

# HOUSEHOLD FOOD WASTE IN MONTENEGRO

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## ABSTRACT

Approximately one third of all food produced for human consumption is lost or wasted. This study provides a general overview about household food waste in Montenegro. An online survey was carried out in 2015 with a random sample of 371 adult Montenegrins (70.1% female; 91.1% less than 44 years old; 81.2% high-educated). Most of the respondents (90.8%) had high concerns related to food waste. Bakery products are the most wasted foods. Monthly economic value of food waste is 5-25 Euro. Raising Montenegrins' awareness about environmental, ethical and economic implications of household food wastage is crucial to address this issue.

**Keywords:** behavior change, food labelling, food waste cost, household food waste, Montenegro, online survey

## 1. INTRODUCTION

Food is lost or wasted throughout the supply chain, from initial agricultural production down to final household consumption (FAO, 2011; CZARNIAWSKA and LÖFGREN, 2013; FAO, 2017; HLPE, 2014). The causes of food losses and waste are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities, infrastructure, packaging and marketing systems (FAO, 2011; HLPE, 2014; OECD and FAO, 2015). Food wastage represents a missed opportunity not only to improve global food security (HLPE, 2014; OECD and FAO, 2015; KADER, 2005), but also to mitigate environmental impacts and resources use from food chains (HLPE, 2014; OECD and FAO, 2015; PARFITT *et al.*, 2010; JEREME *et al.*, 2013; FAO, 2013; CHAPAGAIN and JAMES, 2013; HODGES *et al.*, 2010; SMIL, 2004; GRIZETTI *et al.*, 2013; KUMMU *et al.*, 2012).

Montenegro is a service-based economy; in 2016, the tertiary sector accounted for 71.9% of total gross domestic product (GDP), while the primary production – agriculture, forestry and fishing – accounted for 9.0% (EC, 2018). The green economy concept has a prominent place in the revised National Strategy for Sustainable Development of Montenegro for the period 2014–2020; however, Montenegro does not have a strategic document that would explicitly state the country's commitment to green economy (RADOVIC-MARKOVIC *et al.*, 2015; MINISTRY OF TOURISM AND ENVIRONMENTAL PROTECTION-MONTENEGRO, 2007). Several laws are dealing with waste policies, and Montenegro has made notable efforts to harmonize its legislation with the *acquis* of the European Union (EU). The 2011 Law on Waste Management (GOVERNMENT OF THE REPUBLIC OF MONTENEGRO, 2011, 2016) requires the waste producer to make all efforts to prevent and reduce waste generation. The Law sets up ambitious targets in several areas of waste management and for biodegradable waste by 2020 – the aim is to reduce biodegradables by 50%. Other laws - such as the Law on Environment, a key legal act on the management and protection of the environment - aim to align with obligations resulting from Montenegro's international commitments and relevant EU's directives dealing with waste policy issues. Nevertheless, these laws cover waste in general and are not specifically addressing food waste. Government strategies and actions – e.g. Waste Management Plan 2014–2020, National Policy on Waste Management from 2004 and the 2005 Strategic Master Plan for Solid Waste Management of Montenegro – do not recognize food waste as an important subject (RADOVIC-MARKOVIC *et al.*, 2015). Although several Non-Governmental Organizations (NGOs) deal with environmental protection and waste, they have rarely initiatives related to food waste (e.g. in 2014, Ecological Movement OZON promoted action "Stop food waste" during the European Week for Waste Reduction), with the exception of the NGO "Food Bank" dealing with decreasing food waste and fight against hunger. In several occasions (e.g. primary milk producers in 2013 and watermelon producers in 2011, who demonstratively destroyed their products due to poor government management policies), lack of effective market management resulted in significant food losses. In general, there is a lack of data about food waste and losses in Montenegro, as responsible authorities and relevant strategies do not deal with these issues and data on industrial and municipal solid waste do not seem to realistically reflect food waste generation. Thus, attention should be focused on waste generated by households and at consumer level, as these may be more reactive and likely to yield results faster (GRETHE *et al.*, 2011).

In medium- and high-income countries, such as Montenegro, food is to a significant extent wasted at the consumption stage, meaning that it is discarded even if it is still suitable for human consumption (HLPE, 2014; LUNDQVIST, 2010). There is a growing body of literature dealing with household food waste in different countries and regions (e.g.

BYGRAVE *et al.*, 2017; EVANS, 2011; GRAHAM-ROWE *et al.*, 2014; JEREME *et al.*, 2013; LEBERSORGER and SCHNEIDER, 2011; MONDÉJAR-JIMÉNEZ *et al.*, 2016; NEFF *et al.*, 2015; PRINCIPATO, 2018; PRINCIPATO *et al.*, 2015; QUESTED *et al.*, 2013; SECONDI *et al.*, 2015; STENMARCK *et al.*, 2016; WILLIAMS *et al.*, 2012; WRAP, 2011), but the Balkan region in general and Montenegro in particular are largely underserved. Therefore, in order to address this literature gap, this exploratory study aims to provide a general overview about household food waste in Montenegro.

## 2. MATERIAL AND METHODS

The paper is based on the results of a voluntary self-administered online survey that was adapted to Montenegrin context and designed through elaboration of questionnaires previously used for similar research purposes e.g. Office of Environment and Heritage in the State of New South Wales (NSW), Australia (NSW-EPA, 2012), and the University of Bologna (LAST MINUTE MARKET, 2014). The questionnaire on food waste (FW) was available in Montenegrin online through Survio website ([www.survio.com](http://www.survio.com)) from January until April 2015 (87 days in total) and the participation was entirely on a voluntary basis. Potential adult respondents were contacted using direct emails and social networks (Facebook, Twitter).

The online questionnaire included 25 one-option and multiple-choice questions dealing with: (i) food purchase behaviour and household food expenditure estimation; (ii) knowledge of food labelling information; (iii) attitudes towards FW; (iv) extent of household FW; (v) economic value of household FW; and (vi) willingness and information needs to reduce FW. The concept of FW was briefly presented in the introductory part of the online questionnaire to inform the respondents more about the topic and the research purpose (the following statement was included in the questionnaire: *"For the purpose of the present survey, food waste is considered food that was purchased by the household for human consumption but was thrown away i.e. was not consumed"*), as well as about approximate time needed to complete the survey (10-15 minutes).

The response rate (AAPOR, 2017) was used to provide essential information about the quality of the survey. Received unfinished questionnaires, contradictory or bad quality data, were excluded from further data processing (Table 1). Answering questionnaire on FW required time so that might be the reason why many of those who received the questionnaire did not answer (41.9%).

**Table 1.** Online survey visits and response rate.

Detail	No	%
Total visits	825	100
Just seen by respondents but not answered	346	41.9
Total questionnaires answered (completed and unfinished)	479	58.1
Total questionnaires completed by respondents	371	45.0
Total unfinished questionnaires	108	13.1
Responses included in final analysis	371*	45.0*

Source: Authors' elaboration based on survey results.

\* The number of complete questionnaires divided by the number of total visits (those eligible in the sample).

The questionnaire was disseminated all over Montenegro but most of those who completed the questionnaire (69.5%) were from the capital of Montenegro - Podgorica. Quantitative data collected through the questionnaire survey were analyzed using descriptive statistics (e.g. means, max, min, percentages), in order to get a general picture of frequencies of variables, using Microsoft Excel spreadsheets. Besides descriptive analysis, Chi-Square test was used to analyze the association between different variables in SPSS 16. The null hypothesis was that there is no relation between tested variables (gender, age, level of education, occupation, frequency of food purchasing, estimated amount of food waste, use of shopping list, knowledge about labelling, habits of respondents in terms of food preparation and use) as well as relation between the amount of uneaten food and frequency of throwing away food by households.

The major constraint faced during the research was the shortage and/or difficult access to secondary data on FW in Montenegro. A further limitation of the study is the non-probabilistic sampling design used for data collection as respondents were recruited on a voluntary basis. This also implies the non-representativeness of the recruited sample for the adult population in Montenegro. Moreover, while household food waste surveys are methodologically simple, they are mainly useful to provide qualitative information, because quantification of food wastage (cf. weight of food purchased and discarded, so not consumed) is prone to error as consumers often tend to underestimate their waste (and food waste) when self-reporting (e.g. BERETTA *et al.*, 2013; NEFF *et al.*, 2015; SIMUNEK *et al.*, 2015; VENTOUR, 2008). Moreover, it should be highlighted that the questionnaire was prepared in English then translated into Montenegrin and this may have affected the understanding of respondents of issues regarding food wastage and, consequently, their answers.

### **3. RESULTS AND DISCUSSION**

#### **3.1. Main characteristics of respondents**

Most of the interviewees were females (70.1%), quite young (77.4% less than 44 years old) and had high education level (more than 80% were holders of bachelor, master or PhD degrees). Taking into consideration obtained results, it is clear that mainly younger respondents use social media; the main tool utilized in the online questionnaire survey dissemination. Around 70% of respondents declared they have full-time or part-time paid work, 16.7% are unemployed persons (including housewives), 12.1% are students, while 1.1% is retired. More than a third of the respondents are married with children (37.2%). A significant share of the respondents still lives with parents (36.9%). As for household composition, they mainly consist of four or more members (47.7%).

#### **3.2. Food purchase behavior and household food expenditure estimation**

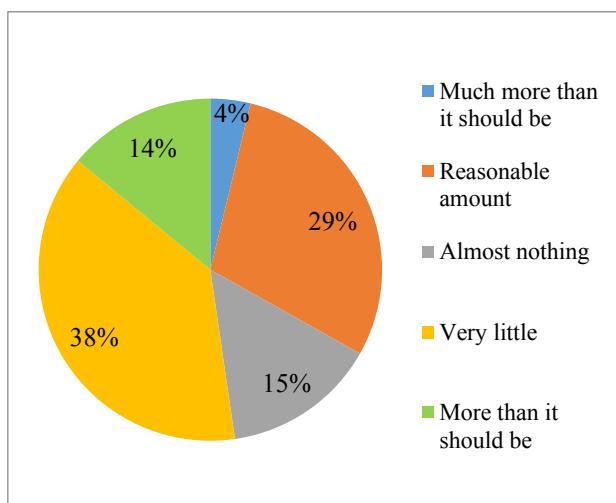
This part refers to respondents' food behavior and an estimation of their food expenditures in order to understand their attitudes towards food. It was found that about 77.4% of the respondents purchase their food from supermarkets and hypermarkets, 12.1% purchase from mini/small markets and 9.2% from small markets. The majority is buying food once a day (36.9%) and once a week (20.5%), while those who buy twice a week and every second day represent 15.4% and 17%, respectively. Food wastage could be attributed to poor planning when purchasing food as only 32.3% of the respondents use list prior to purchasing food. About 70.1% of the respondents spend monthly over 150 EUR for food.

Meanwhile, more than a half of the respondents (53.4%) are attracted to special food offers, which normally take place at super- and hypermarkets.

### 3.3. Knowledge of food labelling information and attitudes towards food waste

The results show respondents' knowledge about food labels, which might eventually affect food wastage among consumers and the respondents' attitudes towards food waste and food habits. It was indicated that 86.5% of the respondents understand and have knowledge about "use by" label as food must be eaten or thrown away by this date. This result could be attributed to the high educational level of the respondents. Whereas only 11.1% regarded the "best before" label as food is still safe to eat after this date.

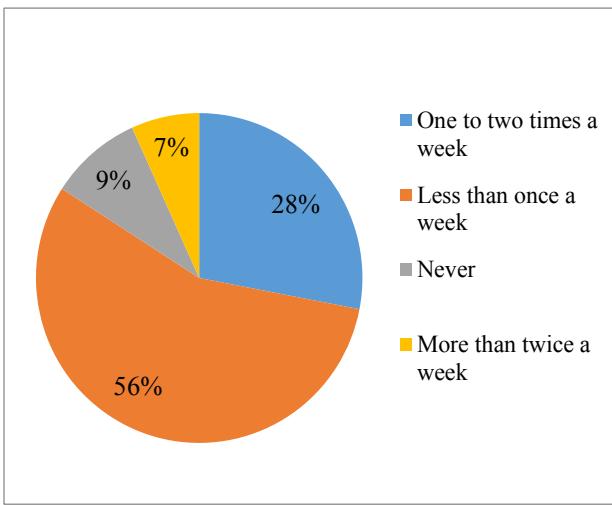
It was evident that 90.8% of the respondents do worry about food waste and they try to avoid it, while 6.5% are aware about food waste problems but have no intention to change their current habits. Moreover, 82.3% of the respondents indicated that they dispose of "very little", or "reasonable amount" of uneaten food (Fig. 1).



**Figure 1.** Quantity of uneaten food thrown away by Montenegrin households.

Regarding food waste management, 49.9% of the respondents give the remained food to animals and 44.7% said they dispose of it in the garbage. Meanwhile, when they were asked about how often they throw away leftovers or food, 56.1% of the respondents declared that they waste food at least once a week (Fig. 2).

Tracking consumers' food habits could explain their attitudes towards food waste and its quantity. In that regard, the survey results showed that 60.9% of the respondents cook a main meal from raw ingredients from 3 to 6 times/week. Furthermore, 73% of the respondents eat a meal left over from a previous day (less than twice/week), and 56.9% eat out of home less than two times a week.



**Figure 2.** Frequency of throwing away food.

### 3.4. Quantity and value of food wasted and extent of household food waste

The analysis regarding the main reasons that contribute to throwing food showed that 45.6% of the respondents throw food because of 'expiration date' (without any differentiation between best-before and use-by dates); 46.6% of the respondents throw food leftovers; and 43.7% states that the main reason of throwing food is its long storage in the refrigerator.

In addition, this part of the results deals with the amount, extent and value of food waste. In Table 2 are presented the results of purchased food, which is thrown in households. The most wasted food group is bakery products while pulses and oilseeds, roots and tubers as well as fish and seafood are the least wasted food products by Montenegrin households.

**Table 2.** Respondents' estimation for food groups wastage (in percentage).

Items	Less than 2%	3 to 5%	6 to 10%	11 to 20%	Over 20%
Cereals and bakery products (bread, rice, pasta, etc.)	146 (39.4%)	96 (25.9%)	50 (13.5%)	33 (8.9%)	46 (12.4%)
Vegetables	227 (61.2%)	81 (21.8%)	41 (11.1%)	14 (3.8%)	8 (2.2%)
Milk and dairy products	231 (62.3%)	80 (21.6%)	36 (9.7%)	16 (4.3%)	8 (2.2%)
Fruits	240 (64.7%)	75 (20.2%)	31 (8.4%)	14 (3.8%)	11 (3.0%)
Meat and meat products	236 (63.6%)	76 (20.5%)	39 (10.5%)	11 (3.0%)	9 (2.4%)
Roots and tubers (potatoes, etc.)	258 (69.5%)	57 (15.4%)	36 (9.7%)	16 (4.3%)	4 (1.1%)
Pulses and oil seeds (e.g. peas, chickpeas, olives, sunflowers)	286 (77.1%)	48 (12.9%)	28 (7.5%)	4 (1.1%)	5 (1.3%)
Fish and seafood	311 (83.8%)	39 (10.5%)	12 (3.2%)	6 (1.6%)	3 (0.8%)

Source: Authors' survey.

As for the extent of food waste, 48.8% of the respondents do not throw away food that is still consumable, 23.5% throw less than 250 gr per week, and 18.1% throw between 250 and 500 gr per week.

Regarding the economic value of wasted food, it was revealed that for about 52.8% of the respondents the value of wasted food is between 5 and 25 EUR per month.

### **3.5. Willingness to behavioral change to reduce household food wastage**

This part deals with the notion of consumers' willingness to change their behavior regarding food waste. Thus, the first step was to explore the respondents' perception of food waste reasons. It was evident from the results that most of the respondents are familiar with such reasons; for instance, 43.7% mentioned food is left in the fridge for too long time, followed by 45.6% of them that said 'food expired', 30.2% indicated food does not look eatable/good, and 46.6% referred to leftovers. While many respondents mentioned "food is left in the fridge for too long time" or "food has expired", it is important to consider the true reasons or root causes that led to this result and, consequently, to food wastage. These reasons are mainly related to inappropriate meals planning and inadequate food preseveration; which surprisingly were less mentioned by the respondents.

Eventually, since the respondents have clear vision about food waste causes or reasons then they could be willing to reduce such waste. Though, willingness is affected by information availability and other factors; so, 39.4% of the respondents mentioned that they will reduce food waste if the packaging was more suitable, followed by if they were better informed about the negative impacts of food waste on the environment (39.6%) or on the economy (21.3%).

Finally, as for the information needed to reduce food waste, 28.8% of the respondents said that they need recipes with leftovers, 48% need tips on how to conserve food properly, 33.7% need information about organizations and initiatives that deal with food waste prevention and reduction, and, finally, 36.7% need information on how to assess the freshness of products.

### **3.6 Relations between tested variables**

The independence of variables was analysed by using Chi-Square Test. In particular, relations between the following variables were tested: gender, age, level of education, occupation, frequency of food purchasing, estimated amount of food waste, use of shopping list, knowledge about labelling, habits of respondents in terms of food preparation and use. All the tested relations were not statistically significant.

According to the conducted online survey, the following results were obtained when it comes to the quantity of uneaten food and frequency of throwing away food by households in Montenegro (Table 3). Regarding the frequency of throwing away food, regardless of the quantity of food, most respondents throw food less than once a week or one to two times a week. Also, regardless of the frequency of throwing away food, most respondents answered that they throw very little quantity of food.

Furthermore, the relation between two key questions was statistically tested by *Pearson's Chi-Square Test*:

- (1) In general, how much of uneaten food your household usually throws away?
- (2) How often your household throws away leftovers and food that you consider not usable?

The value of Pearson's Chi-Square Test of independence was 45.525, which is statistically significant at  $p<0.01$  (Table 4). Therefore, there is a significant relation between the quantity of uneaten food and the frequency of throwing away food (Table 4). In other words, with increasing quantity of uneaten food, also the frequency of throwing away food increases. Therefore, it is crucial to pay particular attention to meals planning in order to reduce the quality of uneaten food and leftovers. Moreover, another strategy consists in providing households with more information (especially recipes) about the use of leftovers.

**Table 3.** Cross tabulation – The relation between quantity of uneaten food and frequency of throwing away food.

		How often your household throws away leftovers and food that you consider not usable? (choose one answer)				
		Never	Less than once a week	One to two times a week	More than twice a week	Total
<b>In general, how much of uneaten food your household usually throws away?</b> (choose one answer)	Very little	28	125	38	5	196
	Reasonable amount	4	59	35	11	109
	More than it should be	2	24	31	9	66
	Total	34	208	104	25	371

Source: Authors' survey.

**Table 4.** Chi-Square Test of independence.

	Value	DF	Asymp. Sig. (2-sided)
Pearson Chi-Square	44.525	6	.000**
Likelihood Ratio	45.744	6	.000**
No of Valid Cases	371		

Asymp. Sig.: Asymptotic Significance.

\*\* - Statistically significant at  $P<0.01$ .

### 3.7. Food wastage in Montenegro: urgent action is needed

Results show that most of the respondents have high concerns related to food waste. According to the respondents, food waste is prevalent in Montenegro and the most wasted foods are bakery products. More than half of Montenegrin respondents declared that the economic value of food waste generated each month is 5–25 EUR. Meanwhile, almost half of the interviewees declared that they throw food that is still edible/consumable.

Food waste is a serious issue that undermines food security and food system sustainability in the Mediterranean region (BERJAN *et al.*, 2018; CAPONE *et al.*, 2016; EL BILALI, 2018). The results of the present survey are in line with those obtained in similar studies on household food waste in the Mediterranean. These include surveys carried out in countries such as Algeria (ALI AROUS *et al.*, 2017), Egypt (ELMENOFI *et al.*, 2015; ABDELRADY *et al.*, 2018), Lebanon (CHARBEL *et al.*, 2016), Morocco (ABOUABDILLAH *et al.*, 2015), Tunisia (SASSI *et al.*, 2016) and Turkey (YILDIRIM *et al.*, 2016). In fact, all these

studies made the case for addressing urgently household food wastage given its negative environmental (FAO, 2013; CHAPAGAIN and JAMES, 2013; QUESTED *et al.*, 2013; WRAP 2011), economic (HLPE, 2014; PRINCIPATO, 2018; RUTTEN, 2013) as well as ethical (STUART, 2009) implications.

Despite that, food waste is still not covered by overarching waste strategic documents in Montenegro. In fact, the *National Strategy for Sustainable Development of Montenegro by 2030* defines the strategic goals and measures for introducing green economy by, among others, improving waste management towards *circular economy*. Using the instruments of *circular economy* is possible to connect the activities and initiatives of producers, retailers, consumers and recyclers. Those strategic goals and measures are related to management of all kinds of waste, but there are no specific strategic goals and measures that address food waste management within circular economy. The new document entitled "A Comprehensive Assessment of the Current Waste Management Situation in South East Europe and Future Perspectives for the Sector Including Options for Regional Co-operation in Recycling of Electric and Electronic Waste" (EUNOMIA RESEARCH & CONSULTING LTD, 2017) deals with national waste assessment and roadmap for improving of waste management in Montenegro. Furthermore, according to the Ministry of Sustainable Development and Tourism of Montenegro (MSDT), there are no existing initiatives on food waste reduction. The only novelty, and this per se is a complex task, is waste separation (on wet and dry fraction), as well as composting possibility. This task is covered with *Waste Management Strategy by 2030*, developed by MSDT. In addition to this should be mentioned that the administration of capital city, Podgorica, announced recently the start of a pilot project related to primary waste selection in households, in cooperation with NGOs and international organizations in Montenegro. The initiative should promote waste selection in households through informing citizens about existing recycling yards in Podgorica (total 6) as well as about possibility of selecting waste at these locations. In addition, big investments are expected in construction of sanitary waste baths, facilities for purification of water, production of energy from landfill biogas.

Local self-government authorities in charge of waste management are poorly staffed and trained, and are in need of stronger capacities. Very often, consumer health and food safety are at the center of regulators' attention and responsibilities for managing waste are broadly separated between government bodies leading to lack of coordination in implementation of policy on food waste reduction (Box 1). Focusing attention on the reduction of food waste generated by households is likely to yield results faster. Therefore, communication campaigns should target consumers with the objective to raise public awareness on the issue of food waste in order to change the behaviour of consumers towards food wastage.

Some potential causes of food waste result from business practices and private standards sometimes set at much higher levels than those set by the government. For instance, the "best before" date displayed on food products is not set by law but rather the result of industry practice that seeks to adapt to business liability constraints (NRDC, 2013). Likewise, marketing and sale strategies influence negatively the waste behaviour of individuals, especially youths (MONDÉJAR-JIMÉNEZ *et al.*, 2016), so that retailers can play an important role in preventing food waste generation. Therefore, the private sector is engaged to reduce food waste throughout the food supply chain through various initiatives such as innovation (e.g. technologies, packages, production processes), corporate initiatives and consumer education via social media and other platforms (BIAC, 2013; BYGRAVE *et al.*, 2017; DI TERLIZZI *et al.*, 2016). Some supermarkets in Montenegro (e.g. VOLI, AROMA/CONTO, IDEA) have introduced the practice of promotional discount due to expiry date or sale of two products for the price of one. These initiatives are directed into improving of products sale as well as reduction of food wastage.

Box 1. Institutions dealing with environmental protection and waste management in Montenegro.

The main governmental authority responsible for policymaking on environment and sustainable development is the Ministry of Sustainable Development and Tourism within which operates the Environmental Protection Agency (EPA) that is responsible for implementation of environmental legislation. While the framework legislation related to food waste is under the responsibility of the Ministry, waste management is the responsibility of local governments and municipalities (*MINISTRY OF TOURISM AND ENVIRONMENTAL PROTECTION-MONTENEGRO*, 2007). In general, lack of investment and poor capacities of local self-government authorities and public enterprises responsible for waste management have been commonly recognized as restricting factors for implementation of the waste management policy. The Ministry of Agriculture and Rural Development (MARD) has responsibilities for food safety and supervises the authorities responsible for policy implementation, in particular, the Phytosanitary Administration, responsible for food safety. "Project – Consulting" Ltd (PROCON) was founded by the Government in 2008 to provide expert support in implementation of projects on environmental protection and communal services, adopted by the Government and/or local self-government authorities and supported by international financial institutions. In early 2014, the Centre for Sustainable Development was established as a programme, jointly implemented by the Montenegrin Government and United Nations Development Programme (UNDP) (PROCON, 2008).

Besides the state institutions responsible for environmental protection as well as for waste management, also NGOs should have a more active role in food waste reduction initiatives. There are three leading NGOs in Montenegro - i.e. Green Home ([www.greenhome.co.me](http://www.greenhome.co.me)), Ozon ([www.ozon.org.me](http://www.ozon.org.me)), Zero Waste Montenegro ([www.zerowastemontenegro.me/me](http://www.zerowastemontenegro.me/me)) - that have undertaken activities related to waste management in the form of implementing projects and organizing roundtables. Ozon currently implements "Establishing of system for waste management in Budva municipality" project whose activities encompass waste collection, selective disposal and recycling of waste. The activities of *Zero Waste Management* include raising awareness on the concept of circular economy, promoting Zero Waste practices, lobbying against waste incineration, providing technical expertise to recycling facilities to increase their recycling rate, establishing a Zero Waste community, supporting establishment of First Zero Waste Municipality. In previous years, these NGOs organized roundtables on waste management within the projects funded by the European Union, but never exclusively on food waste management.

NGOs – in cooperation with public institutions and the private sector – can play an important role in initiatives such as educational campaigns directed to consumers and industry and food recovery as well as research and knowledge dissemination activities. National campaigns, such as consumer education campaigns on reading "use by" or "best before" date labels, can help change consumer behaviour (NRDC, 2013) thus contributing to the prevention and/or reduction of household food wastage. Such campaigns should focus on youths, who proved to be the population segment most inclined to waste food (MONDÉJAR-JIMÉNEZ *et al.*, 2016; PRINCIPATO *et al.*, 2015), and focus on concrete practices such as waste sorting, which was found to be positively associated with food waste reduction (SECONDI *et al.*, 2015). However, actions against food wastage, especially educational campaigns, should also target social marketers, retailers and policy makers (PRINCIPATO *et al.*, 2015). One possible way for rising the awareness of the new generations regarding the issues of waste in general and food waste in particular is the reform of the education system in Montenegro, with the aim of introducing more environment-related disciplines into educational programs at schools and universities (NORTH COUNTRY NGO, 2016).

## 4. CONCLUSIONS

Food losses can take place along the whole food chain from production, handling and storage, processing and packing, distribution and marketing, to final consumption. The purpose of this study was to assess food losses at consumer level (i.e. food waste) in Montenegro. Results show that household food wastage is high in Montenegro and that the most wasted foods are cereals and bakery products. Similarly, economic value of food waste is rather high (generally 5–25 EUR monthly). Despite the evident negative environmental and economic impacts of food waste, it is still not covered by waste management strategic documents in Montenegro. The paper highlights that focusing attention on waste generated at consumer level is likely to yield good results in food waste prevention and reduction strategies. Therefore, awareness raising initiatives should target consumers with the objective to change their attitude and behaviour towards food wastage. However, strategies for food wastage reduction can be effective only if there is a better coordination among all actors of the food chain i.e. public institutions, civil society (cf. NGOs) and the private sector (e.g. retailers). Meanwhile, responsibilities of local self-government authorities should be optimized in order to ensure exchange of information. In fact, data are rarely reported on a regular basis through national statistical databases in Montenegro. In order to establish a reliable food waste dataset in the country, an important first step is to develop a regular inventory for food waste estimation. For that, a more stringent enforcement of separate collection of waste in all Montenegrin municipalities is crucial. Involving broader range of stakeholders in food waste reduction will result in moving from the concept of 'managing food waste' to improving overall sustainability of the food chain in Montenegro.

## REFERENCES

- AAPOR [American Association for Public Opinion Research] 2017. Response Rates - An Overview. [www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx](http://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx)
- Abdelradi F. 2018. Food waste behaviour at the household level: A conceptual framework. *Waste Manag.* 71:485-493. DOI: [doi.org/10.1016/j.wasman.2017.10.001](https://doi.org/10.1016/j.wasman.2017.10.001)
- Abouabdillah A., Capone R., El Youssfi L., Debs P., Harraq A., El Bilali H. *et al.* 2015. Household food waste in Morocco: An exploratory survey. Book of Proceedings of the VI International Scientific Agriculture Symposium "Agrosym 2015", Jahorina, Bosnia and Herzegovina; pp. 1353-1360.
- Ali Arous S., Capone R., Debs P., Haddadi Y., El Bilali H., Bottalico F. and Hamidouche M. 2017. Exploring household food waste issue in Algeria. *AgroFor International Journal* 2:55-67. DOI: [doi.org/10.7251/AGRENG1701055A](https://doi.org/10.7251/AGRENG1701055A)
- North Country NGO 2016. Analiza stanja u oblasti upravljanja otpadom u Crnoj Gori (Analysis of the Current Waste Management Situation in Montenegro). [www.sjevernazemlja.me/wp-content/uploads/2017/01/Analiza-stanja-FF.pdf](http://www.sjevernazemlja.me/wp-content/uploads/2017/01/Analiza-stanja-FF.pdf)
- Berjan S., Capone R., Debs P. and El Bilali H. 2018. Food losses and waste: a global overview with a focus on Near East and North Africa region. *International Journal of Agricultural Management and Development* 8(1):1-16.
- Beretta C., Stoessel F., Baier U. and Hellweg S. 2013. Quantifying food losses and the potential for reduction in Switzerland. *Waste Manag.* 33:764-773.
- BIAC [Business and Industry Advisory Committee] 2013. BIAC perspectives on private sector solutions to food waste and loss. [www.oecd.org/site/agrfcn/BIAC Perspectives on Private Sector Solutions to Food Waste and Loss.pdf](http://www.oecd.org/site/agrfcn/BIAC%20Perspectives%20on%20Private%20Sector%20Solutions%20to%20Food%20Waste%20and%20Loss.pdf)
- Bygrave K., Rogers D., Eisenhauer P., Bruggemann N., Timmermans T., Cseh B., Lopez-i-Gelats F. and Díaz-Ruiz R. 2017. Frameworks for Action - Selection process. REFRESH (Resource Efficient Food and Drink for the Entire Supply Chain) project. [www.eu-refresh.org/sites/default/files/D2\\_3\\_FA%20Selection%20Process%20FINAL.pdf](http://www.eu-refresh.org/sites/default/files/D2_3_FA%20Selection%20Process%20FINAL.pdf)

Capone R., Bennett A., Debs P., Bucatariu C.A., El Bilali H., Smolak J., Lee W.T.K., Bottalico F., Diei-Ouadi Y. and Toppe J. 2016. Food losses and waste: global overview from a Mediterranean perspective. In: Zero waste in the Mediterranean: Natural resources, food and knowledge. CIHEAM and FAO (Ed.), pp. 193-242. Presses des Sciences Po, Paris.

Chapagain A.K. and James K. 2013. Accounting for the impact of food waste on water resources and climate change. In Food industry wastes: assessment and recuperation of commodities. M. Kosseva and C. Webb (Ed.), pp. 217-236. Elsevier.

Charbel L., Capone R., Grizi L., Debs P., Khalife D., El Bilali H. and Bottalico F. 2016. Preliminary insights on household food wastage in Lebanon. *Journal of Food Security* 4: 131-137. [www.pubs.sciepub.com/jfs/4/6/2](http://www.pubs.sciepub.com/jfs/4/6/2)

Czarniawska B. and Löfgren O. 2013. Coping with excess: how organizations, communities and individuals manage overflows. Edward Elgar. Cheltenham, UK.

Di Terlizzi B., Van Otterdijk R., Dragotta A., Pink P. and El Bilali H. 2016. Innovation for the reduction of food losses and waste. In "Zero waste in the Mediterranean: Natural resources, food and knowledge". CIHEAM and FAO (Ed.), pp. 281-301. Presses des Sciences Po, Paris.

EC [European Commission] 2018. Commission staff working document: Montenegro 2018 Report. Strasbourg, France. [www.ec.europa.eu/neighbourhood-enlargement/sites/near/files/20180417-montenegro-report.pdf](http://www.ec.europa.eu/neighbourhood-enlargement/sites/near/files/20180417-montenegro-report.pdf)

El Bilali H. 2018. Research on food losses and waste in North Africa. *The North African Journal of Food and Nutrition Research* 2(3):51-57.

Elmenofi A.G.G., Capone R., Waked S., Debs P., Bottalico F. and El Bilali H. 2015. An exploratory survey on household food waste in Egypt. Book of Proceedings of the VI International Scientific Agriculture Symposium "Agrosym 2015", Jahorina, Bosnia and Herzegovina; pp. 1298-1304.

Eunomia Research & Consulting Ltd 2017. A Comprehensive Assessment of the Current Waste Management Situation in South East Europe and Future Perspectives for the Sector Including Options for Regional Co-operation in Recycling of Electric and Electronic Waste. Task 1: National Waste Assessment and Roadmap for Improving Waste Management in Montenegro. Report for DG Environment of the European Commission. [www.ec.europa.eu/environment/enlarg/pdf/pilot%20waste/Montenegro\\_en.pdf](http://www.ec.europa.eu/environment/enlarg/pdf/pilot%20waste/Montenegro_en.pdf)

Evans D. 2011. Beyond the throwaway society: ordinary domestic practice and a sociological approach to household food waste. *Sociology* 46(1):41-56.

Graham-Rowe E., Jessop D.C. and Sparks P. 2014. Identifying motivations and barriers to minimising household food waste. *Resour. Conserv. Recycl.* 84:15-23

FAO 2013. Food wastage footprint: impacts on natural resources. Rome, Italy. [www.fao.org/docrep/018/i3347e/i3347e.pdf](http://www.fao.org/docrep/018/i3347e/i3347e.pdf)

FAO 2011. Global food losses and food waste – Extent, causes and prevention. Rome, Italy. [www.fao.org/docrep/014/mb060e/mb060e00.pdf](http://www.fao.org/docrep/014/mb060e/mb060e00.pdf)

FAO 2017. The future of food and agriculture – Trends and challenges. Rome, Italy. [www.fao.org/3/a-i6583e.pdf](http://www.fao.org/3/a-i6583e.pdf)

Government of the Republic of Montenegro 2000. Environmental Law. Official Gazette of Montenegro, 55/00. [www.birdwatchingmn.org/images/Zakoni/zakon\\_o\\_zivotnoj\\_sredini.pdf](http://www.birdwatchingmn.org/images/Zakoni/zakon_o_zivotnoj_sredini.pdf) (in Montenegrin)

Government of the Republic of Montenegro 2011. Waste Management Law. Official Gazette of Montenegro 64/11; 39/16. [www.greenhome.co.me/fajlovi/greenhome/attach\\_fajlovi/lat/projekti/zeleni-resursni-centar/2011/10/pdf/Zakon\\_o\\_upravljanju\\_otpadom.pdf](http://www.greenhome.co.me/fajlovi/greenhome/attach_fajlovi/lat/projekti/zeleni-resursni-centar/2011/10/pdf/Zakon_o_upravljanju_otpadom.pdf) (in Montenegrin)

Grethe H., Dembélé A. and Duman N. 2011. How to feed the world's growing billions: understanding FAO world food projections and their implications. Heinrich-Böll-Foundation and WWF Deutschland.

Grizzetti B., Pretato U., Lassaletta L., Billen G. and Garnier J. 2013. The contribution of food waste to global and European nitrogen pollution. *Environmental Science & Policy* 33:186-195. DOI: [doi.org/10.1016/j.envsci.2013.05.013](https://doi.org/10.1016/j.envsci.2013.05.013)

HLPE 2014. Food losses and waste in the context of sustainable food systems: a report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE), Rome, Italy. [www.fao.org/3/a-i3901e.pdf](http://www.fao.org/3/a-i3901e.pdf)

Hodges R.J., Buzby J.C. and Bennett B. 2010. Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *Journal of Agricultural Science* 149:37-45. DOI: [doi.org/10.1017/S0021859610000936](https://doi.org/10.1017/S0021859610000936)

Jereme I.A., Abdul Talib B., Siwar C. and Ara Begum R. 2013. Household food consumption and disposal behaviour in Malaysia. *Social Sciences* 8:533-539.

Kader A.A. 2005. Increasing food availability by reducing postharvest losses of fresh produce. *Acta Hortic.* 682:2169-2176. DOI: doi.org/10.17660/ActaHortic.2005.682.296

Kummu M., De Moel H., Porkka M., Siebert S., Varis O. and Ward P.J. 2012. Lost food, wasted resources: global food supply chain losses and their impacts on freshwater, cropland and fertilizer use. *Science of the Total Environment* 438:477-489. DOI: doi.org/10.1016/j.scitotenv.2012.08.092

Last Minute Market 2014. Trasformare lo spreco in risorse. Last Minute Market S.r.l., Bologna, Italy.  
[www.lastminutemarket.it](http://www.lastminutemarket.it)

Lebersorger S. and Schneider F. 2011. Discussion on the methodology for determining food waste in household waste composition studies. *Waste Manag.* 31: 1924-1933.

Lundqvist J. 2010. Re-thinking water and food security: fourth Marcelino Botín Foundation water workshop. In "Producing more or wasting less? Bracing the food security challenge of unpredictable rainfall". L. Martínez-Cortina, A. Garrido and E. López-Gunn (Ed.) pp. 75-92. Taylor & Francis Group, London, UK.

Ministry of Tourism and Environmental Protection of Montenegro 2007. National Strategy of Sustainable Development of Montenegro 2014-2020. [www.gov.me/files/1207655097.pdf](http://www.gov.me/files/1207655097.pdf)

Ministry of Sustainable Development and Tourism 2015. Waste Management Strategy in Montenegro by 2030. [www.predsjednik.gov.me/ResourceManager/FileDownload.aspx?rid=208740&rType=2&file=6\\_119\\_09\\_07\\_2015.pdf&alphabet=cyr](http://www.predsjednik.gov.me/ResourceManager/FileDownload.aspx?rid=208740&rType=2&file=6_119_09_07_2015.pdf&alphabet=cyr)

Ministry of Sustainable Development and Tourism 2016. National Strategy for Sustainable Development of Montenegro by 2030. [www.mrt.gov.me/biblioteka/strategije?pagerIndex=1](http://www.mrt.gov.me/biblioteka/strategije?pagerIndex=1)

Mondéjar-Jiménez J.A., Ferrari G., Secondi L. and Principato L. 2016. From the table to waste: An exploratory study on behaviour towards food waste of Spanish and Italian youths. *Journal of Cleaner Production* 138:8-18.

Neff R.A., Spiker M.L. and Truant P.L. 2015. Wasted Food: US Consumers' Reported Awareness, Attitudes, and Behaviors. *PloS one* 10(6):e0127881.

NRDC 2013. The dating game: how confusing food date labels lead to food waste in America. Harvard Food Law and Policy Clinic and the Natural Resources Defense Council (NRDC), NY, USA. [www.nrdc.org/food/files/dating-game-report.pdf](http://www.nrdc.org/food/files/dating-game-report.pdf)

NSW-EPA 2012. Food waste avoidance benchmark study. State of New South Wales (NSW) - Environment Protection Authority (EPA). [www.frankston.vic.gov.au/files/34d7963e-24ab-455ba1f5a22300d89be2/Love\\_food\\_hate\\_waste.pdf](http://www.frankston.vic.gov.au/files/34d7963e-24ab-455ba1f5a22300d89be2/Love_food_hate_waste.pdf)

OECD and FAO 2015. OECD-FAO Agricultural outlook 2015. OECD Publishing, Paris, France.  
DOI: dx.doi.org/10.1787/agr\_outlook-2015-en

Parfitt J., Barthel M. and Macnaughton S. 2010. Food waste within the supply chains: quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society of London B: Biological Sciences* 365:3065-3081.  
DOI: doi.org/10.1098/rstb.2010.0126

Principato L. 2018. Food Waste at Consumer Level: A Comprehensive Literature Review. SpringerBriefs in Environmental Science, Springer. ISBN 978-3-319-78887-6.

Principato L., Secondi L. and Pratesi C.A. 2015. Reducing food waste: an investigation on the behaviour of Italian youths. *British Food Journal* 117(2):731-748. DOI: doi.org/10.1108/BFJ-10-2013-0314

PROCON 2008.. Ltd "Project – Consulting" (PROCON). [www.procon.me/index.php/mne](http://www.procon.me/index.php/mne)

Quested T.E., Marsh E., Stunell D. and Parry A.D. 2013. Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling* 79: 43-51. DOI: doi.org/10.1016/j.resconrec.2013.04.011

Radovic-Markovic M., Nikitovic Z. and Jovancevic D. 2015. "Toward green economy: opportunities and obstacle for Western Balkan countries". Xlibris. Bloomington (Indiana), USA.

Rutten M.M. 2013. What economic theory tells us about the impacts of reducing food losses and/or waste: Implications for research, policy and practice. *Agriculture & Food Security* 2:1-13. DOI: doi.org/10.1186/2048-7010-2-13

Sassi K., Capone R., Abid G., Debs P., El Bilali H., Daaloul Bouacha O. *et al.* 2016. Food wastage by Tunisian households. AgroFor International Journal 1:172-181 DOI: doi.org/10.7251/agreng1601172s

Secondi L., Principato L. and Laureti T. 2015. Household food waste behaviour in EU-27 countries: A multilevel analysis. Food Policy 56:25-40. DOI: doi.org/10.1016/j.foodpol.2015.07.007

Simunek J., Derflerova-Brazdova Z. and Vitu K. 2015. Food wasting: A study among Central European four-member families. International Food Research Journal 22(6):2679-2683.

Smil V. 2004. Improving efficiency and reducing waste in our food system. Environmental Sciences 1:17-26. DOI: dx.doi.org/10.1076/evms.1.1.17.23766

Stenmarck Å., Jensen C., Quested T. and Moates G. 2016. Estimates of European food waste levels. FUSIONS project (Reducing food waste through social innovation). [www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf](http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf)

Stuart T. 2009. "Waste: uncovering the global food scandal". Penguin W.W. Norton Co. London, UK.

Ventour L. 2008. Food Waste Report - The Food We Waste. Waste & Resources Action Programme (WRAP), Banbury (UK).

WRAP 2011. The Water and Carbon Footprint of Household Food and Drink Waste in the UK. Banbury, UK.

Williams H., Wikström F., Otterbring T., Löfgren M. and Gustafsson A. 2012. Reasons for household food waste with special attention to packaging. J. Clean. Prod. 24:141-148.

Yildirim H., Capone R., Karanlik A., Bottalico F., Debs P. and El Bilali H. 2016. Food Wastage in Turkey: An Exploratory Survey on Household Food Waste. Journal of Food and Nutrition Research 4:483-489. DOI: doi.org/10.12691/jfnr-4-8-1.

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