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Measuring Food Losses and Waste in Ukraine: A Review

Abstract: Global challenges, including the COVID-19 pandemic, climate change, economic crises, and conflicts, have exacerbated food insecurity, with an estimated 733 million people facing hunger in 2023. Simultaneously, approximately one-fifth of food produced is lost or wasted annually, contributing to greenhouse gas emissions, resource depletion, and economic costs estimated at $1 trillion globally. Alongside Sustainable Development Goals and EU integration objectives, Ukraine has made strides in addressing food loss and waste through legislative initiatives and national strategies. However, challenges persist due to limited data, outdated methodologies, and insufficient integration of FLW-specific policies. This study aims to provide an overview of FLW measurements in Ukraine and outline conceptual steps for achieving a sustainable food future, analyzing the regulatory framework, existing research, and consumer behaviors that influence FLW. The findings highlight gaps in data collection, the need for methodologies tailored to Ukraine's agricultural and cultural context, and the lack of centralized food waste management systems. Ukrainian households, contributing significantly to agricultural production, face losses due to manual practices, inadequate storage, and traditional consumption behaviors. The study underscores the importance of developing robust national strategies, improving data collection mechanisms, and fostering collaboration among policymakers, researchers, and stakeholders to address FLW. By enhancing monitoring and implementing targeted interventions, Ukraine can reduce FLW, contributing to global food security and environmental sustainability.

Keywords: food losses and waste, agri-food chain, consumers, policy, Ukraine.

Abbreviations:

FLW is food loss and waste,

SDG is Sustainable Development Goal.

Introduction

Global shocks and stresses such as COVID-19, climate variabilities and extremes, economic slowdowns and downturns, and wars in various parts of the world have negatively impacted food security. The number of people facing hunger was estimated at 733 million in 2023, an increase of approximately 152 million compared to 2019 (*The state…, 2024*). At the same time, one-fifth

of food produced for human consumption is lost or wasted globally each year (*Food waste…, 2024*), amounting to 132 kilograms per capita in 2022 (*Food waste…, 2024*).

Food losses refer to the decrease in edible food mass throughout the supply chain (from harvest and retail) that does not reenter any other utilization, such as animal feed, industrial use, etc. (*Global food…, 2011*). Food waste occurs at the end of the food chain (retail and final consumption) and is linked to the behaviors of retailers and consumers (*Parfitt et al., 2010*). The total cost of FLW to the global economy is estimated at roughly one trillion dollars US (*Addressing…, 2020*). In addition to exacerbating food insecurity and causing significant economic challenges, FLW is responsible for an estimated 8-10 percent of global greenhouse gas emissions and is a significant methane hotspot, impacting climate change and environmental sustainability (*Food losses…, 2013*). As a result, reducing FLW is a critical component of the 17 SDGs. Specifically, SDG 12 (Responsible Consumption and Production), Target 3, commits to halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains by 2030 (*Transforming…, 2015*). Additionally, Target 16 of the Kunming-Montreal Global Biodiversity Framework addresses "halving global food waste by 2030" (*Food waste…, 2022*).

In Ukraine, food is lost at all stages of the value chain, from production to final consumption by households (*Assessment…, 2024*). Given the national economic development trajectory aimed at EU integration and the global significance of addressing food loss and waste, Ukraine has incorporated this issue into several legislative documents. In particular, following the other UN Member States, Ukraine joined the global sustainable development process. During the comprehensive adaptation of the SDGs in 2016-2017, each global goal was revised to account for national development specifics and to identify priorities up to 2030. In September 2017, the baseline National Report "Sustainable Development Goals: Ukraine" was approved.

In 2019, the President Decree "On the Sustainable Development Goals for Ukraine up to 2030" established that "the SDGs for the period up to 2030 are benchmarks for drafting forecast and program documents, as well as regulatory legal acts to ensure the balanced development of the economic, social, and environmental dimensions of Ukraine's sustainable development" (*On the Sustainable…, 2019*). Ukraine also developed mechanisms to monitor the implementation of the defined 86 SDG targets and 183 indicators annually. Addressing FLW is included under SDG 12, "Sustainable Consumption and Production", with Target 2 aiming to reduce FLW along production and marketing chains.

Several key documents guide the current policy of FLW in Ukraine. In November 2017, the Cabinet of Ministers of Ukraine approved the "National Waste Management Strategy for Ukraine until 2030" by Resolution No. 820-r. In February 2019, the Cabinet of Ministers of Ukraine approved the "National Waste Management Plan until 2030", developed in line with the national strategy by Order No. 117-r. Both documents are based on European directives, which Ukraine must implement under the EU-Ukraine agreements. A special section of the strategy focuses on agricultural waste, including crop waste, livestock and poultry waste, biowaste (animal and poultry carcasses), residual fertilizers, chemical and biological plant protection products, and veterinary drugs. However, food waste is not classified as a separate category but is addressed within the broader context of food industry waste, categorized as part of industrial waste. "On Waste Management", the Law of Ukraine No. 2320, dated June 20, 2022, focuses on

the procedural aspects of preparing and approving waste management plans. However, this law and related regulations do not provide a comprehensive or detailed plan for food waste management. Critical issues, such as food waste across all stages of production and retail, as well as food losses, remain unaddressed in current legislative frameworks.

The most common waste management practice in Ukraine is landfilling, which accounts for about 95% of the total waste generated. On average, each Ukrainian generates about 1-1.5 kilograms of waste daily, 40-70% of which consists of food or packaging waste (*Korbut et al., 2022*). Before the Russian invasion in 2022, the volume of household waste in Ukraine was 1.5 times higher than the European average (*Filippov et al., 2023*).

For decades, Ukraine has faced significant challenges related to waste generation, storage, processing, recycling, and disposal. The country has not established a centralized system for collecting household food waste. When food waste is mixed with other waste in landfills, it produces methane – a greenhouse gas highly detrimental to the environment and a contributor to climate change. Reducing FLW is a critical step toward conserving resources and mitigating environmental impacts. This is a priority for countries worldwide, including Ukraine.

This study aims to provide an overview of FLW measurements in Ukraine and outline conceptual steps for achieving a sustainable food future.

Methods and Materials

We employed a literature review method (*Snyder, 2019*) in this article, providing an approach for examining existing research on FLW measurements in Ukraine. The review aims to summarize and evaluate a body of literature on our specific topic: FLW measurements in Ukraine. Articles were selected using the Google Scholar academic database. Given that this area of study is relatively new in Ukraine and the number of available articles is limited, we considered scientific literature in both English and Ukrainian and grey literature (non-peer-reviewed publications). Our search keywords were food losses, food waste, and Ukraine. To identify relevant studies, we followed these steps:

(1) conducting keywords search in the selected database;
(2) selecting publications that met the inclusion criteria;
(3) scrolling the article to identify those relevant to our research;
(4) reading and analyzing the full text of selected publications.

We identified 21 references through database searches. We found nine studies after excluding records that did not meet our requirements. Among the selected publications, a series of articles authored under O. Kotykova's leadership was included. However, since all these publications followed the same methodology, we included in the table only one article out of six found, which we deemed most relevant to this study (*Table 1*).

Results

To ensure that national efforts to tackle food waste are based on robust evidence and facilitate the sharing of innovation and global best practices, reliable quantification of food waste levels is essential. One of the most comprehensive studies on FLW in Ukraine was conducted by the FAO in 2013 in Ukraine (*Food wastage…, 2013*). The study analyzed five priority agri-food chains to identify critical points of losses and waste across five stages: agricultural production,

post-harvest handling and storage, processing and packaging, distribution, and consumption. The summary assessment expresses the findings as weight percentages of FLW, revealing a range from 1% to 40% depending on the agri-food chain, producer category, and supply chain stage.

In 2019, FAO launched a pilot project under the SAVE FOOD Initiative on Food Loss and Waste Reduction in two Ukrainian cities: Kyiv and Lviv. The project aimed to assist the Ukrainian government in improving municipal food waste management (*Cutting food…, 2021*). The study found that the average Ukrainian generates 230-300 kilograms of waste per year, with up to 60% of solid municipal waste consisting of organic waste, including food waste.

The Ukrainian scientific community began addressing the issue of FLW relatively recently; as a result, the number of studies in this area remains limited. The table (*Table 1*) summarizes publications by Ukrainian scientists on measuring FLW over the past decade. Among the researchers, a group of authors under the leadership of O. Kotykova stands out for their systematic work on the issue of FLW from 2019 to 2024. This group examined various aspects of FLW in Ukraine in a series of studies. They assessed the extent of FLW, analyzed the degree of impact at different stages of the food chain (*Kotykova et al., 2020b*), summarized the causes of FLW (*Kotykova et al., 2020a*), calculated the economic damage and lost revenue resulting from FLW (*Kotykova & Babych, 2019*). Additional studies by this group further highlighted the economic, environmental, and social consequences of FLW, demonstrating that reducing food losses and waste can yield positive environmental and social outcomes (*Kotykova et al., 2021*; *Kotykova et al., 2023*; *Kotykova et al., 2024*). Their research found that approximately one out of every ten calories produced for human consumption in Ukraine is ultimately not consumed (*Kotykova et al., 2020b*). To measure FLW, the authors relied on weight percentages calculated by the FAO for various commodity groups (cereals, roots and tubers, oilseeds and pulses, fruits and vegetables, meat, fish and seafood, and milk) along the value chain – agricultural production, post-harvest handling and storage, processing and packaging, distribution, supermarkets, retail, and consumption in Europe (*Global food…, 2011*). However, the group led by O. Kotykova noted that some coefficients provided by the FAO might be insufficiently relevant for Ukraine, given the wide range of countries (42 European nations) for which the same coefficients were proposed. They argue that these coefficients require adjustment better to reflect the specific conditions and context of Ukraine.

O. O. Varchenko (*2022*) calculated the amount of FLW across various products, including meat, milk, eggs, grains and legumes, potatoes, vegetables, and fruits. These losses were analyzed at different stages: cultivation, harvesting, storage, and transportation from producer to consumer. For this purpose, the author utilized data from official statistics, specifically the report "Balances and Consumption of the Main Food Products by the Population of Ukraine" (*2020*). Additionally, a survey was conducted among managers of small, medium, and large enterprises to gather further insights.

O. V. Kovalenko and L. O. Yaschchenko (*2022*) highlight that, according to state statistics, Ukraine produces more than 250 kg of food waste per person yearly, 1.4 times higher than the average food waste generated in European countries. The authors stress that the total food waste generated annually in European countries, including Ukraine, exceeds 100 million tons. The highest volumes are recorded in the UK (15.9 million tons), Ukraine (11 million tons), and Germany (12.4 million tons).

All the reviewed studies noted a significant lack of data on FLW in Ukraine. This information gap poses a major obstacle to developing an effective national program, policy, or strategy for reducing FLW in the country.

Discussion

The absence of a national strategy on FLW in Ukraine creates challenges for the country in implementing practical approaches and practices to reduce food loss and waste at every stage of the food chain.

According to the UN Food Waste Index Report 2024, food waste in Ukrainian households is estimated at approximately 2,758,037 tons per year, or 69 kg per capita per year in 2022 (*Food waste…, 2024*). However, these figures are provided with a "low confidence" rating, indicating that the reliability of the data is relatively low.

The FAO coefficients (*Global food…, 2011*) proposed for European countries for calculating FLW must also be revised. First, over the more than ten years since their development, changes have occurred in Ukraine's food system. Second, these coefficients are quite generalized, whereas Ukraine has specific national characteristics in food production, storage, transportation, and consumption. Although there is data from official state statistics on food losses during production, storage, and transportation for some types of products, consumers lack information on food waste. Let us now focus on some aspects of the food behavior of Ukrainian consumers that are worth considering in future assessments of FLW.

1. Ukrainian consumers spend a significant portion of their income on food, not due to an increased desire to eat but because of low incomes. In 2022, the share of consumer expenditure on food was 42.7% (*Share…, 2022*). This figure was 11.8% in Germany, 13.6% in France, 19.4% in Poland, 6.7% in the USA, 10.4% in Australia, and 20.1% in China. It can be assumed that food losses will be lower or minimal for the poorer segment of the population in Ukraine.
2. A large number of Ukrainians produce food for the needs of their families. In 2022, approximately 4 million households produced agricultural products in Ukraine. The share of households in the total production of certain products exceeded 90% (*Figure 1*). Such a significant share of household production can lead to greater losses at the production stage due to outdated, predominantly manual methods of planting, tending crops, harvesting, and caring for animals. Household products are used for their consumption, sold at local markets, or given to intermediaries. An important cultural tradition is giving food to children, relatives, or neighbors. During the war, another channel emerged, with food being donated to the military and refugees.
3. Ukrainian consumers tend to stock up on food. Purchasing large quantities of products for storage and canning home-produced goods is a traditional practice among Ukrainians. Losses can occur due to improper storage at home or expiration. The unpredictability of the food supply situation during the war has further exacerbated this tendency.
4. Ukrainians often prepare large amounts of food for celebrations. This food may go uneaten, and leftovers are sometimes thrown away (*Assessment…, 2024*). Additionally, respecting guests is an important part of the culture, sometimes leading to excessive food preparation that ultimately goes unused.

Conclusions

After analyzing the available literature and regulatory framework regarding FLW in Ukraine, several conclusions can be drawn:

1. Although the regulatory framework on FLW in Ukraine is generally satisfactory, it lacks a dedicated section on FLW, creating challenges for implementing approaches and practices to reduce FLW.
2. Data on the extent of FLW in the country is lacking, making it difficult to set specific targets for its reduction and monitor progress. Furthermore, virtually no scientific studies offer methodologies adapted to Ukrainian realities. Therefore, a mechanism for generating data to monitor and assess the achievement of sustainable development goals is needed to address this gap.
3. Since the State Statistics Service of Ukraine is the main body responsible for recording FLW volumes, it would be beneficial to include questions on food waste at the consumer level in the existing household survey, "Expenditure and Resources of Households of Ukraine" based on a sample survey of living conditions of households in Ukraine. This would provide policymakers with representative data and allow scientists to analyze and make recommendations to those interested in reducing food waste. When formulating questions for this survey, it is essential to consider the unique eating behaviors of Ukrainians and the respondents' cultural traditions, age, and education levels.

Conflict of Interest

The author declares that there is no conflict of interest.

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Appendix

Table 1. Studies on measuring food losses and waste in Ukraine

Author(s)	Study specific	Methods	Results of measurement
FAO, 2013	Identifying critical points and patterns of FLW along selected food chains in Ukraine	Methodology established by FAO and the Swedish Institute for Food and Biotechnology. Data sources: statistical data, existing research, key informant interviews. The five priority agri-food chain are: cereals (wheat), roots and tubers (potato), fruits and vegetables (apple), meat (pork), and milk. Stages analyzed: agricultural production, postharvest handling and storage, processing and packaging, distribution and consumption.	FLW on the stage of agricultural production range from 2.5% (large producers of wheat) to 40% (medium producers of wheat); postharvest handling and storage accordingly from 0.5% (large producers of wheat) to 40% (small producers of apples), processing and packaging from 1% (modern producers of pork) to 30% (home processing of milk); distribution from 1% (apple processors) to 20% (small apple producers); consumption from 2% (pork) to 20% (potato).
Kotykova et al., 2020a	Determining the amount of FLW by product and region in Ukraine at each stage of the food chain (grain, potatoes, vegetables, fruits, milk, and meat), including the creation of additional product value in terms of physical volume and kilocalories in 2016	The FAO methodology (*Global food…, 2011*) utilized a mass flow model for each commodity group to account for FLW at each stage of the commodity's food supply chain	In 2016, the level of FLW in Ukraine was 18,365.8 million kcal, which accounted for 8% of the total production of the estimated products. The volume of FLW included 2,548.9 thousand tons of grain (4.9% of total grain production), 4,645.4 thousand tons of potatoes (21.4%), 3,155.3 thousand tons of vegetables (31.6%), 984.8 thousand tons of fruits and vegetables (41.3%), 816.9 thousand tons of meat (35.2%), and 1,715.3 thousand tons of milk (16.5%)
Kovalenko & Yaschchenko, 2022	Studying trends in waste management and losses in the production of raw materials and food products	Calculating the losses during the production and storage of grains and pulses (the authors' method was not described)	The share of losses in grain and pulse production in 2020 was 1.7% of total production. The share of storage losses at enterprises in 2020 was 0.6% of total production.
Varchenko, 2022	Identifying FLW along the supply chain (meat, milk, eggs, grain and legumes, potato, vegetables, fruits)	To determine the FLW, the balances of the main food products were utilized Questionnaires for managers of small, medium,	In 2020, potato losses accounted 18.1% of total produced volume, vegetables for 12-2%, fruits for 10%, grain and legumes for 1.65%, eggs for 0.32%, meat for 0.2%, milk 0.1%

		and large agricultural enterprises were used	Based on the survey, average losses during the harvest stage of crop production range from 3% to 12%. In small and medium-sized agricultural enterprises, losses at the harvesting stage can, in some cases, reach as high as 38% of the total potential output. At the milking and transportation stage, 3% to 9% of milk is declared unfit for processing.

Source: Compiled by the author.

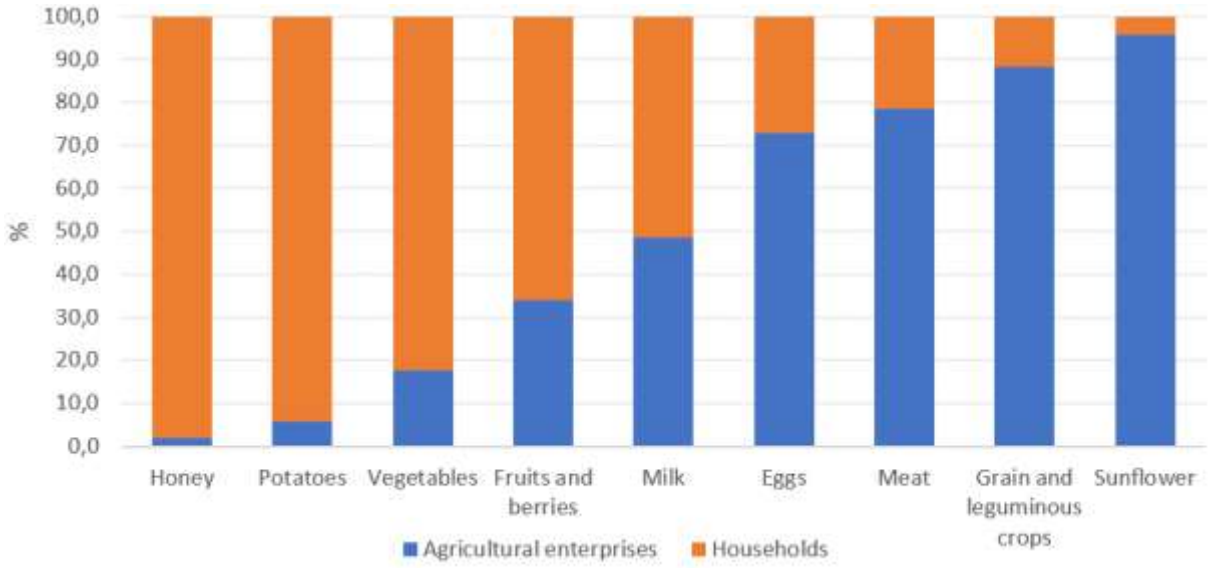

Figure 1. Figure. Share of agricultural enterprises and households in total agricultural production of Ukraine, 2022.
Source: Calculated by the author based on SSSU (*Agriculture…, 2023*)