EXPLORING THE RELATIONSHIP BETWEEN SUSTAINABLE PUBLIC CATERING AND SHORT SUPPLY CHAINS - DEVELOPING AND PRESENTING A SUPPLY CHAIN MAPPING METHODOLOGY THROUGH A HUNGARIAN CASE STUDY

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Abstract

Our study deals with an exceptional area within the food supply chain, the relationship of sustainable public catering and short supply chains. We aim to examine sustainable school food systems. The definition includes not only the operations, ingredients, and stakeholders in connection with the value creation activities (e.g., farming, food manufacturing, catering, consumption, and reverse logistics), but the well-prepared communication about the processes to stakeholders belong to the core values of sustainable school food systems. The research methods include both primary and secondary data analysis. First, we conducted a literature review focusing on supply chain mapping methodologies with a special focus on school food systems. In order to provide a structured interpretation of the topic we present a mapping methodology, and its application demonstrated by a Hungarian school food system sample. The results of the mapping are shown in a case study. The results suggest that our mapping methodology is suitable for school food systems analyses. It seems to be important to detect the focal entity at the beginning of the mapping process to be able to have a comprehensive analysis of the school food system. Limitations of the introduced methodology can be that the interviewed stakeholders have a too narrow focus on their own operations and roles within the very extended food supply network, which cannot be easily tracked. Further research may focus on testing the methodology at other supply chains to gain a comprehensive view. This study should contribute both to the academic sphere and practitioners who are interested in emerging methods supporting the efficient and sustainable operation of school food systems.

Key words: public catering, short supply chain, sustainability, supply chain mapping

1. INTRODUCTION

In the 21st century, sustainability has been becoming increasingly important in many areas of life (Filippi & Chapdaniel, 2021; Kamble et al., 2020; Lavelli, 2021) and the literature on food security issues (Krishnan et al., 2021; Naik & Suresh, 2018) also increasingly addresses sustainability.

In our study, we focus on a prominent food sector, namely public catering. In Hungary, the social perception of public catering is often seen as negative, which is commonly discussed by local media platforms (Munk, 2022a, 2022b), but it has a high potential in terms of sustainability (Vincze, 2022). Sustainability impacts include both environmental and socio-economic aspects. The environmental impacts seem to be the most evident in the choice of raw materials, the mode of transport, processing and the use of water and energy. In addition, the group of socio-economic impacts includes short supply chains, indirectly supporting the economy through relationships with suppliers, job creation, food culture, healthy eating and support for disadvantaged people.

First, we outline the theoretical framework for food supply chains based on the literature. After, we will discuss the links between the value chain, the food supply chain, food systems and regional food hubs, which will be used to formulate a definition of a "sustainable public catering system" that best fits the characteristics of public catering.

Furthermore, methods for mapping supply chains used in other industries are presented. These methods will be adapted to the specific supply network of public catering, with the aim of creating a mapping methodology to analyse different public catering systems. The aim of the analyses is to identify different models of public catering systems, identify areas to be improved, problems to be solved and give recommendations for environmental, social and economic sustainability.

The qualitative methodology developed as a result of the literature analysis, based on in-depth interviews, was tested in a public catering system in a Hungarian location. Our results and the practical usability are presented in the form of a case study, focusing on the task of mapping a public catering system.

2. LITERATURE REVIEW

The literature review chapter focuses on the concepts dealing with the relationship between the actors operating in the food industry (relevant for public catering) and in the second part the possible analysis methods are presented.

2.1. Concepts Describing The Relationships Between Food Industry Actors

The relationships between food industry actors should be discussed and explored along the lines of value creation. For example, the flows of goods, supply chains, financial and contractual relationships between them may function as the fundament of the observation.

The concepts in Table 1. describe the possible relationships between food industry actors. *Value chains* can be understood as strategic alliances between farmers and other supply chain partners. The concept implies customer focus, direct contact between producer and customer, all activities required for the product, full transparency. The focus is explicitly on the added value of the product and the relationship between the actors (Devaux et al., 2016; FAO, 2019). Food value chains are specific in terms of the characteristics of the products. Their value depends to a large extent on the natural environment (humidity, soil mineral content, water quality, etc.), the professional knowledge and know-how of the individual actors, and the length of the supply chains (KPMG, 2013).

Table 1. Framework for describing the relationships between food industry actors

	Value chain	Supply chain	Food hub	Food systems
Focus of relationship	stakeholders	business transactions	operation	operation
Emphasis	socio-economic	economic	social (microenvironment)	socio-ecological
Industry-specific	not	not	yes	yes

Source: own editing, 2022

The *food supply chain* is composed of all actors (producers, suppliers, retailers, and buyers) and all functions within each organisation that are directly or indirectly involved in meeting customer needs (Gelli et al., 2012). Food supply chains can be understood as a set of transactions along the path from producer to consumer (Filippi & Chapdaniel, 2021). The more complex the food product is, the more stakeholders are involved in the production and distribution processes. For this reason, supply chains are typically driven by the final product, but also rely on data from actors in the chain (Van der Vorst, 2006)

Regional food hubs are businesses or organizations that actively manage the collection, distribution, and marketing of labelled foods from primarily local and regional producers to enhance their ability to meet wholesale, retail, and institutional demand. Their necessity lies in the fact that many farmers, especially small and medium-sized farms, are often unable to access trade channels independently. By offering a combination of aggregation, distribution and marketing services at affordable prices, food hubs enable many producers to enter new, larger-scale markets that increase their incomes and provide them with the opportunity to expand production (Horst et al., 2011; Matson & Thayer, 2013).

Based on these three concepts, it is worth exploring the notion of *food systems*, which integrates the three different approaches to interconnectedness in some aspects. Food systems have been considered as social–ecological systems (Berkes et al., 2003; Ericksen, 2008b). In general, the activities in food production, processing and packaging, distribution and retail, and consumption are involved (Ericksen, 2008a). The constant change of the condition of the Earth let us focus on its current

manifestation. Food systems depend on natural resources, not only by value added processes (e.g., production), but also by supporter processes (e.g., distributing (packaging) or consuming (boiling water while cooking) (Westhoek et al., 2016). According to experts not only "in-house" operations, like production, handling, storage, processing, but also operations out of the factory's gates, such as distribution, market, consumption and also food losses and waste build food systems (Tuomisto et al., 2017).

There are several sustainability-related expectations for public catering systems, which are captured in the definition of sustainable public catering systems below.

Sustainable public food systems encompass the full range of activities, components and actors involved in the production, processing, distribution, preparation, serving, consumption, and waste management of food, as well as the spaces and environments in which these processes take place (SchoolFood4Change project - EU Horizon 2020). Public catering systems also include associated educational practices.

Sustainable public food systems aim to promote the health of children and young adults in a way that is profitable for all actors in the food value chain, respects the social and cultural environment, and considers natural resources and ecological processes, while respecting the limits of the planet. Sustainable school catering systems are governed in a democratic and participatory way by all stakeholders, including farmers, purchasers, cooks, teachers, students, parents, municipal and school administrators, researchers, other professionals, and policy makers (SchoolFood4Change project - EU Horizon 2020).

2.2 Methods to Map the Links Between Food Industry Actors

The methodologies used to map the relationships between food industry actors are presented in Table 2.

Table 2. Methods to map the links between food operators

	Value chain mapping	Supply chain mapping	Stakeholder mapping
Focus of relationship	main activities (input-transformation-output)	transaction, documented information flow	groups of stakeholders
Has a prominent role	value added	focal company	the relationship between stakeholders, their expectations
Visualisation method	flowchart	flowchart	stakeholder map (may contain additional information)

Source: own ed., 2022, based on (Berkes, Colding, & Folke, 2003; FAO website, 2018; Smith, 2012)

Value chain mapping is a process that identifies the key activities related to a company's service or product line and is often used in corporate strategy to identify opportunities for performance improvement. Gathering information on a company's key inputs and outputs and examining its role in the overall value chain provides an opportunity to develop sustainability programmes. To this end, sustainability-oriented value chain maps can be drawn up and the impact of the company on a particular process in the value chain (e.g., procurement, supply, and development) can be systematically assessed. The results of the analysis can be used to optimise the value chain (Taylor, 2005).

Supply chain mapping is the process of documenting the relationships between the companies, suppliers, and customers in a company's supply chain, and can even result in a global map of the supply chain from the source of raw materials to the companies that perform the logistics processes and the final consumer. This type of supply chain analysis is best used to identify business opportunities and risks (Anastasiadis et al., 2020; Donaldson et al., 2020).

A *stakeholder map* is the process of visually representing the people and groups associated with an organisation or project. This visual tool should give a clear picture of who the different stakeholder groups are, what their expectations, motivations, interests, and responsibilities are. Stakeholder maps assess each group based on the degree of influence and the level of interest, which contributes to the analysis of the external and internal environment of the organisation by highlighting the forces and interests at play in the life of the organisation (Styk & Bogacz, 2022).

3. RESEARCH METHODOLOGY

Our research is exploratory and started with an analysis of the relevant literature. As a result of the literature review, we compiled a methodology for mapping a public food system from farmers, intermediate actors (processors, traders) and food producers to consumers. Then we tested the proposed methodology and made the necessary modifications as well. The mapping was done with the combination of desk research and in-depth interviews applying the combination of the above-mentioned methods of supply chain mapping (Table 2.). The steps in the data collection process consisted of pre-in-depth-interviews to collect a general view about the specific supply chain being explored. Based on the gained data we contributed to the joint platform of the consortium, in which we participate (SchoolFood4Change project - EU Horizon 2020). Semi-structured questionnaire for each stakeholder group was compiled by the consortium members and we used this structure during the further in-depth interviews with representatives of each stakeholder. Three interviews were taken with the leaders of the catering company and 2 interviews with the representatives of the city involved in the research. The aim of the in-depth interviews was to gain insight into the food system and its processes, and to test the relevance and structure of the interview questions. After revising and correcting the interview questions, we worked on the possibilities of visualising the food system. In our methodological proposal step 1-2-3 represent the basic structure of the questionnaire, they were used only in the questionnaire form in the other participant countries of the

consortium. The visual representation of the interviews provides a possibility for overviewing the public food system and supports further analyses. One public food system in Hungary was selected randomly and based on our possibilities. The information collected was used to produce a case study, which is briefly presented below with the focus on the visualization of mapping a public food system.

3.1 Methodological Proposal for The Analysis of a Public Food System

Our methodology aims to provide guidance for a structured description of a public food system's processes, material flows, stakeholders, legal frameworks, business relationships, "power relations", information flows and funding sources.

We focus on these because they influence the environmental, social, and economic sustainability of a public food system.

The methodology combines methods from supply chain analysis in other industries, as public catering is a very specific field. Our methodology can be characterised as a hybrid of the value chain, supply chain map and stakeholder maps mentioned above.

Our aim is that the proposed methodology can be used to present any other public food system in a standardised way, allowing to analyse the system and identify problems for continuous improvement.

The steps of our methodological solution are listed below, followed by an explanation of each step.

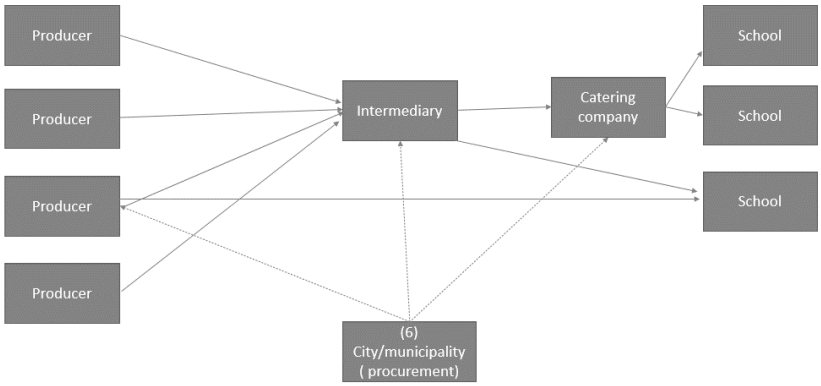
3.1.1. Steps

1. Identification of stakeholders
2. Process mapping (identification of material flows)
3. Analyses of legal and economic environment
4. Selection of the focal company, identification of business relationships (power relations, financing, information flows)
5. Visualisation of the food system map
6. Analysis, identification of problem areas

3.1.1.1 Identification of stakeholders

In terms of food supply chains, we can typically talk about producers, processors, actors with a commercial function, who act as intermediaries in the process. Distribution activities are typically carried out by wholesalers and retailers, for processed or unprocessed food. The distributor is typically followed by a catering company, where ready meals are prepared for schools. This can be either a catering service or a restaurant. At the end of the supply chain, the customer is represented in many different ways. The buyer may be the school itself, the catering company, or even the municipality or the local authority as buyer in the context of public procurement. Beyond the school, the final users are the children and their parents who pay for the meals.

Figure 1: Schematic diagram of the public catering network



Source: own editing, 2022

3.1.1.2 Process mapping

The first thing we expect from the interviewee is a description of the operational activities. Depending on whether the person is a producer or even the actor conducting the interview, we will ask him/her to describe the processes involved in his/her operation. In this section, after the general description of the process, we will describe the relationship with the upstream and downstream actors in the supply chain. Thus, the questions include supplier evaluation, customer relations and partner management, as well as the routes of material and information flows.

3.1.1.3 Legal and economic environment

It is advised to prepare desk research before the interviews about the legal and economic environment in which the food system exists.
Interviewees will be asked to describe the specific food safety and other requirements they are subject to. In addition, a description of the public procurement process is also included in this section if the interviewee is involved in the public procurement process. Questions also relate to how the country/region supports the economic activities of the interviewee in terms of economic policy (tenders, availability of national/international support). We aim to be able to answer the question, what are the regulations and standards for the financing of public catering.

3.1.1.4 Selection of the focal company, identification of business relationships (power relations, financing, information flows)

The primary objective is to identify the focal company against which to assess the buyer/supplier relationships, based on the interviews. In the case of public catering, the focal company is most likely to be the actor with the greatest influence

on the process. These may be the public education institution (as a purchaser in its own right), the municipality (as a contracting authority for public procurement procedures) or even the catering company (as a contractor for public catering in line with legal/customer requirements) in the role of the focal company.

3.1.1.5 Visualisation

After conducting interviews tailored to each actor, visualisation is the next step. The following information is proposed to complement the classic supply chain map:
- Contractual relations
- Stakeholders in the catering system, other stakeholders
- Material flows
- Information flow
- Legislative framework
- Organisational boundaries
- Other relevant information

3.1.1.6 Analysis, identification of problems

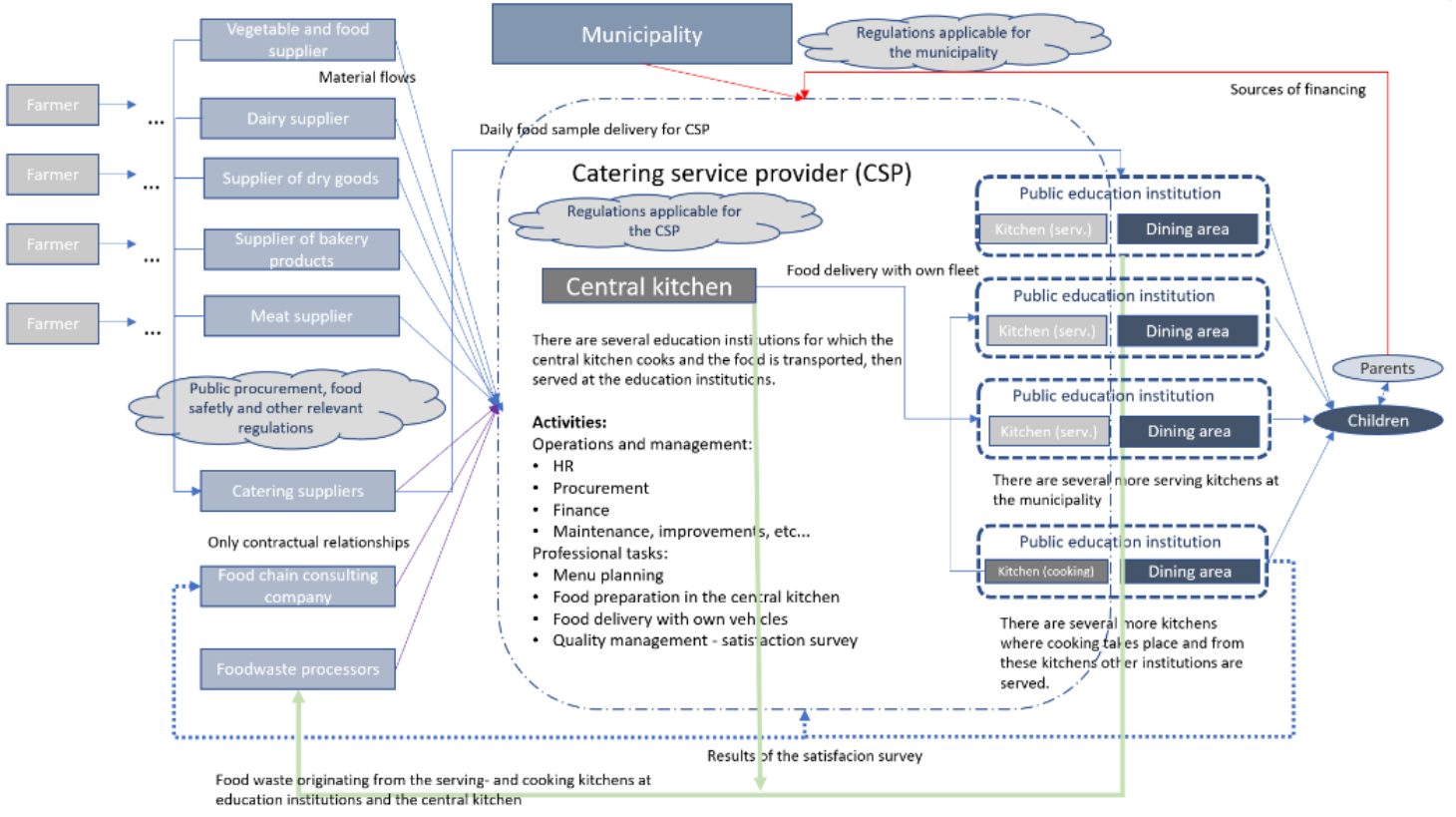
A case study based on the interview transcripts can be prepared and a map of the food system can be used to identify areas of concern. These problems may be caused by customer dissatisfaction, negative environmental impacts, unnecessary costs, or overly strong legal constraints. Once problems have been identified, improvement processes can be initiated with the involvement of stakeholders and with professional support.

4. CASE STUDY

The first results of our research using the methodology described above are presented in the case study below. To test our methodology, we chose a public food system in one of the largest towns in Hungary. The first 5 steps have been carried out, but a more in-depth analysis of the public catering system presented in this study, the formulation of proposals for improvement and the evaluation of their implementation and impact are still tasks for the coming period. Our research is still in its initial phase, and the testing of the methodology on other public food systems is also to be carried out.

The heart of the case study (and the future analyses) is the visualized food system. Figure 2. contains the most relevant information about the public food system and provides a complex overview for better understanding. The farmers, suppliers, catering service provider (CSP), municipality, public education institutions (e.g., day-care, kindergarten, elementary school, high school), children and parents are the most important stakeholders in the system. In the followings the symbols used in Figure 2. are explained, then the relationships between the stakeholders in the food system are described.

Figure 2. Results of the application of the mapping methodology to the food system under study



Source: own editing, 2022

The *full lines with purple* represent a contractual relationship between the parties (e.g., food waste processors have a contract with the CSP, but the food waste is collected physically from different kitchens and sites). The *full lines with blue* represent material flow and contractual relationship on the upstream side of the supply chain (e.g., the supplier of dairy products delivers their products to the CSP, and they also have a contract). On the downstream side full blue lines only represent material flow, there is no contractual relationship between the central kitchen and the other serving kitchens for example.

The *red lines* show the financing arriving from different parties to the catering company for providing meals.

The formalized flow of information is shown with *blue dotted lines* (this means that the schools provide information about their satisfaction with the service within a quality assurance system run by the consulting company). In each case where a contractual relationship exists, we suppose there is some level of interaction and information flow between the parties (for this reason these „natural" information flows are not shown in the figure). Based on the interviews for example market dialogues, consultations with the suppliers are not formally managed and organized by the catering company, which provides room for further development.

Green lines represent the reverse flow of material (food waste) from the place of origin to the food waste processors.

We chose the catering service provider as the "central" actor (focal company) in the public food system because of its greatest impact on customer satisfaction (children and their parents) and sustainability impacts (e.g., support for domestic producers, use of healthy, seasonal, quality ingredients, minimisation of energy use, etc.). However, we should see that the food service provider is in a limited decision-making position in several aspects: market actors/environment, procurement, food legislation, financing, control over the service area all influence the quality-of-service provision and the provider's possibilities for action (hence these elements are also shown in Figure 2).

The food service provider is maintained by the municipality, which provides (part of) the funding on the basis of a legal obligation. The other part of the funding comes from parents. The catering service is subject to public procurement, including the procurement of goods and services. On this basis, on the supplier side, it is in contact with (1) suppliers of food raw materials (the most frequently purchased food groups are shown in Figure 2), from which it prepares meals in its own cooking kitchens using the raw materials and ready-to-cook products it receives.

In our diagram, three points between farmers and suppliers symbolise the unexplored part of the network. In the context of the EU's Farm2Fork strategy (EU Green deal, 2020) and the efforts to support domestic short supply chains (REL) (Government Decree 676), it is important to understand this area in detail, but it is also the biggest challenge (Njt.hu, 2022b). Not only in public catering, but also in other food supply chains, the traceability of raw materials and the identification of producers should be a priority in order to reduce negative environmental impacts and enhance positive social/economic impacts.

On the supplier side, there are also (2) catering service providers who deliver ready meals directly to the public education institutions. One of the contractual

obligations of the catering service providers is to provide a food sample to the catering service provider every day for quality control purposes. Also linked to quality assurance is the (3) food service consultancy partners on the supplier side, who carry out, for example, satisfaction surveys in the public education establishments. The (4) food waste management companies have a contractual relationship with the catering service provider, but at the same time they perform reverse logistics activities from the public education institutions, from where they transport the food waste for further recovery. Of course, the food service provider also has other suppliers (energy, fuel, maintenance, equipment, etc.), but these are not included in the figure for reasons of transparency.

The catering service has a central cooking kitchen and a few cooking kitchens on the premises of public schools, which also serve the institution and other institutions nearby. Food preparation takes place in these areas, from where the food is delivered to the serving kitchens in their own special containers and vehicles. The food service provider has control over the canteens in the public education establishments (both in terms of infrastructure and staff), but the dining area is now the responsibility of the establishment.

The drivers of the system are on the customer side; beyond the school, the final users are the children and their parents who (partly) pay for the meals.

4.1 Analysis, Identification of Problems

Analysing the case, we find several challenges and problems in the public catering system under study. In the followings we only list a few examples, which provide areas of improvement. On the supply side, there is the challenge of tracing the origin of raw materials, and we can state that the upstream side is not sufficiently transparent, involves many actors. The communication between the CSP and their suppliers also provides room for improvement. Regarding the public procurement, scarce funding and legal frameworks also make it difficult to achieve sustainable solutions in public catering.

The catering service provider's internal processes also involve public procurement, which leaves little room for the organisation to engage with small-scale producers, and legislation on public catering also limits the ability to prepare more sustainable food (e.g., it is mandatory to serve animal protein every day (EMMI Regulation 37/2014) (Njt.hu, 2022a), while it is known that 1-2 meat-free days per week (plant-based diet) can significantly reduce environmental impact). The efficiency of the catering service provider's own operations (energy efficiency, waste reduction, chemical use etc.), fleet of vehicles and logistical processes can also be improved to reduce environmental impacts. There is a great possibility in optimizing the forward and reverse flows within the food system in terms of city logistics, GHG emission reduction and also cost optimization.

On the "downstream" side of the food system, i.e., the customer side, the problems are caused by the fact that the canteen is operated, and its staff are employed by the catering service provider, while the dining room is part of the school. This often causes problems in delivering a quality student catering service. The dining rooms are multi-purpose spaces and in many cases the conditions are not ideal for providing a

decent meal (furniture, lighting, etc.). A further problem is the short time available for meals in educational establishments, which does not support a cultural and healthy meal and contributes to an increase in food waste, as children have to rush because they do not have enough time to eat.

5. CONCLUSIONS

In our study, we proposed a methodology for the analysis of public food systems and presented the first results of the testing of the methodology in the form of a case study on the example of a Hungarian public catering system. Public food systems are very complex with a number of constraints (e.g., public procurement, food safety, mandatory service provision) that are not present in supply chains in other industries. They are therefore very interesting systems from a research point of view, but there are also many practical benefits to be gained from understanding them.

We are at the beginning of our research, in the following months the focus of the analysis will be on the upstream side of the supply network (e.g suppliers of the catering service provider, producers, farmers) and parallel to this the improvement action plan for the municipality will be developed. We are also expecting results of similar mapping actions from different EU countries, which migh serve as benchmarks, and provides further analysis and comparison. We are very confident that by the end of our project we will be able to develop a useful and valuable tool for mapping and analysing public food systems and thus contributing to the development of environmentally, economically, and socially sustainable public catering systems.

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