

## Assessing food waste management in the restaurant sector in the Republic of North Macedonia

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### Abstract

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The problem of loss and food waste in the whole food chain is a real challenge for institutions and states and their policies. The food waste is a problem on several levels, from increasing poverty as an economic problem to a real environmental problem from an ethical point of view. This problem requires a fundamental solution in North Macedonia, where little attention is paid to food loss and waste management. This research aimed to understand the problem of food waste and the implications of this problem, as well as to see the possibilities for reducing food waste in restaurants in the country. An online questionnaire was conducted in the food service sector. The results of the research showed that there are drastic differences in the views on the problem of food waste. The food service sector has very few options available but still pays little attention to solving the problem. The actualization of the problem of food losses and waste must be addressed from the lowest to the highest level in both state institutions and the private sector and all those involved in the food supply chain. It is necessary to adopt legal solutions and acts following European legislation, conduct appropriate training for managers of catering facilities on the possibilities of managing food surplus and waste, and improve communication with the Food Bank.

*Keywords:* food waste; online survey; waste management; restaurants

### Introduction

Food is fundamental to human existence. However, despite the annual production of around 4 billion tonnes of food, nearly 1 billion people worldwide suffer from malnutrition. A staggering 30–50% of this food, equivalent to 1.2–2 billion tonnes, is wasted due to inadequate harvesting, storage, and transport techniques, as well as wasteful market and consumer behavior (Katsarova, 2016).

Food waste has significant impacts across environmental, economic, and social dimensions, making it a critical issue for global food security and environmental sustainability (Katsarova, 2016; FUSIONS, 2016; Papargyropoulou, 2019).

Households produce the largest share of EU food waste (53 %), followed by agriculture/food processing (19 %). These two sectors account for over two-thirds (72 %) of EU food waste. The rest is attributed to food service/catering (12 %), primary production (11 %), and retail/wholesale (5 %) (Katsarova, 2016; FUSIONS, 2016).

Within the food services industry, drivers contributing to food waste encompass various elements such as excessively large portion sizes, inappropriate preparation techniques, an excess of food beyond the necessary amount, logistical challenges, cultural norms regarding the appropriateness of taking leftovers home from dining establishments, limited awareness regarding food waste, and customer preferences (Kretschmer et al., 2013; Papargyropoulou et al., 2016; Pa-

pargyropoulou et al., 2019; Filimonau and Sulyok, 2021). Quality assurance standards are another key contributor to food waste in the service section of the food delivery system framework (McAdams et al., 2019). To address the issue of food waste generation in food services, preventive measures such as effective demand forecasting, improving food preparation techniques, reducing portion sizes, behavioral changes towards sustainable out-of-home food consumption practices, increasing ecoefficiency, and revisiting the blanket buffet food safety policy should be taken in consideration (Papargyropoulou et al., 2016; Aamir et al., 2018; Papargyropoulou et al., 2019; Filimonau et al., 2019; Filimonau et al., 2020). Public awareness campaigns should be developed to better engage customers in restaurant food waste minimization (Filimonau et al., 2019, Filimonau et al., 2020a). Nonetheless, vegetables, cereals, bakery products, and fruits are the most wasted food commodities in hospitality services (Papargyropoulou et al., 2016; Papargyropoulou et al., 2019; Filimonau and Sulyok, 2021). The exception is China, where the most wasteful food categories are meat and fish (Filimonau et al., 2020a).

As the prevention of food waste is a top priority, the uncertainty this creates may inhibit investment in the infrastructure and technologies needed to use food waste as a source of energy via composting and anaerobic digestion (Kretschmer et al., 2013).

Across the globe, numerous initiatives are underway to spearhead national efforts aimed at reducing food waste, much like in the USA (ReFED, 2018), Denmark (Katsarova, 2016) and United Kingdom (SRA, 2010; WRAP, 2013).

Regarding North Macedonia, there exists a lack of data about the current situation of food loss and waste generation along the food supply chain. Recently the Association for a Clean Environment 'Let's do It Macedonia' has estimated that food waste makes up more than 10 % of the solid waste generated in the country, i.e. 100 000 tonnes of edible food, mostly coming from agricultural surpluses (EEA, 2023). Efforts were made to assess and evaluate food waste at the household level (Bogevska et al., 2020; Bogevska et al., 2022), but there is still a lack of attention given to the hospitality sector. The aim of this study was to better understand the problem of food waste and its consequences, including exploring strategies to mitigate food waste in the restaurant sector in North Macedonia.

## Material and Methods

In this study, a questionnaire was distributed to the target group of 100 restaurants in North Macedonia. The questionnaire, which consisted of 18 questions, was designed to col-

lect information on how these establishments manage food waste. The data collection process used the online survey tool are available at <https://www.google.com/forms/about/>. To select the restaurants, we began with the neighboring establishments and their contacts. Then we used these contacts to expand the list, covering a wider area. We identified potential participants, too, through publicly available information on websites.

Respondents were given the flexibility to select one or more answers for each question, and in some cases were encouraged to give their personal opinions based on their experiences with food waste. The survey was conducted between May and July 2021, and a total of 57 catering establishments participated by completing the questionnaire.

In order to provide a comprehensive picture of the situation concerning the research topic, the results are graphically presented in two sections. These sections provide insight into the strategies used by catering facilities to deal with surplus food, such as whether they choose to donate it, reuse it for secondary purposes, or whether it ends up as waste.

Like any research, this study has its constraints. Firstly, qualitative research is not generalizable, meaning the study's findings should be seen as exploratory, provisional, and not confirmatory (Filimonau et al., 2019). Secondly, the results may not be universally applicable to all restaurants and should be approached with caution when extrapolated to other restaurant categories, such as quick-service restaurants, where food consumption on-site is less common (Filimonau et al., 2020). Lastly, restaurant owners/managers may not have answered all questions completely honestly. Participants may have been concerned that the authorities might become aware of certain practices that they were following, which may have led them to be cautious in their responses. There is always concern about the confidentiality of their identity (Bharucha, 2018).

## Results and Discussion

Section 1 shows the results of questions concerning food preparation and waste management practices within restaurants. It includes questions that assess various aspects such as the number of employees involved in food preparation, the number of guests served, reasons for food not reaching the consumer, waste reduction practices, and recording of unconsumed food. It also explores the types of food commonly wasted, the average amount of surplus food per day, and the company's approach to surplus food and food waste.

Starting with staff involvement, 45% of respondents have more than 10 employees involved, suggesting operations on a scale that requires a substantial workforce. In terms of

customer numbers, the majority (52%) of restaurants in the survey serve more than 100 customers a day. It is also notable that the survey shows a significant gap in food waste documentation, with 56% of respondents admitting that they do not track the amount of prepared food that does not reach the consumer. This lack of tracking is a critical blind spot and is potentially a barrier to effective waste reduction and management strategies.

When looking at the reasons why prepared foods do not reach the consumer, the main issues noted are inappropriate appearance, taste and smell (30%) and preparation failures (25%). These findings highlight the importance of quality control and food preparation skills as key factors in minimizing waste. On a positive note, a significant majority (73%) of respondents have implemented procedures to reduce food waste, indicating a growing awareness and proactive approach to sustainability in the foodservice sector. However, the 14% who are unsure about their waste reduction processes indicate an area that could be improved. The survey also presents a contrasting picture regarding the tracking of food not consumed, with responses equally split. When considering the types of food most commonly wasted, side dishes emerge as the leading category (53%). This could indicate either a tendency to over-prepare or a lack of popularity among consumers. This information is valuable for establishments to adjust cooking quantities or rethink menu offerings to reduce waste.

There is a complex and varied situation when it comes to food waste management and catering responses to the question *How do you address issues related to food waste?* (Question No.8). One notable aspect, highlighted by the responses, is the diversity of approaches taken by different food operators. However, a concerning trend emerges from the data: a significant number of respondents admit that food is often thrown away without a specific strategy to manage it. This suggests a gap in the sector's approach to food waste, where the lack of structured procedures leads to inefficiency and increased waste.

In addition, while some respondents indicated that surplus food is donated, this practice appears to be random rather than part of an organised system. This lack of formalisation of the donation process suggests missed opportunities to reduce food waste more effectively. While respondents indicated that they try to store waste appropriately, this is also characterised by a lack of consistency, as current regulations on waste storage are considered to be poorly defined.

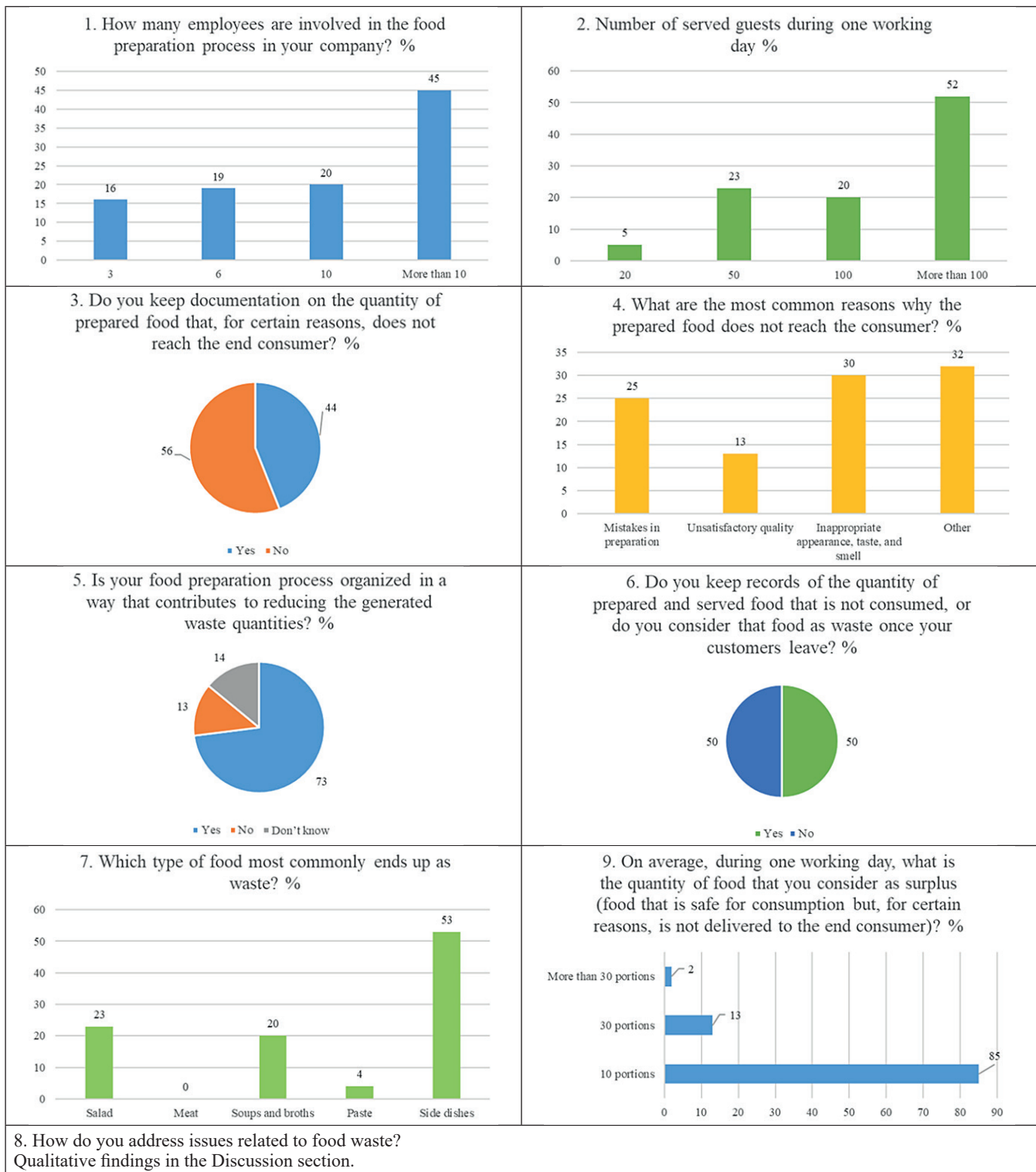
According to the respondents, the amount of surplus food is not very large and the majority, 85%, think it is about 10 portions, 13% said it is about 30 portions, and only 4% more

than 30 portions. But regardless of the amount, it means that there is food that can be consumed, i.e. donated and given to where it is needed, which will feed a certain number of poor people and significantly reduce food waste, which in turn reduces the consequences of such waste.

These findings highlight a wider issue within this sector: the need for more consistent and regulated approaches to food waste management. The diversity of practices, ranging from ad hoc donations to a lack of concrete waste management strategies, reflects a sector that is aware of the food waste problem but struggles to address it systematically. The responses suggest an urgent need for clearer guidelines and more structured methods, possibly underpinned by regulatory frameworks, to ensure that food waste is managed more efficiently. This situation not only requires immediate consideration, but also opens up opportunities for further research and policy development in the country (Filimonau et al., 2020). Waste management policies need to be harmonized and coordinated with broader policies concerning food, agriculture, food standards, efforts to alleviate food poverty, and the promotion of sustainable production and consumption practices (Papargyropoulou et al., 2014). In Canada, the Restaurant Food-Service Delivery Framework model for both academics and industry evaluation could provide a starting point for facilitating better food waste management practices (McAdams et al., 2019).

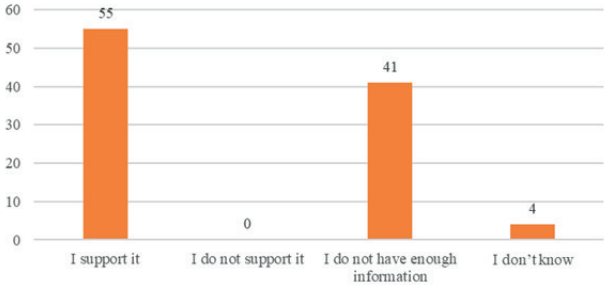
In the section 2 are presented results on the questions focused on external collaboration and views on food management. It explores whether companies have collaborated with food banks or national kitchens in North Macedonia and, if so, the extent of this collaboration. This section also looks at the opinions of these companies on approaches to surplus food management, their efforts to use alternative methods of food waste management, and whether they seek professional help in dealing with surplus food. Lastly, it discusses the challenges companies face in managing surplus food and waste, and suggests for future improvements.

A surprising 88% of respondents do not work with the Food Bank, a key player in addressing food waste in the country by redistributing surplus food to those in need. This lack of engagement with the Food Bank is indicative of a wider issue: the country's major generators of food waste appear to have limited experience or knowledge of the concept, which is highly developed in the European Union and neighboring countries. Some studies have shown that barriers to food donation, such as concerns about liability and financial constraints, are major barriers to the donation process (Sakaguchi et al., 2018; Aamir et al., 2018; Filimonau et al., 2019). The efficient redistribution of surplus food can be significantly improved by implementing policy initiatives



**Section 1. Food preparation and waste management practices in restaurants**

Source: Authors' own elaboration

<p>10. Have you collaborated with any of the food banks in North Macedonia? %</p>  <p>■ Yes ■ No</p>	<p>11. What is your opinion on this approach to dealing with surplus food? %</p> 
<p>12. Have you collaborated with any national kitchen in North Macedonia for food donations? %</p>  <p>■ Yes ■ No</p>	<p>13. If the answer is yes, what is the number of donated portions on a daily basis? Average 10.</p>
<p>14. Do you employ any alternative methods for dealing with food waste, other than disposal in landfills? %</p>  <p>■ Yes ■ No</p>	<p>15. Do you employ any alternative methods for dealing with food waste, other than disposal in landfills? (If yes, What is that alternative?) Qualitative findings in the Discussion section.</p>
<p>16. Have you sought assistance from professionals to address the issue of surplus food and manage food waste? %</p>  <p>■ Yes ■ No</p>	<p>17. What problems do you face as a company when trying to solve the problem of excess food and food waste that occurs in the course of daily operations? Qualitative findings in the Discussion section.</p>
<p>18. Do you have any suggestions on how surplus food could be better handled and utilized in the future, and how this could positively impact the development of various sectors in the country? Qualitative findings in the Discussion section.</p>	

**Section 2. External collaborations and opinions on food waste management**

Source: Authors' own elaboration

such as tax incentives for donations or legislation to reduce liability concerns for restaurants (Aamir et al., 2018; Filimonau et al., 2019).

Despite the apparent support for the food bank concept, with 55% of caterers in favour, a significant proportion, 41%, admit to not having sufficient information about it. This lack of information indicates an alarming level of unawareness about a proven method of reducing food waste. The situation is reflected in engagement with the National Kitchen, where 84% of restaurateurs have no partnership, despite the fact that it operates on humanitarian grounds to serve the poor and low-income families. Even among the 16% who do cooperate, the contributions are modest, generally around a dozen portions, further illustrating the lack of substantial involvement in food waste management initiatives.

Furthermore, when it comes to disposing of surplus food that is safe for consumption, half of the respondents acknowledge the use of alternatives to disposal in landfills, but the other half are either unaware of such alternatives or do not implement them. This split response highlights a gap in the regulatory framework for the management of food waste in the catering sector, suggesting that current practices are inadequate and lack the structure provided by comprehensive legislation.

These findings signal the urgent need for national strategies to manage food waste, calling for legal and normative solutions in line with European Union standards and the efforts of civil society organizations in the country. The data shows that while there is conceptual support for waste reduction initiatives, implementation is constrained by a lack of information and legal guidance. The gap between the recognition of the usefulness of the food bank concept and its adoption in practice underlines the need for educational and policy interventions to facilitate a more effective response to the problem of food waste in the catering sector.

Responses reflect a sector struggling with the complexities of food waste management. When asked “*Do you employ any alternative methods for dealing with food waste, other than disposal in landfills? (If yes, What is that alternative?)*” (Question No.15), the most commonly cited solution is to feed animals, particularly homeless animals, with leftover food. This response was confirmed by many respondents who either feed animals directly or work with companies that facilitate this process. Some restaurants also distribute surplus food to the poor or provide meals for their employees, demonstrating an awareness of socially responsible practices. The majority of the restaurants in Mumbai (Bharucha, 2018), Pakistan (Aamir et al., 2018) and the USA (Sakaguchi et al., 2018) have a clear policy to distribute surplus food among their staff.

In terms of the question “*What problems do you face as a company when trying to solve the problem of excess food and food waste that occurs in the course of daily operations?*” (Question No.17), the main challenge reported is meeting the legal requirements for working with food banks. They express the need for greater state support to make such collaborations feasible and sustainable. In addition, the lack of proper refrigeration facilities to store food and the absence of information on how to deal with surplus food are significant barriers. Some mention the extra cost and planning involved in donating food, while others highlight the lack of timely collection of food from food banks as a logistical challenge.

When asked *Do you have any suggestions on how surplus food could be better handled and utilized in the future, and how this could positively impact the development of various sectors in the country?* (Question No.18), the most common response points towards the need for efficient donation systems. Respondents suggest that better coordination with food banks, organised transport for food collection and government support are crucial. The consensus is that a quick and safe way to donate surplus food would not only solve the waste problem but also have a positive impact on the economy and society by helping those in need.

The survey clearly indicates a community that is aware of the need for change, but is limited by a lack of information and structural support. While there is a willingness to donate and manage food waste responsibly, current communication between catering businesses and organisations such as food banks is poor. Respondents called for better collaboration and clearer guidelines to enable more effective food waste reduction practices in the country.

## Conclusions

The research realistically reflected the situation with excess food and waste in catering facilities, which are considered a very large generator of this problem.

Although caterers are aware of this problem, their responses showed that they do not have many ways available to deal with food waste, while paying very little attention to excess food and the options available to them. A high percentage of those surveyed do not cooperate with either the Food Bank or the National Kitchen. While the study does not aim to generalize findings beyond the sample, the data nonetheless reveal several noteworthy descriptive patterns. For example, restaurants with more than 10 employees involved in food preparation often exhibit greater implementation of food waste reduction procedures. Additionally, establishments serving more than 100 guests daily appear more

likely to report structured practices, such as donating surplus food or storing waste in accordance with internal protocols. Conversely, restaurants that do not track unconsumed food frequently report a lack of collaboration with food banks and limited awareness of external support mechanisms. These observed tendencies suggest that the scale of operation, internal organization, and awareness of existing systems may influence waste management behaviors, even in the absence of broader statistical inference. All of the above shows that there is a need to raise this problem not only at the local but also at the national level. Therefore, from all this it can be concluded that it is necessary:

- Update on the problem of food loss and waste from the lowest to the highest level, both with government institutions and the private sector, and with all those involved in the food supply chain.
- The adoption of legal decisions and acts that conform to European legislation and the application of the same at all the specified levels.
- Creating and executing initiatives aimed at preventing and decreasing food waste in the hospitality sector.
- Provide appropriate training and information to catering managers on how to manage food surplus and waste.

This initial study in North Macedonia serves as a first step in understanding the management of food surplus and waste in the restaurant sector and highlights the need for ongoing research to develop more effective strategies and solutions in this area in the country.

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