rituals such as tea breaks to reinforce sustainable behaviours.

Liceul Teoretic Ovidius

The **Liceul Teoretic Ovidius** approached the issue of energy consumption. Students noted how wasteful habits often go unnoticed in everyday life, both at home and in schools. Their solution was to launch a student-led campaign to reduce energy waste. The results were impressive: a 20% reduction in overall consumption and a 50% decrease in school energy use. Their project demonstrates how small, individual actions can accumulate into significant change, reinforcing the idea that personal responsibility plays a key role in environmental sustainability.

“Gheorghe Duca” Technological High School Constanța

The students of the **“Gheorghe Duca” Technological High School Constanța** dealt with a particular environmental emergency: oil spillage in the Black Sea near Constanța. They recognised the severe threat posed to marine ecosystems and decided to simulate coordinated responses. Their solution involved cooperation among different actors: NGOs monitored biodiversity, the city hall provided funding, universities developed models of pollutant spread, and local communities promoted awareness and legal action. The project showed how vital multi-sector collaboration is in addressing large-scale environmental disasters.

Romanian Intermodal Association

The **Romanian Intermodal Association** turned their attention to schools themselves, identifying them as highly energy-consuming spaces that often lack proper recycling and composting systems. They also noted that sustainability is rarely embedded in the school curriculum. Their project, *Green Schools Now*, sought to transform schools into eco-friendly institutions by conducting energy studies, founding eco-clubs, promoting composting and recycling, and integrating sustainability principles into teaching. Their mission is to empower students and teachers alike to contribute actively to greener schools.

6.3 Spain

The participation of Spanish schools in the Green Hive Contest is characterised by a strong emphasis on creativity, collaboration, and inclusivity. The projects combined art, music, science, and social engagement, showing how sustainability can be embedded into education in innovative and inspiring ways. Each initiative reflects the commitment of students and educators not only to raise awareness of environmental problems but also to provide solutions that are practical, socially relevant, and rooted in community action.

Centro de Formación Profesional EAP

At the **Centro de Formación Profesional EAP**, students developed a collaborative initiative aimed at reducing the carbon footprint of the educational sector by merging art, scientific research, and sustainable education. In partnership with the School of Arts of Pontteras, urban sketching groups from Spain and Portugal, the Spanish National Research Council, and the training company Fetsza, they designed a calendar of events to promote sustainability

through creative engagement. Their three challenges—urban sketching on the impact of waste on biodiversity, fundraising through the sale of artwork to finance eco-friendly infrastructure in schools, and the creation of a directory of sustainable local businesses—combined environmental awareness with practical action. This project illustrates how art can serve as a powerful tool to inspire sustainable behaviour, while also generating tangible benefits for schools and communities.

Grupo Femxa

The students of **Grupo Femxa** focused their project on tackling energy waste, a pressing issue that increases both emissions and costs in daily life. They designed a three-part solution consisting of awareness campaigns, a low-cost monitoring system to display real-time energy usage, and weekly class challenges to actively reduce consumption. What makes their initiative particularly innovative is the attention given to inclusivity: they collaborated with ACCEM, an organisation supporting refugees, and Telento, a centre for people with acquired brain injuries, to ensure their campaign was culturally diverse and accessible. Their approach demonstrated that sustainability cannot be separated from social justice, since vulnerable communities often face additional barriers in adopting sustainable practices. By combining inclusivity with practicality, Grupo Femxa created a solution that is both realistic and scalable.

Ulises

The project from **Ulises** took a different but equally powerful path by using music as a tool for environmental education. Believing that music is the most powerful weapon without bullets to change the world, they organised a workshop in which participants were invited to write and perform a song about the environment. Starting from a simple rhythm and melody,

the children brainstormed topics and solutions related to caring for nature, transforming their ideas into lyrics. This initiative emphasised creativity and emotional expression as drivers of awareness, showing how students can take part in shaping a culture of sustainability through artistic engagement.

6.4 Ireland

The Irish participants in the Green Hive Contest brought forward an inspiring variety of projects that reflect both local challenges and broader global concerns. Their initiatives explored themes such as food waste, sustainable transport and tourism, the responsible use of water, and the greening of educational institutions themselves. What unites these projects is the conviction that education, creativity, and collaboration are powerful drivers of sustainable change, capable of transforming not only individual behaviours but also the wider community.

Laois and Offaly Education and Training Board (LOETB)

The **Laois and Offaly Education and Training Board (LOETB)** focused on two key themes that emerged during their workshop discussions: the food waste crisis and the importance of reconnecting with nature through digital skills. Food waste is a major issue in Europe, with households responsible for more than half of the total generated annually. In Ireland alone, 750,000 tonnes of food waste were recorded in 2022, equating to 146 kilograms per person—above the EU average. The LOETB project emphasised the role of education in changing habits: from better understanding supermarket promotions like “buy one, get one free,” to learning how to plan meals, interpret “best before” and “use by” dates, and bridge the knowledge gaps about the environmental and social costs of waste. Alongside this, they

also explored how digital skills can be used to embrace nature—for example, through apps that identify plants and birds while spending time in green spaces. This dual approach shows how education can both reduce waste and help learners build healthier, more sustainable lifestyles by combining digital tools with nature engagement.

Mayo, Sligo and Leitrim Education and Training Board (MSLETB)

In **Mayo, Sligo and Leitrim Education and Training Board (MSLETB)**, students in Westport examined the impact of tourism and local development on their community. Westport is a popular town along the Wild Atlantic Way, attracting millions of visitors each year. While tourism brings economic benefits, students recognised that it also generates pollution, pressures local water supplies, and increases the strain on old, energy-inefficient buildings. Their solutions addressed these problems holistically. They promoted cycling and train travel as sustainable transport alternatives that also improve fitness, reduce stress, and build social connections. They highlighted the urgent need for education around water conservation, especially in island communities such as Achill, where demand spikes during the summer. They also stressed the importance of better communication about grants to improve energy efficiency in older buildings. Beyond these measures, their training in horticulture—known locally as “the compound”—already provides a practical model of sustainable food production, from composting and irrigation to organic crop cultivation. This combination of sustainable transport, tourism, energy use, and food production demonstrates a comprehensive vision for local resilience.

Technological University of the Shannon (TUS)

At the **Technological University of the Shannon (TUS)**, students tackled the environmental impact of educational institutions themselves, which, despite their role in sustainability

education, often generate high levels of emissions. Using the Climate Action Roadmap and the GreenComp framework, business students proposed three innovative ideas to green their campus. The first centred on promoting local and sustainable food options, linking everyday choices to global goals such as responsible consumption, climate action, and good health. The second, titled “The Green Reset,” engaged staff and students in creating biodegradable and sustainable products to reduce campus waste, while also fostering community and creativity. The third initiative focused on sustainable goods and food options through an open space dialogue method, encouraging inclusivity, collaboration, and future literacy. Together, these ideas emphasised that small actions, whether in food choices, product design, or community dialogue, can accumulate into a lasting culture of sustainability within higher education.

6.5 Italy

Italy’s contribution to the project highlighted the diversity of approaches that can be taken to make sustainability concrete, innovative, and inclusive. From vocational training to gamified platforms and civic engagement, Italian partners demonstrated how technology, education, and participation can merge to address pressing environmental challenges while also empowering learners and communities.

081Lab

081Lab presented *SparkSmart*, a tailor-made digital solution designed to tackle the invisible but significant problem of energy waste in vocational schools. Buildings consume 40% of Europe’s energy, and in schools, lights, heating, and devices are often left running unnecessarily. SparkSmart responds with a lightweight platform that allows learners to collect data, visualise consumption in real time, and analyse trends, before taking action

through student-led initiatives. The platform, developed in collaboration with a local non-profit organisation, combines technical expertise with grassroots environmental education. By tracking, visualising, analysing, and acting, learners not only become more energy-conscious but also take ownership of their school's sustainability journey.

Akira

AKIRA developed *Water Guardians*, an engaging initiative that promotes water conservation through gamification. At a time when over two billion people still lack access to safe drinking water, the project raises awareness of waste, pollution, and the behavioural gaps that persist in everyday life. The platform transforms simple actions—such as turning off taps, fixing leaks, or using eco-friendly detergents—into missions that earn points, badges, and rewards. Community spirit is fostered through team challenges and leaderboards, while partnerships with associations, companies, and researchers ground the project in local realities. By combining fun, competition, and education, *Water Guardians* demonstrates how small individual choices, when scaled up, can generate a lasting collective impact on water conservation.

Forum Lex

Forum Lex focused on the social dimension of sustainability, addressing the risk that the green transition might deepen inequality if marginalised communities are excluded. Their initiative, *Green Together*, works to ensure that sustainability becomes a right rather than a privilege. Through workshops, creative labs, and public campaigns, the project empowers youth from disadvantaged backgrounds to build awareness, participate in civic life, and advocate for climate justice. Collaborations with schools, law enforcement, and policymakers ensure that young people's voices reach decision-makers and shape inclusive policies. With

goals to reach over 200 young participants, deliver more than 10 public awareness actions, and facilitate dialogue events, Forum Lex underscores that no one should be left behind in the transition to a greener future.

7. Ways Forward

The Green Hive experience has highlighted some essential lessons for the future. Digital innovation emerged as a powerful enabler, showing how technology can make sustainability tangible. Yet technology alone is not enough: it was the creativity and determination of young people that transformed these tools into living solutions. Youth engagement has proven to be a driving force in generating creative, practical, and impactful solutions, demonstrating that when given the space to lead, students and young learners can reimagine how communities address their environmental challenges. When young people are trusted as agents of change, their enthusiasm and commitment can transform not only their schools and communities but also broader societal practices. Alongside them, collaboration across sectors—between schools, training centres, businesses, NGOs, and policymakers—proved decisive in breaking silos and making solutions inclusive, practical, and impactful.

Key Lessons from Green Hive

- **Digital innovation as an enabler** – Technology makes sustainability tangible, but requires human creativity to become transformative
- **Youth as agents of change** – When trusted and empowered, young people can reimagine how communities address environmental challenges
- **Cross-sector collaboration is decisive** – Partnerships between schools, businesses, NGOs, and policymakers break silos and create inclusive solutions
- **Scalability through adaptability** – Local ideas can become national models when rooted in everyday practices and supported by strong networks
- **Education, innovation, and participation converge** – Green Hive proves these elements can create systemic change and meaningful impact

Looking forward, the key challenge is how to scale these efforts to confront the wicked problems of our age. Climate change, food waste, and water scarcity cannot be solved in isolation or through small-scale action alone. The Green Hive initiatives show that scalability is possible when solutions are adaptable, rooted in everyday practices, and supported by strong networks of cooperation. A local idea can inspire a national model; a classroom activity can evolve into a cross-border platform. By investing in digital tools, empowering young voices, and strengthening partnerships, the seeds planted through Green Hive can grow into systemic change.

Ultimately, Green Hive is more than a collection of projects—it is a shared movement that proves education, innovation, and participation can converge to create meaningful impact. The road ahead will not be easy, but the creativity, collaboration, and commitment shown by all participants light the way forward. What began as local actions across different schools and communities now stands as an invitation to scale up, to connect, and to keep building a greener and fairer future together.

Bibliography

Acomi, N., Lanzetta, M., Acomi, O., & Abbruzzese, G. (2025). Setting up an educational ecosystem for enabling sustainability competences development. *Revista Românească pentru Educație Multidimensională*, 17(1), 159-179. <https://doi.org/10.18662/rrem/17.1/945>

Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). *GreenComp: The European sustainability competence framework*. Publications Office of the European Union. <https://doi.org/10.2760/13286>

European Commission. (2020). *Communication on achieving the European Education Area by 2025*. Brussels: European Commission.

European Environment Agency. (2023). *Europe's state of the environment 2023*. Copenhagen: EEA.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.

Levin, K., et al. (2012) Overcoming the Tragedy of Super Wicked Problems: Constraining Our Future Selves to Ameliorate Global Climate Change. *Policy Sciences*, 45, 123-152, <https://doi.org/10.1007/s11077-012-9151-0>

Nusche, D., M. Fuster Rabella and S. Lauterbach (2024), “Rethinking education in the context of climate change: Leverage points for transformative change”, OECD Education Working Papers, No. 307, OECD Publishing, Paris, <https://doi.org/10.1787/f14c8a81-en>.

Rieckmann, M. (2018). Learning to transform the world: Key competences in Education for Sustainable Development. In A. Leicht, J. Heiss, & W. J. Byun (Eds.), *Issues and trends in Education for Sustainable Development* (pp. 39-59). UNESCO.

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155-169.

Stang, G., & Ujvari, B. (2015). *Climate Change as a 'Wicked Problem'*. European Union Institute for Security Studies.

Sterling, S. (2010). Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education*, 5, 17-33.

Sund, P., & Öhman, J. (2025). Conflicts of interest in sustainability education: Navigating curriculum tensions. *Environmental Education Research*, 31(1), 45-62.

Voogt, J., & Pareja Roblin, N. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, 44(3), 299-321.