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# ZERO WASTE ECONOMY 4 YOUTH

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*CIRCULAR ECONOMY & ZERO WASTE in Europe*  
**Report**  
Latvia - Slovenia - Italy – Portugal





## ZERO WASTE & CIRCULAR ECONOMY

*“There is no such thing as ‘away’. When we throw anything away it must go somewhere.”*

*— Annie Leonard —*



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# CIRCULATION ECONOMY

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## **Introduction**

Circular economy is a sustainable economic model in which the usefulness of products and materials is sought to be maintained for as long as possible. This means that, unlike a linear economy, where the flow of raw materials is unidirectional, the materials that would become waste at the end of the process are sorted and, if possible, reused in other ways (EC, 2020). According to projections based on current trends, our energy consumption (biomass, fossil fuels, etc.) is expected to double by 2040, which would result in waste increase by as much as 70% by 2050. Currently the EU already produces more than 2.5 billion tons of waste every year. To prevent this bleak scenario, the European Commission has drafted a Green Deal (European Parliament, 2022).

The European Green Deal is a strategic priority first outlined in the political guidelines of Commission President, Ursula von der Leyen. On 11 December 2019, the Commission presented a communication (COM(2019)640) on the European Green Deal that presents a detailed vision to make Europe the first climate-neutral continent by 2050, safeguard biodiversity, establish a circular economy and eliminate pollution, while boosting the competitiveness of European industry and ensuring a just transition for the regions and workers affected. Executive Vice-President Frans Timmermans leads and coordinates the work on the European Green Deal.

This project aims to promote and raise awareness of circular economy fundamentals and zero-waste economy thinking among youth and youth support organizations across EU countries, as well as build circular economy youth networks in project countries. At the current stage circular economy is just becoming a "buzz" word in Latvia, Portugal, Slovenia and Italy and young people are keen to follow zero-waste philosophy by sorting trash, changing purchasing habits and recycling, reusing, and reducing waste. This zero-waste trend is an excellent steppingstone for building societal awareness of circular economy and is the basis for an environmental change.

Through activation of youth and youth support organizations internationally, this project will embrace a paradigm shift in thinking nationally, that would then also be beneficial to local communities in partner countries. This international dimension will help participating organizations and youth to understand and learn from international experiences concerning circular economy.

## **1. Circular Economy and Zero Waste**

The topic of circular economy fully corresponds with Horizontal priority of environmental and climate goals. A circular economy is a sustainable economic model in which the usefulness of products and materials is sought to be maintained for as long as possible. This means that, unlike a linear economy, where the flow of raw materials is unidirectional, the materials that would become waste at the end of the process are sorted and, if possible, reused in other process (EC, 2020).

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The project aims at promoting and raising the awareness of youth and youth support organizations across EU countries about circular economy fundamentals and zero-waste economy thinking building the circular economy youth networks in project countries by learning best practice exchange and promoting this knowledge in partner countries.

The circular economy national network creation as the result 2 (CIRCULAR ECONOMY & ZERO WASTE YOUTH NETWORK CREATION) corresponds with priority - engaging, connecting, and empowering young people. Network the manifestation of Open Innovation approach and this is helpful for young people across EU to develop their profit and non-profit zero-waste initiatives. The result 1 (ZERO -WASTE AND CIRCULAR ECONOMY CAPACITY BUILDING BEST PRACTICE EXCHANGE ONLINE MATERIALS for Young People who are interested to develop profit and nonprofit circular and zero-waste economy initiatives) will help to build and promote green activities among young people.

## 2. Circular Economy in Partner Countries - Policy Documents and Regulations

As of 2021, none of the partner countries are among the European Union’s eco innovation leaders, with Italy and Slovenia showing minimal improvements from 2019, and Latvia and Portugal being in a slightly worse position than 2 years ago. Below situation in each country is described in more detail, as well as their efforts to improve the indicators associated with the eco – innovation index are recognized.

### 2.1. LATVIA

In the Eco - Innovation Index 2019 Latvia ranked 17<sup>th</sup> with 86 points among EU28, having slightly improved their score since the last report in 2017. However, since it has dropped to 18<sup>th</sup> place accumulating 90 points in 2021.

In 2019, Latvia scores highest in socio-economic outcomes, eco-innovation outputs and resource efficiency outcomes, but remains below the EU average in terms of eco-innovation activities and inputs (see Figure 2.1.). A comparatively low score in eco-innovation activities demonstrate the struggle that Latvia has had for a while in the commercialization of research and weak uptake of eco-innovation related ideas among enterprises, while eco-innovation inputs show a low score mainly due to the indicator of total R&D personnel and researchers (Vingre, 2019).

As of 2021 in comparison to 2019, Latvia has experienced decrease in eco – innovation inputs, eco – innovation activities, and socio – economic outcomes, and increase in eco – innovation output, and resource efficiency outcomes (European Commission, 2022).

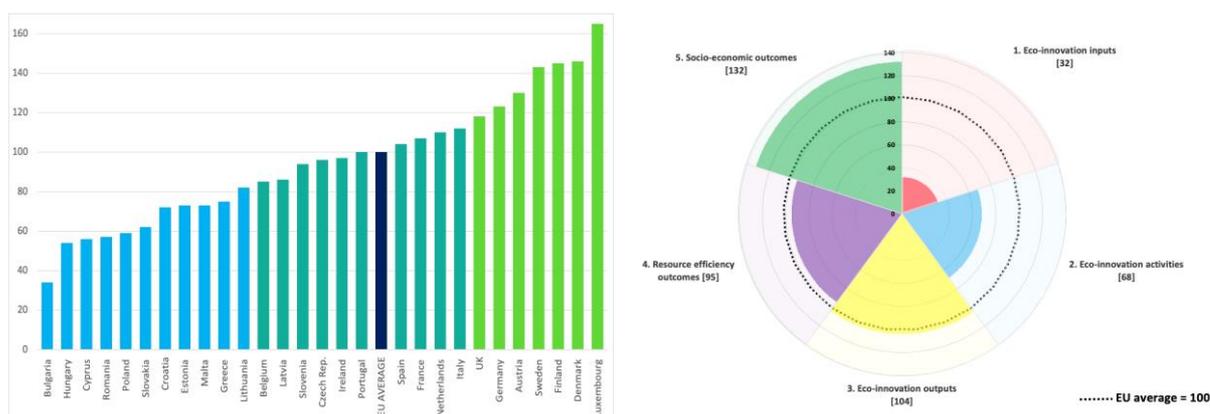


Figure 2.1. Eco – Innovation Index 2019 position and indicators of Latvia (European Commission, 2019)

The concept of circular economy is gaining recognition in Latvia, but it is not among the most topical issues on the political agenda or discussions in the society. Currently, Latvia is

developing a circular economy strategy and has implemented isolated initiatives mostly in the sector of waste management.

Some sporadic examples of development can also be found in food production and in new business models like car sharing, short-term rental, and reuse. Energy efficiency, sustainable transport and knowledge-based bioeconomy have been defined as priority sectors which has helped to increase the number of scientific outputs that are related to eco-innovation. On the policy level, there is a lack of a clear leadership in the development of the circular economy and most actions are scattered among several sectorial responsibilities. Investment in R&D is slowly increasing due to EU Structural Funds resources. However, the measures have insufficient effects on increased research-business collaboration and higher R&D investment by the private sector, which hampers the introduction of significantly increased eco-innovations. Increased performance can be seen in eco-innovation related publications and eco-innovation related media coverage, as well as water productivity and GHG emissions intensity. Weaker performance is found in indicators related to business performance, for example, implementation of resource efficient actions and introduction of sustainable products in businesses as well as exports of eco-innovation products.

## 2.2. SLOVENIA

Slovenia experienced a significant decrease in the overall Eco-innovation index for 2019 compared to 2017 from a score of 115 in 2017 to 94 in 2019, placing the country below the EU average – in the 15th position among EU28. In 2021 it has once again improved its ranking sitting in the 12<sup>th</sup> spot (European Commission, 2022).

In 2019, Slovenia performed close to the EU average in four components in the Eco-innovation Index, whereas the country performed significantly below the EU average in resource efficiency outcomes (see Figure 2.2.). Material productivity, water productivity, energy productivity and GHG emissions intensity remain the main challenges for the country on its path to a climate neutral and circular society (Crnčec, 2019).

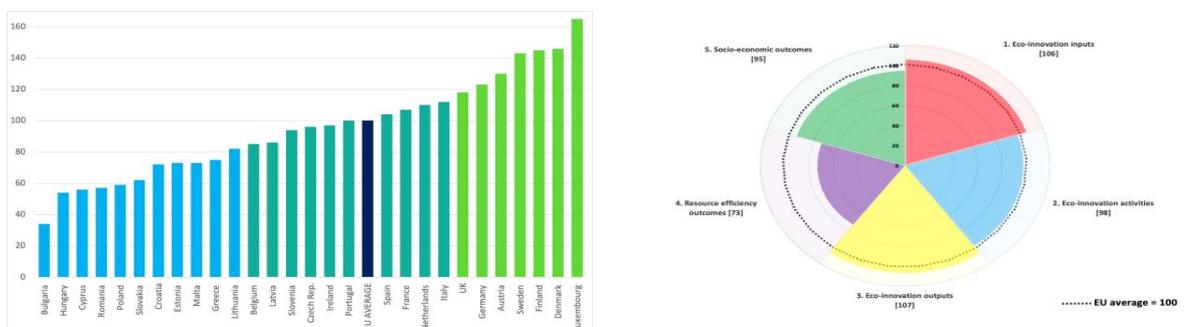


Figure 2.2. Eco – Innovation Index 2019 position and indicators of Slovenia (European Commission, 2019)

In comparison, in 2021 Slovenia has improved its ratings in eco – innovation inputs, eco – innovation activities, and resource efficiency outcomes, whereas has performed worse in eco – innovation output and socio – economic outcomes (European Commission, 2022).

Slovenia is a small and open economy, largely dependent on the international economic environment. There are numerous opportunities but also challenges in its transition to a circular economy and in eco-innovation development. A clear collective political action towards more green and circular economy policies has grown, but integrated policies and a strong political leadership focusing on eco-innovations is still lacking. The trends of 2018 - 2019 continue with a business sector that is the key generator of R&D. The leading areas for circular economy and eco-innovation is the manufacturing industry with automotive companies and electric mobility, energy efficiency in buildings and sustainable construction, efficient electric equipment, smart metering technologies and pharmacy. Slovenia also focuses on energy efficiency in the sectors of agriculture and food, and green tourism as the model for Slovenian tourism. Sustainable mobility and forest-based value chains have been recognized as priority areas for transition to a circular economy. The main drivers to circular economy and eco-innovation in Slovenian companies remain the competitive pressure and the European common market. Digitalization may act as one of the catalysts for the development of new circular business models. Important barriers remain with complex administrative or legal procedures, lack of expertise to implement circular activities, as well as lack of human resources on all levels and difficulties in assessing finance.

### 2.3. PORTUGAL

In 2019, Portugal obtained an Eco-Innovation Index score of 100, which was also the EU average in 2019, and ranked 12th among the EU member states. That was a move downwards from a ranking of 10th in 2017. As of 2021, Portugal has gained back one ranking place and occupies 11<sup>th</sup> position in the EU (European Commission, 2022).

In 2019, Portugal showed a good performance in eco-innovation activities by SMEs. However, it lagged behind the EU average in eco-innovation inputs by showing a decrease in performance since the last reporting period. As of the eco-innovation outputs, resource efficiency and socio-economic outcomes – they aligned with the EU average. The country needs to improve its performance in bringing products to market, namely total value of green early – stage investment and eco – innovation related patents (Lorena, 2019).

In 2021, Portugal has improved its eco – innovation inputs and resource efficiency outputs, but experienced downfall in their eco – innovation output, eco – innovation activities, and socio-economic outcomes if compared to 2019 (European Commission, 2022).

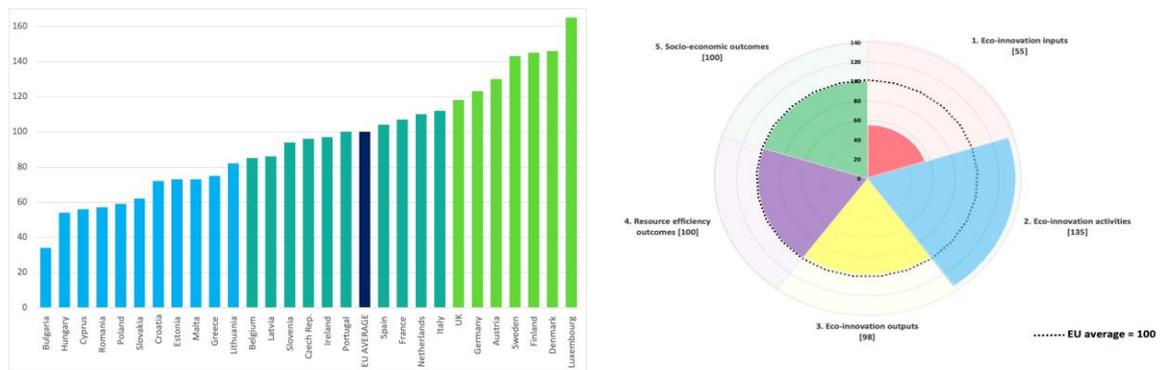


Figure 2.3. Eco – Innovation Index 2019 position and indicators for Portugal (European Commission, 2019)

In Portugal, the years 2018 and 2019 were marked by a growing interest in circular economy, with many companies adopting its principles with the support of instruments such as the *Fundo Ambiental*. In the last reporting period, it was reported that most innovations are confined to niche markets and struggling to scale up to global innovations. In 2018-2019, examples show that there have been attempts to establish sustainable businesses. The policy landscape in Portugal has not evolved significantly during this period. However, the country has shown a significant leap forward in eco-innovation since the previous reporting period and has indeed introduced policy instruments used to help implement circular economy projects across private and public organizations. Portugal needs to address several barriers to eco-innovation, such as the lack of private-sector leadership or investment in eco-innovation efforts, and a lack of specific policies to promote eco-innovation. However, Portugal benefits from several drivers that have and will contribute to eco-innovation efforts, such as the definition of regional agendas for the circular economy and the creation of the *Collaborative Laboratories* to create critical mass in specific R&D fields and foster knowledge transfer.

Portugal is one of the EU members states that have been putting forward strategies, roadmaps, and action plans for circular economy, in line with the ambitions of the European Commission. Circular economy emerges from a history of measures to encourage a change in the economic paradigm – from a linear consumption system, based on the erosion of natural capital, to a restorative and regenerative system, seeking to preserve the usefulness and value of resources (material, energy) for as long as possible, safeguarding the ecosystems and financial capital of business and civil society.

The engine of this transition is based on the encouragement and development of business models, collaborative strategies, products, and services centered on the efficient use of

resources. The benefits that can be achieved are multiple, from reductions of the import of raw materials to the direct contribution to international environmental goals (e.g., Paris Agreement, UN SDG), but, above all, it is about improving the competitiveness of the national economy, generating initiatives with strong export potential and local impact.

The Ministry of Environment assumes its role of modeling a context that supports agents in this transition to the circular economy, acting on the most pressing barriers - culture, market, and politics - in the following areas:

- Political: political instruments that promote the efficient use of resources, from the design of the product/service to the valorization of by-products and waste.
- Knowledge: disseminating information on best practices, case studies, and funding opportunities among others, and promoting the development of collaborative R&D initiatives in this area.
- Economic: through specific interventions in existing financial instruments to value initiatives that effectively contribute to CE, namely through sectorial and intersectoral projects in this area.

The measures to be considered within the scope of government action were consolidated in *LEADING THE TRANSITION: Action Plan for the Circular Economy (PAEC)* (Council of Ministers Resolution No. 190-A/2017 of 11<sup>th</sup> of December 2017), which presents 7 actions aligned with the European pillars of Action for the circular economy, and 3 levels of operationalization:

- National level with dedicated policy instruments (e.g., green taxation, voluntary agreements, Portugal 2020 environmental network).
- Sectoral level that focuses on sectors that are particularly resource intensive (e.g., construction, distribution and logistics, public procurement) or particularly important in the Portuguese business fabric (e.g., tourism, textiles, and footwear).
- Regional level (e.g., industrial symbiosis networks, circular cities, circular companies), which should be implemented through specific support for the development of solutions (planning, technological, etc.), through mechanisms designed for this purpose such as Fundo Environment, Fund for Innovation, Technology and Circular Economy, Portugal 2020.

Upon framing each axis of action, the following measures will also be promoted:

- Continue the implementation of the Green Public Procurement Strategy, namely through action on priority sectors such as construction, transport, or food

- Integration of incentives that benefit “eco.nomic” business models, products, and services, such as tax benefits to encourage ecological design or the use of recycled materials in construction
- Promote the valorization of by-products and waste, acting on prevention, facilitating the development of strategies and mechanisms for extracting resources (e.g., critical metals, nutrients), and acting on regulatory barriers to the recirculation of materials, namely through the performance of the Product Observatory, waste, and secondary raw materials to be implemented
- Promote knowledge about circular economy through mechanisms such as the ECO.NOMIA portal, and whose action is articulated and complements with the ECO.NOMIA@CCV program, which will frame the work of the Coalition for Green Growth, within the scope of project development and collaborative studies
- Promote investment in mobilizing projects in a circular economy, of a sectoral and intersectoral nature, through the structuring and guidance of available investment lines, namely within the scope of the EFTA-EEA Grants, but also within the scope of Structural Investment Funds (e.g., Compete, POSEUR)

#### **2.4. ITALY**

The 2019 Eco - Innovation Index ranked Italy as 8th, right after the index’s leaders. While the performance was 12% higher than the EU average, scoring 112 points, Italy had nonetheless regressed by 1.2 points compared to 2017. As of 2021, Italy placed 10<sup>th</sup> regressing even further (European Commission, 2022).

In 2019, Italy showed its best performance in resource efficiency outcomes with 178 points, where the country ranks fifth after Luxembourg, Malta, the UK, and Ireland. The country’s performance in eco-innovation activities, eco-innovation outputs and socio-economic outcomes was just above the EU average (see Figure 2.4.). The country’s worst performance came in the form of eco-innovation inputs, where Italy ranked well below the EU average with 69 points (Gionfra, 2019).

In 2021 relative to 2019, Italy has improved its eco – innovation inputs and eco – innovation activities, and socio-economic outcomes, while resource efficiency outcomes have stayed the same, but eco – innovation output has decreased (European Commission, 2022).

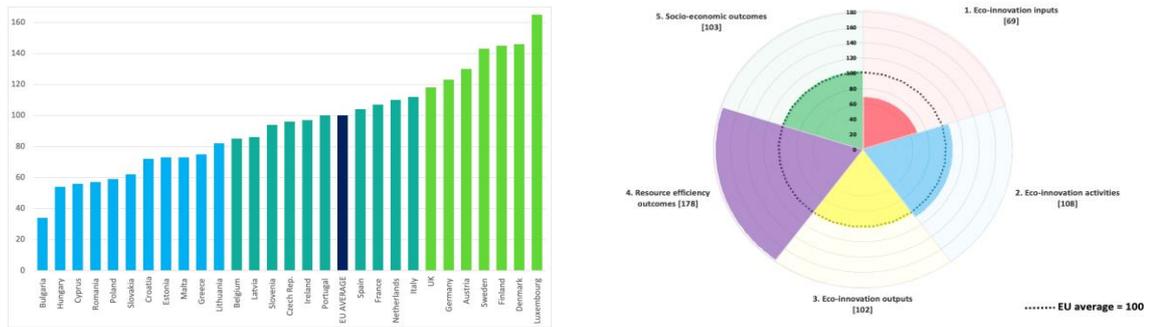


Figure 2.4. Eco – Innovation Index 2019 position and indicators for Italy (European Commission, 2019)

The overall good performance of the country on eco-innovation reflects the efforts made to develop and implement policies dedicated to eco-innovation and circular economy. Circular economy and eco-innovation developments in Italy largely relate to eco-labelling, waste management, bioeconomy, and green industry. In fact, Italy has one of the highest levels of eco-labels and EMAS in the EU. According to the 2019 Report on circular economy in Italy, the country ranks first on waste management performance. Italy is also a leader in bioeconomy, especially in the food and beverage sector. In addition, circular economy is increasingly becoming an important component of the country’s industrial policy. Italy is also witnessing a growing digitalization of the economy, although further efforts are still needed. The country’s policy framework also shows a growing emphasis on circular economy and sustainability as well as a support for eco-innovation. Despite the overall good performance of the country on eco-innovation, barriers to further progress still exist, such as the low levels of R&D investments and the large differences across regions in terms of legislative procedures and performance.

The main legislations and documentation concerning circular economy in Italy:

- The reference legislation in Italy on circular economy is that of waste recycling. The document "Collegato Ambientale" (law no. 221/2015) contains provisions of environmental legislation that allow the promotion of the green economy and sustainable development.
- The Consultation Document contains guidelines for the updating of a national strategy on the circular economy, supported by the MiTE under the patronage of the ISPRA and ENEA.
- The 3° Report on Italy’s transition from circular economy to climate neutrality was prepared by the circular economy working group and the ENEA of the Foundation for Sustainable Development.

- Action Plan for the implementation of the Final Version of the Italian Bioeconomy Strategy.
- The ANCI – CONAI Framework Agreement is a document signed by the Italian Association of Municipalities and the National Packaging Federation, which aims to reduce and regulate the impact of the packaging waste.

### 3. Zero Waste Initiatives in Partner Countries

**Zero Waste in Latvia** is a movement that brings together sustainability enthusiasts to make life without waste in Latvia a norm, as well as a non-governmental organization founded on the Earth Overshoot Day (August 1, 2018) that supports and promotes principles of zero waste lifestyle and circular economy and seeks to reduce the environmental impact of pollution caused by Latvian society.



**Big Clean Up** is a NGO campaign that is based on voluntary participation in cleaning up the environment, creating unity, positivity and a sense of job well done. In its first 10 years of existence, it gathered more than 500 000 participants both in Latvia and Latvian diasporas abroad, making it the widest volunteers' movement in the country. Every year, the Big Cleanup sets out a motive to invite the public to pay attention to how much our daily behaviour is related to the environment and health with the campaign's overall goal being to make Latvia the cleanest and greenest place on the map of the world.

**Deposit System** is a sustainable, convenient, and modern drink packaging (glass, can, PET) sorting and recycling system, which operated based on the zero – profit principle and was introduced in Latvia in February 2022. It is a step towards a cleaner Latvia for us and future generations, it is intended to help propel companies producing and selling drinks, as well as society at large in a climate-friendly direction, while making it possible to properly utilize the most common types of drink packaging. It has expanded and improved the current waste management system, reduced waste, increased resource efficiency and reduced the CO2 footprint. So far more than 46 million deposit packaging items have been collected.

**Zero Waste Shops** are stores where all goods are sold without packaging to encourage reuse of materials and decrease single use plastic consumption, meaning the customer has to bring their own bag or jar to store, for example, oats or nuts they want to buy. First such store in Latvia (*Burka*) opened in 2018, and since then many more such businesses have been established, making Latvia somewhat of a superpower when it comes to the number of zero waste stores in relation to the population size of Latvia.

**Hydrogen Fueled Public Transport** is significantly more environmentally friendly than one running on gasoline. Hydrogen fuel cells provide an inherently clean source of energy, with no adverse environmental impact during operation as the by-products are simply heat and water. Unlike biofuel or hydropower, hydrogen doesn't require large areas of land to produce. While not all, at least some trolleybuses run on hydrogen in Riga, Latvia.

**Everyday Greenery** was a social event (by Smetumet Cultural Ecological Association and Social Enterprise in May 2016) organized in front of the City Hall presenting sustainable solutions for an everyday greener life: waste collection and processing – recycling, global learning, local food, reusable products, packaging-free shopping, fair trade, do-it-yourself principle, creative alternative solutions, item exchange, self-sufficiency, urban gardening, and other good practices.



**Bag on Bag** was a guerrilla event against plastic bags at the Ljubljana Central Market on the World Environment Day, 5 June, where Ekologi brez meja teamed up with artist Luka Mancini. At the event the passers-by had the opportunity to witness the creation of a real-life Bigfoot (in Slovenian it is called Vrečkožer). At a stand they received reusable bags and information about the problem of non-degradable bags and their impact.

**Don't Buy, Repair** was a campaign by SEZAM running in 2017 to raise awareness among the youth about the problem of excessive consumerism and the negative impact it has on the environment. The campaign is focusing on promoting repairs, material recycling and upcycling of different items with special emphasis on furniture, electronics, clothing, and bicycles. Ten videos are planned to be made which are then going to be promoted through different communication channels and a document on state policy in the field of repairs is planned to be produced.

**Re:Costura** transforms old clothing into exclusive pieces, so one can satisfy the need for a changing wardrobe in the most sustainable way possible – by repurposing the clothes they already own with the help of Re:Costura seamstresses and designers. They also organize educational workshops that teach how to sew and reuse textiles so everyone can minimize the textile waste.



**Alimenterra** is a festival dedicated to healthy and sustainable eating and the future of the food system. It strives to inform people about the ways how to improve agricultural practices, how to stop food waste, and how to get food from the producer to the consumer in the most effective, yet sustainable way. The festival includes film sessions, debates, expert visits, and workshops.

**Beautiful Flower** is the name of the recovery initiative of a slope in the Bela Flor neighborhood, using agroforestry techniques and community involvement. Monthly theoretical – practical workshops and “help” workshops in which field work is combined with interactions are organized.

Capannori is a Tuscan town that has one of the highest municipal recycling rates in Europe.

Capannori's path to zero waste is an example of strong policy decisions and community participation achieving groundbreaking results - a small but determined movement to stop the construction of an incinerator led to an Italy-wide grassroots Zero Waste movement.



This town of 46,700 inhabitants near Lucca in Tuscany, was set to be just another step in the relentless march of waste incineration in Italy.

The Northern European model of burning waste to avoid the environmental and social problems associated with landfill and to produce energy was gaining traction in Italy, a country beset with a dramatic and urgent waste management problem. Local medical organizations and even environmental NGOs put up little resistance, seeing incineration as the least-bad solution to a seemingly impossible dilemma. Business interests and pressure from Northern Europe contributed to a rush to incineration that seemed unstoppable.

Those who should have mounted the most strenuous defense against the encroachment of incinerators were lacking. The public debate did not discuss the fact that incineration encourages waste generation, competes with recycling, aggravates the sustainability challenge, sparks corruption and releases toxic emissions while capturing just a tiny bit of the energy stored in waste. Communities such as Capannori were left to fight the construction of incinerators on their own. In 1997, primary school teacher Rossano Ercolini recognized the potentially damaging effects the planned local incinerator would have on the health of residents and on the surrounding landscape. With the help of Dr Paul Connett, a world expert on incineration and zero waste, he set about convincing local residents of the potential danger of erecting an incinerator in their community. The movement was successful in blocking construction and soon spread to three other communities threatened with incineration in the region.

So Capannori became the first city in Europe to refuse waste in 2007, and to this day remains as the best example of zero waste by regularly collaborating with the Zero Waste Research Center, as well as its impressive sustainability performance – by 2017 it had seen 40% reduction in waste, 82% differentiated collection rate, reduction of residual waste from capital by 57%, reduction of the rate of refusals for residuals by 20%, and 93 tons of items deposited at the reuse center. Additionally, around 7000 families in Capannori compose organic waste.

CircOLIamo is a project that aims to raise awareness among the youth on the correct and sustainable method to dispose of wasted oil. It is a truck moving around Italy and meeting young students in school. The project is coordinated by Consorzio Obbligatorio degli Oli

Usati partnering with Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Legambiente.

**Hacking the City** is an initiative that addresses university students and wants to bring to life those projects that re-imagine the city in a more circular way. Teams of students will propose their project to a jury and those selected will see their project realized, funded by those companies that sent some experts as judges. It is coordinated by Tondo, Circular Economy Lab, Fondazione Cariplo in partnership with Esselunga, Mapai, Iren, Arup, Cisco, PUNCH Torino, A2A, 10 Italian universities.

**The Lavender Project** addresses that for many municipalities, small waste, like diapers used and thrown away are one of the most problematic and common items, contributing heavily to the volume of unsorted waste. For an essential part of any company, the nappies used and often thrown away translate into a large volume of waste that cannot be recycled. Implementation and development of the service happened between 2009 and 2011, when the project underwent its experimental phase, which included 8 participating institutions and an approximate volume of 8000 diapers per year. From 2012 to 2014, the service was expanded to include 18 institutions, and then grew again between 2015 and 2019 to 20-22 participating institutions. In 2020, many of the participating institutions (kindergartens, schools) were closed due to the COVID-19 pandemic and did not enter the service when the service was partially open. All participating institutions have been seated in the Province of Bologna, approximately 30 km from the Eta Beta headquarters.

In 2015, the number of nappies washed and removed since they became waste reached 44,030. In each subsequent year up to 2020, the number of nappies washed exceeded 21,700 units, reaching a peak of 35,792 pieces in 2017. Due to the COVID-19 pandemic, only 11,745 diapers were washed in 2020.

A 2008 life cycle assessment by the British Environmental Agency concluded that the unit weight of a diaper before use is 38.6g, while the unit weight of a used diaper can be calculated as 191g. Using these weights, we can reasonably calculate the volume of waste left over by the Lavender project each year. For example, in 2015 the project prevented 8409.73 kg of nappies from being included in unsorted waste. Therefore, if usable diaper projects such as Lavender were expanded to include more nurseries and implemented into more European Municipalities, the potential impact of reducing the volume of waste from one of the more problematic flows would be enormous.

**Making Just and Green Recovery a Reality: The Future is NOW** is a series of events organized by the Italian group Climate Reality Project Italy in partnership with Fridays for Future, Piano Giovani, LCOY, YOUNGO. It is directed to young climate activists, students

and those who work with information and communication, and it organizes workshops, conferences, and seminars to raise the awareness of new generations on how impactful they can be in the struggle for climate justice.

## 4. Circular Economy & Zero Waste Case Studies (Companies)

### 4.1. LATVIA

**Zero waste café “Café M”** opened its doors at the beginning of 2019. The cafe was founded by Latvian Ulla Milbreta and Frenchman Yohann Saffray. "The idea came in 2016 when I was living in Singapore and faced a natural disaster due to reckless human waste. We decided to promote the zero-waste lifestyle in order to raise awareness in people's minds. We decided to show it through the operation of the cafe", says Saffray.

Cafe M operates on the principle of zero waste, which means that no waste is generated as a result of its operation. All bio-waste that occurs after making coffee and food is composted in an industrial composting machine. After 24 hours, it has already processed food residues into compost, which can later be offered to people or used in cafe flowerpots. For example, the cafe owner buys 5l buckets for milk coffees, which are later returned to the producers, and they can use them again. The same goes for drinks in glass bottles – the bottles are returned to the manufacturers.



**“In the café, we sell freshly roasted coffee which people can buy by weight and packaged. In order to avoid unnecessary waste and operate on the principle of zero waste, we buy raw materials here in the nearby shops which offer organic products from local farmers. For the same reason, we serve only vegan food in the cafe because, as we know, by reducing the consumption of meat and dairy products, we will reduce the impact on the planet. As we are a social business, we also offer educational talks on zero waste and environmental protection. At the moment, this is not possible due to the situation, but we are very much waiting for everything to return to normal so that we can continue working in this context as well”**

Asked what the competition in this business is, he says that from the cafe's perspective the competition in this niche is strong. But when looking at the business from the zero-waste point of view, the competition is very small or indirect. “We are the first zero-waste cafe in the Baltic states. For this reason, we attract slightly different customers than other cafes. Ulla and I originally started the business as a couple. Ulla's main goal was to promote the zero-waste lifestyle, and mine was to offer freshly roasted, quality coffee. Over time, however,

we decided to separate our paths and now the cafe has also changed its goals a bit. Maintaining the principle of zero waste, we want to turn this place more towards a restaurant in the future” says Yohann.

**Getlini vegetable farm** operates on the waste energy gathered through their primary operations as a refuse site where rubbish collected from the region is stored. They utilise the heat resulting from this waste management by growing such vegetables as cucumbers and tomatoes in their specially built greenhouses. They started this vegetable farm in 2011 and are now in their 12<sup>th</sup> season selling their production all around the country.

**Burka** is a zero-waste shop that opened in 2018 and prides itself as a store not producing waste. They offer their production without any packaging, minimizing the single use plastics consumption, as well as allowing customers to get an exact amount of a product that they need, minimizing food waste. Besides food, they also offer products that allow one to lead their live in a “greener”, more sustainable manner (bamboo toothbrushes, bee wax food covers, etc.). They also have started an initiative “take and give” that allows customers to exchange resources with one another for free, such as jars, dishes, boxes, candle remains and so on.

## 4.2. SLOVENIA

**The Reuse Centre** includes a small store, a sewing room, and a workshop. In two years, the number of items sold has risen from 50 to 140 a day on average. The Reuse Centre, which opened at the end of 2013, offers work to hard – to - place jobseekers. The concept of the Repair Café, operating within the framework of the Reuse Centre, is to have experts in different professions (electricians, seamstresses, carpenters, etc.) and volunteers available once a month to help repair and refurbish various products.



**Environment – friendly train** is an electric tourist train named “Urban” on the streets of Ljubljana. The environment-friendly train without harmful emissions operates on a circular route with 10 stops (Town Hall, Ljubljana Castle, Park Špica/Botanic Garden, Trnovo Pier, Plečnik House, Križanke, Congress Square, Parliament, Opera and Ajdovščina). Passengers can get on or off the train at any station. Passengers can listen to the presentation of all major city attractions using an audio guide available in nine languages (Slovene, English, German, Italian, Croatian, French, Spanish, Russian and Chinese) and at the end of the tour you can deposit audio guide earphones into a collecting bag to be sent for recycling. In Ljubljana

they are co-creating the circular economy story and that is why they are going to recycle components of worn-out earphones into raw materials for other products.

**The Terrain** is a park that was named Terrain as it represents an area for experimenting, constructing, and testing new ideas with different stakeholders, and it is based on the idea of promoting circular economy. The construction pit has been temporarily transformed into an urban culture construction site. The Terrain offers new opportunities for learning, socializing, discovering, and playing. Current project participants are the



Waldorf School (designing garden beds in line with the re-use principle to grow different vegetables), the Universal Atelier of Street Art and the Sports and Cultural Association GOR (they made benches and outdoor workout equipment, they refurbished an old kiosk into a shed for storing tools). All equipment is made out of waste items and materials found in the collection center run by the public company VOKA SNAGA. This project has two main goals: provide active inclusion of different stakeholders – especially the young (NGOs, associations, schoolchildren, companies, citizens), practically present the significance of circular economy.

**Jelovica** is a house construction company which develops sustainable and environmentally friendly, and most importantly energy efficient houses that can achieve complete self-sufficiency of production in terms of energy. Renewable sources such as sun, water and wood produce more energy and heat than is consumed for the house's operation. Surplus energy is transmitted to the grid for later use – it is not only environmentally friendly but also financially efficient.

### 4.3.PORTUGAL

**Corticeira Amorim cork company** is the largest cork processing group in the world, contributing like no other player to the business, the market, the economy, innovation, and the sustainability of the entire sector. Founded in 1870, the company realized from an early age the infinite potential of this 100% natural raw material, transforming it into an object of choice in the context of an open, curious, alert, informed and prosperous society.



With this in mind, Corticeira Amorim has invested unparalleled in research & development, innovation, and design, perfecting a portfolio of products, objects, and solutions with high added value. Circular Economy 100% use of cork.

Eliminating waste and pollution, keeping products and materials in use, and regenerating natural systems are the three principles behind the circular economy (according to the Ellen Macarthur Foundation) and AMORIM follows those rules. This concept constantly challenges companies and society in general, to value the reuse of products and materials and thus contribute to the mitigation of climate change and the regeneration of ecosystems.

**Sonae** is a multinational that manages a diversified portfolio of businesses in the areas of retail, financial services, technology, shopping centers and telecommunications. Considering the role plastic plays in today's society and an environmental catastrophe, Sonae believe that one of their responsibilities is to promote the responsible use of plastic. They have pledged that by 2025 the plastic packaging for their products will be 100% reusable, recyclable or compostable.



The initiative aims at stimulating Portugal's circular economy as far as plastic is concerned, preventing it from becoming waste. Sonae has joined the Portuguese Pact for Plastic, an initiative that aims at fostering plastic's circular economy in Portugal, preventing it from being converted into waste. This action is part of Sonae's Sustainability Policy which, among other things, prioritizes the sustainable use of plastic. This pact reflects Sonae companies' commitment since, in early 2019, Sonae MC became the first Portuguese retail company to subscribe to the "New Plastics Economy Global Commitment", a pact that precedes in five years the European ambition of making 100% recyclable, reusable or compostable packages. For example, Sonae's subsidiary *Continente* has developed a 100% recycled line of bin liners, incorporating the plastic that results from operations within shops and depots, which will allow for an additional saving of 740 tons of virgin plastic a year.

Sonae has encouraged a more consistent use of plastic, namely with employees and clients. Among the initiatives to fight single-use plastic is the opening of the first fruit and vegetable court on the country with a single-use-plastic free policy, put together by Sonae MC in the end of 2019. In this pilot project there aren't any plastic bags or food wrapped in plastic, with a strong incentive for clients to carry their own bags. Sonae MC has also released a range of cotton and polyester bags, a more resistant, washable, and reusable alternative to single-use plastic bags, strong enough to carry up to 16 pounds of fruit and vegetables.

The establishment of partnerships with universities and research centers is another important field of action followed by Sonae companies, aiming at the development of innovative solutions.

**Moinho** is the name of the Portuguese company, which, since 1993, has been distinguished due to their introduction of an innovative process for the production of paper from waste textile materials, namely used clothes or industrial textile waste that the company collects and reuses to make the paper.



Currently, it has been developing another innovation, seed paper which, after use, can be planted and transformed into flowers and grass in a circular process where there is no "end of life". This company, unique in Europe, bet on this different concept, "circular" having at the center of its action ecological concerns of valuing social and environmental responsibility. Currently the company is already operating in about 10 markets, namely in the Spanish and Angolan ones, and it intends to expand its activities to other markets as well.

**Re.Store** uses fabric leftovers that would otherwise be wasted, creating several handmade products. In the online store, one can find several types of bags and facial cleaning discs 100% produced with reused material, coffee grounds and recycled rubber.

The principle shared by the company "a bag for a cause" reinforces its social character, remunerating the institution, association or social cause that worked on making the products.

**ECO** created an innovative solution that allows consumers to access filtered water through reused bottles. The water comes from the public network, being filtered, allowing consumers a better experience and water free of impurities or residues.



For this purpose, ECO has developed a refill station, which is available in various parts of the country. In the first use, the customer can purchase the ECO bottle, specially designed to be reused, and can then reuse them in future purchases.

**Grow in Peace** combines urban agriculture with social impact, promoting the production of fruits and vegetables in cities, while supporting the public at social risk.

Through sustainable agriculture practices, "Grow in Peace" promotes the inclusion and employability of the most disadvantaged publics, facilitating their financial independence, through the production of fruit and vegetables.



#### 4.4. ITALY

**Edilatte** is part of the green industries of Edizero Architecture for Peace - supply chains that embrace the circular economy concept, using a zero km approach, and producing colors and paints with no water, no pollutants based on milk of lime, ground, surpluses plants for high aesthetic quality finishes and a beautiful, healthy, and ecological interior design. The production consists of 100% micronized slaked lime with a high content of nanometric carbonates: 98% of CaCO<sub>3</sub>, in concentrated cream seasoned in an open tank exposed to the wind, without silos. Zero raw materials, only 100% secondary material, 100% recycled mineral, zero exploitation of quarries, 100% water free. No cements, silicates, polymers, oils and synthetic and / or petrochemical fillers. It does not contain titanium dioxide, whiteners, solvents, preservatives or biocides, boron salts and similar irritants.

**Orange Fiber** is the Italian company that has patented and produces sustainable fabrics from citrus fruit by-products. Established in Catania in 2014, this firm creates high quality fabrics for the fashion-luxury sector. They start from the by-products that the citrus processing industry produces annually — the disposal of which has high costs both for the citrus juice industry as well as for the environment. They have established a fully traced and transparent supply chain to transform this by-product into the perfect ingredient for conscious designers. Their technology is based on the extraction of high-quality cellulose from the citrus juice industry leftovers, which today represents 60% of the original weight of the processed fruits that should be otherwise disposed of, while thanks to the process they can use it to feed cellulose fiber production lines. This process has been patented in 2014 and extended in the main citrus juice producing countries, aiming at replicating, and scaling their solution in promising markets, thus extending their impact.

**Funghi Espresso** is an agricultural start-up inspired by the theories of Circular Economy, in which the waste from a production cycle generates new energy, new wealth and new jobs. Coffee ground is a perfect substrate for growing mushrooms because it contains minerals and nutrients that are useful for their growth: what looks like waste can become a resource.



This firm collects an all-Italian resource: the coffee grounds. In Italy there are 110 thousand bars that produce 300 thousand tons of coffee grounds every year. So Funghi Espresso helps bars to enhance what would otherwise become waste.

Funghi Espresso uses coffee grounds as a growing medium, combining it with the "seed" of the mushrooms, all in a completely natural way, without the use of chemicals. The

mushrooms grow vertically on suspended supports, reducing land use: compared to traditional crops, it is used half the space to grow the same number of mushrooms. The coffee grounds do not need to be pasteurized, and this saves a significant amount of energy. And after use it returns to the ground as compost!

**Greenrail** is an Italian company, internationally recognized as an innovative player of the railway sector, and as an example of a sustainable industrial development in accordance with circular economy's principles. It was created as a result of its founder Giovanni Maria De Lisi's wide experience in the railway sector, and his idea to develop an innovative and sustainable railway sleeper, offering better technical, environmental, and economical features, compared to the present standard sleepers in the sector.

The technology developed by Greenrail allows the production of railway sleepers with secondary raw materials, using a blend of rubber collected from ELTs (End of Life Tyres) and plastic from urban waste. The intellectual property of Greenrail's technology is protected on a worldwide scale in more than 70 patent offices in the world. Moreover, Greenrail is able to design and produce various kinds of railway sleepers, according to the specific international technical regulations and clients' particular needs.

The company handles the whole process of design, prototyping and testing of the products, distinguishing itself on the international level as a synonym of innovation and sustainability, collaborating with primary research centers and industrial partners.

**Favini** is worldwide leader in the design and production of textures and finishing solutions for fashion, luxury, design, and technical sportswear sectors. Favini is also a leading global producer of graphics specialties, natural fibers-based (cellulose, algae, fruits, nuts, leather etc.), for the packaging of luxury and fashion industries. It also operates in the converting products industry sector that includes activities related to the creation and production of stationery for school, leisure, and office, for high-end market.

One of their most known products is Alga Carta, which is a paper created from algae that, by its abnormal proliferation, was damaging the fragile ecosystem of the Venice Lagoon. Favini patented the production process capable of using algae to produce ecological paper according to the principles of circular economy. Even today, the same method is used for the creative reuse (upcycling) of overabundant algae from marine environments in other parts of the world.

Alga Carta is the forefather to a range of sustainable papers, made using by-products from other production chains that partner with Favini following an industrial symbiosis model. Eco-innovation aims to extend the life of resources and decrease virgin raw material use, without compromising aesthetic and technical performance.

The printing and converting ability of Alga Carta makes it ideal for any creative, publishing and packaging project. The seaweed particles are visible on the surface to give a unique natural look. Alga Carta is recyclable, biodegradable, FSC™ certified and made using eco energy, the renewable energy self-produced in our hydroelectric plant. Furthermore, the unavoidable residual emissions have been zeroed.

## 5. Zero Waste Training Materials and Teaching Courses

### 5.1. EUROPEAN UNION

**Education for Zero Waste and Circular Economy (EduZWaCE)** aims to fill a gap in vocational education and training and create new training course focusing on waste and circular economy, and developing interdisciplinary skills needed for new jobs in the area. Their knowledge hub is an interactive resource center which gathers useful information for VET teachers and professionals from companies who seek for knowledge and inspiration on zero waste and circular economy. There one can find scientific and “grey” literature, standards and legislation, books, good practices, case studies, presentations, videos, software, methods, tools, and other relevant resources.

**REFLOW Academy** provides possibility to enroll in a set of three online courses focusing on circular economy – Introduction to Circular Economy, Governing a Circular Economy in Cities, and Circular Business Models for Regenerative Cities – their courses concentrate on different challenges of circular economy transition in cities. They provide practical methods and toolkits that can be directly implemented, and opportunity to learn and exchange information with fellow trainees.

**CIRCLE Training Resources** on circular economy are focused on such key sectors as tourism, transport, construction, and agriculture. These resources are designed for VET educators to use to encourage VET students to develop an understanding of the circular economy in the context of their own workplace and future career. Toolkits have been produced for each sector that include an introduction of the principles of the circular economy, and specialized training units that apply to the sector in the form of lecture plans, presentations, and quizzes.

**Circulab Academy** provides many different training courses to acquire the skills, master the tools and grasp new opportunities to deploy circular business models and design regenerative products and services. Some of the topics covered in courses, that can be taken individually or in groups, include circular and regenerative economy, business resilience, biomimicry, circular design, business design, supply chain, and eco-design.

**Sustainability Academy** is a training course expected to take place in September 2022 in Luxembourg. This course on sustainable youth work will address such concepts as sustainable development, social entrepreneurship, and circular economy. The overall course time will be divided between plenary sessions (keynotes, input sessions, virtual visits, or the projects in Luxemburg), small group work (assisted by coaches and experts), individual learning (research and testing).

The objectives of the course are to understand current environmental and social challenges and the way young people approach them, to rethink the current way of doing: prepare young people to co-create more circular, sustainable world, to learn how the European Solidarity Corps can help youngsters to implement their project, to get to know and apply Futures Thinking tools in youth work, to develop young people's imagination and positive participation (as counterbalance to negativity and fear to act), to use the Design Thinking process to less talking and more doing: visualize ideas, test them, profit from feedback, to identify already existing tools used in youth work and community work in Luxembourg and Europe, to co-create potential solutions that can be multiplied on local, national and European level.

## **5.2. LATVIA**

**Masters in Eco Innovation** at Liepaja University awards the student a professional master's degree in environmental science and environmental management. The program focuses on ecology and development of eco-technologies, environmental technology systems, renewable resources and technologies, application and evaluation of environmental technologies, eco-design and circular economy, development and management of environmental projects, innovation management and eco-innovation, dynamics and modeling of environmental systems, environmental design and landscape architecture, economic evaluation of eco-technology, and health psychology and resort science.

**Zero Waste Latvija** was born out of a Facebook group that was created in January 2016 where anyone with an interest in zero waste could exchange tips and tricks on how to reduce waste. Seeing the tremendous interest that it generated, during the Global Overshoot Day 2018 the Facebook group decided to transform itself becoming an NGO.

Currently, the main focus is raising awareness about waste reduction and prevention through social media, discussion groups, workshops, educational lectures, conferences, and media appearances. This company is also trying to contribute to shaping the policies at the national and local level.

**Greenhead** is a TV show and a podcast educating the population about the environment, ecological practices, pollution, zero waste, problems from the past that still have not been resolved and their possible solutions. Discussions with influential and knowledgeable people from Latvia to talk about how to live more sustainably are also regular.



### 5.3. SLOVENIA

Several training opportunities regarding circular economy and sustainability are available in Slovenia:

- Summer Training School in Piran, Slovenia about circular economy, focusing on water engineering and global diplomacy for sustainable cities, decentralized sanitation, recycling, and zero-waste concepts.
- Bachelor's and Master's in Environment Studies at University of Nova Gorica are degrees that have a goal to educate professionals in the fields of environmental research and protection, as well as the management of the environment. The common characteristics of both study programs is a strong focus on project work and practical field work, which are performed in cooperation with the business and the economy sector, as well as with the research units of the university, particularly the Laboratory for Environmental and Life Sciences.
- Doctoral Degree in Environmental Protection at the University of Ljubljana brings together experts from various faculties and departments with a common interest in protecting the environment. The main emphasis of the program is the students' research work, so choosing their mentors at the beginning of the study is essential. In addition to acquiring research and laboratory skills, students are also offered theoretical knowledge through the choice of several types of courses.

### 5.4. PORTUGAL

Postgraduate Course in Circular Economy at Lusofona University is a multidisciplinary course with seminars in different areas and interactive technical visits that prepare students for an active business life in managing material flows in sustainable development and the green economy.

Companies involved in this business sector, such as renewable energy companies or those in the carbon trading market, are developing rapidly, creating a new paradigm in the economy. Thus, they are looking for highly qualified agents with a strategic vision for the future. Professionals qualified as consultants, project managers or business managers have excellent opportunities in this field at local, national and international level.

The Postgraduate Diploma in Circular Economics combines knowledge of engineering, economics, social and natural sciences, and law in the education of competent professionals capable of facing the global development processes of the 21st century.

Throughout this graduate program, the concepts of sustainable development and management of natural resources, circular economy and management of material flows, circular economics and bioeconomy, sustainable society, climate change and

decarbonization strategies will be introduced throughout this postgraduate course and circularity in the water and wastewater sector.

**Specialization in Circular Economy at Instituto Superior Tecnico de Lisboa** aims to provide you with the basic concepts of circular economy, from a life cycle analysis perspective. With the application of specialized software, one will be able to analyze complex and systemic problems, identifying opportunities for improvement, in order to propose practical circular economy solutions suited to the context of your organization. The course's goals are for the students to acquire fundamental knowledge about circular economy and tools to support its implementation and evaluation (software), identify points for improvement and propose possible solutions from the perspective of circular economy, communicate actions taken from the perspective of circular economy, acquire knowledge of practical cases and the use of tools that allow rethinking and changing the business model and operations in a circular economy perspective.

**Masters in Blue and Circular Economics at Polytechnic Institute of LEIRIA** recognizes that the transition to the circular economy is one of the major goals of the European Union, and for this it is important to train actors and entities directly involved in socio-economic development processes. This transition assumes special relevance in the context of the blue economy, in which the vast majority of sectors depend on bio resources and on the good functioning of marine ecosystems that sustain essential services for the survival of humanity. The Master's in Blue and Circular Economics addresses, in addition to the issues already mentioned, existing and innovative solutions, and examples of interactions between academia, industry and official entities that allow the promotion of blue and economic development, as well as communities, bioproducts and biomaterials that create waste-free systems. Business models based on the circular economy will also be developed, promoting innovative solutions for the blue economy that can contribute to socio-economic development.

**Course in Circular Economy at Faculdade de Engenharia da Universidade do Porto** acknowledges that following the current alignment of European Union policies, the adoption of the circular economy is imperative, for which future and present professionals from different sectors must be prepared. This is a new guideline with a broadly transversal performance, which can range from engineers, managers, economists, scientists from different areas, designers, and architects.

Although the concept has a long history, today, more than internalizing circular concepts, it is necessary to rethink the entire socioeconomic model, reformulating processes, products, relationships, and businesses. Circularity poses challenges, but it can represent the inflection

point for systems transformation and create many opportunities; however, for this, it is seen as strategic and fundamental to allow the development of theoretical and practical skills and provide future and current professionals with specific tools to act according to the assumptions of the Circular Economy. Within the areas of knowledge, the articulation between the UPorto School of Engineering and Economics is seen as strategic.

The goals of the course are to revisit the current linear models of management and review them in light of the new organizational and strategic perspective imposed by the circular economy, rethink production processes and the production and use of products, identify opportunities to improve current processes and products and create new business, develop and influence new production, distribution and consumption relationships, promote, through the innovation of processes, products and materials, a substantial socioeconomic transformation, structure new business models using integrated relationships such as industrial symbiosis (e.g., waste as resources).

## 5.5. ITALY

[Fashion Revolution Is Young](#) is a training course for those who'd like to work in the field of circular economy. As for the contents of the course: one part of the course deals with the analysis of several cases studies of functional and successful organizations and meetings with their founders, whereas the second part deals with marketing in order to be able to precisely communicate the message one would like to convey, with a special focus on messages concerning environmental, ethical, social, and cultural values. The project is carried out in the frame of sustainable fashion, but it is not limited to that: on the contrary, it teaches a *modus operandi* which can be very well used in any other field of circular economy.

[ECCO \(Economie Circolari di Comunita\)](#) is a creation of 13 Ri-hubs, educational and training centers, located in 13 different Italian regions. Activities are organized in these centers, addressing citizens, students, teachers, and activists. Among these activities are trainings, workshops, seminars (webinars at the moment). The Ri-hubs function as info-points where awareness and knowledge of circular economy is shared and disseminated; they also function in reverse, i.e., they gather complaints and suggestions from citizens concerning environmental issues. Moreover, thanks to the complex network around the Ri-hubs, activities often involve schools, cultural centers, and others.

[Higher Education](#) opportunities in this field in Italy:

- [Masters in circular economy](#) at Università della Tuscia
- [Masters in sustainability and circular economy](#) at Università Politecnica delle Marche

- Executive masters in circular economy management at LUISS Business School
- Second level masters in circular economy and efficient resources management at Scuola Superiore di Pisa Sant'Anna
- First level masters in circular economy 4.0: energy, technology, and environment at CRIS Cittadella Universitaria Poggiardo
- Executive masters in business sustainability and circular economy at University of Bologna Business School

## Summary and Suggestions

All four project partner countries – Latvia, Slovenia, Portugal, Italy – have assigned significant time and monetary resources towards efforts to promote zero waste and circular economy principles. Although, as of 2021, none of them are among the European Union leaders when it comes to eco – innovation (18<sup>th</sup>, 12<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup> respectively), all are taking steps to improve their position on the scoreboard.

However, the events of recent years, namely the COVID – 19 pandemic and the escalation of the Russo – Ukrainian War have negatively impacted Europe’s ability to devote as much of the resources to cultivate zero waste and circular economy practices as might have been planned on. That is especially true for countries with smaller economies, such a Latvia and Slovenia, that are more dependent on international players. Nevertheless, some big initiatives have been put forward and implemented on the national level, for example, the drink packaging deposit system in Latvia that started operating in February 2022. Furthermore, other social, political, and NGO’s campaigns have also run their course to help engage the society in a more sustainable way of living.

The European Union as a whole is also trying to raise awareness of circular economy and sustainability practices in general via youth and adult courses and lectures, as well as several free training platforms available on the web that have been funded with the help of the European Union (EduZWaCE, REFLOW, CIRCLE).

Portugal and Italy also have a pretty extensive network of circular economy and sustainability higher education programs across the countries. More educational opportunities, however, are needed, especially in Latvia and Slovenia, as there is a lack of both formal education programs that concern environmental protection and circular economy, as well as not enough non – formal learning possibilities in the form of courses, workshops, or training. It might be worth exploring the possibility of offering this kind of education as part of the VET practices, to ensure youth participation in circular economy, and prepare the future environmental protection and sustainability specialists.

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