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Circular Economy
Stakeholder Platform

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ECESP LEADERSHIP GROUP ON
FOOD WASTE, FOOD SYSTEM AND
BIOECONOMY

AUTHORS

Agneszka Sznyk, INNOWO

Chiara Nobil, ENEA

Johannes Kisser, alchemia-nova

Maite M.Aldaya, ISFOOD-UPNA

Maria Chiara Femiano, Ellen MacArthur Foundation

Mercè Boy Roura, Interreg MED Green Growth

Paola de Bernardi, University of Turin

INTRODUCTION ABOUT THE LEADERSHIP GROUP ON FOOD WASTE, FOOD SYSTEMS AND THE BIOECONOMY

The global food industry is one of the largest sectors of the economy, accounting for 10% of global GDP, and at the same time producing a huge amount of waste. The equivalent of six garbage trucks of food waste is thrown out every second.

On the other hand, 55 million people in Europe cannot afford a good quality meal every day. The total negative consequences of current food production methods are estimated at around USD 5.7 trillion annually. That is why it is so urgent and necessary to introduce sustainable methods of food consumption and production in line with circular economy principles. There is potential for savings of up to USD 700 billion a year if the level of food waste is reduced or the recovery of minerals such as nitrogen and phosphorus from food industry by-products and biomass is increased. On the other hand, by producing regeneratively and locally grown food and minimising waste production, cities could generate benefits worth USD 2.7 trillion annually by 2050.

The Leadership Group on Food waste, food systems and the bioeconomy has been working since November 2020 to highlight and raise awareness of the importance and complexity of food systems and the bioeconomy as a driver of the transition towards a circular economy in Europe. The LG's main objectives are to showcase best practices and successful projects to tackle food waste, to promote suitable solutions and to facilitate the circular transition towards a just and effective bioeconomy and food system.

This year, the Leadership Group on Food waste, food systems and the bioeconomy has focused on three main aspects of the following topics: food, bio-based products and agriculture.

The Leadership Group brings together, analyses and investigates the potential for scaling up examples of circular economy good practices (CEGPs), especially through the linkage between waste prevention and regeneration. CEGPs were established recently in the framework of the International Standards Organization (ISO) with the aim of developing "frameworks, guidelines, supporting tools and requirements for the implementation of activities of all involved organizations to maximize the contribution to Sustainable Development". CEGPs have the pivotal role of facilitating the exchange and mapping of national, regional and local circular economy good practices, as well as examples from businesses, trade unions and civil society organisations.

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In order to do a deep dive into these topics together with all relevant stakeholders, the LG held three #EUCircularTalks in the form of online webinars and workshops.

The recording of the events are still available using these links:

- GOVERNANCE AND SYSTEM CHANGE
- RESOURCE EFFICIENCY TO HELP COMBAT FOOD WASTE
- THE ROLE OF CITIES TO BOOST THE CIRCULARITY OF FOOD SYSTEMS

CIRCULAR ECONOMY FOR A REGENERATIVE FOOD SYSTEM

Transforming our food system is the most impactful action we can take to address climate change, rebuild biodiversity and create a healthy society. Today's food system is highly linear, based on a take-make-waste model, degrading and polluting the environment and creating large amounts of waste. Our food system accounts for up to 37% of global GHG emissions and half of the human induced pressures on biodiversity, while approximately a third of food is lost or wasted. For every dollar spent on food, two dollars worth of health, environmental and economic costs are created for society. Half of these costs — totalling USD 5.7 trillion each year globally — are the result of the way food is produced and food waste and by-products are handled.

If we are to address the root causes of these challenges, a systemic approach is needed to rethink the food system. Based on the three principles of the circular economy (eliminate, circulate, regenerate), we can start building a food system where producing food builds biodiversity and helps with emissions reduction, while providing economic opportunities and enhancing resilience for people and the planet. For instance:

Eliminating waste in the food industry alone would reduce annual emissions by 1.4 billion tonnes by 2050 – that's more than the entire airline industry pre-pandemic.

Circulating food byproducts and upcycling them into new high-value ingredients would open up new opportunities while decreasing pressure on natural systems. With a third of food being lost or wasted, upcycling innovations provide opportunities not only to avoid sending food and by-products to landfill, but also to generate economic opportunities for farmers and food businesses alike.

Regenerating nature by producing soil-based foods and selecting integrated crops and livestock can reduce GHG emissions and sequester CO₂ in soils and plant matter: switching to regenerative food production globally would reduce emissions by 3.9 billion tonnes of CO₂e equivalent per year by 2050.



In a circular economy, food production regenerates rather than degrades natural systems, waste is designed out of the system, and all people have access to healthy and nutritious food. Regenerative and more diverse food production increases biodiversity by improving soil health, reducing the pollution caused by the excessive use of synthetic inputs, and sequestering carbon in the soil. Excess food is redistributed and by-products re-utilised, reducing waste and pressure on natural resources.

A circular economy for food could generate annual benefits worth USD 2.7 trillion by 2050 globally if cities alone take action at scale.

With the top 10 fast moving consumer goods companies and retailers supplying ingredients from 40% of the agricultural land in the EU and the UK, circular design for food can be used as a key approach to unlocking these opportunities. So much of the food eaten around the world everyday is designed, from takeaway meals and school lunches, to boxes of pasta and breakfast cereal. Designing food products for nature by using diverse, lower-impact, upcycled and regeneratively produced ingredients can reduce farm-level GHG emissions and biodiversity impact by an average of 70% and 50% respectively versus business as usual by 2030, while increasing cashflow for farmers by USD 3 100 per hectare on average following a transition period.

Circular design for food encourages food designers to create products and menus with ingredients that have better outcomes for biodiversity and climate through their production. This includes using upcycled ingredients and redistributing or transforming any excess to fully capture its value, reducing pressure to expand agricultural land and protecting biodiversity. With business and policy action around climate and biodiversity increasing, and customers becoming more discerning about the health and environmental impacts of their food, the time is right to adapt our food system to the principles of the circular economy.

TOO GOOD TO GO CASE STUDY

TGTG is a real and virtuous case study of a digital platform with the mission of tackling food waste generated along the food supply chain. TGTG developed an app that can be used to buy food for a discounted price that would otherwise be discarded. This can be done at restaurants, hotels, bakeries, cafés and supermarkets. A "magic box" containing unspecified food can be bought using the app. The "magic box" must then be picked up by the consumer who made the purchase, often within a defined time slot to assure food quality. In this way, the local entrepreneur is supported and generates less food waste and will possibly get new customers.

Established in Copenhagen in 2015, TGTG has rapidly extended its business to 17 European and non-European countries, with 80 million users and 100 000 partners. TGTG is the biggest business working to reduce food waste in the world. As reported on their website, 100 million magic boxes have been sold so far (updated end 2021), saving approximately 100 million kg of CO₂ emissions.

The case study sheds light on the company's win-win-win logic, where the planet, retailers and consumers use the digital platform. It reduces the amount of waste that in traditional supply chains is generated at every step by capturing part of its value, mediating between the later stages of the supply chain and, particularly, between retailers and consumers. In this way, through TGTG, retailers (e.g., bakeries, supermarkets, cafés, shops, restaurants) can offer food that is nearing its expiry date or fresh food left unsold at the end of the day at a discounted price to consumers. According to Jamie Crummie, one of the founders of TGTG, through his company not only can retailers increase their earnings, they are also able to reduce their waste management costs: "We're placing a value on something which businesses have traditionally had to spend a lot of money to get rid of – by that I mean their waste and waste disposal costs – we're shifting an established approach." (Crummie, 2019).

In line with its role as a benefit company, TGTG also focuses on education and on inspiring and empowering everyone to fight food waste together. It finances educational programmes in schools, pushes political changes in countries where it is operative, and encourages other actors in the food supply chain to work with it. The willingness to engage and inform the broader public is so intimately rooted in TGTG's vision that, according to the Education Manager of the company, there were no alternatives to structuring it in the form of an open-access course.

THE BIOECONOMY AS A SYSTEMIC APPROACH FOR CIRCULAR TRANSFORMATION

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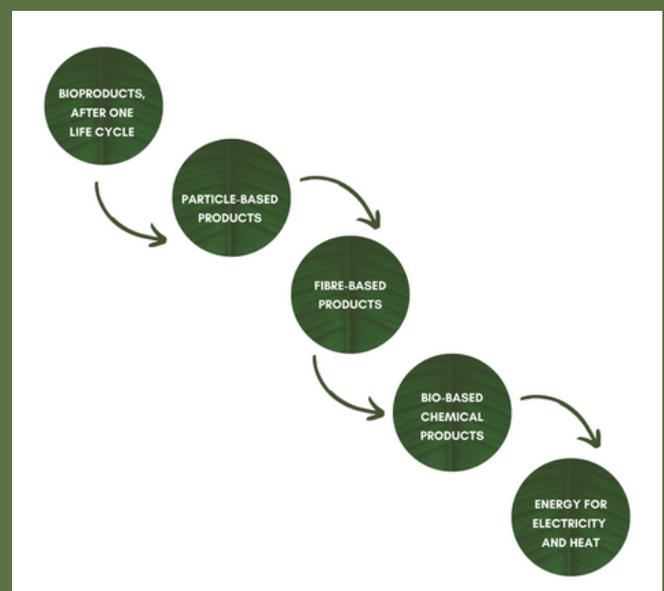


STRATEGIES FOR REDUCING FOOD/BIO WASTE

To prevent and reduce food waste, the agri-food system is up against global challenges, amplified by the pandemic. These include sustainable management of natural resources in the face of a growing global population (Green Deal and BioDiversity), increasing attention to health, nutrition and food safety (One Health), implementation of a circular bioeconomy and system efficiency, from farmer to final consumer (Farm to Fork), as well as growing competition from the new agri-food economies and their sundry rules (SDGs and WTO). The greater vulnerability of ecosystems and biodiversity and the diverging levels of people's livelihoods and food security mean that there are increasingly interconnected markets and forms of food production in more sustainable systems, aimed at the creation of a circular bioeconomy, a pillar of sustainable transformation.

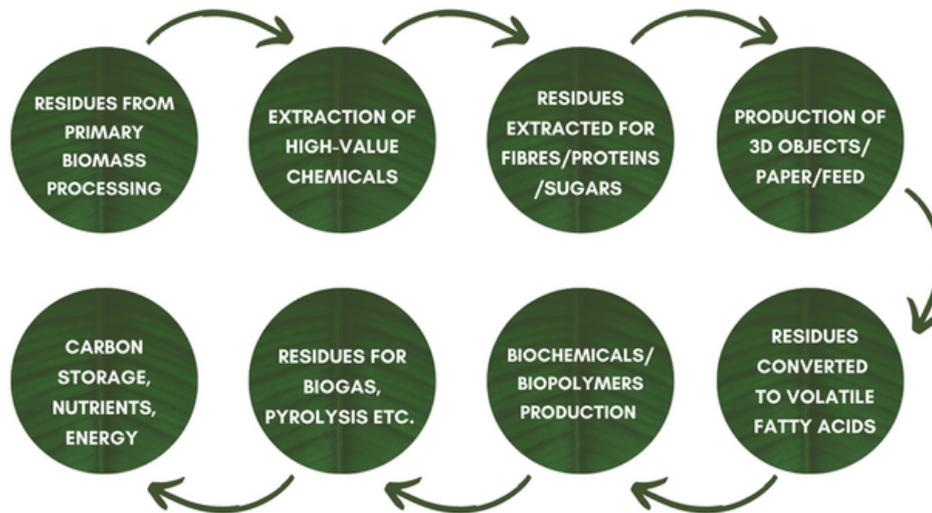
A sustainable and circular bioeconomy would keep resources at their highest value for as long as possible through waste upcycling, cascading biomass use and recycling, while ensuring that natural capital is preserved. This requires proper design, coordinated action and careful consideration of possible trade-offs. By shifting to alternative (aquatic) sources of biomass and using biowaste and residues more effectively, the resource base could be extended without the need for additional land for biomass production. Using this approach, it would be possible to identify strategies that guarantee the continuous regeneration of raw materials, thanks to the application of eco-design principles and the development of cycle closure technologies, while also favouring circular models of collaborative production and consumption.

There are many ways in which industry can respond to food waste, from upcycling leftovers to using technology for smarter use of ingredients. One effective strategy for maintaining the value of biomass for as long as possible, before energy recovery is the **cascading use of biomass**.



Another strategy for recovering the highest possible value of biomass streams can be applied through a direct conversion cascade of resources.

Example of a stepwise bio-cascade in a process chain.



Another example of a food waste solution is to transform what is wrongly considered waste or of little value in the production process into a new service for a different production or consumer cycle in line with the upcycling concept. Contrary to what traditionally happens with recycling processes, where materials often lose their value (downcycling), tangible / intangible and / or relational value is maintained or even increased, while reducing waste disposal costs where possible, especially with regard to special waste which is subject to specific legal regulations.

Duedilatte and Orange Fiber case study

They obtain their textile fibres from milk and orange by-products, respectively. In the first case, fibre is obtained from the processing of casein and separated from whey in a biochemical process. In the second case, the textile fibre consists of cellulose extracted from citrus pulp, which is waste from the industrial processing of citrus fruit. In the Netherlands, the Surplus Food Factory uses tomato stalks and bottoms, which are waste from the production of hamburgers, to produce soups. The Italian company Frumat developed a new raw material to answer both the local apple-waste issue and the increasing demand for ecological alternatives to leather. The result is a cellulose-based material featuring a variety of textures, thicknesses and embossing and laser prints, meaning that it has a very wide variety of applications. It can be produced on demand and easily personalised.

These are all examples of product innovations derived from waste which do not yet fully recover and return nutrients back into production. This long value chain and conversion into a value cycle is still difficult in our market-driven society. There, we will need more systemic innovations, often a change in legal framework, and more incentives.

The difficulty in improving food consumption and making it more sustainable and, in particular, in reducing the generation of food waste is partly due to the lack of coordination and of common sustainability objectives among the different stakeholders. Food products are wasted along the entire supply chain due to a lack of demand, they have to be taken off the shelf because they do not comply with sales requirements, they are close to reaching the expiry date or because of errors in production planning, etc.

To overcome these drawbacks, the agri-food ecosystem must take a huge leap forward: from being the backbone of the economy and society, it must generate a new, more cohesive economy shared by the diverse actors that have to cooperate for the sake of increasingly interested and informed consumers. Consumers can also create a more sustainable bioeconomy by changing consumption patterns (e.g., reducing meat consumption), preventing food waste and separating biowaste from other waste streams so that it can be (partly) converted to fertiliser by composting or digestion.

Stakeholders are currently engaged in seeking effective and acceptable solutions that are compatible with upholding a standard of living suited to the needs of a globalised world, but that suggest or impose different lifestyles and a profound rethinking of the exploitation of the planet's resources.



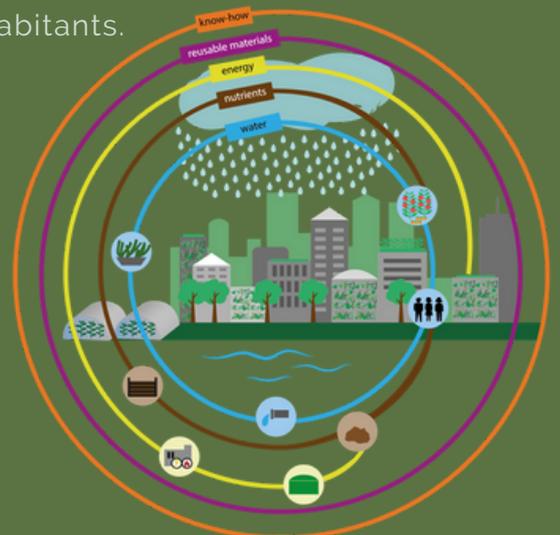
This new vision of an interconnected agri-food system requires multistakeholder partnerships to integrate the different cultural dimensions of sustainability and circularity.

THE ROLE OF CITIES IN BOOSTING THE CIRCULARITY OF FOOD SYSTEMS - THE LOCAL HUB AGAINST FOOD WASTE

Cities are major resource sinks in our system. Many different products from all around the world enter these markets and are then usually lost forever. In the best case, a certain amount of organic waste is converted into (low-quality) compost, which can be used directly in cities for landscaping or a bit of urban farming. These urban systems need to become resource turntables and return nutrients to the fields. In this framework, there are many barriers and some of them are unlikely to change in the near future (e.g., big wastewater treatment plants in several EU Member States will not be allowed to use wastewater sludge for agriculture but need at least to install phosphorous recovery, which will lead to mono-incineration and loss of all left carbon plus other elements).

Still, many nutrient recovery and reintegration pathways have been tested and strategies devised. These can now be rolled out more systematically. For example, wastewater-fed nature-based solutions can play an important role in the use and recovery of nutrients while offering all multiple functions useful for a city. These co-benefits include converting CO₂ to edible or utilisable biomass and improving air, water and soil quality. The treated wastewater plus the nutrients can be reused in urban farming setups, while excess nutrients can be returned to green belts around cities and rural areas. The excess nutrient availability in cities is enormous, for example the wastewater and kitchen waste of around 230 000 people could cover the nitrogen and phosphorus fertiliser demand of the entire vegetable production for Vienna, a city of 1.9 million inhabitants.

The projects HOUSEFUL (houseful.eu) and HYDROUSA (hydrousa.org) are examples of on-site nutrient and water loops. Urban greens, parks and underutilised infrastructures in cities can be used for urban farming and the bounty distributed via soft urban infrastructures such as regular markets with local food suppliers.



MILAN FOOD POLICY <https://www.milanurbanfoodpolicypact.org/>

The City of Milan created the Milan Food Policy in 2015. The incentive to focus on food came from the Milan Expo 2015 (theme "Feeding the Planet, Energy for Life") and the Milan Urban Food Policy Pact (launched during the Expo). The international pact has united cities wanting to develop their food systems in a sustainable way. Those actions were the start of a transition towards a more sustainable food system in Milan. Milan City took a chance to establish its own food policy based on five priorities:

- Access to healthy food for all,
- Sustainable food production,
- Food education and awareness,
- Food losses and waste management,
- Scientific research promotion.

Working on the policy, the municipality of Milan created a complex strategy including four strands of action at the city level:

- Waste tax reduction (incentives for private companies),
- Food waste hubs (redistribution of food surplus to those in need),
- Open street market (food collection),
- Projects in school canteens (educational programmes, promotion of doggy bags).

The idea of creating food hubs has been a big success and during the pilot year (2019) alone, Milan saved 660 tonnes of food (equivalent of EUR 4 100 000). Since 2019, three food hubs have been launched and the municipality plans to launch others. When implementing the food hubs, the municipality developed a system for measuring and monitoring the whole project. Furthermore, they also drew up guidelines for companies to simplify implementation of the new law. Since 2015, the Food Policy has involved many stakeholders such as public authorities, municipal agencies, private companies, cities and third-sector organisations. That is the result of a broad and well thought-out food policy in Milan.

CATALAN LAW ON FOOD WASTE

The strategy of Catalonia on food loss and waste (FLW) focuses on five main strands:

- 1) Knowledge generation,
- 2) Awareness raising,
- 3) FLW prevention actions,
- 4) Regulation and
- 5) Governance.

In terms of regulation, in March 2020, the government of Catalonia adopted a pioneering law aiming to reduce FLW: Law 3/2020, of 11 March, on Food Loss and Wastage Prevention. The law has the overall objective of raising awareness of the problem of food wastage and providing some tools to enable its prevention, as well as promoting measures that provide incentives for wastage reduction. Unlike much legislation, the Catalan law focuses on the entire food supply chain - from primary production to households - including food companies and social entities from food production to the hospitality industry. Moreover, it seeks to promote food waste prevention, rather than to redistribute food surplus. This is done through various obligations for stakeholders across the supply chain, including the primary sector, on the adoption of specific measures such as:

- To have and implement a food loss and waste prevention plan;
- To reduce, measure and annually report the quantity of food loss and waste;
- To account for the food products that are intended for free distribution or animal feed.

Read online the Law on Food Loss and Wastage Prevention from the Government of Catalonia: [CLICK](#).

THE ROLE OF EDUCATION FOR CIRCULARITY

The circular economy is a paradigm linking new economic and employment opportunities with the potential to create more resilient communities, businesses and supply chains, improve competitiveness, spur on innovation, and attract new investment that can support economic recovery.

In a circular economy, food is grown, processed, transported, prepared and by-products managed in ways that benefit the health of people and natural systems and where the concept of "waste" no longer exists. Food is designed to cycle, so by-products from one production line provide inputs for the next. Cities have great potential to influence the way in which food is grown, consumed and disposed of. By sourcing food grown regeneratively, and locally where appropriate, cities can use their public and private demand power to motivate a shift to regenerative food production. While urban farming has some potential, the bulk of food eaten in cities will continue to come from outside their boundaries. However, cities can form mutually reinforcing relationships with their peri-urban surroundings – where 40% of the world's cropland already exists.

In this context, the role of education and training involve all of society, from children in kindergartens to adult learners. Circular mindsets and skills must be addressed at every level of school education, but at the same time also outside educational institutions. This requires an investment in resources such as suitable training equipment, educator training, resource libraries, and more. We are all learners and we need to consider life-long learning as a constant process in our personal and professional life. Only in this way will we be able to lead the transition, which is cultural even more than economic and environmental.

The Fourth European Education Summit, the annual flagship event of the European Education Area, shared the vision of a modern and inclusive European Education and training sector fit to face the green and circular transitions. What can be done to drive on the green and circular transformations of our society? The transition to a carbon-neutral circular society will affect education, upskilling and reskilling systems, as well as employment and jobs: some jobs will be lost, new jobs will emerge and most jobs will change in one way or another. In the future, the principles of a circular economy need to be integrated into all professions, including engineering, design, industrial processes, logistics and customer service. This will generate new requirements for education and skills training, and demand for opportunities to make career changes.

THE ROLE OF FOOD BANKS IN REDUCING ENVIRONMENTAL IMPACTS BY REDUCING FOOD WASTE: THE CASE OF THE FOOD BANK OF NAVARRA, SPAIN

Food banks are a partial solution to the problem of food waste, as their activity is directly related to preventing the waste of food fit for consumption throughout the entire production chain. However, the activity of food banks is directly related to environmental sustainability. Recent research highlights the environmental benefits of food bank activities and the reduction of food waste, focusing on the minimisation of greenhouse gas emissions and freshwater consumption and pollution, and their positive influence on the climate and conservation of water resources.

The Food Bank of Navarra (FBN) received and distributed nearly 2 700 tonnes of food in 2018. In this period, the GHG emissions generated and the freshwater used by FBN activities were notably lower than those in a scenario without the FBN.

The carbon footprint of the FBN was 147 t of CO₂e in 2018, mostly associated with the transport of food and volunteers. In the hypothetical scenario without the FBN, the GHG emissions related to the production of food would amount to 4272 tonnes of CO₂e, whereas the emissions associated with waste management would have been 443 tonnes of CO₂e. Thus, the GHG emissions avoided by the FBN, by salvaging and using food that would otherwise be wasted, amounted to 4 568 tonnes of CO₂e.

As regards water, the freshwater required to carry out FBN activities amounted to 1925 m³, while the freshwater use avoided by the FBN amounted to 3 286 099 m³. Thus, the water saved was 1700 times higher than the water used by the Food Bank. **The strong impact of food production on water resources is remarkable: in the theoretical scenario without the FBN, food production represented 98% of water use, while waste management accounted for the remaining 2%.**

The results obtained show the social and environmental importance of the activities of the Food Bank of Navarra, as it not only avoided the waste of 2.7 thousand tonnes of food fit for consumption, but it also prevented a large amount of GHGs from being emitted into the atmosphere and the unnecessary waste of more than 3.2 million m³ of freshwater, the equivalent of filling 974 olympic swimming pools.

CIRCULAR DESIGN FOR FOOD - DESIGNING FOOD FOR NATURE TO THRIVE

Combining food design with the principles of the circular economy offers an actionable framework for redesigning product portfolios for nature-positive outcomes by combining four opportunities: using diverse, lower-impact, upcycled and regeneratively produced ingredients.

This approach can generate environmental, economic and yield benefits. Analysis of example ingredients - wheat, dairy and potatoes - in the EU and UK shows it can reduce farm-level greenhouse gas emissions by an average of 70% and the impact on farm-level biodiversity by an average of 50% versus business as usual by 2030. It also creates significant food production and economic benefits for farmers, with analysis indicating there is the potential to achieve 50% higher "steady state" total food production versus baseline and USD 3 100 per hectare per year net value creation.

