

ANALYZE OF FOOD WASTE AND IT'S ECONOMIC IMPACT TO CITIZENS OF EU STATES AND CANDIDATE STATE REPUBLIC OF MOLDOVA

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Abstract. *This study explores the extent of food waste in different European countries, such as the Benelux Union, the Republic of Moldova and Ukraine, and highlights the economic burden of food waste on households, particularly in the EU candidate country, the Republic of Moldova. By defining and quantifying food waste, the study provides a framework for assessing the environmental and economic consequences of food waste, affecting both individual households and businesses. Moldova, as an EU candidate country, has significant levels of food waste comparable to, or even higher than, many Benelux Union countries. By presenting recent data and analysis, this research emphasizes the need for systematic policy interventions and educational initiatives among both the younger and the active generations to reduce food waste among citizens.*

Keywords: *food waste, Republic of Moldova, European Union, economic impact, Benelux Union.*

INTRODUCTION

Our understanding of food waste within the food supply chain has grown, yet limited research has focused specifically on food waste in primary production. This study aimed to measure the total amount of food waste in primary production across the Benelux Union, the Republic of Moldova and Ukraine and to establish a framework for defining and quantifying food waste at this stage. The food waste quantification relied on case studies from the current research and existing scientific estimates. The study focused on quantifying the amount of edible food (excluding non-edible parts like peels and bones) intended for human consumption that ultimately did not serve as food. This approach differed from current guidelines, particularly as food used for animal feed was included here, unlike in the FUSIONS project's recent food waste definition [4,5].

Approximately one-third of food produced globally is lost along the food chain, posing environmental challenges and highlighting inefficiencies in the food system. Addressing food waste has become a global priority to ensure food security, and establishing a methodology for measuring food waste is essential for tracking progress toward reduction goals. This paper summarizes the outcomes of a workshop on food waste accounting, co-organized by the European Commission's Joint Research Centre and the Directorate-General for Health and Food Safety. The workshop aimed to encourage harmonization of methodologies, identify challenges and opportunities, and explore further advancements in food waste accounting. The paper discusses key methodological aspects—such as setting system boundaries, data reliability, and accounting for water flows—to enhance support for food waste policy development and interventions. It is directed at stakeholders across the food supply chain, including governments and research institutions [3].

MATERIALS AND METHODS

Through an extensive literature review, the authors present the feasibility and constraints of applying industrial symbiosis in the recovery of food processing waste, focusing on the recycling (with the exception of energy recovery) of solid and liquid waste

from the food industry. The main uses of the functional ingredients derived from this transformation are presented and discussed, highlighting the main application sectors, e.g. in the nutraceutical and pharmaceutical industry. Another research method was the observation of reports involving the following elements:

- UN Global Food Risk Index Report 2021 edition [11]
- UN Global Food Risk Index Report 2024 edition [12]
- Statistical data of the NBS on the evolution of the average net monthly wage per economy, in the Republic of Moldova, MDL, 2013-2023 [9]
- Statistical data of the NBS on the evolution of the average total monthly consumption expenditure per person in the Republic of Moldova, period 2019-2023 [10]
- Study of the economist of the Republic of Moldova, Veaceslav Ionita on Food waste and how to fight it [15].

RESEARCH RESULTS

The economic impact of food wastage on the citizens of a state can be determined by analyzing the personal financial status of the citizen which would imply analyzing the average income and expenditure per economy in this state, thus thanks to the National Bureau of Statistics (NBS) it is possible to examine the evolution of the average monthly net monthly wage earnings and respectively the destination of the average monthly consumer expenditure per person, thus according to the data provided by the NBS, the average monthly net wage earnings during the period 2013 - 2023 has experienced an increase with a rate on average of about 696.6 MDL per year, which is estimated positively [13]. As for the indicator Total average monthly consumer expenditure per person in the Republic of Moldova, in the period 2019 - 2023, it has also increased at an average rate of about 384.46 MDL per year, but at a slower rate than the rate of growth of the average monthly net salary, which is also considered positive, these facts can be visualized in Figure 1 [9,10].

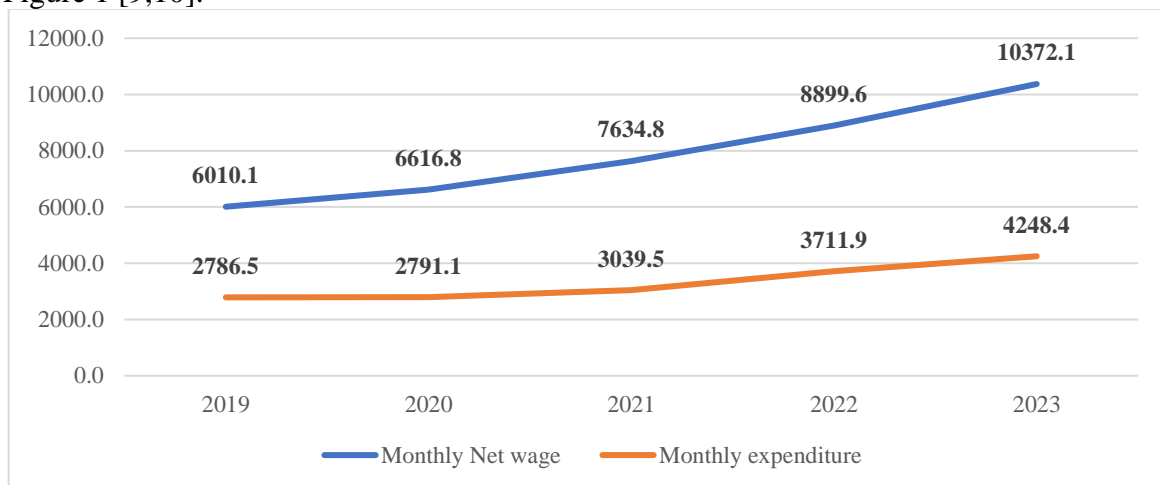


Figure 1. Average net monthly wage and average total monthly consumption expenditure in the economy, in the Republic of Moldova, MDL, 2019-2023

Accordinging of Figure 2, created by Moldovan economist Veaceslav Ionita, provides insight into household expenses in the Republic of Moldova. Notably, it shows that 41.1% of household spending goes toward Food and Non-Alcoholic Beverages, underscoring the high priority of food in the family budget. Of this, 35.9% represents the portion actually consumed, indicating that while most purchased food is used, there is a gap.

Alarmingly, 5.2% of household spending is allocated to Wasted Food, highlighting a significant issue with food waste. Reducing this waste could not only lead to cost savings

for households but also contribute to environmental sustainability by decreasing the overall waste generated.[15]

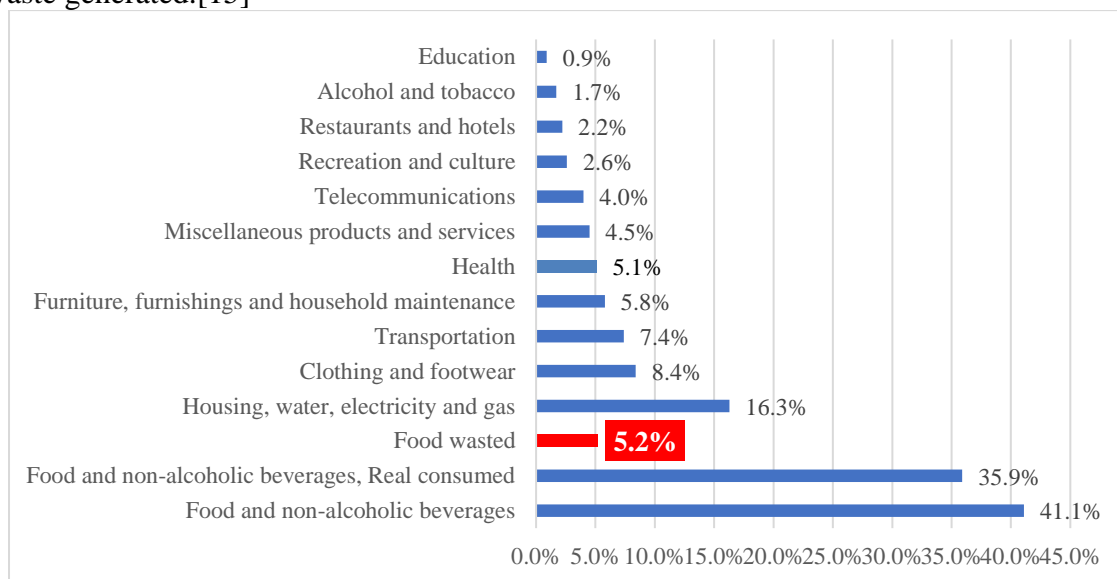


Figure 2. Destinations of monthly expenditure of Moldovan households in 2023. [15]

Figure 3, created by Moldovan economist Veaceslav Ionita, illustrates the rising trend in food waste and losses in the Republic of Moldova from 2015 to 2023, measured in billions of lei. The chart reveals a growing issue of food wastage in Moldova, highlighting both total food waste and waste specifically from household consumption between 2015 and 2023.

Over this period, total food waste has escalated from 11 billion MDL in 2015 to 19.2 billion MDL in 2023. This steady rise suggests increasing inefficiencies in Moldova’s food supply chain, where inadequate storage, limited transportation infrastructure, and the absence of a cold chain system lead to significant spoilage before food even reaches consumers. Without improvements in these areas, food losses are likely to continue climbing, placing further strain on the economy.

Household food waste, while smaller in scale, has also risen from 3.8 billion MDL in 2015 to 6.6 billion MDL in 2023, pointing to consumer-level challenges. Moldovan families spend a substantial portion of their income on food, with waste representing a direct financial drain on households [14,15].

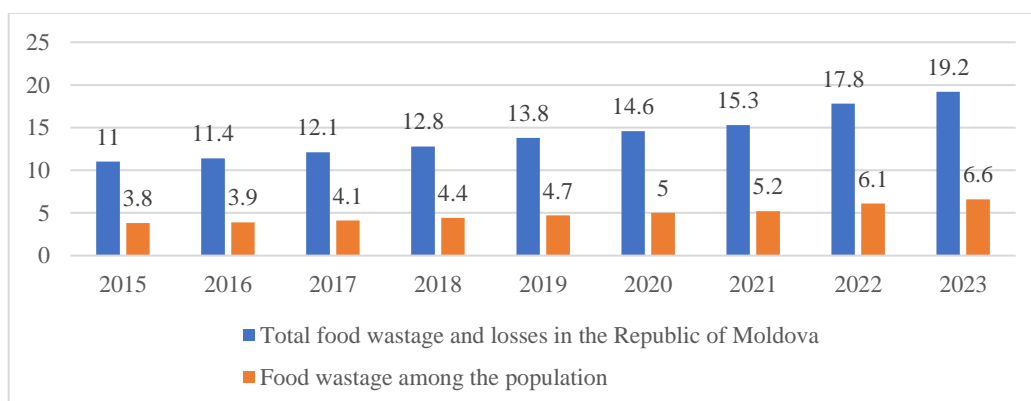


Figure 3. Food wastage and losses in the Republic of Moldova in 2023, billion MDL.

Based on data from the United Nations Food Waste Index Report 2024, in Figure 4 the food waste measured in kilograms per capita in the Benelux Union countries, as well as

in Moldova and Ukraine, has been presented, according to which it is possible to make the following conclusions:

- Namely Luxembourg stands out with the highest food waste per capita at 87.89 kg.
- Moldova also have relatively high levels of food waste, exceeding 75 kg per capita.
- Ukraine (72.85 kg) is in the medium range, alongside countries such as Belgium (70.52 kg)
- Countries such as Romania (69.63 kg) and Netherlands (56.84 kg) have the lowest levels of food waste per capita.

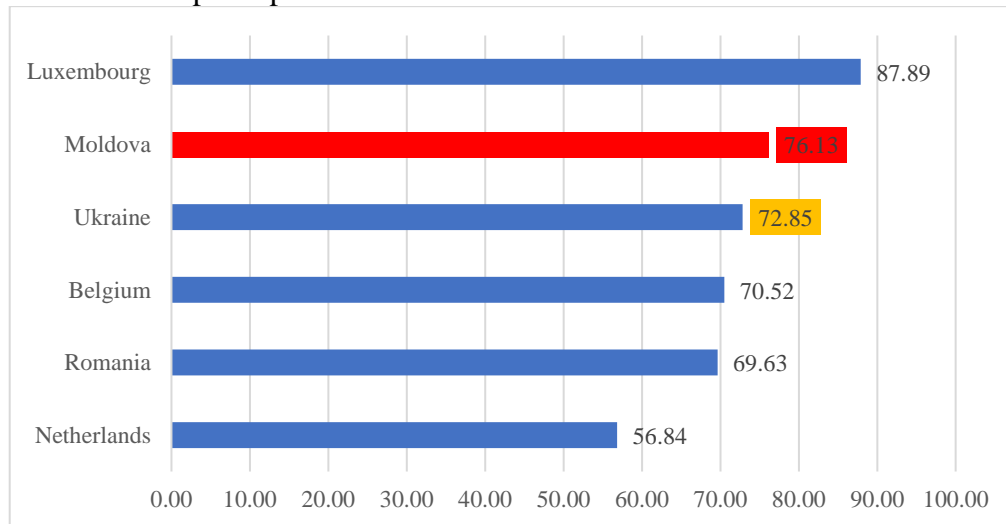


Figure 4. Food waste per capita in EU, Moldova and Ukraine, kg 2024.

In the data it can be seen that the Republic of Moldova, as a candidate country for integration into the European Union, has a high degree of food wastage compared to most Benelux countries.

At the same time, Ukraine, another candidate state for integration into the European Union, has a lower degree of food wastage than the Republic of Moldova.

However, Romania, which is a neighboring state to both Moldova and Ukraine, and is an EU member state, has a lower food wastage compared to its neighbors. Romania in turn registers a food wastage of about 69.63 Kg.[1,2]

As far as the Benelux union is concerned, made up of 3 countries, namely Luxembourg, Belgium and the Netherlands, the highest degree of food wastage is recorded in Luxembourg, namely 87.89 kg, while the Netherlands has the lowest degree of wastage in this union, about 56.84 kg. And Belgium in turn has an average degree compared to the 2 countries of the union, this degree constitutes 70.52 kg.

These figures highlight potential good practices or cultural factors that contribute to minimizing food waste in these regions.[12]

In contrast, Moldova's high level of food waste per capita, recorded at 76.13 kg and highlighted in red, reveals a different set of challenges. Moldova is not part of the European Union, and it faces unique socioeconomic challenges that distinguish it from the wealthier EU nations.

The high food waste in Moldova is particularly concerning given that it is a lower-income country compared to the EU average. In such contexts, food waste often stems from inefficiencies in the supply chain rather than from consumer habits alone. Issues like inadequate storage facilities, limited access to refrigeration, and transportation challenges can lead to significant spoilage before food even reaches consumers.[6,7,8]

This is a common issue in countries with less developed infrastructure, where food waste at the production and distribution stages can be as high as, if not higher than, waste at the consumer level.

For Moldova, reducing food waste may thus require investments in infrastructure to ensure that food remains fresh throughout the supply chain. This could involve upgrading storage facilities, improving transportation networks, and investing in cold chain technologies. Additionally, education and awareness campaigns could help consumers make more informed decisions, particularly in terms of storage practices at home and understanding expiration labels.

CONCLUSIONS

The analysis of food waste and its economic impact on EU citizens and the candidate state, the Republic of Moldova, offers insights into the complexities of managing food waste and the financial burdens it creates. By examining food waste levels in Moldova in comparison to EU nations—especially those in the Benelux Union (Belgium, Netherlands, Luxembourg)—and Ukraine, the study sheds light on the economic, environmental, and infrastructural factors that drive food wastage across different socioeconomic contexts.

The study reveals that Moldova, despite being a lower-income country relative to most EU states, has high food waste levels, comparable to affluent nations like Luxembourg. While Luxembourg's waste, recorded at 87.89 kg per capita, is often driven by high consumer purchasing power and a "throwaway culture" common in wealthier societies,

Moldova's food waste issues stem largely from systemic inefficiencies. In Moldova, food waste represents 76 kg per capita, a rate that highlights significant structural issues within the country's food supply chain. Addressing this waste could require substantial investment in infrastructure to improve storage and distribution, as well as public education on reducing waste at the household level.

The economic impact of food waste is particularly significant in Moldova, where a substantial portion of household income is dedicated to food expenses.

The study points out that 41.1% of Moldovan household spending goes toward food and non-alcoholic beverages, and 5.2% of this expenditure is allocated to food that ultimately goes to waste.

For families with limited budgets, reducing food waste could free up resources for other essential needs, such as healthcare and education. For Moldova, aligning with EU standards in food waste reduction could facilitate its integration process, support economic stability, and enhance sustainability.

The study also highlights that Moldova's candidate status for EU membership places additional pressure on the country to align with European standards, including those related to environmental sustainability and food waste management.

Reducing food waste could not only support Moldova's efforts to meet EU integration requirements but also demonstrate its commitment to sustainable development. By adopting policies that encourage responsible consumption, improving supply chain efficiency, and fostering a culture of sustainability, Moldova could make progress in reducing waste and strengthening its economic resilience.

REFERENCES

- [1]. **ANTONESCU DANIELA** et al., 2022, The dimension of food waste phenomena in Romania. Case-study: Agro-mountain pensions, "0 Years of Inspiring Academic Economic Research – From the Transition to Market Economy to the Interlinked Crises of 21st Century, Sciendo, pp. 561-574
- [2]. **ANTONESCU DANIELA**, 2024, Food Waste Dilemma and Scenarios for Agri-tourism in Romanian's Mountain Region: An Analysis of Literature and Secondary Data, Grassroots Journal of Natural Resources, 7 (2): 179-198. <https://doi.org/10.33002/nr2581.6853.070209>
- [3]. **CORRADO S., CALDEIRA C., ERIKSSON M., HANSEN O.J., HAUSER H.-E., VAN HOLSTEIJN F., LIU G., ÖSTERGREN K., PARRY A., SECONDI L.** et al., 2019, Food Waste Accounting Methodologies: Challenges, Opportunities, and Further Advancements. *Global Food Security*, 20, 93–100, doi:10.1016/j.gfs
- [4]. **DOU Z., TOTH J., WESTENDORF M.**, 2017, Food waste for livestock feeding: Feasibility, safety, and sustainability implications. *Global Food Security*. <https://doi.org/10.1016/J.GFS.2017.12.003>
- [5]. **HARTIKAINEN H., MOGENSEN L., SVANES E., FRANKE U.**, 2018, Food Waste Quantification in Primary Production – The Nordic Countries as a Case Study. *Waste Management*, 71, 502–511, doi:10.1016/j.wasman.2017.10.026.
- [6]. **MIRABELLA N., CASTELLANI V., SALA S.**, 2014, Current options for the valorization of food manufacturing waste: a review. *Journal of Cleaner Production*, 65, 28-41. <https://doi.org/10.1016/J.JCLEPRO.2013.10.051>
- [7]. **TEIGISEROVA D., HAMELIN L., HOMSEN M.**, 2019, Towards transparent valorization of food surplus, waste and loss: Clarifying definitions, food waste hierarchy, and role in the circular economy.. *The Science of the total environment*, 706, 136033 . <https://doi.org/10.1016/j.scitotenv.2019.136033>
- [8]. **ŻUKIEWICZ K., DUDZIAK A., SŁOWIK T., MAZUR J., ŁUSIAK P.**, 2022, Analysis of the Problem of Waste in Relation to Food Consumers. *Sustainability*. <https://doi.org/10.3390/su141811126>
- [9]. ***Castigul salarial mediu lunar https://statbank.statistica.md/PxWeb/pxweb/ro/30%20Statistica%20sociala/30%20Statistica%20sociala__03%20FM__SAL010__serii%200lunare/SAL014900.px/?rxid=21ca4b52-567d-4b47-b17c-8439fb1b89d6
- [10]. ***Cheltuieli de consum medii lunare pe o persoana https://statbank.statistica.md:443/PxWebPxWeb/pxweb/ro/30Statistica%20sociala/30%20Statistica%20sociala__03%20FM__SAL010__serii%20anuale/SAL010100.px/
- [11]. ***Environment, U.N. Food Waste Index Report 2021 | UNEP - UN Environment Programme, <https://www.unep.org/resources/report/unep-food-waste-index-report-2021>
- [12]. ***Environment, U.N. Food Waste Index Report 2024 | UNEP - UN Environment Programme, <https://www.unep.org/resources/publication/food-waste-index-report-2024>
- [13]. ***Ghid de prevenire a risipei alimentare organizat de Kaufland S.R.L.
- [14]. ***Legea Parlamentului RM nr.299/2022 privind prevenirea pierderii și risipei alimentare, https://www.legis.md/cautare/getResults?doc_id=143912&lang=ro#
- [15]. ***133 Analize Economice: Risipa Alimentară Și Cum Luptăm Cu Ea | Veaceslav Ioniță, <https://ionita.md/2024/01/12/133-analize-economice-risipa-alimetara-si-cum-luptam-cu-ea/>.