FoodLoops

LOCAL COOPERATION FOR CIRCULAR BIOWASTE IN SCHOOLS AND BEYOND, MANUAL

Interreg Baltic Sea Region
Co-funded by the European Union
CIRCULAR ECONOMY FoodLoops

EXECUTIVE SUMMARY

The purpose of this manual is to foster cooperation among stakeholders in the local food (waste) value chain, specifically focusing on circular bio-waste management. It serves as a guide to enhance understanding of each other's motivations and pain points, ultimately finding common ground and co-developing solutions. This manual reflects the experiences of project partners from activities aimed at building collaboration among targeted stakeholder groups.

It includes case studies from various localities and regions, addressing the food (waste) value chain and highlighting local activities, challenges faced, and developed solutions. Additionally, it features case studies on local cooperation for circular bio-waste management in schools and beyond, including the processes of stakeholder engagement and the associated challenges and solutions.

This manual is designed for various stakeholders involved in the food (waste) value chain, particularly in regions within and beyond the Baltic Sea Region (BSR) countries targeted by the Foodloops project. The project specifically focuses on Lithuania, Finland, and Poland, aiming to close the biowaste loop within school settings.

The primary goal of the Foodloops project is to enhance biowaste management through strong stakeholder engagement. It empowers municipalities, educators, and caterers to improve biowaste separation at the source, such as in school canteens and kitchens. By guiding these actors in collaboration, the project seeks to develop solutions that transform unavoidable food waste into valuable products, such as organic compost.

Emphasis has been placed on these three countries due to the critical situation regarding food waste in each. For instance, Lithuania experiences over 50 kg of food waste per capita annually, while Poland generates approximately 4.8 million tons of food waste each year. Addressing these challenges is essential for promoting sustainable practices and reducing the environmental impact of food waste. This manual serves as a resource for stakeholders aiming to implement effective strategies for biowaste management and foster cooperation in their communities.

The circular bio-waste cooperations fostered in three countries provides valuable insights for other regions. Key learnings include the importance of fostering collaborations between schools, local farmers, and regulatory bodies to create sustainable food practices and reduce waste. Engaging students in hands-on activities, like gardening and composting, can enhance their understanding of food systems. Additionally, negotiating flexible procurement contracts with suppliers promotes the inclusion of organic foods in school meals. Municipalities play a crucial role in supporting these initiatives by offering legal guidance and facilitating partnerships. Improvements to the cafeteria atmosphere, such as redesigning the space to enhance comfort and aesthetics, can further enrich the dining experience for students. Collaborating with students and parents on menu planning ensures meals are both nutritious and appealing, promoting healthier eating habits. Overall, adapting these cooperative models can lead to more sustainable and efficient food systems in schools, benefiting both the environment and educational experiences.

This manual should be adapted to the local contexts of each region, taking into account their unique challenges and stakeholder interests. It should not be regarded as a one-size-fits-all solution; rather, it should be implemented according to the specific circumstances of each school food system within the respective region. The manual is intended to serve as inspiration for initiating cooperation among stakeholders.

The case studies from FoodLoops countries emphasize the importance of fostering cooperation for circular bio-waste management in schools for other regions as it leverages the strengths and resources of diverse stakeholders, including schools, local farmers, caterers, municipalities and regulatory bodies. By working together, these entities can develop innovative solutions to minimize waste at various stages of the food value chain, from production to consumption.

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Chapter 1

1. WHERE DID THE FOODLOOPS PROJECT COME FROM?

The FoodLoops project was started in 2023 with the goal to close the bio-waste loop in the Baltic Sea Region (BSR) to tap into the economic potential of food waste valorisation. Food waste represents a major challenge globally, and equally in the BSR. With the countries of focus (Finland, Poland, Lithuania) each facing millions of tons of food waste every year, the FoodLoops project tackles this challenge over the course of two years with multiple stakeholders of the BSR's food value chain. The project builds on the HOOP project, which aimed to improve biowaste valorisation in municipalities by creating new value chains and solutions. After the end of the project, some of the involved partners decided to continue the collaboration in order to address the challenge in the context of schools' food value chains, leading to the creation of the FoodLoops projects.

1.1 Vision and Mission of the Project

Combatting food waste counts as one of the most pressing issues not only for combatting world hunger, but also for sustainability. For example, food loss and waste make up a significant part of agriculture's impact on climate change. The United Nation's Sustainable Development Goal 12.3 aims to reduce global food waste at the retail and consumer levels, specifically targeting "the reduction of per capital food waste worldwide." This includes decreasing food loss during production and supply chains, encompassing post-harvest loss, by 2023. Reducing food waste is a significant part of strategies to combat climate change.

With huge amounts of food being thrown away every year, there is a lot of potential for creating value (in the form of new products) from bio-waste. The FoodLoops project aims to close the biowaste loop by facilitating waste valorisation on multiple levels. On the one hand, the project works with various stakeholders, including municipalities, educators, caters and farmers to improve biowaste separation in school kitchens, canteens and households. Further, it strives to support these actors in developing waste valorisation solutions, turning food waste into new products, such as organic compost.

Transnational cooperation is a key part of this project, as sharing experiences and knowledge among actors from different countries is crucial to create global solutions for combatting food waste. While food waste is often an issue at a local level, it is part of a worldwide challenge. Collaborations with transnational partners can foster, scale, and speed up possible solutions by replicating them in more places and sharing tips for improving them.

The goals of the project are thus summarised as follows:

1. Empowering better bio-waste separation at its source, namely school kitchens/ canteens.

2. Facilitating the valorisation of unavoidable (food) waste by turning it into products of value, such as compost, that helps close the resource loop.

The project focuses on the BSR, specifically Poland, Lithuania and Finland because the Interreg Baltic Sea Region programme is from this area. FoodLoops is centred around multi-stakeholder collaboration, with the aim being to create trust and understanding between the local stakeholders in the (school) food value chain. This way, the actors will be able to co-create solutions that work within their specific context, and hopefully enable replication of the cooperation models in other places.

1.2 Project Partners and Associated Organisations

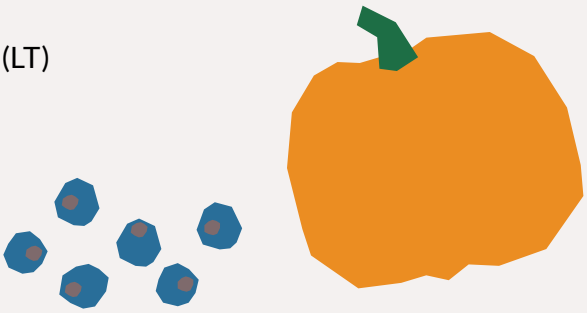
As a multi-stakeholder project spanning three countries in the BSR, several project partners and various other organisations are contributing to the project to achieve the highest possible impact. Each plays a crucial role in the execution and coordination of the project and comes with their own specific areas of expertise and tools.

1.2.1 Project Partners

- Savonia University of Applied Sciences
- Collaborating Centre on Sustainable Consumption and Production
- Municipality of Gdansk
- Lithuanian Consumer Institute

1.2.2 Associated Organisations

- Sustainable Gastro
- City Initiative Association (PL)
- Servica Ltd (FI)
- Kaunas University of Technology (LT)
- Gut Einern



2. WHO IS THIS MANUAL FOR?

2.1 Target Groups

The FoodLoops project serves a variety of different stakeholders and target groups, with the aim of connecting them and encouraging multi-stakeholder dialogue and collaboration. One of the key goals of the project is to engage all stakeholders relevant to bio-waste separation in school canteens and waste valorisation, build understanding and trust among them and facilitate the finding of common and collaborative solutions. The project provides a structured platform for the targeted stakeholders to engage, enabling them to co-create models of local cooperation for waste separation and valorisation.

2.1.1 Farmers Associations

Farmers associations represent the agricultural sector and are a crucial actor in the (school) food value chain. They constitute potential customers for products of valorised bio-waste from schools' kitchens and canteens, such as organic fertilisers. Thus, they play an important role in driving demand for bio-waste, for which there is currently a limited supply.

2.1.2 Schools and school administrators

Schools, including their kitchens, canteens and administrators, are important to the school food system and efforts to improve bio-waste valorisation. School administrators have the power to change their school's procurement processes related to caterers, meaning that they can negotiate agreements with them related to the treatment of waste. Further, they can bring to life extra-curricular initiatives supporting the school's waste separation efforts and valorising food waste. However, school administrators and involved staff require training and equipment (such as methodologies and best practice examples) to do so.

2.1.3 Municipalities

Another target group of the project are municipalities, specifically in the Baltic Sea Region. They play an important role in bio-waste valorisation because of their position, as they can support organic local farmers in the growing and supply of organic foods. Furthermore, they can facilitate and encourage cooperation between these local farmers and schools. To enable this, municipalities need to dedicate (human) resources to emerging waste separation/valorisation initiatives.

2.1.4 Caterers

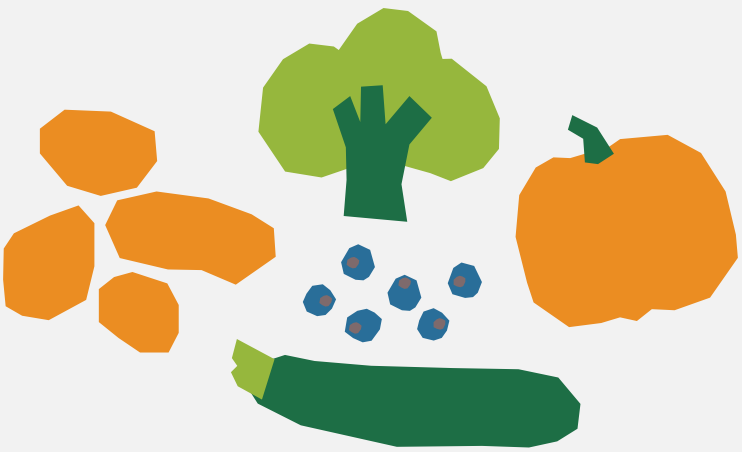
Lastly, catering companies are a target audience of FoodLoops, since they are in the unique position to directly access and work with food waste. Other than preventing food waste in their operations, once created, they can separate it at the source and immediately valorise it into new products, generating new revenue streams when selling them to local farmers. However, to enable this caterers need to be connected to the food system better and gain and understanding of other players in the market to foster collaborations.

2.1.5 Actor interdependencies

All the targeted actors play crucial roles in schools' food value chains and also largely depend on one another. For instance, farmers can be the direct suppliers of schools or caters, who in turn are the customers of the farmers, creating a direct dependency on each other. Municipalities can also play into this mix by facilitating this connection through food programmes or local policies regarding organic food and waste, or simply nutrition guidelines. Especially public schools are strongly connected to municipalities as they are usually funded by the state and thus need to comply with very specific guidelines, some of which will affect these schools' food systems. In light of these clear interdependencies, the goal of FoodLoops is to build additional trust between the actors as well as foster mutual understanding and solutions for the challenges faced.

2.2 The Baltic Sea Region

Food waste is still a major issue in the Baltic Sea Region, with lots of space for improvement regarding the separation and valorisation of bio-waste, especially in Finland, Poland and Lithuania, the focal countries of FoodLoops. However, the topic is gaining importance in the three countries, and all of them have recently started to test new solutions regarding the matter, making them interesting cases to study further. Moreover, other countries in the BSR, such as Denmark and Sweden, have already successfully implemented solutions addressing food waste separation and valorisation. For instance, Sweden has had the topic of food waste on its policy agenda for many years already. The country has undertaken many exemplary measures to cut food waste or use it for innovative purposes, such as implementing pre-treatment steps to food waste treatment to turn it into biogas or bio fertilisers. Further, projects and surveys in schools have helped raise awareness, including the



"Food Weighting in Schools" campaign, which shed light on how much food is wasted in school canteens and educated staff and pupils. Lastly, the establishment of 'SaMMa', a platform for cooperation of food chain stakeholders has enabled cooperation and exchange of knowledge and experiences for the joint reduction of food waste (Filho & Kovaleva, 2015).

These can serve as inspiration for FoodLoops and the planned replication workshops, testing how these solutions can be adapted to function in other countries, particularly Finland, Poland and Lithuania.

Given that these countries have similarly sized agricultural sectors (compared to GDP), they are easily comparable and show a high potential for a bio-waste fertiliser market. Moreover, some municipalities, such as Gdansk, is already showing strong support for organic farmers, increasing the potential for successfully implemented solutions.

2.3 School Kitchens and Canteens

In response to the Joint BSR Strategy for Municipal Waste the FoodLoops project is focusing on school kitchens and canteens because children can play powerful multipliers in the circular food value chains, bringing their knowledge home and thus contributing to avoiding food waste in their households.

The project is addressing several recommendations, namely, to enable waste separation at the source, support the development of demand and markets for recyclable materials and compost, enable stakeholders to engage consumers in the sorting of waste, and involve all stakeholders in waste governance.

3. HOW SHOULD YOU USE THIS MANUAL?

3.1 Project Timeline

The FoodLoops project is divided into several distinct steps, each contributing to development of solutions for bio-waste valorisation in school food chains in the BSR.

3.1.1 Assessing the Local Situation

The first step, preceding the identification of possible solutions and collaboration, is an assessment of the local situation in the relevant regions. This is important to determine individual challenges and enablers to improve food waste valorisation in the different countries' schools and be able to tailor the solutions to them. This step is also crucial to determine the most important stakeholders involved in the school food value chains and analyse their influence on the food systems.

3.1.2 Building Trust

Crucial for any manner of collaboration is to build trust between them. This first official step is to bring together all the involved local stakeholders, including the farmers associations, school administrators, caterers and municipal representatives. Through initial workshops the stakeholders are supposed to agree on areas of cooperation and common goals to close the local bio-waste loop. This is meant to foster mutual understanding and build trust among them through interactive and moderated exchanges.

3.1.3 Co-developing Solutions

Based on these common goals and understandings the local stakeholders next go through a workshop series aimed to co-develop solutions. With a minimum of six workshops in each Finland, Lithuania and Poland, the goal of this step is to develop concrete ideas and action plans to improving cooperation on bio-waste valorisation in schools. Depending on the scope of the developed solutions they may be tested through small-scale pilots with a view on how they could be upscaled. This could include the introduction of bio-waste bins in schools or the optimisation of food distribution in schools but is fully dependent on the outcomes of the co-development process.

3.1.4 Replication

To ensure that the findings of the workshops find their way and application outside of the project and lead to the initiation of similar initiatives, the project findings will be fed into transnational replication workshops. With participation of representatives from all key stakeholder groups from Finland,

Lithuania, Poland and Germany, the aim is to increase the institutional capacity or all stakeholders and empower them to initiate new cooperation processes, bringing together even more local farmers, schools, and caterers.

3.1.5 Feedback, Validation, Clustering with Others

Last but not least, the transnational replication workshops allow for the collection of feedback from all the stakeholder groups which can subsequently be evaluated for the future. Furthermore, the FoodLoops project joins an existing stakeholder network, which implies that regular online meetings will be held that allow for the exchange of experiences, inspiration and the alignment of activities to avoid overlapping work. This also allows for partner associations to be inspired by the project outcomes or give their own ideas, fostering collective learning, capacity building, and builds stronger regional and transnational collaboration.

Chapter 2

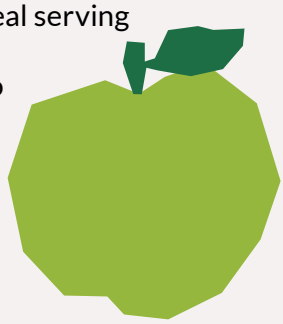
1. CURRENT STATUS QUO OF CHALLENGE OF FOOD WASTE IN THE FOODSERVICE SECTOR

Food loss and waste represent a significant contributor to agriculture's impact on climate change, accounting for approximately 3.3 billion tons of CO_2 emissions each year. Additionally, it raises further environmental concerns, including land use, water consumption, and a decline in biodiversity. Much of the food that is produced is lost or wasted throughout the supply chain. It is estimated that globally about 1.3 billion tons of food is lost or wasted per year (Leal Filho & Kovaleva, 2015). This constitutes a significant global challenge considering that large parts of the world population are still affected by food poverty while the large amounts of food production and waste from the developed countries lead to environmental degradation and greenhouse gas emissions.

In Europe, most food waste relates to factors such as consumer behaviour, food quality standards, legislation and lacking cooperation between the different actors in the food value chain (Leal Filho & Kovaleva, 2015). This spurs questions on how food loss or waste can be avoided at different stages in the food value chain. One crucial step within the value chain to consider in food waste prevention is the food service sector, which in the EU is estimated to cause 10.5 million tonnes of waste per year, about 12% of the total EU food waste.

1.1 Status Quo of Food Waste in the Food Service Sector

The foodservice sector includes different aspects, such as school, work or university canteens, restaurants, communal food services. Especially school canteens are considered to contribute significantly to food waste. During the different stages within schools' food value chain, from processing in kitchens, to serving and consumption, a lot of food is wasted, with both avoidable and unavoidable waste (see Section 3). There are many different factors influencing this, from portion sizes and canteens' atmosphere to meal serving method and time and communication between administrative staff and the canteen staff (Derqui et al., 2018; Dhir et al., 2020; Pancino et al., 2021; Priefer et al., 2016). As studies from Germany show, catering companies and schools contribute to about 17% of total food waste (Leal Filho & Kovaleva, 2015). Considering all these



factors, there is a lot of potential to reduce waste during all of these stages and improve the organic waste valorisation at the end of the value chain through collaborative solutions turning waste into value.

With a focus on the Baltic Sea Region (Finland, Poland and Lithuania), such comprehensive information is still lacking. However, it has been estimated that in Finland, household food waste is responsible for 46% of national food waste (Katajajuuri et al., 2014; Riipi et al., 2021), while in Lithuania households are responsible for approximately 43,7 kg per capita (Ei□ait□ et al., 2022). It can be assumed, that the proportion of food waste caused by the food service industry, and especially school canteens, also reaches significant levels in these countries.

2. VALUE CHAIN STAGES

The food value chain consists of multiple steps, each crucial to consider where food loss or waste are generated and what potential causes and solutions might be. Even when considering only the food service sector and school canteens, each step of the value chain is still critical to consider understanding the whole picture and tackle sources of food waste.

Considering the operational steps of the food value chain within schools, it should first be mentioned that there are several ways in which these steps can be organised. Generally, public authorities play an important role with both procurement and catering. They can choose to either outsource the service to external contractors or provide in-house catering. While in the past most schools in the Baltic Sea region have had their own kitchens where food was prepared directly, recently outsourcing to central kitchens and catering companies has become a trend. Within the latter option, central kitchens can choose from providing fresh hot meals, or pre-cooked meals, which can be either chilled to be heated up or cold meals that are cooked completely at the site. Thus, there are several ways in which food goes from the procurement to the serving stage.

It is also crucial to note, that any changes to the structures within school's value chains, such as changes to sustainability levels, usually need to come from public authorities. However, initiatives can also come from smaller actors, including schools, for instance to collaborate with local farmers for the food supply.

2.1 Production

The first step of the food value chain is the production of foods, such as grains, vegetables, fruit, meat and other animal produce. It involves the growing and harvesting of food. Food crops face challenges from adverse weather conditions, which can lead to losses before harvest. Since natural factors, such as temperature and rainfall are key drivers of crop growth, the effects of these factors can be observed in all forms of outdoor agriculture.
Therefore, the production phase is a critical stage in the value chain, as it not only gives rise to potential food losses (due to weather conditions etc.), but also sets the quality and quantity of the food entering the next stages, and thus influences food waste later in the value chain, including waste resulting from surplus or low quality.

In schools, food production may be linked to supply from local farms or even food grown directly by the school. However, most school kitchens or catering companies will source the raw food from external producers, while the processing takes place either in school kitchens themselves or catering companies.

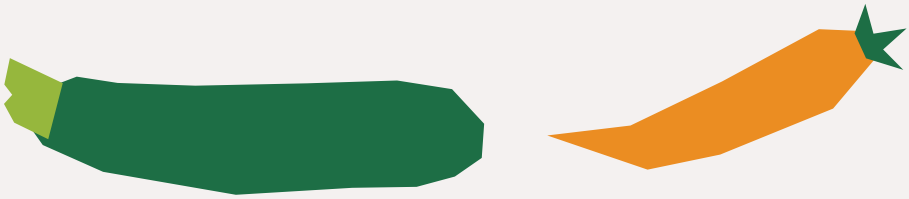
2.2 Distribution

The distribution stage in the value chain refers to the transportation and delivery of food from the primary producers to destinations such as retailers, processing sites, or directly to the consumer. It thus has a heavy focus on transport logistics, and factors such as the correct cooling, transport duration and storage may have a critical influence on food waste, as it can, for instance, cause spoilage or damage of foods.

In the school context, if schools prepare their meals themselves, they may receive fresh produce from local farms or other suppliers directly to their kitchens. To avoid food waste at this stage, efficient transportation is critical to ensure the freshness of food and avoid waste. School food system decision makers, such as administrative or responsible kitchen staff can play a critical role at this stage in preventing future food loss with the food they order. This goes together with menu planning (see section 2.3) and choosing foods that pupils are more likely to eat. Further, school administration needs to have proper knowledge of how much food is required to feed pupils and order a suitable quantity to avoid kitchen surplus.

2.3 Processing (School Kitchens or Catering Companies)

During the processing stage, the fresh produce is converted into processed foods for consumption. This may include anything from cleaning the food, to cutting, cooking, packaging or preserving it. Correct processing is a crucial step where food waste may be created but also prevented. Processing can cause especially unavoidable food waste, as many parts of the products that are not edible are removed and discarded. However, processing can also avoid food waste later on if is preserved in a way that makes the food last longer.



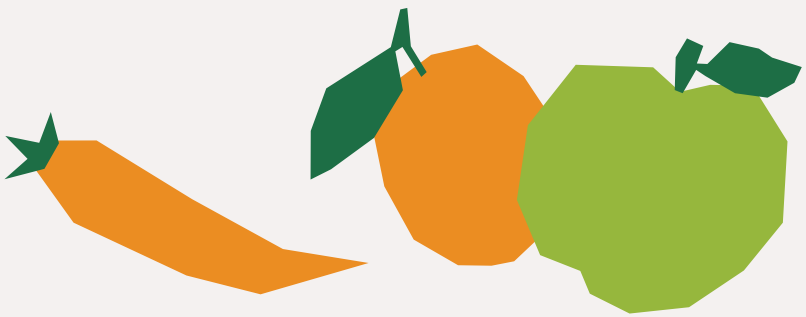
Schools can either process food themselves or outsource this step to external catering companies. If they have their own kitchens, schools can prepare the meals themselves. Schools that do not have a kitchen might streamline meal preparation externally in large kitchens or through catering providers. Regardless of where the food is prepared, the processing is carried out by food professionals such as cooks.

A crucial step preceding the processing of food is the planning of the school menu. If used, an external caterer might prescribe a menu through the contract with the school, otherwise the school needs to plan the menu themselves. Many factors need to be taken into consideration, such as nutritional requirements and meal variety, and environmental factors. Not only do certain products have a higher environmental impact, but choosing meals that students are less likely to eat may also result in more food waste (Benvenuti et al., 2016). Therefore, a school's choice of the right menu can critically influence food waste, and trying to avoid food waste through the right menu will in turn influence what foods to procure and how to process them. While on-site cooking provides more flexibility in choosing the school's menu, if external caterers set the menu, school decision makers will need to collaborate with them to work towards a reduction of food waste through the right menu.

Furthermore, there are often national regulations or municipal measures regarding schools' food programmes, nutritional requirements and food waste, making policymakers and health professionals important actors to collaborate with for healthy and sustainable menus (Balzaretti et al., 2018: Benvenuti et al., 2016). Governments and regulators set food safety regulations to ensure children receive healthy food at public schools by mandating standards for the quality and freshness of the food served.

2.4 Consumption

As the name suggests, consumption is the stage where the food is prepared for consumption and then eaten. Importantly, the preparation only includes steps that were not taken during the processing, as to ultimately prepare the food for consumption, such as through cutting, peeling or cooking. Further, it includes the choice regarding the manner of how the food is served, which can be either in buffet style or as portioned meals, followed by the consumption by pupils and staff. It is also the stage where most of school's food waste will emerge, namely due to waste generated in the kitchen (expired foods and non-edible parts), during serving, and from meal leftovers. The cosmetic standards for fruits and vegetables can also impact food waste at the consumption stage; if produce is misshapen or superficially bruised, it is often rejected by the pupils.



The consumption stage also relates to the most important actors within the school food system. The preparation of meals in kitchen, serving and cleanup naturally involves kitchen and school staff, but also the school administration responsible for ensuring good communication between the kitchen, suppliers and administration. This is critical to determine the right amounts of food ordered and meals produced, which influences the level of food waste. The serving and consumption stage also includes pupils as important actors.

2.5 Waste Valorisation

The last stage of the food value chain, valorisation, is preferably avoided by preventing food waste in earlier stages. However, once there is waste, it is important to manage it in a way that recovers some of its value and finds other purposes. Waste valorisation is the concept of recovering food waste's biological and nutritional value, using it to develop new products. Valorisation includes the reincorporation of food waste into the food supply chain, in line with the circular bioeconomy (Gómez-García et al., 2021).

Food waste and by-products can be converted into new products and resources, such as other food products, energy, compost, or animal feed. The food waste hierarchy (see Section 4) gives a good overview of what the most preferable ways to manage food waste are.

Valorisation may also be an actionable step for schools, who can implement waste management activities such as composting their leftovers, implement food sharing programs or recycling it for other purposes. It can be relevant for schools' management staff to engage with valorisation steps to save resources and raise awareness among students and staff.

3. FOOD LOSS VS FOOD WASTE

The Food and Agriculture Organisation (FAO) published the most well-known definition of food waste, defining it as "Wholesome edible material intended for human consumption, arising at any point in the FSC that is instead discarded, lost, degraded or consumed by pests." According to Papargyropoulou et al. (2014), Smil (2004) adds that food waste encompasses the aspects mentioned by the FAO, but also over-nutrition, defined as "the gap between energy value of consumed food per capita and the energy value of food consumed per capita". Stuart adds that "food waste also includes edible material that is intentionally fed to animal or is a by-product of food processing diverted away from the human chain." (Papargyropoulou et al., 2014, 5).

Thus, food waste encompasses edible material that is discarded, lost, consumed by pests or redirected for other purposes than human consumption, and over-nutrition.

3.1 Food Loss

Food loss generally seems to refer to early stages of the value chain during production, harvest and processing. Thus, it refers to food lost at the start of the chain, rather than being wasted. Reasons for food loss relate more strongly to infrastructural or technological issues, as well as climate conditions (Dhir et al., 2020).

3.2 Food Waste

Food waste occurs during the later stages of the food supply chain including retail and consumption. It is more closely related to behavioural factors, such as attitudes towards food waste, meal traditions and preferences. The concept of food surplus also plays into food waste, which is the food produced beyond our nutritional needs, leading to food waste (Dhir et al., 2020; Papargyropoulou et al., 2014).

3.2.1 Avoidable Food Waste

A further distinction should be made between avoidable and unavoidable foot waste as it illustrates the degree to which food waste can be prevented. Avoidable food waste generally refers to food wasted because it is no longer desired, spoiled or beyond its best before date. It is usually food considered edible by most people, meaning that despite certain cultural differences, most people would consider the parts edible (Papargyropoulou et al., 2014).

3.2.2 Unavoidable Food Waste

On the other hand, unavoidable food waste refers to food that is generally not edible, at no stage during its lifecycle. This may be parts of certain foods such as bones, peels, skins or pits. (Papargyropoulou et al., 2014). There is also potentially avoidable food waste, which is food that is not always consumed but sometimes, such as potato skins (Dhir et al., 2020).

On the contrary, unavoidable food waste refers to food that is generally not edible, at no stage during its lifecycle. This may be parts of certain foods such as bones, peels, skins or pits. (Papargyropoulou et al., 2014). There is also potentially avoidable food waste, which is food that is not always consumed but sometimes, such as potato skins (Dhir et al., 2020).

3.3 In the School Value Chain

Food waste in school food value chains come from three primary sources: Kitchen waste, serving waste, and plate waste. Kitchen waste is caused through spoiled products, incorrectly prepared food, expired products (avoidable waste), and from the non-edible parts of vegetables and meats (unavoidable waste). Serving waste is mainly due to overproduction of food and resulting leftovers in the canteen (avoidable waste). Further, some serving waste results from non-edible parts of vegetables and meats that could not be removed during the preparation stage (unavoidable waste).

Lastly, plate waste results from consumer leftovers, thus what pupils leave on their plates because it was too much food (avoidable waste), as well as non-edible parts such as peelings or bones (unavoidable waste)

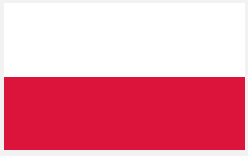
Research has also analysed reasons for food waste in school canteens, grouping them into **behavioural drivers**, operational drivers and situational drivers. Under behavioural drivers the scientists understand factors such as attitudes towards food waste and habits by pupils.

Operational drivers refer to the efficiency in the school canteen management, procurement guidelines, attention paid to dietary habits, menu composition or level of communication between the canteen and school management regarding number of meals to be prepared.

Lastly, **situational drivers** may be the canteen environment, which can increase plate waste if the canteen is noisy or crowded, or if there is not enough time to eat. They can also include aspects such how easy it is to eat a meal or the aesthetics of the meal (Derqui et al., 2018; Dhir et al., 2020). It appears that especially the communication between kitchen and school administration plays a crucial role in avoiding waste, as it may help estimate the number of meals required and thus reduce serving waste. However, regulations and contractual obligations can also influence levels of food waste in school canteens, as schools may be obliged to purchase certain amounts and kinds of food for the duration of a contract.

3.3.1 Finland

Finish schools provide meals either by preparing them in their own kitchens or they get them delivery by catering companies. A case study by Silvennoien et al. (2019) in Finish school canteens found that around 17.4% of food prepared in schools is wasted. Distributed over the three relevant categories of food waste (kitchen waste, serving waste, plate waste), the study found that this kitchen waste made up 2.2%, serving waste 11.3%, and plate waste 3.9% of the total food waste in schools. This makes serving waste the largest share of food waste in Finish schools. This was also confirmed by a study by Katajajuuri et al., in 2014. This may be due to very short lunch times of between 15 and 30 minutes, which may not allow students to finish the plates. Further, it was noted that students have requested improvements to acoustics, aesthetics and queuing in school canteens, tying in with situational drivers for food waste.



3.3.2 Poland

In Poland, most schools are equipped with a kitchen where meals are heated, while schools without kitchens receive their meals from catering companies. It has been noted that students have very little time to eat their lunch with an average of only 20 minutes. This, in combination with oversized portions leads to a lot of plate waste. Further, a challenge in larger schools is that mealtimes may be very early to logistically handle the crowd in the cafeteria, which affects the hunger levels of students. Hence, the level of food waste in Polish schools is very high.

3.3.3 Lithuania

In Lithuania some schools prepare food on-site, ensuring fresh meals for the students, while others rely on the external catering services where meals are delivered and/or then heated at the schools. With some exceptions, pupils typically have around 20-30 minutes to eat their meals. In big schools, younger pupils often eat earlier (not during the main break), which means that they have less time to eat and are not hungry enough to finish their meals. Due to this, plate waste is a prevalent issue. National estimations show that 60,4% of food waste at schools is plate waste (2021). A recent study (2024) of a primary school with six classes showed that some 180kg of edible food waste wasted within 10 days. Depending on the catering approach some 5 to 20% of prepared meals are wasted at schools.

4. HIERARCHY OF FOOD WASTE

The hierarchy of food waste is a tool introduced into European food policy with the 1975 Directive on Waste. Its purpose is to aid waste management as a framework to determine the most effective and favourable actions regarding food waste. The hierarchy is an upside-down pyramid, with the most desirable option of waste management on the top, and the least desirable option on the bottom. Importantly, the ranking shows the most favourable option for environmental factors rather than economic factors (Papargyropoulou et al., 2014).

Starting at the bottom, the least favourable way to manage waste is through plain **disposal**, where food waste is discarded in landfills. This is clearly not desirable, since food degrading in landfills releases greenhouse gas emissions and uses up space.

The second least desirable action is **recovery**, implying that food waste is turned into energy through anaerobic digestion.

Recycling of food waste into animal feed or compost forms the mid-level of the food waste hierarchy, as it maintains some use of the food for other purposes.

The second-most desirable option is **re-use** of surplus food for human consumption, distributing surpluses to poor communities and people affected by food poverty. This involves redistribution networks and food banks as central player in food management.

The most favourable way to manage food waste is to **prevent** it from coming into existence. This implies stepping in early in the value chain, avoiding the generation of food surpluses during the production and consumption stages. However, prevention of food waste remains relevant throughout the entire value chain, tying back into food management practices to avoid avoidable food waste during all stages of the supply chain.

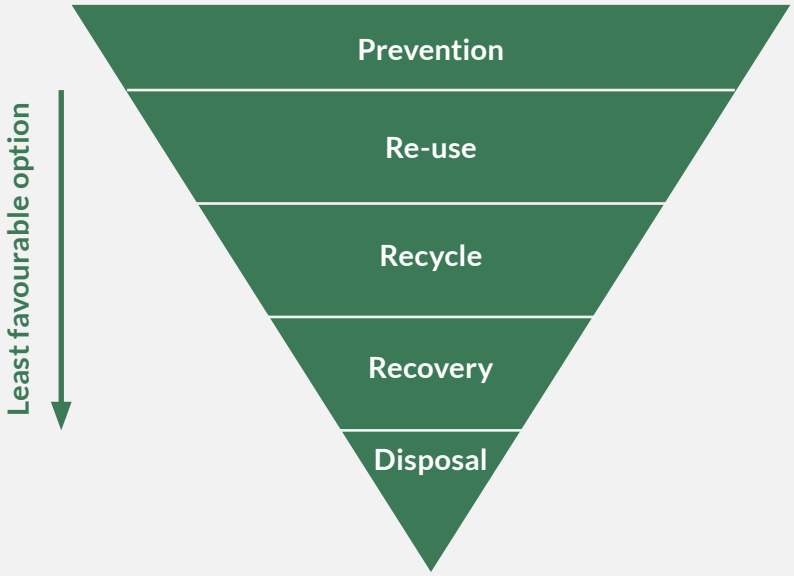


Figure 1: The Waste Hierarchy

5. WASTE VALORISATION – COLLABORATION BETWEEN ACTORS IN THE SCHOOL FOOD SYSTEM

As the Hierarchy of Food Waste shows, waste valorisation and prevention play a crucial role in a circular bioeconomy pertaining to food. Not only does it contribute to the creation of new resources, such as animal feed, energy and fertilisers, waste prevention can contribute to a reduced need for production by avoiding or re-allocating surpluses (De Menna et al., 2020).

A crucial step to achieving proper waste prevention and valorisation, collaboration between the many different actors within the value chain is crucial. This is not only important along the general food supply chain, considering for instance the collaboration between local producers and retailers regarding food quality standards, but also in the specific school food systems. For example, studies found that the communication between kitchen staff and administrative staff within a school can support the avoidance of food waste by communicating the exact number of meals required. This contributes to avoiding surpluses in the preparation of food and thus avoid serving waste (Derqui et al., 2018; Silvennoinen et al., 2019). Furthermore, close collaboration with suppliers of school meals, such as local farmers or catering companies can create agreements tailored to the momentary needs of a school and thus avoid waste (Dhir et al., 2020). Lastly, education of all

relevant actors in the school food system, including cooks, pupils, or managerial staff, regarding food waste can increase awareness and improve attitudes towards preventing food waste and improve collaboration (Derqui et al., 2018).

One possible solution for food waste valorisation in schools is composting leftovers, either in close-by offsite composting facilities, or in the schools' own gardens. Either way, schools can separate their food scraps from those that are recyclable and those that are not, and this way prepare their leftovers for composting. If a school chooses to handle the composting on-site and also has a school-own garden, this can create a full soil-to-soil loop and can constitute a sustainable strategy for schools. According to the Vermont Agency of Natural Resources (1996), there are different ways of setting this up, with one of the easiest methods being a Bin Compost System. The agency published a full guide for schools how to set up such systems.

The alternative for schools setting up their own compost would be to collaborate with farmers on composting projects, where farmers would receive the leftovers from schools. There are different benefits and value propositions coming from this, such as increased access to compost for producers, reduced need for chemical fertilisers, improved soil quality, and, of course, a reduction of non-valorised food waste (USDA, 2024).

Chapter 3

1. IDENTIFYING CHALLENGES AND MAPPING STAKEHOLDERS

The FoodLoops project initiated the process of identifying challenges to the circular food system in schools through a workshop. During this workshop, two methodologies were applied helping the project partners determine their focal challenges, as well as map their relevant stakeholders. These two methodologies, the Impact-Effort Matrix for problem assessment and the Power-Interest Matrix for stakeholder mapping, will be explained below for readers of this manual to draw upon as inspiration for replication efforts.

1.1 Identifying Challenges: The Impact-Effort Matrix

Traditionally used as a tool for the assessment solutions and root cause analysis, the Impact-Effort Matrix can be used to assess a set of challenges for their impact on the problem and the effort required to resolve them. The method relies on a diagram, with the impact of the solution/ challenge mapped against the y-axis, and the effort to implement/ solve it on the x-axis. Below there is a short outline of the steps of this methodology

1.1.1 Determine Challenges

The successful use of the matrix requires that some initial research is conducted to come up with a set of challenges that are to be assessed. In the FoodLoops project, the CSCP provided this list through previous desk research. With this list, the participants can further brainstorm and adapt the challenges before mapping them on the Impact-Effort Matrix.

1.1.2 Draw Up an Empty Diagram

Figure 1 below shows how the matrix should look like, with the impact of the challenge mapped on the y-axis, and the effort to solve it on the x-axis. This results in four quadrants, giving an indication on the priority of the challenges later on.

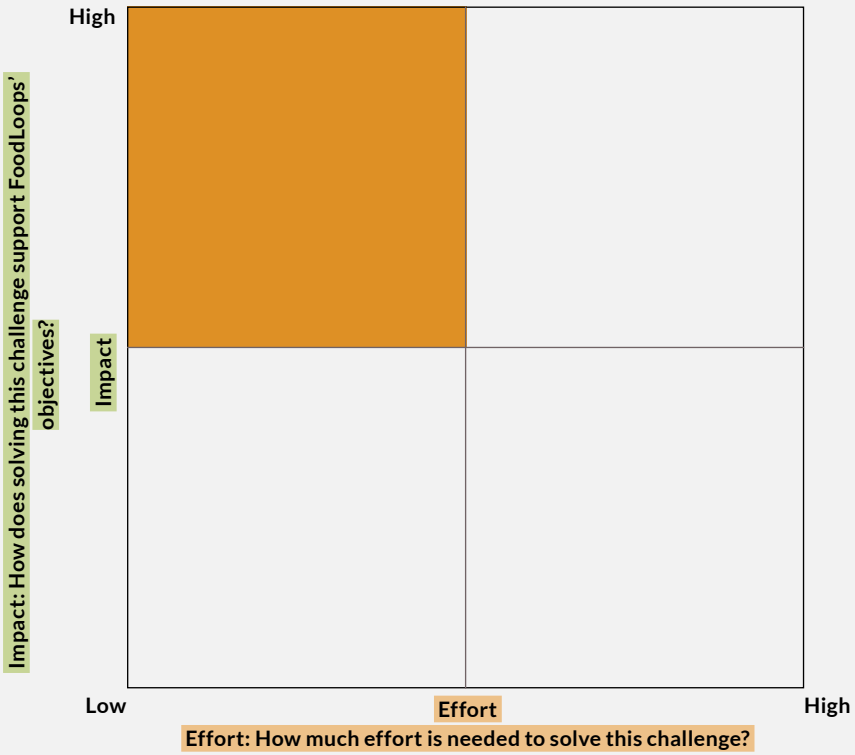


Figure 2: The Impact-Effort Matrix

1.1.3 Assess Impact and Effort

Each identified challenge should now be assessed for their impact on the problem and the effort required to address it. According to this, the challenge is placed on the diagram. The higher the impact, the higher it should be placed along the y-axis, and the higher the effort, the more it should be placed on the right.

1.1.4 Evaluate Priority Challenges

With all challenges placed on the diagram, there should be a good overview of how these challenges differ in their impact and effort, which in turn can give an indication which challenges should be prioritised. Generally, challenges places in the upper left-hand quadrant should be addressed first because they have the highest impact on the problem, making them urgent to solve, and simultaneously do not require the most effort to be addressed.

On the contrary, the challenges placed in the lower right-hand quadrant should not be prioritised due to the high efforts required to solve them while they do not have as much impact. Problems placed in the other two quadrants (high impact – high effort and low impact -low effort) might be considered as well, but should not come first.

The evaluation might also reveal surprises, especially if the participants were rather fixated on a particular challenge before, but which then for instance turns out to be higher in effort to resolve than another, equally impactful challenge.

1.2 Mapping Stakeholders: The Power-Interest Matrix

Similar to the Impact-Effort matrix to map challenges, the Power-Interest matrix is a useful tool to categorise stakeholders relevant to a given situation or challenge. It can help determine which stakeholders are most important to collaborate with, which ones need to be engaged or informed to a certain extent, and which ones might not be as critical to involve.

The framework functions similar to the first one, sorting stakeholders into four distinct quadrants. The two variables against which they are assessed are:

1) Power/Influence: The stakeholder's power to influence the situation
2) Interest: The stakeholder's interest in the situation or the outcomes of the proposed change

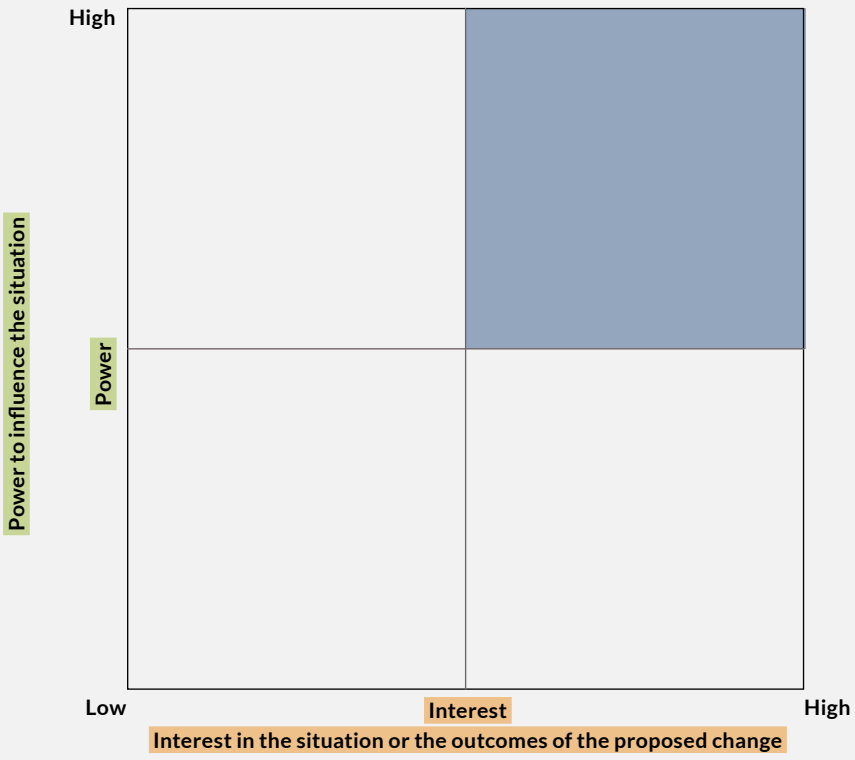
The steps for mapping stakeholders are very similar to those of identifying challenges.

1.2.1 Determine Stakeholders

Before stakeholders can be assessed for their influence and interest, they need to be identified first. This means coming up with a list of any stakeholder that might in some way be relevant to the problem. Importantly, this step should not restrict itself to the most influential/interested ones, since they will only be determined through the analysis. Thus, this list should also include stakeholders which, at least at the first glance, do not seem critical to the situation, since the findings might always differ from initial expectations.

1.2.2 Draw Up an Empty Diagram

The Power-Interest matrix looks very similar to the Impact-Effort matrix, with influence mapped on the y-axis and interest on the x-axis.



1.2.3 Assess Impact and Effort

Now each stakeholder is placed on the matrix according to their level of influence and interest in the subject. The stakeholders with higher power are placed higher along the y-axis. The higher their interest, the further they need to be placed to the right. This requires a careful analysis of the stakeholders, since sometimes it is not immediately clear how influential or interested, they are.

1.2.4 Evaluate Most Critical Stakeholders

The four quadrants on the matrix indicate which stakeholders are the most important to consider and how should be dealt with each of the categories.

- **High influence/high interest:** The upper right-hand quadrant indicates the stakeholders with the highest influence and highest interest in the problem or situation, making them the most critical stakeholders to engage with. They should be collaborated with very closely, since their influence on the situation will be crucial for the outcome of the suggested change, and their interest in the outcome can make them close allies – or strong opposition.
- **High influence/ low interest:** The upper left-hand corner includes stakeholders that still hold a lot of influence over the situation but are not as interested in the outcomes. As such, they can still be important supporters and should be kept close, ensuring they maintain satisfied to avoid them blocking the suggested change. Thus, they should still be engaged, but not on such as close level as the first group.

- **Low influence/ high interest:** The lower right-hand corner consists of stakeholders that are strongly affected by the situation and any changes within it. While they do not have as much influence over the situation, for instance due to lack of political or market power or financial assets, they are still an important group to consider. Due to their closeness to the situation, they might wield important knowledge and have concerns that the solutions proposed might address. Therefore, they are important to collaborate with to understand their interests and gain their support. Moreover, even though an individual stakeholder in this group might have little influence, there might be collective power if several stakeholders from this category act together.

- **Low influence/ low interest:** With neither a strong influence over the situation, nor a particular interest, the lower left-hand quadrant stakeholders are arguably the least crucial ones. They might also be hard to collaborate with due to their low stake in the matter. Nevertheless, they should remain informed about the situation, since their interest or influence may increase depending on changes to the situation or the direction of the solution.

2. CASE STUDIES

The FoodLoops project works together with three partner regions in Finland, Poland and Lithuania. Each of the partners are applying the steps and methodologies discussed above. This manual will use the case studies of the partners to display how the steps and methods can be used in practice.

2.1 Kuopio, Finland

2.1.1 About Kuopio

Kuopio is located in the North Savo region in Finland. The municipality consists of about 124.000 inhabitants. The region can be classified as a lake area with many forests and agricultural land. The city´s economy is characterised by a strong primary production sector, particularly milk and meat products. The relatively closer position of schools to farms compared to bigger cities like Helsinki opens a natural path for collaboration between schools and the local food industry.

There are 43 schools in the area. In addition, there are nine vocational schools. Most of the food is delivered to the schools by one centralised lunch service provider, Servica. Some schools subsequently heat the food or prepare it further if they have a kitchen. Lunch time is very short with only 15 to 30 minutes for pupils to eat their meals. On average there are 500 pupils per school, which may lead to some logistical issues for meal provision.

Also notable about the region are its inhabitants' dietary habits. Due to the colder climate in Finland, the Finnish diet is traditionally meat-based with fewer vegetarian options. Nowadays, many people still like to eat traditionally, which has so far limited the spread of vegetarian and vegan diets. In fact, labelling food as vegetarian has been noted to deter people from consumption.

2.1.2 Identifying Challenges of Kuopio

Following individual conversations with key stakeholders, the partner organisation attended FoodLoops' initial kick-off workshop where they worked together on the Impact-Effort matrix to identify challenges. Following this, the partner conducted more conversations and interviews with stakeholders to gain a better understanding of the identified challenges. A discussion with municipal representatives revolved around important aspects of challenges regarding food waste reduction. Interviews were conducted with the staff of four different schools and the catering company Servica, and the partners attended quarterly meetings of one school where Servica,school staff and pupil representative discussed their collaboration. Furthermore, the project partner distributed a questionnaire to pupils, with a total of 126 respondents.

Through this, the partner came to an initial set of information. The questionnaire distributed to pupils revealed that **pupils on average prefer traditional food**, with some asking for **more variety and vegetarian options**, though the **naming of vegetarian dishes** also came up. Further, some students asked for **improvements on the canteen environment, such as better**

acoustics, decoration, or queuing solutions. The partners found out that the **school staff does not get trained on food waste issues**. However, these topics are addressed in sustainability weeks. In multiple schools, there are info screens showing images of food waste. Overall, pupils were positive about the reduction of food waste in their schools. **There have been some discussions about food waste tracking applications** and some schools have experience of piloting applications in other areas, e.g. wellbeing and health. The practice showed that users' activity lasted for a relatively short time. One option would be to include signing-up to to Wilma that is a Finnish web-based student administration system used by schools to manage communication between teachers, students and guardians. It includes tools for tracking grades, attendance, assignments, and messages.

A range of **cooperation areas** were determined during the initial kick-off workshop and based on the subsequent research. Additional challenges that were found were **the issue of assessing demand for food correctly, adapting food menus to meet student preferences (in line also with the demand for more vegetarian options and variety as revealed in the questionnaire) and how to improve the atmosphere in school canteens (as was also criticised by some pupils in the questionnaire).**

2.1.3 Identifying Relevant Stakeholders

The identification of relevant stakeholders occurred primarily via a snowballing system of the partner organisation. Through previous projects carried out with relevant stakeholder groups (including Servica) and the municipality, there had been existing contacts that the project partner could draw back on. Beyond this, partner schools were found through a small exploration and conversations with representatives to determine which schools were the most enthusiastic and suited to the project. This excluded some schools who did not have enough time or resources, and whose requirements to school lunches (for instance if the canteen was closed to outsiders) made it too complicated to carry out the project activities.

Contrasting to the other stakeholders where contacts already existed to were easily identified, contacting farmers was slightly more complicated. Because Kuopio applies a centralised food service for schools, with Servica being the only supplier, it was found difficult to engage small farmers in the projects who are not usually involved in the school food chain. The core question for generating the interest of small farms was thus how to adapt the model to make it work for their interest and how to include them in the circular food chain.

2.1.4 Building Trust with Stakeholders

Having determined the relevant stakeholders, the Savonia proceeded with efforts to establish trust with and between them. Due to past projects carried out with key stakeholders such as Servica, the municipality and schools, there was already a strong base level of trust on which the project partners could build further. Many past and ongoing projects offered collaborative workshops with schools and other stakeholders, meaning that the process of solving common challenges was not a new one to most involved parties. The

project partner built on this further through regular meetings and a knowledge exchange on food waste through networking events.

More concretely, the project partners had individual meetings with important stakeholders. A visit to a Dairy farm helped to map and understand challenges and opportunities in developing cooperation with the local school food system. Moreover, a meeting with a network company marketing Finnish vegetables gave access to a large network of farmers and opened the door for a possible collaboration with the school food catering company Servica.

During these multi-stakeholder meetings, a range of cooperation areas was identified that reflected how the stakeholders would address each other's needs, interests and motivations. The first area of cooperation is targeted catering companies and school food providers and addresses the challenges of assessing demands for school meals correctly. Another cooperation area relates to school administrators, educators and school cooks, aiming to adapt school food to children's preferences. Lastly, one area targets the same stakeholders, but with the goal to improve the presentation of food and atmosphere in school cafeterias and involves cooperation with multiple relevant stakeholders such as pupils, student unions, principals, teachers, and kitchen staff.

However, when it came to establishing trust with small local producers, establishing trust was more difficult, because they are usually not included in the local food value chain due to a lack of competitiveness with the established players. It was therefore a challenge to find a way to include them and convince them that the project should benefit them, too.

2.1.5 Co-Developing Solutions

In the effort to co-develop solutions within the project, the project partners in Kuopio organised six workshops. The first was organised with staff and pupils from basic, upper basic, and high schools, as well as a vocational school and the catering company Servica. The goal of this workshop was to identify underlying challenges and their **solutions to increase the attractiveness of school lunches to students.** The brainstorming topics included the following:

- tested applications: benchmarking existing applications, ResQ, Power Bi reporting, maistuvakoulu.fi, neuvokasperhe.fi, nykytila.fi

- sale of surplus lunch: surplus food for food aid, surplus lunches offered to each center, surplus lunch sales for schools (at the moment six schools), ResQ is applied in Nilsiä, could Savo Catering organise surplus lunch sales?, surplus food for free to high school students following the City of Oulu.

- utilization of organic waste: Does the food from rural schools end up as organic waste? (The sorting obligation does not apply.), How could we know which ingredients/parts of food end up as waste? From an environmental perspective, there is a huge difference between whether it is meat/protein or vegetables that are wasted.
- conducted experiments: taste panels, good experience with the surplus lunch program, Food community model
- predicting the number of meals: Utilizing the Tuudo app: For example, in the “Restaurants” section, there could be an option to sign up for lunch attendance. As motivation, users could receive a free coffee after a certain number of sign-ups, linking waste amounts with meal types, Customer cooperation: School/preschool-specific numbers are known Preschools, the customer makes the orders., Could secondary school students “reserve” or register their participation in meals through Wilma or another app?, Notify the number of students in different fields, e.g., during work-life placements.
- value proposition in brief: Servica is committed to reducing waste by 15% by 2025. Controlling service waste, the most important table in the municipality is the children’s dining table.
- upcoming experiments: from school cafeteria to school restaurant, aromi14 waste tracking, expanding the ResQ app, minimizing waste in the teaching kitchen food preparation, creating a comprehensive school lunch survey at the city level (for high schools), creating a food education yearly calendar together with the school

In addition what emerged were the potential solutions such as rebranding the school canteen to become more attractive, reduce queues at the buffet, and renaming vegetarian food to the name of the food it is made with.

The project partner carried out interviews and a questionnaire with the school staff and pupils. According to staff, the consumption of school lunches has decreased in recent years. Results were presented to the schools and representatives from Servica. The second workshop themes were **how to expand the presence of info screens in schools, displaying information about food waste, to improve the aesthetics, comfort and acoustics of canteens, make queuing arrangements more efficient, rename vegetarian food to the names of the main ingredients and to dedicate more days to food and involve students better in the menu planning.** The findings of the interviews and questionnaire were also analysed in a subsequent and separate event with representatives of the municipality, Servica, and the collaborating

project Agri Food. This session aimed to identify factors that prevent food waste in school canteens and suggested solutions such as using **positive food speech, improving the timing and duration of the lunch, and making the canteen branding more appealing.** In August a workshop with the Implementing organised climate work in North Savo region project was organised to plan collaboration across projects. The event gathered online around twenty five participants repsentings schools, municipalities and waste management companies. The topics related to materials to be developed and disseminated, communication throughout project cycles, schools' and food producers' collaboration and how to include agricultural and food associations into RDI and education, using existing material on food waste and utilisation of left over food in education and training, organising tastings at schools, increasing use of vegetarian food, utilizing left over food in waste battle, co-operation with retail groceries, sustainability activities according to the yearly calendar of the local waste management company and implementing the use of carbon foot print calculators at schools.

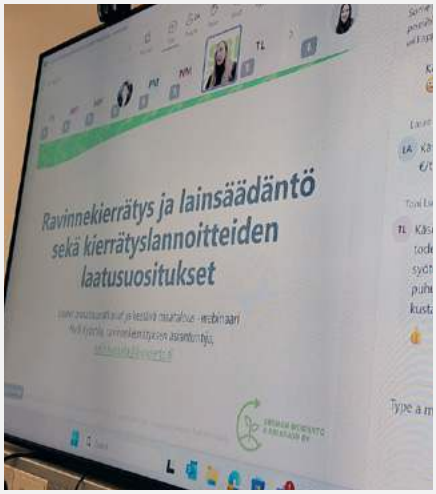
The fourth workshop took place in conjunction with the national waste week in September. The event titled *Superpower from School Lunch* was hosted digitally and organised in collaboration with the Implementing organised climate work in North Savo region. About 50 participants represented pupils, teachers, waste management company, municipalities and parents. The participants discussed three themes: Why do pupils not eat the school lunch and what to do about that, how to eat by listening to your body, and how to increase vegetarian food options. Presentations and conversations revolved around topics related to health, wellbeing and nutrion, impacts of food waste on climate. **The high involvement of pupils and parents in this workshop was regarded as highly important by the project partner**, especially since it is seen as difficult to involve them in the conversation without invoking guilt about their way of teaching their children about food at home. During the national waste week, Savonia UAS entrepreneurship course students produced three short videos on creative ways to use left over food. The videos were broadcasted in social media and they gathered more than 1500 followers.

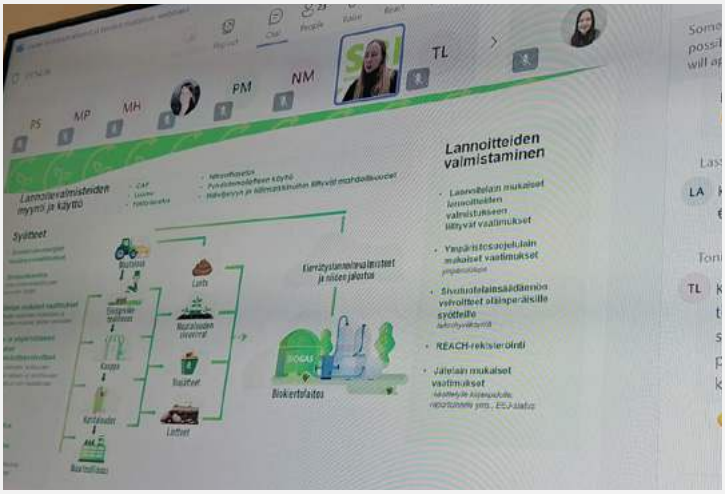
End of October, the fifth workshop involved a visit to a local milk, dairy and grain cultivation farm with 17 high school students and two teachers of the sustainability studies course to familiarise students with primary production. The event focused on farming industry, food origin, food value chain, food production and consumption as well as biowaste valorisation. The owner of the farm introduced participants to milk production, robotic barn and grain farming. The event offered students, teachers and FoodLoops project an opportunity to brainstorm ideas on how to integrate various aspects of food value chain across school curriculum. Based on the feedback, students learnt about the modern technology, how farming has evolved, e.g. technological and environmental requirements as well as the scale of production profitability and farming as livelihood.

Farm visit with pupils

In December, the 6th workshop titled *New Bioeconomy Solutions and Sustainable Agriculture* was held for twenty-four participants. The webinar focused on sustainable agriculture, biowaste valorisation as well as innovations and new expertise. In addition, the aim was to increase opportunities for cooperation between schools, primary production, food service operators as well as circular economy companies.

The event was launched with the FoodLoops project aims and results and laboratory services of Bio and Circular Economy research area of Savonia UAS. The key note speakers focused on themes of the recycling of biowaste into fertilizer products for agriculture and substrate production, projects supporting agricultural production and technologies in the production of soil amendments. In addition, expert speeches were delivered about the development of bioeconomy expertise, tenders and small producers' products in school catering and nutrient recycling and legislation, as well as quality recommendations for recycled fertilizers.
The event gathered twenty-four experts from schools, universities of applied sciences, scientific universities, associations, authorities and companies promoting agriculture, sustainable development and food as well as natural resources and circular economy, food producers, food service companies and municipalities.





Content of the event

The event was launched with the introduction, activities and results of the *Foodloops* project by the **Savonia UAS** staff. In addition, the comprehensive laboratory services of Bio and Circular Economy research area were presented.

The recycling of biowaste into fertilizer products for agriculture and growing media production was the topic of the speaker from **Kekkilä**. Company with four business units provides horticultural solutions and its landscaping and recycling services consist of composting facilities, soil stations, and growing media factories. The composting process is either tunnel composting or windrow composting. The finished soil improvement compost is an important recycling raw material in Kekkilä's growing media, as it increases the amount of organic matter in the growing medium. The prerequisite is cost-effective production based on local raw materials, short transportation distances, consistent raw material availability and sufficient volumes.

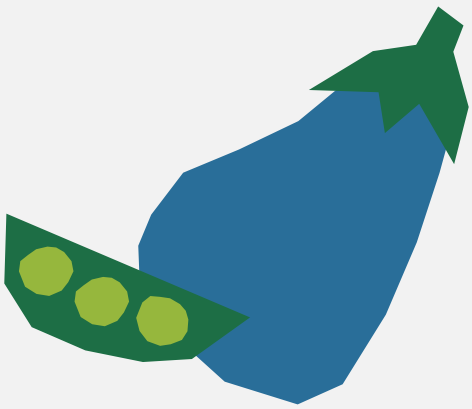
The **Central Union of Agricultural Producers and Forest Owners (MTK)** presented *sustainable agricultural activities*, projects and reducing the environmental impacts of agriculture, carbon sequestration and soil improvement. MTK is involved in bioenergy projects and supporting biogas production and in some twenty versatile projects including Paths to rural employment and Plant Skills 2.0. There are ongoing projects promoting the recycling of bio-waste while simultaneously creating renewable energy production, for example Farmgas 3. Circular economy business models in agriculture where 'waste' can be converted into valuable products (e.g., biogas, fertilizers, animal feed). The vitality of agriculture and rural areas. MTK supports cooperation between local producers and food services. Projects that promote the use of local food in schools and food services can enhance both food security and the regional economy. New innovations, investments in sustainable production methods, and the use of digital tools that enhance the efficiency of agricultural businesses.

Production of soil improvers was presented by **Biopallo Technology.** The end products made with Biopallo are organic fertilizers, soil improvers, and raw materials for growing media. The company has developed the reuse of peat-based growing media using a bioreactor.

Rural Profession Association has vast experience of the *development of bioeconomy expertise*. The organization advances the availability of new entrepreneurs and skilled professionals for agriculture and forestry, as well as increased visibility and networking. Core activities include study trips to rural areas. In the "Opportunities in the Bioeconomy and Creative Entrepreneurship" project, the bioeconomy expertise of young people and teachers was enhanced, and science camps and new elective courses, such as *Nature Specialist*, were implemented in collaboration with schools.

Servica's procurement director informed participants about *tenders and small producers' products in school catering*. The strategic objectives of procurement are increased productivity, enhanced regional vitality through cooperation with local businesses, and improved security of supply. Servica will independently tender food products for its service production in the future. Excluding the wholesale agreement, the company seeks supplementary suppliers for each contract, allowing them to offer by product line and location.

Representative from the **Finnish Biocycle and Biogas Association** gave an introduction to *nutrient recycling, legislation, and quality recommendations for recycled fertilizers*. There is potential and a need for efficient nutrient recycling. Recycled phosphorus could cover 90%, and recycled nitrogen could account for over one-third of Finland's annual phosphorus and nitrogen needs for plant production. The greatest recycling potential is in livestock manure. Regional differences exist in potential and nutrient demand. Special treatment is required in areas with nutrient surpluses. The market value of recycled fertilizers depends on the degree of processing, availability, and usability. The national market share for organic recycled fertilizers is estimated to be approximately 5–7% of the total fertilizer market, equivalent to around €49–68 million. Markets are marginal compared to the mineral fertilizer market. Security of supply and self-sufficiency goals could accelerate market development. Future markets can include e.g. carbon removal certificates.



2.1.6 Lessons Learnt

Demand for vegetarian food in on rise, however traditional preferences still prevail in schools, in particular among the youngest pupils. According to the school staff that were interviewed, overall, the demand for school lunch has decreased during recent years. Innovative practices regarding food value and production chain, consumption and food waste valorisation could be furher elaborated in order pupilis and students to learn about the environmental impacts of food waste and see how food production is linked to the state of biodiversity.

There is need to integrate contents of food value chain across curricula at all school levels. Some practical tools can be visits to farms, food production facilities and industrial settings that process biowaste and create new innovations from it. Teachers' education could be updated and integrated into work life situations and RDI work.

Practices to reduce school food waste:

School lunch planning

- Organising regular menu planning opportunities for pupils and students
- Naming vegetarian food with a proper name rather than "vegetarian food"
- Testing applications to sign up for lunch
- Handling Waste in Future Ordering Processes

Education pupils, students and staff

- Organizing study trips to farms, restaurants, food industry, groceries
- Including food value chain topics and food waste into different of curriculum
- Staff's continuing education and workplace learning and involvement in RDI projects
- Workshops and competitions to reduce food waste
- Organizing tastings at school to get acquainted with new tastes

Improving school canteen experience

- Sufficient time for meals reduces the rush and prevents food from being left uneaten.
- A calm dining environment encourages focus on eating; Acoustics and design of spaces to make them comfortable and pleasant
- Naming school canteen to restaurant with an appealing name

Collaborating with local stakeholders

- Food procurement system needs to include small food producers
- Utilising farmers' expertise e.g. as guest lecturers
- Joint RDI projects with schools, training institutions and local food production entrepreneurs and companies
- Creating joint RDI activities and projects with retail stores and food and beverage companies

2.2 Gdańsk, Poland

2.2.1 About Gdańsk

The city of Gdańsk lies in the Pomeranian Voivodeship and consists of approximately 450.000 inhabitants. It is a large city with a small number of farms in the surrounding area. The city runs 75 primary schools, 64 of have their own kitchen, 7 schools have catering only, and 4 schools are affiliated to a hospital organising the meal provision. The schools that have their own kitchen prepare their own food, whereas the ones without use external catering services for meal provision. The school sizes vary with between 60-80 and 1000 pupils per school. Especially for the larger schools there are significant logistical issues with meal provision. Consequently, lunch time is extremely short with only about 20 minutes, and lunch may be served as early as 10:30.

Polish schools also underly strict nutritional standards and regulations which influence the provision of school meals. These standards, provided by national legislation, aim to provide children with health and quality meals and include recommendations for a greater supply of vegetables and fruit, whole grain products and fish, whereas fried foods and high sugar products should be limited. Any school catering must comply with these rules, influencing the meals provided by them.

School meal organisation in Gdańsk: In primary schools, food is mainly prepared in school kitchens. In some schools, catering companies are organising food provision

2.2.2 Identifying Challenges of Gdańsk

Through the initial kick-off workshop and a follow-up workshop with local principals, stewards and chefs in Gdańsk, the project staff outlined the most important challenges for the implementation of a circular food system in schools. One major challenge concerns the size of menu portions and the short lunch time students get. This raises the additional challenge of what to do with leftover food, since there are currently knowledge barriers to reusing leftover food for meals, as well as regulatory barriers to community fridges or donations to charities.

In addition to the Impact-Effort matrix used at the kick-off meeting, the partner used further methods to identify challenges, including desk research and the commissioning of a legal expertise of the avoidance of food waste in schools. Some of the challenges identified through this process concerned what to do with unused food in schools (can it be redistributed through a food

sharing system?), legal aspects on food surpluses in educational institutions, nutritional requirements, the involvement of children in avoiding food waste, reducing waste in canteens, how to collaborate with parents and children on menu planning, and whether schools can set up their own compost.

Furthermore, additional regulatory barriers have been identified with procurement, which make it difficult for schools to buy food directly from local farmers, which consequently does not help to improve the quality of meals. Lastly, knowledge barriers among staff and chefs constitute an important challenge for both menu planning, appealing naming, and using leftovers for new meals.

2.2.3 Identifying Relevant Stakeholders

As the project focus is on avoiding food waste in schools, the local partners identified schools in Gdańsk as the primary stakeholders, in particular directors, teachers, staff, intendants and chefs working in schools. Catering companies were considered only to a limited extent since most schools prepare the food themselves, and they thus only account for a small percentage of food supplied to schools.

At the beginning of the project and stakeholder identification process, the project partner sent a questionnaire to primary schools via the Department of Education to identify schools willing to participate in the project. The questionnaire also included research questions to clarify the challenges faced by schools, thereby already serving the next steps of the project. From the questionnaire, 34 schools were identified for potential collaboration and pathways for project activities were paved. An initial workshop was organised to get in contact with the schools and exchange experiences, contacts and lead constructive discussions.

Meetings with school principals before and during the first phase of the project made it possible to identify and further expand the project's stakeholders. School principals identified specific catering companies and product suppliers serving the schools.

The project partners obtained contact information of urban farmers and local food producers from the Marshal's Office for the Pomorskie Voivodeship, the Department of Environment and Agriculture, and the Pomeranian Agricultural Advisory Centre, the Agricultural Producers Group, and the Pomeranian Chamber of Agriculture. The urban farmers and local food producers were subsequently interviewed and invited to participate in the project, most importantly in the Clean City Festival in Gdańsk and to run a workshop for schools on composting.

2.2.4 Building Trust with Stakeholders

After identifying the key stakeholders for the project, the project partners visited the Green Market in Gdańsk to talk with local farmers about potential food deliveries to schools. The emphasis was on improving the contact with the farmers, learning about their business profile, and presenting the project and its goals to them.

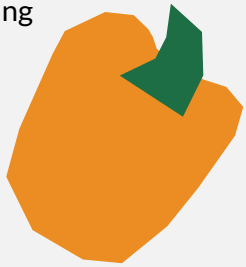
The stakeholder mapping exercise and close cooperation between the Municipal Services Department (which is carrying out the FoodLoops project) and the Department of Education within the same municipal office in Gdansk, from which one employee was recruited to the project team, provided an excellent basis for the trust-building process.

Additional information was provided by the experience of the Municipal Services Department's staff in the areas of food waste prevention and responsible municipal waste management (waste sorting, bio-waste composting). The Municipal Services Department invited the Municipal Utilisation Company Ltd. and urban farmers to participate in the project. A schedule of meetings was drawn up with key actors to build trust and cooperation in order to develop solutions for the project and to ensure a high level of commitment during the implementation phase of the pilot solutions.

In addition, in view of the legal barriers identified in the Impact-Effort Matrix, the Regional Sanitary and Epidemiological Inspectorate was invited to cooperate. A workshop with representatives of this local government institution was scheduled as the first and most crucial meeting, along with the commission a legal expertise on the avoidance of food waste in primary schools.

As a workshop to introduce stakeholders to the concept of cooperation for a circular economy in local food production, consumption and valorisation of food waste in schools, we used a workshop for school staff: two workshops on food waste in schools and prevention in January 2024 and a workshop on circular food system and bio-waste composting in schools in November 2024 at the Municipal Utilisation Company Ltd.

The project partner also visited the Green Market in Gdansk to talk to local farmers identified as important stakeholders about the potential supply of food to schools. The focus was on improving contact with the farmers, learning about their business profile and introducing them to the project and its objectives. These multistakeholder meetings led to the identification of multiple cooperation areas, serving each stakeholder's unique needs and interests. For example, the stakeholders agreed to work together on adapting school meals better to student preferences, targeting the needs of students, school cooks, and kitchen staff. Other cooperation areas focus on increasing the competences of school staff responsible for the food procurement process and efforts to close the school food loop by composting food waste and green waste and using the compost as a soil improver in the school garden.



Working meeting with representatives of the Municipality of Warsaw

2.2.5 Co-Developing Solutions

A workshop meeting between representatives of the Municipality of Gdansk (the authority in charge of public primary schools) and representatives of the Regional Sanitary and Epidemiological Inspectorate was devoted to presenting the concerns and doubts of school employees regarding the organisation and implementation of school meals. The issues discussed during this workshop were: 1) nutrition requirements based on current national laws and WHO guidelines, 2) analysis of the current legislation and discussion on the rules and inspections in this area carried out by the Regional Sanitary and Epidemiological Inspectorate, 3) recommendations for schools with regard to the preparation of balanced and adequate caloric meals, 4) recommendations for actions that can prevent the waste of food. The above guidelines and recommendations were sent to interested schools.

Workshops with school directors, intendants, representatives of the municipality of Gdańsk

The second workshop was held with the school director of Primary School No. 88 in Gdańsk, where 148 out of 163 pupils eat lunch at school. Primary School No. 88 is an example of how to move towards a more sustainable approach to the topic of not wasting food and acts as a local partner in co-creating pathways for implementing solutions to reduce food waste. Some of their good practices include, among others, **accurate calculation of the amount of food needed, reusing uneaten vegetables for other dishes, composting uneaten fruit, letting children discard the food themselves so they learn about portioning and composting it, and heating food flexibly for second servings.**


Workshop in Primary School No.88

During the Clean City Festival in Gdańsk, a cooking workshop was held with the main aim of educating pupils, parents, school staff and the general public about **making full use of products when preparing meals and reducing food waste.** It was a show full of inspiration, encouraging the use of all kitchen products, the use of different techniques of handling food, supplemented with quizzes and interaction with a lively audience. Among other things, the workshop discussed pathways for cooperation between representatives of farmers and schools, where farmers can supply their products to schools and cooperate in compositing and collecting bio-waste from schools.



Image upper left: Gdansk Clean City Festival
Images upper right and 2nd row: Workshop for school chefs, intendants, and families with Kamil Sadowski's live cooking with leftovers at Clean City Festival Gdansk

A fourth workshop was held with the director of the Gdansk Shared Services Centre, where the implementation of joint procurement for schools was discussed, as well as the content and format of a workshop for schools on the procurement of food products or catering services, including public procurement criteria. Lastly, visits to green markets were used to find out what urban and peri-urban farmers have to offer and understand the challenges and opportunities for cooperation with school food systems.

Workshop on the procurement of food

Two more workshops were held on food purchasing for school staff in Gdansk. This aimed to promote and teach about sustainable procurement by purchasing local, organically grown, and eco-packaged produce, supporting local producers and farmers. Participants highlighted challenges faced in the reality of procurement, as school staff responsible for this is struggling to secure quality products and are bound by supplier contract terms, limiting their flexibility in where to purchase products. Four key recommendations emerged from these workshops:

- **Organising meetings between school representatives, municipal representatives and suppliers to address dissatisfactory and unreliable school meal deliveries,**
- **Create model contracts based on municipal templates for the procurement of food products including precise criteria for the evaluation of deliveries and closer participation in the procurement procedure,**
- **Municipal layers should support schools in enforcing contract terms related to complaints, penalties and termination, and**
- **Organising training sessions for procurement officers in schools to enhance their skills and knowledge. These recommendations aim to ensure that sustainable procurement practices are effectively implemented, allowing schools to obtain quality products while benefiting local producers and urban farmers.**

Workshops on public procurement of food for schools

2.2.6 Lessons Learnt

In Gdansk, the workshops held met with a great response. The need to educate and train school staff and children in schools about not wasting food is high. The workshop revealed several difficulties faced by school staff such as school procurement and the restrictive food sanitation regulations that must be applied in educational institutions. However, it also indicated that there are many good local and national practices in the area of organising and serving meals that are worth sharing and attempting to implement in as many Gdansk schools as possible.

The workshop helped participants to understand and better prepare for food procurement procedures in order to improve the quality of meals. In addition, they supported the process of educating school staff and pupils on the topic of composting and closed-loop food circulation.

2.3 Vilnius and Panevėžys

2.3.1 About Vilnius & Panevėzys

Vilnius is the capital city of Lithuania with around 630.000 inhabitants. The city is densely populated in the centre and strongly urbanised. The other region considered in Lithuania is the Panevėžys district and city. The city has around 87.000 residents with a lot of agricultural output through the many local food producers and farmers in the surrounding area. Both cities are interesting to consider in this case study due to their differences in agricultural output and size.

In Vilnius there are about 176 schools with on average 500 students, in the Panevėžys region 34 schools with on average 300 students. There is a mix of schools preparing their own food and those getting it delivered from catering services. Most pupils have between 20 and 30 minutes to eat their lunches with some cases of longer breaks for 35 or 40 minutes for lunch.

Meals in Lithuanian schools have to follow nutritional requirements laid down in the regulations for catering in kindergartens and schools. This regulation aims at healthier diets and related behavioural changes (for example, setting volume of vegetables, fruits, no spices with food additives, prohibited foods and other requirements). Not only healthier foods, but also food preparation methods preserving nutritional properties are promoted. Lunch should be organized not earlier than 2.5 hours and not later than 4 hours from the beginning of the lessons.

2.3.2 Identifying Challenges of Vilnius and Panevėžys

The Lithuanian partners used a combination of desktop research and interviews with their stakeholders to identify a first list of challenges. The desktop research helped to gather data and insights about the current situation and potential challenges regarding food waste in schools. This was followed by interviews with different stakeholders, such as researchers from relevant institutes, representatives of Panevėzys Regional Waste Management Centre, and representatives from school catering companies.

These steps in line with the first workshops revealed relevant challenges in Vilnius and Panevėžys, including high levels of plate waste, a need to analyse the legislation governing composting practices and **how to streamline menu planning and waste reduction in schools in general. Though digital platforms for meal planning could be a solution, improvement and mainstreaming of technology role remain a challenge, too. Further, it was found that there is a shortage of educators that are qualified to teach students about circular food systems, impacting the effectiveness of implemented educational initiatives.** Thus, there is **a need for better educated school staff and a more educational materials** covering the topic effectively. Another challenge is limited schools-farmers partnership due to the production quantities and existing legislation, as well centralized catering.

Moreover, cooperation areas were identified through the Impact-Effort matrix during the kick-off workshop. This revealed, similar to Kuopio and Gdańsk, that **meals need to be better adapted to student preferences.**

Moreover, it became clear that there are difficulties with properly assessing demand for meals, causing leftovers. The workshop also confirmed the earlier findings of the project partner that there are some barriers like regulations for composting food waste and a lack of knowledge among teachers and pupils on how to valorise food waste.

2.3.3 Identifying Relevant Stakeholders

The stakeholder mapping of the Lithuanian partners took place primarily through the systematic power/interest matrix approach. Through this process, the project staff identified key target groups including farmers, school administrators, educators, municipality servants, catering companies, waste management companies and pupils.

Having a vast experience in the field of educational campaigns on food waste and sustainable consumption, the LCI has extensive established contacts with school administrators and teachers all over Lithuania. This helped to identify active and interested ones in the project activities.

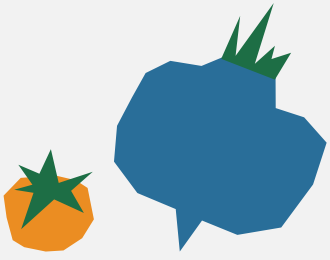
Catering related companies like digital platform provider were identified under the desk research.

Authorities responsible for education, public health and regional waste management centres were identified and approached according to municipalities under the study.

Relevant farmers are one of the most challenging groups to be involved. However, the LCI has an extensive experience of cooperation with farmers from the previous projects and particularly pilot project in Panevėžys district, which served a basis for the farmers contacts. Additionally, the Chamber of Agriculture as the initial contact was approached to reach relevant farmers interested in the project.

2.3.4 Building Trust with Stakeholders

To build trust between the identified stakeholders, the project staff involved them in a continuous exchange of knowledge and experiences. For that project information and dissemination activities were useful. Moreover, long lasting cooperation with some of the relevant stakeholders helped to build up trust throughout the first of the FoodLoops project stages, particularly with schools administrators and teachers. In addition, individual interviews and first workshops indicated high commitment of the stakeholders to cooperate in the future looking for the best solutions for food waste management in schools. A follow-up workshop was initiated by the Vilnius municipality to discuss education on food waste sorting in the Vilnius Municipality. Following the workshop in the Vilnius regional waste management centre, this workshop brought together a broad range of stakeholders, indicating mutual trust and interest in finding solutions.



Trust has not only been built with LCI and the other stakeholders, but amongst the stakeholders as well. Stakeholders openly shared their views with each other, looking for joint solutions or shared their role and responsibilities. These efforts highlight the strong interest in continuing local cooperation to enhance sustainability and reduce food waste in schools. For example, the waste management centres acknowledged their importance for awareness raising activities; Panevėžys Municipality finance and supports nonformal education fostered in Panevėžys nature school etc.

Special attention was given to strengthening contacts with the farmers. This was done in several ways, including through the Chamber of Agriculture for the initial contact, a conference for organic food, and conversations with a farmers' cooperative participating in a pilot project in the Panevezys region regarding the shorting of food supply chains. This opened the door to share best practices, determine challenges and needs, and build trust between farmers and the project partners.

The trust-building process helped the stakeholders identify relevant areas of cooperation. Similar to the other cases, one key area relates to the adaptation of school meals to pupils' preferences, requiring collaboration between caterers, school administrators, teachers, and municipalities. Some other areas addressed challenges such as difficulties with assessing demands for meals by caterers and school administrators and the limited knowledge of teachers on food waste valorisation. Farmers' needs were also targeted through a cooperation area on the fact that they are often unable to sell food to schools due to low ordering quantities.

2.3.5 Co-Developing Solutions

The first workshop was aimed at fostering dialogue among various stakeholders from Panevėžys (municipalities, caterers, school administrations, teachers, and waste management companies) on implementing circular food systems in schools, with a focus on valorising food waste and identifying collaboration opportunities. The workshop highlighted education's role in circular food systems within schools, **emphasizing awareness and behavioural changes in food consumption and waste**, while noting challenges in tailoring food services to student preferences due to strict legal constraints.

The second workshop focused on gathering insights on circular food systems in schools from their perspective. Representatives of various schools from Panevėžys town and district indicated challenges in pupils' involvement in menu planning, and the absence of partnerships with food suppliers and waste management companies for on-site waste sorting. These insights highlight the **need for collaborative efforts to address these issues and enhance sustainability practices within the school environment.**

The third workshop to co-develop solutions for the reduction of food waste in schools was held with the Panevezys Nature School, which focuses on non-formal education. It showed best practices on teaching children about organic food and food waste: showcasing food growing in school garden (Image 21), letting children pack their own, healthy lunch boxes, interactive training on waste sorting (Image 20) and reduction, involving students in discussions on the topic, and teaching them about their own environmental responsibility. Co-developed solutions include organizing events and initiatives for sharing best practices, with a focus on circular food system principles, developing additional programs that examine the role of local ecosystems and biodiversity, implementing long-term projects where students monitor and assess their environmental impact, encouraging participation in environmental and circular economy-related competitions or projects and establishing long-term partnership agreements with local farmers and businesses to ensure sustainable food and biodegradable waste management.

Images left: Composting at Panev□žys nature school; Image right: School garden and greenhouse

Another meeting for co-developing solutions was run with the Vilnius regional waste management company and aimed to determine approaches to facilitate waste sorting in schools and improving education towards waste sorting. It also discussed the **potential of information campaigns**, both current and future ones. Further, legal barriers to waste sorting in schools were identified, as well as the **need for professional training for teachers to enable them to teach children about waste sorting**. Lastly, it was discussed to **expand existing field trips and site visits to the company to showcase the process of waste sorting at a larger scale.**

The fifth workshop as follow-up event to previous one, brought together a wider range of stakeholders, including municipality employees, school administrators, teachers, and healthcare specialists working in schools, to discuss education on food waste sorting in the Vilnius Municipality. Participants **agreed to share educational ideas for food waste sorting and**

create a potential resource base for schools. It became apparent that legal restrictions on sorting food waste along with other barriers schools may face, could create uncertainties in effectively teaching students about this topic. It was recommended to **organize a follow-up workshop focused on these issues, including representatives from relevant national institutions, such as the Ministry of Health and the Food and Veterinary Service.**

The sixth workshop dedicated to the cooperation areas on adapting meals to student preferences and assessing demand of meals in schools included community members who also serve as food service providers, school administrators, and teachers. Solutions suggest **conducting regular feedback sessions with students to adapt menus based on their preferences, introducing a greater variety of flavours and meal options to make food more appealing, organizing training programs for teachers, pooling food waste from multiple schools in a region to create transport-efficient quantities and offering subsidies or financial incentives to offset the high costs of transportation and handling of food waste.**

Two more workshops to address cooperation areas 3 and 4 are planned.

2.3.6 Lessons Learnt

Despite successful workshops and stakeholder engagement, holistic approach to food waste management in schools remains a challenge. Within cooperation areas stakeholders expressed high interest, however interlinkages in-between those areas also need to be addressed via political will both on national and municipality level, knowledge sharing and promotion of food waste reduction thru the whole food supply chain. Experience and long existing contacts with potential stakeholders were very beneficial for engaging them into the project activities. Constant communication and knowledge exchange on the topic also contributed to the fruitful results of the workshops and future cooperation.

Chapter 4

1. KEY TAKEAWAYS FROM THE FOODLOOPS PROJECT

1.1 Project Summary

The FoodLoops Project, launched in 2023, aims to close the bio-waste loop in the school food value chain in the Baltic Sea Region, in particular Finland, Poland and Lithuania. Recognising the significant challenge of food waste in this area, the FoodLoops initiative builds on the HOOP project, expanding efforts to improve bio-waste valorisation by focusing specifically on school food value chains.

The project's mission is to combat food waste as a part of a larger sustainability effort. Multi-stakeholder engagement has been a key aspect of the project, including diverse stakeholders such as municipalities, schools, caterers and farmers to reduce food waste and improve biowaste valorisation in school kitchens. The main goals of the project were to 1) improve bio-waste separation in school kitchens and canteens, and 2) to turn unavoidable food waste into valuable products, like compost, to help close the resource use.

The FoodLoops project has emphasised collaboration among local stakeholders to build trust and create effective co-created solutions in the school food value chain, combined with the cross-border replication of models in other regions.

1.2 Food Waste

The foodservice sector, especially school canteens, contributes significantly to food waste across stages like preparation, serving, and consumption. Factors such as portion sizes, canteen atmosphere, and staff communication drive waste levels.

Food waste occurs at all stages of the (school) food value chain. On the production stage, food losses occur on the field and the quality and quantity of harvested food can influence food waste at later stages in the value chain. During the distribution stage, food waste can occur due to inadequate transportation conditions. Schools also play a critical role here, as procurement of too high quantities or poor menu planning during this stage can lead to greater amounts of food waste later on. The third stage,

processing, refers to meal preparation, in our case in school kitchens or by catering companies. Here, food waste can occur from leftovers during cooking. Further, food waste in later stages can be prevented through proper menu planning, as cooking meals students are more likely to eat and finish will lead to less leftovers.

Next, during the consumption stage food waste is primarily caused by meal leftovers and serving waste. Proper planning and communication of the right amount of meals is of the essence here and can prevent food waste from occurring. Lastly, the valorisation of food waste constitutes the last step of the (school) food value chain. While food waste does not occur here, the question is how to create new value from it, such as through composting of meal leftovers, food sharing programmes or reuse of ingredients for new meals. Regulations play a critical role here, as there may be rules for or against such activities.

These stages indicate a variety of points at which challenges may occur and where action can be taken to prevent food waste, or how to create value from it.

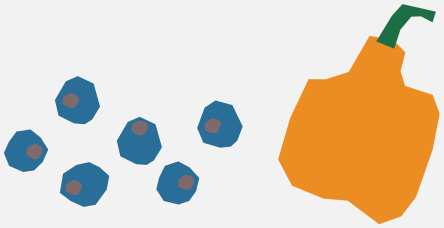
1.3 Summary of Project Structure

Assessing the local situation, building trust, developing solutions, replication, feedback/ validation/ clustering

The project followed five distinct steps, constituting the overall methodology the local partners followed. The first step is an assessment of the local situation, which serves to determine individual challenges of a region regarding food waste reduction and valorisation in the school food system. This step also involves the identification of stakeholders relevant in the local context, such as specific schools, catering companies, farmers, or municipal branches.

The second step aims to build trust with and among the stakeholders the project manager choses to collaborate with, aiming to agree on common definitions, understandings, and areas of cooperation. This step is followed by the process of co-developing solutions with all stakeholders. Through a series of workshops, the stakeholders come together and try to formulate concrete ideas addressing the previously identified challenges and create pathways for improving collaboration.

To scale the impact of the local projects to greater levels, replication is the crucial fourth step in which the findings of the co-creation process are fed into transnational replication workshops. This brings together stakeholders from wider networks and enables local ideas to scale to larger impact. Lastly, the transnational replication workshops allow for the collection of feedback,



which can in turn improve local efforts. Clustering with more stakeholders on new projects can also further foster regional and international collaboration, collective learning, and improve overall sustainability outcomes.

2. SUMMARY OF SOLUTIONS

2.1 Cooperation within the different stages of the value chain

From the co-creation process of the project partners, we can identify some key cooperation areas between stakeholders at different points of the value chain. These are naturally not exclusive, and depending on the local situation there may be different scenarios for cooperation. The sections below thus outline a few example collaboration areas which have emerged from the FoodLoops project case studies. They can serve as inspiration for other projects.

Stage of value chain	Key actors	Cooperation areas
Production	• Local farmers • Schools (administrators, teachers) • Catering companies	• Field trips with pupils to local farms, teaching about origins of food • Local farmers support schools in setup of own fruit and vegetable garden
Distribution	• Schools (administrators, procurement officers) • Catering companies • Suppliers • Local farms • Municipalities (legal departments)	• Procurement of organic food from local farms • Collaboration on contract terms regarding procurement sources (schools/ caterers/ suppliers) • Legal support from municipalities to meal procurement officers to enforce and challenge contract terms
Processing	• Schools (adminstrators, pupils, kitchen staff, cooks, parents) • Municipalities	• Improving cafeteria atmosphere through re-design, better acoustics and queuing arrangements • Involve pupils and parents in menu planning and naming of dishes • Educational activities for sustainable consumption practices • Collaboration between schools and municipalities to improve organisation of school meals to prevent food waste
Consumption	• Schools (adminstrators, pupils, kitchen staff, cooks, parents) • Municipalities	• Improving cafeteria atmosphere through re-design, better acoustics and queuing arrangements • Involve pupils and parents in menu planning and naming of dishes • Educational activities for sustainable consumption practices • Collaboration between schools and municipalities to improve organisation of school meals to prevent food waste
Valorisation	• Schools • Farmers • Regulatory bodies	• Reuse food leftovers for next-day meals or food sharing, ensure regulations allow this • Collaborations between schools and farmers to set up compost on school grounds or return food waste to farmers

2.1.1 Food waste valorisation

At the last step, food waste valorisation requires collaboration between schools, farmers and regulatory bodies. Schools and farmers might be able to cooperate in returning the food waste to them for composting purposes, or farmers can support schools on how to set up their own food compost. For this to work, support is needed from regulatory bodies, who might need to adjust rules on school-ground composting to enable this. Furthermore, in case there are rules preventing the reuse of leftovers, for instance for next-day meals or community fridges, these should also be adjusted in consultation with the schools.

2.2 Solution Clusters

From the case studies, a few key solution clusters have emerged which tackle the challenge of food waste in schools.

2.2.1 Adapting School Meals to Meet Pupils' Preferences

The first theme that emerged are solutions related to the adaptation of The first theme that emerged are solutions related to the adaptation of school meals to the preferences of students. This targets primarily the consumption stage within the value chain, and includes solutions such as:

- Improved menu planning: Include pupils (and potentially parents) in the planning of lunch menus, including which meals they like, and adding more diverse dishes and flavours to the list
- Accurate planning of meals: Developing measurement systems that allow schools to procure accurate amounts by determining how much food is actually required
- Renaming dishes: Vegetarian meal options should have more appealing names, such as using the names of the ingredients they contain, rather than simply adding the label "vegetarian"
- Improving cafeteria atmosphere and aesthetics: Making changes to the lunch environment to let pupils enjoy their meals more, including better aesthetics, more comfortable seating arrangements, and better acoustics.
- Improve queuing arrangements and meal timing: Giving students more time to enjoy and finish their meals by shortening queues and lengthening meal times

2.2.2 Education on Food Origins and Food Waste

- The second solutions cluster relates to overall awareness and education on food, including its origin and the implications of food waste. This targets awareness levels among both pupils and teachers, for instance through solutions such as:
- Field trips to local farms or food waste processing sites: Practically teach students about the topic
- Raise awareness: Improve knowledge and have conversations about food waste through info screens and targeted information campaigns

- Include topic in school curriculum: Directly and systematically teach pupils about food waste through educational materials, either directly in classes or through projects
- Educate educators: Teachers need to expand their knowledge on the topic to properly teach their pupils
- Share best practices among stakeholders: educational institutions, catering companies and other relevant stakeholder should establish and continue close cooperation and communication amongst each other to share best practices and continuously improve educational pathways.

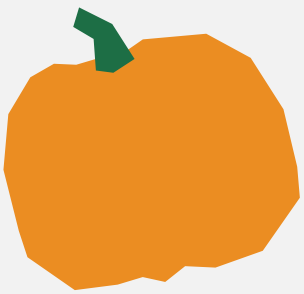
2.2.3 Food Waste Valorisation

The third cluster addresses solutions related to the valorisation of food leftovers that could not be avoided through other solutions. To ensure no food ends up in landfills, stakeholder can:

- Set up food sharing systems: Using solutions such as community fridges encourages the redistribution of leftovers amongst pupils and staff
- Reusing leftover ingredients: Kitchen staff and school chefs need to be educated on how to reutilise leftovers for next-day meals, and minimising leftovers during the cooking process
- Composting: Leftovers that cannot be reused should be valorised in composting systems, either on school grounds directly or in collaboration with local farmers or processing sites.

2.2.4 Regulations and Legal Support on Food Procurement and Food Waste Valorisation

- The last solutions cluster that emerged during the project targets regulations and legal matters that currently restrict what schools and other stakeholders can do related to sustainable food practices. Some solutions include:
- Regulations regarding procurement: In some places, current regulations restrict where schools and catering companies are allowed to source their food from. Collaborations with national or regional institutions should ensure that stakeholders can procurement from local farms and other sustainable sources
- Legal support for procurement terms: Municipalities should offer legal support to procurement officers when it comes to contract terms that fixate amounts and sources of food, to ensure flexibility, high quality meals and sustainable procurement
- Nutritional requirement: national nutrition guidelines should be adjusted to allow for more vegetarian meal options



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