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Final report

Marita Kettunen, Kirsi Silvennoinen, Joel Kostensalo and Vesa Lampi



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Abstract

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Robust Food Waste Management Method for Food Services (ROMANCE) project aimed to identify effective solutions for reducing food waste, motivating staff, and fostering a waste prevention culture within food services. This report presents the results of food waste monitoring conducted in pilot restaurants alongside findings from the project's experiments, feedback book initiative, food waste mentor program, and motivational feature of the Lukeloki application.

The food waste monitoring focused on public food services and was successfully carried out in 39 units across 10 organizations, including 23 schools, 9 daycare centres, and 7 elderly care facilities. On average, 22.3% of the prepared food became wasted, of which 15.3% being serving waste, 6.7% plate leftovers, and 0.3% kitchen waste. Food waste per customer was highest in elderly care facilities (285g), followed by daycare centres (166g) and schools (52g). The higher food waste rates in elderly care facilities and daycare centres were attributed to factors such as cart service and the larger number of meals served. The most significant sources of serving waste included meat main dishes (16%), porridges (16%), carbohydrate side dishes (15%), and fish main dishes (10%).

The feedback book experiment aimed to modernize the traditional feedback books found in restaurant lobbies by providing a digital tool for collecting customer feedback and enhancing interaction. Integrated into the Lukeloki platform, the feedback book allowed customers to share feedback via QR codes using their smart phones. Although it aimed to help restaurants improve their operations, including waste management, the response rate was low. Future development should focus on enhancing interaction, diversifying questions and simplifying implementation in different environments.

The food waste mentoring programme was a peer-learning and support initiative for food service professionals, where participants acted as waste mentors in their workplaces. The programme was tested with three small peer groups: meal service employees, public food service managers, and company specialists. Feedback indicated the programme was suitable for professionals in various roles and organizations, promoting waste management improvements through the exchange of best practices and peer support.

The motivational feature in the Lukeloki application aimed to encourage kitchen staff to record food waste regularly. Tested in 42 locations which participated in waste monitoring, the motivational messages included daily greetings and site-specific waste data on the application. While designed to be non-intrusive, feedback revealed that the messages often went unnoticed, presenting a challenge for future refinement.

Keywords: Food Waste; Food Waste Management; Food Services; Restaurants; Experiments; Peer Learning; Customer Feedback

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1. Introduction

Food waste is unnecessary waste, the generation of which could have been avoided, for example, by better estimation or by preparing or storing food differently. As food is always prone to turn to waste, spoil, rot and become mouldy, working with food is a constant balancing act with its edibility and inedibility (Koskinen et al. 2018). In food services, food waste accounts for roughly one fifth of served food (Silvennoinen et al. 2019 a). Reducing food waste is part of the responsibility of restaurants and food services.

The aim of the ROMANCE project was to find effective solutions for waste reduction practices, personnel motivation and a culture that supports waste prevention in food services. The project studied what kind of a measurement and monitoring method can best assess the amount, type and origin of waste. A particular aim was to enhance the methods used for monitoring food waste at a national level from the perspectives of reliable results and resource efficiency. In addition, we tested new ways to reduce waste and technical applications at pilot restaurants.

Food waste management can be understood as all practices and measures in food services to prevent the generation of waste and reduce the amount of waste. Compliance with the waste hierarchy (European Court of Auditors 2016, 10) is key in food waste management in food services: Preventing food waste takes priority. However, if waste is generated, food should be used for human consumption by donating or reselling it, then as high-value processed products and animal feed, and as a last resort, in composting or energy generation.

Food waste is a tricky problem (Närvänen et al. 2020), where trials can provide keys to finding a solution. Reasons for food turning into waste are manifold, and food waste is generated from various sources at different stages of food preparation and serving. The aim of trials is to quickly and cost-effectively find several alternative solutions or enablers for large-scale challenges, to create preconditions for the stabilisation and scaling of solutions, and to identify which ideas should be continued or abandoned (Motiva 2024). The idea behind trials is that they can be allowed to fail because even information obtained from a failed experiment can be used in significant ways for both the conceptualisation of an idea under development and the progress of a development project (Paju 2016).

In this report, we focus on describing the results of the ROMANCE project's trials and the results of food waste monitoring at the project's pilot restaurants¹. In the second chapter of this report, we also present the project's food waste measurement results, i.e. the amount of food waste at the pilot restaurants that participated in food waste monitoring. In the third chapter, we discuss the feedback book trial. In the fourth chapter, we describe the course of the food waste mentoring programme and the results of the trial. Finally, chapter five summarises the results of the trials and draws conclusions. The second chapter was written by Kirsi Silvennoinen and Joel Kostensalo, the third and fifth chapters by Vesa Lampi, and the fourth chapter by Marita Kettunen.

¹ The results of another key component of the ROMANCE project—developing a harmonized method for food waste measurement—are presented in the article *Optimal Design of National Food Waste Monitoring for the Food Service Sector* (Kostensalo et al. 2025).

Concepts used in this report

Food waste: All originally edible food and drink which ends up discarded.

Serving waste: Food which is discarded from buffet or trolley after serving, or food that was prepared but never served, hence ends up discarded.

Kitchen waste: Food waste that is generated before food is served. Kitchen waste can be divided into storage waste and preparation waste.

Storage waste: Food waste that is generated in restaurant cold and/or dry storage due to expired products or discarding prepared products that have been stored or previously made in a kitchen.

Preparation waste: Food waste that consists of food that is not served due to a preparation error such as food burnt on a pan.

Kitchen biowaste: Originally inedible biowaste such as coffee grounds, bones, skin, vegetable peelings and stems.

Backup food: A meal that is pre-defined to be served in case a planned menu item is outsold (runs out).

Bonus food: (also joker food) Food usually served the following day due to over-preparation, which is offered as an additional option.

2. Food waste measurement results

Monitoring food waste, that is, weighing and registering waste, is one of key measures in food waste management in food services so that decisions on food preparation volumes, for example, can be made based on data, and food waste reduction measures can be targeted correctly (Silvennoinen et al. 2019). By maintaining records of ingredients purchased and food prepared in a kitchen, as well as discarded ingredients and food, restaurants can estimate the average and regular amount of food wasted and identify recurring patterns in the generation of food waste (Sakaguchi et al. 2018). Systematic monitoring can help increase waste awareness and motivate the kitchen personnel to prevent food waste (Burton et al. 2016). Regular food waste monitoring can also reduce the amount of food waste (Silvennoinen et al. unpublished).

In the project, food waste was measured in 42 locations. The measurements were successful in 39 locations, whereas the entries made in three locations were incomplete and could not be used in the analyses. Measurements were conducted in schools (23), daycare centres (9) and elderly care centres (7). The locations were in ten municipalities across Finland.

The measurements were arranged so that interested food services first completed a registration form attached to the participation letter or on Luke's Ravintolafoorumi horeca-aimed communication site. In the form, companies defined the number of locations they would like to have measured. Before the measurements, personnel guidance was provided for using a Luke-developed *Lukeloki* food waste monitoring application and measurement details.

Employees in each location measured and registered food waste. The amount of food prepared, the amount of food discarded, the amount of kitchen biowaste and the number of customers were measured every day. Menus were entered into *Lukeloki* by Luke's researchers in advance, making the food amount recording simple.

Measurement results

In total, 22.3% of food waste was generated from food prepared in all locations (Figure 1). Of this, serving waste accounted for 15.3 and plate waste for 6.7 percentage points. Very little kitchen waste was generated, only 0.3% of all prepared food.

A total of 17.0% of food waste was generated in schools: serving waste was 11.0%, plate waste 5.0% and preparation waste practically zero. A total of 30.9% of food waste was generated in daycare centres: serving waste was 22.6%, plate waste 8.2% and kitchen waste 0.1%. A total of 28.7% of food waste was generated in elderly care centres: serving waste was 17.7%, plate waste 10.3% and kitchen waste 0.7%.

When studying the amount of food waste per customer (Figure 2), food waste was 52 g per customer in schools, 166 g per customer in daycare centres and 285 g per customer in elderly care centres. The amount of food eaten was 245 g per customer in schools, 359 g per customer in daycare centres and 682 g per customer in elderly care centres.

The large amounts of food waste in elderly care centres and daycare centres can partly be explained by serving several meals per day in both location types. Ward and trolley food service also increases the generation of food waste, as it is more difficult to estimate and

carry exactly the correct amount of food for several small groups, than to provide a correct amount of food from buffet for number of people during one service. In addition, it may not be possible to carry more food to wards when needed, in which case more food than is necessary will easily be carried.

In schools, food waste was generated more moderately than in the other location types included in the project. In schools, food waste management is easier because food is served from buffets, and lunch is most often the only meal served. The highest amounts of food waste was produced from meat main dishes and (carbohydrate) side dishes, both of which accounted for about a fifth (18%). Based on the results, far too much potatoes, rice and pasta are prepared.

In daycare centres, porridge (22%) was the largest food waste fraction. This was followed by meat dishes (19%), side dishes (14%) and salads (8%). Porridge is also significant in relative terms – as much as 30% of the porridge prepared was wasted.

Elderly care centres generate a relatively large amount of food waste: almost a third of the food served turned into waste. The most food waste during the survey period was generated from porridge, accounting for as much as a quarter of all food waste. It was followed by meat main dishes and meat soups.

When studying all participating locations, the largest amount of serving waste was generated from meat main dishes (19%), porridge (16%), side dishes (15%), fish main dishes (10%) and salads (9%). Over-preparation of porridge and side dishes seems to be common across all participating locations (Figure 3).

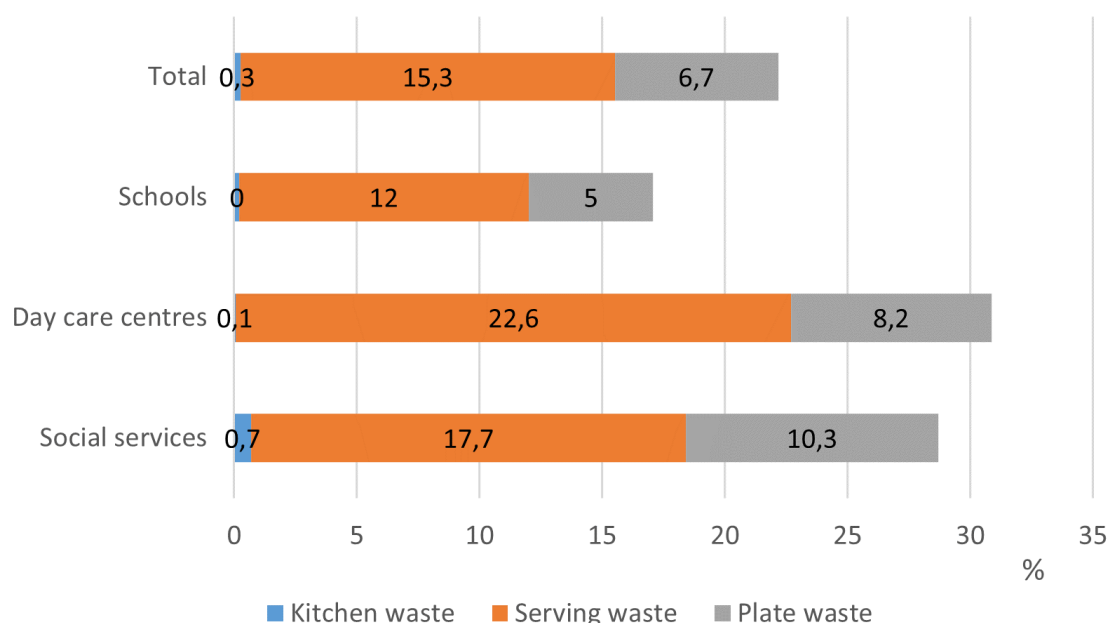


Figure 1. Share of food waste from food prepared; total, in schools, daycare centres and elderly care centres.

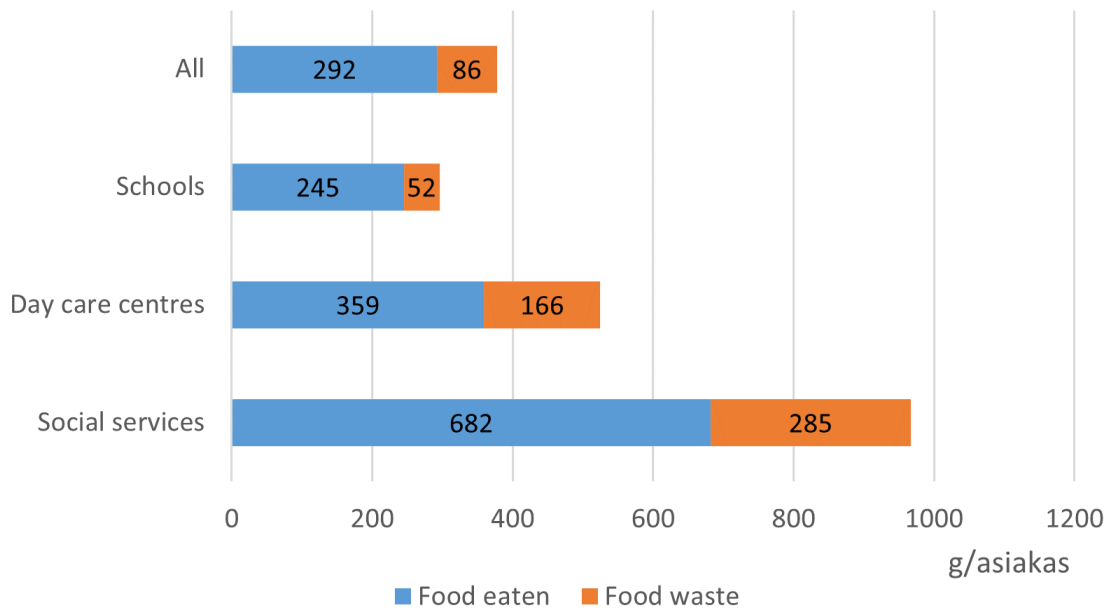


Figure 2. Amount of food eaten and food waste; total, schools, daycare centres, elderly care.

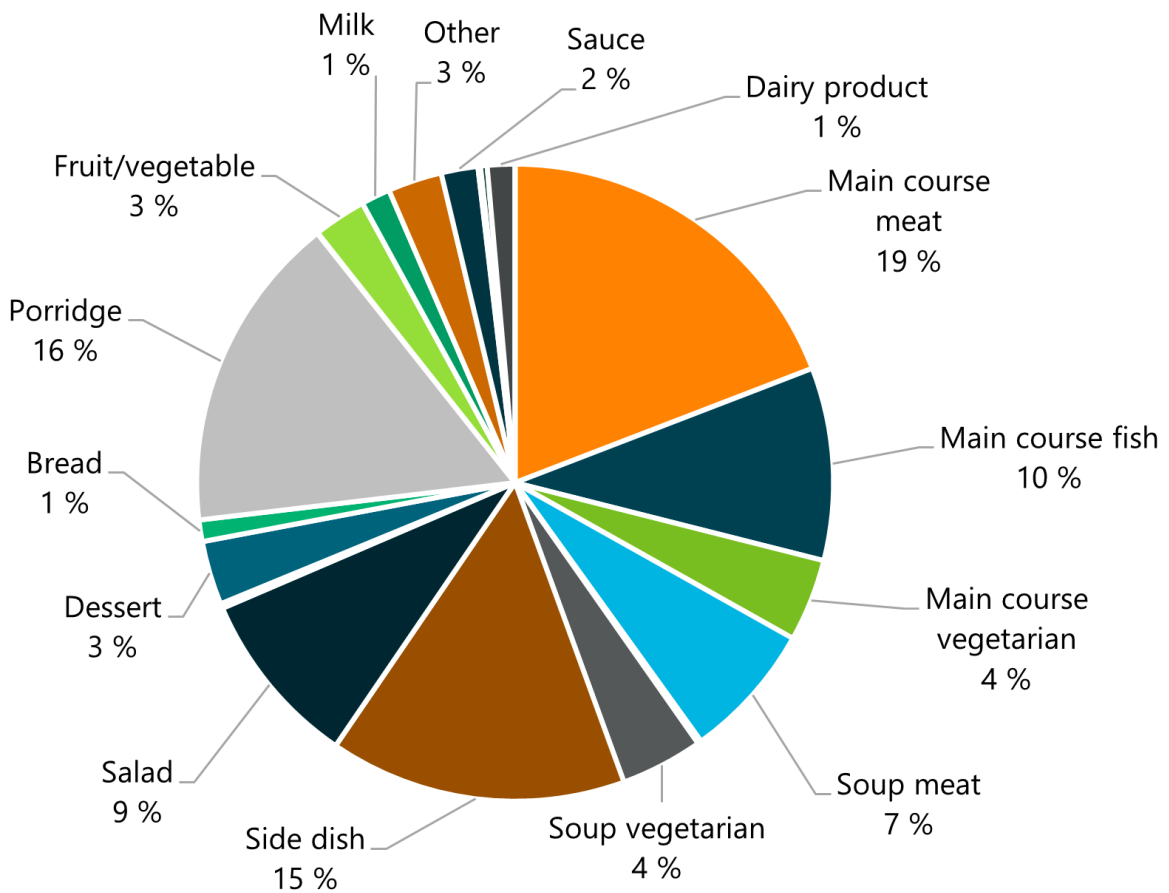


Figure 3. Distribution of serving waste into different food categories across all locations.

3. Feedback book as an additional feature in Lukeloki application

Objectives and background

The aim of the feedback book trial was to develop a modern electronic version of the traditional feedback booklets placed in restaurant lobbies. The feedback book allows customers to give open-ended feedback. It can also be used to ask customers for their opinion on menu changes, new recipes or development ideas to improve the enjoyment of the dining experience and restaurant environment, for example. Knowing customer preferences and increasing customer interaction is a key in food waste management.

These were set as the feedback book objectives: increasing interaction between the restaurant and customers, and emphasising customer-driven menu planning, also with a view to developing food waste management. Based on the feedback book's replies, restaurants should be able to develop their operations, taking the preferences and perspectives of customers into account. A digital app was selected as the final format, as requested by the project's steering committee. However, a tight budget limited the implementation of our solution.

Execution

The feedback book was added into *Lukeloki* app as an external feature, produced by MediaSignal Oy (Ltd). Food services use the browser-based Lukeloki app to register food waste and obtain reports with illustrative key figures and graphs over the food waste measurement period. While the app has been developed for research purposes, organisations that have participated in measurement periods can continue to use the app for a monthly fee even after the measurement period. Using the feedback book as an additional feature has the advantage of Luke researchers being able to use the existing platform, whose use has been made as simple as possible for restaurants. Therefore, no separate logins are required, as restaurants can use the same IDs they used when measuring food waste. The feedback book can also be used as a separate feature without participating in food waste measurements. The app automatically generates a QR code for each restaurant. The QR forwards users to a Finnish and English feedback page by scanning with a smartphone. The code is sent to restaurants to be attached to communication material, including table signs and websites. Luke also offered a simple poster template which can be printed or placed on a customer display and to which the QR code can be easily added.



Figure 4. Customer-focused posted with a QR-code, provided by Luke.

To encourage users to return feedback, they can click a section on the feedback page in which they can enter their contact details to enter a prize draw. If users' contact information is collected, the required privacy statement can also be added to the page. Using a prize draw increases customers' willingness to give feedback by about 10% (Holtom et al. 2022). The organisation using the feedback book can download the responses directly from *Lukeloki* using their user identifiers, or alternatively a researcher can help in feedback compilation and interpretation, as well as in the creation of graphs, for example.

Formulating feedback questions

The feedback book was tested so that three question scales with a happy, neutral and sad smileys as response options and one open-ended question were used. Though the questions could be modified, the style and number of questions were always the same. In the demo version tested, a researcher uploads questions to *Lukeloki* using the administrator account.

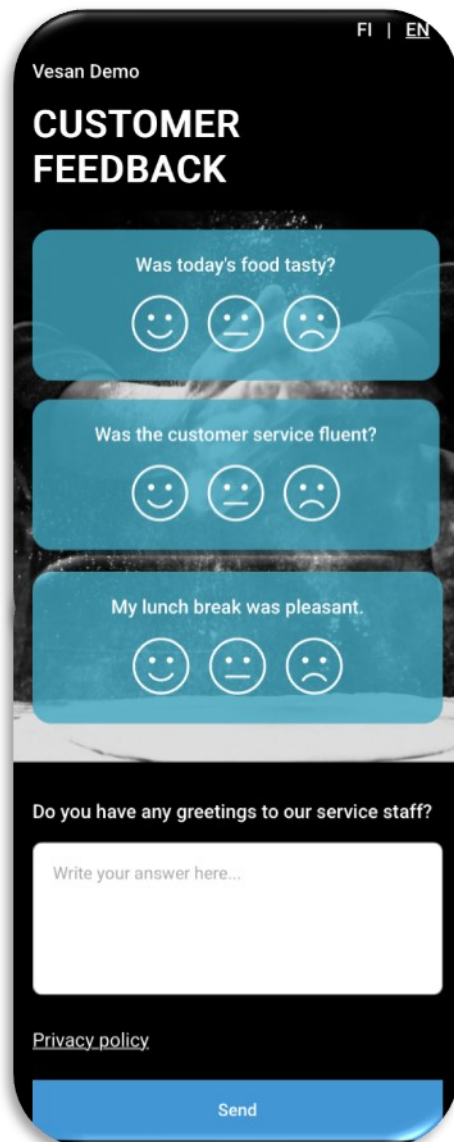


Figure 5. Feedback book's customer interface.

The trial showed that the formulation of good feedback questions – especially those that provided information to support food waste management – was challenging for some restaurants. Therefore, Luke and food services that tested the feedback book compiled the feedback questions together. In an effective feedback questionnaire, the questions must be understandable and unambiguous. For example, the claim *"I had enough time to empty my plate"* may be difficult for the respondent to determine whether they are asked to assess if they had enough time to eat or whether they ate all the food that was on their plate. In this case, it is also difficult to interpret the responses.

Good questions regardless of the food service type were related to enjoyment and time management such as *"Was the dining environment peaceful?"* and *"Did you have enough time to eat?"*. While the experience of enjoyment or time is purely subjective, it gives the restaurant operator feedback on the customer experience and can help develop the service path, environment and service resources better. Asking customers about these issues is also key in considering food waste, since peaceful dining atmosphere has been found to reduce

food waste (Byker et al. 2014, Kinasz et al. 2015, Painter 2016), and to reduce food waste, people must have enough time to eat (Byker et al. 2014, Niaki et al. 2017).

Feedback book trials

The feedback book was tested during the spring and autumn of 2024 at one staff restaurant, two comprehensive schools and six elderly care centres. In the comprehensive schools, the feedback book was only in use for pupils in grades 7–9 and upper secondary school students due to smartphone use restrictions for younger pupils. In addition, the school's food service manager considered that the use of a smartphone while having lunch is not good food education for younger children. In the other comprehensive school, a preschool teacher collected feedback from a group of pupils. In the elderly care centres, employees assisted the residents in using the feedback book or entered the responses on a mobile device on their behalf.

In the trials, questions included taste of food, sufficient eating time, menu suitability and enjoyment of the restaurant environment. The open-ended question field asked for views of the menu as well as favourite foods (given options a–f). The aim of the questions was to customise menus based on feedback to meet customer preferences.

A few dozen responses were received, and the response rates were very low. For example, only 62 responses were received from one of the six elderly care centres, corresponding to 1.4% of all residents during the period. Very few responses were received from the staff restaurant (<10).

No reliable research source could be found regarding a satisfactory response rate to feedback surveys in food services, the tourism and hospitality sector, or even the service sector in general. Then again, according to Holtom et al. (2022), a high response rate does not guarantee valid responses, which supports the findings of Goldammer et al. (2020) regarding negligent respondents. Even a small number of carelessly completed response forms (5–10% respond too quickly, carelessly, inconsistently, etc.) can significantly distort the survey results. Instead of maximising the number of respondents in customer surveys, Holtom et al. propose a strategy that results in a low response rate but a sample that is very representative of the customer base.

Despite the relatively small amount of feedback, the comprehensive school personnel considered the received responses useful. Especially those about favourite foods provided sought-after, albeit partly expected information. The two most popular favourite foods were promised to be added on menu immediately. The elderly care centres were very satisfied with the trial, and the personnel said that they would immediately implement the information received from the feedback in menu planning. For example, the feedback provided information about the appearance of food, as well as how they [physically] felt eating many vegetables and salads and what kinds of vegetables and salads the residents like to eat. The personnel were enthusiastic about the feedback and said that they were ready to collect feedback from the elderly in the future as well. Our approach, where personnel asked the questions from eaters, and then recorded their responses in Lukeloki was considered effective. The personnel reacted positively to the collection of feedback, albeit recording it may have caused them additional work.

Advantages of the electronic method

Editing questions is effortless and easy using the Lukeloki administrator ID. The app is easy to use for collecting feedback from different target groups, both customers and personnel. In the future, the feedback book feature can also be used for research purposes. For example, personnel can be asked about their views on food waste measurement period success. Food waste measurement data and the feedback book responses can be easily combined for research purposes, as both are available in Excel format. As a result, it is easy to make illustrative graphs of the feedback report.

A study by Guirao et al. (2015) found that, in customer feedback surveys, the absolute advantage of using a QR code is its ease, the flawlessness and speed [of forwarding users to the survey site], and low costs [vs. conventional feedback surveys using interviews or paper forms]. Other studies on the use of QR codes in customer feedback surveys were still difficult to find, even though Guirao et al. also mentioned this ten years ago.

Weaknesses of the method

In its current format, the solution provides little added interaction between an organisation and customer which does not fully achieve the original objective. While the organisation receives customer feedback, customers can mainly leave a follow-up question in the open-ended field with their contact information – if the open-ended question is genuinely open-ended (e.g. “do you have any other feedback?”). How the given feedback will be addressed also remains unclear for customers.

The web-based app does not work in places where mobile access is restricted; for example, restrictions on the use of mobile devices in schools, restricted/prevented access to the Internet at a restaurant (train, ship), or customers without a mobile device or knowledge of their use (elderly care centres). In the other school participating in this trial, where even older students were not allowed to use mobile phones while eating, feedback posters with QR codes were placed outside the refectory on corridors. At least in this sample, the school’s response rate was lower (0.36%) than the other school where mobile phones could be used while eating (response rate 0.85%). However, the sample size was too small to draw any strong conclusions from this. Having said that, the majority of potential *Lukeloki* user organisations have unrestricted access to the Internet. A larger obstacle to the use of a separate feedback book is that many organisations already have an established feedback channel (e.g. integrated into a table booking system), and the use of an overlapping channel is not necessary.

In this trial version, the feedback book could only be used by one food service at a time, limiting the amount of feedback for both organisations and researchers. Then again, the original purpose of the feedback book was to encourage food services to conduct *Lukeloki* food waste measurements and participate in research, not to reach as many users as possible.

Suggestions for the future

Based on the trial, the questions received from organisations are often too simple to discover the reasons for customer behaviour or the causes of food waste. The possibility to set a multiple-choice question would be important, for example, to learn about favourite foods or improve enjoyment. However, many existing free web-based survey solutions may work better here.

If built on another platform, the feedback survey would enable funnelled chatbot-type questions that would specify follow-up questions based on customers' responses. If required, the chatbot would also be able to provide responses to frequently asked questions, as well as request the respondents' contact information for further information or questions. This would significantly increase interactivity and improve understanding of the reasons for feedback or customers' consumption behaviour.

For further use, it would be a good idea to create a more detailed description of the service path for the feedback book, in which case instructions and typical obstacles to receiving feedback would be easier to share with users. The service path would include what users want to discover through the questions, Luke's tips on effective or weak questions, where to place a poster/QR code in the eating area, and how to use the feedback received to develop food services.

4. Food waste mentoring programme

Objective and background

The food waste mentoring programme is a model based on peer learning and peer support to share best practices in food waste management. The programme's participants become representatives for the development of food waste management in their own working community – food waste mentors. Every month, the participants meet in small groups and carry out tasks related to the development of food waste management in their workplace between meetings. The meetings focus on discussions between professionals, mentoring and information sharing.

The food waste mentoring programme is based on peer learning and support. Peer learning is defined as the acquisition of knowledge and skills through assistance and support between people in the same position (Topping 2005). In it, learners learn together with each other and from each other, without a teacher's central role in the learning process (Koho et al. 2014). Peer learning has been found to improve learning results and increase learners' motivation towards the subject of learning (Quarstein & Peterson 2001). Moreover, peer learning is considered an essential part of group work, active participation and engagement in a learning group's activities, interaction and discussion (Fawcett & Garton 2005).

In contrast, peer support can be defined as a voluntary exchange of experiences in which peers, i.e. people with similar experiences, share their experiences with each other and receive shared support, aid and new perspectives. Peer support and peer support groups are used especially in healthcare and social services. In management and supervisory work, the opportunity to share difficult issues and obtain support from peers in solving problems are seen as advantages of peer support groups which can reduce the experience of workloads and the feeling of inadequacy (Pirinen 2023). Participants in the groups feel relieved to notice that other participants have the same challenges in developing their activities (ibid).

The aim of the food waste mentoring programme is 1) to strengthen the know-how of food service professionals on food waste management through peer support and learning; and 2) to increase the participants' capabilities to develop the food waste management practices of their own organisation or workplace, and to support and encourage employees in their working community to reduce waste. The objective of the trial groups was to test the suitability of the model as a food waste management tool for professionals in different food services and to develop the programme concept further based on the gained experience and feedback.

The idea of the food waste mentoring programme is to act as a tool to transfer know-how both within and between organisations. There is a need for new solutions, as considerable variation has been seen between the food waste percentage of similar workplaces in a single organisation (Silvennoinen et al. unpublished), which can probably at least partly be explained by the different food waste management skills and practices of the personnel. In such situations, the organisation could benefit from transferring know-how from employees and workplaces that are effective in waste minimisation to others. Within an organisation, the programme can also support the harmonisation of varied food waste practices.

Trial groups

The food waste mentoring programme was tested in three small groups: in a group of food service employees to share expertise within the organisation, and in a group of supervisors and company employees to share expertise between organisations. Meetings were held using the Teams app, and the discussions were facilitated by a researcher from Luke. Participants in the groups of food service employees and public food service supervisors were recruited from the pilot restaurants that participated in the ROMANCE project's food waste measurements. Participants in the company group were recruited with the help of the Finnish Hospitality Association (MaRa). The groups are described in more detail in Table 1.

Table 1. Descriptions of the trial groups.

	Food service employees	Supervisors	Companies
Group description	Professionals working in a public food service organisation providing meals in daycare centres and schools.	Professionals working as supervisors in food services providing meals for students and in schools and daycare centres. The participants' job titles include Food Service Manager and Restaurant Manager.	Professionals working as specialists in private restaurant and food service companies. The participants' job titles include Sustainability Manager, Business Development Manager, Production Manager and Chef.
Group size	4	6	6
Participants from a single organisation or different organisations	Participants from different workplaces within a single organisation	Participants from different organisations	Participants from different organisations
How food is served in the organisations	Buffet and trolley	Mainly buffet	Plated service, buffet, fast food
Meeting schedule	2–4/2024	2–4/2024 + additional meeting 8/2024	9–12/2024

The participants in the trial groups were informed during the registration phase that 1) the food waste mentoring programme is a trial; 2) the programme's discussions can be used for research purposes, in which case 3) by participating, the person accepts that the discussions held in the meetings can be used for research purposes in such a way that the participants or their organisation cannot be identified; and 4) the discussions will be recorded using the Teams recording feature. In addition, the information was repeated to the participants at the beginning of the programme.

Progress of the programme

The framework of the food waste mentoring programme was roughly the same for all groups. However, the themes raised in discussions varied according to the participants' profile, needs, wishes and themes raised in previous discussions. In addition, small changes were made to the meeting schedule based on experiences and feedback obtained from previous groups.



Figure 6. Framework of meetings in the food waste mentoring programme.

The first meeting was started by explaining the discussion instructions. For the trial groups, the participants had to keep the cameras on, and all discussions would be confidential. The participants were encouraged to be active and to take advantage of the opportunity to ask questions from each other. To increase interaction and engage in discussions, the participants of the last company group were instructed to think ahead about what they would like to ask others.

Before the start of the discussion, the researcher in charge of organising the programme went through the key food waste vocabulary so that the participants would have a common language and understanding of what different terms mean, including serving, kitchen and storage waste. Explaining the terms is important because they are not fully established among professionals, and a single term can carry different meanings in different organisations.

The first meeting was started with presentations. In addition to presenting the participants, the meeting in the group of employees working in a single food service, in which the employees already knew each other, started by discussing how much the participants had already talked about food waste and about what kinds of issues. It turned out that there had been very little discussion. After this, the trial groups discussed how the management and reduction of food waste had already succeeded, and what is already effective in workplaces. A positive perspective can make it easier to engage in a discussion, especially if the participants do not know each other. In the trial groups, the discussion also moved naturally, without separate instructions, to problems and challenges.

Towards the end of the first meeting, the homework assignment was discussed: *"Reflect on your role as a food waste mentor in your workplace. Write down a list of the most concrete actions you intend to promote as a food waste mentor in your workplace."* The participants were instructed to present their list to each other at the next meeting. The participants were instructed to select, according to their own resources, how large or small themes they intend to promote.

To support the homework assignment, the researcher presented an abundant information package. The researcher had compiled examples for the participants in which employees with different profiles focused on developing food waste monitoring; training and motivating the personnel; providing instructions and harmonising food waste practices within the organisation; testing something new and improving customer communication and interaction. Example lists were used to share the idea that everyone can oversee food waste management in a natural and meaningful way based on their own strengths, and, on the other hand, focus on developing themes that require the most significant changes in their workplace.

To support the homework assignment, the participants were also given a list compiled by the researcher of the most common methods of food waste management. The purpose was not to provide exhaustive lists for the participants to select their development areas, but to present ideas of all the themes that can be developed. In addition, the participants received information from Luke's training materials (Ravintolafoorumi, 2024a) and newspaper articles focused on food waste compiled to inspire the participants.

The second meeting was started by discussing the homework assignment. The participants presented their lists one by one, after which the other participants had the opportunity to ask questions and present comments. In addition, the researcher organising the programme asked clarifying questions to help the participants concretise their plans. In the company group, the discussion of the homework assignment was enhanced so that the researcher asked the participants to break up large themes into intermediate stages and plan schedules for them.

Between discussing the previous homework assignment and giving a new one, the content of the second meeting was flexible according to the participants' needs and the time required to discuss the homework assignment. In the groups of food service employees and supervisors, an exercise was carried out in which each participant selected an adjective from a list to describe their recent feelings regarding the reduction of food waste. Based on a request presented in the company group, Luke's researcher presented English training materials and food waste measurement results during the second meeting. In addition, the researcher presented the food waste measurement results made during the project to some groups.

At the end of the second meeting, the next homework assignment was presented: *“Put your plan into practice. Implement at least one plan you have listed (or its intermediate stage if the project or theme is large). We’ll discuss how you succeeded at the last meeting.”* In addition, the participants again received tips for further reading from the researcher as extra homework.

During the third meeting, the homework assignment was discussed as before so that each participant said what they had developed, after which the participants had the opportunity to ask questions and present comments. In the company group, a Flinga app was used to discuss the homework assignment so that the participants first considered the success of the assignment with the help of a few leading questions.



Figure 7. Leading questions for the company group’s homework assignment and answers on the Flinga platform (translation from Finnish answers).

After discussing the homework assignment, the themes discussed during the third meeting varied from one group to the next. An employee specialised in reducing food waste in a similar municipality was invited as a guest to the third meeting of the food service employee group so that the participants of this group also learned practices and received tips from another organisation.

Because the discussions of the previous groups, especially the food service group, significantly highlighted the feelings raised by the personnel’s food dimensioning decisions and the uncertainty caused by food running out, the participants in the company group’s third meeting and in the supervisor group’s extra meeting talked about how management can

support employees so that reducing food waste does not cause unnecessary or excess stress and emotional loading. At the end of the third meeting, the participants were able to give feedback on the programme verbally.

Four months after the meeting, an extra meeting was held with the supervisor group focused on a food waste week. The aim was to discuss and plan how to participate in the food waste week's communication campaigns. Two people participated in the meeting. However, the discussion was lively and delved deep in the theme. Possible reasons for this are that the discussion in Teams came more natural with a smaller group of participants and a confidential discussion culture had already been built during the previous meetings. In addition, it may have been easier to grasp the themes when the researcher presented them more extensively.

Key findings

In all three trial groups, the participants engaged in discussions and were active. The participants were also open and willing to share their experiences in the groups in which the participants came from different (and possibly competing) organisations. When completing the homework assignment, the participants' activity varied: one participant provided their detailed development plan list voluntarily by email, while a couple of participants did not do their homework at all. It is likely that those participants who did not do their homework assignment between meetings found the programme less useful.

Discussions in different groups were focused differently. In the company group, the development plans selected in discussions and the homework assignment focused on harmonising the food waste practices of workplaces, including food waste monitoring. In their homework assignment, the development areas selected by the company group's specialists included the procurement of scales suitable for preparing portions of the same size and weighing food waste in all workplaces, the development of a food waste recording feature in a new checkout system, and the preparation of various instructions. In the discussions, the specialists were also interested to talk about where they had acquired their food waste expertise.

In the food service employee group, discussions repeatedly focused on how people eating in different locations had welcomed each new dish added to the menu, and how the participants would like to develop new recipes from the point of view of increasing sales and avoiding food waste. The group also discussed preparations for interruptions in food services. In the homework assignment, different customer campaigns aimed at reducing plate waste, as well as closer cooperation in orders with the central kitchen to avoid excess orders, were selected as development plans.

In the group of public food service supervisors, discussions focused on how to improve the estimation of customer volumes. Because the discussions highlighted the use of the Power BI app as a tool to estimate customer volumes, as well as the preparation of a sustainability education plan for educational institutions, those employees who had experience in the tools were allowed to briefly present the tools and talk about their experiences during the third meeting. In their development plans, the participants focused on setting goals to reduce customers' plate waste, increase the preparation of partial portions, and switch to smaller serving containers at the end of service.

In the trial groups, customer communication and reducing plate waste often caught the participants' attention and were common themes in the homework assignment. However, these do not have any significant impact on the prevention or reduction of serving waste, which is the largest source of food waste. Especially in the spring groups of food service employees and supervisors, the development plans of several participants focused on setting a target level for plate waste or holding various food waste reduction campaigns or competitions for food service users. To keep the programme's focus on key issues related to the reduction of food waste, the programme's organiser showed the division of food waste into different types of waste to the participants at later meetings and steered the discussion especially towards themes related to the reduction of food waste.

In the discussions of the food service employee group, it was emphasised that there were strong emotions associated with decisions related to the dimensioning of food and the reduction of serving waste. When discussing dimensioning decisions, words that describe emotions and uncertainties were repeated such as "*fear of running out of food*", "*playing it safe*" and "*taking a risk*". Particularly interruptions in serving food can be very stressful situations for employees working in the customer interface. When discussing the dimensioning of food, unfortunate experiences due to running out of food or interruptions, such as negative customer feedback or undesirable publicity, were also raised. Supervisors and the participants in the company group also identified the pressure and stress associated with interruptions and running out of food.

The researcher organising the programme found that it is important to instruct the participants specifically to discuss together so as not to create a situation where the participants respond to the researcher instead of engaging in a genuine discussion. Therefore, it is important to formulate the assignments by saying "*Let's talk about what kinds of things are difficult to manage food waste*" rather than asking "*What kinds of things have been difficult to manage food waste in your workplaces?*".

Holding the meetings through Teams enabled professionals to participate from their own workplaces and from different locations. In particular, the work of food service employees is location-specific and highly structured and scheduled. Participating from the workplace can be the easiest or even the only way for them to participate.

Feedback on the programme

Participants in the trial groups of the food waste mentoring programme were able to give feedback on the programme verbally at the last meeting and using the feedback form after the programme. The form was completed by 12 out of 16 participants (response rate 75%). In the responses of the spring group of food service employees and supervisors, the average value given to the claim "*I considered the food waste mentoring programme useful*" was 8 on a scale from 0 (I didn't consider the programme useful at all) to 10 (the programme was very useful). The average score given by the participants in the autumn company group was 7.8.

The participants felt that the best part of the programme was talking with peers: sharing experiences, as well as receiving tips from others and learning from the discussions to develop their own activities.

"It's nice to talk to people who are struggling with the same problems, so peer support is OK." Company group participant, 3rd meeting

*"The best part was to hear what others have done; I really could learn from them."
Supervisor group participant, feedback form*

"The joint discussions were good. I saw that monitoring food waste and developing it are hot topics. Recording and tracking food waste have been useful tools. As a result, the amount of food waste in ordered food has been specified. And there won't be that much waste." Food service employee group participant, feedback form

However, two respondents to the feedback form also wrote that they had not learned anything new during the programme.

In particular, the participants in the company group also felt that the assignments completed during the programme helped them become more active in the development of food waste management in their own organisation and to find new ways to reduce waste. Particularly for the last company group, the assignment instructions had been clarified and the discussion of the assignments had been enhanced.

*"This really encouraged me to think about food waste and its reduction in various ways, and to take action. To really think about solutions, several of which can ultimately be found, even though it may seem difficult to start or come up with anything at first."
Company group participant, 3rd meeting*

The participants were satisfied with the programme's structure. Of all participants, 92% felt that informal discussions and the themes discussed facilitated by the organiser were appropriate methods, and 8% wanted the themes to have been discussed more under the organiser's facilitation. All respondents considered the one-month meeting interval to be appropriate. The duration of the meetings (1 hour) was considered appropriate by 92% and too short by 8% of the respondents, while the number of meetings (three meetings) was considered appropriate by 83% of respondents and too small by 17%. One participant regarded the programme's structure as its merit: participating in the programme does not require a lot of time from the participants but gives a good start for development. As a development proposal for the programme's structure, one respondent suggested that there could be more meetings, and at the last meeting, each participant could talk about the results that they had achieved in the programme.

The spring groups' development proposal was to use digital tools such as the Padlet or *Flinga* app to support discussions. The programme started in autumn was developed based on this feedback. Other development proposals suggested that the organiser could send a list of possible discussion themes in advance to the participants, so that they could choose from the list what they would like to discuss next.

Overall, the food waste mentoring programme trial was a success. Lessons were learned from the trial groups for the development of the concept, and the final concept and instructions for organising the programme were also modified based on the feedback received. Based on experience and feedback, the programme was suitable both for food service employees, supervisors in public catering services, and specialists in private food services. The suitability of the programme for different types of groups and employees was supported by the fact that the programme's content could be modified according to the needs of each group, the participants could steer the discussion in directions that interested them, and each

participant was able to choose what to develop in their organisation in the homework assignment.

Proposals for further development

The food waste mentoring programme could be developed to describe the programme concept in such a way that, for example, educational institutions, organisations, projects or individual food service organisations could, with the help of instructions and materials, establish their own food waste mentoring group to share best practices. The organising instructions will be available openly and free of charge on Luke's Ravintolafoorumi website. The next step is to test the programme concept so that the programme will be independently organised by a party other than Luke. A large food service organisation has expressed interest in implementing the programme.

In the trial groups, the participants were selected from similar positions, but in the future, the programme could also be tested in a group with participants from different positions and from different levels of the organisation. In the feedback given by the food service employee group, a development proposal suggested that a supervisor or a member of the organisation's management could have been invited to participate in one meeting.

Particularly in groups in which the participants are from a single organisation, the programme could be enhanced by jointly reviewing the organisation's workplace-specific food waste measurement results. The role of the homework assignment could also be further enhanced by the programme organiser requesting the first homework assignment to be sent to the organiser in advance so that they can provide written feedback on the lists.

5. Encouragement feature in the Lukeloki app

Background and objective of the trial

An encouragement feature was tested in the Lukeloki app to motivate app users to measure food waste and continue the measurements. Developing new solutions to motivate staff and personnel to monitor and reduce food waste is essential, as the personnel attitudes towards food waste can play a significant role in the generation of waste (Sakaguchi et al. 2018, Filimonau et al. 2019, 2024, Stirnimann et al. 2022). Everyday life in a kitchen is hectic, and the lack of time has been identified as one of key challenges in the regular measurement of food waste (ibid, Goh et al. 2019). However, Finland's new Waste Act obliges food service organisations to maintain food waste bookkeeping (Waste Act 646/2011, as amended 714/2021). Therefore, it is important to establish routines for monitoring food waste, as well as to allocate the employee [working] time required to weigh and record food waste. The positive management attitude and support for sustainable working methods – including food waste management – promotes the self-efficacy of the kitchen staff (i.e. the experience of competence) as well as increases team spirit and innovation to come up with different reduction methods (Stirnimann et al. 2022 Filimonau et al. 2024, Pearson et al. 2025, Goh et al. 2019, Pellegrini et al. 2018).

Implementation of the trial

The development of the Lukeloki app has focused on user-friendliness and the ease of making entries by eliminating all unnecessary steps and details. Therefore, encouragement messages were to be implemented so that they would not be perceived as disturbing and would not make the app use more complicated. In the trial, a petrol-coloured pop-up message was added on top of *Lukeloki* landing page, which was visible to users for five seconds. Encouragement messages could then be read by clicking the clock symbol in the top corner of the front page. Three alternating "fact of the day" or "why you should record food waste" messages were shown to users on the start page:

"Welcome to Lukeloki! Reducing food waste produces significant savings!"

"It's nice to see you! It's good that you've started to record food waste!"

"You're doing important work! It's good that you're recording food waste today!"

Once a user had saved the food waste entries, an encouragement message with location-specific data or a generic message was shown on the screen in alternating days:

"Great! You've already measured food waste for [consecutive number] days in a row! Regular measurements help reduce food waste!"

For this message type, the app calculates the number of measurement days.

"Today's food waste totals [weight] kg. The average in previous days is [weight] kg."

For this message type, the app adds up the weights of different food waste types recorded by the user on the registration day and preceding registration days.

"It's great that you've measured food waste today! It helps you achieve your goals!"

Lukeloki administrators (i.e. Luke researchers) can disable the encouragement messages for each organisation.

Feedback

The organisations that participated in the project's food waste measurement periods were sent a feedback survey regarding the encouragement feature, to which 21 responses were given. The survey consisted of four responses on a scale from 1 to 10 and one open-ended field for development proposals:

1. What did you think about the welcome message on the login page?
2. What did you think about the message shown after measurements?
3. What did you think about the message shown after recording food waste that indicated the amount of food waste and the average amount on previous days?
4. What did you think about the message that indicated the number of measurement days in a row?

The average score given to the welcome message on the start page (Question 1) was 7.7 (standard deviation 2.1). The second question about the encouragement message shown after recording the day's food waste received an average score of 7.3 (standard deviation 2.2). Communicating the daily amount of food waste (Question 3) received an average score of 7.1 (standard deviation 2.5), and the fourth question about the duration of measurements was given an average score of 6.8 (standard deviation 2.8). Therefore, the feedback on the encouragement messages was largely neutral, and the messages did not raise any special reactions.

Several respondents had not noticed the messages at all. Therefore, the highlight colour of the message field may not stand out sufficiently, the message disappears too quickly – or as one respondent wrote, *"I was apparently so focused on entering numbers [that I didn't notice the message]"*. According to feedback received from two respondents, the numerical messages did not show information about food waste in their kitchen. Two respondents wrote that the encouragement feature offered motivation – although one was hypothetical because they had not seen the numerical messages. After the trial, Mediasignal Oy, which is responsible for app management, found out that there had indeed been interruptions in showing the messages during updates made to the application.

The purpose was that the encouragement messages should not have any irritating features, including a separate pop-up window that could be closed by clicking it (and that would still possibly be closed unread) and the use of highlight colours. With this method, the risk of not noticing the messages seemed to have materialised for some users. Then again, attention-grabbing pop-up windows could have been perceived as disturbing, in which case the messages would not have served their purpose to motivate users to continue measuring and recording food waste.

As a limitation of the encouragement feature, it was found that some organisations using the Lukeloki app do not make daily entries in *Lukeloki* but record the measurement results first on paper and only once a week in the app, in which case the messages indicating the number of measured days work poorly. Entering food waste entries over several days into the system at the same time is not optimal, but it may be the only way possible in some kitchens.

Reflection on motivating the personnel to reduce food waste

Pearson et al. (2025) found little research on how restaurants encourage their personnel to reduce food waste by means of communication. In addition, employees' personal (e.g. social media) and the organisation's (internal) information flow reduces the effectiveness of communication (Pearson et al. 2025, Goh et al. 2019). Using pop-up windows may not therefore be effective if there is not enough time to use the measurement app, the prevention of food waste is not important for the management or in job descriptions, or there are specific attitudes towards food waste (mainly the problem of high-quality restaurants, where ingredients are wasted to maximise the aesthetics of portions or the desired "high quality") (e.g. Goh et al. 2019).

Giving encouragement for measurements (here: Lukeloki pop-up messages) may not be an effective way to reduce food waste but may affect attitudes or motivation. Employees interpret sustainability-related communication through their own attitudes and motivation, no matter how clear it is, in which case the implementation of reduction methods at work may change according to the situation (Pearson et al. 2025, Goh et al. 2019). *Internalising* food waste communication and instructions is essential for its effectiveness in reducing food waste (Pearson et al. 2025, Goh et al. 2019, Pellegrini et al. 2018).

Based on this, the *Lukeloki* encouragement message feature may partly act as one way in reducing food waste, at least for employees with a positive attitude towards sustainability. However, several new articles state that the causal relationship between the attitudes and motivation of restaurant employees and the reduction of food waste needs to be studied further.

6. Summary and conclusions

The Robust Food Waste Management Method for Food Services (ROMANCE) project focused on developing effective solutions to reduce food waste, motivate the personnel and support a culture of preventing food waste in food services. In food services, there is a demand for scalable solutions to reduce food waste. Especially, digital tools and peer-learning-based solutions have potential. In the project, 39 successful two-week food waste measurement periods were carried out in public food services. On average, 22.3% of the food prepared ended up as food waste, and food waste per customer was highest in elderly care centres.

The project tested three new ideas:

1. The feedback book app made it possible to collect customer feedback through the Lukeloki app. Although the response rate was low, the feedback was used to develop activities, especially in elderly care centres. The feedback book feature will continue to enable research settings in which the Lukeloki app simultaneously collects food waste and sales data as well as feedback from customers or the personnel.
2. The food waste mentoring programme was based on peer learning and support. It provided a platform for food service professionals to share best practices and develop food waste management in their working community. In the homework assignments, the participants planned concrete measures to reduce food waste in their workplaces. The programme was considered effective and suitable for professionals working in different types of roles and organisations.
3. The encouragement feature of the Lukeloki app aimed to motivate the personnel to regularly record food waste. Potentially unseen messages was considered a challenge and will be developed further.

Food waste management in food services emphasises systematic measurements and the use of data in decision making. As the food waste measurement results show in the second chapter, most food waste generated in food services consists of food that remains in buffer or is intended to be used there, i.e. serving waste. Therefore, using past operational data as a basis for scaling the amount of prepared food, and component preparation [rather than ready dishes] are essential factors for organisations to succeed in reducing the amount of food waste.

In the food waste mentoring programme's trial groups, customer communication and reducing plate waste often caught the participants' attention and were common development areas. However, these do not have any significant impact on the prevention or reduction of serving waste, which is the largest source of food waste. For food waste management to be effective, food waste reduction measures must also be targeted at the largest sources of waste.

The feelings of uncertainty raised by food scaling decisions among professionals, as well as the stress caused by interruptions in serving food, were strongly present in the food waste mentoring programme's trial groups. When food runs out or is changed, the staff also are faced with negative customer emotions. Where the over-preparation of food, i.e. the generation of serving waste, is usually not visible to food service users, under-preparation, i.e. running out of food or switching to backup food, is visible and can cause reputational

damage. This mismatch resulting from incorrect preparation scaling and/or predicting correct food amounts can understandably incline the personnel to over-prepare food.

Food waste reduction has focused on technical solutions, including sales forecasting tools, smart scales and food waste measurement apps. However, based on the results of the food waste management programme, soft management skills are also needed alongside technical solutions: the ability to support employees so that there is no excess stress or other emotional burden associated with food scaling and practices that support the reduction of waste, including the preparation of food in parts and backup food practices.

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