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Article

Exploring Sustainable Food Waste in Serbian Hotels: Practices, Challenges and Managerial Perceptions

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Abstract

Food waste is a major economic and environmental problem and challenge in the hospitality sector in the global market and in developing countries such as the Republic of Serbia. This exploratory expert-based research aims to investigate the management opinions, as well as the practices and challenges faced by them regarding the sustainability of food waste management in hotels in Belgrade. A specially designed questionnaire, created by the author, was administered to general managers of 9 hotels of different sizes and structures. For the methodology of this study, a five-point Likert scale was used to assess sustainability awareness, employee training and operational constraints. In addition to the Likert scale, methods such as Spearman's rank correlation and Mann-Whitney U tests were used to analyze the relationship between the variants. The results from this exploratory expert-based research indicate a high level of management awareness of the importance of food waste monitoring, among which there is a significant lack of employee training systems and established procedures in hotels. Moreover, the results show significant positive correlations between training awareness and sustainability, as well as between operational procedure challenges and perceptions of business profitability. The study contributes significantly to the lack of literature on the sustainability of food waste management in hotels. The contribution of the research work is reflected in the conclusion that daily education, standardized procedures and defined food waste monitoring systems are absolutely necessary for achieving business and environmental efficiency and effectiveness in hotel operations.

Keywords: food waste management; tourism; practices; challenges; sustainability; hospitality

1. Introduction

One of the biggest industrial sectors in the world, tourism is a major driver of economic growth and development as well as the generation of jobs [1]. However, 35 million tons of solid trash are produced annually by tourism-related businesses worldwide [2]. In many areas, the amount of waste produced exceeds the authorities' ability to collect and dispose of it in a safe, effective, and sustainable manner.

Food waste in the hospitality industry is a major social problem. One-third of the 1.3 billion tons of food produced annually for human use worldwide is lost or wasted [3]. Given its significant effects on corporate profits, public health, and the environment, waste is a significant sustainability concern [4]. For the hospitality industry, whose operations produce disproportionately high amounts of trash, this is a crucial concern [5]. Food waste has increased because of the hospitality industry's growth [6], making up more than half of all solid waste produced. About 75% of food waste is still edible, making it the biggest waste stream in the hospitality sector [7]. As a result, food waste management has emerged as a major issue that requires mitigation to prevent its negative consequences on the environment and the socioeconomic welfare of the populace [8].

Hospitality waste is a broad category that includes solid waste of energy waste, water, food and hazardous and non-hazardous waste [9]. Oversized servings, ineffective service techniques, and menu diversity can all lead to food waste after consumption, which affects customer choices [10]. Depending on the food items utilized, several sorts of waste are generated at hotels and restaurants.

Eggshells, fruit and potato peels, bones, food leftovers, and packaging materials are a few examples. Waste's complex composition and varying nature make it difficult to define. According to [11], waste is defined as "any substance or object which the holder discards," meaning that waste is something that people find invaluable. This definition's usefulness has been called into doubt since it ignores consumers' subjective assessments of waste's value. According to shocking data released by the Food and Agriculture Organization [12], over one-third of the food produced worldwide is either wasted or thrown away needlessly. There are two primary categories of food waste: "food waste," which refers to food that spoils during transportation or does not reach retail destinations, and "food loss," which includes any uneaten edible items from unharvested crops to unconsumed food in homes and stores [13].

In terms of both numerical numbers and the financial consequences for hospitality service providers, food waste is a significant portion of hospitality waste [14]. Over 12 million tons of food waste were created by the EU's hospitality industry in 2010 [15]. About 3 million tons of food waste were produced by hospitality companies in the UK alone in 2011, accounting for 88% of all hospitality trash [16]. In contrast, hospitality operations in Scandinavia produce more than 0.45 million tons of food waste annually, which has an equally detrimental effect on the financial performance and corporate image of the sector [17]. The production of food waste in the hospitality industry is positively correlated with the rise of tourism [18]. For instance, in Mallorca, a 1% increase in visitor arrivals results in a 1.25% increase in trash production, with food waste accounting for most of this increase [19]. Food waste in the hospitality industry affects both industrialized and developing nations, as rising levels of public money and international travel are driving up food consumption outside the house. To help the hospitality industry manage food waste more sustainably, the European Hospitality Industry (HOTREC) established a food waste hierarchy [20]. This hierarchy states that preventing food waste in the first place is the best approach; if not, excess food can be donated to feed animals and those in need. Redirecting leftover and inedible food waste to non-food applications, such as recovering food waste through composting and energy production, is another possibility. The whole disposal of food waste in landfills is the least desirable choice, which hospitality business operations should try to avoid. A startling 55% of these edible leftovers are thrown away, according to [21], which shows that patrons in restaurants usually leave 17% of their meals uneaten. The issue of food loss is made worse by elements in the kitchen, such as over-preparing food, improper storage techniques, and not using leftover food. Health standards prohibit hospitality establishments from repurposing or donating leftover food, buffet-style restaurants are especially susceptible to high waste levels. Buffet service and plate waste are frequently cited by hotels throughout Europe as the main causes of preventable losses, especially at breakfast when overproduction and portion size have a significant impact on visitor behavior. About 44% of the world's food waste is lost during the post-harvest and processing phases in impoverished nations [22]. Inadequate procedures, technological limits, budgetary constraints, and a lack of effective infrastructure for appropriate transportation and storage are often the causes of this. In sharp contrast, 40% of food waste in industrialized nations, which accounts for 56% of the world's food waste-occurs at the consumer level [23]. Consumer attitudes, values, and actions about food play a major role in this. Furthermore, a large amount of food waste in these areas is caused by incorrect handling of prepared foods and misconceptions regarding product expiration labels [24].

In Serbia, food waste poses an increasing economic challenge for the hospitality industry in addition to an environmental burden. The nation is thought to produce almost two million tons of organic garbage a year, which puts a strain on landfill capacity, causes over 300 landfill fires annually, and has significant negative effects on the economy and ecology. According to [25] reports that Serbia discards more food than the world averages each year—roughly 83 kilograms per person. An estimated 40,000 tons of food waste are produced annually by hotels and restaurants; the great majority of this trash ends up in landfills, where it releases greenhouse gas emissions [26]. Despite this, just 13% of hospitality organizations use authorized operators to handle garbage, which reflects a lack of awareness and inadequate financial incentives [27].

When considered collectively, these results demonstrate that food waste in Serbian hotels is both an ecological risk and a quantifiable financial loss, highlighting the necessity for further research to connect chef-led preventive measures with specific financial evaluations. There is still a study gap concerning the human aspect of food waste management, even though the literature now in publication recognizes several variables that contribute to food waste in the hospitality industry, including overproduction, inadequate storage, excessive portion sizes, and mismatched consumer expectations.

By providing a critical, analytical assessment of the problem of food waste in hotels in Serbia and considering the prospects and difficulties in its mitigation from a hospitality management perspective, this paper fills a gap examining hotel food waste prevention, strategies practices and challenges towards sustainability management. The aim of the exploratory expert-based research is to identify the main forms and causes in Serbia, to analyze existing food practices and challenges in sustainable management, to assess the level of awareness and behavior of employees regarding waste reduction, as well as to determine the connection between these practices and the concept of sustainable business.

This exploratory expert-based research contributes to the academic literature, because it deals with empirical research that was not a subject of interest in Serbia, and it refers to the perception of hotel general managers on food waste management. There is a large number of scientific research papers dealing with analyzing food management in the hotel industry with a focus on operational business, amount of food waste, logistics, standards, procedures and implementation of hotel business policy. However, the views of managers, who are the decision-makers regarding budgets, training and education of employees and the implementation of adopted and established strategies, are rarely studied. The originality of this exploratory expert-based research is highlighted by the uniqueness of the smaller sample that focuses on general managers of hotels of different business types, including those with Michelin business experience and diverse kitchen backgrounds. With a smaller but more experienced base, a deeper analysis of managers' attitudes and opinions is possible, which provides a new perspective in food waste management in regular hospitality business. The obtained results of the exploratory expert-based research can have practical implications, revealing the possibilities but also the barriers that general managers notice when implementing a business policy to reduce food waste. Thanks to the managers' perspectives, this study greatly complements both domestic and international studies with operational data, providing insight into management strategies, with the development of strategies and recommendations that hotels can adopt in terms of circular economy. In this regard, this research fills a gap in domestic academic literature, and provides fresh insights that were not previously covered by research in the hotel industry. Executive-level decision-makers are still largely unstudied, especially in developing hospitality markets. Previous research has mostly concentrated on operational food waste monitoring, kitchen logistics, or consumer plate waste.

2. Materials and Methods

To investigate GM (general manager) perceptions of food waste management and sustainability procedures in Belgrade hotels, this exploratory expert-based study used a quantitative descriptive methodology in conjunction with a correlational analytical technique.

The research is conceptualized as an exploratory study, with the main goal of showing the opinions and perspectives of management regarding food waste in hotels, providing a basis for future, more complex, extensive and quantitative research in the field of food waste management in the hotel sector in Belgrade and other cities in Serbia. A deliberate sample of 9 general managers from 9 hotels in Belgrade hotels was employed in the study. A systematic questionnaire that was thoughtfully created to evaluate and record many facets of hotel management was utilized in the data collection procedure. Practices, challenges, economics, sustainability, and food waste management were the main topics of discussion. The survey was conducted in person to the participating managers in the field in October 2025. Real-time communication, more question

clarification, and a quicker response rate were all made possible by this approach. After receiving thorough descriptions of the study's goals, participants gave their informed consent. Strict confidentiality and anonymity were used to safeguard respondents' privacy.

2.1. Research Design

The study questionnaire used in this research was carefully designed by author to assess hotel managers' perceptions of food waste management practices and sustainability-related challenges. "Strongly disagree" (1) to "Strongly agree" (5) was the range of the scale. A thorough set of statements covering many facets of food waste and its effects on the hotel sector, such as practices and challenges in food waste management towards sustainability, were included in the questionnaire. Descriptive statistics, mean and standard deviation were used to summarize the answers to each of the ten questionnaire items. An overview of the central patterns and variability in participants' perceptions was given by these statistics. Study has exploratory character, and questionnaires serve as a preliminary assessment of managers' perceptions food waste practices. To provide deeper analytical insight beyond descriptive results, Spearman's rank correlation coefficient was applied to examine associations between selected variables, particularly between managerial sustainability awareness and employee training frequency, as well as between perceived operational challenges and profitability orientation. This non-parametric correlation method was chosen due to the small sample size and ordinal nature of the data. In order to evaluate any potential disparities in perceptions between groups, hotels were also categorized based on their cuisine typology (traditional, fusion, and international). The Mann-Whitney U test was used as a reliable substitute for the independent samples t-test due to the small number of cases per category, allowing the comparison of median values between two independent groups. The purpose of these analytical techniques was to investigate if different managerial attitudes on sustainability and food waste reduction are correlated with different operational characteristics. SPSS software (version 29.0) was used for all statistical analyses. The threshold for statistical significance was fixed at $p < 0.05$. This combined descriptive and correlational approach guaranteed a thorough but methodologically straightforward assessment of the data, improving the study's empirical robustness while preserving interpretive clarity suitable for exploratory hospitality research.

3. Results

The results of the study on hotel management in Serbia will be examined and interpreted in this chapter. The results of the research represent a relevant insight into the existing food waste practices and challenges in hotels in Belgrade. The aim of the analysis was to assess the extent to which food waste practices are aligned with the concept of sustainable management, as well as to identify key problems and opportunities for improvement. Based on descriptive statistics, it can be concluded that respondents generally show a positive attitude towards the importance of rational food management, but that there is a pronounced inconsistency in the implementation of certain measures and policies.

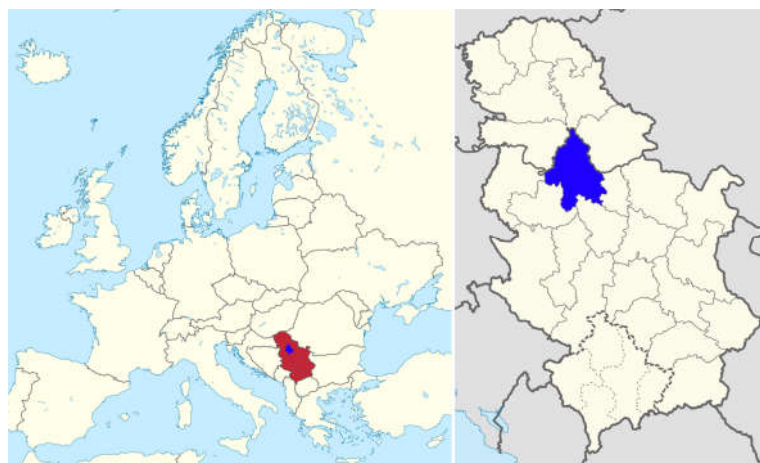


Figure 1. The position of research area: left picture - position of Serbia in Europe; right picture position of Belgrade capital city in Serbia. *Source* [28].

To protect the privacy of the respondents, general managers are labeled with numbers from 1 to 9. This prevents direct identification of specific individuals while still conveying the sense of numerous voices. Table 5. Shows that all participants in the study have more than a decade of experience working in hotels. Three general managers work in hotels where traditional food is prepared, only one general manager works in a hotel where international food is prepared, and five managers work in hotel facilities where fusion cuisine is prepared.

Regarding the size of the restaurants, it varies from small (<40 seats) to large (>60 seats). Of the nine hotels that are a prerequisite for the study, only two managers have a Michelin key background and only one manager has a Michelin plate background. A standardized questionnaire was used for personal on-site interviews that lasted an average of 20 minutes.

Table 1. Study data ($n = 9$).

Role	Work Experience in Hotels (Years)	Cuisine (Type)	Hotel restaurant size			
			Small (<40)	Medium (40-60)	Large (>60)	
General Manager 1	12	Traditional			Large	The Michelin plate
General Manager 2	15	Fusion		Medium		
General Manager 3	18	Fusion			Large	The Michelin key
General Manager 4	17	Traditional		Medium		The Michelin key
General Manager 5	14	Traditional		Medium		
General Manager 6	14	Fusion		Medium		
General Manager 7	15	Fusion			Large	
General Manager 8	12	Fusion			Small	
General Manager 9	11	International			Medium	

Source: Author calculation.

Table 1. highest values of mean scores were recorded for claims related to the monitoring of waste and the identification of challenges in resource management ($M = 4.14$). These results indicate that in most catering facilities there is a developed awareness of the need for monitoring and control of waste, as well as that the management clearly recognizes the limitations related to the lack of time, staff and technical equipment. Such findings are in line with contemporary studies that highlight human and material resources as the biggest obstacles in the implementation of sustainability policies in gastronomy. On the other hand, the lowest average score was obtained with the statement "Employees are regularly trained to reduce food waste" ($M = 1.80$), which clearly shows that regular education of employees represents the weakest segment within the *food waste management system*. This data is of particular importance, because the knowledge and awareness of employees is directly

related to daily operational decisions that affect the amount of waste. Insufficient training can lead to inefficient handling of food, improper storage and over-planning of production, all of which are reflected in the economic and environmental aspects of the business. At the same time, management's attitudes show a high level of awareness of corporate responsibility and the impact of sustainable practices on profitability ($M = 3.80$). These results confirm that a positive business culture is gradually forming in the hospitality sector, which integrates the principles of sustainability and social responsibility. However, moderate values of standard deviations (SD between 0.44 and 1.32) indicate that there is some diversity in the attitudes of respondents, which may depend on the size of the facility, the number of employees, and the level of internal organization.

Table 2. Reliability values and item descriptive values.

<i>Items</i>	<i>M</i>	<i>Sd</i>
There are clearly defined procedures for managing food waste within the hotel.	3.740	.780
Food waste in hotels raises operating expenses and may have a detrimental effect on guest service fees.	3.371	.060
Employees are regularly trained to reduce food waste.	1.800	.833
Monitoring the amount of food waste is an integral part of our hotel operations.	4.140	.810
The biggest challenge in food waste management is the lack of resources (time, staff, equipment).	4.141	.121
Increased knowledge and instruction regarding food waste reduction can have a positive impact on sustainability.	3.491	.324
Management believes that reducing food waste is an important part of corporate responsibility.	3.800	.502
The financial costs of food waste management represent a significant obstacle to the implementation of sustainable practices.	3.800	.443
The measures we implement to reduce food waste have a positive impact on the efficiency and profitability of our business.	3.800	.502
Kitchen and service employees show a high level of awareness of the importance of reducing food waste.	4.030	.747

Source: Author calculation.

The results indicate that the hotels managers show positive knowledge in the field of food waste management, but that additional measures are needed in the field of education, standardization of procedures and rationalization of resources. Strengthening internal policies, continuous training of employees and introduction of monitoring and reporting systems are key steps towards establishing a more sustainable and efficient food waste management system. In this way, the gastronomy sector can significantly contribute to the overall goals of sustainable development and the improvement of corporate responsibility in tourism and services. Spearman's rank correlation analysis was used to examine connections between the primary aspects of managerial perception (Table 3).

Table 3. Key Variable Spearman's Correlation Matrix ($n = 9$).

Variables	Awareness of Sustainability	Employee education/ training	Challenges in operations	Impact on profitability
Awareness of Sustainability	1.000	.621*	.514	.581*
Employee education/training	.621*	1.000	.467	.538
Challenges in operations	.515	.467	1.000	.603*
Impact on profitability	.581*	.538	.602*	1.000

Source: Author calculation.

There is a significant positive correlation between operational challenges and profitability impact ($r = .601$, $p < 0.05$) and between sustainability awareness and employee training ($r = .621$, $p < 0.05$). These findings suggest that managing challenges successfully enhances profitability perception

and that higher sustainability engagement is linked to greater investment in staff education. The Mann–Whitney U test was used to see whether various hotel types show different attitudes toward sustainable operations (Table 4). Hotels were divided into three categories based on the predominant cuisine concept: international, fusion, and traditional.

Table 4. Managerial Perceptions Compared by Hotel Type (Mann–Whitney U Test).

<i>Variables</i>	<i>Traditional cuisine (n=3)</i>	<i>Fusion cuisine (n=5)</i>	<i>International cuisine (n=1)</i>	<i>U</i>	<i>p-value</i>
Awareness of Sustainability	3.80	4.00	3.60	5.0	0.317
Employee education/training	1.60	1.80	2.00	6.5	0.284
Challenges in operations	4.20	4.10	3.90	7.0	0.353
Impact on profitability	3.75	3.85	3.80	8.0	0.401

Source: Author calculation.

Fusion-oriented hotels had somewhat higher mean rankings in employee training and sustainability awareness, but differences between hotel types were not statistically significant ($p > 0.05$). This pattern implies that more contemporary, conceptually adaptable businesses might show more adherence to sustainability-focused procedures.

4. Discussion

Prevention and reduction, recycling, donation, composting, monitoring, enhancing ingredient procurement and storage, smart food sales, menu design, staff training, customer interaction, portion control, and service model modifications are all examples of hotel waste management techniques.

The study's findings support the growing recognition of food waste management as a crucial element of sustainable business operations in Serbian hotels. Hotel managers are aware of the financial and environmental effects of food waste, as evidenced by the high mean values for resource management and monitoring. Nonetheless, a significant implementation gap between managerial understanding and operational practice is revealed by the low average score for employee training. This disparity is in line with earlier international research that highlights inadequate staff training as one of the primary obstacles to successful food waste prevention. [29–31].

Management commitment and organizational capability are mutually reinforcing, as seen by the favorable correlations found between sustainability awareness and employee training, as well as between operational issues and perceived profitability. Similar correlations have been found in European hospitality research, where leaders that prioritize sustainability typically make more systematic investments in digital monitoring systems and staff competency development [32,33]. These results corroborate the theory that managerial involvement in sustainability improves hospitality businesses' financial stability and environmental performance.

Fusion-oriented hotels showed somewhat greater awareness and training indicators, even if variations between hotel types were not statistically significant. This suggests that more modern and creative culinary ideas may be more receptive to implementing sustainability efforts. This result is consistent with research conducted in the UK and Scandinavia, where hotels have demonstrated greater flexibility in adopting circular food management systems and redistributive practices [34,35]. Current study supports the claim that a comprehensive strategy including operational uniformity, staff training, and managerial awareness is necessary for sustainable food waste management in the hotel industry. The lack of regulatory incentives and restricted access to specialized training make implementation more difficult in poor nations like Serbia. Waste reduction results could be significantly enhanced by addressing these gaps by focused government initiatives, business collaborations, and academic engagement.

5. Conclusions

Food waste in the hospitality industry is a rising global issue that needs the cooperation of many stakeholders. The problem of food waste in the hospitality business is still poorly researched, particularly from the viewpoint of experts in the field, despite its political, socioeconomic, and environmental importance.

This study highlights the growing significance of sustainability principles in the country's hospitality industry by offering an exploratory look into food waste management procedures, difficulties, and managerial attitudes in Serbian hotels. The findings indicate that hotel managers exhibit a comparatively high level of awareness of the financial and environmental consequences of food waste; however, there is still a lack of operational translation of these principles, especially through ongoing employee training and procedural consistency.

The statistically significant relationships between perceived profitability, training frequency, and sustainability awareness show that management commitment is crucial in determining the general effectiveness and accountability of hotel operations. Notwithstanding budget constraints, the results indicate that developing organized instructional programs, enhancing management-staff communication, and fortifying internal waste monitoring systems could result in quantifiable environmental and financial gains.

Practically speaking, the study emphasizes how important it is for hotels to incorporate sustainability metrics into their strategic decision-making procedures. Hospitality practices can be aligned with the Sustainable Development Goals and promote the circular economy by establishing clear operating norms, designating sustainability coordinators, and working with regional suppliers and non-governmental organizations.

The study contributes to the expanding corpus of theoretical research that connects operational effectiveness in hospitality management with sustainability leadership. Additionally, it emphasizes that reducing food waste is a comprehensive administrative task that considers organizational culture, corporate principles, and the opportunity for innovation. Despite the small sample size, the study lays the groundwork for further empirical research that may make use of bigger datasets, cross-national comparisons, and long-term tracking of hotel sustainability initiatives. In the end, other developing tourism markets looking to strike a balance between economic expansion and environmental stewardship may find inspiration in the Serbian hotel sector's implementation of methodical food waste management programs.

5.1. Study Limitation

The instrument's dependability could not be statistically confirmed using Cronbach's alpha due to the comparatively small sample size ($n = 9$) and the use of aggregated descriptive data. However, the pattern of responses across items demonstrates coherent directionality, with consistent mean values and moderate standard deviations, indicating that the questionnaire's internal consistency is adequate. It is advised that future research with bigger sample sizes use composite reliability tests to confirm the scale dependability.

5.2. Future Study Recommendations

Future study should include bigger number of hotel to get even better picture of managers perceptions about food waste in hotels. Comparative analysis with other studies in Serbia can be concluded to explore opinions of executive chefs and see if there are similarities and differences about food waste practices and challenges among back of the house staff. Also, future studies should be longer. Longer studies can might give better understanding about food waste in hotels. All this future data can be use as a tool, to create plan and structure for prevention food waste on regular business daily basis. Furthermore, future studies can include Cronbach's alpha for reliability-test, to verify internal consistency food waste proposed scale.

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