



Mapping school food provision models in European cities: Operational, infrastructural, and financial insights

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ABSTRACT

Objective: This study aims to provide a comparative overview of school food provision models in 17 cities across 12 European countries. It explores the operational, infrastructural, and financial dimensions of these models, identifying key trade-offs, challenges and opportunities for promoting healthy and sustainable school food environments.

Methods: Data were collected via an electronic questionnaire administered to SchoolFood4Change project partners in 2022. The questionnaire covered meal types and costs, operational and manufacturing models, and kitchen infrastructure. Supplementary desk research was conducted to clarify responses and gain a deeper understanding of the findings' context.

Results: The analysis reveals that school food provision models are more influenced by institutional, historical, and policy contexts than by city size. Contract catering dominates, yet in-house systems persist where welfare traditions and nutrition education policies emphasise child health and learning. Centralised kitchens often reflect historical planning or socialist legacies, while mixed systems arise in decentralised governance contexts.

Conclusions: Organisational diversity stems from the interaction of governance structures, policy priorities, and infrastructure, illustrating how Europe's school food systems balance economic efficiency with social and educational goals for children's wellbeing. This study contributes to a deeper understanding of school food provision models in Europe.

1. Introduction

Food provided in schools plays an indispensable role in supporting children's nutrition, health, learning, and social development. Balanced school meals help meet children's daily nutritional needs, promote healthy eating habits, and lay the foundation for lifelong dietary behaviours (Smolnikova et al., 2019; Ishida, 2015; Hayes and Dodson, 2018; Eustachio Colombo et al., 2020). School lunches significantly contribute to children's dietary intake, providing essential nutrients and helping to mitigate social inequalities in nutrition (Eustachio Colombo et al., 2020).

In Europe, school food policies promoting equitable access to healthy meals have become vital for addressing childhood obesity. Currently, the majority of European countries have implemented school food policies, either mandatory or voluntary,

aimed at improving child nutrition and establishing healthy lifestyle habits (Storcksdieck Genannt Bonsmann, 2014). These policies generally cover food-based standards for menu composition and portion sizes, emphasising lunch and snacks (Tregear et al., 2022).

The role of school food also extends beyond nutrition and health. Well-designed programmes are related to improved educational outcomes, including higher school enrolment, better attendance rates, and enhanced academic performance (Taras, 2005; Florence et al., 2008; Daftari and Umeodum, 2022). Well-nourished children tend to exhibit greater concentration and more active participation in classroom activities, supporting their educational and social development (Mwiria, 2005).

In recent years, momentum has grown to improve the quality, equity, and sustainability of school meals. This shift is driven by broader European policy initiatives such as the EU Farm to Fork Strategy and the

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EU Child Guarantee, which emphasises sustainable public procurement and universal access to healthy food for vulnerable children. Local and national reforms, as well as civil society campaigns, are also playing an increasingly significant role in reshaping school food systems toward more nutritious and environmentally responsible models (Vidal et al., 2023).

Despite these developments, comparative knowledge on how school food provision is organised and implemented in European countries remains limited. Much of the existing research focuses on isolated aspects – such as nutrition standards (Ishida, 2015; Taras, 2005; Vidal et al., 2023; Prescott et al., 2022) or school food programs (Cupertino et al., 2022) – without capturing the full complexity and diversity of operational models, meal production or infrastructure. Also, the most recent study on school food policies in the European Union (Storcksdieck Genannt Bonsmann, 2014) emphasises that the latest analysis dates back to 2014 and primarily focused on isolated aspects, such as child nutrition, preventing obesity, promoting healthy diet habits and standardising the menu composition and sizes.

This study aims to systematically map and analyse the diversity of school food provision systems across 17 European cities in 12 countries, focusing on their operational models, kitchen infrastructure, manufacturing practices, and cost structures. The study seeks to understand the evolution of these models and identify the key trade-offs, challenges, and enabling factors within them.

2. Methods

2.1. Study design

This study was part of the European-funded project “SchoolFood4Change”, which aims to make the school meals nutritious and appealing, supporting both child wellbeing and sustainability.

Our study area spanned 12 countries (Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Slovakia, Spain, and Sweden), encompassing 17 municipalities within these nations: Vienna, Ghent, Leuven, Copenhagen, Tallinn, Viimsi, Lyon, Dordogne, Essen, Nuremberg, Budapest, Milan, Nuoro, Valencia, Madrid, Malmö, and Umeå (Fig. 1). All selected study sites were partners in the project.

The ethical screening was conducted in accordance with Stockholm Environment Institute's Ethics Review Guidelines. It revealed that no ethical approval was required for conducting this study.

2.2. Data collection

The survey questionnaire was jointly designed by the research team and selected project partners to gather information on school food provisioning models, including meal types and costs, operational and manufacturing practices, and kitchen infrastructure. Partner municipalities were consulted for feedback to ensure the clarity of questions. A detailed guide was developed to ensure consistent data collection across all participating countries. The survey was conducted in English, and no translations were required. The guide, including the questionnaire, is presented in Appendix A.

All municipality partners of the SchoolFood4Change project participated in the survey, as this was an agreed task outlined in the project proposal. Therefore, no separate recruitment process was carried out. The Czech and Slovak partners, who operate as school associations, also participated in the survey, but they responded from a generic perspective rather than representing specific cities or schools. Similarly, no formal consent procedure was implemented, as participation was part of the partners' project responsibilities and contributions.

We administered the questionnaire electronically using Google Forms. Invitations were emailed to the designated contact persons at



Fig. 1. Countries and municipalities who participated in the mapping of school food provision models in 2022.

each partner organisation, who engaged additional colleagues as needed to compile the required information. Data were collected between May and August 2022.

2.3. Data analysis

For the survey data analysis, we used Excel and combined both quantitative and qualitative approaches. Most questions were closed ended, allowing the use of descriptive statistical methods to summarise response patterns in participating municipalities. We used a qualitative coding process for the open-ended questions to identify recurring themes and categorise responses systematically. The coding focused on questions about the school food system, cost structure, and the type of meals provided in schools. Additionally, we conducted supplementary desk research to clarify and confirm responses, thereby gaining a deeper understanding of the context of the findings.

To examine the relationship between municipal characteristics and the models used for school food provision, a correlation analysis was conducted. Data on population size and land area were compiled for each municipality and grouped by the operational, infrastructure, and manufacturing models applied. After excluding country- or region-level cases (Czech Republic, Slovakia, and Valencia), Pearson correlation coefficients (R) were calculated between population and area within each model type using the *CORREL* function in Excel. This analysis assessed whether larger or more spatially extensive municipalities tended to apply particular model types, thereby identifying possible size related patterns in model adoption.

3. Results

After collecting and analysing data on school food provision models from 17 cities, we present the results for these specific features: 1) operational models, 2) kitchen infrastructure and manufacturing models, and 3) school meal provision and cost structures.

3.1. Operational models

The comparative analysis of 17 municipalities revealed a diverse spectrum of operational models, with no clear relationship between city size and the organisational form of school food provision ($r \approx 0.03$). Instead, institutional and contextual factors, such as global governance structures, management traditions, and policy priorities, could be associated with the main determinants.

Similar operational models among cities within the same country were observed only in Estonia and Sweden (Table 1); in contrast, cities in other countries displayed different models, and no clear patterns were identified country-wise.

Contract catering, provided by either privately or publicly owned companies, emerged as the predominant operational model. Specifically, more than half (ten) studied municipalities/regions utilised only contract catering. In Milan and Budapest, catering services were provided by publicly owned companies, while the remaining eight municipalities engaged private companies through public procurement.

In-house catering (direct management) was implemented in Malmö, Umeå, Essen, and Dordogne, with meals prepared and served by staff directly employed by the schools or the municipality. These municipalities tend to represent smaller and mid-sized cities.

Typically, the food provision operational model was decided at the municipal level. However, in certain instances, such as in Leuven (Belgium), the responsibility for determining the type of food provided and the organisation of its provision rested entirely with individual schools, resulting in the coexistence of all models within one municipality. The mixed operational model was also observed in Copenhagen, Madrid, and the municipalities in Slovakia and the Czech Republic.

Table 1

Operational models for school food provision identified in the studied European municipalities in 2022.

Municipality	Operational model		
Model (see below)	Contract catering by private catering company;	Contract catering by public catering company;	In-house catering
Vienna, Austria	v		
Ghent, Belgium	v		
Leuven, Belgium	v	v	v
Czech Republic municipalities	v		v
Copenhagen, Denmark	v		v
Tallinn, Estonia	v		
Viimsi, Estonia	v		
Dordogne, France			v
Lyon, France	v		
Essen, Germany			v
Nuremberg, Germany	v		
Budapest, Hungary		v	
Milan, Italy		v	
Nuoro, Italy	v		
Slovakian municipalities	v		v
Madrid, Spain	v		v
Valencia, Spain	v		
Malmö, Sweden			v
Umeå, Sweden			v

The V marks if the model is present in the municipality or a region.

3.2. Kitchen infrastructure and manufacturing models

The studied municipalities employed nine main models for school food preparation. In the on-site kitchen model, meals were prepared and served directly at the school. In the centralised model, food was produced at a central facility and distributed to schools for serving. The central kitchens were either publicly (municipal or regional) or privately owned.

In Dordogne, Nuoro, and Slovakian municipalities, school meals were mainly prepared in on-site kitchens. In contrast, six other municipalities used central production kitchens. These were publicly owned in Leuven, Budapest, and Essen, while private catering companies operated them in Vienna, Viimsi, and Ghent. In the remaining municipalities, some schools had on-site kitchens, and others received food from central kitchens. In these areas, municipally owned central kitchens were more common (see Table 2 for further details).

The correlation between municipality size and infrastructure type was weakly positive ($R = 0.15-0.16$), confirming that historical planning and governance choices, rather than demographic scale, could explain these differences.

The kitchen infrastructure tended to influence the manufacturing models for meal preparation and serving in schools. On-site kitchens typically prepare and serve hot meals directly on the premises. This model was used in all or some schools across 12 municipalities with onsite kitchens. Centralised production involved two main approaches: meals were either delivered hot in thermoses for immediate serving or cooked, cooled, transported, and reheated at schools. Both methods were common in municipalities with central kitchens, with no clear prevalence. Some municipalities also offered cold food (mainly snacks and sandwiches) either alongside warm lunches or as substitutes during off-site activities, such as excursions. Further details are provided in Table 3.

3.3. School meal provision and cost structures

Most surveyed countries and municipalities provided a hot meal for lunch every day (Table 3). However, some schools in the Lyon and

Table 2
School food infrastructure used for school food provision in the studied European municipalities in 2022.

Municipality Model (see below)	Infrastructure		
	Onsite kitchen	Central kitchen owned by private catering service provider;	Central kitchen owned by public entity;
Vienna, Austria		v	
Ghent, Belgium		v	
Leuven, Belgium			v
Copenhagen, Denmark	v		v
Czech Republic municipalities	v		v
Tallinn, Estonia	v	v	
Viimsi, Estonia			v
Dordogne, France	v		
Lyon, France			v
Essen, Germany			v
Nuremberg, Germany	v	v	
Budapest, Hungary			v
Milan, Italy	v		v
Nuoro, Italy	v		
Slovakian municipalities	v		
Madrid, Spain	v		
Valencia, Spain	v	v	
Malmö, Sweden	v		v
Umeå, Sweden	v		v

The V marks the type of infrastructure (kitchen) is present in the municipality or a region.

Dordogne regions offered lunch only four times a week, excluding Wednesdays. In contrast, in Belgium, students typically brought packed lunches from home. In Leuven, which had no municipal schools, individual schools decided on lunch services, resulting in fewer establishments offering warm meals. In Ghent, municipal authorities provided hot meals only in schools under their jurisdiction, but not those managed by other authorities.

Where hot lunch was provided, it was typically a hot meal, including meat and vegetables. Non-meat or vegetarian options were available daily or on some days of the week. In some instances, such as in Copenhagen and Milan, both hot and cold meal options were available

to students. Additionally, six municipalities reported that certain schools offered breakfast in addition to lunch. This provision, prevalent in Budapest, Copenhagen, Malmö, Tallinn, Viimsi, and the Department of Dordogne, was often subject to supplementary charges, distinct from regular school meal fees. Also, cold food, such as snacks and sandwiches, was offered to students, in some cases at an additional cost.

The cost of a school meal within the municipalities under analysis was calculated based on two distinct methodologies for structuring and computing the expenses associated with school meals. One approach involved deriving the cost of school meals, particularly lunch, solely from the expenditures attributed to procuring food ingredients, thereby excluding ancillary expenses. This method was predominantly applied when the school had an on-site kitchen facility, simplifying direct calculation based on ingredient costs. Moreover, if incurred, labour expenses were typically absorbed within the operational budgets of the school or the municipal administration. The meal cost based only on food ingredients varied from one euro in Malmö to 1.9 euros in Budapest.

The alternative cost structure included food ingredients and all additional costs associated with school meals, such as salaries for canteen and kitchen staff, as well as expenses related to transportation, electricity, and equipment maintenance. This method predominated in operational models where catering services were outsourced, a prevalent practice observed across the study sites. The per-meal costs under this model exhibited considerable variability, ranging from 1.56 euros in Tallinn to eight euros in Dordogne.

School meal subsidies in surveyed municipalities ranged from no support, i.e. parents covering all costs, to full subsidies with free meals for all pupils. In municipalities where parents were required to contribute fully or partially, as in Ghent, Nuremberg, and various Czech municipalities, vulnerable groups typically received free meals. Municipal and/or national subsidies partially covered meal costs for all children in Lyon, Dordogne, and Slovakian cities. In Vienna and Ghent, subsidies varied by school type as some offered free meals, while others provided income-based support.

In contrast, Tallinn, Viimsi, Malmö, and Umeå provided universal free school meals. In Tallinn and Viimsi, costs were shared: the national government contributed one euro per meal, and the municipality covered the rest. In Malmö and Umeå, municipal governments fully funded meals for preschool, primary, and secondary students.

Table 3
Manufacturing models applied for school food provision in the studied European municipalities in 2022.

Municipality Model (see below)	Manufacturing model			
	Cook and serve (hot meal cooked on site);	Cook and hold (food is delivered hot);	Cook and chill (meal cooled down and heated served later as a hot meal).	Cold food (sandwiches, snacks);
Vienna, Austria			v	
Ghent, Belgium			v	v
Leuven, Belgium			v	
Copenhagen, Denmark	v	v		
Czech Republic municipalities	v	v		v
Tallinn, Estonia	v			v
Viimsi, Estonia		v		v
Dordogne, France	v			
Lyon, France			v	
Essen, Germany		v		
Nuremberg, Germany	v		v	
Budapest, Hungary	v			
Milan, Italy		v		
Nuoro, Italy	v			
Slovakian municipalities	v			
Madrid, Spain	v			
Valencia, Spain	v			v
Malmö, Sweden	v			v
Umeå, Sweden	v	v		

The V marks which model is present in the municipality or a region.

4. Discussion

This discussion interprets the main findings from the cross-country analysis of school food systems, focusing on how different organisational and operational models shape the delivery, sustainability, and equity of school meals. It integrates quantitative results from the mapping study with contextual evidence on the historical, institutional, and policy drivers that influence municipal decision-making. The discussion explores the trade-offs between in-house and contract catering, the implications of kitchen infrastructure and preparation methods, and the cost structures that underpin meal provision. Drawing on both empirical findings and literature, this analysis reflects on how governance traditions, policy priorities, and infrastructural legacies shape the diversity and evolution of European school food systems.

The results of this study reflect broader European trends discussed in the literature. Contract catering can deliver economies of scale and managerial expertise, enabling municipalities to meet nutritional and administrative requirements efficiently (Wilson et al., 2001). Cost efficiency is the main reason for the domination of this model in the studied cities. However, empirical and theoretical evidence indicates that outsourcing does not always result in cost reductions, as private caterers do not necessarily transfer procurement or labour savings to schools (Hammerling, 2022). Moreover, reliance on external providers can reduce flexibility and impose administrative burdens related to contract management.

In contrast, in-house catering provides greater control over menus, sourcing, and educational linkages, allowing adaptation to local dietary preferences and sustainability objectives (Tregear et al., 2022; Galli et al., 2014). In Sweden and France, school meals were historically integrated into broader social policy frameworks promoting universal welfare and public responsibility for child nutrition (Lundborg et al., 2022; Avallone et al., 2023). These origins explain the continued prevalence of in-house or municipally managed kitchens in Malmö, Umeå, Dordogne, and Lyon. In these contexts, food provision is perceived as a social service rather than a market commodity.

International data indicate that on-site kitchens remain prevalent globally, especially in lower-income countries; however, the European trend is shifting toward centralised or hybrid production models (GCNF, 2025; Harper et al., 2008). Our study reflects this shift: only two municipalities operated fully publicly owned kitchen systems, while most relied on private or mixed arrangements.

From a sustainability and health perspective, on-site kitchens support the preparation of fresher, less processed meals and can enhance students' food literacy by engaging them in the preparation and education process (Prescott et al., 2022; Darmody, 2023). However, they demand skilled staff and modern facilities, which can be costly to maintain (Vincent et al., 2020). Conversely, central kitchens allow standardised menu management and logistics efficiency, appealing to municipalities seeking cost control or facing limited infrastructure, such as Vienna or Viimsi, where the absence of school-based kitchens stems from earlier construction and planning policies.

The coexistence of both systems in Europe thus reflects not only current budgetary or sustainability goals but also historical planning legacies and institutional inertia. In former socialist countries, large-scale public kitchens designed initially for mass feeding were retained and adapted to new procurement regimes, while in Western Europe, decentralised kitchen networks evolved from municipal welfare systems.

Universal free school meals can represent a significant cost for municipalities; however, this should be viewed as an investment rather than an expense. Evidence shows that such programs improve school attendance and reduce long-term healthcare costs (Silva et al., 2023). When complemented with nutrition education, they further promote healthier food choices and foster lasting positive habits (Mikkelsen, 2014; Chaudhary et al., 2020; Franco and Fajó-Pascual, 2023). In Sweden, free school lunches have been linked to increased lifetime earnings, suggesting

that improved attendance contributes to better long-term economic outcomes (Lundborg et al., 2022). Moreover, investing in school meals can stimulate local agriculture and support the development of more sustainable and resilient food systems (Hernandez et al., 2018). Universal free meals, however, were a common practice only in the Estonian and Swedish cities under study. In other cities, subsidies were available for vulnerable groups, which is particularly important given that these groups often rely heavily on the nutrition provided through school meals.

The variation reflects institutional path dependence, for example, Nordic and French municipalities maintain public models rooted in welfare traditions, while Central and Eastern European systems, shaped by socialist-era canteens, have evolved into mixed or centralised public-private models. Historical infrastructure, such as Vienna's and Budapest's central kitchens, continues to influence current operations.

The findings suggest that school food systems are institutionally embedded rather than functionally optimised. Reforming them requires alignment between governance capacity, infrastructural realities, and policy ambitions. Efforts to advance sustainable procurement or universal free meals should account for the existing operational models and the institutional legacies that sustain them. Moreover, integrating educational and community perspectives, as advocated in the Whole School Food Approach, can enhance both health and sustainability outcomes of various model types (Vidal et al., 2026).

By offering a cross-country analysis perspective, this study contributed to a better understanding of the systems that shape school food provision and how they can be improved to ensure long-term health, equity, and sustainability outcomes. In doing so, it supports the exchange of good practices and informs evidence-based policymaking in the European context. However, this study has several limitations that should be acknowledged. First, the sample is limited to 17 cities from 12 European countries, all partners in the SchoolFood4Change project, potentially restricting the extrapolation of findings to broader European or global contexts. Furthermore, there might be other models and meal types evident in European countries and cities that are not reflected in this study. Secondly, in some cases – particularly in the Czech Republic and Slovakia – responses reflect national or regional averages rather than city-specific data, reducing comparability. Finally, the data were collected in 2022, and cost structures or operational models may have since changed due to inflation or policy reforms.

5. Conclusion

School food provision in selected European cities is highly diverse, shaped by governance, infrastructure, and welfare traditions. While no single model suits all contexts, in-house catering and on-site kitchens offer greater flexibility and local engagement. Strengthening school food provision models requires integrated approaches that align health, equity, and environmental goals. The findings support evidence-based policymaking and cross-country learning to foster more resilient, healthy and inclusive school food environments.

CRediT authorship contribution statement

Evelin Piirsalu: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **Brigita Tool:** Writing – review & editing, Writing – original draft, Visualization. **Irene Vidal:** Writing – review & editing. **Manuel Franco:** Writing – review & editing, Validation, Methodology, Conceptualization.

Ethical approval

To determine whether an ethical plan for approval was required, the ethical screening was conducted in accordance with Stockholm Environment Institute's Ethics Review Guidelines. The screening revealed that no ethical approval was needed because the research did not

involve the collection of primary or personal data from human beings, contact with vulnerable groups, or activities posing physical, psychological, or ethical risks, and no AI technologies were used in a way that could affect decisions.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) utilised Copilot and ChatGPT to enhance readability and language, as well as SciSpace and Elicit for literature searches. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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