THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

School Meals as Climate Policy: "As Long as It Tastes Good"

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Cover artwork: Still from the animated video shown to students in the intervention study where schools in Lund municipality changed to low-carbon recipes (Paper I). Illustration by Faktabruket.

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Abstract

Reducing greenhouse gas emissions from food consumption requires dietary changes, yet policies supporting such changes remain limited. Nevertheless, measures to reduce the carbon footprint of school meals are being implemented in several countries. This thesis examines the potential of school meals to foster low-carbon food consumption, within and beyond school, focusing on policy outcomes, policy conditions and policy design.

Two of the four papers draw on a controlled intervention in six Swedish schools, four of which introduced dishes with less red meat and other high-emission ingredients (low-carbon recipes). One analyses effects on food taken, plate waste and meal satisfaction; the other examines students' perceptions of low-carbon recipes and of all-vegetarian days. The remaining two draw on a survey of public acceptability of such measures in France, Poland and Sweden, and interviews on the design of school meal climate policies with officials responsible for school meals in Swedish municipalities.

In the intervention, low-carbon recipes reduced the carbon footprint of the menu by 20% without significant negative effects on these outcomes. Although students recognised that red meat has a higher carbon footprint than vegetarian food, they described their food choices as guided primarily by taste, satiety and familiarity, and expressed slightly stronger support for low-carbon recipes than for all-vegetarian days. Public support for such measures was around neutral: significantly higher than for a tax on high-emission foods, but lower than for subsidies and labelling. Municipal strategies primarily sought to reduce emissions by changing meal composition and presentation. Their main potential beyond school therefore appears to lie in repeated exposure to low-carbon meals, which may build familiarity, habits and norms.

Overall, the thesis shows that school meal climate policies can reduce the carbon footprint of public meals without significantly undermining student acceptance, particularly when changes fit students' expectations of an acceptable meal. The findings raise questions about how quickly and visibly changes should be introduced, and whether targets should consider consumption outside school. School meals may contribute to wider shifts towards low-carbon food consumption alongside other policies, but how school meal climate policies can best be designed for this remains to be examined.

Keywords: school meals; low-carbon food consumption; school meal climate policies; food policy; public acceptability; student acceptance; policy design; dietary change

List of appended papers

This thesis is based on the papers:

I **André, E**., Eustachio Colombo, P., Schäfer Elinder, L., Larsson, J., & Hunsberger, M. (2024). Acceptance of low-carbon school meals with and without information—A controlled intervention study. *Journal of Consumer Policy*, 47(1), 109–125. https://doi.org/10.1007/s10603-023-09557-4

II **André, E**., Ejelöv, E., & Larsson, J. (2026). Public acceptability of school meal climate policies: Findings from a survey in France, Poland and Sweden. Submitted to *Frontiers in Sustainable Food Systems*.

III **André, E**., & Larsson, J. (2026). Exploring the potential of climate strategies for school meals to promote low-carbon food consumption. In review at *Journal of Consumer Policy*.

IV Hunsberger, M., Fatani, R. Z. A., & **André, E**. (2027). "As long as it tastes good": Students' perceptions of climate-friendly school meals in a mixed-methods study. *Appetite*, 228, 108793. https://doi.org/10.1016/j.appet.2026.108793

Author Contributions

Paper I: EA, PEC, LSE, JL and MH conceptualised and designed the study. EA managed the intervention, including planning and coordination with Lund municipality and participating schools, with support from MH. EA and MH conducted the analysis. EA wrote the paper with contributions from PEC, LSE, JL and MH. JL acquired funding.

Paper II: EA, EE and JL conceptualised and designed the study. EE managed data collection. EA conducted the analysis. EA wrote the paper with contributions from EE and JL. JL acquired funding.

Paper III: EA and JL conceptualised and designed the study. EA conducted the interviews and analysed the data. EA wrote the paper with contributions from JL. JL acquired funding.

Paper IV: MH and EA conceptualised and designed the study. EA managed data collection, including qualitative sessions and surveys, with support from MH and

RF. RF transcribed and translated the qualitative data. MH conducted the qualitative analysis with support from RF and EA. MH and EA conducted the quantitative analysis and integrated the qualitative and quantitative findings, with support from RF in the integration. EA developed the visualisations. MH wrote the paper with contributions from RF and EA.

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Göteborg, November 2026

Erik André

Use of Generative AI in this Thesis

Generative AI tools (ChatGPT and Claude) were used in the writing of this thesis, and their use is acknowledged here in the interest of transparency. I used them to help draft, restructure and edit text, working from my own instructions, outlines and notes and from the appended papers. The arguments, interpretations and conclusions in the introductory chapters are my own. I have reviewed and edited all text and checked factual claims, references and technical content against their sources. I take full responsibility for the content of this thesis.

Table of contents

Abstract ..... **i**

List of appended papers ..... **iii**

Acknowledgements ..... **v**

Use of Generative AI in this Thesis ..... **vii**

Terminology ..... **xi**

Core outcomes xi
Policy concepts xi
Acceptability and acceptance xii

Introduction **1**

1.1. Aim 1
1.2. Scope and delimitations 2
1.3. Analytical structure in relation to the policy process 2
1.4. Disposition of the thesis 4
1.5. Dual role as researcher and civil servant 5

Background **7**

2.1. The carbon footprint of food consumption 7
2.2. School meals as an institutional food context 9
2.3. School meals as a potential pathway to low-carbon food consumption beyond the school setting 10
2.4. Previous research on school meal climate policies 12
2.5. Research gaps 13
2.6. Research questions 14

Theory **15**

3.1. Behavioural perspective based on the COM-B model 15
3.2. Public acceptability, student acceptance and policy effectiveness 18

Policy Outcomes: Student Responses to School Meal Climate Policies **21**

4.1. Data and methods 21
4.2. Main findings 27
4.3. Key insights on policy outcomes 31

Policy Conditions: Public Acceptability of School Meal Climate Policy **33**

5.1. Data and methods 33
5.2. Main findings 34
5.3. Key insights on policy conditions 37

Policy Design: Behavioural Potential of Municipal School Meal Climate Policies ... 39

6.1. Data and methods ... 39
6.2. Main findings ... 41
6.3. Key insights on policy design ... 44

Discussion and Conclusions ... 45

7.1. Synthesis and relation to prior research and theory ... 45
7.2. The potential role of school meals as a lever for a food system transition ... 51
7.3. Strengths and limitations ... 54
7.4. Conclusions, implications, and future research ... 55

Reflections: Doing Research as a Municipal PhD Student ... 59

8.1. What counts as useful evidence ... 59
8.2. Producing evidence in municipal practice ... 60
8.3. Both researcher and civil servant ... 61
8.4. Ethics and research in a contested policy area ... 62
8.5. Concluding reflections ... 63

References ... 65

Followed by four appended papers (Papers I–IV)

Terminology

To ensure conceptual clarity and consistency, the following core terminology is used throughout the thesis.

Core outcomes

CO_2e (carbon dioxide equivalents) and carbon – CO_2e is a standardised measure used to express the combined emissions of different greenhouse gases as an equivalent amount of carbon dioxide, based on their global warming potential. Throughout this thesis, *carbon* is used as shorthand for greenhouse gas emissions expressed in CO_2e.

Low-carbon food consumption – The primary focus of the thesis, referring to dietary patterns characterised by greenhouse gas emissions substantially lower than those of current average food consumption in high-income countries.

Carbon footprint – The aggregated greenhouse gas emissions (CO_2e) associated with a given unit of food consumption, such as a recipe, meal, menu, or diet.

Policy concepts

Policy – An overarching course of action adopted to address a societal issue.

Policy instrument – A tool or lever used to achieve policy goals, such as communication and marketing, guidelines, fiscal measures, regulation, legislation, environmental and social planning, or service provision.

Policy measure – A concrete action implemented within a specific policy context, such as all-vegetarian days, low-carbon recipes, nudging in the lunch line, or linking school meals to classroom teaching.

Policy context – A setting within which policy measures may be implemented and operate, such as school meals.

School meal climate policies – Policies implemented within school meal settings that aim to reduce greenhouse gas emissions from food consumption.

Low-carbon school meals and menus – Meals and menus designed to have a lower carbon footprint.

Low-carbon recipes – A policy measure involving recipes designed to reduce greenhouse gas emissions.

All-vegetarian days – A policy measure in which only vegetarian options are served on specified days.

Acceptability and acceptance

Acceptability – An attitudinal evaluation of a proposed or anticipated policy measure, often referred to as policy support.

Acceptance – Attitudinal or behavioural responses to an implemented policy measure, reflecting how it is received or experienced in practice.

The distinction is not always clear-cut. In Paper IV, for example, students evaluated proposed measures that partly resembled the school meals they were already eating, so their responses lie between acceptability and acceptance.

CHAPTER 1

Introduction

Our collective everyday eating contributes substantially to global greenhouse gas emissions. Shifting diets towards lower-emission foods is therefore recognised as a central component of climate mitigation (Mbow et al., 2019; Poore & Nemecek, 2018). Particularly in high-income countries, this implies that reducing consumption of high-emission foods, such as red meat and dairy, may be necessary to meet climate targets (Rockström et al., 2025; Sun et al., 2022). At the same time, food consumption is deeply embedded in preferences, habits, identities, social norms, and culture. Initiatives to influence dietary patterns are therefore often perceived as sensitive.

This tension is especially visible when dietary change becomes a matter of public policy. Measures that seek to influence food consumption raise questions about the legitimacy and effectiveness of public policies that shape individual choices. Compared to many other domains that cause large greenhouse gas emissions, interventions targeting diets remain relatively limited, particularly those that directly restrict or disincentivise high-emission foods, such as taxes (Parkin et al., 2024; Pechey et al., 2022). At the same time, school meals in several countries have become a common setting for reducing consumption of meat and other high-emission foods, with initiatives such as meat-free Mondays increasingly implemented across public meal systems (e.g., Dahmani et al., 2024; Eustachio Colombo et al., 2020; Lombardini & Lankoski, 2013). These initiatives have, in several instances, sparked debate and opposition among students, parents, the public, political parties, farmers, the food industry, and other actors.

School meals occupy a particular position in this context. As a publicly organised and recurring part of everyday life for many children, school meals constitute a context in which food consumption is structured, repeated, yet also open to renegotiation and change. This has led to an interest in whether school meals can serve not only nutritional purposes, but also contribute to broader shifts towards more sustainable diets (Oostindjer et al., 2017; Roque et al., 2022). This thesis takes that possibility as its starting point.

1.1. Aim

The overall aim of this thesis is to examine the potential of school meals as a policy context for fostering low-carbon food consumption, within and beyond the school setting. The ambition is to inform school meal climate policymaking by examining

acceptance, design, implementation, and behavioural potential across different stages of the policy process.

1.2. Scope and delimitations

The thesis focuses on strategies to change dietary composition by reducing consumption of high-emission foods and increasing consumption of lower-emission alternatives in school lunch provision.

The thesis is delimited in four main respects. First, it adopts a consumption-side perspective and does not analyse production-side mitigation of the food system's greenhouse gas emissions.

Second, the analysis focuses on dietary shifts rather than on other consumption-side changes, such as reducing food waste, reducing transport, or buying organic and locally produced food.

Third, the thesis centres on policy measures that directly or indirectly shape students' food-related behaviours, such as menu reformulation, vegetarian provision, nudging, or informational measures. Management processes and procurement practices are not part of the analysis unless they are directly linked to student-facing measures.

Fourth, the thesis examines policy design, acceptance, implementation, and behavioural potential. It does not seek to quantify aggregate emission reductions at the system level.

1.3. Analytical structure in relation to the policy process

The thesis adopts an analytical structure that distinguishes between three levels of the policy process: 1) policy conditions, 2) policy design and 3) policy outcomes (Figure 1.1). This structure is used as a device to clarify how the included papers address different parts of the policy process, covering questions of design, implementation, acceptance, and behavioural potential.

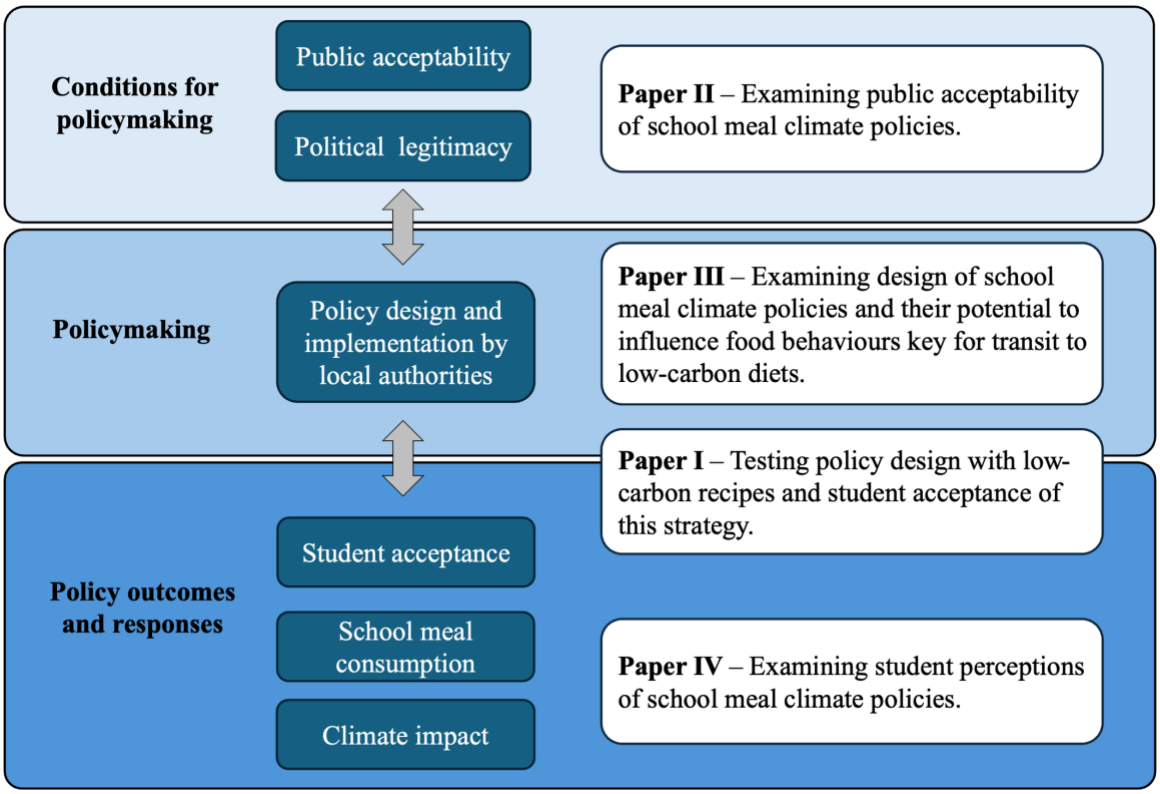


Figure 1.1: Analytical levels of the policy process

Note: The figure illustrates the analytical structure of the thesis and the relationships linking public acceptability, policy design and implementation, and student responses and outcomes. These relationships are understood as part of a broader chain connecting policy to food consumption and its environmental impacts, while acknowledging the presence of additional influencing factors and feedback processes.

First, at the policy conditions level, the focus is on public acceptability. Public support or opposition influences the perceived legitimacy and political feasibility of introducing and sustaining school meal climate policies, as politicians may be reluctant to propose measures that could provoke opposition from voters and affect future electoral outcomes (Burstein, 2003; Glynn & Huge, 2008; Wallner, 2008).

Second, the policy design level concerns how school meal climate policies are designed and implemented, primarily by local authorities. This includes how policy objectives are translated into concrete measures such as menu planning, nudging, or informational interventions, and how these measures may influence food-related behaviours. At this level, the focus is on the type of measures used and their potential to influence food-related behaviours within and beyond the school setting.

Third, the policy outcomes level concerns students as the primary target group of school meal policies. At this level, the focus is on how policy measures are perceived and accepted, and how they translate into actual food consumption and reductions of the carbon footprint of school meals.

The structure not only serves as an analytical framework for the thesis but also offers a simplified representation of how school meal climate policies can be understood to generate intended outcomes. It highlights a chain in which public acceptability influences policy, policy influences behaviour, and behaviour influences food consumption and its carbon footprint. Within this chain, the thesis focuses on how public acceptability relates to policy adoption, and how implemented policies influence student responses, food-related behaviours, and the carbon footprint of school meals.

Analytically, the structure emphasises that acceptance is relevant for both the adoption and the outcomes of policy: public acceptability contributes to political legitimacy and thereby influences whether policies are introduced and sustained, while at the level of implementation, policy changes must be accepted by students in order to fully influence food intake and thereby the climate footprint of school meals.

This structure is simplified in several respects. One important simplification is that policymaking and implementation are influenced by a range of factors beyond those included here, such as political priorities, administrative capacity, economic constraints, media discourse, and stakeholder influence. Another important simplification is that feedback mechanisms are not represented. For example, students' and the public's experiences with implemented policies may influence their attitudes and feed back into the policy process. The framework highlights the relationships most central to the analysis in this thesis rather than representing the full complexity of the policy process.

1.4. Disposition of the thesis

The thesis is structured to reflect the analytical logic outlined above in Section 1.3, moving from contextualisation and conceptual framing to empirical analysis across the three levels, and finally to discussion, synthesis, and reflection.

Chapter 2 presents the empirical and policy context. It situates food consumption in relation to climate change, provides background on school meals as an institutional food environment, reviews previous research on school meal climate policies, and identifies research gaps. Based on these gaps, the research questions are introduced.

Chapter 3 presents the theoretical perspectives that inform the thesis. These are introduced as conceptual tools for the analysis and include a behavioural perspective based on the COM-B model and research on policy acceptability and acceptance, providing an analytical grounding for the levels examined in the thesis.

Chapters 4–6 summarise the appended papers and reflect the three analytical levels of the policy process. The empirical summary begins in **Chapter 4**, at the level of **policy outcomes**, focusing on students as the primary target group of school meal climate policies. The chapter examines how students respond to low-carbon school meals in practice, including acceptance, food consumption, plate waste, meal satisfaction, and perceptions of low-carbon school meals and menus. **Chapter 5** then addresses **policy conditions** through a cross-national examination of public acceptability of school meal climate policies. Finally, **Chapter 6** focuses on **policy design**, examining how Swedish local authorities design and implement school meal climate policies in practice, and what this implies for their potential to influence behaviours relevant to low-carbon food consumption.

Chapter 7 provides an integrated discussion and conclusions. It synthesises findings across the analytical levels, relates them to prior research and theoretical perspectives, considers implications for policy design and targets, and discusses the broader role of school meals in contributing to more sustainable food consumption.

Chapter 8 reflects on experiences of conducting research as a municipal PhD student, including questions of positionality, ethics, and policy-relevant research.

1.5. Dual role as researcher and civil servant

I wrote this thesis as a municipal PhD student. Throughout my doctoral studies, I have worked half-time as an environmental analyst at the City of Gothenburg's Environment Administration, in recent years with strategies for a sustainable food system, including the city's targets for public meals. I have not studied Gothenburg's own strategies or school meals, but my municipal experience has informed the research, particularly the interviews in Paper III. Chapter 8 reflects on how this dual role has shaped the research and how I have handled it.

CHAPTER 2

Background

Examining school meals as a setting for policies aimed at fostering low-carbon food consumption requires understanding the carbon footprint of food consumption, the role of school meals as an institutional food environment, and what existing research suggests about their potential to influence dietary behaviour. This chapter situates school meals within the broader context of food-related emissions and examines their role in shaping food consumption within and beyond the school setting. It then reviews research on school meal interventions and climate-related policies, focusing on behavioural outcomes, student responses, and public acceptability. Based on this review, research gaps are identified, and research questions are formulated to guide the analysis in this thesis.

2.1. The carbon footprint of food consumption

Food systems account for a substantial share of total anthropogenic greenhouse gas emissions, approximately one-quarter to one-third of global emissions (Crippa et al., 2021; Poore & Nemecek, 2018). However, the carbon footprint of food consumption varies considerably between countries. High-income countries are characterised by dietary patterns associated with higher per capita emissions, and emissions tend to increase as countries become wealthier, driven by rising consumption of meat and dairy products (Behrens et al., 2017; Tilman & Clark, 2014).

A central driver of food-system greenhouse gas emissions is the production of animal-source foods, although footprints vary substantially across product types. Ruminant meat, particularly beef and lamb, has the highest emissions intensity, primarily due to enteric methane and the substantial land requirements of grazing and feed production. The footprints of dairy products, pork, poultry and fish are lower but still typically exceed plant-based protein sources. Livestock supply chains contribute methane, nitrous oxide and carbon dioxide, including through manure management, fertilised soils, feed production and land-use change linked to pasture expansion and feed crops (Crippa et al., 2021; Poore & Nemecek, 2018). Land requirements are also relevant beyond direct supply-chain emissions, since land used for livestock and feed production has alternative uses, including carbon storage (Searchinger et al., 2018). In this sense, dietary composition, and especially the share of ruminant meat and dairy, can be understood as a key determinant of the carbon footprint of food consumption and of the mitigation potential of dietary change (Hedenus et al., 2014; Poore & Nemecek, 2018).

The IPCC thus identifies dietary change as a major demand-side opportunity for reducing greenhouse gas emissions from food systems (Creutzig et al., 2022; Nabuurs et al., 2022). Scientific assessments consistently emphasise shifts away from high-emission animal-source foods, particularly ruminant meat and dairy, towards lower-emission foods, especially plant-based foods (Poore & Nemecek, 2018; Rockström et al., 2025). Other components of the food chain, such as transport and packaging, typically account for about a tenth of total emissions compared with primary production (Poore & Nemecek, 2018), meaning that mitigation measures targeting these stages alone have more limited potential to reduce the overall carbon footprint of food consumption. Reducing food loss and waste is also identified by the IPCC as an important demand-side mitigation option (Mbow et al., 2019), but because the emissions associated with wasted food depend on which foods are wasted, shifts towards lower-emission diets also reduce the carbon footprint of food loss and waste.

Consumption-side policies for dietary change are relevant because dietary demand helps shape what and how much is produced. When demand shifts away from high-emission foods and towards lower-emission alternatives, it can contribute to reducing the climate impact of food production. This relationship is not one-directional: production systems also shape consumption by influencing what is available, affordable, appealing and socially normal to eat. This thesis focuses on the consumption side, examining how school meal climate policies can influence food demand and behaviours.

From a mitigation perspective, a transition towards diets with a lower share of animal products can thus be understood as a central challenge for high-emitting countries. Achieving such a transition requires changes in food-related behaviours, which is difficult because these behaviours are embedded in and shaped by a combination of individual-level factors, such as habits, preferences, and knowledge, and broader structural conditions, such as social norms, culture, food availability, pricing, marketing, and institutional food provision.

Because many of these conditions extend beyond individual choice, policy interventions that shape the environments in which food choices are made become central for influencing dietary patterns at scale. Institutional food settings are particularly relevant in this regard, as they structure repeated consumption, have the potential to influence habit formation and can be directly shaped through policy measures. School meals constitute one such policy context, where menu composition, availability, and information can be adjusted to influence food-related behaviours and, ultimately, the carbon footprint of food consumption.

2.2. School meals as an institutional food context

School meal programmes reach more than 400 million children globally, corresponding to 25% of all students in pre-school, primary, and secondary education, according to a 2024 global survey by the Global Child Nutrition Foundation (GCNF, 2024). Coverage varies substantially between countries, but in high-income countries school meals reach, on average, around 50% of primary and secondary school students. In this sense, school meals constitute a substantial and recurring component of children's diets in countries where diets have high carbon footprints.

In countries with comprehensive provision, school meals may account for a substantial share of total daily food intake for a non-negligible proportion of the population. In Sweden, for example, publicly funded school lunches are provided free of charge to all students in compulsory school, and are designed to cover one-third of daily energy and nutrient requirements (Swedish Food Agency, 2026). Swedish school meals account for approximately 3% of total food consumption[1], indicating they constitute a small but potentially systemically relevant component of the overall diet. As such, school meals can be understood not only as a social policy instrument but also as a structured, repeated food environment that shapes everyday eating behaviours.

Access to school meals differs across countries. In some countries, programmes are universal and free of charge. In others, meals are means-tested, partially subsidised, or targeted at specific socio-economic groups (GCNF, 2024). These differences shape not only how many students are reached, but also the role school meals play in society. Universal programmes may position school meals as a general welfare institution and a shared food context, while such a position may be weaker in more targeted programmes. Such differences are important because they influence the extent to which school meals can serve as a broad policy context for sustainable food consumption.

School meals most commonly consist of lunch, although some programmes also include breakfast or afternoon snacks. Their governance also varies. Typically, national authorities often define nutritional standards or overarching guidelines, while local authorities are often responsible for menu design, procurement, and implementation (GCNF, 2024). Municipalities or equivalent local authorities therefore often play a central role in translating national objectives into the concrete implementation of food provision. In this sense, school meals often operate at the

[1] Own estimate, based on Swedish school meals being intended to provide approximately one third of students' daily energy intake on school days, combined with the share of the Swedish population enrolled in compulsory school. See Paper III for details.

intersection of national policy frameworks and local implementation. This thesis focuses specifically on lunch provision, as it typically accounts for the largest share of food served in school settings. The thesis also focuses on local authorities, given their central role in shaping how school meal policies are designed and implemented in practice.

The Global Child Nutrition Foundation (GCNF, 2024) reports that approximately 40% of countries with a school meal programme indicate some focus on climate-adapted or low-carbon food provision. However, the meaning of such objectives varies considerably. In some cases, the climate aspect refers to food system resilience or climate adaptation, such as promoting crops that are more resilient to changing climatic conditions, rather than to reducing the carbon footprint of the food that is served. At the same time, national or local authorities in several countries have introduced school meal policy measures aimed at reducing greenhouse gas emissions by changing menu composition. This includes measures such as introducing vegetarian days or changing to low-carbon recipes, with examples from Spain, the US, France, Belgium, South Korea, Brazil, Finland, and Sweden (Batlle-Bayer et al., 2021; Blondin et al., 2022; Dahmani et al., 2024; De Keyzer et al., 2012; Kim & Kim, 2025; Kluczkovski et al., 2022; Lombardini & Lankoski, 2013; Swedish Food Agency, 2026). In these cases, school meal policy is positioned not only as a nutritional or social intervention, but as part of broader climate mitigation efforts.

2.3. School meals as a potential pathway to low-carbon food consumption beyond the school setting

Beyond their immediate nutritional function, school meals have been discussed as a potential lever for promoting healthier and more sustainable food practices beyond the school setting, both in policy literature (Nordic Council of Ministers, 2024; School Meals Coalition, 2025; WFP, 2024) and in academic literature (Oostindjer et al., 2017; Roque et al., 2022). While these discussions also include wider pathways such as education, community engagement, and public procurement, the rationale most directly relevant to this thesis is that school meals are recurring, publicly organised, and socially embedded meals that reach students across socio-economic groups over several years. From this perspective, school meals may shape food consumption not only by changing what is served in school, but also by familiarising students with low-carbon foods and meal compositions within everyday routines. However, these discussions primarily establish school meals as a plausible pathway for broader dietary change, rather than providing direct evidence that school meal provision leads to sustained low-carbon food consumption beyond the school setting.

Research provides some support for the broader idea that school meal measures can influence children's diets. Systematic reviews indicate that policies and interventions targeting the school food environment can produce modest improvements in children's dietary intake, particularly fruit and vegetable intake, nutrient profiles, and the selection or consumption of healthier foods (Durão et al., 2024; Micha et al., 2018; Nury et al., 2022). Some of this evidence concerns habitual intake measured beyond the school setting, suggesting that school-based changes can affect overall diet rather than only consumption during school meals (Micha et al., 2018). Although this literature is primarily health-oriented, it is relevant because it shows that institutional food environments can shape dietary behaviour beyond the immediate meal context.

One possible mechanism is repeated exposure. Studies with children show that repeated tasting can increase liking and acceptance of initially unfamiliar or disliked vegetables, although effects vary by food and evidence for longer-term changes in consumption is more limited (Lakkakula et al., 2010; Wardle et al., 2003). This suggests that repeated exposure to low-carbon dishes at school could, in principle, support familiarity and acceptance, especially if such meals are appealing and integrated into ordinary meal routines.

School meals may also connect with food practices beyond school through students' participation in food decisions at home. Household meals may be influenced by negotiations between family members, and research on meat reduction in families with adolescents shows that young people's preferences can matter, but that change is mediated by family routines, taste expectations, care, meal planning, and the desire to maintain family harmony (Hesselberg et al., 2024). A small study of families' meal decisions similarly suggests that adolescents' influence on family meat consumption is conditional rather than general, depending for example on their own dietary practices and whether sustainability arguments are raised in family meal discussions (Mata et al., 2025).

Direct empirical evidence linking school meal provision to sustained changes in food preferences, habits or behaviours beyond the school setting nevertheless remains limited. Much of the available evidence concerns health-related outcomes rather than low-carbon food consumption, and many studies examine multicomponent interventions, making it difficult to isolate the independent role of school meals. Consequently, while school meals are frequently conceptualised as a lever for wider dietary change, robust evidence of their impact on meat reduction, plant-based eating, or other forms of low-carbon food consumption beyond school remains underdeveloped.

2.4. Previous research on school meal climate policies

Empirical research on school meal climate policies remains limited, but a small number of studies have examined aspects such as effectiveness, student acceptance, and public acceptability.

With regard to menu changes aimed at reducing the share of animal products, Lombardini and Lankoski (2013) examined the introduction of vegetarian days in Helsinki, Finland, and reported initial resistance among students, manifested as decreased participation in school lunches, reduced amounts of food taken, and increased plate waste in the short term. These patterns were interpreted as signs of non-compliance with the policy, with the strongest effects among older students. However, these effects diminished over time. In contrast, De Keyzer et al. (2012) found no evidence of resistance or increased plate waste at the weekly vegetarian lunches in schools in Ghent, Belgium. Similarly, intervention studies in Swedish municipalities reported reductions in greenhouse gas emissions of 28 to 40% per meal, reaching 0.5 kg CO_2e per lunch, without indications of lower taste satisfaction, consumption, or higher plate waste (Elinder et al., 2020; Eustachio Colombo et al., 2020). These studies indicate that substantial emission reductions can be achieved through menu reformulation. Eustachio Colombo et al. (2021) explored how students view school meal climate policies, highlighting both support and concerns, and pointing to the importance of communication and framing as well as issues related to taste, choice, and the perceived purpose of the intervention.

A smaller body of research has examined the public acceptability of school meal climate policies, compared to research focusing on student acceptance. Such school food measures have in some cases been subject to public debate and controversy, and occasionally linked to political contestation around food and climate policy as reported by media outlets in several countries, including the UK, Sweden, South Korea, Germany, France, and Finland (Busby, 2020; Deininger, 2022; Eun-ji, 2020; LTO, 2025; Rio, 2023; Salovaara, 2024). However, existing research tends to report relatively high levels of acceptability, but primarily focuses either on parents' views regarding their own children or on comparatively non-intrusive policy measures such as offering more vegetarian dishes, but without restriction (Dahmani et al., 2024; Roque et al., 2023). A study analysing online discussions about all-vegetarian days in Swedish school canteens similarly found that nearly 60% of posts were positive, often referring to perceived effectiveness and health benefits, while negative comments emphasised restrictions on choice, nutritional concerns, and doubts about policy effectiveness (Bendz et al., 2023).

Taken together, existing studies provide initial evidence that school meal climate policies can reduce the carbon footprint of school meals without undermining

student acceptance. Although evidence on public acceptability is more limited, existing studies indicate that such measures can receive support, while also suggesting that acceptability may depend on perceived policy effectiveness, implications for individual choice, and health-related considerations. More broadly, there is little evidence on whether and how such policies may support low-carbon food consumption beyond the school setting.

2.5. Research gaps

Building on the preceding review of school meals as a policy context (Section 2.2), their potential to influence food consumption beyond the school setting (Section 2.3) and existing research on school meal climate policies (Section 2.4), several gaps in the literature can be identified. These gaps relate to different aspects of how school meal climate policies are expected to operate, including their behavioural potential, how they are perceived and accepted by students, and their public acceptability.

The existing literature suggests that school meals may have the potential to contribute to low-carbon food consumption beyond the school setting (see Section 2.3). However, research remains limited on whether and how school meal climate policies are designed to foster behavioural change beyond the school setting and thereby support broader shifts towards low-carbon food consumption.

There is also limited knowledge about student acceptance of low-carbon school meals when students are explicitly informed about the climate objectives behind menu changes. Previous intervention studies have generally implemented low-carbon menu changes with limited student awareness or communication of the changes and have therefore not examined whether explicit information about low-carbon menu changes affects students' acceptance. More broadly, research remains scarce on how students perceive and evaluate menu changes aimed at reducing the carbon footprint of school meals. This limits understanding of how policy communication and framing may influence acceptance. It is also relevant because information and awareness of why meals are changed may be important if school meal climate policies are to support low-carbon food consumption beyond the school setting.

With regard to public acceptability, to my knowledge, no previous studies have examined attitudes among the broad public towards menu-based climate policies in school meals, such as low-carbon recipes or vegetarian days. Existing studies tend to focus either on parents' views on increasing the frequency of vegetarian meals for their own children, or on comparatively non-intrusive policy measures (see Section 2.4).

These identified gaps, spanning different levels of the policy process, form the basis for the research questions that guide the analysis in this thesis.

2.6. Research questions

As stated in Section 1.1, the overall aim of this thesis is to examine the potential of school meals as a policy context for fostering low-carbon food consumption, within and beyond the school setting, and this aim is addressed through three primary research questions.

RQ1. How do students perceive and accept policy measures aimed at reducing the carbon footprint of school meals?

RQ2. What is the level of public acceptability of school meal climate policies, and which factors are associated with support?

RQ3. What potential do existing school meal climate policies have to influence food-related behaviours within and beyond the school setting?

The research questions are addressed as follows: Paper I and Paper IV examine student acceptance and perceptions (RQ1). Paper II analyses public acceptability in a cross-country perspective (RQ2). Paper III investigates the design and implementation of municipal school meal climate policies and assesses their behavioural potential (RQ3).

CHAPTER 3

Theory

This thesis proceeds from a pragmatic starting point. The overarching motivation is to examine whether, and in what ways, school meals can contribute to reduced dietary greenhouse gas emissions. This practical orientation has guided both the choice of methods and the theoretical framework. Rather than beginning from a specific theory, the thesis adopts conceptual tools suited for analysing policy design, implementation, and behavioural outcomes in concrete institutional settings.

Two theoretical perspectives are central to the thesis. First, the COM-B model is used to examine the behavioural conditions and mechanisms through which school meal climate policies may shape food-related behaviours. Second, research on policy acceptability is used to analyse the conditions under which such policies are likely to receive support, be politically feasible, and be practically implementable. Together, these perspectives make it possible to examine school meal climate policies as both behaviour-change interventions and contested public policies whose implementation depends on acceptance among students and the broader public.

Finally, Section 3.1 ends by briefly introducing selected concepts from transition research, which are used in the discussion to situate the findings in a broader system-level context.

3.1. Behavioural perspective based on the COM-B model

The thesis uses the COM-B model as a pragmatic framework for analysing behavioural mechanisms (Michie et al., 2011; West & Michie, 2023). COM-B conceptualises behaviour as dependent on three broad conditions: *capability*, *opportunity* and *motivation*. Capability refers to the *psychological* and *physical capabilities* required to perform a behaviour, such as knowledge, understanding and practical skills. Opportunity refers to external conditions that enable or constrain behaviour, including *physical opportunity*, such as availability, access, time and material resources, and *social opportunity*, such as norms, expectations and interpersonal influence. Motivation refers to *reflective* and *automatic processes* that energise and direct behaviour, including beliefs, intentions, habits, impulses and emotional responses. These components are interrelated: capability and opportunity may shape motivation, while repeated behaviour may feed back into future capability, opportunity and motivation through learning, habit formation and social normalisation. The model is illustrated in Figure **3.1**.

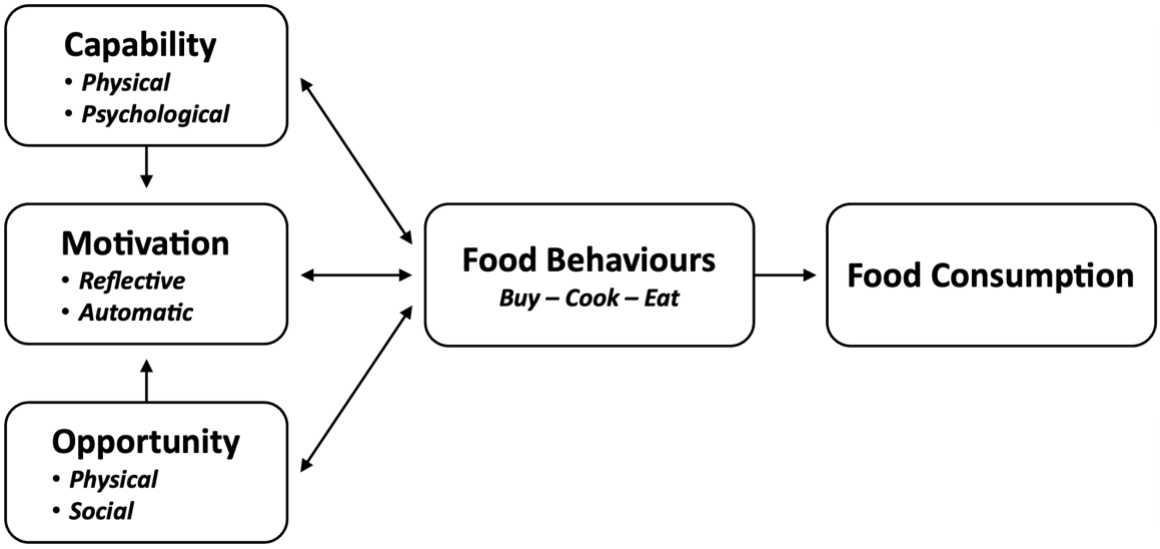


Figure 3.1: Adapted COM-B model illustrating key food-related behaviours in relation to low-carbon food consumption (Michie et al., 2011; West & Michie, 2023).

Note. The figure adapts the COM-B model to the thesis focus by treating low-carbon food consumption as an outcome of three key food-related behaviours: buying, cooking and eating.

COM-B forms the behavioural core of the Behaviour Change Wheel (BCW), a framework for characterising and designing behaviour change interventions. The BCW links behavioural diagnosis to nine *intervention functions* – education, persuasion, incentivisation, coercion, training, restriction, environmental restructuring, modelling and enablement – and to seven *policy categories* that can support their implementation: communication and marketing, guidelines, fiscal measures, regulation, legislation, environmental and social planning, and service provision (Michie et al., 2011). The thesis draws on the COM-B model, intervention functions and policy categories to assess the behavioural potential of municipal school meal climate policies and to analyse how policy measures are expected to influence food-related behaviours.

COM-B is suitable for analysing school meal climate policies, since measures such as menu reformulation, vegetarian provision, nudging, communication and education may operate through different behavioural pathways. For example, changing meal composition may alter physical opportunity, repeated exposure may influence familiarity and thereby automatic motivation, and information or linking school meals and teaching may support psychological and physical capability as well as reflective motivation.

In this thesis, low-carbon food consumption in general is understood as the outcome of several food-related behaviours rather than as a single act of choice. Three behaviours are treated as central: *buying*, *cooking* and *eating* food. Together, these behaviours shape the carbon footprint of food consumption through what foods are

acquired, prepared and consumed, and how. School meal policies most directly shape eating behaviour within the school setting, but they may also contribute more indirectly to behaviours beyond school if they affect students' familiarity with low-carbon dishes, social norms, knowledge, skills or motivation.

COM-B has previously been applied in research on food consumption and sustainable diets. It has been used to map barriers and enablers to reducing meat consumption and increasing plant-based eating, including knowledge, cooking skills, availability, affordability, social norms, taste expectations and habits (Graça et al., 2019; Kuosmanen et al., 2023). It has also been used to analyse sustainable food shopping and the role of information across planning, purchasing and reflection (Ran et al., 2022). Beyond individual-level consumer behaviour, COM-B and the Behaviour Change Wheel have also been used to analyse local authority policy documents, assessing whether policy measures specify target behaviours and align intervention content with plausible mechanisms of change (Mills et al., 2023). Reviews of interventions for environmentally sustainable diets further suggest that multicomponent interventions combining education, persuasion and environmental restructuring may be promising, although the evidence base remains limited (Wadi et al., 2024).

One limitation of COM-B is that its opportunity component can encompass a wide range of contextual influences, ranging from canteen-level food availability to norms related to food choices. Recent work integrating COM-B with a socio-ecological model of behaviour into a combined model, SeCOM-B, argues that for complex sustainability problems, the opportunity component needs to be further developed. While capability and motivation are treated at the individual level, opportunity is unpacked into nested levels, from immediate settings such as the home and school to wider community, institutional and policy contexts (Nguyen-Trung et al., 2025). This is relevant for school meal climate policies, where students' food-related behaviours are shaped not only by the school food environment, but also by municipal governance, peer and household contexts, and broader societal norms around meat and low-carbon food consumption. For the purposes of this thesis, however, the more parsimonious COM-B framework is used because it can be applied directly to the specific school meal climate policy measures under study and their plausible behavioural mechanisms. SeCOM-B provides a promising approach for analysing how behaviour is embedded in wider interacting systems, but applying it would require a broader mapping of the school, household, municipal, and wider institutional contexts surrounding students' food-related behaviours.

COM-B provides the main behavioural lens in this thesis, but, like SeCOM-B, it is mainly designed to analyse the conditions for specific behaviours. The discussion in

Section 7.2 asks a different question: whether changes in school meals can contribute to wider and longer-term shifts in food consumption, which also depend on the practices, norms, markets and policies that stabilise current consumption. For this, the discussion draws on socio-technical transition research. Concepts from the multi-level perspective (often called MLP) and strategic niche management are used, as a vocabulary rather than an analytical framework, to discuss whether school meals can function as a setting for experimentation, learning and normalisation in broader shifts towards low-carbon food consumption (Geels, 2002; Schot & Geels, 2008).

3.2. Public acceptability, student acceptance and policy effectiveness

In addition to the behavioural framework, the thesis draws on research on policy acceptability and acceptance as conditions for policy feasibility and effectiveness. This section elaborates on the role of acceptance in the analytical structure outlined in Section 1.3, where public acceptability operates at the level of policy conditions, while student acceptance operates at the level of policy outcomes.

In this thesis, acceptability and acceptance are treated as related but distinct concepts. Public acceptability refers to attitudinal evaluations of proposed or hypothetical policy measures, while acceptance refers to responses to implemented measures among those directly affected. Both may involve support or opposition, but neither should be equated with behavioural change. A policy may be considered acceptable without substantially changing food consumption, and an implemented policy may reduce emissions even if support is limited, provided that it changes the food environment and is not rejected in practice.

At the policy conditions level, public acceptability shapes the political feasibility of introducing and sustaining policy measures. Environmental policy measures are more likely to be adopted when public opinion is favourable (Anderson et al., 2017; Burstein, 2003), whereas measures perceived as intrusive, ineffective, or unfair entail greater risks of public resistance and political contestation (Bergquist et al., 2022; Jagers et al., 2024; Pechey et al., 2022). Research on climate and food policy acceptability shows that support is often associated with perceived fairness and effectiveness, climate concern, problem awareness, institutional trust, and ideological orientation, while socio-demographic variables tend to play a more limited role (Bergquist et al., 2022; Jagers et al., 2024; Pechey et al., 2022).

At the level of policy outcomes, acceptance among those directly affected influences how implemented measures work in practice. In school meals, this primarily concerns students' responses to changes in what is served and how such changes are communicated. As reviewed in Section 2.4, school meal climate policies have generated both successful implementation and resistance among students,

depending on policy design and context. Such resistance is consistent with broader food-policy research showing that acceptability tends to decline as measures become more intrusive, particularly those involving restrictions on choice (Ammann et al., 2023). Changes to what is served in school, especially measures such as all-vegetarian days, may be perceived as both intrusive and restricting students' choice. At the same time, studies of vegetarian food choice show that the way vegetarian meals are presented can affect what people choose: neutral or alternative framings can increase vegetarian choices compared with explicitly labelling meals or menu sections as vegetarian (Hielkema & Lund, 2022; Krpan & Houtsma, 2020). Together with the school-meal studies reviewed in Section 2.4, this suggests that student acceptance matters not only for whether menu reforms directly translate into actual changes in consumption patterns, but also for their maintainability over time.

Policy acceptance is thus conceptualised as a condition that links political feasibility, implementation, and behavioural outcomes. A school meal climate policy may be technically capable of reducing the carbon footprint of school meals, e.g., by directly reducing the share of high-emission food, but still fail or be weakened if it lacks sufficient public acceptability, generates implementation resistance, or is rejected by students in practice. Conversely, a policy may be accepted but still have limited effects if it does not sufficiently alter food provision and the behavioural conditions that shape food consumption.

Beyond acceptance, policy effectiveness depends on whether interventions translate into actual changes in food-related behaviour. Evidence from recent reviews suggests that interventions targeting environmentally sustainable dietary behaviours can influence food choices, but effects are often modest and context-dependent, with stronger outcomes when multiple intervention components are combined (Ran et al., 2025). This aligns with the intention–behaviour gap in food consumption, where expressed support for sustainable diets does not consistently translate into changed eating practices because of psychological, habitual, and contextual barriers (Linder et al., 2026). Regarding acceptability, evidence from research on consumer responses to retail-led protein-shift interventions suggests that less restrictive measures, such as information, social norms and choice architecture, tend to be more acceptable than price-based measures and choice restrictions, with perceived effectiveness, fairness and freedom of choice shaping acceptability (Linder et al., 2025). This points to a recurring tension in food policy: less intrusive instruments, such as information and nudging, tend to be more popular but less effective, whereas market-based and regulatory instruments tend to be more effective but less acceptable (Ammann et al., 2023).

Taken together, this means that effective school meal climate policies require both sufficient acceptance and alignment with behavioural mechanisms that enable

changes in food consumption. The policy-acceptance perspective explains when such policies are likely to be politically and practically viable, while the COM-B perspective outlined in Section 3.1 helps assess whether policy measures address the behavioural conditions that may support reducing the carbon footprint of food consumption.

CHAPTER 4

Policy Outcomes: Student Responses to School Meal Climate Policies

This chapter summarises Papers I and IV and addresses policy outcomes. It focuses on students as the primary target group of school meal climate policies and examines how low-carbon school meals are received in practice. Paper I analyses students' acceptance of low-carbon recipes tested through a controlled school meal intervention. Paper IV broadens this by examining students' perceptions and attitudes towards school meal climate measures more generally, with particular attention to both low-carbon recipes and all-vegetarian days.

4.1. Data and methods

Papers I and IV are based on the same intervention, conducted in collaboration with Lund municipality in southern Sweden, in which a low-carbon menu was introduced in compulsory schools. While both papers draw on this shared intervention context, they use different data and analytical approaches. Paper I is an experimental, quantitative analysis centred on the low-carbon menu in practice, using indicators such as food taken, plate waste, and meal satisfaction to examine students' acceptance in practice. Paper IV uses additional items from the same survey dataset alongside qualitative data to examine students' perceptions and attitudes in greater depth, including how they perceive low-carbon recipes, all-vegetarian days, and school meal climate measures more broadly. Together, these approaches make it possible to examine student responses both as observable behavioural outcomes and as expressed perceptions and evaluations. Paper I captures whether the low-carbon menu affected what students ate, wasted, and reported about meal satisfaction, while Paper IV complements this by examining how students interpreted and evaluated climate measures in school meals.

The intervention study was implemented within the ordinary school meal system of Lund municipality. In Lund, school lunches were served as a self-service buffet and, as in every Swedish compulsory school, free of charge for all students. Each day, students chose between two main dishes: one was always vegetarian, and the other alternated between meat, fish, chicken, and vegetarian options, accompanied by a salad buffet, bread, and milk or water. Meals were prepared and served as part of regular school operations, meaning that the intervention was embedded in a setting familiar to the students. This real-world setting was important because the study examined student acceptance under ordinary school meal conditions. A typical self-service arrangement in a Swedish school canteen is shown in Figure **4.1**.



Figure 4.1: Typical self-service lunch buffet in a Swedish school canteen.

Note: The photograph illustrates the type of school meal setting in which the study was conducted, but is not from any of the participating schools. In the participating municipality, lunches were provided free of charge and typically served as a self-service buffet with two main hot dishes, one of which was vegetarian, together with a salad buffet, bread, and milk or water. The intervention analysed in Paper I and the student perceptions examined in Paper IV were embedded in this everyday setting. Photo: Erik André.

The research approach included a pre–post design and a control group. Six compulsory schools (grades 0–9) participated and were assigned to three conditions, with two schools in each group: (1) schools introducing a low-carbon menu, (2) schools introducing the same low-carbon menu combined with information provided to students, and (3) control schools continuing with the standard menu. The study comprised a seven-week baseline period followed by a seven-week intervention period (Figure **4.2**). This design allowed changes from baseline to intervention to be compared across schools that did and did not receive the low-carbon menu, making it possible to assess whether changes in intake, waste, or satisfaction were specific to the intervention rather than reflecting general changes over time.

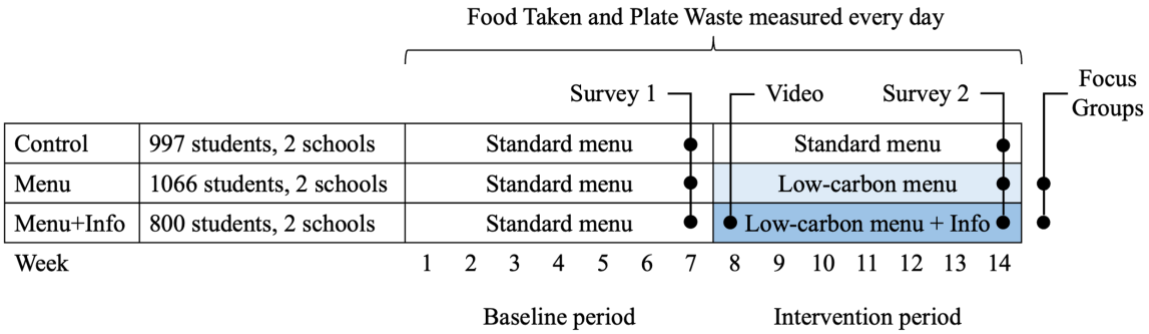


Figure 4.2: Design of intervention study.

Note. The figure shows the three study conditions, the timing of data collection, and the introduction of the low-carbon menu and information components. The study comprised a seven-week baseline period followed by a seven-week intervention period. Food taken and plate waste were measured continuously throughout both periods. Surveys were conducted before and after the intervention, and qualitative sessions were held afterwards.

The intervention introduced a new menu of low-carbon recipes, developed using an optimisation model to reduce greenhouse gas emissions by 20%. The model used linear programming to identify the ingredient combination that best met a specified objective within a set of constraints. It optimised the ingredient composition of the seven-week menu to lower the carbon footprint while meeting nutritional guidelines, maintaining cost levels and the share of organic food, and minimising changes to the existing ingredient list. Preserving familiar dishes and meal formats with minimal changes was done with the aim of sustaining student acceptance. This strategy had previously been developed and tested by the OPTIMAT project in school meal interventions in Uppsala and Botkyrka, Sweden, where carbon footprint reductions of 28% and 40% were implemented (Elinder et al., 2020; Eustachio Colombo et al., 2020). Lund municipality chose a 20% reduction as a substantial step towards their target of 500 g CO_2e per meal by 2030, representing about two-thirds of the reduction required. This was a pragmatic compromise, set together with the municipality's Meal Services Administration, between their concern that larger changes might reduce student acceptance and the research interest in a reduction large enough to be meaningful to study. The Lund intervention was carried out in collaboration with Schäfer Elinder and Eustachio Colombo from the OPTIMAT project, both co-authors of Paper I. The optimisation model provided a systematic way of optimising the menu, but is not necessary for applying the underlying strategy of reducing high-emission ingredients while retaining familiar recipes. As Paper III shows, several other Swedish municipalities also reduce the carbon footprint of school meals through recipe reformulation without using any optimisation model, for example by reducing the amounts of beef and dairy products in recipes and replacing them with plant-based alternatives.

Paper I: Student acceptance

Paper I analyses the students' acceptance of the new menu with and without information provision. The condition with salient information was included to assess whether making students aware of the menu change influenced their acceptance of the change. In an earlier intervention study using the same optimisation approach, some students had not noticed that the menu had changed, likely due to the relatively small menu modifications and minimal communication of the changes (Eustachio Colombo et al., 2021).

However, in real-world implementations of these kinds of policy measures, municipalities or local authorities may often choose to include information as a component, for example, to explain the rationale behind menu changes, communicate climate or health objectives, and increase transparency towards students, parents, and school staff. The information condition therefore allowed for examining whether increased awareness of the change affected behavioural and reported acceptance. In the information condition, students were shown a 3-minute animated video (Figure **4.3**) in class explaining how food relates to climate change and how the school menu would change, supported by posters in the dining area throughout the intervention period.



Figure 4.3: Still from the animated video shown in class.

Note. An animated 3-minute video was used in the information condition to explain the link between food and climate change and the planned changes to the school menu. The video is available with English subtitles at https://youtu.be/euSk9N_Z1mI?si=vrK8Q2xT2yTzVtzc.

Acceptance was operationalised through both behavioural indicators and self-reported evaluations. Behavioural acceptance was captured through daily weighing

of food taken and plate waste, measured at the school level. These measures reflected how much food students took and how much they discarded after eating. In addition, surveys were administered to all students in grades 4–9 at the end of both the baseline and intervention periods to capture their evaluations of meal taste and overall meal satisfaction. The analysis of survey data was based on the 653 students who completed the survey at both time points and whose responses could be linked, enabling paired analysis of changes between baseline and intervention.

The analysis was designed to test whether changes from baseline to intervention differed between the three conditions. For the behavioural measures, two-way ANOVA was used to estimate main effects of condition and time, as well as their interaction, to capture whether the change from baseline to intervention differed between conditions. For the survey data, individual-level difference variables were constructed for taste and overall evaluation by comparing each student's responses before and after the intervention. The distribution of these changes across conditions was then compared using Fisher's exact test.

Paper IV: Students' perceptions and attitudes

Paper IV used a convergent mixed-methods design, in which quantitative survey data and qualitative data were analysed separately and then integrated at the interpretation stage (Creswell, 2014). The purpose of this design was to combine a broad assessment of patterns in students' attitudes with a more detailed understanding of how students perceived and evaluated school meal climate policies in everyday school settings. In this way, Paper IV complements Paper I by moving beyond behavioural and self-reported acceptance of the low-carbon menu to examine students' perceptions of both low-carbon recipes and all-vegetarian days. The survey data made it possible to analyse patterns in attitudes, support, and reported food choices across a large group of students, while the qualitative sessions provided insight into how students reasoned about taste, satiety, meat, vegetarian food, and climate concerns in their own words.

The quantitative component draws on other items from the baseline survey than those used in Paper I to analyse factors associated with attitudes towards school meal climate policies. The survey was answered by 1,331 students in grades 4–9, and the 1,268 with complete data were included in the regression analyses. The sample is larger than in Paper I, which only included students whose baseline and follow-up responses could be linked.

In addition to attitudes towards two specific policy measures, low-carbon recipes and all-vegetarian days, the survey included items on food consumption habits, perceptions of school meals, concern for climate when choosing food, and background characteristics. These variables enabled analysis of how acceptance and

perceptions vary between students and how different factors relate to support for specific types of school meal climate policies.

The quantitative analysis was conducted in two stages. First, descriptive patterns in responses were examined using a heatmap that summarised mean values across a broad set of variables, organised by students' stance towards school meal climate policies. Students were classified into negative, neutral, and positive groups based on a summed attitude index ranging from 0 to 8, constructed from their attitudes towards all-vegetarian days and low-carbon recipes. Scores of 0–2 were classified as negative, 3–5 as neutral, and 6–8 as positive. This grouping indicated the size of each group and enabled comparison of how they differed across multiple domains, including school meal experiences, food consumption habits, and climate-related perceptions and beliefs. Second, regression analysis was used to examine associations between individual characteristics and the attitude index, enabling a more systematic assessment of which factors were linked to support for school meal climate policies.

The qualitative component was conducted after the intervention in two of the schools that received the low-carbon menu, one of which also received the information. It comprised four qualitative sessions with a total of 20 students: three focus group discussions and one individual interview. The interview had been planned as a focus group, but only one student attended; it followed the same guide and was retained in the analysis. The discussions were held at the schools and focused on students' experiences with school meals, their views on plant-based foods, and their perceptions of various climate-related changes to school meals.

The qualitative data were analysed using reflexive thematic analysis (Braun & Clarke, 2006). The analysis involved repeated reading of the transcripts, coding of meaningful segments, and iterative development of themes that capture how students reason about school meals and climate-related changes. This approach made it possible to identify central patterns in how acceptance and perceptions were shaped in practice, including how students evaluated different types of policy measures and low-carbon meal formats.

The quantitative and qualitative findings were interpreted together, focusing on convergence, complementarity and divergence between the two strands. The survey data provided an overview of general patterns in students' attitudes and factors associated with support, while the qualitative data helped interpret how students reasoned about and made sense of school meal climate policies. In this way, the integration enabled the analysis to combine breadth and depth in examining students' acceptance and perceptions.

4.2. Main findings

This section presents the main empirical findings from Papers I and IV. Together, they shed light on student responses to low-carbon school meal climate policies at two complementary levels: observed behaviour under implementation and students' attitudes and perceptions.

Paper I: Student acceptance

Paper I examines how introducing low-carbon recipes in school meals affected students' acceptance of the meals. The intervention achieved the intended reduction in greenhouse gas emissions, with the average carbon footprint of the menu decreasing by 20%, while maintaining nutritional adequacy and cost levels. No new ingredients were added, but lower-emission ingredients already on the ingredient list were used more often, and dishes remained within familiar formats. The intervention involved modifying the recipes of on average two dishes per week, primarily by reducing the quantities of high-emission ingredients such as red meat, cream, and rice, and increasing lower-emission components such as potatoes, pasta, bread, and plant-based fats. In a minority of the seven intervention weeks, this also included introducing an additional all-vegetarian day.

The results show no significant negative effects on students' acceptance following the intervention. Behavioural indicators of acceptance, the amounts of food taken and plate waste, showed no significant intervention effects, as there were no significant group-by-time differences between the control group, the low-carbon menu group, and the low-carbon menu with information group. Student-reported evaluations followed the same pattern. Taste satisfaction and overall ratings of the school meals did not change significantly across groups between baseline and intervention (Figure **4.4**). Hence, the informational component had no significant effect. Providing students with information about the menu change and its climate rationale led to neither significantly higher nor lower acceptance, indicating that awareness of the change did not alter how the meals were evaluated or consumed.

Taken together, the findings show that the introduction of low-carbon recipes reduced the carbon footprint of the menu by approximately 20% without significant negative effects on food taken, plate waste or reported meal satisfaction. This suggests that such policy measures can be implemented within existing school meal systems without disrupting students' food choices or evaluations.

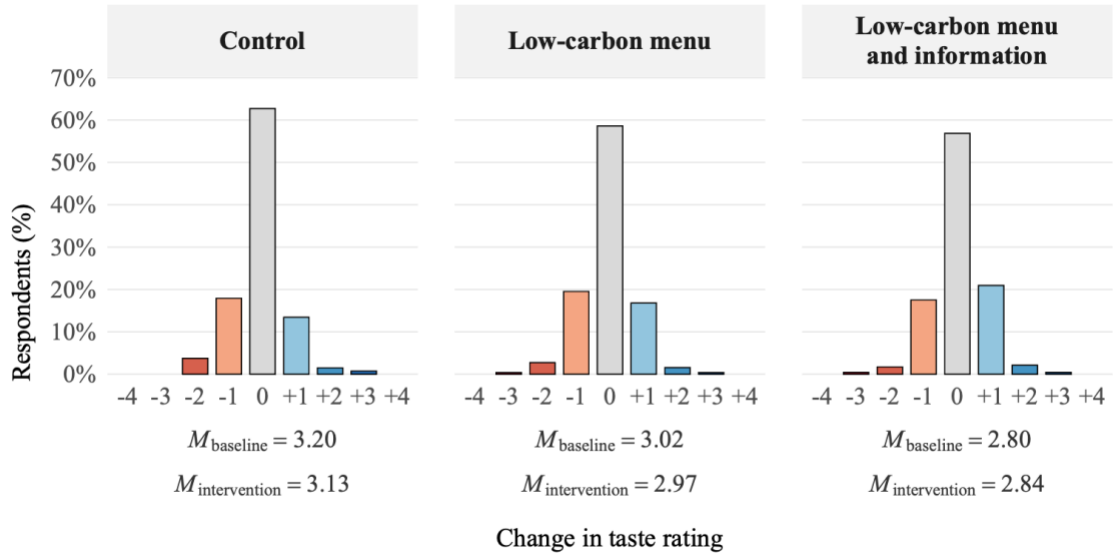


Figure 4.4: Distribution of change in taste rating between baseline and intervention

Note. Taste ratings changed little from baseline to intervention, with no meaningful differences between groups; overall lunch experience ratings showed the same pattern. Change in taste rating = taste rating at intervention − taste rating at baseline, calculated for each student (range: −4 to +4). Taste was rated on a 5-point scale, from 1 (most negative) to 5 (most positive). Mean ratings at baseline and intervention, by group, were: Control, baseline M = 3.20, intervention M = 3.13; Low-carbon menu, baseline M = 3.02, intervention M = 2.97; Low-carbon menu and information, baseline M = 2.80, intervention M = 2.84. A Fisher's exact test on the distribution of change in taste rating across groups revealed no significant difference, p = .880.

Paper IV: Students' perceptions and attitudes

Paper IV examines how students perceive and evaluate different school meal climate policies. The results show that acceptability is closely linked to whether they consider climate important in their food choices, how much vegetarian food they eat, and their gender.

Using the grouped attitude index described in the Methods section, the responding students were divided into three groups with negative (30% of respondents), neutral (43%), and positive (27%) attitudes towards the tested school meal climate measures. As shown in Figure **4.5**, these groups differ consistently across a range of variables. Students in the positive group attach greater importance to climate considerations when choosing food, report more frequent consumption of vegetarian food both at home and in school and are predominantly girls. This group also reports more positive experiences with school meals in general, for example, higher levels of taste satisfaction. In contrast, perceptions of the carbon footprint of red meat and vegetarian food are similar across all groups and fairly accurate.



Figure 4.5: Heatmap of characteristics across students grouped by overall attitude towards school meal climate measures (negative, neutral, positive).

Note. Students are grouped based on a summed attitude index (range 0–8) derived from survey responses to two policy measures: all-vegetarian days and low-carbon recipes. The index is divided into three categories: negative (0–2, n=398), neutral (3–5, n=577), and positive (6–8, n=356). The heatmap shows normalised mean values, enabling comparison across variables.

Whereas the heatmap provides a descriptive overview of these attitude groups, the regression analysis focuses on factors with plausible explanatory relevance based on the study's aims and previous literature. The regression analysis of factors associated with support for low-carbon school meals (Figure 4.6) further supports

the pattern shown in the heatmap (Figure **4.5**). Higher climate consideration in food choice, higher consumption of vegetarian food, and being female are all positively associated with support for school meal climate policies. By contrast, students' perceptions of how large the carbon footprints of red meat and vegetarian food are show weaker, though statistically significant, associations: students who perceived vegetarian food as having a lower carbon footprint tended to show somewhat higher support. Perceived peer consumption of red meat and vegetarian food shows no significant association.

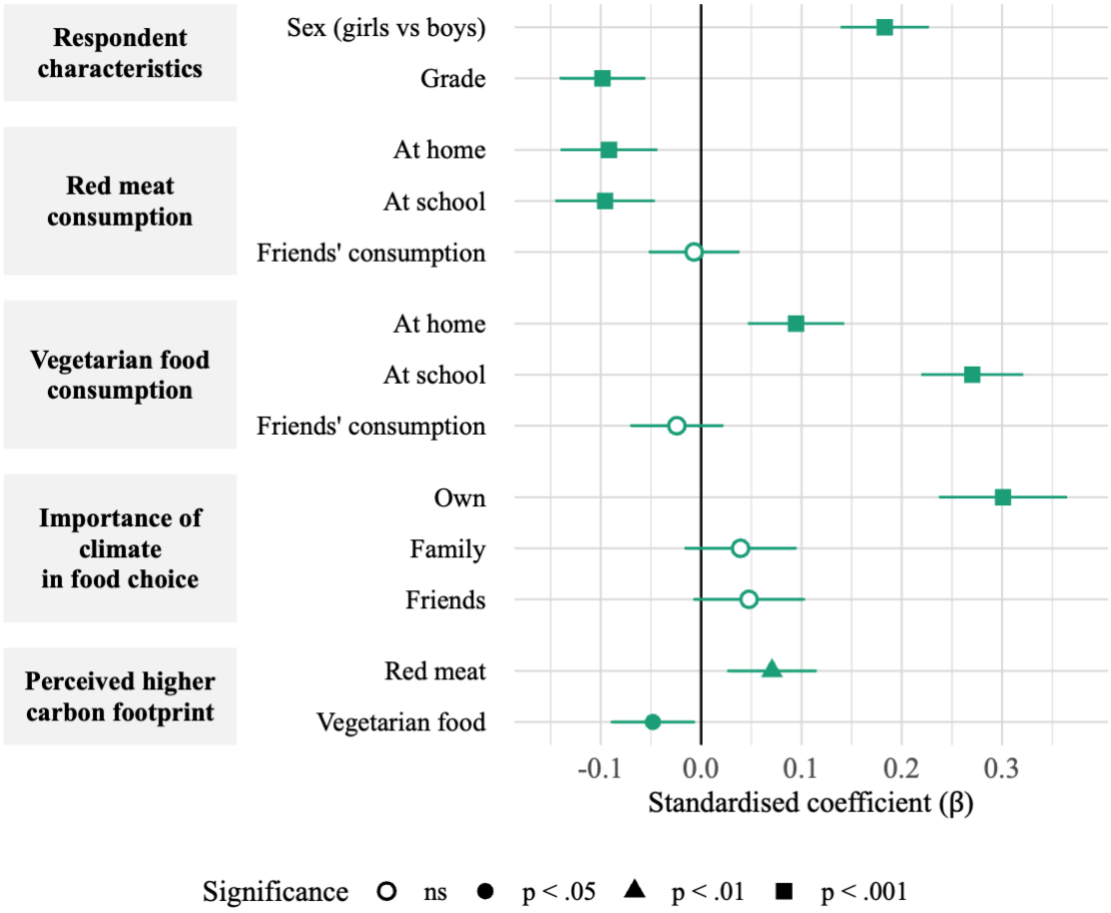


Figure 4.6: Factors associated with student support for low-carbon school meals.

Note. Standardised regression coefficients with 95% confidence intervals. Coefficients show associations with support for school meal climate policies: positive values indicate higher support, and negative values indicate lower support. For perceived carbon footprint, the coefficients indicate whether higher perceived emission levels of each food are associated with support. For example, the negative coefficient for vegetarian food indicates that students who perceive it as having a higher carbon footprint tend to show lower support.

Across both policy measures, students' average evaluations are close to neutral on the 0–4 scale. However, a paired t-test comparing students' ratings of the two

measures showed significantly higher support for low-carbon recipes (M = 2.03) than for all-vegetarian days (M = 1.87), although the difference was small (d = 0.17).

The qualitative findings provide additional insight into how these patterns are formed. Students generally showed awareness that food affects the climate and that different foods have different carbon footprints. However, they consistently emphasised taste, satiety, and familiarity as important when evaluating school meals, while climate considerations played a secondary role in actual food choices.

The qualitative findings also shed light on the difference between policy measures. Students distinguished between less visible changes to familiar dishes and more explicit vegetarian measures that removed meat from the menu. Reducing meat within familiar recipes was generally described as less problematic, whereas all-vegetarian days were expected to generate stronger resistance. Meat was frequently associated with satiety and with what constitutes a proper meal, reinforcing its normative role in students' expectations of school lunches.

4.3. Key insights on policy outcomes

Papers I and IV jointly show that students can accept low-carbon school meal measures when they preserve the basic qualities expected of school meals. In Paper I, low-carbon recipes reduced the menu's carbon footprint by 20% without significant negative effects on food taken, plate waste, taste satisfaction, or overall meal evaluation, and explicit information about the menu change did not significantly affect acceptance. Paper IV helps explain this pattern by showing that students generally understood that foods differ in their carbon footprints, but evaluated school meals primarily in terms of taste, satiety, familiarity, and their expectations of a school lunch.

Although many students reported that it mattered whether the food they ate had a low carbon footprint, and this was associated with stronger support for school meal climate measures, these considerations did not appear to override meal-centred expectations in practice. The key outcome-level insight is therefore that student acceptance appears to depend primarily on whether low-carbon meals meet expectations of taste, satiety and familiarity, rather than on their climate rationale. Consistent with this, low-carbon recipes were rated slightly more favourably than all-vegetarian days, possibly because they involved less visible changes to familiar meal formats and a less complete removal of meat from the menu. These findings indicate that low-carbon recipes can be implemented without significantly reducing consumption, increasing waste, or lowering satisfaction.

CHAPTER 5

Policy Conditions: Public Acceptability of School Meal Climate Policy

While the previous chapter analysed students' attitudes, this chapter addresses the conditions for policymaking by examining public acceptability of school meal climate policy measures. This chapter presents the results of Paper II, comparing levels of support between all-vegetarian days and low-carbon recipes and examining factors associated with policy support.

5.1. Data and methods

Paper II is based on a preregistered cross-sectional survey of the public acceptability of school meal climate policies in France, Poland and Sweden. All three are high-income European countries with school meal programmes, but they differ in coverage, in the promotion of plant-based options and in dietary norms. This allows acceptability to be compared across contrasting national settings.

Data were collected through an online survey administered by YouGov in October 2024 as part of a larger research project on climate and health policy. The survey was completed by 3,038 adults, of whom 2,411 were retained in the final analytical sample after additional data-quality checks. The sample was stratified by age, gender, education and geographical region to approximate national representativeness.

The analysis first compared the acceptability of school meal climate policies with other food-related climate policy instruments, including a tax on high-emission foods, subsidies for low-emission foods, and labelling of high-emission foods, situating the school meal climate policies within a broader policy landscape. It then compared support for all-vegetarian days and low-carbon recipes across the three countries, assessing both differences between the measures and variation across national contexts (respondents were randomly assigned to evaluate either all-vegetarian days or low-carbon recipes). Both proposals were described as meeting nutritional guidelines and reducing the share of ingredients with a large carbon footprint by about 30%. Respondents rated their attitudes towards each proposal on a seven-point scale. Finally, regression models were used to examine factors associated with policy acceptability, including dietary behaviour, climate-related attitudes and awareness, trust, political orientation, and socio-demographic characteristics.

5.2. Main findings

The analysis shows that when France, Poland and Sweden are combined, the acceptability level of school meal climate policies is slightly below neutral. There is no significant difference in acceptability between all-vegetarian days and low-carbon recipes, either in the pooled sample or within individual countries. Across countries, acceptability is at a similar, approximately neutral level in France and Sweden, whereas Poland shows lower support. The mean values in France and Sweden mask some differences in response distributions. In Sweden, responses are more polarised, with a somewhat stronger tendency towards both negative and positive evaluations.

Compared with other food-related climate policy instruments, both all-vegetarian days and low-carbon recipes receive significantly higher support than a tax on high-emission foods, but significantly lower support than subsidies for low-emission foods and labelling of high-emission foods (Figure **5.1**). This places school meal climate policies in an intermediate position regarding public acceptability.

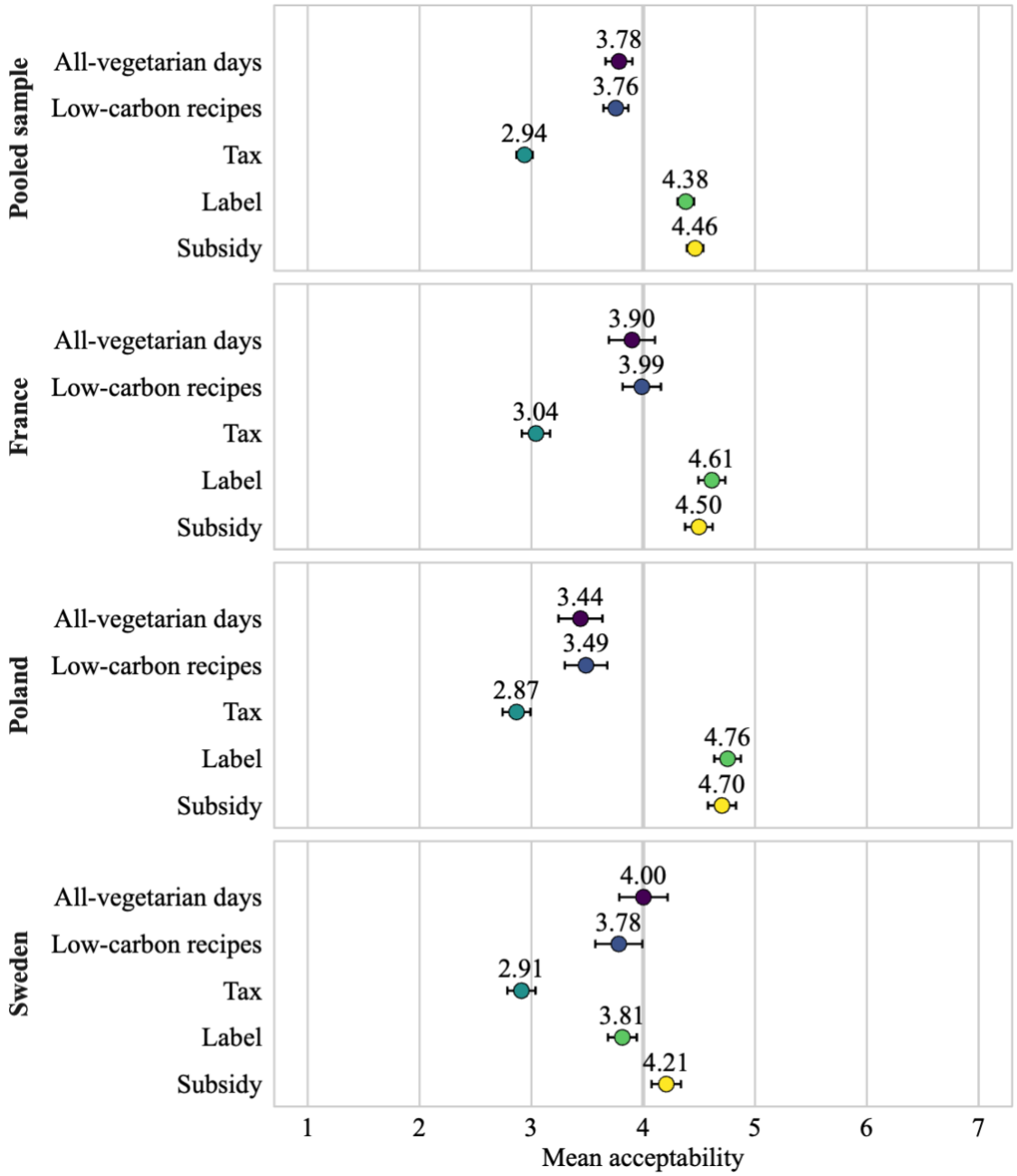


Figure 5.1: Mean acceptability of climate-related food policy measures.

Note. Ratings are shown on a 1–7 Likert scale, with 4 marking the midpoint, and include 95% confidence intervals. Results are shown for the pooled sample and for France, Poland, and Sweden separately. Colours distinguish the policy measures across panels.

The regression results in Figure **5.2** provide insight into factors associated with acceptability. For this analysis, responses to all-vegetarian days and low-carbon recipes were combined into a single indicator of school meal climate policy acceptability. This was done because the two measures did not differ significantly in acceptability, and because separate models for each measure showed very similar patterns of association.

The results show that a high awareness of beef's carbon footprint is by far the strongest correlate of higher acceptability, followed by high climate concern and low own beef consumption. Political and scientific trust show weaker but significant positive associations. Political ideology is only weakly associated with acceptability and is not significant once socio-demographic variables are included. Socio-demographic variables add little explanatory power overall, although younger age, tertiary education and rural residence are associated with slightly higher acceptability and having children in the household with somewhat lower acceptability once other factors are controlled for.

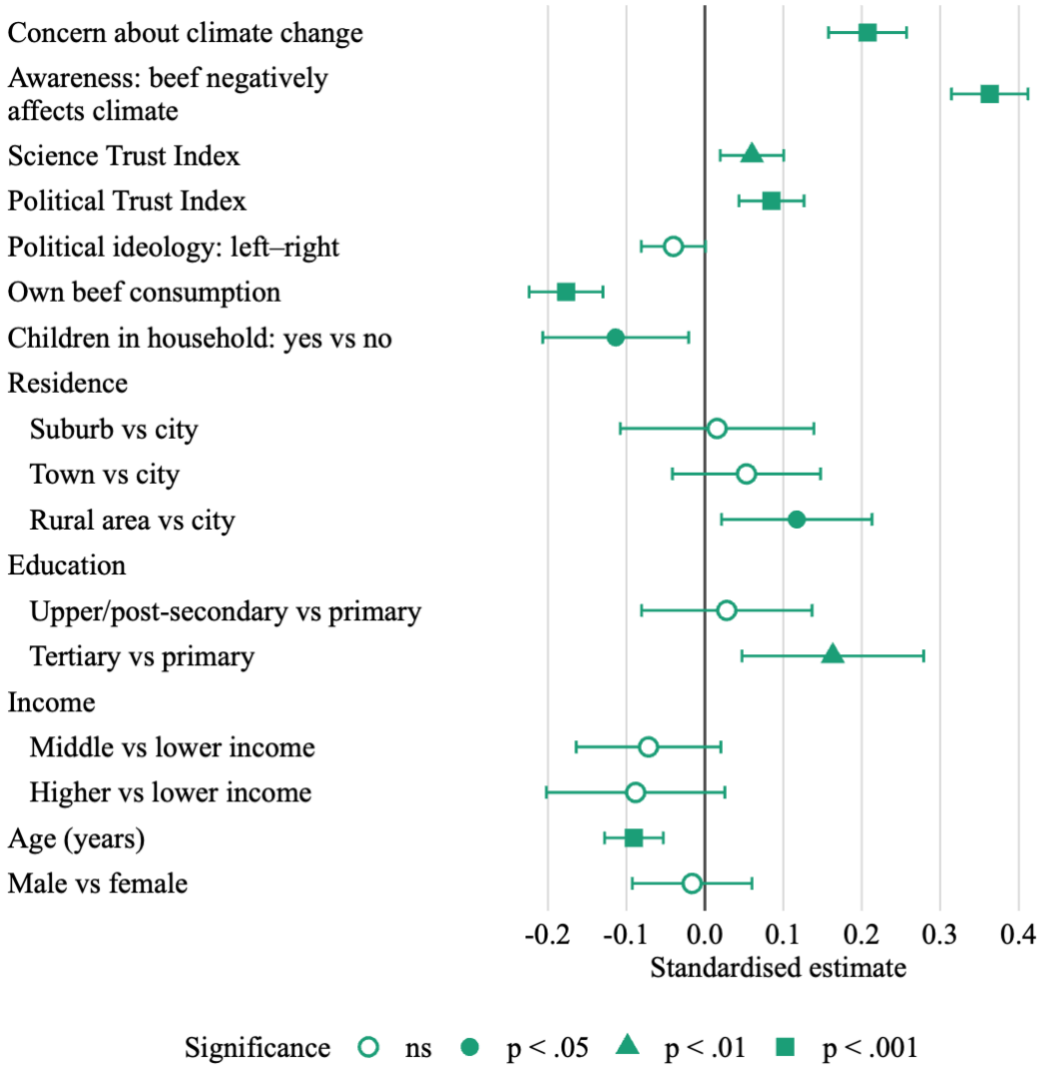


Figure 5.2: Factors associated with public acceptability of school meal climate policies.

Note. Standardised regression estimates with 95% confidence intervals. Estimates show associations with support for the pooled school meal climate policies (all-vegetarian days and low-carbon recipes). Country and policy condition were included as covariates but are not shown here. Positive values indicate higher support, and negative values indicate lower support.

5.3. Key insights on policy conditions

Public acceptability of school meal climate policies is around neutral. These measures are more acceptable than a tax on high-emission foods, but less acceptable than subsidies for low-emission foods and labelling of high-emission foods. There is no significant difference in acceptability between all-vegetarian days and low-carbon recipes, suggesting that the public does not clearly distinguish between the two school meal measures in terms of overall support. Cross-country differences are modest, but support is lower in Poland, while responses in Sweden are more dispersed than in France and Poland. Acceptability is most strongly associated with awareness of beef's carbon footprint, climate concern, and lower beef consumption.

CHAPTER 6

Policy Design: Behavioural Potential of Municipal School Meal Climate Policies

This chapter examines the design and behavioural potential of school meal climate policies, focusing on how policy measures may shape low-carbon food consumption both within and beyond the school setting. It adopts a behavioural perspective, drawing on the COM-B framework to analyse how policy measures address capability, opportunity and motivation for food-related behaviours relevant to low-carbon food consumption. The chapter is based on Paper III, and focuses not only on which measures municipalities use, but also on which forms of behavioural change these measures can support.

6.1. Data and methods

Paper III examines how municipalities design and implement policy measures to reduce the carbon footprint of school meals, and how these measures may influence food-related behaviours relevant to low-carbon food consumption. A qualitative approach was used because the study aimed to identify and interpret policy design in practice, that is, how municipal officials describe their measures and how these are implemented, rather than to measure their outcomes for food consumption or greenhouse gas emissions.

The empirical material consists of semi-structured interviews with meal coordinators or equivalent officials responsible for the strategic planning of school meals in 11 Swedish municipalities. The municipalities were selected based on ranking data on the carbon footprint of public meal purchases, enabling the study of policies in municipalities that had already achieved relatively low emission levels. The interviews were used to identify and understand the policy measures employed. This selection was suitable for exploring what school meal climate policy can look like in municipalities that are relatively advanced in this area. The trade-off is that the findings should not be interpreted as a national overview of ordinary municipal practice, but as an analysis of policy designs among municipalities that had already achieved relatively low carbon footprints in public meals. This is relevant because many municipalities have ambitious climate targets for the carbon footprint of school meals and are therefore likely to implement measures similar to those in the sample.

First, the analysis identified concrete municipal measures used to reduce the carbon footprint of school meals. These measures were categorised according to their main area of action, such as meal composition, meal presentation, education and communication, and organisational capacity-building, and according to how frequently and intensively they were used across municipalities. Combining deductive and inductive coding allowed the analysis to be guided by existing knowledge about common school meal climate measures while remaining open to measures and implementation practices that did not fit predefined categories.

After the initial mapping of municipal measures, the analysis narrowed to measures affecting students and therefore potentially relevant to influencing their food behaviours. The measures were classified according to their mode of interaction with students: direct student interaction, indirect student interaction, or background measures without student interaction. The behavioural-potential analysis focused only on measures with direct or indirect student interaction, since these were the measures that could plausibly influence students' behaviours. Background and capacity-building measures were not included in this part of the analysis because they do not directly address students. This delimitation made the behavioural analysis more focused, but it also means that the study does not fully capture how organisational capacity, procurement routines, staff training, or political steering may indirectly shape what students encounter in the school meal setting. The student-facing measures were then analysed regarding the COM-B components they may address and the food-related behaviours they may influence, as summarised in Figure **6.1**. Paper III also classified the measures according to leverage points, a synthesis of barriers and enablers for low-carbon diets, but as these results largely overlap with the COM-B analysis, they are not summarised here.

The first analytical perspective operationalised the COM-B and Behaviour Change Wheel framework described in Section 3.1. Each student-facing measure was first classified according to its likely intervention functions: environmental restructuring, restriction, education, persuasion or training. Following Michie et al. (2011), these intervention functions were then used to identify which COM-B components the measure may address. For example, measures that change the placement or presentation of food or add plant-based options correspond to environmental restructuring, which Michie et al. (2011) link to physical opportunity, social opportunity and automatic motivation, while measures that reduce the availability of meat, such as all-vegetarian days and low-carbon recipes, correspond to restriction, which is linked to physical and social opportunity. Educational measures were linked mainly to psychological capability and reflective motivation. This procedure made it possible to assess whether municipal school meal climate measures primarily change the eating environment, or whether they also address knowledge, skills and motivation relevant to low-carbon food consumption. The

strength of this approach is that it analyses plausible behavioural mechanisms and potential of the policy measures, rather than merely the immediate effects in food consumption. Its limitation is that it assesses likely behavioural mechanisms based on policy descriptions and interview accounts, rather than measuring whether these mechanisms actually changed students' behaviour.

The second analytical perspective concerned the food-related behaviours that the measures may influence. This perspective was included because low-carbon food consumption depends on more than what students eat in the school canteen. While school meal policies most directly shape what students eat at school, broader dietary change also involves acquiring and preparing food outside school. As in Paper III and Section 3.1, three behaviours were distinguished as central to low-carbon food consumption: buying, cooking and eating. This distinction was used to assess whether municipal measures primarily targeted students' eating within school meals or had potential to support food-related behaviours beyond the school setting.

Together, these perspectives enabled an assessment of whether the analysed school meal climate policies primarily reduce the carbon footprint of meals served in school, or whether they also address behavioural conditions that may support low-carbon food consumption beyond the school setting. The analysis should therefore be read as an assessment of policy design and plausible behavioural pathways, not as an evaluation of actual behavioural outcomes. Its strength lies in showing how existing municipal measures are oriented behaviourally; its limitation is that the effects on students' food choices, habits, knowledge, or practices beyond school were not measured directly.

6.2. Main findings

Paper III identifies fifteen measures used by Swedish municipalities to reduce the carbon footprint of school meals. These measures covered meal composition, meal presentation, education and communication, and organisational capacity-building. As the behavioural-potential analysis focused on student-facing measures, Figure **6.1** summarises measures with direct or indirect student interaction. These measures are primarily clustered around meal composition and meal presentation, while education and communication measures receive much less emphasis.

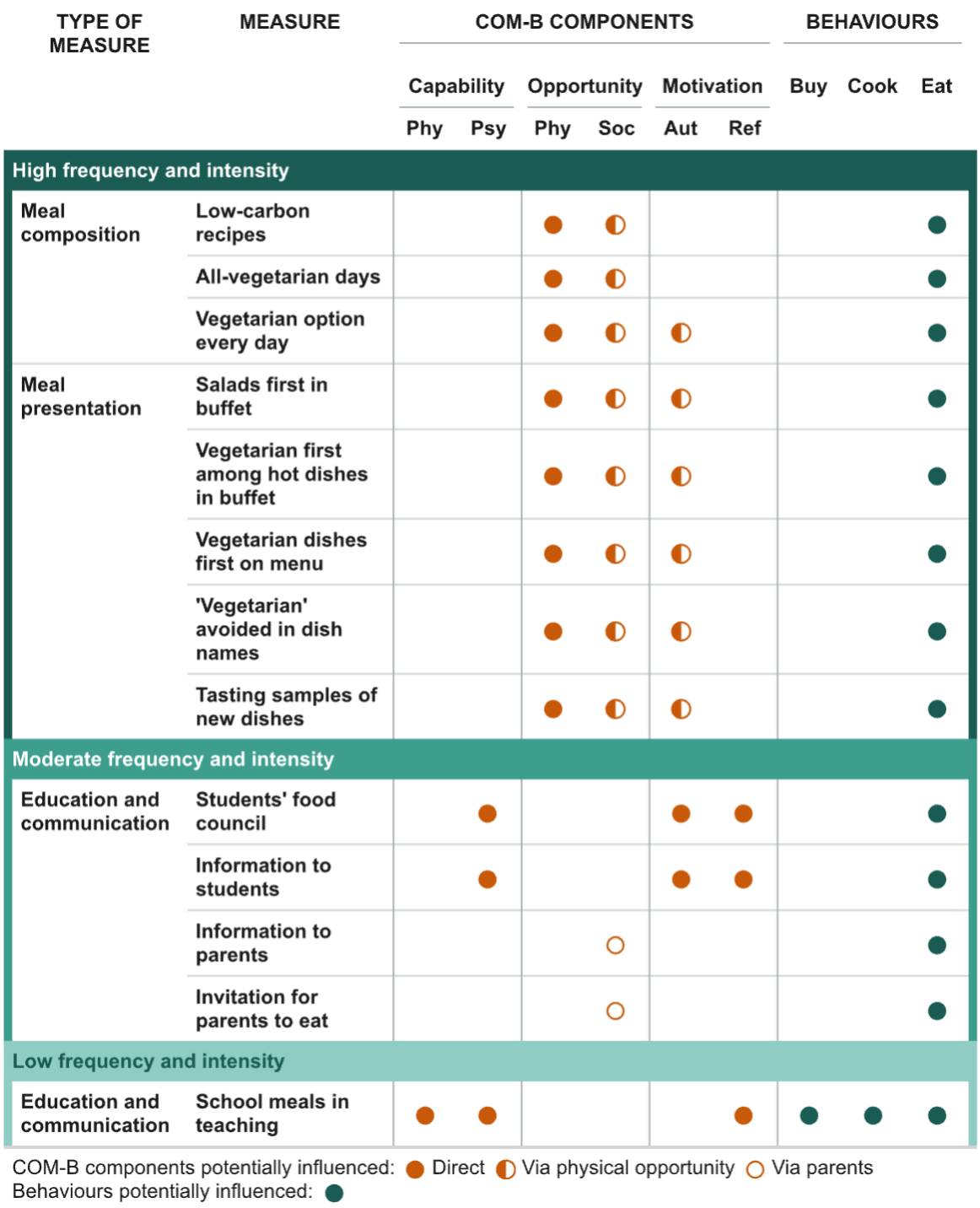


Figure 6.1: School meal climate measures and their behavioural potential.

Note. The figure includes measures with direct or indirect student interaction, grouped according to how frequently and intensively they were used across municipalities. COM-B components and behaviours follow the classifications in Paper III. The distinction between direct and indirect links, via physical opportunity or via parents, is a judgement added to the mapping in Michie et al. (2011). All-vegetarian days and low-carbon recipes correspond to restriction and are therefore not linked to automatic motivation, although repeated exposure may increase familiarity (Chapter 7).

The most widely used measures are related to meal composition and presentation. These include offering a vegetarian option every day, using low-carbon recipes,

introducing all-vegetarian days, and applying nudges such as placing salads first in the buffet and positioning plant-based dishes more prominently. Together, these measures make lower-emission options more available, visible, and easier to choose, and are intended to reduce the carbon footprint of the food served. In contrast, measures intended to support understanding, reflection, or broader learning, such as information to students, food councils, or using school meals in teaching, were used less frequently and generally with lower intensity.

A further finding is that background and capacity-building measures were important for enabling and sustaining municipal school meal climate work. These included staff training, policy targets, monitoring systems, management support, and long-term continuous development. Such measures did not directly address students and were therefore not included in the behavioural-potential analysis, but they formed important implementation conditions for reducing the carbon footprint of school meal provision over time.

When analysed through the COM-B framework, the findings show a clear concentration on physical opportunity. The dominant measures work by changing the food environment, making lower-emission meals more available, visible, and easier to choose. They may also indirectly address social opportunity and automatic motivation, for example by increasing familiarity with plant-based meals and potentially over time supporting a normalisation of such choices. By contrast, psychological and physical capability, as well as reflective motivation, are only weakly addressed. In other words, current strategies are much more oriented towards changing the immediate eating environment than towards building knowledge, skills, or reflective motivation for low-carbon food consumption.

The analysis also shows that the identified measures are primarily oriented towards eating behaviour. They are designed to influence what students choose and consume in the school meal setting, while buying and cooking are only marginally addressed. Measures with potential to influence these behaviours, such as linking school meals to teaching, were used only to a limited extent.

This does not mean that knowledge and skills related to sustainable food consumption are absent from schools more generally. The national curriculum includes food and sustainability content, including practical cooking skills in home economics. However, the municipalities in Paper III rarely integrated such teaching with school meal provision. The school meal was therefore only to a limited extent used as a practical context for connecting classroom teaching to everyday low-carbon food consumption.

6.3. Key insights on policy design

The analysed school meal climate policies are primarily designed to reduce the carbon footprint of school meal provision by changing the meal environment and increasing the availability of low-carbon meals. Their behavioural potential is therefore concentrated on eating behaviour within the school setting, while buying and cooking are only marginally addressed. The measures may have potential to support familiarity, habits and social norms through repeated exposure to low-carbon meals, but they place limited emphasis on knowledge, practical skills and reflective motivation. Although sustainable food consumption may be addressed through classroom teaching, this is only weakly integrated with school meal climate policies, if at all.

Overall, current policy designs appear primarily oriented towards reducing the carbon footprint of school meal provision, rather than explicitly using school meals as a practical context for supporting low-carbon food consumption beyond the school setting. Paper III also suggests how designs could be adapted if supporting low-carbon food consumption beyond school were an explicit aim. This would involve balancing it against other aims, such as rapid emission reductions and minimising food waste, for example by allowing a more gradual pace of change, giving students room to try new foods, and preserving choice while increasing the availability of plant-based meals.

CHAPTER 7

Discussion and Conclusions

This chapter returns to the aim of the thesis by bringing together the findings from the appended papers and discussing what they show as a whole. Section 7.1 synthesises the main patterns and contrasts that emerge across the papers and analytical levels, and in relation to prior research and relevant theory. It moves from what the findings show is possible, through the conditions for and design of school meal climate policies, to their implications for practice and research.

Section 7.2 builds on this synthesis by further considering the potential role of school meal climate policy at the societal level. The chapter then turns to the strengths and limitations of the thesis in Section 7.3. Finally, Section 7.4 addresses the research questions and summarises the main conclusions.

7.1. Synthesis and relation to prior research and theory

The synthesis follows the three levels of the policy process introduced in Section 1.3: policy outcomes, policy conditions and policy design. The last section then discusses implications across the levels.

7.1.1 Policy outcomes: Reducing emissions while maintaining student acceptance of meals

Student acceptance appears to depend less on the climate rationale of the measures than on whether low-carbon meals meet the students' meal expectations. In Paper I, low-carbon recipes reduced the menu's carbon footprint by 20% without significant negative effects on food taken, plate waste, taste satisfaction, or overall meal evaluation. Although the absence of significant effects does not establish that the true effects are zero, this finding points in the same direction as two earlier intervention studies in Sweden (Elinder et al., 2020; Eustachio Colombo et al., 2020). Together, they indicate that menu optimisation can substantially reduce the carbon footprint of school meals without undermining student acceptance, at least in a Swedish context where vegetarian meals are generally already a familiar part of the school meal provision.

Paper IV adds insight into why student acceptance may have been maintained. Students emphasised taste, satiety, familiarity and expectations of a proper school lunch when discussing low-carbon meals. This aligns with earlier qualitative research identifying taste, choice, familiarity and perceptions of vegetarian food as important for students' responses to school meal changes (Eustachio Colombo et al., 2021; Frödén, 2021). Together, this suggests that reducing the share of animal-based

ingredients need not undermine student acceptance, as long as those changes align with what is perceived as familiar and appealing meal formats.

This interpretation aligns with recent research indicating that vegetarian meals are not necessarily less liked than non-vegetarian meals, when they are well designed and integrated into ordinary school meal provision (Marty et al., 2024). Furthermore, studies on repeated exposure show that children's liking for initially unfamiliar or disliked foods can increase through repeated tasting (Lakkakula et al., 2010; Wardle et al., 2003), suggesting the possibility that acceptance of low-carbon meals may rise over time after their introduction. This aligns with findings from when schools in Helsinki, Finland, introduced all-vegetarian days, and initial negative responses diminished over time (Lombardini & Lankoski, 2013).

However, research on meat reduction and plant-based diets also identifies meat-centred meal norms, taste expectations, habits, and social context as barriers to change towards low-carbon diets (Graça et al., 2019; Stoll-Kleemann & Schmidt, 2017). This aligns with Paper IV, where meat was associated with satiety and expectations of a proper meal, while vegetarian dishes were accepted more conditionally. In the school meal context, negative attitudes to vegetarian or low-carbon meals should therefore not necessarily be interpreted as opposition to climate policy or plant-based food in general. Rather, they may reflect concerns about whether the meal is familiar, will taste good and will be filling.

Knowledge and climate concern do not automatically translate into corresponding food choices. In Paper IV, taste, satiety and familiarity were more prominent than climate considerations in students' discussions about school meals. This is consistent with research showing that food choices are also shaped by habits, preferences and social context (Graça et al., 2019; Kollmuss & Agyeman, 2002). In COM-B terms, awareness (psychological capability) and climate consideration (reflective motivation) were often present, but acceptance in practice appeared to depend more on physical opportunity and automatic motivation: what is served, and whether it is familiar, tasty and filling.

One possible reason why recipe optimisation can maintain student acceptance is that the changes are relatively subtle, and students may not notice them; in an earlier intervention, some students had not noticed the menu change (Eustachio Colombo et al., 2021). This was examined in Paper I by explicitly informing students about the menu change, what it consisted of and why it was introduced. No significant effects of the information were found, suggesting that making students aware of the changes did not in itself detectably reduce acceptance, although the information may not have been salient enough to provoke stronger reactions.

More subtle changes such as low-carbon recipes may nonetheless be somewhat easier for students to accept than more visible measures such as all-vegetarian days. In Paper IV, students rated them more positively, though the difference was small (d = 0.17). Low-carbon recipes may be less disruptive because they reduce high-emission ingredients within familiar dishes, rather than making the absence of meat the defining feature of the meal. In practice, the two measures are often combined, as in the intervention study.

Together, Papers I and IV and prior research also suggest that how low-carbon menus are implemented matters, particularly whether meals meet students' expectations of taste, familiarity and meal format. This raises a possible balance between preserving familiar and appealing meals to maintain acceptance and introducing new foods and meal compositions that students may gradually become accustomed to, which is discussed further in Section 7.1.4.

7.1.2 Policy conditions: Acceptability of policies versus acceptance of meals in practice

Public acceptability and student acceptance concern different aspects of the feasibility of school meal climate policies. Public acceptability concerns attitudes towards proposed policy measures and may influence whether they are introduced and sustained. Acceptance in practice concerns how students respond to implemented changes in school meals, including whether they eat and appreciate the food served.

In Paper II, public acceptability of school meal climate policies in France, Poland and Sweden was close to neutral overall. Low-carbon recipes and all-vegetarian days received greater support than a tax on high-emission foods, but less than labelling and subsidies. This is consistent with broader food-policy research showing that less intrusive instruments tend to receive higher support than taxes and restrictions (Ammann et al., 2023; Pechey et al., 2022).

In Paper II, acceptability was most strongly associated with awareness of beef's carbon footprint, high climate concern and lower personal beef consumption. This partly aligns with broader climate-policy research identifying climate concern as an important correlate of support (Bergquist et al., 2022), although in Paper II the more policy-specific awareness of beef's climate impact was the stronger correlate. Political ideology was only weakly associated with acceptability and was not significant once socio-demographic variables were included. This suggests that public attitudes towards school meal climate policies are not primarily divided along left–right lines, despite the controversies described in Section 2.4. A weak association at the individual level does not, however, rule out that these policies become politicised by particular parties or in particular local contexts.

The distinction between acceptability of proposed policies and acceptance in practice is also relevant when comparing the findings across the papers. In Papers II and IV, respondents evaluated described policy measures, with average attitudes generally close to neutral. While adults in Paper II did not distinguish significantly between low-carbon recipes and all-vegetarian days, students in Paper IV expressed somewhat stronger support for low-carbon recipes, although the difference was small. These findings are not directly comparable, given differences in samples and survey contexts. In Paper I, by contrast, the implemented low-carbon menu caused no detectable reduction in acceptance. Since the Paper IV survey was conducted at baseline in the same schools as the Paper I intervention, this contrast also holds within one student population: close-to-neutral stated support coexisted with no detectable negative response to the menu change in practice. This suggests that changes to school meals may be accepted in practice even when support for such policies is not particularly strong. However, practical acceptance does not necessarily imply approval of the policy itself, just as stated support does not necessarily translate into acceptance of the meals served.

Average acceptability ratings also conceal variation. In Paper II, more than 20% of the adult respondents were very negative towards the school meal measures. Although mean support was broadly similar in Sweden and France, responses in Sweden were more polarised than in France and Poland, with the lowest and highest ratings being the most common. In Paper IV, the neutral group was the largest among the students, but around 30% of students were negative towards the measures, slightly more than were positive. Boys were strongly overrepresented in this group, outnumbering girls by about three to one.

7.1.3 Policy design: The orientation of municipal measures

In the Swedish municipalities studied in Paper III, school meal climate measures were primarily directed at reducing the carbon footprint of school meals through changes to meal composition and presentation, including low-carbon recipes, vegetarian provision and nudging. In COM-B terms, these measures mainly targeted physical opportunity by changing the food environment, with possible indirect effects on habits and norms through repeated exposure. Targets concerned the carbon footprint of food purchased, food waste and the share of organic food, while supporting low-carbon food consumption beyond school was not explicitly addressed. Measures explicitly aimed at influencing students' knowledge, skills and motivation relevant to low-carbon food consumption beyond school, such as linking school meals to classroom teaching, were also much less prominent. The municipalities did, however, emphasise gradual, long-term development of measures, dishes and staff competence.

Paper III argues that reducing the carbon footprint of the meals served and supporting low-carbon food consumption beyond school are complementary aims, but that they call for different emphases in policy design (Section 6.3). The latter may, for example, require a slower progression towards climate targets, to give students time to become familiar with new dishes, and less ambitious food-waste targets, to leave room for menu development and for students to try new foods. At the same time, the most ambitious municipal targets, around 1.25–1.30 kg CO_2e per kilogram of food purchased against an average of about 2.0, require deeper reductions than the 20% in Paper I and are therefore likely to involve more visible changes.

Communication with students was a less prominent part of the municipal strategies. The thesis gives little reason to expect that information about the climate rationale would in itself increase students' acceptance: limited awareness of meat's carbon footprint was not a major apparent barrier to support (Paper IV), and informing students did not significantly affect acceptance in Paper I. Paper I tested information as a complement to a menu change rather than as a stand-alone measure, and found no significant effect on acceptance in either direction. This differs from the more common focus in food policy research on information-based instruments in their own right, which often show limited effects on food-related behaviour (Ammann et al., 2023). The role of information in school meal climate policy may therefore lie less in driving acceptance than in providing transparency about menu changes without undermining them.

Subtle changes also raise the question of transparency. Transparency about the policy, however, differs from the salience of specific changes at the point of choice. Municipalities can be generally open about their climate objectives for school meals towards students, parents and the public without specifically marking each change on the menu. Paper I examined such general openness, through a classroom video and posters explaining the menu change and its climate rationale and found no significant effect on acceptance. In line with this distinction, some municipalities in Paper III avoided labelling dishes as vegetarian, and studies of menu labelling indicate that explicit vegetarian labels can reduce uptake among meat eaters (Hielkema & Lund, 2022; Krpan & Houtsma, 2020). Subtle menu changes are therefore not the same as reduced transparency.

7.1.4 Across the levels: Implications for pace, choice and targets

Similar trade-offs have been noted before, for example between restricting choice and encouraging wider change (Lombardini & Lankoski, 2013) and are raised in Paper III. The findings here help to specify where they arise. Measures that appear to maintain acceptance, such as reducing meat within familiar dishes and keeping changes subtle, suit current targets to reduce the carbon footprint of the food served,

but to what extent they also influence preferences and norms is less clear. Avoiding salient menu changes altogether may reduce the opportunity for students to familiarise themselves with new meal formats, ingredients and tastes, while more visible changes may increase exposure but also resistance.

Measures may also shape students' attitudes, but how depends on their design. Repeated exposure may increase familiarity and liking (Section 7.1.1). Paper III also draws on self-perception and cognitive dissonance theory: students who regularly eat low-carbon food may come to see themselves as people who eat such food, and since it is uncomfortable to hold a negative attitude towards something one does often, their attitudes may become more positive. This effect is weaker when the behaviour is perceived as imposed, as the external pressure itself then explains the behaviour. Paper III proposes, as one possible approach, serving three daily options, two plant-based and one containing animal products, instead of the common practice in Swedish school canteens of one plant-based and one animal-based option on most days and all-vegetarian days once or twice a week. This would increase the relative availability of plant-based meals while preserving choice. Such a model would be worth testing and evaluating in practice. In a French university cafeteria, doubling the share of vegetarian options roughly doubled their uptake without reducing satisfaction (Arrazat et al., 2024). With retained choice, however, the emission reduction depends on what students choose. Restriction and choice may also complement each other, as restricting choice on some days may increase plant-based choices on others. In Helsinki, the mandatory vegetarian day was followed by more vegetarian choices on other days, particularly among the lower-secondary students who had initially shown the clearest signs of non-compliance (Lombardini & Lankoski, 2013).

Moving too quickly or too visibly may also have effects that school meal targets do not capture. Measures perceived as restricting choice may provoke psychological reactance, a motivation to restore a freedom perceived as threatened, and students who skip lunch or eat less, whether because of reactance or dislike of the food, may compensate by eating more meat elsewhere (Lombardini & Lankoski, 2013). Evidence on such compensation is limited and mixed: Micha et al. (2018) found that some school food policies carried through to children's overall diets, while others appeared to be offset outside school. Acceptance and appreciation of the meals are therefore also conditions for lower emissions from school meals to mean lower emissions from students' diets generally, which is an argument for considering consumption outside school when designing school meal climate policies.

How these mechanisms balance out is likely to depend on context, such as prior familiarity with plant-based food, food culture, public debate and the experience of the meal organisation. Paper I relates the different responses in Helsinki and Lund

partly to the media debate preceding the Helsinki initiative and Lund's decade of prior work with reducing the carbon footprint of school meals. The step-by-step development emphasised in Paper III therefore appears a reasonable strategy for building both acceptance and organisational competence, although it has not been tested against faster or more visible implementation.

Using school meals to influence students' food choices and preferences also raises normative questions. This thesis examines how school meals can contribute to climate mitigation rather than whether they should. However, it is clear that dietary change is a major climate mitigation option (Creutzig et al., 2022), and over 40% of Swedish municipalities have targets to reduce the carbon footprint of their school meals (Paper III). Any school meal provision will also shape what students become familiar with, and retaining the status quo is also a choice. As Shove (2010) argues, policy always plays a part in shaping ways of life, whether intentionally or not. School meal climate policies must also meet nutritional requirements and may need to consider other environmental impacts, such as effects on biodiversity and food culture. Lower-carbon meals need not conflict with these. Reducing meat consumption generally lowers land use and pressure on biodiversity as well as emissions (Poore & Nemecek, 2018; Rockström et al., 2025), and low-carbon school menus can meet nutritional recommendations (Eustachio Colombo et al., 2020). Iron needs particular attention, however, as iron deficiency is more common among adolescent girls with low-carbon diets (Hallström et al., 2025). Since iron in plant-based foods is generally less bioavailable, meals need to be designed to provide sufficient bioavailable iron, for example by including ingredients that enhance bioavailability and limiting or treating those that reduce it. Hybrid dishes that combine smaller amounts of meat with plant-based ingredients are another way to reduce the carbon footprint substantially while maintaining bioavailable iron (Wollmar et al., 2025). This resembles the low-carbon recipes in Paper I, which reduced rather than removed high-emission foods such as meat within familiar dishes, although iron bioavailability was not assessed there. In this thesis, these aspects were addressed by studying measures that met nutritional guidelines and retained familiar dishes, costs and the share of organic food, while effects on biodiversity and food production were not assessed.

7.2. The potential role of school meals as a lever for a food system transition

So far, the discussion has mainly concerned what happens within the school. Yet school meals account for only a small share of total food consumption (approximately 3% in Sweden; Paper III). Section 7.1.4 also discusses whether measures that maintain acceptance support changes in food preferences and consumption beyond school. This section therefore considers whether school meal

climate policies can contribute to low-carbon food consumption beyond the school setting, first through students' food-related behaviours and then from a wider food-system perspective.

School meals have been discussed as a possible arena for promoting healthier and more sustainable diets, partly because they reach many children repeatedly and are embedded in educational institutions (Oostindjer et al., 2017; Roque et al., 2022).

The most direct pathway is that repeated provision of low-carbon meals shapes students' food preferences, habits and expectations of what constitutes a normal meal, which may in turn affect what they eat outside school. As discussed in Section 7.1.4, this is likely to depend on how measures are designed and introduced. Changes in school meals may also influence family meals, depending on family routines, taste expectations and negotiation between family members (Hesselberg et al., 2024; Mata et al., 2025; Roque et al., 2022).

The behavioural perspective used in Paper III does not fully capture the societal role of school meals. Socio-technical perspectives can help here, as they understand transitions as changes in interconnected technologies, institutions, markets, practices and norms. The multi-level perspective describes how emerging alternatives developed in niches may interact with established socio-technical regimes and broader landscape developments (Geels, 2002, 2011). Strategic niche management further highlights how protected spaces can support experimentation, learning and the development of new technologies and practices (Schot & Geels, 2008). Here, prevailing food consumption patterns, including established dietary habits, meal norms and practices, are understood as part of the current regime. Low-carbon food consumption is not an innovation in itself, as a portion of the population already practises it, but mainstreaming it would require substantial changes in production and distribution and could therefore be understood as part of a regime shift. School meal provision may offer a publicly governed arena in which alternative low-carbon food practices can be developed and tested. Unlike the protected spaces described in strategic niche management, however, school meal provision is an established public service, shaped by expectations, budgets and nutritional requirements. It resembles a niche mainly in that public authorities can decide how school meals are provided and use this to experiment and learn. Even so, introducing such practices in school meals does not automatically mean that they will become more widely adopted or lead to broader changes in food consumption.

For school meals to contribute to a wider food-system transition, there must be pathways through which changes within school meal provision can influence practices and structures beyond the school setting. In the MLP, a regime is stabilised by linkages between several dimensions, such as user practices and markets, symbolic meanings, infrastructure, industry structure, policy and knowledge (Geels,

2002). School meals could contribute to change in some of these dimensions, both by weakening linkages that stabilise current food consumption and by helping alternatives to become anchored in the regime. Gaddis and Jeon (2020) show how South Korea's school lunch programme has served as a niche for agri-food transitions, primarily through public procurement, new supply chains and certification standards that created stable demand for environmentally preferable products. Similarly, procurement for school meals could create stable demand for low-carbon foods and new low-carbon products, an example of anchoring that was not examined in this thesis.

The contribution suggested by this thesis lies on the consumption side. School meals may be able to influence some consumption-side dimensions of the current food regime, such as everyday meal practices, food preferences and taste expectations, familiarity with plant-based meals, knowledge and beliefs about sustainable food, and norms concerning what counts as a proper meal. These dimensions matter because high-emission food consumption is stabilised not only by prices and supply chains, but also by habits, meanings and expectations. Changes in these dimensions could thus help loosen the hold of the current regime from the consumption side. At the same time, school meals reach only a specific population in a specific setting, and whether such changes extend beyond school remains uncertain.

School meals cannot be expected to drive a transition towards low-carbon food consumption alone. Rather, they could be one part of a broader policy mix. Their direct contribution is to reduce the carbon footprint of public meals; any indirect contribution depends on the pathways discussed above. Developing this potential would require experimentation and learning about feasible measures and strategies (Schot & Geels, 2008). The long-term development work described in Paper III is an example of such learning. However, local experimentation does not guarantee wider change. As Geels (2026) argues, social innovations and changes in everyday practices often lack the strong self-reinforcing mechanisms that have accelerated the diffusion of some low-carbon technologies, where increased adoption can reduce costs, attract investment and support further expansion. There is little basis for assuming similarly strong mechanisms in school meal climate policies. Other policy measures and changes in the wider food system would therefore still be needed to address other dimensions of the regime, for example taxes and subsidies affecting food prices, labelling and nudging in retail environments, food education, support for changes in agricultural production and national targets for low-carbon food consumption. Paper II suggests that some of these, such as labelling and subsidies, have higher public acceptability than school meal measures, while a tax on high-emission foods has lower.

In this sense, school meal climate policy may be a useful case for considering how local authorities can contribute to societal transitions. It illustrates the distinction between reducing emissions within municipal operations and using municipal services as arenas for broader change. The latter is more difficult to achieve and evaluate. School meals may contribute to such change alongside other policies, but this remains to be demonstrated.

7.3. Strengths and limitations

7.3.1 Methodological strengths and complementary perspectives

A central strength of this thesis is its multi-perspective examination of school meal climate policies. It examines whether low-carbon school meals can reduce greenhouse gas emissions, whether they are accepted by students and the public, and how their design may support low-carbon food consumption.

The appended papers also complement one another by addressing different evidential needs. The intervention study examines low-carbon school meals as an implemented practice, rather than only as a hypothetical policy. The mixed-methods study adds interpretive depth by analysing how students make sense of low-carbon meals, meat reduction and vegetarian food. The cross-national survey broadens the analysis regarding public legitimacy, using a large sample across three countries with differing food cultures, school meal systems and policy contexts. The municipal policy study examines how such policies are designed and what behavioural conditions they address. Together, the papers support a thesis-level argument about the possibilities and constraints of school meal climate policy, rather than four separate conclusions.

7.3.2 Limitations, uncertainty and transferability

The way the papers are combined also sets limits on what the thesis can conclude. The papers' perspectives are complementary but do not constitute a longitudinal evaluation of one policy process. Papers I and IV draw on the same empirical school context and do not provide independent replications. Papers II and IV involve different groups, survey designs and scales, which limits direct comparisons of attitudes. Paper III analyses municipal policy measures and their plausible behavioural potential, rather than testing the resulting changes in students' behaviour. The combination therefore supports a thesis-level synthesis, not a measured causal chain from public acceptability through policy design to dietary change.

A further limitation is that the thesis provides evidence on what school meal climate policies can achieve within school meal provision, but only maps potential behavioural pathways for their effects beyond school. The COM-B analysis

identifies which behavioural conditions current measures address and plausible pathways beyond school, but not whether these lead to durable behavioural change.

The findings are also shaped by their empirical contexts. Sweden is a strong case for studying school meal climate policies because of its universal free school meal system. At the same time, this limits direct transferability to countries where school meals are less universal and less publicly governed. The intervention study and the student survey and focus groups were also conducted in Lund, a municipality that had already worked with carbon footprint reduction and vegetarian meals for some time. This limits generalisability to municipalities with less experience, weaker organisational capacity or more contested school meal contexts. The cross-national survey broadens the thesis beyond Sweden, but it concerns stated public acceptability rather than implementation in different school meal systems.

The interpretation of Paper I also depends on the precision of its estimates: no statistically significant difference in the acceptance indicators is not equivalent to demonstrating that all meaningful effects are absent. Other Swedish interventions using similar optimisation approaches found broadly consistent results, strengthening the case for feasibility under comparable conditions, but small adverse effects and differences among students remain possible. Nor does the thesis measure longer-term nutritional outcomes.

Each paper also has specific limitations. For example, in Paper I, schools were not randomly assigned, the intervention lasted only seven weeks, and food taken and plate waste were measured at school level, which limited statistical power. The Paper III municipalities were selected for their low carbon footprints, and the COM-B classification relied on interpretation of interview accounts.

Overall, the strongest evidence supports the feasibility of introducing lower-carbon school menus without detectable reduction of student acceptance. Whether such menus lead to sustained changes in food consumption beyond school was not directly examined, and the thesis offers only indirect indications of this potential.

7.4. Conclusions, implications, and future research

This thesis shows that school meals can be a meaningful policy context for reducing the carbon footprint of food consumption. On how students perceive and accept measures to reduce the carbon footprint of school meals (RQ1), the strongest empirical conclusion is that lower-carbon menus can be introduced without detectable deterioration in students' consumption, plate waste or meal satisfaction under the studied conditions. Students' reported evaluations indicate that acceptance is shaped mainly by taste, satiety, familiarity and expectations of a school lunch, more than by the climate rationale behind the changes.

Low-carbon recipes appear a feasible approach in the studied context because they can reduce high-emission ingredients within familiar dishes. All-vegetarian days may also contribute to reducing the carbon footprint of school meals, but students in Paper IV evaluated them somewhat less favourably. The difference was small, however, and the two measures can be combined.

The public acceptability of school meal climate policies (RQ2) is neither an insurmountable barrier nor something that can be assumed. Across the three countries in Paper II, acceptability was close to neutral overall, with more support for school meal measures than for the food tax examined but less than for labelling and subsidies. Awareness of beef's carbon footprint, climate concern and lower beef consumption were most strongly associated with public acceptability. Mean scores, however, obscure considerable variation, particularly the polarisation in Sweden. These associations do not show that providing information would increase support.

As for the potential of existing policies to influence food-related behaviours within and beyond school (RQ3), current municipal policy design is mainly oriented towards reducing the carbon footprint of school meals themselves. Measures such as low-carbon recipes, all-vegetarian days and nudging primarily change the food environment. Their behavioural potential is therefore concentrated on eating at school, with indirect potential to influence food consumption beyond school through familiarity, habits and norms. School meal measures give students repeated exposure to low-carbon meals, but they are not explicitly designed to build food knowledge, cooking skills, reflective motivation or low-carbon food practices beyond school. Such dimensions are addressed in the curriculum, which includes food and sustainability, but school meals are rarely used to support this teaching. For policy and practice, menu reformulation, vegetarian provision and related measures can reduce the carbon footprint of school meals, while explicitly supporting low-carbon food consumption beyond school requires additional measures, such as linking school meals with teaching. The findings also point to a tension between maintaining acceptance within school and changing food preferences and consumption beyond school, whose balance is likely to depend on context (Section 7.1.4). This suggests step-by-step development that retains choice, openness about the aims of school meal climate policies, and targets that consider food consumption outside school, not only the carbon footprint of the food purchased for schools.

Future research could examine whether and under what conditions repeated exposure to low-carbon meals changes preferences, norms or food consumption outside school. This includes whether students compensate by eating more meat outside school, how acceptance and familiarisation develop at different paces of implementation and degrees of choice, and whether experiences of implemented

measures feed back into attitudes. Longitudinal and intervention studies could follow students and families over time, ideally distinguishing changes that last only as long as low-carbon meals are served from durable changes in preferences and habits that persist beyond school. Further studies could assess smaller effects on consumption and meal satisfaction with greater statistical precision and test approaches across municipalities with different experience and capacities. Where menu changes are more extensive, research on actual nutrient intake and nutritional quality, including relevant questions of bioavailability, could complement environmental and acceptance assessments. Research could also assess whether linking school meals and teaching improves skills or food-related practices.

Taken together, the thesis suggests that school meal climate policies are neither marginal nor transformative by default. Their strongest demonstrated contribution lies in reducing the carbon footprint of public meals in ways that can be accepted by students. Their broader contribution to low-carbon food consumption is plausible but not demonstrated and depends on whether school meals are designed as part of a wider behavioural, educational and policy strategy. From a transition perspective, school meals may help weaken the norms, preferences and habits that sustain high-emission food consumption, while building familiarity with low-carbon meals and, through procurement, helping alternatives become anchored in the food regime. Other dimensions of the regime, such as food prices, retail environments and agricultural production, need to be addressed by other policy measures.

CHAPTER 8

Reflections: Doing Research as a Municipal PhD Student

This chapter considers how my dual role has shaped the research, its opportunities and its limitations. My doctoral studies have been half-time, combined with half-time work as an environmental analyst at the climate unit of the City of Gothenburg's Environment Administration. In recent years, this work has mainly concerned strategies for a sustainable food system. It has involved developing, implementing and following up on measures towards the city's food-related environmental targets for 2030. Before that, I worked for more than ten years on sustainable energy projects in municipalities in western Sweden. During that time, I came to realise that the main barriers to change were often not technical or economic but related to beliefs, attitudes and norms, among individuals as well as within organisations. Therefore, it was sometimes hard to know whether the initiatives we carried out addressed the barriers that mattered. I therefore began the PhD wanting clear, preferably quantitative evidence about what works, and saw the researcher as a neutral provider of such evidence.

8.1. What counts as useful evidence

Knowing whether a measure produces an outcome is often not enough for effective policy design; it also matters why it works and under what conditions. Policy measures rest on an often implicit theory of change, that is, assumptions about how they will change behaviour. Paper I showed that acceptance was maintained, and Paper IV helped explain why. The COM-B analysis in Paper III made the assumptions behind municipal measures explicit by showing which aspects of capability, opportunity and motivation they address.

What is measured also shapes how policies and strategies are implemented, and what counts as success. Carbon footprints, consumption and plate waste are easy to quantify; norms, preferences and learning are not. Gothenburg's Environment and Climate Programme has a climate goal for the city as a whole, but its climate indicator for food covers only what the city itself purchases: emissions per kilogram of food, to be reduced from 1.9 kg CO_2e in 2019 to 1.3 kg by 2030 (Göteborgs Stad, 2026). The indicator steers procurement and menus, but cannot show whether school meals support low-carbon food consumption beyond school (Section 7.1.4). Similarly, the outcomes in Paper I (food taken, plate waste and meal satisfaction) largely mirror the indicators the meal organisation itself uses to judge whether a meal works, whereas Paper IV showed that students judged meals by taste, satiety

and familiarity, and that accepting a meal is not the same as approving of the policy behind it.

8.2. Producing evidence in municipal practice

In the Lund intervention (Papers I and IV), research interests had to be balanced against practical priorities. The officials saw the study as support for reaching their 2030 target, but their primary objective was to ensure that students got enough to eat and the right nutrition, 'mat i magen' ('food in their bellies'), as they put it. Fearing that drastic changes would reduce acceptance, they initially wanted a smaller reduction, whereas I argued for one large enough to be meaningful to study, pointing to earlier interventions with larger reductions. The 20% we agreed on balanced these concerns, and I fully understand and share the officials' perspective. This also aligns with the finding of Paper III, that steady, gradual change is viewed as a route to successful implementation of school meal climate strategies.

The study also showed how an intervention in a real organisation differs from a controlled experiment. The officials proposed schools partly on the basis of which ones could manage the extra work, and the pandemic delayed the study and ruled out in-person meetings. Once the study was under way, many things happened that were hard to anticipate, affecting both how the menu was served and how the data could be interpreted. In the data, for example, when kitchens added fruit to a meal, peel and apple cores ended up in the plate waste. Baked potatoes, a new dish in the low-carbon menu, produced high plate waste because students took whole potatoes and many left some of the flesh in the skin. Such waste increased the measured weight without saying much about how students liked the food, which was what plate waste was meant to indicate. Each such case called for a judgement on how to handle the data so that they gave as accurate a picture as possible; in Paper I, days with baked potatoes were excluded from the plate waste analysis. Together, this means that Paper I is best read as evidence of feasibility under realistic conditions, rather than as a precise estimate of causal effects.

Even so, I see considerable potential for municipalities to test and evaluate measures in their ordinary operations, if outcomes and implementation conditions are documented and reported rigorously. This is the kind of learning that strategic niche management emphasises, and it reflects the view of van Kerkhoff and Lebel (2006) that knowledge and action are linked through interaction, rather than knowledge being produced first and transferred afterwards.

8.3. Both researcher and civil servant

I began the PhD intending to keep my roles as researcher and civil servant apart and to avoid researching matters in which I had a stake, while still wanting to answer questions and give impartial advice based on research.

In Pielke's (2007) terms, this ambition was close to that of a science arbiter, who answers factual questions put by decision-makers, rather than a pure scientist, who provides knowledge without engaging with decisions, or an issue advocate, who uses expertise to argue for a particular choice. As my research progressed and I was asked to present my work to other municipalities and authorities, I increasingly tried to act as what Pielke calls an honest broker of policy alternatives, clarifying what is and is not known, under what conditions, and which measures matter more or less, in relation to what I understand to be their underlying aim.

In my work within the City of Gothenburg, however, the two roles are harder to keep apart. As a civil servant, I am expected to use the best available knowledge in my work and to act with the objectivity and impartiality required of public authorities (SFS 2017:900, Section 5). I took part, for example, in developing the city's Environment and Climate Programme 2021–2030, including proposing the target value for its food indicator. Here, the researcher in me acts as an honest broker to the civil servant in me. Pielke's typology assumes that scientists and policy practitioners are different people; in a dual role, the boundary between providing and using knowledge runs through one person.

As a civil servant, I am guided by the city's adopted governing documents, targets and political decisions, not by my research interests. Proposing target levels and measures is part of preparing decisions that are then made by elected politicians. Being guided by adopted decisions does not mean that I always agree with these goals or strategies, although I would not help implement objectives that clearly went against my own values. There is also room for interpretation: since the city's climate goal covers consumption-based emissions, I can raise the question of whether measures aimed at the carbon footprint of public meals make sufficient use of opportunities to support low-carbon food consumption beyond the meals themselves.

The dual role creates tensions in both directions. My municipal role may influence my research: I may want measures and strategies I have helped shape to succeed, which could affect the choice of research questions and outcome measures, and how results are interpreted and reported. Conversely, research interests may influence practice, as when I argued for a larger reduction in Lund to make the study meaningful. Finally, others may not know whether I speak as a researcher or for the city, so that research authority lends weight to municipal positions, or the reverse.

Had I studied Gothenburg's own strategies, the research would have resembled insider action research, directed by the city's adopted goals rather than my own values, and might have benefited from safeguards such as external co-authors, aims and analyses specified in advance, and transparent reporting of my role. Such safeguards would not remove the tensions but would make them visible and manageable. Looking back, I am more positive towards this way of doing research than when I began. As an insider, I have access to knowledge and situations that external researchers rarely reach, and the tensions it brings can be handled openly rather than avoided.

8.4. Ethics and research in a contested policy area

The research raised ethical questions both in direct contact with students and through its position in a contested public debate. The intervention study was reviewed by the Swedish Ethical Review Authority, which judged formal approval unnecessary and issued an advisory opinion. However, research with children carries a particular responsibility. Focus groups are an unusual situation for students, who share their views with unfamiliar adults in front of classmates whose relationships we do not know. School staff helped ensure that the randomly selected students invited were suitable to take part, and as facilitator I made it a priority to make everyone feel comfortable and listened to.

The intervention also raised an ethical issue, as it changed what students ate for seven weeks, in a meal intended to provide about a third of their daily energy and nutrient needs. I consider this justified, as the menu met nutritional recommendations, earlier interventions had maintained intake, and municipalities make such changes without research.

The research has been carried out while vegetarian school meals in particular have been debated in the media and in national and local politics, with protests from students, political youth organisations, teachers, parents, farmers' organisations and the meat industry. In Gothenburg, other municipal low-carbon food measures have been more contested than school meals, such as vegetarian food as the default at conferences organised by the city. I have mostly followed the debate at a distance, but it has made me careful not to appear as an advocate, while motivating me to communicate what research says about claims in the debate, many of which concern student acceptance and public acceptability.

Research can inform such debates but cannot resolve disagreements about values or the legitimate role of public authorities. Since such questions also concern which outcomes should count, I see value in engaging more with students, parents, politicians and the wider public. So far, I have mainly presented my research to practitioners and researchers.

8.5. Concluding reflections

Looking back, I still consider systematic empirical evidence essential, but I have become more interested in why measures work and under what conditions. I no longer see producing and applying evidence as something that must be separate activities, or distance from policy as necessarily the best position for a municipal PhD student. Engagement with practice has shown me what knowledge is sought and usable and has given me opportunities to apply it. Since public authorities must act on incomplete knowledge, the challenge is less to produce complete evidence than to combine research, practical experience and critical reflection, while being open about how evidence, adopted objectives and personal values shape both research and advice.

References

Ammann, J., Arbenz, A., Mack, G., Nemecek, T., & El Benni, N. (2023). A review on policy instruments for sustainable food consumption. *Sustainable Production and Consumption*, *36*, 338–353. https://doi.org/10.1016/j.spc.2023.01.012

Anderson, B., Böhmelt, T., & Ward, H. (2017). Public opinion and environmental policy output: A cross-national analysis of energy policies in Europe. *Environmental Research Letters*, *12*(11), 114011. https://doi.org/10.1088/1748-9326/aa8f80

Arrazat, L., Cambriels, C., Noan, C. L., Nicklaus, S., & Marty, L. (2024). Effects of increasing the availability of vegetarian options on main meal choices, meal offer satisfaction and liking: A pre-post analysis in a French university cafeteria. *The International Journal of Behavioral Nutrition and Physical Activity*, *21*(1), 75. https://doi.org/10.1186/s12966-024-01624-4

Batlle-Bayer, L., Bala, A., Aldaco, R., Vidal-Monés, B., Colomé, R., & Fullana-i-Palmer, P. (2021). An explorative assessment of environmental and nutritional benefits of introducing low-carbon meals to Barcelona schools. *Science of The Total Environment*, *756*, 143879. https://doi.org/10.1016/j.scitotenv.2020.143879

Behrens, P., Kiefte-de Jong, J. C., Bosker, T., Rodrigues, J. F. D., de Koning, A., & Tukker, A. (2017). Evaluating the environmental impacts of dietary recommendations. *Proceedings of the National Academy of Sciences*, *114*(51), 13412–13417. https://doi.org/10.1073/pnas.1711889114

Bendz, A., Bäckstedt, F., Harring, N., & Martin Persson, U. (2023). Why do people accept or reject climate policies targeting food consumption? Unpacking justifications in the public debate in online social forums. *Food Policy*, *121*, 102544. https://doi.org/10.1016/j.foodpol.2023.102544

Bergquist, M., Nilsson, A., Harring, N., & Jagers, S. C. (2022). Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change*, *12*(3), 235–240. https://doi.org/10.1038/s41558-022-01297-6

Blondin, S. A., Cash, S. B., Griffin, T. S., Goldberg, J. P., & Economos, C. D. (2022). Meatless Monday National School Meal Program Evaluation: Impact on Nutrition, Cost, and Sustainability. *Journal of Hunger & Environmental Nutrition*, *17*(1), 1–13. https://doi.org/10.1080/19320248.2020.1842283

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Burstein, P. (2003). The Impact of Public Opinion on Public Policy: A Review and an Agenda. *Political Research Quarterly*, *56*(1), 29–40. https://doi.org/10.1177/106591290305600103

Busby, E. (2020, February 13). Schools offering vegetarian-only lunches forced to make changes after backlash. *The Independent*. https://www.independent.co.uk/climate-change/news/schools-vegetarian-lunches-parents-hungry-meat-environment-climate-change-a9332226.html

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th edn). SAGE Publications.

Creutzig, F., Roy, J., Devine-Wright, P., Díaz-José, J., Geels, F. W., Grubler, A., Maïzi, N., Masanet, E., Mulugetta, Y., Onyige, C. D., Perkins, P. E., Sanches-Pereira, A., & Weber, E. U. (2022). Demand, Services and Social Aspects of Mitigation. In IPCC, *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 503–612). Cambridge University Press. https://doi.org/10.1017/9781009157926.007

Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*, *2*(3), 198–209. https://doi.org/10.1038/s43016-021-00225-9

Dahmani, J., Nicklaus, S., & Marty, L. (2024). Willingness for more vegetarian meals in school canteens: Associations with family characteristics and parents' food choice motives in a French community. *Appetite*, *193*, 107134. https://doi.org/10.1016/j.appet.2023.107134

De Keyzer, W., Caneghem, S. V., Heath, A.-L. M., Vanaelst, B., Verschraegen, M., De Henauw, S. D., & Huybrechts, I. (2012). Nutritional quality and acceptability of a weekly vegetarian lunch in primary-school canteens in Ghent, Belgium: 'Thursday Veggie Day'. *Public Health Nutrition*, *15*(12), 2326–2330. https://doi.org/10.1017/S1368980012000870

Deininger, L. (2022, October 20). Kostchefen införde mer ekologisk mat – tvingas backa efter kritik och hot. *SVT Nyheter*. https://www.svt.se/nyheter/lokalt/vasterbotten/kostchefen-klaus-dudenhofer-i-lycksele-inforde-mer-ekologisk-mat-tvingas-backa-efter-hart-kritik-och-hot

Durão, S., Wilkinson, M., Davids, E. L., Gerritsen, A., & Kredo, T. (2024). Effects of policies or interventions that influence the school food environment on children's health and nonhealth outcomes: A systematic review. *Nutrition Reviews*, *82*(3), 332–360. https://doi.org/10.1093/nutrit/nuad059

Elinder, L. S., Eustachio Colombo, P., Patterson, E., Parlesak, A., & Lindroos, A. K. (2020). Successful Implementation of Climate-Friendly, Nutritious, and Acceptable School Meals in Practice: The OPTIMAT^{TM} Intervention Study. *Sustainability*, *12*(20), 8475. https://doi.org/10.3390/su12208475

Eun-ji, B. (2020, October 6). Controversy rises over vegetarian school meal options. *The Korea Times*. https://www.koreatimes.co.kr/www/nation/2020/10/181_297108.html

Eustachio Colombo, P., Elinder, L. S., Patterson, E., Parlesak, A., Lindroos, A. K., & Andermo, S. (2021). Barriers and facilitators to successful implementation of sustainable school meals: A qualitative study of the OPTIMAT^{TM}-intervention. *International Journal of Behavioral Nutrition and Physical Activity*, *18*(1), 89. https://doi.org/10.1186/s12966-021-01158-z

Eustachio Colombo, P., Patterson, E., Lindroos, A. K., Parlesak, A., & Elinder, L. S. (2020). Sustainable and acceptable school meals through optimization analysis: An intervention study. *Nutrition Journal*, *19*(1), 61. https://doi.org/10.1186/s12937-020-00579-z

Frödén, S. (2021). Skolans gröna matlandskap: Elevers uppfattningar om och upplevelser av vegetarisk skolmat. *Socialmedicinsk Tidskrift*, *98*(3), 421–434.

Gaddis, J. E., & Jeon, J. (2020). Sustainability transitions in agri-food systems: Insights from South Korea's universal free, eco-friendly school lunch program. *Agriculture and Human Values*, *37*(4), 1055–1071. https://doi.org/10.1007/s10460-020-10137-2

GCNF. (2024). *School Meal Programs Around the World: Results from the 2024 Global Survey of School Meal Programs*. Global Child Nutrition Foundation. https://gcnf.org/global-reports/

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, *31*(8), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, *1*(1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002

Geels, F. W. (2026). Why sustainability transitions are starting to accelerate via technical innovations but not through social innovations: Five reasons and some critiques of transformations research. *Global Sustainability*, *9*, e13. https://doi.org/10.1017/sus.2026.10054

Glynn, C. J., & Huge, M. E. (2008). Public Opinion. In *The International Encyclopedia of Communication*. John Wiley & Sons, Ltd. https://doi.org/10.1002/9781405186407.wbiecp124

Göteborgs Stad. (2026). *Göteborgs Stads miljö- och klimatprogram 2021–2030*. Göteborgs Stad. https://goteborg.se/wps/portal/enhetssida/miljo-och-klimat-goteborg/miljo-och-klimatprogrammet

Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, *91*, 380–390. https://doi.org/10.1016/j.tifs.2019.07.046

Hallström, E., Löfvenborg, J. E., Moreaus, L., Sjöberg, A., Winkvist, A., & Lindroos, A. K. (2025). Iron intake and iron status of Swedish adolescents with diets of varying climate impact. *European Journal of Nutrition*, *64*(2), 93. https://doi.org/10.1007/s00394-024-03572-y

Hedenus, F., Wirsenius, S., & Johansson, D. J. A. (2014). The importance of reduced meat and dairy consumption for meeting stringent climate change targets. *Climatic Change*, *124*(1), 79–91. https://doi.org/10.1007/s10584-014-1104-5

Hesselberg, J., Pedersen, S., & Grønhøj, A. (2024). Meat reduction meets family reality: Negotiating sustainable diets in households with adolescents. *Appetite*, *195*, 107213. https://doi.org/10.1016/j.appet.2024.107213

Hielkema, M. H., & Lund, T. B. (2022). A "vegetarian curry stew" or just a "curry stew"? - The effect of neutral labeling of vegetarian dishes on food choice among meat-reducers and non-reducers. *Journal of Environmental Psychology*, *84*, 101877. https://doi.org/10.1016/j.jenvp.2022.101877

Jagers, S. C., Harring, N., & Matti, S. (2024). Impact of ideology on individuals' attitudes to a climate-motivated tax on food. *Climate Policy*, *24*(10), 1381–1394. https://doi.org/10.1080/14693062.2024.2385484

Kerkhoff, L. van, & Lebel, L. (2006). Linking Knowledge and Action for Sustainable Development. *Annual Review of Environment and Resources*, *31*, 445–477. https://doi.org/10.1146/annurev.energy.31.102405.170850

Kim, S.-Y., & Kim, M. (2025). Nutritional quality evaluation of plant-based elementary school meals in Seoul. *Nutrition Research and Practice*, *19*(3), 453–463. https://doi.org/10.4162/nrp.2025.19.3.453

Kluczkovski, A., Menezes, C. A., da Silva, J. T., Bastos, L., Lait, R., Cook, J., Cruz, B., Cerqueira, B., Lago, R. M. R. S., Gomes, A. N., Ladeia, A. M. T., Schmidt Rivera, X., Vianna, N., Reynolds, C. J., Oliveira, R. R., & Bridle, S. L. (2022). An Environmental and Nutritional Evaluation of School Food Menus in Bahia, Brazil That Contribute to Local Public Policy to Promote Sustainability. *Nutrients*, *14*(7), Article 7. https://doi.org/10.3390/nu14071519

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Krpan, D., & Houtsma, N. (2020). To veg or not to veg? The impact of framing on vegetarian food choice. *Journal of Environmental Psychology*, *67*, 101391. https://doi.org/10.1016/j.jenvp.2020.101391

Kuosmanen, S., Niva, M., Pajari, A.-M., Korhonen, K., Muilu, T., & Konttinen, H. (2023). Barriers associated with pulse and plant-based meat alternative consumption across sociodemographic groups: A Capability, Opportunity, Motivation, Behaviour model approach. *Frontiers in Nutrition*, *10*. https://doi.org/10.3389/fnut.2023.1186165

Lakkakula, A., Geaghan, J., Zanovec, M., Pierce, S., & Tuuri, G. (2010). Repeated taste exposure increases liking for vegetables by low-income elementary school children. *Appetite*, *55*(2), 226–231. https://doi.org/10.1016/j.appet.2010.06.003

Linder, N., Bergquist, M., Bjälkebring, P., & Jonell, M. (2025). (Un)acceptable protein shift: Consumer attitudes toward retail-led interventions promoting sustainable diets. *Food Policy*, *136*, 102971. https://doi.org/10.1016/j.foodpol.2025.102971

Linder, N., Lindahl, T., & Wijermans, N. (2026). Psychological barriers for sustainable diets: Unpacking intention-behavior gaps in meat consumption. *Food Quality and Preference*, *135*, 105721. https://doi.org/10.1016/j.foodqual.2025.105721

Lombardini, C., & Lankoski, L. (2013). Forced choice restriction in promoting sustainable food consumption: Intended and unintended effects of the mandatory vegetarian day in Helsinki schools. *Journal of Consumer Policy*, *36*(2), 159–178. https://doi.org/10.1007/s10603-013-9221-5

LTO. (2025, May 26). *Kein Recht auf täg-li-ches Schul-Schnitzel?* Legal Tribune Online. https://www.lto.de/recht/nachrichten/n/2-k-1477-25-vg-freiburg-eilantrag-schulessen-vegetarisch-vegan-mangelernaehrung

Marty, L., Dahmani, J., & Nicklaus, S. (2024). Children's liking for vegetarian and non-vegetarian school meals at the scale of a French city. *Appetite*, *200*, 107547. https://doi.org/10.1016/j.appet.2024.107547

Mata, J., Knobl, V., & Takezawa, M. (2025). Exploring the role of adolescents in healthier, more sustainable family meals: A decision study on meat consumption. *Appetite*, *208*, 107916. https://doi.org/10.1016/j.appet.2025.107916

Mbow, C., Rosenzweig, C., Barioni, L. G., Benton, T. G., Herrero, M., Krishnapillai, M., Liwenga, E., Pradhan, P., Rivera-Ferre, M. G., Sapkota, T., Tubiello, F. N., & Xu, Y. (2019). *Food Security. In: Climate Change and Land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Cambridge University Press. https://doi.org/10.1017/9781009157988.007

Micha, R., Karageorgou, D., Bakogianni, I., Trichia, E., Whitsel, L. P., Story, M., Peñalvo, J. L., & Mozaffarian, D. (2018). Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis. *PLOS ONE*, *13*(3), e0194555. https://doi.org/10.1371/journal.pone.0194555

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 42. https://doi.org/10.1186/1748-5908-6-42

Mills, Z., Wright, K., & D'Lima, D. (2023). Applying the Behaviour Change Wheel to UK Local Authority Policy Documents: A Content Analysis in the Context of Financial Behaviour. *Behavioral Sciences*, *13*(12), 991. https://doi.org/10.3390/bs13120991

Nabuurs, G.-J., Mrabet, R., Abu Hatab, A., Bustamante, M., Clark, H., Havlík, P., House, J., Mbow, C., Ninan, K. N., Popp, A., Roe, S., Sohngen, B., & Towprayoon, S. (2022). Agriculture, forestry and other land uses (AFOLU). In IPCC, *Climate change 2022: Mitigation of climate change. Contribution of working group III to the sixth assessment report of the intergovernmental panel on climate change* (pp. 747–860). Cambridge University Press. https://doi.org/10.1017/9781009157926.009

Nguyen-Trung, K., Saeri, A. K., Zhao, K., Boulet, M., & Kaufman, S. (2025). SeCOM-B: An integrated model for understanding human behaviour change in wicked socio-ecological problems. *Socio-Ecological Practice Research*, *7*(3), 367–386. https://doi.org/10.1007/s42532-025-00227-y

Nordic Council of Ministers. (2024). *Policy tools for sustainable and healthy eating: Enabling a food transition in the Nordic countries* (Nord 2024:007). Nordic Council of Ministers. http://dx.doi.org/10.6027/nord2024-007

Nury, E., Stadelmaier, J., Morze, J., Nagavci, B., Grummich, K., Schwarzer, G., Hoffmann, G., Angele, C. M., Steinacker, J. M., Wendt, J., Conrad, J., Schmid, D., Meerpohl, J. J., & Schwingshackl, L. (2022). Effects of nutritional intervention strategies in the primary prevention of overweight and obesity in school settings: Systematic review and network meta-analysis. *BMJ Medicine*, *1*(1), e000346. https://doi.org/10.1136/bmjmed-2022-000346

Oostindjer, M., Aschemann-Witzel, J., Wang, Q., Skuland, S. E., Egelandsdal, B., Amdam, G. V., Schjøll, A., Pachucki, M. C., Rozin, P., Stein, J., Lengard Almli, V., & Van Kleef, E. (2017). Are school meals a viable and sustainable tool to improve the healthiness and sustainability of children´s diet and food consumption? A cross-national comparative perspective. *Critical Reviews in Food Science and Nutrition*, *57*(18), 3942–3958. https://doi.org/10.1080/10408398.2016.1197180

Parkin, B., Attwood, S., & Hernandez, M. (2024). *Sustainable Behavior in Climate Pledges: An Analysis of Top Emitters' Strategies* [Working paper]. World Resources Institute. https://doi.org/10.46830/wriwp.23.00058

Pechey, R., Reynolds, J. P., Cook, B., Marteau, T. M., & Jebb, S. A. (2022). Acceptability of policies to reduce consumption of red and processed meat: A population-based survey experiment. *Journal of Environmental Psychology*, *81*, 101817. https://doi.org/10.1016/j.jenvp.2022.101817

Pielke, R. A., Jr. (2007). *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge University Press. https://doi.org/10.1017/CBO9780511818110

Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Ran, Y., Nilsson Lewis, A., Dawkins, E., Grah, R., Vanhuyse, F., Engström, E., & Lambe, F. (2022). Information as an enabler of sustainable food choices: A behavioural approach to understanding consumer decision-making. *Sustainable Production and Consumption*, *31*, 642–656. https://doi.org/10.1016/j.spc.2022.03.026

Ran, Y., Persson, U. M., Lindahl, T., Jonell, M., Brons, A., Macura, B., Candel, J., Abu Hatab, A., & Röös, E. (2025). Are interventions for environmentally sustainable dietary behaviours effective? A review. *Environmental Research: Food Systems*, *2*(3), 032001. https://doi.org/10.1088/2976-601X/adda4e

Rio, I. (2023, January 17). *VIDEO. La mairie de Limoges abandonne le deuxième repas végétarien de la semaine dans les cantines scolaires*. France 3 Nouvelle-Aquitaine. https://france3-regions.franceinfo.fr/nouvelle-aquitaine/haute-vienne/limoges/video-la-mairie-de-limoges-abandonne-le-deuxieme-repas-vegetarien-de-la-semaine-dans-les-cantines-scolaires-2695894.html

Rockström, J., Thilsted, S. H., Willett, W. C., Gordon, L. J., Herrero, M., Hicks, C. C., Mason-D'Croz, D., Rao, N., Springmann, M., Wright, E. C., Agustina, R., Bajaj, S., Bunge, A. C., Carducci, B., Conti, C., Covic, N., Fanzo, J., Forouhi, N. G., Gibson, M. F., … DeClerck, F. (2025). The EAT–Lancet Commission on healthy, sustainable, and just food systems. *The Lancet*, *406*(10512), 1625–1700. https://doi.org/10.1016/S0140-6736(25)01201-2

Roque, L., Campos, L., Guedes, D., Godinho, C., Truninger, M., & Graça, J. (2023). Insights into parents' and teachers' support for policies promoting increased plant-based eating in schools. *Appetite*, *184*, 106511. https://doi.org/10.1016/j.appet.2023.106511

Roque, L., Graça, J., Truninger, M., Guedes, D., Campos, L., Vinnari, M., & Godinho, C. (2022). Plant-based school meals as levers of sustainable food transitions: A narrative review and conceptual framework. *Journal of Agriculture and Food Research*, *10*, 100429. https://doi.org/10.1016/j.jafr.2022.100429

Salovaara, M. (2024, January 18). *Kaupungin ruokahuollolla visainen pulma: Liharuoasta tulee tutkitusti isot päästöt, mutta kasvisruoka ei lapsille maistu*. Yle Uutiset. https://yle.fi/a/74-20069752

School Meals Coalition. (2025). *Report on school meal programmes in the European Union | European School Education Platform*. https://school-education.ec.europa.eu/en/discover/publications/report-school-meal-programmes

Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. In *The Dynamics of Sustainable Innovation Journeys*. Routledge.

Searchinger, T. D., Wirsenius, S., Beringer, T., & Dumas, P. (2018). Assessing the efficiency of changes in land use for mitigating climate change. *Nature*, *564*(7735), 249–253. https://doi.org/10.1038/s41586-018-0757-z

Shove, E. (2010). Beyond the ABC: Climate Change Policy and Theories of Social Change. *Environment and Planning A*, *42*(6), 1273–1285.

Stoll-Kleemann, S., & Schmidt, U. J. (2017). Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: A review of influence factors. *Regional Environmental Change*, *17*(5), 1261–1277. https://doi.org/10.1007/s10113-016-1057-5

Sun, Z., Scherer, L., Tukker, A., Spawn-Lee, S. A., Bruckner, M., Gibbs, H. K., & Behrens, P. (2022). Dietary change in high-income nations alone can lead to substantial double climate dividend. *Nature Food*, *3*(1), 29–37. https://doi.org/10.1038/s43016-021-00431-5

Swedish Food Agency. (2026). *Nationella riktlinjer för måltider i skolan*. Swedish Food Agency. https://www.livsmedelsverket.se/om-oss/publikationer/broschyr/nationella-riktlinjer-for-maltider-i-skolan/

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518–522. https://doi.org/10.1038/nature13959

Wadi, N. M., Cheikh, K., Keung, Y. W., & Green, R. (2024). Investigating intervention components and their effectiveness in promoting environmentally sustainable diets: A systematic review. *The Lancet. Planetary Health*, *8*(6), e410–e422. https://doi.org/10.1016/S2542-5196(24)00064-0

Wallner, J. (2008). Legitimacy and Public Policy: Seeing Beyond Effectiveness, Efficiency, and Performance. *Policy Studies Journal*, *36*(3), 421–443. https://doi.org/10.1111/j.1541-0072.2008.00275.x

Wardle, J., Herrera, M.-L., Cooke, L., & Gibson, E. L. (2003). Modifying children's food preferences: The effects of exposure and reward on acceptance of an unfamiliar vegetable. *European Journal of Clinical Nutrition*, *57*(2), 341–348. https://doi.org/10.1038/sj.ejcn.1601541

West, R., & Michie, S. (2023). Why are there different versions of the COM-B model diagram? *Qeios*. https://doi.org/10.32388/awanwg

WFP. (2024). *School Meals Policy*. World Food Programme. https://www.wfp.org/publications/wfps-updated-school-meals-policy-november-2024

Wollmar, M., Post, A., Elf, M., Ingridsdotter, J., Prim, M., & Sjöberg, A. (2025). Balancing trade-offs between nutritional quality, consumer acceptability and climate impact across a spectrum of chili con carne formulations: From plant-based to hybrid. *Frontiers in Nutrition*, *12*. https://doi.org/10.3389/fnut.2025.1716322