WUSTE

REUSE OF FOODWASTE TO CREATE NEW MATERIALS AND REDUCE POLLUTION

WusTe Handbook

Reuse of food waste to create new materials and reduce pollution

Erasmus+ Project Ref. 2021-2-ES02-KA210-YOU-000047991

Co-funded by the European Union

CAS•AUPA

ŞEHİT KEMAL TOSUN ANADOLU İMAM HATİP LİSESİ 2017 NİĞDE

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ABOUT

The present document was produced in the frame of the Erasmus+ project **"WusTE-Reuse of food waste to create new materials and reduce pollution"** (2021-2-ES02-KA210-YOU-000047991).

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PROJECT COORDINATOR:

- **Asociación para el desarrollo socioemocional de la persona, la sociedad y para la cooperación internacional UNO - Valencia, Spain**

PROJECT PARTNERS:

- **Circolo Cas*Aupa APS - Udine, Italy**

- **SEHIT KEMAL TOSUN ANADOLU IMAM HATIP LISESI - Nidge, Turkey**

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INTRODUCTION

The project

The Erasmus+ Small Scale Partnership in Youth project "WusTE-ReUSE of FoodWASTE to create new materials and reduce pollution" focuses on raising youth's awareness of the food waste issue and inspiring a collective (re)action through knowledge and empowerment.
It aimed at empowering young artisans, fashion designers, and product designers (aged 18-35 years old) with know-how on recycling, downcycling and upcycling methods, providing them with empirical experiences and theoretical knowledge.
The main activities carried out during the 20 months (01/03/2020-31/10/2023) of the project were:

A1. Desk research on the project topics
A2. Learning mobility on Food Waste, Climate change, circular economy in Turkey
A3. Learning mobility on Food Waste upcycling in clothing manufacturing and handicraft in Spain
A4. Learning mobility on Upcycling and Recycling techniques in Italy

WUSTE HANDBOOK

The present handbook is the main output of the project. It contains the results of the desk research carried out by the project partners:

- Asociación Uno (Spain) – project coordinator
- Circolo Cas*Aupa APS (Italy) – project partner
- Sehit Kemal Tosun Anadolu Imam Hatip Lisesi (Turkey) – project partner

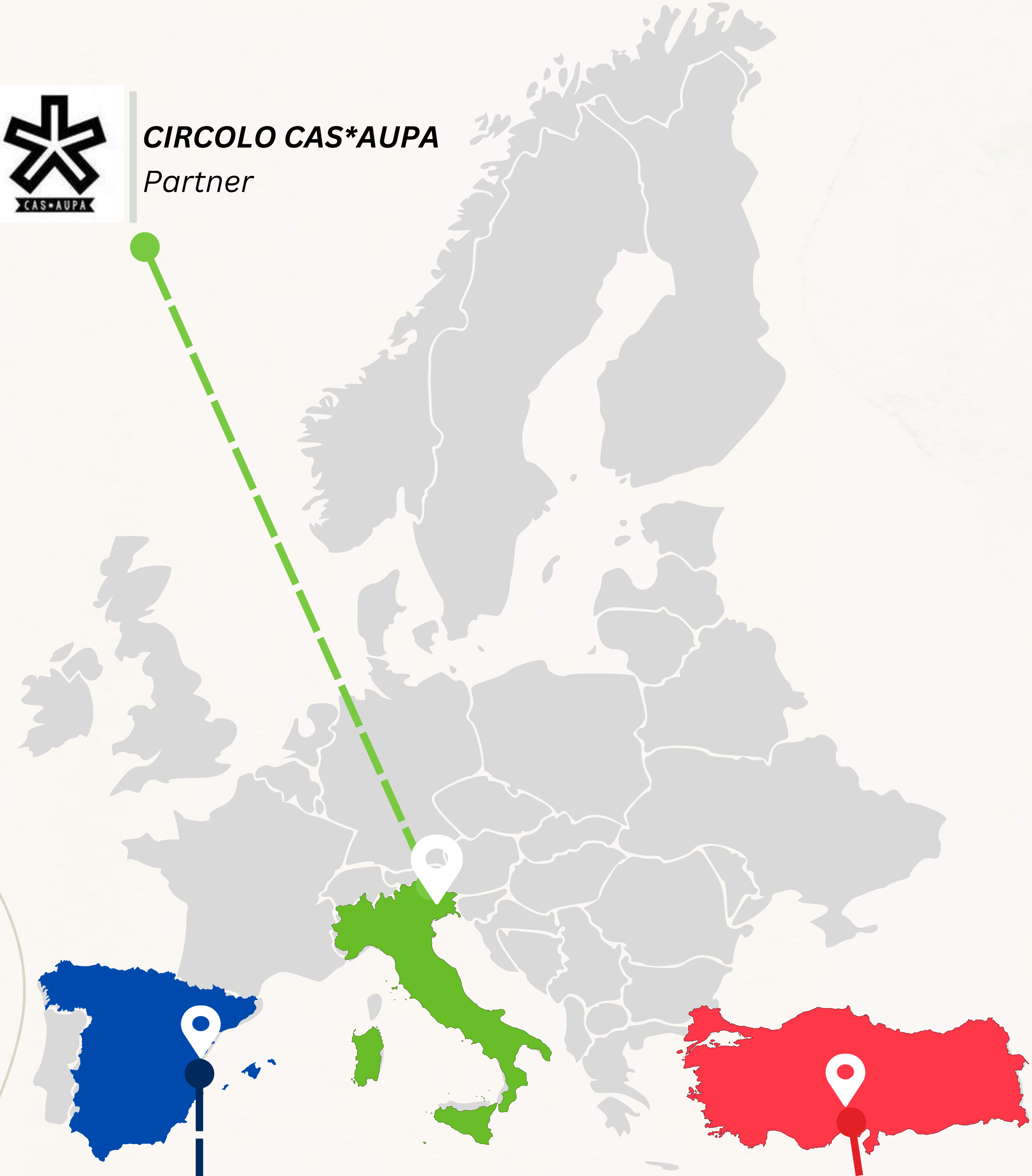
The Desk research focused on the state of the art in each partner's country on the following thematic issues:

- food waste and its relation to climate change
- food waste upcycling potential in the clothing manufacturing and local handicraft
- food waste processing techniques
- food waste upcycling and circular economy.

Moreover, best practices about upcycling and recycling food waste and other pollutant materials (such as plastic) were analysed, collected, and used as the basis for the learning mobilities.
This document starts with the guidelines created for conducting the desk research. It continues with the state-of-the-art report produced by each partner at national level. After that, the collected best practices are described. In the last section of the handbook, it is possible to read the summary of the project experience containing a detailed description of each learning mobility together with the most significant pictures.

PARTNERS

CIRCOLO CAS*AUPA
Partner



Asociación para el desarrollo SocioEmocional de la persona, la sociedad y para la cooperación internacional Uno
Coordinator

SEHIT KEMAL TOSUN ANADOLU IMAM HATIP LISESI
Partner

Asociación Uno, Spain (Coordinator): "Asociación para el desarrollo SocioEmocional de la persona, la sociedad y para la cooperación internacional Uno" (Uno) is a no-profit organization founded in 2021 in Valencia, Spain. Uno focuses on life-long learning, believing that everyone should be able, and should aim, to study and improve themselves continuously. In doing so, also improve the society we live in. Uno's idea is that individuals and society can only be fully complete if they learn to interact and give their very best to each other. To help this process, Uno focuses its activities on four areas: Social Inclusion; Gender Equality; Development of Socio-Emotional Intelligence Competencies; and Sustainability. For all these problems, solutions could only come from a collective approach that puts together individuals and their communities. This concept fully embodied the spirit behind Uno. Uno is fighting the social exclusion of all the marginalised social classes that are the most at risk of being left behind due to difficulties in social activities, studies, job placement, etc.

Cas*Aupa,Italy (Partner), was born in 2009 from the desire of a young group of people to create a space for youth creativity, by regenerating an abandoned building in the peripheral neighbourhood of the city of Udine: Villaggio del Sole. It represents a place of youth aggregation and cultural activities. Its main focuses are youth activities, community development, sustainability, urban regeneration, arts and culture. Cas*Aupa manages a creative plastic recycling lab, a concert hall with a capacity of 100 people, a fully equipped rehearsal room, a screen printing workspace. It also functions as an incubator for other local youth organisations. It organises yearly workshops and courses (screen printing, wood carving, pottery, painting, creative art, as well as graphic design and music production). It organises yearly workshops and courses targeting young people. the aim of events organised by Cas'aupa focused to foster youth education, community development, sustainability, urban regeneration, youth participation, arts and culture

SEHIT KEMAL TOSUN ANADOLU IMAM HATIP LISESI, Türkiye (Partner) since 2019 organized, related to their strategic target in the field of Higher Education, seminars, activities, and informative events. They placed at their school, enhancing different participants including NGOs, Institution Representatives, Politicians, and Managers. In this context, they intend to achieve the objectives under the heading "Increasing Academic Success-Scientific, Social Cultural, Artistic and Sporty Activities-Preparing for Higher Education-Employability and Guidance" in the Quality Theme in Education and Training. Their vision and mission show innovative approaches and methods according to high expectations by educational authorities, parents and students. Moreover, since 2019, they organized Biology seminars, activities, and informative events inside the High School, involving numerous students and also NGOs, Institution Representatives, Politicians, and Managers, located in their Biology and Chemical Laboratories, inside the buildings.

GUIDELINES FOR THE DEVELOPMENT OF THE DESK RESEARCH ON UPCYCLING AND RECYCLING FOOD WASTE

The following pages provide the guidelines for conducting the desk research foreseen in the framework of the Erasmus+ Small Scale Partnership in Youth project “WusTE”.
The guidelines were drafted by the Coordinator, Asociación Uno (Spain), in collaboration with the partner organizations, Circolo Cas’Aupa APS (Italy) and Sehit Kemal Tosun Anadolu Imam Hatip Lisesi (Turkey).
The goal of the guidelines is to support the desk research on the state of the art and the collection and analysis of good practices regarding upcycling and recycling food waste by all partners at the national level.
The guidelines start with the definition of two terms: desk research and good practice. Then, there is the definition of the criteria for choosing a good practice regarding the upcycling and recycling of food waste. In the last section, the framework of the project desk research to be followed is defined.

What is desk research?

Desk research is a type of research where a researcher finds, collects, and reviews publicly available data about the research topic.
In primary research, the researcher interacts with people and collects data firsthand using different primary research methods.
On the other hand, desk research is conducted by gathering and analyzing information available on public platforms such as Internet forms, newspaper articles, magazines, market intelligence, government reports, databases, statistics, and data sets.

What is a good practice?

A good practice is not only a practice that is good, but a practice that has been proven to work well and produce good results and is therefore recommended as a model. It is a successful experience, which has been tested and validated, in the broad sense, which has been repeated and deserves to be shared so that a greater number of people can adopt it. (Definition by FAO – Food and Agriculture Organization of the United Nations).

What were our good practice criteria?

The project partners identified some criteria that a practice should meet to be defined as a “good practice” and gathered in the project collection.

- Effective and successful: a good practice is effective in its way of achieving a specific objective; it has been successfully adopted and has had a positive impact on the context it has been adopted.
- Sustainable: a good practice is sustainable in different aspects, such as environmentally, economically, and socially.
- Feasible: a good practice is technical feasibility, that is easy to learn and to implement.
- Replicable and adaptable: a good practice has the potential for replication and is adaptable to similar objectives in in different contexts and levels (ex. Local or national).
- Innovative: a good practice contains some new elements in its method/approach/tools that allow an improvement in the context where it is adopted.

The framework of the WusTE desk research

In the frame of the project WusTE, all partner organizations conducted desk research composed of two parts:

1. **State-of-the-art report at the national level of the following topics:**

- food waste and its relation to climate change;
- food waste upcycling potential in clothing manufacturing and local handicrafts;
- food waste processing techniques;
- food waste upcycling and circular economy.

Each partner studied the situation in its own country regarding the mentioned points, highlighting the following aspects:

- Data about upcycling and recycling materials (in particular food waste);
- Regulations and/or legislative rules for recycling and upcycling materials;
- Programs of incentives for supporting upcycling and recycling;
- Any other interesting information related to the topics

2. **Collection of best practices at the national level regarding:**

- upcycling food waste (methods, processing techniques, materials) and circular economy;
- upcycling of other otherwise pollutant materials, such as plastic;
- recycling food waste

Each partner collected, described, and analyzed 2 best transferable practices for each topic, for a total of 6 best practices per partner. They considered regulations, public and private projects, public and private actors, top-down and bottom-up initiatives, etc.

The desk research helped researchers and trainers from partner organizations to ideate and develop the activities that were implemented during the 3 learning mobilities of the project. Moreover, the sharing of good practices provides the possibility for partners, local associations, youth workers, and decision-makers to learn more about innovative solutions and methodologies for recycling and upcycling.
The desk research was carried out by youth workers from participating organisations, in collaboration with some external experts.
The material used and produced for the mobilities, together with the desk research, have been gathered and edited to become the "**WusTe Handbook**".

What kind of sources could be used?

The principle consists of using any source that can be relevant to the project scope and topic. In saying this though, the most authoritative sources available were used and all the sources were quoted.
For data, it was possible to refer to European and national institutional research bodies (i.e., EUROSTAT, Statista, ILO, OECD, etc.).
For texts, articles published in scientific journals, and research conducted by local, national, and international institutional bodies (i.e. https://www.researchgate.net/, etc.) could be used.
When several sources are available on a given topic, it is recommended to use the most recent data and sources, in general not going back more than 3 years, unless they are the only data available, or the most recent available.

Format

The desk research is written in a narrative way, without using a specific table or template. The graphic design is defined at the time of producing the handbook.
Only to avoid misunderstanding and irregularities in length and form, all partners followed the following indications to write the research:

WORD Document
FONT: Calibri
CHARACTER: 12
SPACE IN BETWEEN LINES: 1.5 pt

QUOTING METHOD: Oxford Style

In-text citation	Reference list
[1] [1] C Neville, *The complete guide to referencing and avoiding plagiarism,* 2nd edn, Open University Press, New York, 2010, p. 25	Neville, C, *The complete guide to referencing and avoiding plagiarism,* 2nd edn, Open University Press, New York, 2010.

Could pictures be included?

Yes, 1 or 2 pictures could be included in each good practice to show the process or the result of upcycling or recycling. It is very important to use pictures with Creative Commons licenses, otherwise, the permission of the owner of the picture to share is needed. Each picture should have its source written as a caption.

How long could the desk research be?

There is no conventional limit but given the number of partners and the resources that can be deployed to the task, each partner produced written material from 6 to 10 pages, plus 6 Best Practices.

How to document a good practice

The description of a good practice should contain the following information (not necessarily in this order):

- Title: name of the project/method/training/regulations/Etc.
- Date: When (month and year) the good practice was implemented and how long it lasted
- Location: Where the good practice was used
- Coordinator: who was the applicant?
- Main Goals: What are the main goals of good practice?
- Target group: Who are the beneficiaries or the target group of the good practice? Who are the users of the good practice?
- Methodological Approach: What methodology had been used to reach the goal? What was the process?
- Impact: What had been the impact (positive or negative) of this good practice on the beneficiaries?
- Stakeholders and Partners: Who are the institutions and partners involved in the good practice, and what is the nature of their involvement?
- Innovation: In what way has the good practice contributed to innovation in the community?
- Replicability and Sustainability: What are the elements (institutional, economic, social, and environmental) that need to be in place for the good practice to be successfully replicated (in a similar context) and sustainable?
- Outputs produced
- Link to websites of social media accounts
- Contact details: What is the address of the people or the project to contact if you want more information on the good practice?
- Pictures
- Any other useful information

DESK RESEARCH ITALY STATE-OF-THE-ART REPORT AT THE NATIONAL LEVEL

FOOD WASTE AND ITS RELATION TO CLIMATE CHANGE

The fact that substantial amounts of food are produced but not eaten by humans has substantial negative impacts: environmentally, socially and economically.
The relevance of the topic is confirmed by one of the Sustainable Development Goals (SDGs), also known as the Global Goals, adopted by the United Nations in 2015, which aims at halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains, including post-harvest losses (SDG 12.3).
However, it needs to be highlighted that the true scale of food waste and its impacts on the environment have not yet been well understood due to the lack of reliable data.

Considering the research conducted up to 2021 and the available data, according to the UN, around 14% of food produced globally is now lost between harvest and retail. Significant quantities are also wasted in retail and at the consumption level. An estimated 17% of total global food production is wasted (11% in households, 5% in food service, and 2% in retail). Food that is lost and wasted accounts for 38% of total energy usage in the global food system contributing significantly to polluting the environment.
Globally, a single consumer wastes 121 kilograms of food every year, of which 74 kilograms in households. Moreover, 8% -10% of global greenhouse gas emissions are associated with food that is not consumed, if losses are taken into account before reaching the level of the consumer, having an undeniable impact on the environment.

There are ongoing attempts from world leaders to make agreements to reduce gas emissions, which are one of the main causes of global warming and sea level rise, threatening our planet. According to a study by the German Potsdam Institute for Climate Impact Research (Pik) published in the journal Environmental Science & technology , reducing food waste around the world would help limit harmful emissions as well as allow for a more equitable redistribution of food. By 2050, by better managing the use and distribution of food, about 14 % of gases from agriculture could be cut.

According to Andrew Steer, a member of the World Resources Institute, but also according to the Food and Agriculture Organization of the United Nations, if the total loss of food were a country, it would be the third largest responsible for greenhouse gas emissions in the world. The situation becomes even more critical if we think about the near future. Indeed, the amount of wasted food is expected to increase dramatically if, as it seems, China and India get used to consuming the same amount of meat as Westerners. According to the researchers, the richest countries on the planet either use more food than it would be healthy to eat or tend to waste it, especially in domestic consumption. In poorer countries, on the other hand, food waste is caused by infrastructure and services that are not up to par in the food storage supply chains. The study predicts that by 2050 the CO2 emissions linked to this waste could become between 1.9 and 2.5 billion tons.

Despite the geographical or economic classification of countries, reducing food waste at retail, food service and household level is an urgent need, and it could provide multi-faceted benefits for both people and the planet.
Moreover, climate change continues to threaten the future of our planet and it may have a serious impact on our ability to grow enough food which makes it even more urgent to tackle the issue of reducing food waste and its vicious cycle which is damaging the environment.

FOOD WASTE UPCYCLING POTENTIAL IN THE CLOTHING MANUFACTURING AND LOCAL HANDICRAFT

The fashion industry contributes with its 1.7 billion tons of CO2 per year to global greenhouse gas emissions.[1]
A trend that doesn't seem to have any positive evolution: according to forecasts, the demand for clothing will continue to grow, going from 62 million tons in 2015 to 102 million in 2030. Consequently, according to estimates, pollution and risks to the environment will increase.[2]

Despite the long way to go, Italy is taking small steps toward a brighter future and from January 2022 has come into force the obligation to separate textile waste. Although the Ministry of Ecological Transition has not yet defined clear rules and objectives and there is still no system of extended producer responsibility that would indicate precise obligations on the collection and recycling of goods, the regulatory provision of an obligation is a step in an excellent direction of textile waste recycling.

Currently, Italy already offers various inspiring models of textile waste upcycle. We will have a closer look at some of them:

1 Oekom Research - Carbon Risk Rating, 2018
2 https://www.wwf.ch/it/i-nostri-obiettivi/rating-wwf-industria-tessile-e-dellabbigliament

MUSKIN

The Tuscan company, GZI - Grado Zero Innovation, involved in applied research, consulting and prototyping of new materials and innovative technologies, has created "MuSkin", a 100% plant-based eco-alternative to animal skin.
MuSkin is a type of vegetable leather made from the cap of a gigantic, inedible mushroom, Phellinus ellipsoideus, treated without using polluting substances. This mushroom species, native to subtropical forests, feeds on tree trunks making them putrefy, therefore it's a harmful parasite that needs to be removed for the health of the trees. Due to its feature of wakening the tree and its inedibility, this mushroom ends up belonging to the scrap material that, thanks to Grado Zero Innovation, instead of contributing to the increasing amount of food waste produced, can now be reused, with benefits both for the forest and for the clothing industry.
Once extracted, the material is treated in a similar way to animal leather but with completely natural techniques, using eco-friendly products such as eco-wax. It's similar to suede to the touch; it may have a soft to cork-like texture and is also a thermal insulator that absorbs dampness and releases it immediately, thus limiting bacterial proliferation. Moreover, it is transpiring, water-repellent, and non-toxic, making it ideal for producing eco-friendly shoes, hats, bags, and much more.[3]

Blue Eco Lab MEDSEA

The collaboration between Blue Eco Lab, the MEDSEA Foundation and the product designer, Lorenzo Finotto, expert in plastic recycling and eco design, is a virtuous example of upcycle of waste potentially impacting on marine-coastal ecosystems.[4]

Mussels are among the most consumed farmed products in the European Union, second only to salmon and its production covers more than 35% of the total European aquaculture production.

The shells of mussels are considered waste materials of the maritime industry and largely end up in landfills, generating approximately 7 million tons of waste every year. Being mainly composed of calcium carbonate (90-95%), the shells are of inorganic nature and calcareous composition, incompatible with the accelerated composting process[5] .Disposal, therefore, is not only expensive for entrepreneurs and harmful to the environment, but also represents a huge waste of precious biomaterial perfect for other uses.

3 https://materialdistrict.com/material/muskin/
4 https://www.ilgiornaledelcibo.it/riciclare-gusci-cozze/
5 EUMOFA, Europena Market Observatory for Fisheries and Aqualculture products, Mercato Ittico _ 2020, https://www.eumofa.eu/it/market-analysis

The Sardinian foundation MEDSEA, a non-profit institution that promotes the protection and sustainable development of coastal ecosystems, and Nieddittas, a company that manages the entire mussel farming chain in the Gulf of Oristano, have instead grasped the enormous potential of mussel shells and plastic waste from mussel farming such as fishing remains and ropes, and have started a recovery and recycling project for the production of eco-design objects, such as chairs or vases, or urban furniture, such as benches. Shortly, the construction of artificial islets in the Corru Mannu pond is also planned using the material created by the upcycle of Sardinian mussel shells.[6]

RICEHOUSE

Ricehouse was born in 2016 as an innovative start-up that, starting with rice, seeks to initiate a positive and responsible change, in the name of regenerative architecture, whereby not only is it built without having an impact on the environment, but by regenerating it. Without creating problems for future generations for the disposal of buildings, but rather giving them a new resource.

Rice waste can shift from a problem - for farmers and the environment - to a real resource that leads to the production of clean and ecological building materials to create new housing models in the name of the circular economy and of "ethically, culturally, technically and deeply committed to making the territory, the city and the building return to being a living organism".

Rice is present in all 5 continents, a raw material that is never lacking, so abundant that it could annually replace more than 75% of all building materials.[7]

The architect Tiziana Monterisi, co-founder and CEO of the Piedmontese start-up, explains "we simply ask the rice farmer to give us everything inedible and, thanks to research, we can use all the waste: husk, straw, chaff, ashes, starch, cooking w

Furthermore, concerning the aforementioned SDGs, the Biella-based startup Ricehouse directly pursues 8, including the 3rd, health and well-being; the 8th, decent work and economic growth; the 9th, industry, innovation and infrastructure: the 11th, sustainable cities and communities; the 12th, responsible consumption and production; the 13th, act for the climate; the 15th, life on earth and the 17th, partnership for the objectives.

In addition to the others that are touched indirectly, such as the reduction of water consumption, the final aim is to arrive at a zero-footprint regenerative model.

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6 http://www.matrika.it/medsea/index.php/en/news-eng/458-blue-eco-lab-mussels-waste
7 https://www.ricehouse.it/

Ricehouse has therefore created a true model of circular economy. Enhancing rice waste means, first of all, reducing CO2 introduced with disposal, but also drastically reducing the extraction of virgin materials to make edible products and reducing also the use of water and energy because no major industrial transformations are necessary[8].

The farmer produces food that feeds the people, rice, and Ricehouse asks him to deliver the waste to them, but it needs to be processed in a certain way according to a certain protocol, and this is a job that is paid to the farmer.

Ricehouse therefore recognizes a value to the human work that the farmer does, to make that agricultural by-product, with a reward and a material that communicates with the world of the construction site is thus enhanced. This material is then processed and sent to the production centers, all of which are Italian-based, and enter the products on the construction market through B2B or B2C[9].

FOOD WASTE PROCESSING TECHNIQUES

From January 2022 the collection of separate organic waste has been introduced as mandatory in all municipalities of Italy. Organic waste is therefore collected in special bags and as soon as it arrives to the facilities it is grinded and mixed with water. From this mixture plastic and fibrous material are removed, which are shredded and become CSS, Secondary solid fuel. It is used in cement factories to produce energy instead of fossil fuels.

The filtered mixture, free from plastics and fibrous material, is placed in the "biodigesters", huge heated tanks. Here 3 types of bacteria transform part of the sewage into biogas (60% biomethane, 40% carbon dioxide). The remaining sludge is mixed with green waste (mowing and pruning) and left to ferment in large "biotunnels". Here the waste becomes organic fertilizer, compost.

Compost is a quality fertilizer, comparable to humus, which can be used for agriculture and gardening. Humus is a dark colored earthy material found in the upper soil layer. It derives from the partial decomposition and recomposition of biodegradable organic waste.

One of the techniques used to recycle food waste is the **Anaerobic digestion**. It consists of a series of biological degradation operations of organic materials that occur in the absence of oxygen. The products resulting from degradation can be classified into two categories, biogas and digestate[10]. Biogas is a mixture of gas (methane and carbon dioxide) and water vapor, as for the digestate, it is the liquid residue containing the non-degraded organic matter.

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8 https://www.ilgiornaledelcibo.it/ricehouse/
9 B2B - business-to-business, B2C business-to-customer
10 https://www.gestioniabc.it/cosa-succede-ai-rifiuti-che-vengono-raccolti/

The biogas is separated into its macro components: biomethane and carbon dioxide. The biomethane is fed into the Snam network and is used for heating or transport. The carbon dioxide, suitably purified, can be sold for industrial uses or carbonated drinks.[11]
Eventually, household waste that is not recycled, is collected through regulatory bags at door-to-door collection or from the street bins and it is recovered by incineration. This process not only eliminates waste but also produces energy and therefore allows a considerable saving of fossil fuels (gas, coal, oil, etc.). The incineration of waste makes it possible to destroy the microbes, viruses, and infectious germs that propagate epidemics.

FOOD WASTE UPCYCLING AND CIRCULAR ECONOMY

Each Italian produces about 65 kg of food waste a year, 7 kg more than the European average of 58 kg. Many, even if the situation has improved thanks to the good practices introduced also very recently, during the lockdown. The improvement of the phenomenon in Italy is however destined to last over time, indicates the Barilla Foundation[12], which would guarantee a benefit in environmental but also economic terms. According to recent research, waste in Italy is worth around 10 billion euros, or almost 5 euros per family per week.[13]

The study also reveals another positive note: food losses along the production chain, from the post-harvest phase to industrial processing, correspond to 2% of the total food produced. Many good anti-waste practices become part of the daily life of Italians during the lockdown, even very simple but effective ones, like preparing a list of products to buy before going shopping, planning meals, and understanding which ingredients are needed and which ones to buy. An excellent practice is also to arrange foods in order of expiration to use the "older" ones first and, last but not least, to consume the leftovers.
According to a study, 53% of waste is attributable to household consumption, in particular vegetables, fruit, and cereals.[14]

According to the Food Sustainability Index, a project developed by the Economist Impact and the Barilla Foundation, which analyzes food in three areas: nutritional challenges, sustainable agriculture and the fight against food waste, Italy excels in the world in the fight against food waste and food losses along the production chain.

The new edition, the fourth of the FSI, analyzes the food-health-environment link in 78 countries (which represent over 92% of global GDP and over 92% of the world population) using 38 indicators and 95 individual metrics.

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11 ANSA, Riciclo, come rinascono rifiuti organici e plastica - dall'umido biometano e concime, da bottiglie imbottiture sedili, 2018, https://www.ansa.it/canale_ambiente/notizie/rifiuti_e_riciclo/2018/02/19/riciclo-come-rinascono-rifiuti-organici-e-plastica_792d2cc8-0f78-42a2-8974-7d65c54b74c7.html
12 https://www.fondazionebarilla.com/
13 https://www.fondazionebarilla.com/food-sustainability/
14 N. Zeccato, Spreco alimentare: ogni italiano spreca 65 kg di cibo all'anno, 7 kg sopra la media Ue, 2021 https://www.sudfood.com/magazine/spreco-alimentare-ogni-italiano-spreca-65-kg-di-cibo-allanno-7-kg-sopra-la-media-ue/

The purpose of the study is to investigate the current situation of global food systems to highlight best practices and areas for improvement, towards achieving the Sustainable Development Goals of the circular economy indicated by the UN. [15]
Although food waste is a serious global problem, less than a third (28%) of the countries analyzed by the FSI show that they have a strategy dedicated to the issue. In this context, the five countries with the best policies in place are France, Italy, the United States, Germany and Argentina. Globally, food losses among the top 19 rankings do not exceed 3% of total food production, compared to the general average of 6%.
Italy has taken big steps in the last decades and recent years in becoming greener and more active in the food waste upcycle through many initiatives, from single citizens to start-ups and municipalities, realizing on small and larger scales, the circular economy model.

We will take a closer look at a few examples:

- In April 2022, a wider project against food waste was presented in Rome, the first national campaign focused on the practice of taking home leftover food from restaurants, through a project promoted by Anci - Associazione Nazionale Comuni Italiani. It must be specified that from a social point of view, in Italy the action of requesting for a “food-bag” to take leftovers home from a restaurant has been stigmatized and it’s not a common practice to take the uneaten food back home. It used to be considered almost impolite, rude, and inappropriate as if the person was showing that they were not wealthy enough to cook for the next meal.Luckily the social stigma is slowly falling apart but it is still a very little diffused practice to take away the food from an unfinished meal at the restaurant.The initiative, financed by The Ministry of Ecological Transition and by the Ministry of the Environment and the Protection of the Territory and the Sea, in collaboration with the CIAL Consortium, is divulged by the motto “Non riesci a finire il tuo piatto al ristorante? Chiedi il BIS! Raddoppia il gusto, azzero lo spreco”- ”**Can’t you finish your dish? Ask for the BIS! Doubles the taste, eliminates waste**.” More specifically, the campaign intends to involve catering establishments and restaurants towards the adoption of communication measures and tools - aimed at their customers - that actively promote greater awareness of the "value of food" and, with it, the virtuous practice of bringing home their uneaten food, overcoming mistrust and embarrassment and saving potential food waste.[16]

- The project for the sustainability of the waste cycle on the Amalfi Coast, called Zero Waste Amalfi Coast, is an initiative put in place and promoted by the Amalfi Coast Tourist District together with Zero Waste Hotel, a consulting firm specializing in green practices aimed at the restaurant and hospitality industry, and the Omega Consortium, a leader in waste management.

15 A. Begnini, Food Sustainability Index: l'Italia e il contrasto allo spreco alimentare, 2022 https://www.italiacircolare.it/it-it/food-sustainability-index-litalia-e-il-contrasto-allo-spreco-alimentare.aspx
16 http://sprecoalimentare.anci.it/campagna-bis/

The aim is to bring inside the hotel facilities, good practices in waste reduction both for workers and guests, and to realize a virtuous cycle of reuse of by-products, such as lemon peels, orange peels, coffee residues, foods widely used in this territory, which is worldwide famous for its citruses.The goal is to bring the hotels to reach 90% separate waste collection and at least 20% waste reduction, moreover developing a circular economy, using by-products such as waste from lemons, oranges, and other foods to produce electricity from biomass.[17]

- An energy provider, Sorgenia, offers a free App, **Greeners**, to create a green community among the customers, to reward and encourage virtuous behaviors that are attentive to sustainability issues and encourage a circular-economy approach. It's a simple and fun formula where, with the sole access to the customer area of the App, the customer enters a world of missions, quizzes, surveys and meetings, with contents that aim to reduce CO2 emissions, correcting consumers' habits and promoting new, greener, ones. At the end of the levels, the knowledge acquired is questioned with a quiz that, if completed with success, generates the possibility of accumulating points and accessing sustainable and ethical rewards. It already counts 45,000 members, 200,000 completed missions and a CO2 saving of 20,000 trees.[18]

- Since 2017, **Alberone market** in Rome has a well-know, very useful and effective practice of food upcycle: Once the market closes, they put up a cardboard box with a handwritten sign, "**raccolta e distribuzione gratis**" (free collection and distribution) and give all the collected unsold fruits and vegetables to the ones in need who wouldn't be able to afford buying healthy food. The idea actually originated at the Turin market, where Paolo Hutter, former councilor of the municipality of Turin, who runs a non-governmental organization, Eco dalle Città, launched a project for the recovery of unsold food involving Italians and foreigners. Hutter, the creator of this initiative, has also invented the word "Ecomori", combining the term ecological with "moru", that is the Piedmontese epithet with which black people are identified.[19] The choice of such a name is since the group of refugees, guests of the city centers, have given their full willingness to get involved and build a culture of reuse. Ecodellecittà organization recruited asylum seekers from sub-Saharan and north Africa to collect, recycle, and distribute unsold foods at Porta Palazzo, Europe's largest open-air market, situated in the northern Italian city of Turin.This was to foster better relationships between communities and to reach inclusion, mutual help, and food waste recycling goals all together.[20] The project in Turin, supported by Novamont, an Italian biochemical company, now collects about 400 kg of unsold products every day.Viola De Andrade Piroli attended the Festival of Migrations in Riace, where she met Paolo Hutter who inspired her to try and recreate the same project in her own town: Rome

17 https://distrettocostadamalfi.it/portfolio/zero-waste-amalfi-coast/

18 https://www.sorgenia.it/entra-in-greeners
19 https://www.nonsprecare.it/ecomori-contro-lo-spreco-alimentare?refresh_cens
20 A., Sintini, Contro la cultura dello spreco alimentare, una bella iniziativa romana all'Alberone, 2017, https://left.it/2017/11/08/contro-la-cultura-dello-spreco-alimentare-una-bella-iniziativa-romana-allalberone/

Ever since, at the Alberone Market every day there is a stand with collected unsold goods from the market for the ones who don’t have the means to buy them, combining many important needs: reducing food waste, providing healthy food to the less wealthy part of the population and creating community besides boundaries with migrants and locals both giving and receiving, co-living.The Alberone Market covers just one short street, but only on one Saturday, Viola and Francesco Fanoli, the antropologist who joined her in the adventure, collected 99 kg of food that would likely have gone to rot otherwise. “At the beginning, we were collecting between 30 to 50 kilos. Then it started to grow. After three years the average is 130, 150 kilos every Saturday,” said de Andrade Piroli.[21]

DATA ABOUT UPCYCLING AND RECYCLING MATERIALS (IN PARTICULAR FOOD WASTE)

The need for a change of perspective and an acceleration in upcycling and recycling materials worldwide is confirmed by the alarming data coming from the new United Nations Food Waste Index Report of 2021.[22] It estimates that the amount of food wasted every year has reached almost one billion tons considering the food that ends up in the waste bins of households, retailers, consumers, restaurants and other food services. An amount that, according to the report, can be equated with about 23 million fully loaded 40-ton trucks that, lined up, would circle the Earth seven times.

The Report underlines how per capita domestic waste is similar in all countries in the same income brackets, regardless of the country's wealth, a fact that cancels the widespread idea that food waste almost exclusively affects rich countries.
Furthermore, producing food and throwing it away weighs down the waste management system and aggravates the consumption of resources: approximately 1.4 million hectares of arable land are used to produce food that will never be consumed.[23]

In Italy, food waste has decreased in the past two years, but the figure is partly due to the Covid-19 emergency. However, according to the Waste Watcher International Observatory, 5.2 million tons of food ended up in the garbage, in the home and along the entire supply chain. This has also an economic value: it means a waste of 9.7 billion euros, 6 billion and 403 million of food waste in Italian homes and over 3.2 billion losses in the fields, in trade and in distribution.[24]

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21 T. L., Win, Thomson Reuters Foundation, Food-mad Italy on mission to cut waste, feed hungry, 2018, https://www.reuters.com/article/us-italy-food-waste/food-mad-italy-on-mission-to-cut-waste-feed-hungry-idUSKBN1FR1UD

22 UNEP - United Nations Environmental Program, Food Waste Index Report, 2021 https://www.unep.org/resources/report/unep-food-waste-index-report-2021

23 https://zerowasteeurope.eu/2016/10/the-italian-recipe-against-food-waste/

24 https://www.fondazionesvilupposostenibile.org/spreco-alimentare-gettato-il-17-di-cibo-con-gravi-impatti-sul-clima-rapporto-unep/#:~:text=Circa%20931%20milioni%20di%20tonnellate,le%20mura%20domestiche%20(61%25).

The numbers of Conai - the national Consortium, which directs the activity and guarantees the recovery results of six material consortia (steel, aluminum, paper / cardboard, wood, plastic and glass) - estimate that in 2020, 9 million were recycled of tons of packaging and it was forecasted for 2021 to reach 9 and a half million.

Confirming a greater willingness of Italians to recycle are the data, still disseminated by Conai with the Waste Watcher International Observatory, according to which packaging and its environmental characteristics are elements that condition consumers' purchasing choices (for 73% of respondents). For 71% the product is sustainable, first of all, if its packaging is recyclable or if it is made with recycled material (69%). If the package is not recyclable 1 out of 4 Italians (25%) buys it the same; 47% buy it, but unwillingly; 22% change their mind and focus on a product with recycled or recyclable packaging, and one in twenty Italians, in addition to not buying it, also spreads the word and advocates against its use with friends and family.[25]

The organic waste has always been the most recycled part of Italian municipal waste. In 2019 over 7 Mt of organic and garden waste were collected (+7.5% compared to 2018). in 2019, the system comprised 345 plants: integrated plants (anaerobic digestion and composting) process 51% of organic waste, almost equaling composting plants in terms of processed quantities. A study conducted by CIC between 2019 and 2020 shows that organic waste plants treated about 83,000 t/year (dry waste) of bioplastics, compared to 27,000 t/year in the years 2016/2017. It consists almost exclusively of flexible bioplastics derived from organic waste collection bags and over 70% of it consists of flexible packaging (shopping bags and fruit and vegetables bags) and of other hard compostable items (catering, food packaging and coffee pods).[26]

Separate collection of textile waste amounted to 158 kt in 2019 (latest available data), increasing by 8% compared to 2018. The collection increased in all the macroregions in Italy, with a very significant increase in Central Italy, from 29.6 kt in 2018 to 35.4 kt in 2019, increasing by 20%.

On a more general note, 82% of Italian young people between 14 and 19, declare their willingness to minimize the waste of water, electricity, plastic and food, while 70% prefer to choose companies whose values they share and some researchers have high hopes for the so-called “Greta’s generation”. Furthermore, according to 2019 data from the Nomisma GenZ Observatory, the %age of young people who do separate collections is 85%.tory, the %age of young people who do separate collections is 85%.It is a transversal attitude that teenagers also bring home, trying to condition and change family habits as well.[27]

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25 V., De Ceglia, Spreco alimentare e rifiuti, le sfide dell’Onu al 2030, Green and Blue, La Repubblica, 2021
26 E. Pettinao, S. Navach, S. Leoni, D. Cesaretti, D. Cancelli, Italy of Recycling Research Summary 2021, A report by Sustainable Development Foundation FISE UNICIRCULAR, Union of Circular Economy Industries, 2021
27 A. Caporale, Cibo e cambiamento climatico: qual è la situazione in italia?, 2019
https://www.ilgiornaledelcibo.it/cibo-e-cambiamento-climatico/

REGULATIONS AND/OR LEGISLATIVE RULES, PROGRAMMES OF INCENTIVES FOR SUPPORTING UPCYCLING AND RECYCLING

Being Italy a member of the European Union, its waste regulations are an implementation of European directives and the European circular economy principles. In particular, the following Italian legislations are the main ones receptive to the European directives regarding recycling and upcycling waste:

LEGISLATIVE DECREE 3 September 2020, n. 116
Implementation of directive (EU) 2018/851 amending directive 2008/98 / EC on waste and implementation of directive (EU) 2018/852 amending directive 1994/62 / EC on packaging and packaging waste. (20G00135) (GU General Series n.226 of 11-09-2020).

LEGISLATIVE DECREE 3 September 2020, n. 118
Implementation of articles 2 and 3 of directive (EU) 2018/849, amending directives 2006/66 / EC relating to batteries and accumulators and waste batteries and accumulators and 2012/19 / EU on waste electrical and electronic equipment. (20G00136) (GU General Series n.227 of 12-09-2020)

LEGISLATIVE DECREE 3 September 2020, n. 119
Implementation of Article 1 of Directive (EU) 2018/849, which amends Directive 2000/53 / EC on end-of-life vehicles. (20G00137) (GU General Series n.227 of 12-09-2020)

LEGISLATIVE DECREE 3 September 2020, n. 121
Implementation of Directive (EU) 2018/850, which amends Directive 1999/31 / EC on waste landfills. (20G00138) (GU General Series n.228 of 14-09-2020).

In order to understand the current Italian legislation on recycling and upcycling waste we need to start from the analysis of the past decade of regulations.
With the Directorial Decree of 7th October 2013, the Italian Ministry of the Environment, Land and Sea (MELS) passed the National Waste Prevention Programme (NWPP), in accordance with the provisions of Art. 29, clause 1 of the "Waste Framework Directive" (Dir. 98/2008/EC). The Italian NWPP, in line with the "European guidelines on the preparation of waste prevention programs"2, identifies bio-waste (especially the food waste fraction) as one of the key waste streams to be targeted.

Five specific “prevention measures” targeting the food waste stream are included:

1. valorization of food industry by-products
2. donation of unsold food from large-scale retail trade
3. promotion of short supply chain systems
4. promotion of voluntary ecolabelling schemes for the food service sector
5. reduction of household food waste

Per Art.199 clause 3, letter r) of D.lgs 152/2006 (the so-called “Consolidated Environmental Act”), the Italian regions have been called to integrate these provisions within their Regional Waste Management Programs (RWMP) within a year of its adoption, by October 2014. A few months later, embracing the European Commission's invitation to tackle the issue of food waste through National Waste Prevention Programs (see Com. 571/2011 - “Roadmap to a Resource Efficient Europe”), the Italian MELS - Ministry of the Environment, Land and Sea, with the technical-scientific support of the Department of Agricultural and Food Sciences (DISTAL) of the University of Bologna and the cooperation of the University spin-off Last Minute Market[28], gave the go-ahead to the definition of a National Food Waste Prevention Plan (also known as PINPAS).
To this aim, with Decree 358/2013, the former Italian Minister of the Environment (Andrea Orlando) established “Task Force no.5 - Analysis and elaboration of food waste reduction models” within the framework of the “Study group for the identification of political strategies and priorities”. As expressly indicated within the Decree, the term of office of the Task Force's members expired soon afterward at the end of the government's term. The interest in the definition of a NFWPP was then publicly, even if not formally, reconfirmed by the following Minister of the Environment who, with Decree no185 of July 8th 2014, established the Technical-Scientific Committee for the implementation of the NWPP. The Committee (among other duties) draws up proposals addressed to the MELS - Ministry of the Environment, Land and Sea aimed at preventing food waste generation within the framework of waste prevention policies.[29]
The activities carried out during the PINPAS program and the related findings and recommendations then inspired several bills on food waste prevention that led to the approval of Law 166/2016, a milestone on food waste that considerably raised public and media attention on the issue.[30]

28 https://www.lastminutemarket.it/english

29 PINPAS has taken a course of actions aimed at engaging the main national food supply chain (FSC) stakeholders toward the identification of policy measures to reduce food waste. Two main summary documents were drawn up during the course of the Plan's work: the document containing the “priority actions to reduce food waste” (see section E3.1) and the “position paper on the donation of unsold food” (see section E3.2). The work was mainly developed and coordinated within a Doctorate programme at DISTAL - University of Bologna - between 2012 2 BIOIS 2012: Preparing a Waste Prevention Programme - Guidance document, available at: http://ec.europa.eu/environment/waste/prevention/pdf/Waste%20prevention%20guidelines.pdf

30 P., Azzurro, S., Gaiani, M. Vittuari, Italy – Country Report on national food waste policy - FUSIONS, 2016

Law 166/2016 provisions on the donation and distribution of food and pharmaceutical to limit food waste

On 14th September 2016, in Italy, it came into effect the Law No. 166/2016, concerning provisions on the donation and distribution of food and pharmaceutical to limit food waste. "*Legge 19 agosto 2016 Disposizioni concernenti la donazione e la distribuzione di prodotti alimentari e farmaceutici a fini di solidarietà sociale e per la limitazione degli sprechi*."
The standard, once approved definitively, was published in the Official Journal of the Italian Republic on the 30th of August 2016, even though the original legislative proposal (3057) was presented to the Italian Parliament in 2015 and only later merged, along with another six bills on the same subject, into the unified text adopted in 2016.

It pursues (among others) the objective of reducing food waste in each stage of the food supply chain (FSC), from production to consumption. The original Act specifies that the purpose is "*to reduce waste for each of the stages of production, processing, distribution and administration of food, pharmaceuticals and other products, through the implementation of some priorities*".

The rule is followed by a list of priorities:

a) promoting recovery and donation of food surpluses for solidarity purpose
b) promoting recovery and donation of pharmaceuticals and other products for solidarity purpose
c) contributing to limiting the negative impacts on the environment and natural resources, reducing the production of waste, and promoting reuse and recycling to extend the products' life cycle;
d) contributing to achieve the general objectives set by the National Waste Prevention Program and by the National Food Waste Prevention Plan contained therein and contributing to the "*reduction of the amount*" of biodegradable waste presently consigned to landfill sites; The National Waste Prevention Program, *Programma Nazionale di Prevenzione dei Rifiuti*, was adopted pursuant Article 180, paragraph 1-bis of the Decree Legislative April 3, 2006, No. 152.
e) contributing to information, consumer awareness (with reference to younger generations) and research on the matters within the scope of this law.

What can be donated?

1) Food, agricultural and agri-food goods that remain unsold or discarded from the food supply chain for commercial or aesthetic reasons, or proximity to the expiry date.
2) Food products that have passed the date of minimum durability, if the packaging integrity and suitable storage conditions are guaranteed.

The destination of the goods suitable for human consumption should be provided to the poorest citizens, the destination of the goods non-suitable for human consumption should be used for animal consumption and/or composting.[31]

The Law states also that it is possible for receiving associations to collect free agricultural products directly from the farmers. These donations are carried out by and under the responsibility of the receiving association or non-profit organization.

As we have seen the Italian law on the donation of food waste, unlike the French one[32] or the Romanian one,[33] does not impose the donation of food waste to processors and supermarkets, but establishes several incentives, rationalizations and simplifications for donors and donees.

Thanks to a very accurate analysis that the University of Bologna commissioned to three of his professors for the Italian European Commission, published under the title "*Italy– Country Report on national food waste policy - FUSIONS*" we have a very accurate, detailed and critic analysis of the law, considering both its strenghts and the consideration of what could have been improved.

Among the main strengths of the law [34] are the following:

- Transparency and wide stakeholder's involvement into the decision-making process;
- Simplification of the bureaucratic procedures required for donating surplus food (art.16);
- Clarification of several key aspects of the donation process, namely:

1. the possibility of donating food products with expired "best-before date" (art.4 clause 1): the law specifies that they can be donated provided the integrity of the primary packaging and the appropriate preservation conditions;
2. the possibility of donating bakery products not requiring thermal conditioning after 24 hours from production (art.4 clause 3): they can be donated even after 24 hours from production; o the possibility of donating food products with labelling errors (art. 3 clause 4): they can be donated provided that the errors are not related to the "sell-by-date" or to the substances or products causing allergies and intolerances;
3. liability burdens in the case of gleaning (art.3, clause 5): the liability for what happens in the field is on those who perform the gleaning activities, not on the farmer that owns the field.

- Donation of confiscated food products: in the case of confiscation, food products suitable for human consumption have to be donated by the competent authority (art.6);

31 http://www.agrilegal.it/approfondimenti/the-italian-law-against-food-waste-encouraging-firms-to-donate-food-rather-than-throw-it-away
32 http://www.assemblee-nationale.fr/14/dossiers/lutte_contre_gaspillage_alimentaire.asp
33 http://www.romania-insider.com/romanian-mps-adopt-law-food-waste/
34 Law 166/2016 provisions on the donation and distribution of food and pharmaceutical to limit food waste, https://www.gazzettaufficiale.it/eli/id/2016/08/30/16G00179/sg

- Widening of the potential beneficiary organizations (and, consequently, extension of the liability exemption for businesses who donate their surplus food): according to art.13 (that modifies Law no. 155/2003, the so called “Good Samaritan Law”), besides the O.N.L.U.S., as defined by art. 10 of D.lgs no. 460/1997, also “*public as well as private entities set up as non-profit entities with the aim of pursuing civic and social objectives that promote and carry out activities of general public interest*” shall be equalised, within the bounds of the service provided, to final consumers in order to meet the proper state of preservation, transport, storage and use of food.

Among the main weaknesses of the law are the following:

- Lack of national food waste prevention targets;
- Limited scope/vision of the Law: the Law mainly focuses on the issue of food donation for charitable purpose, while other options are weakly taken into account;
- Limited commitment/involvement of the Italian MELS - Ministry of the Environment, Land and Sea: the issue of food waste is mainly seen as an option to feed the needy instead of being contextualized within the framework of resource efficiency and waste prevention strategies;
- Lack of integration with the local and regional waste prevention planning;
- Lack of appropriate resources for the definition and implementation of food waste prevention measures/strategies at local and regional level;
- Lack of a reference framework for the definition and implementation of voluntary agreements at local, regional and national level;
- Lack of suitable tools and appropriate resources for research, quantification and monitoring;
- Lack of tools/measures aimed at facilitating dissemination and sharing of good practices and networking among stakeholders;
- Poor integration between GPP policies and food waste prevention in the “food and catering sector”;
- Lack of fiscal/economic incentives addressed to the “voluntary/non-for-profit” sector“;

Moreover, the aforementioned Law 166/2016 introduces a series of market-based instruments, which, directly or indirectly affect the generation and/or the management of food waste. We can divide them into four different categories:

- Economic disincentives for disposal: the so called ‘landfill tax’, introduced in Italy in 1996 by Law no. 549/1995, and is a special tax for the disposal of waste in landfills to discourage the disposal of waste in favor of more sustainable management. The tax is applied at regional level, and it’s directly paid to the regions by landfill operators.

- Incentives for energy production from biomass: the Ministerial Decree no. 6/2012 grants financial incentives for using certain types of food waste/byproducts in biomass/biogas plants. As criticized by the feed industry, some of these food waste streams could better be used for human consumption or for animal feed according to the food waste hierarchy.[35]
- Tax incentives for the donation of food surplus: the Italian law provides fiscal incentives in two ways:

1. it allows food business operators to recover VAT on surplus food donated to non-profit organisations (NPOs);
2. it allows for the exclusion of the economic value of donated surplus food from the company's income so that they do not have to pay the related income taxes.

- Tariff-instruments: municipalities can apply a special reduction on waste tax to the companies that make food donations.[36]

New decree 116/2020 on environmental matters, which implements the EU directives 2018/851 on waste and 2018/852 on packaging and packaging waste

The text of the new Italian Decree n. 116 was approved in September 2020, and it implements the EU directives 2018/851 on waste and 2018/852 on packaging and packaging waste. These directives are part of the so-called "Circular Economy Package",[37] which is an economic model with the long-term goal of producing less waste and, when this is not possible, increasing the recycling of municipal and packaging waste.

As defined in the press release of the European Union, its purpose is to strengthen the "waste hierarchy", giving priority to the use, recycling and prevention of waste, rather than its disposal in landfills. The publication of these decrees is a fundamental step to help the environment and limit the damage already done. [38]

Firstly, Article I, modifies part IV of the legislative decree of 3 April 2006, no. 152.In particular, paragraph 3 amends Article 178-bis "extended producer responsibility". What is it about? Extended Producer Responsibility, or EPR, can be defined as an environmental management and policy approach, in which the producer of a product or good remains responsible for it even once it has become waste, in the so-called 'post-consumer phase'.This requirement does not apply if the initial producer or holder transfers the waste to an intermediary, a trader, an entity or company that carries out waste treatment operations, or to a public or private entity in charge of collecting waste.[39]

35 R. Laraia - ISPRA - Istituto Superiore Per la Protenzione e la Ricerca Ambientale, Ecomondo, I rifiuti organici: inquadramento normativo e scenario di riferimento, 2012
36 Disposizioni concernenti la donazione e la distribuzione di prodotti alimentari e farmaceutici a fini di solidarieta' sociale e per la limitazione degli sprechi. (16G00179) (GU Serie Generale n.202 del 30-08-2016), https://www.gazzettaufficiale.it/eli/id/2016/08/30/16G00179/sg
37 https://www.cial.it/quadro-normativo-rifiuti/
38 https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en
39 https://www.cial.it/quadro-normativo-rifiuti/

Directive 851/2018, in fact, introduces the definition of "extended producer responsibility regime", a series of measures adopted by the Member States aimed at ensuring that product producers have the financial responsibility or the financial and organizational responsibility for managing the phase of the whole life cycle of the product including when it becomes waste. It also defines the general minimum requirements for extended producer responsibility.[40]
Paragraph 3 contains all the changes and insights of Article 178-bis, considering the innovations and progress achieved in environmental matters.[41]

PREVENTION OF WASTE PRODUCTION

The idea of avoiding or reducing the production of waste as much as possible, encouraging the design and manufacture of efficient materials, encouraging their reuse, etc. is very important and continually emphasized.

Article 180 paragraph 2 specifies the objectives for food waste:

g) reduce the production of food waste in primary production, processing and manufacturing, in the sale and other forms of food distribution, in restaurants and catering services, as well as in households as a contribution to the sustainable development goal United Nations to reduce global food waste per capita at the retail and consumer levels by 50 % and reduce food losses along production and supply chains by 2030. The National Waste Prevention Program includes a specific section dedicated to the food waste prevention program that favors the use of the tools of measures aimed at reducing waste according to the provisions of the law of 19 August 2016, n. 166;

h) encourage the donation of food and other forms of redistribution for human consumption, giving priority to human use over feed and reprocessing to obtain non-food products.[42]

ORGANIC WASTE

The objective of the decree is to increase the commitment to recycling and composting starting from the source, from production and for all stages of the production and use process. It also promotes the use of materials and goods obtained from the recycling of organic waste.

40 https://www.ambientesicurezzaweb.it/rifiuti-che-cosa-cambia-con-il-nuovo-decreto/
41 It also inserts an additional article, not present in decree 152, art. 178-ter:
General minimum requirements regarding extended producer responsibility. Among the requirements discussed are:
- definition of the roles and responsibilities of all relevant actors involved
- definition of waste management objectives in line with the waste hierarchy
- communication system
- administrative burdens
- correct information to users of their product and to the waste holders concerned.

42 S. Maglia, A. Corrù, Rifiuti organici: quali novità dopo il D.L.vo 116/2020?, 2020, https://www.tuttoambiente.it/casestudies/rifiuti-organici-novita-classificazione/

From the 1st of January 2022 all Italian municipalities will have to implement the mandatory separate collection of the organic waste and of textile waste.[43]
In practice, organic waste must be separated from other waste and, with food residues, biodegradable and compostable plastic packaging certified EN 13432 must also be collected, all for transformation into compost. Not only food waste, but also bioplastic bags, plates, glasses and disposable tableware made of compostable material.
The provision therefore requires Italian municipalities to activate a separate collection service for organic waste, using reusable emptying containers or compostable bags certified in accordance with UNI EN 13432-2002.[44]

FOOD PACKAGING ASSOCIATED WITH ORGANIC WASTE

Packaging is also covered by this decree. For this reason, Article 182-ter, as amended by Legislative Decree 116, relating to organic waste, includes the management and destination of biodegradable and / or compostable packaging waste, if they meet certain requirements. In fact, if the packaging is:

- certified according to the standard EN 13432 for packaging recoverable by composting and biodegradation or EN 14995 for other products other than packaging;
- correctly labeled (certification above, identity of the manufacturer and certifier, disposal instructions for consumers);
- traced (by 31 December 2023) correctly to distinguish them from conventional plastics in waste sorting plants;

They can be assimilated and, therefore, collected and recycled together with organic waste.[45]

FOOD PACKAGING

The decree also dedicates an entire section to the management of packaging. The purposes are consistent with the text and, in other words, are intended to prevent, in this specific case, the production of packaging waste, and to encourage the reuse and recycling of packaging, in order to reduce its disposal.

Furthermore, it implements, modifies, and updates the articles relating to packaging, pointing out that the measures adopted by economic operators, aimed at ensuring, in fact, the increase in the market of reusable materials, must not have a negative impact on human health or even compromise in no case food hygiene and consumers' safety.[46]

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43 M. Facchini, Rifiuti tessili: dal primo gennaio 2022 scatta l'obbligo della differenziata. Senza linee guida, 2021, https://altreconomia.it/rifiuti-tessili-dal-primo-gennaio-2022-lobbligo-della-differenziata-senza-linee-guida/
44 G., Carillo, Rifiuti organici: da gennaio 2022 scatta l'obbligo di raccolta dell'umido e delle bioplastiche in tutti i Comuni, 2021, https://www.greenme.it/ambiente/rifiuti-e-riciclaggio/rifiuti-organici-obbligo-comuni-2022/
45 https://normativaalimentare.it/legislazione-alimentare/novita-ambientale-decreto/
46 https://www.tuttoambiente.it/casestudies/rifiuti-organici-novita-classificazione/

DESK RESEARCH SPAIN STATE-OF-THE-ART REPORT AT THE NATIONAL LEVEL

FOOD WASTE AND ITS RELATION TO CLIMATE CHANGE

Land, water, and other natural resources must be used extensively in the production of food. Similarly, energy and economic resources, among others, are required for the proper distribution of food on a worldwide scale. Food waste is an issue because it wastes resources; however, the depth of the problem resides in how this waste impacts the ecosystem and the long-term viability of this production and consumption paradigm. When we discard food, we also discard the water, land, and energy that were utilized to generate it. Food waste's environmental impact is depleting the earth's natural resources and speeding up climate disaster.

We not only overproduce food, but we also lose a lot of it: it is estimated that food lost and wasted each year could feed 1.26 billion hungry people. Meanwhile, global hunger will afflict around 9.2% of the world's population in 2022, and greenhouse gases (GHG) emitted by the food sector account for one-third of the overall emissions that have produced the present climate disaster. The figures shown above are consistent with data published by the Food and Agriculture Organization of the United Nations (FAO), which indicates that loss and waste account for 8 to 10% of the gases responsible for global food warming.

According to the agricultural group, food waste leads to an unstable climate and extreme weather events like droughts and floods, which have a detrimental influence on crop yields and crop quality.

The blue water footprint for agricultural output from discarded food is approximately 250 km3, according to the FAO Report on World Food Losses and Waste 2013. According to a recent WWF research, 760km3 of fresh water is drawn from nature for food that is then squandered, which is comparable to 304,000,000 Olympic-size swimming pools of water.

This value is much higher than earlier estimates from the FAO study on the food waste footprint published in 2013. In Spanish households, the quantity of water wasted equals the amount of water utilized. According to this study by CEIGRAM, a collaborator of the EsAgua Network, food waste in homes wastes 131 liters per person every day in Spain.

According to INE statistics, this is the volume of water that a person consumes per day for household usage.
Nevertheless, according to FAO data, around 30% of the world's agricultural land is utilized to produce food that will never be consumed. In addition, they have a large environmental cost since the trash reduces the quality of the soil, the amount of water flows, and biodiversity.According to WWF, as agricultural resource consumption rises throughout the world, 440 million hectares of agricultural land are being utilized to generate food that will be wasted.

According to the FAO[47], 931 million tons of food waste were created in 2021, with homes accounting for 61%, food service accounting for 26%, and retail accounting for 13%. This implies that around 17% of total world food output may be squandered. Food waste has a detrimental impact on our ability to sustain ourselves; therefore, climate change undermines the four principles of food security:

- Availability, on a national, regional, or local scale, availability refers to the capacity to rely on an adequate supply of food.
- Accessibility means having the financial, physical, or cultural means to access the most essential food.
- Consumption, the ability to obtain food of sanitary quality that can meet nutritional requirements
- Stability, the capacity to deal with cyclical or seasonal food shortages.

Considering the effects of our diet on climate change, the UN concludes that food loss and waste are major challenges for generations to come, as they have a negative impact on food security and nutrition, as well as significantly contributing to greenhouse gas emissions and biodiversity loss. It is therefore necessary to introduce a transformative change to make the most of the food produced. To accomplish this, it is critical to raise collective awareness and ensure the implementation of effective actions such as the incorporation of innovative technologies (for example, e-commerce platforms for marketing) and the adoption of new forms of work and good practices to improve food quality management.
According to the Ministry of Agriculture, Fisheries, and Food, households in Spain discarded 1,352 million kg/l of food and beverages in 2019. Most of the wasted products were fresh ones, such as fruits (30.8% of the wasted volume of unused products), followed by vegetables (13.5%) and dairy products (12.6%). Households with people under 50 years old and couples with children were the ones that wasted the most products without having previously used them. A phenomenon that, by area, occurred more in the Levante and the metropolitan area of Madrid. As a result, in order to address climate change, it is also necessary to improve the food system.

47 https://food.ec.europa.eu/safety/food-waste_en

FOOD WASTE PROCESSING TECHNIQUES

Composting and anaerobic digestion or biogas technology are two methods for recycling food waste. Composting is a treatment that uses naturally existing microorganisms and oxygen to break down biodegradable garbage in an enclosed vessel tunnel or pit. It is an alternative to putting food waste in landfills; nevertheless, it requires a large amount of land, produces volatile organic compounds, and uses energy.

Compost is an organic substance that may be used as a soil supplement or a plant-growing medium. Grown compost is a stable substance with humus content that is dark brown or black in color and has a soil-like, earthy odor. It is made by combining organic wastes in proper ratios (e.g., yard trimmings, food wastes, manures) into piles, rows, or vessels; adding bulking agents (e.g., wood chips) as needed to accelerate the breakdown of organic materials; and allowing the finished material to fully stabilize and mature through a curing process.

Composting types: homemade composting, the first step in this approach is determining which organic waste is appropriate for this formula. Options include fruits and vegetables, coffee grounds, eggshells, twigs and bits of wood, paper, and dead leaves. It is not recommended to compost waste meat, fish, or dairy products at home.

Vermicomposting is a second form of composting. It's a similar technique to the previous one, but this time worms are thrown into the mix. Considering the benefits of this formula, we discover that the presence of these organisms adds to water retention and supplies more nutrients to the compost. As in the prior situation, this approach should only be used with fruit and vegetable waste. These methods are employed in houses throughout Spain, although primarily in rural areas or in households with a garden.

The third form of composting is external, which requires the intervention of a third party. Not in vain, in certain places, a supplier of these services is responsible for collecting this trash in the same manner that recycling or regular waste is collected.

In Barcelona, for example, this service exists as well as in some other cities in Spain. This alternative is ideal for those who want to contribute their grain of sand but do not know or do not want to compost themselves at home.

Anaerobic digestion for biogas is a treatment that breaks down biodegradable waste in the absence of oxygen, yielding sustainable energy (biogas) that may be utilized to create power and heat.

Anaerobic digestion has been utilized effectively in a number of European and Asian nations to stabilize food waste while also producing valuable outputs. Sweden, Austria, Denmark, Germany, and England have been in the forefront of developing more sophisticated biogas technology and launching new projects to convert food waste into electricity.

The importance of biogas technology stems from its ability to make the best use of varied organic wastes as a sustainable source of clean energy. A biogas plant is a decentralized energy system, which can lead to self-sufficiency in heat and power needs, and at the same time reduce environmental pollution.

Food waste has the largest economic potential of the many forms of organic waste accessible since it includes a significant quantity of carbon and can be easily transformed into biogas and organic fertilizer.

Food waste can be used as a single substrate in a biogas plant or combined with organic waste such as cow manure, poultry litter, sewage, agricultural residues, slaughterhouse wastes, and so on. There is now an open-air experimental pilot plan for this method in Spain, namely at the Institute of Sustainable Processes at Valladolid University.

DATA ABOUT UPCYCLING AND RECYCLING MATERIALS (IN PARTICULAR FOOD WASTE)

The report on recycling statistics of firms in Spain for 2021-2022[48] is as follows: the production of recycled garbage at Spain's over 400 recycling factories grew by 2.3% over the previous year and metal, paper, and cardboard accounted for 80% of the garbage created, totaling 20.3 million tons, metal trash accounted for more than 60% of the total volume recycled, followed by paper and cardboard, which accounted for just over 20%, with the remainder comprising glass, wood, and plastic recycled.

In terms of volume, waste imports declined considerably compared to the rise projected for 2021, while exports climbed by 2.5%. Both imports and exports climbed in value terms, owing to the continuance of the trend of significant price increases in this area, 340 trash recycling businesses with 400 facilities have been found.

The majority of small businesses are specialized on single material recycling, and they coexist with a smaller number of large operators.

48 According to https://www.dbk.es/

Number of companies	340
Production (thousand tones)	20.300
% change	+2.3
Distribution of production by business segment (%), 2021	
Metal	61
Paper and cardboard	22
Wood	8
Glass	5
Plastic	4
Export (thousands of tones)	2.150
Import (thousands of tones)	5.300
Production (millions of euros)	5.100

Table according to DBK Report

In terms of households, 1.627.313 tons of domestic plastic, metal, cartons, and paper and cardboard packaging were recycled and given new life in 2022, a 3.6% increase over the previous year, according to the Ministry of Ecological Transition and Ecoembes.[49]

By type of material, of the 1,627,313 tons recycled, 708,596 tons were plastic packaging (4.7% more than in 2021); 666,344 corresponded to paper and cardboard (+4.5%); 243,360 were metal containers (a decrease of 1.5%); and 9,012 tons were wooden containers (+6.8%).

Of the total tons of recycled packaging, 1,205,378 came from packaging separated by citizens in yellow and blue containers on the street and in colored bins installed in high-traffic areas such as theme parks, airports, stadiums, football stadiums, offices, bars, and restaurants. The remaining waste was recovered at rest fraction facilities, which receive all forms of unseparated trash.

In 2022, each citizen separated 27.1 kilos of plastic containers, cans, cartons, and paper and cardboard to make their recycling possible. These data are in line with the objectives set by the new national and environmental legislation to improve the quantity and quality of the separation that citizens conduct.

49 https://www.ecoembes.com/es/datos-de-reciclaje-2022.

REGULATIONS AND/OR LEGISLATIVE RULES, PROGRAMMES OF INCENTIVES FOR SUPPORTING UPCYCLING AND RECYCLING

It was reported that in 2020, households in Spain discarded over 1,300 million kilos of food. That is an average of around 31 kilos per person. Furthermore, this represents a financial loss of approximately €250 per person, according to data provided by the Spanish government.[50]

To reduce food waste and create a circular economy in the country, the Spanish government has implemented several initiatives to tackle food waste, such as the establishment of the Circular Economy Spanish Strategy which aims to reduce food waste by 50% by 2030. The general principles that are the pillars of this strategy, inspired by the European and Spanish legal frameworks, are the following:[51]

- Protection and improvement of the environment
- Preventive action
- Decarbonisation of the economy
- "Polluter pays" principle
- Health protection
- Rationalization and efficiency
- Cooperation and coordination between public entities
- Public participation
- Sustainable development
- Solidarity between people and territories
- Integration of environmental conscience in decision-making
- Increasingly competitive economy
- Generation of quality employment.

The following strategic guidelines are provided as a decalogue for[52]:

a. Protection of the environment, protecting terrestrial and marine environments and their biodiversity, contributing to the fight against climate change and preserving the Product life cycle, implementing a product life cycle approach including eco-design criteria, restricting the use of harmful substances in manufacturing, favoring products that can be repaired or re-used, extending products' useful lives and enabling them to be valorized at their end; that is, maintaining the value of product, materials, and resources within the economy for as long as possible;

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50 https://www.mapa.gob.es/es/alimentacion/temas/desperdicio/15informe_desperdicio_alimentario_hogares_2020_tcm30-620745.pdf

51 https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/temas/economia-circular/200714eeec_resumenejecutivo_en_tcm30-510578.pdf

52 https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/temas/economia-circular/200714eeec_resumenejecutivo_en_tcm30-510578.pdf

b. Waste hierarchy, effective application of the principle of the waste hierarchy, promoting waste prevention, recycling, and valorization of the waste that cannot be recycled for energy generation or other purposes, and enabling traceability in order to prevent littering and waste dumping in the environment and the oceans;

c. Reduction of food waste, reducing food waste in order to reduce the economic and environmental impact of resource use and to favor a more equitable distribution of such food resources;

d. Production efficiency, introducing guidelines that increase global efficiency and innovation of productive processes; this may be achieved by using digital services and infrastructures, as well as by implementing environmental management systems, with the ultimate goal of promoting competitiveness and sustainable growth for companies;

e. Sustainable consumption, promoting innovative models for conscious and sustainable consumption, including products and services, as well as the use of digital infrastructures and services, based on transparent information on the characteristics of products and services, including their duration, their capacity to be repaired and energy efficiency, using measures such as the ecolabel;

f. Communication and awareness, communicating the importance of transitioning to a circular economy, promoting, and enabling the appropriate channels for coordination between administrations and for exchange of information between public entities, economic and social stakeholders, as well as the technological and scientific communities, to create synergies that can fuel this transition;

g. Employment for the circular economy, designing employment policies that favor a fair transition to a circular economy based on solidarity, identifying new employment niches, and enabling capacity-building for such employment;

h. Research and innovation, promoting both public and corporate research and innovation initiatives, especially under public-private partnerships, as drivers of change and transition towards a sustainable social and productive model, which is based on the creation and transfer of knowledge and adoption of new technologies;

All of these strategies were developed in order to reach the following goals by 2030:[53]

- Reducing by 30% domestic material consumption in relation to national GDP, taking 2010 as a reference;
- Reducing waste by 15% with regard to 2010 waste levels;
- Reducing food waste throughout the entire food chain: 50% reduction per person in retail and households and 20% in production chains and supplies from 2020, thus advancing towards the Sustainable Development Goal (SDG);
- Promoting reuse and reuse-enabling activities until reaching 10% of municipal waste;
- Reducing greenhouse gas emissions to under 10 million tonnes of CO2eq ;
- Improving water use efficiency by 10% ;

Consumer items are one of the key areas in which these strategies and goals are defined; the circular economy plan suggests developing European standards for a Framework Policy on Sustainable items.

The policy's foundation is to provide a broader range of products covered by the Ecodesign Directive while also incorporating elements characteristic of a circular economy, such as improving durability, increasing the number of recycled materials, imposing marketing restrictions on some single-use products, and combating planned obsolescence. All of these policies, among others, will reduce trash creation, particularly in the case of electronic products and components, which require special attention due to the massive amount of waste created by this flow and the challenges connected with its processing.

New business models based on servitization, in conjunction with technologies such as the Internet of Things, bring up a new set of options for improving efficiency in the use of materials for product maintenance management, perhaps extending the end of its useful life.

As of June 2022, a new law has been drafted with a range of proposals and initiatives to help with the country’s food waste reduction.[54] One idea encourages supermarkets and businesses to reduce the price of items that are about to expire, thus offering product discounts. They have also been requested to give food to food banks and other organizations that will not be used. Businesses may face fines of up to €60,000 if they do not limit the quantity of food waste they create, according to reports.

Furthermore, canteens at schools, businesses, and hospitals have been directed to transform wasted produce into novel food forms such as jams and pastes. If not, they have been requested to give the food waste to compost or animal feed.

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53 https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/temas/economia-circular/200714eeec_resumenejecutivo_en_tcm30-510578.pdf
54 https://www.lamoncloa.gob.es/lang/en/gobierno/councilministers/Paginas/2022/20220607_council.aspx.

Likewise, pubs and restaurants around the country have been directed to provide free takeaway bags to clients so that uneaten food is taken home and enjoyed rather than thrown.

The legislation also governs food bank donations, stating that only food that is inside the favoured consumption time, i.e. while all of its features are effectively in force, can be donated.

The government has decided to grant 176.5 million euros to autonomous communities and cities in order to improve municipal waste management and assist compliance with European goals.

The **Recovery, Transformation, and Resilience Plan**[55] is providing 175 million euros, while the other 1.5 million is being provided by the Ministry of Ecological Transition and Democratic Challenge, to build and improve waste treatment, collection, and recycling facilities, in addition, 47% of the funding will be utilized for garbage collection, sorting, and reuse.

According to the Food Packaging Forum[56] the Spanish Parliament passed a law on waste and contaminated soil for a circular economy in 2022 (*Law 7/2022, of April 8, on waste and contaminated soil for a circular economy*)[57] in which includes a ban on phthalates and bisphenol A (BPA, CAS 80-05-7) in packaging, significant support for reusable packaging in the food sector, and concrete goals aimed at reducing waste in general and single-use plastic waste in particular.
Changes in the chemicals allowed in packaging are one of the waste prevention provisions of the law.The Spanish Waste Law also supports initiatives and products that encourage reuse in several circumstances, including emphasizing waste reduction, "through the sale of bulk products, [and] the sale and use of reusable containers or devices."

Public places and structures must make tap water more accessible, restaurants and hotels must provide free tap water, and all food sellers must accept filling reusable containers if a client requests that food or drink be placed in it.Beginning in January 2023, customers "must be charged for each of the plastic products [such as single-use drinking cups and takeaway containers] that are delivered to the consumer."

Additionally, by January 1, 2023, grocery stores with a floor space of at least 400 square meters must "allocate at least 20% of their area of sales to the offer of products presented without primary packaging, including sale in bulk or through reusable packaging." This complements the *Spanish Ministry of Ecological Transition*'s initiative to prohibit the sale of fruits and vegetables in plastic by 2023.

55 https://planderecuperacion.gob.es/
56 https://www.foodpackagingforum.org/news/spain-passes-comprehensive-waste-reduction-regulation-eases-the-way-for-reuse
57 https://www.boe.es/buscar/act.php?id=BOE-A-2022-5809

To break the link between economic growth and its effects on human health and the environment, Congress established a national objective of decreasing total waste by 13% by 2025 and 15% by 2030 (by weight) compared to 2010.
The objective for single-use plastic is significantly stricter: a 50% decrease in the weight of single-use plastics by 2026, followed by a 70% reduction by 2030 compared to 2022.

There are several regulations particular to the manufacturing of plastic beverage containers: by July 3, 2024, lids and caps must stay attached "during the intended use phase" of the container, by 2025 all polyethylene terephthalate (PET) bottles must contain at least 25% recycled plastic, and by 2030, PET bottles must contain at least 30% recycled PET.
Plastic bottles are collected separately from other items in Spain to aid in the development of a bottle-to-bottle recycling system. Spain intends to collect at least 70% of all plastic bottles brought to the market by 2023. This goal will be raised every two years until it reaches 90% collection by 2029.
The law states that if the 2023 or 2027 objectives are not met, "a deposit and return system for these containers will be implemented throughout the territory within two years to guarantee compliance of the objectives in 2025 and 2029."

PROGRAMS OF INCENTIVES FOR SUPPORTING UPCYCLING AND RECYCLING

RECICLOS

RECICLOS is an initiative of TheCircularLab, Ecoembes' innovation center, which rewards your responsible environmental behavior through a Return and Reward System (SDR).

RECICLOS is a virtual reward token designed to encourage family recycling by using incentives and awards as a tool to enhance their recycling behavior. In terms of personal benefits for recycling, it represents a paradigm change, with recyclers frequently engaging in weekly and monthly raffles, jackpots, and special lotteries, among other cutting-edge incentives such as reductions on local trash taxes and donations to NGOs of the user's choice.

RECICLOS benefits both you and the environment.

How it works:

- First, you download the app from the Google App Store or Apple Store;

- Second, scan the cans and plastic bottles of beverages you consume and deposit them in the yellow container or RECYCLE machines;
- The third step, collect recycles, you will receive one RECYCLE for each container placed in the containers or machines
- Last, but not least, redeem your RECYCLES for entries in raffles or if you prefer, donate them to social and environmental projects. Also, they have already done more than 3,000 raffles and have given out incredible prizes such as electric scooters, tablets, and electric bicycles

https://www.reciclos.com/

For the public, RECICLOS provides:

- An ecosystem for incentive initiatives that can foster responsible behavior and awareness of environmental sustainability.

- A boost to sustainable services, resulting in a cleaner environment for the whole of society.

- Mechanisms to track all transactions and information, helping people to have a greater sense of ownership of their actions.

- Digital asset management by means of user wallets. The use of RECICLOS is similar to the use of cryptocurrency wallets or cryptoassets, but with one key difference: people can receive credit for the efforts they make to improve recycling and track their impact on sustainability.

DESK RESEARCH TÜRKIYE STATE-OF-THE-ART REPORT AT THE NATIONAL LEVEL

FOOD WASTE AND ITS RELATION TO CLIMATE CHANGE

How does food waste contribute to climate change in Turkey?

Food waste is an ethically objectionable issue. In addition, when we consider that one third of the food worldwide is becoming waste, we see that today's agri-food system has become an important actor of the climate crisis. In other words, in order to reduce food waste, examining how waste is formed in this whole system is an important step. A study covering Turkey in this direction is the environmental impact assessment of food waste in Turkey by Belkıs Çakar and colleagues from Istanbul University Cerrahpaşa Faculty Environmental Engineering Department.

According to the research, the carbon footprint accumulated by food waste throughout its life cycle from agricultural production to waste disposal in Turkey is 237 Mt/year, which corresponds to approximately 4.5% of greenhouse gas emissions. Belkıs Çakar focused on the findings of the research and the food waste problem in Turkey for the Climate Newspaper.

Findings on life cycle analysis of food waste in Turkey, life cycle analysis for food waste, numerical findings and their environmental footprint, water footprint, energy carbon footprint are as follows:

Life cycle assessment / analysis is an ISO standardized method that aims to analyze the impact of any good or service throughout its entire life cycle, from production to consumption. Thus, besides the emissions released, in order to measure the resource and energy use, taking into account all the life cycle stages from the extraction of the raw materials that make up a product or service to its production, distribution, use, waste, recycling and final disposal processes, direct and indirect effects are evaluated systematically.

If life cycle analysis is expressed for food waste, It encompasses all impacts along the supply chain from agricultural production (and associated inputs) including processing, packaging, transportation, retail sale, storage, cooking and disposal of the final food waste.

In this respect, when talking about the carbon footprint of 'food waste', first of all, the energy consumed and the emissions released during the processes such as the production and distribution of the determined food group should be taken into account, and then the carbon footprint associated with the disposal of the waste food mass should be included. The same approach applies when talking about the water and energy footprint of food waste.

In the research published in the *Journal of Cleaner Production*, we tried to estimate the carbon, water and energy footprint of food waste in Turkey on a national scale and on an annual basis, using the life cycle assessment approach. According to the results that do not include domestic (household level) food waste and do not include packaged food products, we have seen that 16 million tons of waste is generated annually in Turkey.

According to the analysis carried out in 5 main categories as vegetable, fruit, meat, milk and cereal groups, the carbon footprint accumulated by food waste throughout its life cycle from agricultural production to waste disposal is 237 Mt/year CO2-eq, It corresponds to 4.38%of annual national-scale greenhouse gas emissions.

The water footprint due to the food waste in question is 6.2 * 109 m3/year, and according to TUIK data, it reveals that it causes water wastage almost twice the annual amount of water distributed by municipalities. The energy footprint of food waste throughout its life cycle is 13.5 * 10^4 TJ/year, which corresponds to 8% of Turkey's annual energy consumption.

It can be said clearly that wasted food also means wastage of limited resources such as water, energy and land use. Considering that today's food production systems are largely based on fossil fuels, the measurement of greenhouse gas emissions released during the life cycle of food waste also enables us to understand the share of food waste in climate change.

According to the 2014 data of the UN Agriculture and Food Organization FAO, it is estimated that the carbon footprint arising from the production of food that goes to waste without being eaten is 4.4 Gigatons and corresponds to 8% of global greenhouse gas emissions (FAO, 2014). This shows that if food waste were a country, it would have the highest greenhouse gas effect after China and America. In March 2021, the UN announced that 7.7 million tons of food waste is generated annually in Turkey.

The main questions are: *Does this amount increase over the years? Is it possible to find out what and which type of food is wasted the most?*

The amount of waste in question is only the amount of domestic (household) food waste, as stated in the report, and is not an estimate of the total amount of food waste. The report also includes estimates for waste food generated in food services and retail chains of businesses such as hotels and restaurants for each country.

It is important to determine the stages at which food becomes lost and waste, in terms of guiding us about the precautions we should take and structural changes. At this point, we need to express that we need more and more comprehensive field studies based on current data. When food waste are examined in terms of formation stages and causes, it is possible to make a causal classification regarding the development levels of countries.

According to FAO's global study on food waste, in developing countries, food waste mainly occurs at the beginning stages of the food chain (FAO, 2011). This can be significantly prevented by financial, managerial and technical regulations and by improving collection, storage and cooling processes. In middle and high-income countries, most of the waste is at the end of the food chain; takes place at the retail and consumer level.

The reason for this is the role played by consumer behavior and attitudes in industrialized countries. The fact that the crop is not collected under certain quality standards such as shape and weight and left in the field, and the excess production of the food is left on the shelf and spoiled are among the main causes of food waste in developed countries.[58]

The carbon footprint or water footprint of a banana and red meat is not the same. From this point of view, should a *'priority order' be followed while preventing food waste*?

It should be noted that the carbon footprint of different food products can vary greatly depending on the food production system and methodological choices. In this sense, it is ideal for each country to create a carbon and water footprint database and inventory information according to its own product range and production model.

However, it is possible to make some generalizations, animal-based products have a significantly higher carbon footprint than plant products - in relation to inputs in agricultural production processes. Examining the food waste literature, approximately 70% of the environmental footprint accumulated by food waste throughout its life cycle originates from the agricultural production phase.

Therefore, it can be say that giving priority to meat and dairy products in food waste prevention efforts will be meaningful in terms of reducing environmental impact.

58 Buzby and Hyman, 2012, Parizeau et al., 2015

The results of the studies also support this. Although the amount of waste of animal-derived foods is less, their carbon footprint is much higher. This gave similar results for the water and energy footprint of foods. (National greenhouse gas emission (Mt CO_2-eq/y) according to the amount and types of waste food.)[59]
In addition, when the food waste is evaluated according to the life cycle stages, it can be seen that this effect largely belongs to the production phase.[60]
According to the results of the research that does not include food waste at the consumer level, 200 kg/year food waste is generated per person in Turkey, and the highest food loss occurs in the fruit-vegetable group.

Poor production planning, early harvest, inadequate storage facilities, inadequate infrastructure conditions for storage and distribution, and inadequate marketing systems can be counted as the causes of food waste. In order to prevent these losses, the products should be stored in suitable weather conditions and the distribution processes should be carried out with refrigerated transportation.

According to EBRD Turkey's 2019 data, 70% of food transportation in Turkey is unfortunately carried out by refrigerated transportation.[61]
Food waste should be handled not only as an environmental problem, but also as an ethical and governance issue, covering all segments of society. Losses in the food supply chain are reflected in consumer prices as the income provided by the producer decreases economically. The increase in consumer prices also threatens the national food security capacity by restricting access to food, especially for the low-income population.[62]

FOOD WASTE UPCYCLING AND CIRCULAR ECONOMY

Food systems damage natural systems and threaten the health of living things due to the linear structure of current food production, which operates with very low efficiency. We need to reconsider the entire value chain to eliminate the destruction caused by these unsustainable production and consumption patterns in food, to ensure economic growth in harmony with the Planet, and to feed the growing population at an adequate rate.

The circular economy offers many opportunities for the agri-food value chain to become more resource efficient. The circular economy in food focuses on the production of agricultural products with minimal inputs, closing as much as possible all loops in the system, including food processing and distribution processes, and reducing harmful discharges (in the form of waste and emissions) into the environment.

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59 Cakar et al., 2020
60 National GHG emissions by life cycle stages, Turkey (Cakar et al., 2020)
61 EBRD Turkey, 2019
62 World Bank, 2018

According to the article by Tansy Robertson, published on 24 February 2021 at Ellen Macarthur Foundation, the circular economy for food could reduce the sector's greenhouse gas emissions by 49% (5.6 billion tonnes CO_2e) by 2050.

So, what does all this mean? What can be done to create a circular food system, what approaches can support this transformation?

Restorative production:

In a circular economy, food is produced as a reparative. This means using techniques that restore and improve the overall health of the local ecosystem. Regenerative productions support rebuilding and restoring natural systems and ecosystems while maintaining air and water quality.
Examples of restorative practices include switching from synthetic fertilizers to organic fertilizers (reducing the use of chemical inputs), crop rotation and using more crop diversity to promote biodiversity, and developing a production model that is compatible with the local environment.

What is regenerative agriculture? Why is it important? Does it require new technologies? Why is it not widely used?

Regenerative agriculture[63] is a form of agricultural production that restores ecosystems. For this reason, it is an important mode of production, as the degraded ecosystems, especially soil ecosystems, are restored at the same time as agricultural production.

In this method, there is a win-win situation for both the farmer, the nature and the people who consume these products. In a repaired soil, the need for external input to grow the plant decreases day by day; the plant becomes resistant to disease, pest and climatic effects and thus pest management becomes easier; healthier plant also means more nutritious food.

The basic principles of restorative agriculture are not to leave the soil bare (cover crop application varying according to scale, mulching, etc.); minimizing tillage to preserve soil vitality (mulch/direct sowing crowbar, etc.); avoiding monoculture in the crop pattern and creating diversity (stripe planting, afforestation at field borders, etc.); integrating animal influence into crop production.

Regenerative agriculture promotes the development of healthy soils that can result in crops with higher nutrient content. Agroecology, regenerative grazing, agroforestry, conservation agriculture and permaculture all fall under this definition.

63 Please see the link to learn about regenerative agriculture https://www.youtube.com/watch?v=DJJ7W4tuAIQ

Companies – with the support of governments – can implement restorative approaches to food production and grow food in ways that improve the environment rather than degrade it.

The main goal of a regenerative food system is that all stakeholders see the net positive effect of being in the system. It is also underlined that these positive effects will naturally create strong local economies and communities.

Preventing food loss and waste:

About one-third of the food produced in the world each year – about 1.3 billion tons – is lost or wasted. This represents a major nutrient loss and a major cause of environmental problems. However, it is estimated that 690 million people are facing hunger, and this figure will reach 840 million by 2030. In short, 10% of the world's population continues to starve due to the linear nature of the food produced.
This highlights the urgency of rethinking food systems and tackling inefficiencies such as food loss and waste.

One of the biggest problems in food systems is that most of the food produced is lost along the supply chain. The most important factors affecting this are unsuitable transportation conditions and long supply chains. Most products that reach the markets at the end of the value chain are wasted when their shelf life expires or when they are not consumed after purchase.

However, there are different applications developed to prevent waste generation at its source. Technology-based startups, which have been increasing in number in recent years, produce beautiful and effective solutions to these problems.

REGULATIONS AND/OR LEGISLATIVE RULES, PROGRAMMES OF INCENTIVES FOR SUPPORTING UPCYCLING AND RECYCLING

The **Turkish Republic Eleventh Development Plan**, which was prepared by the Presidency of Strategy and Budget, covers the years 2019-2023. In this context, "*effective stock management, reduction of losses in the supply chain, prevention of waste, and regulation of markets will be ensured to develop rules and capacities to ensure food safety.*" In addition, consumer awareness will be increased in order to prevent food loss and waste.

Based on these objectives, in order to adopt a comprehensive strategy on food loss and waste, a core meeting was held in 2018, under the coordination of the Ministry of Agriculture and Forestry, General Directorate of European Union and Foreign Relations, with the participation of FAO-Central Asia Sub-Regional Office (SEC) and representatives of other units of the Ministry.

In this framework, focus group meetings were held with the participation of relevant stakeholders, and the roadmap of the Strategy was discussed and developed along with the problems and solution proposals. Initially, official correspondence was made with the 81 Provincial Directorates of the Ministry and relevant local stakeholders (Governorships, Municipalities, Universities, NGOs, etc.), and they were asked to examine food losses and waste at the local level and make a situation assessment. Reports were received and reviewed.

In recent years, the Turkish Ministry of Agriculture has put the issue of reducing food losses and waste on a sustainable basis on its agenda and has carried out many studies on a national and global scale.

In line with these developments, the Turkish Ministry of Agriculture, being aware of the fact that the issue of reducing food losses and waste is not only a national but also an international issue, has been cooperating with the United Nations Food and Agriculture Organization (FAO).

FAO has launched a large scale national campaign called "**PROTECT FOOD**" to reduce food losses and waste. The Ministry has recently carried out various studies on a national and global scale, focusing on the sustainable reduction of food loss and waste.
Being aware of the fact that reducing food loss and waste is a global problem, Turkey has launched a national campaign called “**Save Food**” under the coordination of the Ministry and in cooperation with FAO.

Another study on the subject is the "**Reducing Food Loss and Waste in Sub-Regional Countries**" project within the scope of the FAO-Turkey Food and Agriculture Partnership Program (FTPP II), which is an important initiative at the regional level and financed by the Government of Turkey.

The project aims at developping measures to reduce food loss and waste in Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and Turkey.

BEST PRACTICES IN ITALY

UPCYCLING FOOD WASTE (methods, techniques, materials)

1 .**ORANGE FIBER -** *fashion products starting from citrus juice by-products.* — **Sicily,Italy**

2 .**MILK BRICK -** *patented eco-organic milk fiber bricks.* — **Sardinia, Italy**

UPCYCLING OF OTHER OTHERWISE POLLUTANT MATERIALS, SUCH AS PLASTIC

3 .**SAFILO_ECONYL®** - *regenerated nylon glasses.* — **Veneto,Italy**

4 .**PET_IT Alisea** - *backpack made of post-consumer recycled PET.* — **Veneto, Italy**

RECYCLING FOOD WASTE

5 .**MILAN FOOD WASTE HUBS -** *recovering unsold and unused food to distribute it to those in need.* — **Lombardy, Italy**

6 .**CIC MODEL OF ORGANIC WASTE COLLECTION -** *from organic waste to compost and back to soil.* — **Italy**

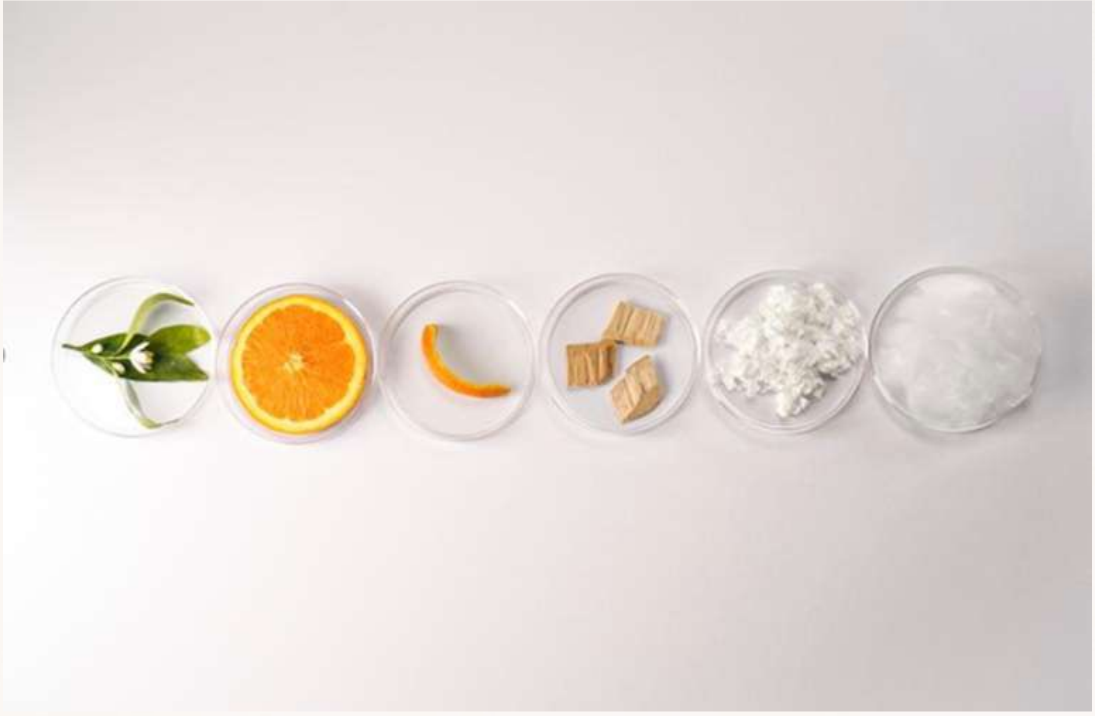
LOCAL FVG REGION BEST PRACTICES

7 .**PLASTICART - Cas*Aupa -** *Eco-design art from recycled local plastic.* — **FVG, Italy**

8 .***AGRILANA IN PELLET*** - *Transformation of wool into fertilizer* — **FVG, Italy**

1 .ORANGE FIBER

Orange Fiber is an Italian company that produces sustainable fabrics from citrus fruit by-products, using an innovative patented process. Established in Catania, Sicily, in 2014, it creates high quality fabrics helping to shape a new concept of luxury based on ethical and sustainable.



https://orangefiber.it/tencel-limited-edition-initiative/

Orange Fiber starts from the by-products that the Italian citrus processing industry produces annually — the disposal of which has high costs both for the citrus juice industry as well as for the environment.

The technology used 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, and use it to feed cellulose fiber production lines. This process has been patented in 2014 staring from Italy and, later, extending it to the main citrus juice producing countries.

The idea was born in October 2012 from A. Santanocito and E. Arena who worked to develop a disruptive technology that creates an innovative fabric out of industrial by-products, seeing an opportunity instead of a problem in the more than 700.000 tons of citrus juice by-products are produced annually in Italy.

The resuLt is a fully traced and transparent supply chain to transform citrus by-product into the perfect ingredient for conscious designers.[64] Over the years the Sicilian company has developed partnerships with other Italian excellencies in the fashion industry.

https://orangefiber.it/collaborations-emarinella/

Partnerships:

- From the combination of innovation and sartorial tradition comes the E. Marinella made with Orange Fiber, an exclusive collection of sustainable ties, pocket squares and lady silk scarves made by the historic Neapolitan tailoring brand E.Marinella.

- Faithful to their motto, Responsible Passion, Salvatore Ferragamo is the first fashion house to employ Orange Fiber fabrics in 2017, on the occasion of the 47th Earth Day. This collaboration involves the high quality of the Orange Fiber fabric, the precious prints by the Italian designer Mario Trimarchi and the stylistic mark of the Salvatore Ferragamo Maison for a collection which turns into a hymn to Mediterranean creativity.[65]

- In line with its commitment to a greener direction, H&M 2019 Conscious Exclusive collection was made only with recycled and sustainable materials. In collaboration with Orange Fiber a sophisticated boho-style top, a tribute to the beauty of Nature, was realized with the citrus fabric.

64 https://orangefiber.it/process/
65 https://orangefiber.it/collaborations-ferragamo/

The approach of various big fast-fashion brands, and in particular of H&M, to the environment sustainability of their products is a delicate and very controversial topic. H&M has often been pointed out for greenwashing and of advertising its commitment to ethical fashion with misleading information. [66]

In a recent article published by the Guardian[67] we can read “The report[68] particularly criticized the use of polyester made from recycled plastic bottles which it said was a “false solution” and said brands were not doing enough to ensure their clothing was recyclable. (...) It picked out H&M’s ethical Conscious Collection for using more synthetics than in its main collection, with one in five items analyzed found to be made from 100% fossil fuel-derived synthetic materials.

H&M said it based its product sustainability claims on “credible third-party certification schemes for our materials to ensure sustainable sourcing and integrity” such as the Global Recycled Standard. The Swedish fast-fashion retailer said that polyester made up 27% of its material use, however it agreed that “recycled polyester from single-use plastic bottles shouldn’t be the long-term solution for the industry”.[69]

In August 2019, the Norwegian Consumer Authority condemned the Swedish clothing retailer as it provided "insufficient information about the sustainable nature of its sustainable style collection” and declared that the portrayal of the sustainability of its collection breached Norwegian marketing laws.[70]
The topic would deserve a deeper and broader degree of in-depth analysis which would not be possible to offer here.

CONTACTS

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https://orangefiber.it/

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66 Changing Markets Foundation, Licence to Greenwash, Full Report, 2022
67 S. Butler, Dirty greenwashing: watchdog targets fashion brands over misleading claims, 2022 https://www.theguardian.com/business/2022/jan/14/dirty-greenwashing-watchdog-targets-fashion-brands-over-misleading-claims
68 The pressure group Changing Markets Foundation released a report last year into the use of synthetic fibres by 46 leading brands. It said that 60% of claims by UK and European fashion companies, including Asos, H&M and Zara, were unsubstantiated and misleading shoppers.https://changingmarkets.org/media/publications-landing/
69 S. Butler, Dirty greenwashing: watchdog targets fashion brands over misleading claims, 2022 https://www.theguardian.com/business/2022/jan/14/dirty-greenwashing-watchdog-targets-fashion-brands-over-misleading-claims
70 N., Hitti, H&M called out for "greenwashing" in its Conscious fashion collection, 2019 https://www.dezeen.com/2019/08/02/hm-norway-greenwashing-conscious-fashion-collection-news/

2 .MILKBRICK

Milk Brick is an Innovative Startup that produces patented eco-organic milk fiber bricks. It recovers the waste milk from the Dairy Industry and transforms it into a new second raw material to be used in the industrial production of hundreds of products for the construction industry.

Milk Brick enhances 100% of the recovered milk without generating production residues. Its products have a continuous life cycle, they are 100% recyclable. The idea came in 2011 to the CEO and founder Giangavino Muresu and after 5 years of research on the enhancement of waste milk from the Dairy Industry, in 2016 the industrial patent to produce building products made of milk was obtained.

In November 2017 the Sardinian start-up MilkBrick was funded in Ossi, Italy.

https://www.milkbrick.com/prodotti/

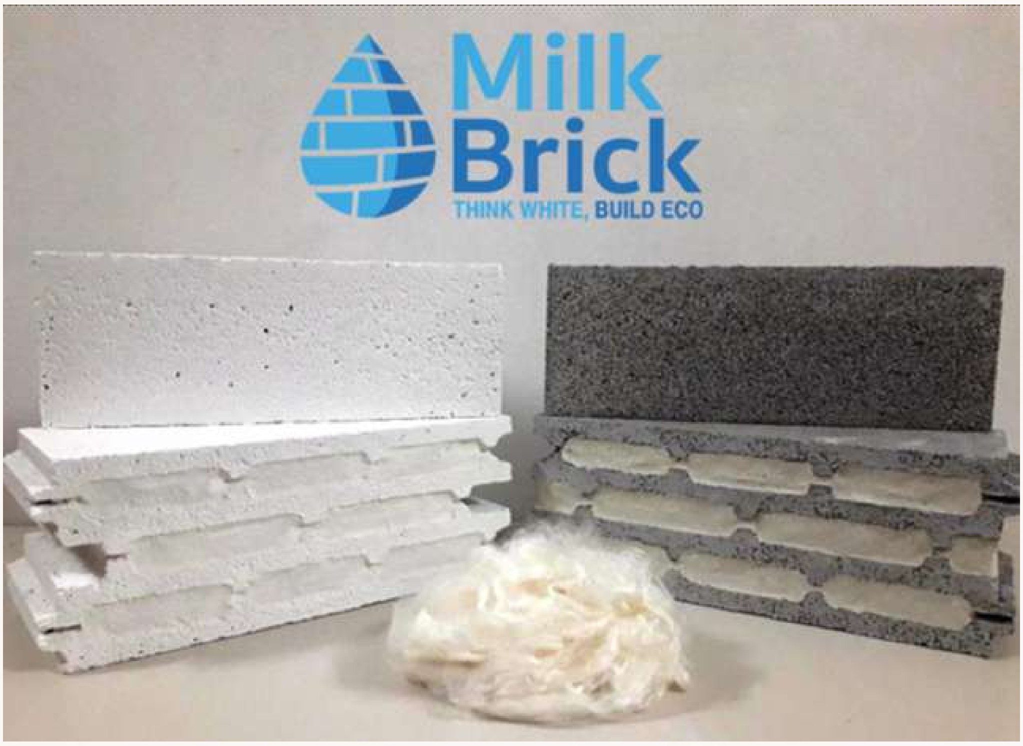
The Milk Brick Industrial project was born to solve mainly 3 problems:

- The disposal of milk waste from the dairy industry and large-scale retail trade;
- The heat loss of buildings;
- Excessive water consumption in the construction industry.

The innovative start-up Milk Brick has developed products for 4 sectors of the construction industry: thermal insulating bricks; prefabricated concrete products; concrete conglomerates and pre-blended milk fiber mortars.[71]

71 https://www.ilgiornaledelcibo.it/milk-brick-mattoni/

Milk Brick uses 100% of the recovered milk without generating production waste. In the milk processing processes the water content is separated from the casein content. The water obtained from the milk is used in the mixing phase to replace the fresh water, while the casein content is transformed through an extrusion process into 'milk fiber', a biological fiber that absorbs moisture and then releases it quickly in thermoregulation. Milk fiber has important thermal insulation characteristics and is highly breathable and antibacterial.



https://www.milkbrick.com/prodotti/

MilkBricks are a great example of quality products combined with a competitive price, of the upcycle of dairy industry waste, moreover they are an eco-bio solution that provides a single step of laying the brick, thus speeding up the builder's installation times, saving the end customer the cost of labor. Last but not least, the lack of use of freshwater: unicum at the international level, to be able to preserve billions of m3 of fresh water throughout the planet every year.[72]

CONTACTS

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https://www.milkbrick.com/

72 https://www.milkbrick.com

3 .SAFILO_ECONYL® REGENERATED NYLON GLASSES

Since 2020, Safilo has launched the first eyewear collections made of Econyl® regenerated nylon, a plastic material with a low environmental impact as it is obtained by regenerating synthetic (nylon) waste such as fishing nets, carpets and fabrics.[73]
It has the same features as nylon from virgin sources or from oil, with no differences in quality or performance, and can be recycled, recreated and reshaped many times without losing its properties.[74]

These recycled plastic sunglasses are produced thanks to the design of Yves Béhar, the expertise of the famous Italian eyewear brand Safilo, in collaboration with The Ocean Cleanup, the Dutch non-profit organisation set up to develop advanced technologies for removing plastic waste from the oceans. Interesting note: 100% of the profits go to the continuation of the ocean clean-up operations.[75]

https://www.mffashion.com/news/livestage/safilo-svela-gli-occhiali-green-per-the-ocean-cleanup-202010261055057759

The Ocean Cleanup products are made of injected plastic from the Great Pacific Garbage Patch (GPGP) -the island of plastic floating in the middle of the ocean- thanks to an innovative upcycling process that reuses heterogeneous plastics that are traditionally more difficult to recycle, turning them into safe, high-quality materials

73 https://www.safilogroup.com/en/sustainability/product
74 B., Curti, Safilo svela gli occhiali green per The ocean cleanup, 2020 https://www.mffashion.com/news/livestage/safilo-svela-gli-occhiali-green-per-the-ocean-cleanup-202010261055057759
75 http://www.safilo.it/en/4-press-releases?cont=1031

A unique QR code inside the glasses explains more about the product and The Ocean Cleanup project. Each pair of sunglasses is estimated to enable cleaning an equivalent of 24 football fields worth of the GPGP and the entire limited edition will equate to approximately 500,000 football fields of clean-up in the GPGP. [76]

https://www.safilogroup.com/en/sustainability/product

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4 .PET_IT - ALISEA

From the correct recovery and recycling of 35 plastic bottles, PET _IT backpack was created by Alisea, the Italian company that has made of Reuse and Recycling a form of corporate identity since 1994.

More than 100 million of plastic bottles are used and thrown away every day. Alisea contributes to their recovery and recycling with PET _IT, the backpack made of post-consumer recycled PET, customizable with customer's logo.

76 http://www.safilo.dk/it/4-comunicati-stampa?t=safilo-produce-per-the-ocean-cleanup-i-primi-occhiali-in-plastica-riciclata-dagli-oceani&d=2020-10-27

https://alisea.it/en/plastic/

PET _IT is Global Recycled Standard certified and has a very modern and useful design, which makes it appealing for all targets, young generations and businesspeople. Allianz Global lnvestors, showing their commitment to social and environmental issues, was the first to choose PET _IT, with an order that allowed the recycling of 3500 plastic bottles.

PET_IT customizable backpack is only one of the products of Alisea, which produces various other products created only by recycled or upcycled materials such as agendas, handbags, pens, pencils and much more.

Alisea Communicating Objects are made in Italy and certified ReMade in Italy, the first certification for products and materials that are recycled, reuse and made in Italy. The label describes the sustainability characteristics of the material, the product and process, in terms of saving in raw materials, energy savings, and CO2 emission reductions.

ReMade in Italy was created to promote Italian sustainable industries The Italian Ministry for Environment is ReMade in Italy's technical and scientific partner

https://alisea.it/en/plastic/

Among the many partnerships that Alisea has, it's worth to mentioning the one with ISIA Roma design - Pordenone Branch - which gave birth to the UP Project. It was launched in 2013 as a chian of ideas and people. It involves entrepreneurs, businesses and universities researching into eco design.

As part of their study, the students have the opportunity to develop and be the authors of an environmentally friendly objective, which will be created with the support of Alisea.[77]

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https://www.alisea.it/en/

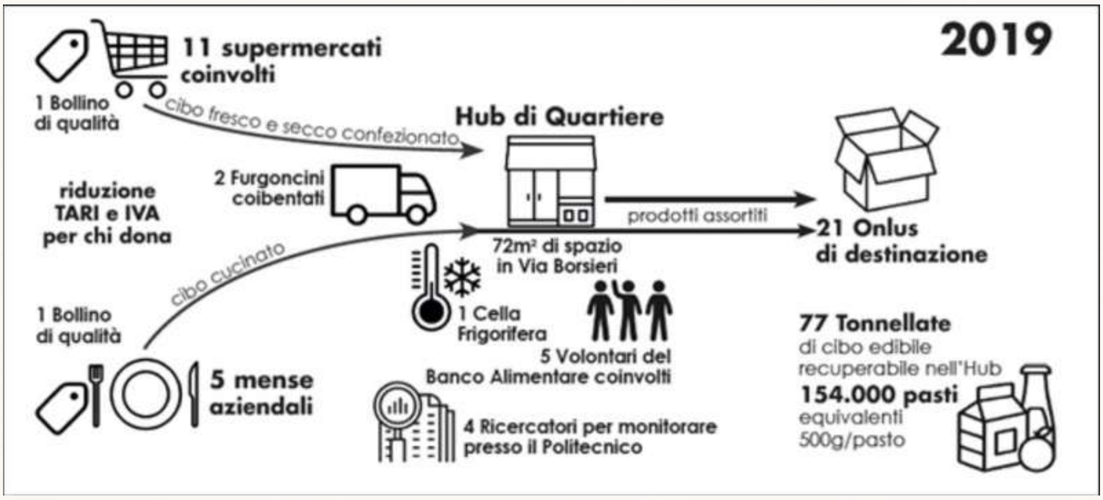
77 https://alisea.it/en/plastic/

5 .MILAN FOOD POLICY and FOOD WASTE HUBS

In 2015, the Municipality of Milan adopted a comprehensive Food Policy with the overall objective of increasing the sustainability of its food system. Reducing food waste is one of the priorities of the Food Policy,[78] with the goal of cutting food waste by 50% by 2030. To do so, the Municipality signed a joint agreement with Assolombarda and the Polytechnic University of Milan, with the aim of designing innovative and participatory solutions to fight food waste.

In 2016 the three partners shared "Zero Sprechi" memorandum of understanding, with the aim of reducing food waste and innovating the ways of recovering food for the people in need, designing and experimenting a model of collection and redistribution of food surplus, based on local neighborhood networks.

The actions started between 2018 and 2019 with the Municipality of Milan identifying an empty and free location in Municipio 9 and making it available for the pilot project as a Hub for the collection, storage and distribution of recovered food from supermarkets to local non-profit organizations.



https://foodpolicymilano.org/hub-quartiere-spreco-alimentare/

First of all, the Politecnico di Milano developed a feasibility study of the network involved and monitored the 12-months-impact Hub operations. This, building an extendable and spreadable logistic model for other city neighborhoods. Assolombarda engaged some local companies, promoted, and shared with the other partners "ZeroSprechi" label, designed by Armando Testa Group. Banco Alimentare della Lombardia, selected through a public tender,guaranteed its daily operational management model, designed by Politecnico, recovering food surplus and distributing it to charities.

78. https://foodpolicymilano.org/
"La Food Policy è la politica alimentare della città. Rappresenta una delle eredità di Expo 2015, ed è uno strumento di supporto al governo della città promosso in sinergia dal Comune di Milano e Fondazione Cariplo per rendere più sostenibile il sistema alimentare milanese" - (eng) The Food Policy is the food policy of the city. It represents one of the legacies of Expo 2015, and is a support tool for the city government promoted in synergy by the Municipality of Milan and the Cariplo Foundation to make the Milanese food system more sustainable

QuBì program- La ricetta contro la povertà infantile, who has already launched a similar Hub in Umiliati street, joined the project financing the set-up and management of Hub Isola and promoting the linkage with local networks.

This model allows to provide beneficiaries with a[78] mixed offer of food, thanks to the intermediation of the hub, which recovers food from both supermarkets and canteens. This project is complemented by a tax reduction measure, that rewards businesses that donate food with a 20% reduction on the waste tax. The reduction is based on the quantity of food donated and acts in synergy with the establishment of Food Waste Hubs. Similarly, Assolombarda created a label dedicated to food donations to signal virtuous businesses. [79]

Each Hub is equipped with:

- a refrigeration unit for the management of fresh food
- shelves for dry packaged foods
- a small office for the management of archives and logistic procedures.

The use of a small, refrigerated van allows the daily recovery of food surplus from supermarkets and canteens, to deliver it in the hubs for the redistribution or directly to nonprofit organizations.

https://foodpolicymilano.org/hub-quartiere-spreco-alimentare/

Food Waste Hubs model allows to act on all types of food collected: fresh, cooked, dry, bread. Direct contact between supermarkets and non-profit organizations risks generating single-product peaks that are difficult to manage.

The Hubs allow the mixing of recovered food, making it possible to donate a varied, nutritious and balanced food offer to people in need, alongside the direct contact between the supermarket and the non-profit organization.

79 https://www.good.is/milan-food-hubs

Also, with regard to supermarkets, besides the fresh fruit and vegetable markets, through the action of the Politecnico di Milano, several important distribution chains with local sales shops, have already joined the initiative in the various districts: Lidl Italia, Esselunga, Coop Lombardia, Carrefour, Il Gigante, Penny Market, Natura Si, Bennet, Erbert. New stores will be involved with the openings of the next hubs.

The logistic model for collecting food surplus allows two daily paths for collecting food surplus: in the morning the organizations in charge of the management of the Hub, collect fresh, dry and packaged unsold foodstuff, from supermarkets directly from the points of sale belonging to the network, using the insulated van. In the afternoon the collection of cooked unserved food, packaged or bulk fruit and bread surplus from company canteens, is directly delivered to people in need through the non-profit organization connected with the Hub.

Where possible, it is carried out at the same time as collection from supermarkets. Moreover, Non-profit organizations who offer canteen service or package distribution for people in need can reach the hubs, by their own means, to pick-up the food they need in an assorted way.

Although the Hubs look like any other supermarket, the food on their shelves have been donated by local businesses and other supermarkets. The markets collect local surplus food, and, when necessary, supplement their stock with purchase food aid.

The customers at the Hubs, hundreds of Milanese families in need, don't pay with cash, but rather a prepaid card supplied through the program. The Hubs also provides social services such like legal aid, counseling, and childcare support.[80]

There are 5 food waste hubs with different actors participating. 3 are already fully operational, (Isola Hub at Municipio 9 launched in 2019, Lambrate Hub, Municipio 3 in 2020 and Gallaratese Hub, Municipio 8, in 2021) each recovering about 130 tons of food per year or 350 kg per day, an estimated 260,000 meals equivalent, utilizing around 30% of Milan's would-be food waste.[81]

A new Hub has been just launched at the Milan General wholesale market – Foody Sogemi, through the "Foody Zero Waste" call developed by the Cariplo Foundation, the Municipality of Milan and the public company SogeMi.[82] The call is aimed at innovating the way of recovering and redistributing surpluses of fruit and vegetables from the Milan General grocery market.[83]

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80 E., Camisana, G., Cellottini, F., Federici, M., Lepratti, Fondazione Cariplo, A2A, AMSA, Novamont, ESTà - Economia e Sostenibilità, Comune di Milano, Economia circolare del cibo a Milano, 2021

81 https://www.euronews.com/green/2021/10/18/milan-food-waste-scheme-among-first-winners-of-prince-william-s-earthshot-prize

82 https://foodpolicymilano.org/lanciato-il-progetto-valore-al-mercato-ortofrutticolo-la-nuova-iniziativa-per-contrastare-lo-spreco-alimentare-a-milano/

83 https://foodpolicymilano.org/hub-quartiere-spreco-alimentare/

The city of Milan was handed an award in 2021 for this pioneering scheme to combat food waste, at the inaugural ceremony of Prince William's Earthshot Prize, the global environment prize that aims to turn the current pessimism surrounding environmental issues into optimism, by highlighting the ability of human ingenuity to bring about change, and inspiring collective action.[84]

Milan is the first major city to enforce a city-wide food waste policy encompassing public agencies, food banks, charities, NGOs, universities and private businesses therefore it has created a blueprint that can be scaled throughout the world. If more follow Milan's lead, cities may become one of our greatest assets in humanity's progress toward a waste free world.[85]

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https://foodpolicymilano.org/hub-quartiere-spreco-alimentare/

6 .CIC MODEL OF ORGANIC WASTE COLLECTION -Italian Composting and Biogas Association-

The Italian model of organic waste collection is considered a successful case study in Europe. Since the 1990s, this model involves the distribution of compostable bags for the separate collection of organic waste in municipalities and a door-to-door collection system. The organic waste is then treated in composting plants to produce compost, a valuable soil improver.

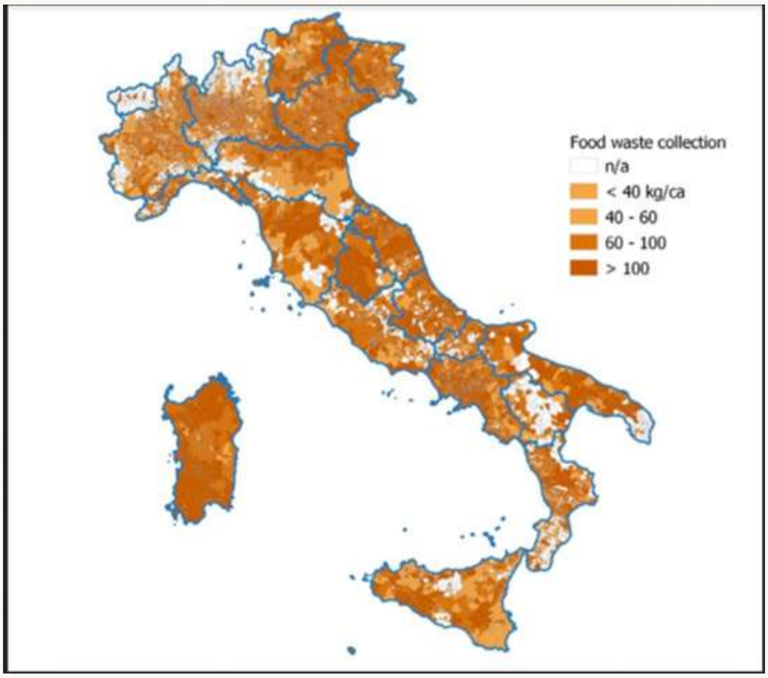
Separate collection of food waste started in 1993 in pioneer municipalities in northern Italy, and over the years this model has been extended to the whole country, and thanks to Italy's 2012 law to reduce disposable bags and the use by citizens of compostable bags for organic waste collection, Italy is now first in Europe for food waste recycling (47 % against the European average of 16 %).[86]

84 https://earthshotprize.org/about-us/
85 https://earthshotprize.org/london-2021/the-earthshot-prize-winners-finalists/waste-free/
86 https://www.novamont.com/eng/read-news/italian-organic-waste-collection-model-at-ifat-2022/

https://www.compost.it/en/

This is an important recognition, confirmed also thanks to the recent introduction in all Italian municipalities of the mandatory separate collection of the wet fraction through Legislative Decree 116/2020, which implements in our country the European Directive 2018/851 on waste, anticipating by two years the obligation at European level.

The efficiency of the Italian model for the collection of wet kitchen waste has been developed thanks to the collaboration between the municipalities, the Italian Composting and Biogas Association, and Novamont S.p.a., which is in charge of the production of the compostable bioplastic bags supplied by the municipalities.



https://www.compost.it/en/publications/

In many areas in Italy, (but also in Norway, certain parts of the UK and Spain) the common collection scheme focuses mainly on food waste, leaving garden waste as a separate fraction to be collected at civic amenity sites or with specific collection rounds (at reduced frequency of collection to promote home composting to the largest possible extent).The basic concept is to seek to avoid drawing excess garden waste into the collection system by offering small containers to households for the collection of food waste only.
According to 2018 data, in Italy around 5,000 municipalities (46 million people, 76% of the population) captured more than 60 kg per capita of food waste.
No national waste management plan is in place, but many regions have set specific targets for food waste separate collection, and some have specific incentive schemes to reward municipalities which start separate collection.

Since 2004 Sardinia is an interesting case of how to promote separate collection of food waste without engaging regional funds, by simply taking money from the laggards and rewarding the pioneers. A €30/t fee on mixed waste disposal was introduced for municipalities not separately collecting food waste, and this amount is returned to those who have implemented the scheme as a discount on the gate fee for composting plants.[87]
The Italian Composting and Biogas Association (ita. C.I.C. Consorzio Italiano Compostatori) is a noprofit organisation established in 1992 and currently the unique association in Italy for the recovery and recycling of organic waste. It promotes biowaste recycling and prevention, enhances compost quality and market, organises technical training for the composting sector and assists government bodies in improving biowaste recycling.

Italy is a consistent example of MSW management and shows that the recycling of foodwaste and greenwaste is a binding condition to reach the UE recycling set by the Circular Economy Package approved in April 2018. The Italian model has even been exported in New York City where it was adopted for a successful trial for a two months period, with a result of an increas of the organic waste collection of + 400%.[88]

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87 E. Favoino, M. Giavini, Bio-waste generation in the EU: Current capture levels and future potential, 2020 https://zerowasteeurope.eu/library/bio-waste-generation-in-the-eu-current-capture-levels-and-future-potential/

88 F., Fotia, Raccolta umido, New York copia il modello italiano, 2018 https://www.meteoweb.eu/2018/05/raccolta-umido-new-york-copia-modello-italiano/1091545/

7 .PLASTICART - Cas*Aupa

Thanks to the inspiration received from Precious Plastic, a Dutch open-source community promoting an alternative global recycling system providing a combination of people, machines, platforms and knowledge,[89] the PlasticArt Project was started in Udine, created by Cas*Aupa with the contribution of the Fvg Region (Creativity calls for 2019), the collaboration of Confartigianato Udine and the Fablab Udine, Mentilibere, Puntozero and Bloom associations.

https://plasticart.casaupa.org/il-laboratorio/

PlasticArt aims at demonstrating the possibility of inserting plastic within a (re) cycle that is not only productive but also creative, in contexts of alternative reuse such as those of art and design.

The project aims at bringing together artisans, artists and businesses and at encouraging the development of creative and innovative ideas on the repositioning of recycled plastic and eco-design. Last but not least, its goal is also to inform and raise awareness among citizens on environmental issues, the possibilities of recycling and of new materials (PLA[90]).

The artist director, Eleonora Majeroni, together with the project manager Rossella Bugliesi in cooperation with Cas*Aupa, have implemented the principles of reusing and recycling also in the practical organization of the Lab: the oven used to melt the plastic is the upcycle of an old pizza owen, and the presses are the ones previously used for the silk-screen printing.

89 https://preciousplastic.com/
90 PLA (Polylactic Acid), was a bioplastic that is obtained from the grinding of corn. The second to have been marketed and sold on a large scale. It is a biodegradable product, even if precise conditions are necessary for the decomposition process to be triggered.

The project took shape with a learn-by-doing approach where the team learnt and improved day by day, learning by trial and error how to treat the different kinds of plastic, the right temperature at which they melt and how to best created new original recycled eco-design objects.

In March 2021 an international call for artists was launched and 8 participants were selected: five local artisans from FVG region, one from Greece, one from the Czech Republic and one from Austria (the only one who already had some expertise in plastic art upcycle). Due to Covid-19 restriction the original idea of a two-weeks residential workshop in-person had to be readapted and reshaped therefore the international artisans were partnered with local ones, creating new synergies and developing even more interesting products, combining their original idea with the expertise and sensitivity of the friulan partners. Thanks to the collaboration of Confartigianato Udine the international artists co-created their piece of PlasticArt together with the local artisans partner who could attend in person the Lab and use the facilities.

All the pieces of PlasticArt where exposed in July 2021 within the PlasticArt week, a week-long space for conferences, divulgation of awareness of the territory and workshops with local artisans and artists of plastic upcycling.

https://plasticart.casaupa.org/

PlasticArt was awarded at European level with the Encc UP grants for “environmental sustainability", a European initiative that saw the participation of over 40 projects. The reward was given, coincidentally, on World Recycling Day, March 18, 2021, to PlasticArt, the only Italian winning project, voted by the combination of a jury of experts and of the “popular” one who was able to choose their favorite project online.[91]

91 https://www.friulionline.com/cultura-spettacoli/plasticart-progetto-casaupa-premiato-a-livello-europeo/

Despite the end of the Regional Creatività Project which originally funded the project, the plastic upcycle Lab is far from being over, it's an on-going Laboratory and it has already recycled and upcycled 254kg of plastic.

The idea had always been to become a point of reference for the city of Udine and the FVG region, to promote and show how plastic can (and must) be recycled and how it can give shape to art and creativity. The PlasticArt Lab is located within the site of Cas*Aupa cultural association and it's open to everybody willing to try first-hand how to make an impact by transforming waste into art.[92]

Thanks to a crowdfunding Project with Naturasi, the next step is to create a recycled bench - using the new machinery bought thanks to the participation of the great number of people who donated for the project and who have been awarded with recycled PlasticArt useful and eco-design objects. Moreover, the team is already working on a PlasticArt Project aimed at younger generations which will include the production of montessorian toys, divulgation and another call for artists.

The commitment of the team is also rewarded by the great response of the schools which are receiving very practical and interactive workshops where the kids experiment first-hand how they can recycle the plastic they bring from home. They leave with knowledge and practical proof of the art they realized upcycling used plastic, a potential waste.

The knowledge, the enthusiasm and the PlastiArt objects are then carried home, spreading the message and hopefully contaminating family and friends on the potentials and need for plastic to be reused and recycled, why not, creating ecodesign products.[93]

CONTACTS

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info@casaupa.org

https://plasticart.casaupa.org/

92 https://www.udine20.it/casaupa-plasticart-la-plastica-per-larte/2021/02/04/
93 https://plasticart.casaupa.org/

8 .AGRILANA IN PELLET -Transformation of wool into fertilizer-

From a collaboration between the University of Udine with the Department of Agri-food, Environmental and Animal Sciences (Di4a), Friuli Centrale University Health Authority (Asufc), and Agrivello start-up, supported by the Friuli Foundation was born the "Agrilana in pellet" project, with an innovative plant for transforming wool into fertilizer.

The initiative is part of the activities undertaken by the four partners in support of local businesses to develop and enhance the multifunctionality of social agriculture in Fruli Venezia Giulia region.

An authorized plant, unique in Italy, for the transformation of sheep's wool into organic fertilizer (pellets) with a production capacity of about 30-40 kilograms per hour. A machine intended for sheep farmers in FVG region with a view to the circular economy, is one of the first results of the "Agrilana in pellet" project.[94]

https://euroregionenews.eu/agrilana-in-pellet-dalla-lana-al-fertilizzante/#!prettyPhoto

94 Trasformazione della lana in fertilizzante, i risultati del progetto "Agrilana in pellet", 2022, https://qui.uniud.it/notizieEventi/ricerca-e-innovazione/trasformazione-della-lana-in-fertilizzante-presentazione-dei-risultati-del-progetto/#null

The aim of the collaboration is to help support local businesses for the development and enhancement of multifunctionality in the social agriculture sector, for activities and research in the agroecological and small-scale livestock sectors.
Born three years ago from the research of the University of Friuli, the project aims to give shape to a company, the Agrivello startup, which has contributed to building and managing the transformation plant in collaboration with the University. The aim is to produce organic fertilizer on a regional scale, at least initially. The manager of Agrivello is Chiara Spigarelli, PhD in Agricultural Sciences and Biotechnology from the University of Udine and the production chain is currently in the process of patenting.

The plant transforms 100 % of the wool with a one-to-one ratio, that is, one kilogram of wool is converted into one of pellets. The hourly production may vary due to the unevenness of the wool, coming from different races and from different contexts. This non-standardization is a positive factor as it allows to recover any type of wool.[95]

https://www.ilnordestquotidiano.it/2022/06/06/agrilana-in-pellet-il-primo-impianto-che-trasforma-la-lana-in-fertilizzante/

Use in the agricultural sector is an innovative alternative to the classic destinations of wool, because it is able to best enhance its multiple properties. The wool, transformed into pellets,can be used as an organic fertilizer, because it is a soil improver, with a slow release of nutritional elements for plants, with strong imbibition and water retention capacities.

95 Agrilana in pellet: dalla lana al fertilizzante, 2022, https://euroregionenews.eu/agrilana-in-pellet-dalla-lana-al-fertilizzante/#!prettyPhoto

The pellet can be used on pots or free ground, for any type of plants: horticultural, fruit or balcony. It appears as an organic fertilizer that gradually releases nitrogen (N 9-10%) and improves the quality of the soil.

“Agrilana in pellet” gives a practical answer to one of the problems of sheep farms in Friuli Venezia Giulia region, well over 650 with about 20,000 head. This condition favors the permanence of the population, especially in the mountain area.

Today the key role of pastoralism is no longer only to produce quality food, but also to generate eco-systemic services for local communities, ensuring biological diversity, the conservation of meadows and pastures and the protection of the landscape. However, these functions of the primary sector, especially in mountain areas, are now poorly recognized and must be recovered and revalued. The profession of shearer as well as that of shepherd, for example, are activities that are less and less practiced, with consequent difficulties in the generational transmission of skills.

Wool is a noble fiber. However, not all sheep are the same and the most common genetic types in Italy are not specialized in the production of wool for industrial textile use. Alternative forms of use must be envisaged for them as, anyway, all sheep must be shorn regularly, at least once a year, to ensure animal welfare. This need can determine, and in fact frequently determines, an environmental problem connected to the disposal of wool which, when it does not have its own channel of use, is configured as waste material. In this case, the processes of shearing and disposal of the wool represent a significant cost for breeders, equal to about 6 euros / head / year. Wool today can therefore be presented not as a resource, but as a serious problem, especially for the small farmer. This type of farmer, in fact, even if he wants to bear the costs of shearing and transport, has neither the possibility of conferring the natural fiber to the textile, construction or other uses, nor an easy access to the service of disposal of waste wool. This results in the consequent risk of uncontrolled dispersion into the environment due to burial, polluting practice, or improper bagging for landfilling or, worse, abandonment in illegal landfills that "Agrilana in pellet" aims to avoid.
The reuse of the wool by-product to produce organic fertilizer in the form of pellets is a forward-thinking circular economy project for the enhancement of wool with undeniable benefits for the environment and the incentive of permanence of the people inhabiting the mountain areas of FVG.[96]

CONTACTS

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96 Agrilana in pellet, il primo impianto che trasforma la lana in fertilizzante - Il nordest quotidiano, 2022, https://www.ilnordestquotidiano.it/2022/06/06/agrilana-in-pellet-il-primo-impianto-che-trasforma-la-lana-in-fertilizzante/

BEST PRACTICES IN SPAIN

1 .REMIX EL BARRIO

Remix El Barrio is a project created by FAB LAB BCN during the SISCODE project, funded by the European Union's Horizon 2020 programma [97] .Remix El Barrio was created in Poblenou, a neighbourhood in Barcelona known for its creativity, in January 2019.
The intention of Remix El Barrio is to create a "mix of people, material and social experience.", Fab Lab Barcelona has been engaging with stakeholders and innovative designers in the SISCODE pilot to support a circular transition that revalues surplus food and biowaste.
The SISCODE project bridges the gap between co-creation, policymaking, and science, enabling local community members to become active stakeholders in decision-making and practical solution-finding. The SISCODE project experiments co-creation in 10 existing fab labs, living labs, and science centers across Europe.

Composed of nine projects, Remix El Barrio identified possible waste streams in Poblenou markets, restaurants, and cooperatives to create new product-service systems. Participants were able to activate local neighbourhood spaces whilst learning from peers, team members, experts, and stakeholders from the local community and global networks. The '*Remixers*' (participants) experienced circular and hands-on making practices by creating biomaterials with food waste, such as olive stones, avocado skins, coffee shells, vegetables, and fruits.

The participants also shared knowledge about eco-design, digital fabrication, collaboration, inclusiveness, and democracy with local neighborhood actors. Remix El Barrio reaches out to communities, food value-chain stakeholders, designers, creatives, solution-finders, and policymakers.

The project is aimed at:

- **Designers, Makers, and Creatives** who wish to experiment hands-on with projects that transform food waste into new materials, products, or services.
- **Restaurants and markets** are looking for more sustainable and responsible practices by exploring food waste as a resource and being part of a community.
- **Policymakers** who are looking for ways to co-create with local communities to innovate within circular food policies.
- **Communities** who wish to develop more circular practices and strengthen social networks over actionable research by learning and working with waste.

97 Project code n. 788217

Some projects inside Remix el Barrio are:

A. Squeeze the orange- *bioplastic orange skin for fashion*

It is a project about the investigation of the use of orange skin to create biodegradable and compostable materials for the fashion industry. Orange skin is a food waste that is generated in abundance in the Mediterranean diet and can be used in a recycled process to reduce food waste. With the work and knowledge of the creators and the designers, the project managed to create a material that can be used by all the fashion designers. The project has been developed in collaboration with restaurants from the neighborhood of Poblenou with the purpose of manufacturing waterproof bioplastic by using dehydrated orange skin to produce clothing and accessories for the fashion industry, completely biodegradable or compostable. It is innovative to use local orange waste to manufacture a piece of fashion design using environmentally sustainable and locally produced materials. Their collaborators are neighborhood catering businesses that can provide them with orange waste, local artisans and fashion designers, urban gardens and compost services, workshops, and collaborative entities in the neighborhoods, Ateneus 3D Manufacturing and Labs.

https://www.instagram.com/squeeztheorange/

B. Circular Gos - *environmentally conscious pet snack*

Food waste is made up of all those foods that are wasted despite still having value as a nutritional resource for people. These foods are all those food remains that we throw away, such as those that spoil or expire in the refrigerator, and we have not been able to consume. In a current context, where nearly one billion people suffer from hunger around the world, food waste has a serious social and ethical impact.

In the continuous search for sustainability within LEKA to cause the less impact and as an initiative against food waste, Circular Gos is based on a project where waste and discards are converted into snacks for pets. Reusing a waste with high nutritional value, to transform it into a mixture of proteins with high biological value that results in a crunchy biscuit for pets, without preservatives or additives and with food traceability.

Circular Gos proposes a change in waste management not only in restaurants but also in school cafeterias, as a way of reusing and transforming this waste into food for pets or consumer animals, thinking now of smart, productive cities. and self-sufficient.

www.restauranteleka.com/

https://www.instagram.com/circular_gos/

C. Reolivar- *biomaterials made from olive pits*

Creativity and design as a formula to convert waste into quality raw materials. A new line of circular materials that use olive pits as a base, a very abundant by-product whose current use is basically burning for biomass, and for which we have created a recovery process as raw material. They began working with small bone samples obtained from their own consumption.

Later, they went to the olive sector (oil mills) to obtain the waste in bulk with less energy expenditure, by taking advantage of the resource already mechanized during the grinding process to extract the oil.

Since the beginning of the project, they have applied the principles of maker culture, combining in parallel the research of the material with its application to prototypes to validate its use.
They imagine Reolivar as a reference brand that can be applied in various sectors interested in the properties of the material, furniture, toy, packaging companies and others. They are interested in strengthening collaboration ties with social labor to produce objects and being able to promote the development of other biomaterials projects through licensing.

https://www.instagram.com/naifactory_lab/

D. Dulce de Piel- *soaps from used oils*

Soaps made from used oil Dulce de Piel was born from the desire to recycle one of the most polluting food products in Spain, the oil coming from homes and the hospitality industry. Studies reveal that 20 million liters of used domestic oil ends up in Barcelona's water each year.

The mission of this project is to restore the value of used household oils and reduce their negative impact on the environment. Dulce de Piel aims to raise awareness among citizens about the damage caused by cooking oils spilled into the water and to mobilize citizens by inviting them to participate in informative and creative sessions.

This project was designed within Remix el barrio, a local circular economy program aimed at bringing together and collaborating with different actors from the same neighborhood to improve the management and recycling of our food waste.
Reusing household oil is a circular opportunity to create low-cost cleaning products, including laundry, cutlery, floor, and body detergent, as well as shampoo and hand soap.

Using different recipes, Dulce de Piel seeks, in addition to used oil, to recycle waste such as fruit skins, which contain antioxidant and regenerating properties for all skin types.

https://www.youtube.com/watch?v=lEkOTILamNU

E. Colores- *Exploration of materiality from organic waste*

A project that wants to investigate, transform, and value local organic resources, activating a sense for a more responsible environment through creativity, design, and color.

The research of this project, in the experience of Remix el Barrio, has focused on the reuse of the avocado seed to create colors and natural dye for fabrics, with the aim of simulating a circular waste management process and minimizing waste in each transformation phase. The avocado pit has been chosen for its availability, not so much because it is local but because it is a waste that indicates a culinary trend.

Thanks to our collaboration with *Little Fern Café*, we have been able to obtain this material for the development of tests and experiments. From direct experimentation with the natural dyeing process, we try to understand how to acquire data on its consumption, nature, physical-chemical properties, and life cycle, and the energy necessary to achieve the final product.

As a final product, kits have been developed that contain the indications, ingredients, and basic tools for independent research, and others for the organization of educational events and collective workshops with the aim of disseminating techniques, and knowledge and raising awareness about the consumption of resources and respect for the environment.

https://ars.electronica.art/newdigitaldeal/en/el-barrio-food-waste-biomaterial/

2 .Ekonek

Ekonek is part of the internationally renowned INZU Group, with headquarters in Pais Vasco, which is made up of highly specialized companies in diverse areas of the machinery manufacturing sector.

They are ambitious pioneers designing for real impact, that develops revolutionary drying systems to obtain new powder and granulate products with a high commercial value, creating an impact on business, industry and the environment that cannot be achieved with existing technologies.

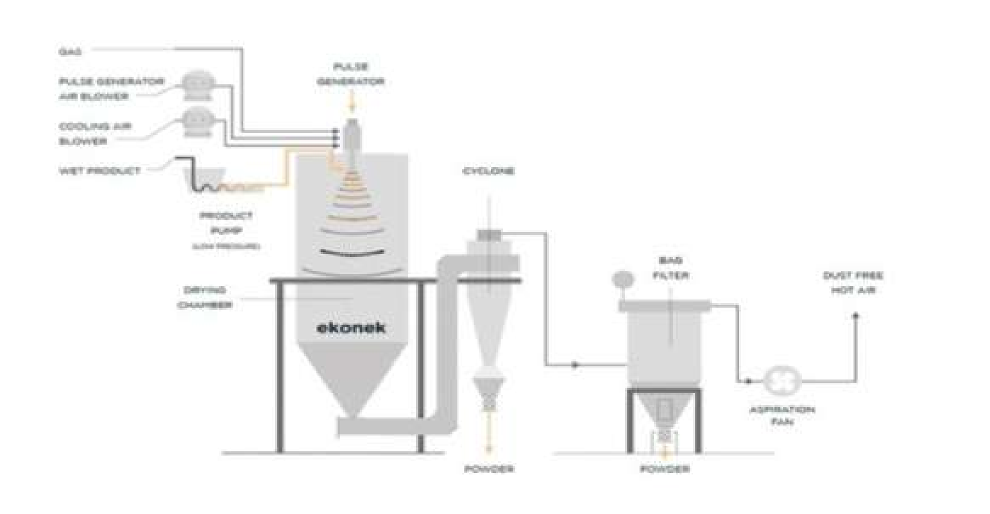
Ekonek's innovative technology, **Pulse Spray Drying (PSD)**, transforms liquids and pastes into powder, almost instantaneously, keeping its nutritional value with huge energy savings and even more, PSD technology can dry products impossible to dry for other technologies.

Their innovative technologies bring real benefits and make a difference with solutions that can have several applications in a wide range of industries food industry, organic waste, and other industries.
The main benefits are circular economy (Transform food by-products, like fish, meat, vegetables, and organic wastes like digestate, liquid manure, and compost into dried products, to convert them into high-value commercial products food ingredients, feed ingredients, fertilizers), developing new products (their drying technologies can dry products that are not normally dried because of their complexity.

That means they are opening new possibilities to develop new food ingredients, new feed ingredients, new fertilizers, new fine mineral or ceramic powders) and energy saving (their drying technologies can save 20-30% energy compared to conventional drying technologies. Additional savings can be obtained because we can dry more concentrated products after evaporators, or when waste heat recovery systems are applied).

The advantages of using **Pulse Spray Drying**, compared with traditional spray drying :

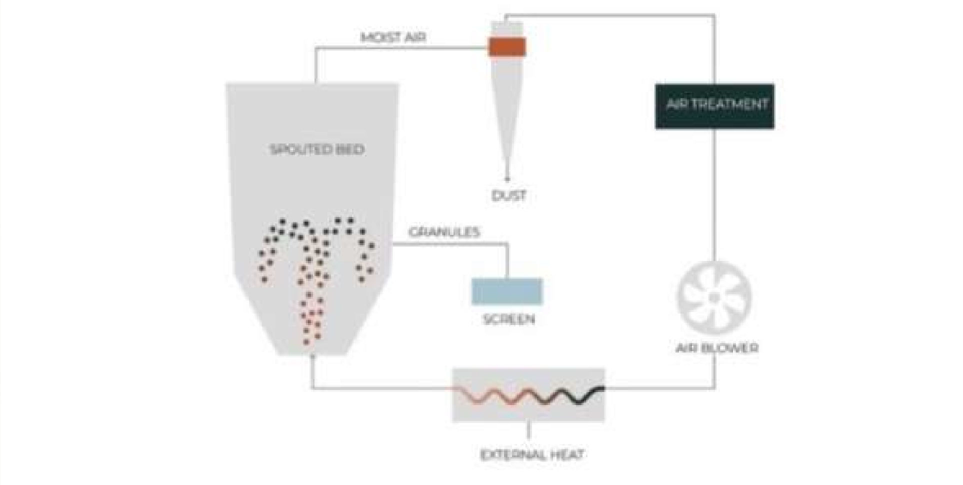
- it uses thermoacoustic shockwaves (pulses) to atomize, while Spray Drying uses nozzles or discs.
- PSD can atomize 10 times higher viscosity pastes than Spray Drying
- PSD uses 20 to 30% less energy than Spray Dryer
- PSD uses between 1/3 and 1/2 the air that is used by a Spray Dryer, to evaporate the same amount of water.



Some applications:
https://www.ekonek.eu/en/solutions/pulse-spray-drying

Another method used by Ekonek is Spouted Bed Drying which transforms liquid or pasty organic wastes into little dry spherical granules, like mineral fertilizers. The key benefits of this process are: it can granulate liquid and pastes that contain organic matter such as digestate, liquid manure, and sewage sludge; its granules are totally spherical, hard, dust free.

It can make 2-4 mm diameter granules or 0,5-2 mm microgranules. It´s the same format as most mineral fertilizers, it can use waste heat from other processes, or use different types of fuels (biogas, biomass, natural gas, ...).Drying in a closed circuit can be achieved, by reusing exhaust gases and minimizing emissions/odors.



https://www.ekonek.eu/en/solutions/spouted-bed-drying_

Application industries for the PSD and SBD:

- Food industry - Ekonek is adding value with this technology transforming Food Industry products and by-products into powder, with a minimum of energy and opening new possibilities. Examples of food types:

1. Brewer´s yeast: from concentrates at 30% dry matter or more, to animal feed or human food ingredients
2. Pomaces: from fiber-rich pastes to new ingredients for human food
3. Broccoli: from non-commercial trimmings to new ingredients for human food
4. Olive vegetable water: high potassium soluble fertilizer
5. Meat hydrolysates: from concentrates at 70% dry matter or more, to animal feed or pet food ingredients
6. Fresh meat, meat trimmings, and MDM: from mechanically milled pastes at 30% dry matter, to new ingredients for human food
7. Blood: to animal feed ingredients
8. Viscera: from mechanically milled pastes at 30% dry matter, to new ingredients for human food, pharma, or pet food
9. Fish hydrolysates: from concentrates at 70% dry matter or more, to animal feed or pet food ingredients
10. Fish Trimmings: from mechanically milled pastes at 30% dry matter, to new ingredients for human food: fish flavouring as a natural ingredient
11. Whole fish: from mechanically milled pastes at 30% dry matter (including bones, guts, etc.), direct to fish meal
12. Seafood: new natural ingredients for human food such as seafood flavouring
13. Milk, whey, permeates, and cheese, ... can atomize at more than 70% dry matter

- Organic waste:

1. Sewage Sludge, Digestate, Liquid manure, and Compost, combining those materials with other organic wastes (struvite, bone meal, biomass ash, etc.) or with mineral fertilizers, we make a paste with a more commercial NPK (Nitrogen Phosphorus Potassium) value, that they dry and granulate at the same time in a Spouted Bed Dryer and making a commercial fertilizer as a final product
2. Paper Sludge, different sludges from the paper industry, containing cellulose, calcium carbonate, lignin from mechanical pulp, and black liquor, can be dried into powder with PSD technology. New applications are arising for those powders, as biomaterials.

https://www.ekonek.eu/en/solutions

3 .Laüd Recycled

LAÜD Recycled is a brand of trainers made with vegan, recycled, and coffee fabrics, and manufactured in Elche (Alicante, Spain), in an ethical and sustainable way.

This is a footwear project developed in Elche that emerged at the end of 2019 under the slogan "Design philosophy and trend through sustainability". Its objective is to bring sustainable fashion closer to society, in addition, the company uses sustainable and recycled materials throughout its process.

This young brand defines itself as a slow fashion project that tries to raise awareness about the great impact that the textile industry has on the planet. For this reason, they use vegan and recycled materials from plastic or industrial waste, and, in addition, they work with factories in Spain that work ethically.
For example, their first capsule collection was created with materials made from recycled plastic bottles combined with a recycled EVA and coffee sole. On the saw-style sole, in fact, you could see the specks of coffee that they have included to reduce the percentage of rubber used.

The circularity of waste is one of the fundamental pillars on which the brand is based. They use coffee grounds in the soles of their trainers to reduce the use of virgin materials and transform textile waste into high-quality recycled fibers, closing the fashion loop.
With a pair of LAÜD Recycled shoes you are recycling or reusing: 22 plastic bottles, 3 coffee capsules, 0,78 gr of recycled EVA rubber, 0,52 gr of mattresses and pillows and 0,45 gr of recycled cotton.

They decided to opt for recycled materials made from recycled plastic bottles, which they combined with a sole made of 50% recycled EVA rubber and coffee. On their saw-style soles, you can see the coffee specks of organic material that have been included to reduce the percentage of rubber used. The insoles of their slippers are removable, and are made with industrial waste from mattresses, pillows and industrial waste, and covered with a vegan antibacterial fabric that guarantees the protection of our feet against fungi and bacteria.

They also have very careful details, such as the ribbons they have used, which are made from recycled cotton. In addition, the straps they have used in the heel area is the remains of the samples they were working with during the creation process.
They are members of goCircular Radar, TheCircularLab's map of circular companies, which certifies that LAÜD Recycled relies on the development of the circular economy to manufacture its products.The circular economy is the identity of this brand that seeks to achieve the circularity of its products!

https://www.instagram.com/laudrecycled/

Behind them, there is a great team of local suppliers and factories, LAÜD Recycled collections are born under ethical and sustainable values. They are manufactured in Elche, in small family factories, which for years have given and give work to many families. In addition, their main factory, where they carry out the pattern making, cutting, assembly, and packaging work, has the SMETA audit, Sedex Members Ethical Trade Audit Report, one of the most widely used social audits in the world, which evaluates a factory according to the standards of its organization in terms of work, health and safety, environment and business ethics, to ensure good conditions. In addition, each of its products is handmade. An artisanal process that is aided by technological development.

Promoting local employment in the area is one of the objectives of the founder of LAÜD Recycled. Therefore, it works with factories and workshops of the traditional shoe industry in the area of Elche (Spain). Direct contact with the external factories and workers ensures that they can manage the entire production chain and maintain direct contact with the employees. In addition, working with local factories allows them to produce collections that reduce their carbon footprint. Compared to conventional, non-sustainable footwear, their footprint is reduced by 40%.

They have very good product traceability, i.e. they have provided us with information about where they make their products, the names of their suppliers and they have even shown us their certificates and very detailed information. In addition, they publicly disclose detailed information about the real cost of their shoes in the “Transparency” section of their website.

We contacted them to find out more details regarding the start-up and here are the answers from the creator of the project, Oneida Roman:

“ Q: Do you think your start-up/project has the potential for replication and is adaptable to similar objectives in different contexts and levels (local or national)?

A: Yes, - said Oneida.

Q: Can you explain why?

A: Today many sectors promote recycling of their materials or incorporate recycled materials, in some sectors it has been done for many years, before the concept of circular economy or sustainability emerged but these aspects were not given visibility.

A: Currently, in the textile sector, there are many technologies and developments that allow the introduction of respectful or more sustainable materials, but I think one of the problems that exist is that there is no regulation to determine guidelines and limits of sustainability. In my opinion, the concept of sustainability has begun to be established in finished products without a manual and this generates a lot of controversy and manipulation by brands. All sectors can be sustainable, just as there is the degree of efficiency in household appliances, there should be for products so that the consumer can also be aware of their sustainability capabilities.

Q: Can you give us some details about the degree of innovation of your start-up / project?

A: In our case, when we started the project we started with a product consisting of coffee, a coffee extracted from the recycling of coffee capsules. Over time, we have realized that it is not more important the innovation of the product itself, but the durability (the more durability a product has, the more sustainable it is) and the use of recycled materials."

4 .FOS Eyewear

FOS is a forward-thinking sunglasses brand that designs sustainable products that benefit the environment and people. Comfortable, lightweight, and designed to be easily recycled repeatedly, they are made from local waste in Barcelona.

FOS Barcelona is a brand that explores current production and consumption systems, waste management systems and the cultural habits around them through products that offer an expanded view on the meaning of quality.

Quality must go beyond the mere tangible properties of a product. It must include its wider implications for society, the economy, and the environment. If we as users are not educated to understand this, quality becomes a perception of quality, which is generally not linked to actual quality.
The characteristics of the products are:

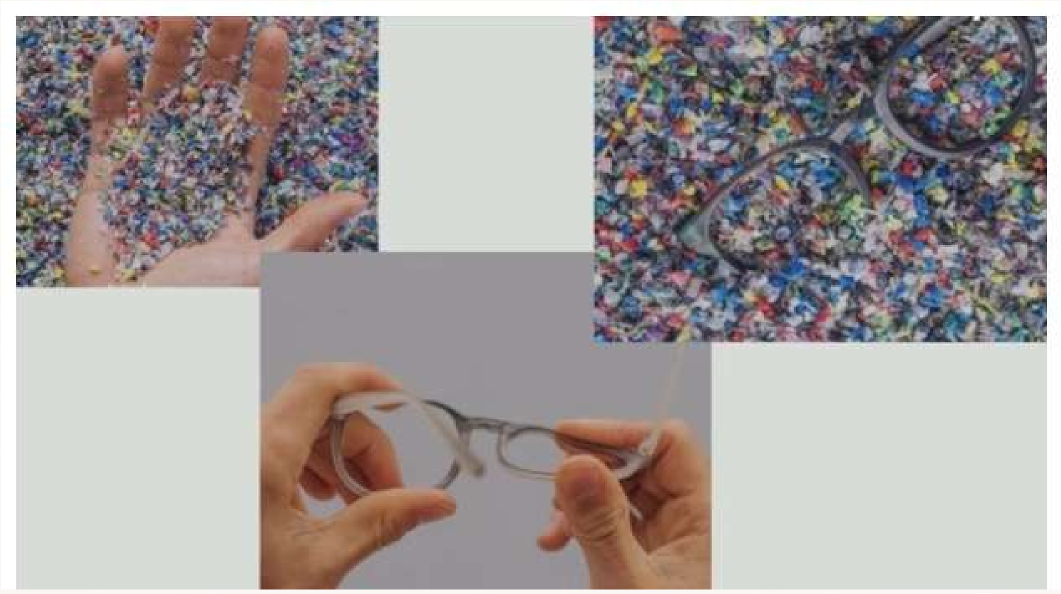
- *Unic Design*, unlike mass production, each FOS eyewear is different. No matter what, it is completely impossible to make two pairs alike due to the process. All their frames are handmade in Barcelona with intention and care;

- Local production, these sunglasses are manufactured in Barcelona from local waste, fully processed by FOS. This ensures that the team knows what material goes into your product and makes it possible for the material to be safely recirculated when it is returned to them. Producing locally and in a decentralized manner reduces transportation-related emissions and generates local wealth ;

- *Circular Design*, the glasses are recycled and easily recyclable thanks to their design, in which each material can be separated. These products are designed to be repaired, upgraded, and returned at the end of their useful life;

- Durability, FOS eyewear is extremely light, strong, and comfortable. These attributes make their products functional and durable. They take great care in the design process to deliver the best results without compromising (almost) anything ;

- Distributed design, they offer a package called "Powered by FOS", a set of training, designs, and tools for organizations to start producing sunglasses locally, as they do in Barcelona. Till now three Latin American organizations have bought into the idea: San José (Costa Rica), Catamarca (Argentina), and Bogotá (Colombia)



https://www.instagram.com/fosbarcelona/

BEST PRACTICES IN TÜRKIYE

1 .DARWIN'S BOTANICALS

How was Darwin's Botanicals born and how did its story progress? Let's listen to this story from Tuğay Guven.

Hello, I am a natural dyer and founder of **Darwin's Botanicals** brand. At the same time, I am a PhD candidate in the Department of Biomedical Engineering at Boğaziçi University.Actually, Darwin's story began with a floristry adventure. As someone living in the city, I wanted to be close to nature and dreamed of doing a job intertwined with nature, so I decided to study floristry. However, throughout the training, I felt closer to the foliage and flowers that were discarded because they faded or would not look good in the design, rather than the flowers designed in all their splendor. After a while, this feeling took hold of me so much that I started to research how to keep them alive, and thus I met with natural dyeing, which is actually one of the forgotten crafts of Anatolian lands. I can obtain color from many food waste besides plants and flowers. When I learned that I could upcycle these waste by dyeing many natural materials from fabric to paper with these colors, I could never give up. In 2017, I decided to found Darwin's and recycle more waste and tell more people the story of this transformation.

Q: Can we hear from you a little bit about Darwin's products? What are the qualities that make them different and what are the stages they go through from the beginning?

At Darwin's, we dye 100% natural fibers one by one, using colors that we obtain entirely from nature, plants and food waste, without using any chemicals. Our biggest production principle is to take minimum from nature throughout the whole process. Whenever possible, we paint with the water we have collected from the rains and if the season is suitable, we paint with the sun. The fact that this whole process is free of harsh chemicals ensures that they do not harm the environment when it is time to say goodbye to our paint boilers, which are tired by using them over and over again, and when these paints mix with groundwater. In addition, since natural fibers are dyed with the colors of nature, they are completely biodegradable. This is actually a point that is often overlooked. The general perception is that if a fiber is natural, it can easily be mixed with nature. However, fibers colored with dyes containing especially azo chemicals cannot dissolve in nature even if they are 100% natural.

Therefore, the dye of the fabric we buy while making our consumption choices is much more important than we think.
Of course, the ratio of dyestuffs contained in plants and food waste also varies from season to season or depending on where and what kind of soil that plant grows. This means that we can develop our own formulas as much as we want, some variables that we cannot interfere with mean that our colors also change. We cannot say that we have no control over the process, but this control can only be up to a point. But frankly, this controlled and uncontrolled situation is something that we like very much and that leaves room for surprises.

Q: Obtaining different colors from plants and fruits, creating your own special recipes... There is an enormous creativity and imagination dimension. What are you inspired by?

When you work directly with nature itself, it is inevitable that the source of inspiration is nature. In fact, we are inspired by nature both in terms of our working principle and our design language. While we paint, we try to adapt the cyclicity of nature and the absence of waste to our own way of doing business. We work to get the maximum benefit from all kinds of materials we use, and when we need to say goodbye to them, we strive to do so with the least amount of waste.
In terms of colors and designs, nature directs us in a completely different way. It is always very fascinating that the natural can exist in its own world, while preserving its unique individuality and originality, on the other hand, in harmony with those around it, unobtrusively, without shouting that I am here. A leaf that looks exactly the same as those around it becomes visible with all its individual beauty when we go near to see it. And once you see it, you don't have a chance to forget it, you fall under its spell.
This feeling of being in harmony with its surroundings and being completely different from those around it in details is reflected in every aspect of Darwin's, from its colors to its designs.

Q: Why do you think natural dyeing is less preferred when compared to chemical dyeing?

The main reason for this is the same reason that natural dyes were replaced by synthetic dyes after the 18th century. The accessibility of chemical dyes is much higher, and therefore their cost is much lower; with them it is much faster to produce in large volumes; It is much easier to achieve the standard in colors. However, the indispensable basic production principle in natural dyes is patience. Unless you are patient, it is almost impossible to get the right color from the plants and to combine these colors with the fiber correctly. When all these come together, natural dyes are not preferred, especially by fast fashion brands. However, the cost of preferring chemical dyes to our world is very high.

The textile industry uses 8,000 different synthetic chemicals to dye fabrics sold globally throughout the year. According to World Bank data, 20% of industrial pollution occurs during fabric dyeing, only in China 90% of groundwater is polluted and 72 of the toxic chemicals in this water belong to fabric dyeing.
There is no concept of waste in nature, waste is a problem related to people and their lives. Simply put, in nature, a leaf that withers and rots becomes food by mixing with the soil.
We tried to approach this huge waste problem in city life from this perspective. Instead of leaving organic plant or food waste to rot, we wanted to give them a new role and a longer life, albeit in a different form. We called this process someone's trash, someone else's treasure. Although this hashtag seems to represent only the dyeing process at the moment, our dream is to include many different upcycling projects in the future.

Q: What do you think we should pay attention to in order to be a conscious consumer on the way to a more waste-free and more sustainable world?

Nature is a system that can renew itself and replace what we have taken from it. However, in our case, the problem stems from the fact that our consumption frenzy and the rate at which we consume nature have already exceeded the rate at which it renews itself. This means that we consume resources that will meet the needs of future generations.
Therefore, in our opinion, the best step to take on this path is to consume at a minimum and to support up-cycling whenever possible. Thus, instead of producing something from scratch, enabling the already produced ones to be evaluated by gaining a new function.

Inspired by the absence of waste in the life cycle of nature, we work to apply this cycle to our daily lives. Instead of throwing away the flowers, fruits and leaves of plants that have reached the end of their life stage, we use the colors we obtain from them to dye natural fabrics. Unlike synthetic dyes that are produced from petroleum or oil, synthesized in factories, are non-renewable and non-recyclable, we aim to contribute to upcycling and cyclical fashion thanks to these natural dyes. We hand-paint all Darwin's products one by one, using colors that we obtain entirely from plants, without using any chemicals. For this reason, each one is unique and unique, just like all living things in nature.

Thank you for being a part of upcycling by choosing environmentally friendly Darwin's products and contributing to our dreams of a more waste-free and more sustainable world.

Company webpage: https://darwins.com.tr/

Instagram: https://www.instagram.com/darwinsbotanicals/

2 .100% ISTANBUL: FROM TRASH TO TREASURE

-Upcycled from waste material into brand new products-

Let us introduce you to 100% Istanbul, which makes a difference with its design products such as backpacks, clutches and laptop covers, and aims to increase Istanbul's awareness of the environment and waste. This responsive initiative designs all of its products, from advertising posters in the city to used food sacks and waterproof paper, by completely upcycling and reusing. We listened to 100% Istanbul, whose original designs you can find in its stores in Tomtom Neighbourhood, and its upcycling concept from İpek Sabuncu, the founder of the successful enterprise.

Q: First of all, can we get to know you and your startup a little better? We are 100% curious about the origin story of Istanbul.

https://www.instagram.com/100de100istanbul/

I, İpek Sabuncu, worked in different positions in the fields of event management, congress tourism, media and marketing until I founded 100% Istanbul. 100% Istanbul started out in 2011 as a design brand that is closely related to contemporary art. In the same year, it met with consumers for the first time at the Istanbul Biennial. It was sold only in museum stores for four years. We opened our store in Tophane in December 2014, approximately five hundred meters below where we are now. From the first day, we used different alternative materials in our designs. Starting in 2014, we started working with materials that we gradually upcycled.

Q: For those who do not know what upcycling is, can we listen to this beautiful concept from you? What is upcycling, how is it different from recycling?

Upcycling means reusing waste material, making it a more valuable product than it was in its first use. For example, 100% Istanbul transforms a lentil sack or a billboard that hangs on the facade of a building for a maximum of 1-2 months into a bag or suitcase, adding more value to that material than in its previous life, both in terms of its intended use and duration of use.

Q: 100% Istanbul is an initiative that embraces the consumption side of environmental awareness by placing upcycling in its focus. Can you tell us a little about the customer profile that comes to your store in Tomtom District?

Since the first day it was opened, tourists take the first place among the regulars of our store. There are regular visitors to Istanbul among them and they always stop by us every time they come. When they cannot come, they order from their own countries and recommend them to their friends who come to Turkey. Most of our regulars here are foreigners living in Istanbul. The profile of our domestic customers is formed by those who are environmentally conscious and prefer original design.

Q: So, what kind of materials do you use when creating these products, how does the process progress?

In our designs, we use fully functional outdoor advertising posters, used food sacks and a special paper made from recycled textile waste. We buy paper from abroad, sacks from second-hand sacks sellers. It is not easy to reach the posters. Events are held in almost every part of Istanbul. Posters and billboards promoting these events surround the entire city, but collecting them takes a lot of effort. First of all, we need to find out who is authorized by researching with the meticulousness of a detective and get in touch. The authority can sometimes be in the company that organizes the organization, sometimes in the sponsor, and sometimes in the company that makes the pressure.

When we say that we want to collect and evaluate these materials, which are mostly thrown away after completing its function, the garbage suddenly becomes valuable. If we can successfully pass this stage, the quality of the material and the condition in which we receive it determine whether we can use that material or how much of it we can use. Then the material is cleaned and cut. All of the materials are hand sewn. The most difficult but most enjoyable is the cutting process. There are different prints on the colorful posters. We need to transform them into models that will be liked by us and then by the consumer, with minimum waste.

Q: Do you have any new plans for the future?

At the moment we only have bags that cater to different requirements. Backpacks, clutches, shopping bags, weekenders, laptop covers, organizers of various sizes and models, etc. We want to increase the product variety. We are considering adding new materials to the materials we use. But since every material is different from each other, it needs to go through a long R&D process to find out which models we can apply it to. We are planning to make 100% Istanbul more widespread and offer it for sale at different points outside of our store. Since there is only one product from each pattern, especially in designs made from billboards, we have not been able to start online sales yet, and we aim to start online sales this year.

Q: Perhaps the most important point of upcycling is to come up with ideas, that is, to decide what to transform into what. What would you recommend to those who want to adopt upcycling as a lifestyle and make it a part of their life by making use of the materials they do not use at home?

Faith and courage. Let them take a step, not be afraid to try and make mistakes, and learn from their mistakes.

https://www.instagram.com/100de100istanbul/

Good practices for Recycling food waste

3 .IDV Private Bilkent High School Young Spokespersons of the Environment Project

The project started in early December 2019. To adopt and achieve this project, the school started with 20 volunteer students from the 9-12 grade levels from the entire school base. The project team observed that organic food waste in the school cafeteria could not be recycled or separated, based on the idea of being aware of environmental problems and being a part of the solution rather than the problem.

The aim of the project is to minimize organic food waste and to reveal what can be done to recycle it back into nature. Another aim is to show that CO2 emissions are reduced by composting food waste. In order to reduce waste in the cafeteria, in addition to making awareness studies and presentations, changes were made on the menus after several meetings with the catering company. Afterwards, a food questionnaire was applied to the school to collect data by creating waste sections where organic food waste were separated.

The waste created by technology, industrialization and ever-increasing consumption cause global warming and damage to natural resources all over the world, together with the increase in population rate. According to the researches, 1.3 billion tons of domestic waste is generated annually in the world and 6.5 million of these waste are organic waste. The most important element of waste management is recycling and minimizing environmental pollution. Healthy products are required for a healthy life, and healthy organic fertilizers are required for healthy foods. Compost that can be formed from organic food waste is the richest, sustainable and efficient fertilizer. Compost is a form of recycling that allows natural and organic waste to be decomposed and reintroduced to the soil.

The aim of this study is to produce and use compost to protect natural systems, to ensure the sustainability and productivity of the soil, which is the basis of agriculture, and to find a solution to the waste problem, which is the biggest environmental problem of settlements. A healthy and safe growth environment for plants is created by reintroducing organic waste into the soil, improving soil structure, aeration, and regulating the pH value in the soil.
Conversion of organic waste to renewable energy sources with technological developments and awareness, in other words, the idea of composting has emerged as a solution proposal.

Storing organic waste under inappropriate conditions creates air and water pollution as well as visual pollution. Uncontrolled burying of these waste in the ground poses a great threat to both human health and nature, as it disrupts the chemical structure of the soil.

In this context, it is necessary to return organic waste to the soil as fertilizer and to create a sustainable system. In this way, the nutrients needed by the soil can be provided by converting our organic waste into compost.[98]

The project development team started by determining the food preferences and waste rates of the students with the food menu in order to minimize the amount of organic waste with the survey study in the school cafeteria. Awareness raising activities “Take as much food as you can!” slogans and posters were prepared. It was suggested to make new arrangements in the menu in accordance with the needs by negotiating with BCC. Presentations were made to raise awareness of secondary school students as well as school stakeholders for the separation of organic and plastic-paper waste.

Waste separation studies in the cafeteria were organized and implemented by the students of the project development group.
Based on a study conducted in Egypt in 2010, the formulas for the amount of organic waste collected in the school cafeteria were calculated (Luske 14).

- OBL; 1 day food waste: 25.4 kg
- OBL; 1 year of food waste: 25.4 x 20 days x 9 months = 4572 kg/year (Assuming the school is open 20 working days in a month and 9 months in a year)

With the awareness-raising activities carried out at the school, the average tray food waste was reduced from 25.4 to 9.75. When the CO2 emission calculation is made again.

The reduction is mainly due to the storage of methane gas from the storage or discharge of organic waste. As a result, they have reduced CO2 emissions by 96.15% with the compost machine and awareness-raising activities.

As a result of the awareness-raising efforts, the rate of tray food waste has decreased. A presentation was made by the students of the project development group to IDV Bilkent University Environmental Unit and Conservation Directorate in order to ensure that the compost from the IDV Bilkent University campus is used as organic fertilizer. By moving the project out of the campus, Başkent Ayedaş Toroslar company was informed about the compost machine related to “renewable energy”.

98 Tunçez and Baştan 145

As a result of the study, it has been calculated that the composting of organic waste will cause a great reduction in greenhouse gas emissions. In addition, as a result of awareness raising studies, a significant decrease is observed in organic waste from tray waste. With the awareness-raising activities of the project group students, it has been proven that turning organic waste into compost will be a very effective solution in order to reduce the amount of food waste as well as to minimize CO2 emissions. In addition, it was put forward as another suggestion that IDV Bilkent University allocate an area where organic waste can be evaluated.

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New business models for waste prevention and recovery efforts

4 .Fazla Gida – Whole Surplus

Fazla Gıda - Whole Surplus was founded in 2015 by Olcay Silahlı and Arda Eren as one of the first startups working on food waste in Turkey. It started with the goal of developing technology-based solutions to reduce food waste in the food supply chain by 50 percent by 2030. Not long after, he took place as the sole representative from Turkey among the 9 impact initiatives selected for the Accelerate 2030 Acceleration Program supported by the United Nations Development Program (UNDP).

The initiative, which makes it easier for food businesses to donate their unsold food, sell it at affordable prices or recycle it, has recently released its application called Surplus (App Store, Google Play). The users of the application are allowed to buy food that is produced in excess by the food businesses near them with a discount of at least 50 percent.

We asked Surplus Food, one of the well-known impact initiatives in Turkey, about its social and environmental impact, culture and business model.

Q: As one of the well-known examples, can you share your data on your social and environmental impact?

Our Surplus Food adventure started in 2016 with a mission: To create a sustainable business model while working impact-oriented on behalf of the world and to be an example for Turkish youth in the field of social entrepreneurship.

In this regard, we started our work by examining in depth the Sustainable Development Goals (SDGs) determined by the United Nations. During our work, the 3rd sub-article under the 12th Sustainable Development Goal, Responsible Production and Consumption, focuses on halving global food waste per capita at retail and consumer levels by 2030 and reducing food losses in production and supply chains, including post-harvest losses. We started to develop our solutions.

On the path we set out with the donation, we continued to develop technology-based holistic solutions with a focus on reducing food waste and waste-related carbon emissions.

With the guidance of the Food Recovery Hierarchy, we have implemented our Animal Feed and Biogas services to bring foods that are not suitable for donation into the circular economy. While we continue to improve our influence and expertise day by day, we determined the solutions needed in the supply chain for the reduction target at source, which is the first step of the hierarchy, through the analysis of operation-based data

While we continued our R&D studies in line with the target of reducing the source, we continued our journey without being affected by the global pandemic. During this period, we developed our commercial online shopping platform, Excess Market service, and made it possible to make available excess products that are at risk of being wasted. Our R&D team added the Smart Weighing System, which prevents waste generation by monitoring waste in professional kitchens, to our portfolio as an Internet of Things (IoT) solution.

We didn't stop there. We achieved another first in our adventure and implemented our Business to Consumer (B2C) business model: We included local businesses and consumers in the food rescue movement with the More Good application.

We are pursuing the same dream with our dynamic and impact-oriented team that does not shy away from taking responsibility: A sustainable and fair world.
We manage the systemic transformation we dream of. We work with the goal of operational excellence while gaining strength from technology and innovation for this transformation. While we utilize the waste generated throughout the supply chain with the highest benefit, we aim to reduce the source that lies at the core of our business.

In line with this goal, we continue to work tirelessly with more than 100 employees in total and lead the waste management sector while strengthening our impact.

As a result of our collaborations with more than 40 global and national companies, we have evaluated more than 16 thousand tons of food products in less than 4 years, creating maximum financial, environmental and social benefit with food donation, resale, animal feed production and biogas production solutions.

While preventing more than 53 thousand tons of carbon emissions, we brought about 300 million TL worth of products back to the economy. In addition, thanks to our food rescue operations, we indirectly prevented 61 billion liters of water from being wasted.

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In a circular economy, different solutions can be developed for the high amounts of waste and by-products generated in the food processing process. New opportunities may arise when materials or by-products attributed to one company as waste are used as inputs in a different company's production process.

For example, a natural food preservative can be produced from waste eggshells, or waste vegetables and fruits can be used as natural dyestuffs.

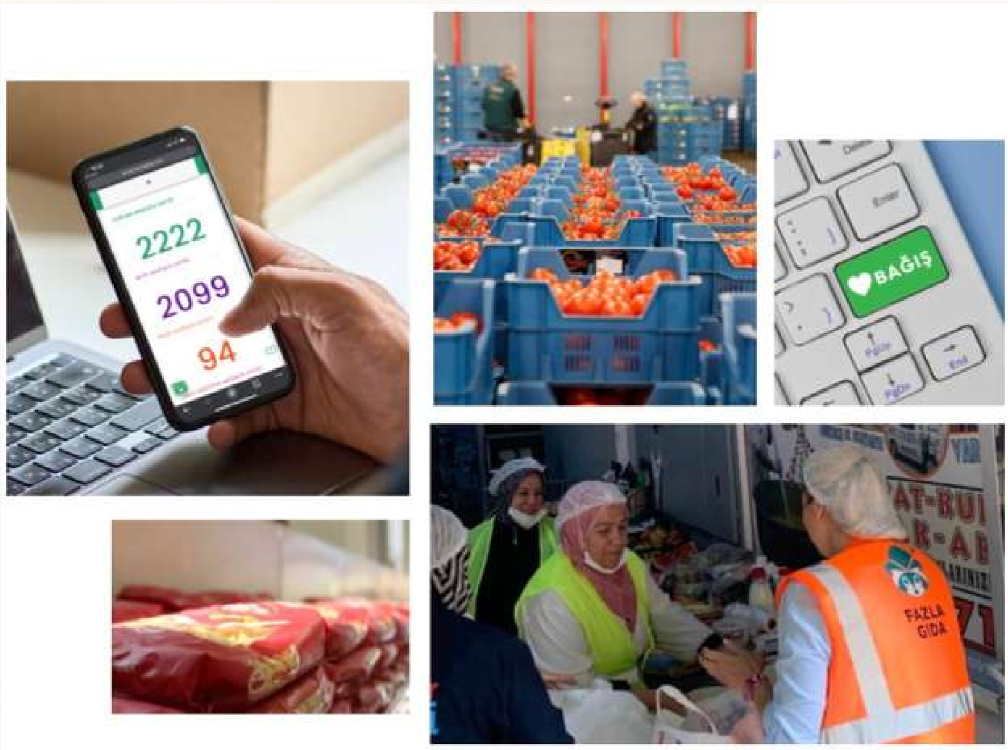
In summary, companies can minimize loss and waste by optimizing their production processes through better technology and workforce training, recycle food that would be wasted back to the production line, or create new products with leftover by products and materials. Apart from this, the foods that reach the market and are suitable for consumption can be redistributed, and the spoiled and non-renewable foods can be converted into different new products such as organic fertilizers, biomaterials, pharmaceuticals, cosmetics and bioenergy, and new economic gains can be achieved.

The Sustainable Development Goals were brought together by the United Nations in 2015 as a global call to establish fair and sustainable systems. These 17 goals were determined with the focus on ensuring sustainability and development from environmental, social and economic perspectives until 2030. Each goal is dependent on the other, and these goals are a systemic integrity where the development in one area affects the others.

The Services of the company that Turn Excess Food into Benefit :

- It supplies excess foods that are aging in their stocks and that institutions cannot sell through the standard sales channel for various reasons; We bring these foods to new buyer groups. While we provide financial advantages for both suppliers and buyers, we create environmental benefits by saving food from being wasted through sales.

- We deliver excess food to those in need with our digital infrastructure, wide stakeholder ecosystem and food banking network that reaches all over Turkey;While strengthening the social impact of institutions, we transform the surplus into social, environmental and financial benefit.



- We bring the excess food of institutions that are not suitable for human consumption into the circular economy by using it in animal feed production, regardless of product category, through our digital platform and with the support of our expert staff.

- It monitors waste generation in professional kitchens with the Smart Weighing System, which measures at what stage and in what amount food turns into waste on the basis of meal, product and cost; Thanks to the reports created with the data collected by the system, we enable waste reduction actions and reduce the purchasing costs and carbon emissions of institutions

- With the Extra Good application, we bring together the products of local businesses that did not have the chance to be sold during the day, in surprise boxes according to their categories. We bring the excess food of businesses waiting to meet customers on their shelves to consumers at discounted prices, and prevent waste while increasing food accessibility.

CONTACTS

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DESCRIPTION OF THE MOBILITY IN TÜRKIYE

Activity 2: Food Waste, climate change, circular economy in Niğde, Türkiye

The Turkish partner Şehit Kemal Tosun Anadolu İmam Hatip Lisesi hosted the first mobility of the Erasmus+ project WuSte, which took place in Niğde from 10th to 15th October 2022.

On the first day of the activity, introductions and icebreaker activities were organized by the hosting partner in the city park. The group of participants was composed of 8 Italians, 6 Spaniards and 8 Turks, for a total of 22 youngsters, accompanied by 3 group leaders, one for each partner. As a stakeholder of the Turkish school, a scout leader organized social and cultural integration activities and a drama event with all participants. During the lunch break, all participants had lunch together outdoors.Then, waste collection activity was carried out.

In the second part of the day, a nature walk activity was organized with all participants. Thanks to these activities, participants had the opportunity to get to know each other on the first day. At the same time, on the first day, the general activities of the project and the activity plan of this mobility were explained to all participants. The city presentation was held in the city center before dinner. All the dinners were organized in a typical Turkish restaurant that represents Turkish Cuisine, to give the opportunity to participants to try different traditional flavors from the first to the last day.

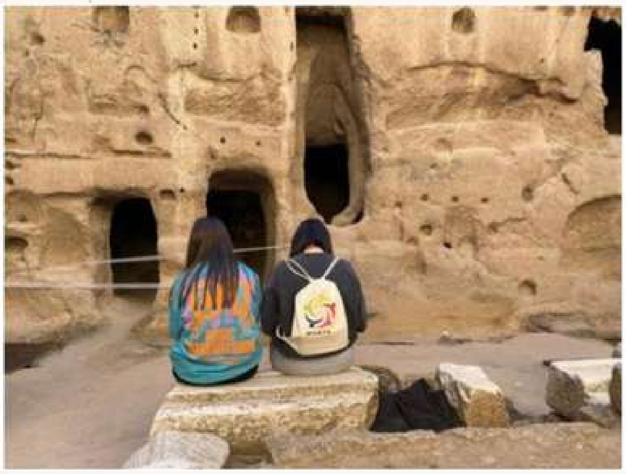
On the second day, all participants met at the host institution. The school was introduced to the guests. To ensure project visibility, backpacks, pens, notebooks and files with the project logo were distributed to the participants. After that, a workshop on the theme of Environment and Climate Change was held. This workshop was led by an academician from Niğde, Ömer Halisdemir University, a local stakeholder. All participants addressed the workshop topic in a multifaceted manner from academic, social and individual perspectives. Particularly academic and scientific presentations and explanations increased the interest of the participants.

In group studies, each participant shared their views and ideas on their own country and life. In this workshop on sustainable environment and economy, which is one of the aims of mobility, participants offered solutions for the project goals. The aim of this activity was to develop consciousness and awareness among the participants and thus ensure a change in individual attitudes. For this reason, addressing the issue especially from an academic and scientific perspective played a major role in achieving the goals.

In the second part of the day, all participants visited **Gümüşler Monastery**, one of the important ancient sites of the region. Here, participants witnessed how a historical heritage of at least a thousand years old was transferred to the present day through civilizations. The participants examined all the works of art with great interest, especially since the Smiling Virgin Mary Fresco in the monastery is one of the rare works in the world. The purpose of this trip was to raise awareness of the importance of transferring a sustainable lifestyle to future generations.







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WUSTE

On the third day of the mobility, all participants visited the local market. The aim of this visit was to develop an applied model of the processes of collecting food waste generated in the market and classifying this food waste, thus incorporating food waste into the sustainable economy in the most efficient way. While the participants collected food waste, they also had the opportunity to get to know the social structure of the region in the market. All collected waste was taken to **Niğde Ömer Halisdemir University's Waste Management Center.**

First, the group met with the University Rector and together they talked about the project and the goals of this learning mobility. After the meeting, the participants went to the Waste Management Center and waste management systems were observed by all of them. Compost production techniques and processes, especially with food waste, were demonstrated to the participants in practice. The composts were prepared from one month before the mobility. In this way, the participants saw what kind of product they could obtain after the theoretical and practical process that day.

They learned how important the contribution of compost is to the circular economy and agriculture using food waste.
In particular, they saw the ideas of starting a business on compost production and how they could generate income in terms of circular economy.

In the second part of the day, a Sustainable Agriculture seminar was held at the Faculty of Agricultural Sciences at **Niğde Ömer Halisdemir University**. An interactive seminar on sustainable agricultural practices was organized by the faculty member who is the Head of the Faculty Department.

The fourth day of the learning mobility was one of the most important days devoted to youth activities. All project participants and other young people of the school came together in the school hall. The activities started with the introduction of the project, the introduction of the guests and then a mini concert.

In this activity, young people from the University's Conservatory department were invited to introduce traditional Turkish music, and young people from another school were invited to perform and promote local folk dances. Young people who came together in this fun environment had the opportunity to get to know other lifestyles and introduce themselves in a multicultural environment.

On the evening of the same day, a Culture Night was held at **Göncü Mansion**, one of the historical mansions of our city. All participants made visual presentations on their culture and lifestyle on this night. In addition, Turkish participants presented many different tastes and dishes to the guests. The guests presented the treats they brought from their own countries to the Turkish participants.






On the fifth day, 5 academicians and 15 department students from the **Fashion and Design Department of the Faculty of Fine Arts of Niğde Ömer Halisdemir University**, one of the local stakeholder, were invited to the school. The invited academics firstly presented academic information on natural dye production from food waste and fabric processing.

Following this theoretical part, all participants participated in the workshop to carry out the applications. Academicians guided this study, and all participants started their individual creation work within the group. In the first stage, they learned fabric tying techniques.

Then, they learned paint production techniques practically as a group activity. A group activity was organized for each participant to paint the white t-shirts distributed. Each resulting individual product was dried and exhibited by the participants. And these t-shirts were given to them as souvenirs. With this workshop, participants learned how to combine food waste upcycling techniques with fashion design techniques.

This work found coverage in local and national media, helping our project reach a much wider audience.






As the last day of the learning mobility, the participants visited the **Cappadocia Region** because it is famous for its natural beauties and handicrafts.

Field trips and inspiration from local craftsmen was organized here. In this context, different handicraft workshops in the region were visited and the participants observed the craftsmen at work.

At the end of the day, certificates were presented to all participants.




DESCRIPTION OF THE MOBILITY IN SPAIN

Activity 3: Food waste Upcycling in Clothing Manufacturing and Handicraft

The Spanish association Asociación Uno hosted the second mobility of the Erasmus+ project WuSte, which took place in Valencia from 21st to 26th of February 2023. The group of participants was composed of 8 Italians and 8 Spaniards, for a total of 16 youngsters, accompanied by 2 group leaders, one for each partner.

For reasons of force majeure, the group of participants from Turkey could not participate due to a hard earthquake that hit their region. The learning mobility was implemented again with the same mobility program from 22nd to 27th of May 2022 in Valencia, only for the Turkish participants.

During the activities implemented in Valencia, the participants increased their knowledge about the concepts of upcycling, downcycling, and recycling. More specifically, the learning mobility focused on the upcycling processes in manufacturing and handicrafts and how food waste could be used and reprocessed throughout them. Finally, by studying successful stories about brands and small activities producing recycling and upcycling products, participants visualized their idea of a startup in this field.

On the first day, the trainer of Asociación UNO organized some ice-breaking and getting-to-know-each-other activities to let the participants introduce themselves in a non-formal way. Another interesting activity, after the presentation of the WusTe project, was the "Expectation Tree".

Through this activity, the participants can express their expectations and fears about the mobility experience that is going to start: a tree drawn on paper where participants can attack Post-it with written feelings and emotions to share among the group and discuss them all together.

The second day started with some energizer activities in the park. This was repeated every day, in the morning and after lunch, to warm up the participants before starting the sessions.
Once in the training room, the trainer explained 3 important processes: recycling, upcycling, and downcycling.

To understand better the differences between these processes, several best practices were presented and discussed with the participants. Then, the group was informed about how to apply these processes in everyday life: how to reinvent a material by upcycling, getting creative by recycling, and how to reuse paper and plastic by upcycling. After that, the participants were divided into groups and created their products putting the above concepts into practice, using creativity.



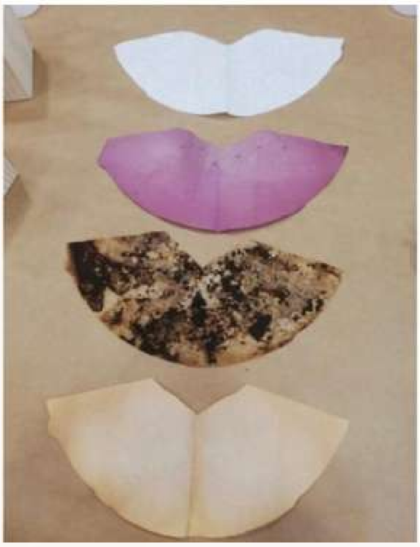

On the third day, each group of participants explained what was created the day before, by putting into practice the concepts they had just learned. After that, the participants shared more best practices at their national level about recycling, upcycling, and downcycling, and got prepared for the first study visit planned in the afternoon.

The first study visit was organized at **A la Lona De Valencia**, an association based in Valencia. It is an occupational project that combines the achievement of objectives related to the recovery of people affected by mental illness with the recycling of advertising banners, giving them a second life. They collect the advertising banners, which would otherwise go directly to destruction with an added cost, both economically and in terms of pollution, to convert them, through craftsmanship, into a new, useful, and attractive product.

A La Lona de Valencia Workshop - Brochure

On day 4, the concepts of Circular Economy and Circular Business were analyzed and discussed. After that, the trainer presented the Business Model Canva and how to develop a business idea using this model. The participants were happy to acquire this information and were excited by the idea of designing their own Circular Business Plan. So, divided into groups, they started thinking about a successful idea to be developed the following day.

In the afternoon, a second study visit was organized. The participants were invited to participate in a workshop organized by Estevid – Decoración y manualidades, a shop based in Valencia. The group of participants had the opportunity to create a pen holder by upcycling food waste, such as onion peels and espresso coffee residues.



Workshop at Estevid - http://estevidvalencia.es/

On the day 5, the groups of participants developed their business idea using the Business Model Canva. They showed a strong interest and creativity in imagining a company that would present the market with a great innovation from the recycling point of view. In the afternoon, they presented their start-up idea using a Powerpoint presentation. All the ideas were discussed and evaluated by the participants with the support of the trainer.

The last day of the mobility was dedicated to the evaluation of the learning mobility.

The participants met in Turia Park and they had several outdoor activities. There was a moment of debriefing in which everyone shared feedback, feelings, and emotions about the experience. Moreover, an evaluation questionnaire was sent to all the participants to gather feedback anonymously. After that, a final ceremony for delivering the certificates of participation was organized.
Finally, after lunch, the participants enjoyed the city of Valencia and spent a nice free time all together.

In conclusion, the entire group showed interest and enthusiasm in tackling mobility and active participation and discipline in carrying out the activities.In particular, during the business plan development activity, they expressed their intention to realise their start-up idea because they feel driven by an ideal in which they truly believe.

DESCRIPTION OF THE MOBILITY IN ITALY

Activity 4: Upcycling and Recycling techniques in Udine, Italy

The Italian association Cas'Aupa hosted the third mobility of the Erasmus+ project WuSte, which took place in Udine from 18th to 23rd September 2023. The group of participants was composed of 8 Italians, 7 Spaniards and 7 Turks, for a total of 25 youngsters, accompanied by 3 group leaders, one for each partner.
The mobility in Udine focused on recycling and upcycling. These practices play a key role in mitigating the environmental challenges we face.
Cas'Aupa is a dynamic youth association that stands out for its commitment to sustainability and environmental consciousness.

At the heart of its mission lies a remarkable initiative: a plastic recycling lab. This lab serves as a hub for young activists and aspiring environmentalists to come together and address one of the most pressing issues of our time: plastic pollution.

The recycling plastic laboratory was the starting point for the mobility's activities. By concentrating the activities on recycling and upcycling, Cas'Aupa aimed to harness the potential of this innovative space to inspire and educate participants from diverse backgrounds. Through hands-on experiences, workshops, and study visits, the participants explored the transformative power of recycling and upcycling.

Initially the hosting association took a collaborative approach by splitting into mixed groups, creating a diverse and dynamic environment for sharing knowledge and beliefs on upcycling and recycling. This exercise encouraged participants to bring their own perspectives and experiences to the table, fostering an exchange of ideas and insights. Later, it delved into the practical side of things. Drawing from the best practices they were familiar with, the group initiated a hands-on workshop in the afternoon.

This workshop involved the transformation of old, used car tires into small tables and seats. It was an opportunity to apply the knowledge and ideas shared earlier in the day, turning them into tangible, eco-friendly creations. By repurposing these materials and giving them a second chance, all together not only showcased the power of upcycling but also created functional and sustainable pieces that are now put to good use in the association's site.



On the third day, an expert was invited to deliver a presentation on the different types of plastics, recycling methods, and the pressing issues surrounding plastic waste. These insights equipped the participants with a deeper understanding of the complexity of plastic materials and the environmental challenges they pose. Following this session, there was an hands-on experience in Cas’Aupa's plastic recycling lab. With access to four specialized machines, the youngsters had the opportunity to put theory into practice.

These machines served as tools to experiment and learn firsthand about the processes involved in recycling plastic materials. The activities went on with the creation of pieces for Cas’Aupa second bench crafted entirely from recycled plastic materials. Placing the bench in the association's neighborhood is a gesture of community engagement and an example of how small actions can make a significant impact.


An important moment of the mobility was the study visit to **Plaxtech**, a local business in Udine. It provided a unique opportunity to witness recycling efforts at an industrial scale and witness the transformation of plastic waste into 100% recycled pallets.

This visit offered valuable insights into the practical applications of recycling and showcased the potential for sustainable solutions within the business sector. **Plaxtech's** commitment to creating recycled pallets not only reduces the environmental impact of plastic waste but also demonstrates the economic viability of such endeavors. It served as a remarkable example of how innovative businesses can play a key role in advancing circular economy practices and promoting environmental responsibility.

Their engagement in business collaborations with countries like China and others to export this cutting-edge technology demonstrates a global commitment to addressing plastic waste issues on a grand scale. By producing machinery that effectively transforms plastic waste into moldable materials for pallet production, **Plaxtech** not only contributes to waste reduction but also actively participates in the global shift towards more sustainable industrial practices. This international outreach highlights the significance of technology transfer and knowledge sharing in the context of sustainable development.

Experiencing the entire lifecycle of **Plaxtech's** recycled pallets, from raw material to finished product, was a truly hands-on educational journey. The opportunity to touch and examine the final product allowed for a tangible connection to the positive impact of their efforts. Visiting their factory and observing the machinery in action took participants' understanding to another level. It allowed them to witness the efficiency and precision with which they transformed plastic waste into valuable pallets. They had the chance to ask questions and collect useful information.

The comparison between local, artisanal plastic recycling efforts and **Plaxtech's** global-scale operation was inspiring. It highlighted the diversity of approaches and scales at which recycling can be carried out, each contributing in its own way to the greater cause of environmental sustainability. The juxtaposition of these two approaches serves as a reminder that there is no one-size-fits-all solution to environmental challenges. Instead, it highlights the importance of a multi-faceted approach, where local initiatives and global endeavors can complement each other in working towards a common goal of a more sustainable and eco-friendly future.

Plaxtech's 100% recycled and recyclable pallets represent an example of a circular economy in action. Their commitment to sustainability extends beyond just the production process; it encompasses the entire lifecycle of their product. The fact that these pallets are made entirely from recycled materials not only reduces the demand for new resources but also minimizes waste.

Even more impressive is the pallets' repairability. In contrast to traditional wooden pallets that often need to be replaced when damaged, these recycled plastic pallets can be easily fixed, ensuring a longer and more durable lifespan. This not only reduces the overall environmental impact but also saves resources and costs in the long run.

It's a perfect embodiment of circular economy principles, where products are designed to last, and materials are continuously reused, closing the loop and minimizing waste generation.

https://plaxtech.eu/

The participants also had the opportunity to visit the Midolini Art Prize. Midolini is a local gravel business, headed by a forward-thinking chief with a dedication to sustainability, who gave the start to an annual artistic competition. Artists are asked to present land art works that are in connection with the themes of waste and nature. It was a fascinating experience that demonstrated the intersection of business, art, and environmental consciousness. The importance of this competition also lies in the intention to donate these land art works to a public park in Udine, as a thought-provoking and powerful initiative for the community.
https://www.premiomidolini.it/

Another activity was the cleaning march of the park in Cas’Aupa’s neighborhood. Conducting such clean-up events demonstrates a sustained commitment to keeping the community clean and raising awareness about the importance of waste management.

Following the clean-up, the group of participants discussed waste sorting in the respective countries (Italy, Spain and Turkey). Sharing insights and experiences on waste sorting practices can be enlightening, as it allows participants to learn from each other's successes and challenges. It also highlights the importance of waste sorting as a fundamental step in recycling and reducing waste.

Finally, the last study visit was organized at the *Officine Giovani*, a project initiated by Cas’Aupa that directly benefits the youth of Udine, offering free rehearsal rooms and co-working spaces. This project serves as a valuable resource, empowering the youth with access to spaces that foster artistic and professional development.
Moreover, the project included an action-call for young architecture students to contribute with urban planning projects for the requalification of the park.

The trip to Trieste to explore the urban gardens created by an Italian partner association **Ugorà** is a remarkable example of how community initiatives can transform urban spaces into hubs of sustainability, social interaction, and food production.

These urban gardens not only provide a green and welcoming environment for residents but also serve as vital sources of sustainably grown vegetables and fruits, addressing the challenges of food security in urban areas where many people lack access to gardens or orchards.

These gardens become places where people can connect, share knowledge, and collaborate on the cultivation of healthy, local food. It's a powerful reminder of the potential for urban spaces to serve multiple functions, including addressing environmental concerns, improving food access, and enhancing the overall well-being of residents. **Ugorà** is also planning to use pots made of recycled plastic from our plastic lab for smaller plants in their urban gardens, which is a fantastic way of coming together.

This forward-thinking approach not only reduces waste but also sets a positive example for others to follow. It showcases how innovative solutions and responsible choices can be integrated into community initiatives to promote a more sustainable and eco-friendlier urban environment. It's an exciting development that reflects **Ugorà's** ongoing dedication to environmental stewardship and sustainability.

https://sites.google.com/view/ugora/home-page

The final debriefing session on the last day of the mobility program provided a valuable opportunity for reflection and a chance to revisit the initial perceptions of recycling and upcycling. After days of immersive experiences, knowledge sharing, and hands-on activities, it's no doubt that the participants gained new insights and perspectives on these crucial environmental practices.

This exercise allowed them to articulate how their understanding had evolved over the course of the program. It's common for such experiences to challenge preconceived notions and open new avenues of thought. By sharing their opinions and reflections, everyone contributed to a deeper, more nuanced collective understanding of recycling and upcycling.

This final debriefing not only served as a personal journey of growth and learning but also helped solidify the key takeaways from the program. It reinforced the importance of ongoing education and engagement in environmental issues and underscored the significance of collective efforts in shaping a more sustainable future.

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