Measuring food loss and waste – instruments, challenges and global perspectives

Food loss and waste is a pressing global concern with significant environmental, social, and economic implications. Understanding its causes and scale is essential for creating effective strategies to reduce it. Our authors explore the diverse methodologies and instruments available for this purpose.

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Measurement is the critical starting point for effective management, a well-worn principle echoed by the adage "If you cannot measure it right, you cannot manage it well." This also holds true for food loss and waste (FLW). Understanding the scale and sources of FLW is essential for creating effective strategies to reduce it. Quantitative measurement of FLW provides the data required to make informed decisions. It not only helps in achieving food security but is also a fundamental element of sustainability. Developing targeted interventions is challenging without accurate and comprehensive data on FLW.

An enumerator administering survey questions to record food loss and waste during the transportation of sweet potatoes in Ethiopia.

Photo: Aditya Parmar

Keeping an eye on quantity and quality

Until recently, there was no common methodology for assessing food loss and waste, leading to confusion, particularly at global and national levels. Efforts were made to standardise loss assessment methodologies, especially for durable products like cereals and pulses. A more precise estimation of (post-harvest) losses began with the counting and weighing method. Visual loss estimation methods, requiring less labour, were also developed. Initially, studies focused on storage losses, but by the late 1980s, a holistic system approach emerged, encompassing all stages of production, processing, marketing and consumption. Perishable products introduced complexity due to their quality-sensitive nature. To address this gap, the Food Loss and Waste Accounting and Reporting Standard was launched in 2016 by a multi-stakeholder partnership, offering comprehensive guidelines for measuring losses and enabling spatial and temporal comparisons. The Standard offers a decision tool to help organisations select appropriate methods.

The systematic measurement and quantification of FLW by actors in the food supply chain can help the public and private sectors contribute to finding viable and sustainable solutions to the food and environmental challenges of today. Here, the UN Food and Agriculture Organization (FAO) has developed a methodology for measuring and monitoring progress with Sustainable Development Goal 12 (Sustainable production and consumption), indicator SDG 12.3.1a – the food loss index (FLI). The FLI measures the percentage of food lost from the farm level up to – but not including – retail and compares it to percentage losses in the base year (2015).

At the organisational level, measuring food loss and waste helps an organisation understand the root causes and thus work to prevent it. The International Food Policy Research Institute (IFPRI) has developed a methodology that aims to improve the measurement of food losses across the value chain and includes stakeholders at each processing stage (farmers, intermediaries and processors). This approach not only measures the quantities of food lost but importantly takes into consideration deterioration in quality, which entails economic losses. The objectives of this methodology are to gauge the extent of food losses across a wide array of commodities in developing countries, measure both quantitative and qualitative economic losses, determine the nodes where losses are more prevalent, and identify particular production processes during which losses occur.

Quantifying FLW serves multiple academic and management objectives by providing baseline data, setting targets, monitoring progress, making comparisons, calculating costs, identifying critical areas, evaluating measures' effectiveness, creating statistical databases and modelling future trends. One such initiative is The African Postharvest Loss Information System (APHLIS), which models the future trends of food losses in the majority of African countries, with a particular focus on durables (cereals and grains).

Finding the right approach

Achieving absolute precision in measuring food losses is a formidable task. Historically, two main approaches have been employed: precise measurements from representative product samples (weight scales, load tracking) and informed estimates considering variable dimensions (surveys and questionnaires). The challenge lies in determining the extent to which measurement techniques and methodologies should be applied, balancing the cost against the benefits.

Depending on the value chain, the food commodity in focus and geographical location, appropriate methods (i.e. direct or indirect) can be employed. Direct measurement including weighing, surveys and counting allows direct quantification of data, while indirect measurement, such as literature data, modelling, etc., includes information from a secondary set of sources. Each of these methods has its own set of advantages and disadvantages (also see Box). For example, surveys help collect data in a cost-effective manner as interviews can be conducted over different communication platforms. On the other hand, data obtained through surveys could also be biased (aspirational or participant), thus leading to inaccurate data. To obtain a useful data set of FLW, it is important to consider various criteria, including accuracy, costs and significance, and assess each measurement against these criteria. The accuracy of measurements is a decisive factor, as decisions and interventions are commonly based on acquiesced data. Furthermore, the chosen method should also align with the specific goals of FLW reduction i.e. be significant and relevant in this regard. Finally, depending on the context, cost-effective instruments can also be implemented for FLW measurement. Comparative studies and cost-effectiveness analyses can guide the selection of appropriate instruments for FLW measurement.

Commonly used FLW measurement and assessment methods – advantages and disadvantages

Weighing scales and data loggers (also sometimes referred to as load tracking) are the most accurate and precise way to measure FLW. They can be used to measure the weight of food at different stages of the supply chain, from production to consumption. This data can then be used to calculate the amount of food that is lost or wasted at each stage. However, weighing scales and data logger approaches can be expensive, and they require extensive time and effort to collect enough data. This makes them less suitable for large-scale FLW measurement or for small businesses with limited resources.

Surveys and questionnaires are a more cost-effective and versatile way to measure FLW. They can be used to collect data from many people, including consumers, businesses and other stakeholders. This data can then be used to estimate the amount of food that is lost or wasted at different stages of the supply chain. However, these instruments rely on self-reporting, which can be inaccurate. People may forget or exaggerate the amount of food they waste, or they may be reluctant to report food waste if they perceive it to be socially unacceptable.

Remote sensing and GIS technology can be applied to measure FLW on a large scale. This technology provides real-time data and can be used to track changes in crop yields, land use and other factors that can contribute to FLW. However, this technology requires a high initial investment in equipment and software, as well as technical expertise to operate and interpret the data. This makes it less accessible to small businesses and developing countries.

Literature data can be used to estimate FLW when there are no resources available for conducting other methods. It is a low-cost method for a rough estimation of FLW. However, available data is often skewed towards a few developed countries and a few stages in the food supply chain, while the extent of FLW in developing countries and other stages of the food supply chain remains largely unexplored.

Global collaboration for local solutions

The fight against FLW is a global endeavour. Currently, a large set of data is obtained through indirect measurements such as literature from secondary or inconsistent/ outdated data sources. Furthermore, the data is limited to only a few sets of countries and a few stages in the food supply chain, thus leading to a significant data gap. To overcome such challenges, data sharing and international collaboration on a multidisciplinary level are essential to achieving meaningful progress. It is crucial to establish databases and to create a global repository of knowledge and best practices that are consistent and follow a standardised framework for FLW measurement to address FLW's transboundary nature. Platforms and initiatives for data sharing, like FAO's "Save Food: Global Initiative on Food Loss and Waste Reduction", are connecting stakeholders world-wide. Furthermore, involving the public through initiatives such as citizen science can also support the collaborative goal of reducing FLW.

In the quest to reduce FLW and achieve sustainable food systems, quantitative measurement is a critical first step. Selecting the right instrument is not a one-size-fits-all process; it requires a thoughtful evaluation of accuracy, costs and significance. Sharing data as well as successes, challenges and lessons learnt from FLW measurement efforts can be beneficial on a global scale. Here, emerging and developing countries offer unique insights and solutions. As we navigate the path towards a world with less FLW, it is crucial to understand, measure and tackle FLW at local level, in particular among rural communities.

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