A mini review on "Improving data on food losses and waste: From theory to practice"

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Abstract

This article is a review of the article "Improving Data on Food Losses and Waste: from theory to practice" published in Food Policy (vol. 98, January 2021). In this article, the authors discuss the main conceptual frameworks proposed for informing the measurement of food losses, present the most recent quantitative evidence, and sketch out a number of steps aimed at gathering internationally comparable policy relevant information. The quantitative evidence presented by the authors of this article confirm: the importance of losses for perishable crops such as fruits and vegetables, with median losses of 6.4% compared to 2.7%-3.8% for other crops; the higher losses in low middle income regions, with 10%-15% median losses for example for fruits and vegetables, compared to 4%-7% for Europe and North America. The authors also stress that while the evidence on food losses has increased in the past few years, information gaps remain important and the comparison of results across countries or even between sectors within countries remain delicate or simply impossible. Acknowledging that some of these gaps are the result of insufficient coordination between different initiatives, they propose operational frameworks to better integrate the work of the different institutions involved in FLW. This review briefly introduces the concepts, evidence and international initiatives on food losses brought forward by the authors (Chapter 1), present and discuss the main conceptual frameworks that underpin the measurement of food losses (Chapter 2) along with the most recent quantitative evidence (Chapter 3). Chapter 4 discusses the main policy implications identified by the authors and Chapter 5 concludes.

Keywords: Functional foods, Foodlosses, Food Policies

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Introduction

Food Losses and Waste (FLW) have received increased attention in the past decade, after the 2007-2008 food crises exacerbated the structural problems of access and availability of food. This crisis also highlighted the urgent need to reduce harvest and post-harvest losses and lower the exposure to market shocks of the most vulnerable countries, mostly low- to middle-income countries. The publication by the Food and Agriculture Organization of the United Nations (FAO), in 2011[1], of a study presenting estimates of food losses and waste at global level further spurred the interest of the research and international communities on the conceptual frameworks underpinning FLW, the measurement approaches and the interventions to reduce FLW. The article "Improving Data on Food Losses and Waste: from theory to practice" intends to contribute to the first two dimensions.

While some progress has been made both on the conceptual and measurement frameworks, the authors argue that obtaining reliable information on the amount of losses and waste for a wide range of commodities along the whole food chain is yet to be achieved. The evidence gathered so far is scattered and widely heterogeneous because of the differences in definitions and measurement frameworks. As pointed by the authors, this lack of standardization in loss assessment approaches are considered by many [2-4] as the main reason for the limited usability for policy analysis and decision-making of the existing evidence on food losses. The existence of several international and regional initiatives containing FLW reduction targets reinforces the need to draw on agreed upon concepts, definitions and measurement approaches to report losses in a way that the progress made can be compared across countries, stages of the value chain and over time. In this context, the Sustainable Development target 12.3 states "By 2030, to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses." In Africa, countries have pledged to halve

post-harvest losses under the Malabo Declaration [5]. According to the authors of the article, a major challenge for international organizations, development agencies and donors is how to assist low- and middle-income countries in reporting on the progress made towards these goals, ensuring that the information provided meets minimal requirements in terms of relevance, accuracy and comparability.

Further to agreeing on a common conceptual framework (Chapter 2), the development of cost-effective measurement strategies needs to maximize use of the existing evidence on FLW, which has increased in the recent past but is of a limited use because it remains to a large extent scattered and unstructured. The main findings of the meta-analysis presented in the article "Improving Data on Food Losses and Waste: from theory to practice" are discussed in Chapter 3. The authors argue that this evidence base can be used to identify information gaps and allocate the measurement efforts where they are the most needed. In Chapter 4, we discuss how the strategy proposed by the authors to delineate a common ground for information collection and gathering may facilitate the implementation of sound national, regional and international policies for reducing FLW. Chapter 5 concludes by summarising the main findings of the article and emphasising the international initiatives that can be instrumental in accelerating the generation of solid and comparable empirical evidence on food losses to help improve decision making.

What are Food Losses and Wastes, and can we Measure Them?

The initial question addressed by the authors of the article "Improving Data on Food Losses and Waste: from theory to practice" is the definition of what constitutes food loss and waste. They argue that some definitions are statistical in essence, emphasizing the need to set boundaries that facilitate the measurement. Other definitions focus on the reasons that generate the food losses and waste and the analytical framework behind it. The choice of one or the other has implications on the measurement strategy.

Definitions stressing statistical coherence can be found, among others, in the APHLIS framework [6] in Bellemare et al. (2017) [7], and the U.S. Environmental Protection Agency (2016), that highlight the importance of getting information first and foremost on the quantities involved, building on previous definitions provided by FAO (2014; 2019) [8,4], which however accounts for qualitative changes. The definition is based on the notion of production chain, whose role in generating losses and wastes is described, and it analyzes a number of related practical issues for instance, the treatment of the inedible parts. From this definition, any transformation of commodities that were intended to constitute food and are reused with the same value chain or in other value chains are ignored. The authors note that defining and measuring losses in relation to its causal factors is preferred by many, such as Delgado et al. (2017), Affognon et al. (2015), Parfitt et al. (2010) and FAO (2011, 2019) [1-4,9]. The authors of the article describe the economic underpinnings of losses and loss reduction strategies, citing for example FAO (2019) [4] that described the trade-offs and redistribution effects along the food chain. The economics of loss and waste are comprehensively described in Anríquez et al. (2019) [10], starting from the assumption that FLW is the outcome of rational decisions dictated by prices, technologies and preferences. In this framework, food losses and waste are defined as those "…which occur when there is a wedge between the social marginal benefit of loss abatement (in the absence of externalities, the output price), and the social marginal cost of reducing food losses." [10]. According to the authors, reducing losses is therefore an issue of increasing productivity in critical points of the value chain, in the presence lower marginal costs for reducing losses.

The article "Improving Data on Food Losses and Waste: from theory to practice" being centred on the measurability and measurement of food losses, the authors assessed the implications of these different definitions on the measurement approaches. On the one hand, they observe that while analytical definitions are more complete, they are more difficult to operationalize especially on an international scale as they require data that is rarely available and that must be derived from complex constructs, which entail assumptions. On the other hand, they note, while a physical aggregation of loss and waste along value chains within an accounting structure may seem easier to operationalize, it may also turn out to be less policy relevant. The economics-based definitions, instead, provide a direct qualification of the problem in policy relevant terms, as they point to what is assumed to be relevant for reducing losses and waste-productivity, externalities or consumers' preferences and which can guide action. The authors stress that the existence of multiple possible conceptual frameworks for losses entails challenges in measuring FLW in an internationally comparable form. One point around which there is consensus, they state, is the need to consider the whole food system when measuring food losses and waste [1,3,4]. This expands the information needs as data collection needs also to track complex commodity flows at a granular level, considering feed use and possibly industrial uses, for example. Among the main conceptual issues to address to improve comparability is the distinction between losses and waste. The two concepts are often intertwined in the theoretical constructs explaining FLW but there seems to be consensus around the idea that they refer to separate segments of the value chain and tend to be sensitive to different types of

policy incentives. In the methodology for measuring SDG target 12.3, an effort was made to set clear boundaries along the value chain, particularly between food loss and food waste, with a view to facilitate international comparability [11]. Another conceptual challenge that affects comparability is the fact that in some characterizations of the value chains, harvest losses are merged with on-farm post-harvest losses. The two types of losses should in fact be distinguished, as harvest is a critical activity affected by its own set of causal factors [1]. Another source of lack of consistency in the reporting on FLW identified by the authors is the differences in the way value chains are defined. For instance, Corrado, Sala et al (2019) [12] compare critical loss points for Fruits and Vegetables across seven main studies by referring to four main stages (primary production and post- harvest, manufacturing, distribution, and consumption). Transportation and storage are not singled out as stages, whereas they are emphasized as critical loss points in other studies, such as Affognon et al. (2015) [2] on cereals in Sub Saharan Africa and Rolle (2006) [13] on fruits and vegetables in Asia, and in the measurement guidelines on grain losses published by the Global Strategy to improve Agricultural and Rural Statistics.

In terms of a working definition, the authors propose a possible solution: to start from the simpler end, by considering where in the value chain most losses occur and how to collect data in those areas. They stress the importance of adjusting the measurement frameworks and toolkits to the stages at which losses occur where most losses occur in the early stages of the supply chain, quantitative losses are simpler to measure. For instance, losses in a traditional food value chain characterized by small informal operations, where farmers operate in isolation and are small-scale, are better measured by sample-based agricultural surveys (GSARS, 2018) [14]. On the contrary, where stakeholders along value chains have access to sophisticated technologies, production is horizontally and vertically integrated [9]. Data on losses in those cases may be more difficult to obtain, and may be collected in enterprise surveys. The more such surveys include information on the organization of production and its socio-economic features, the more it is likely for the survey to capture the gist of what is generating the losses, such as productivity conditions, structural constraints, social organization of production and other features that help to explain why losses are generated, and thus help in defining the needed policy interventions.

Notwithstanding the importance of qualitative losses, covered by the definition in FAO's conceptual framework, FAO (2014) [8], that considers food losses to be any reduction in quantity or quality of food commodities in the supply chain, the authors focus on the measurability of losses and consider quantitative losses to be the primary and achievable measurement objective.

Before discussing the high-level initiatives presented by the authors on the measurement of food losses and how these could be better articulated to generate policy-relevant and comparable information on food losses (and waste), the next chapter presents a summary of the quantitative evidence provided by the article “Improving Data on Food Losses and Waste: from theory to practice”.

Unearthing Data on Food Losses

The authors start by pointing the general weakness or lack of robustness of the measurement approaches, by indicating that out of the 800 or more potentially relevant publications identified, only 25% were considered satisfactory from the methodological perspective and finally used in the analysis. The size of the usable evidence base was analogous to similar studies. For example, with a broader scope, the meta-analysis presented in Xue et al. (2017) [15] retained a similar amount of documents (202 publications).

The meta-analysis carried out by the authors of the article “Improving Data on Food Losses and Waste: from theory to practice” is based on a set of approximately 180 references and databases, representing around 20,000 data points. The authors stressed the limitations of this exercise and the need to interpret the results with care. For example, a major limitation identified by the authors is that research may focus on where the problem is more acute, for example in terms of countries (e.g. developing) or type of farmers (e.g. smallholders), a bias that leads to overestimate losses and may overstate their importance.

Despite its limitations, the quantitative evidence presented in the article “Improving Data on Food Losses and Waste: from theory to practice” certainly contributes to a better appraisal of the magnitude of losses and complement recent global meta-analysis and studies, such as FAO (2011), Xue et al. (2017) and Affognon et al. (2015) [1,2,15]. The meta-analysis confirms some of the main statements on food losses that are found in the literature, often without a solid empirical justification, in particular that: fruits and vegetables are affected by the highest losses (median of 6.4%), followed by other crops (3.8%) and cereals (2.7%), as illustrated by (Figure 1); and that losses on the farm are higher than off-farm, irrespective of the commodity group considered. For cereals, for example, on-farm losses are estimated at 2.8%, compared to 1.4% off-farm. One of the explanations put forward by the authors for the existence of structurally higher losses on the farm is the difficulty for producers to reach the technical efficiency frontier, which is more acute in developing countries where most farmers, especially the smallest ones, do not have an easy access to affordable inputs and capital.

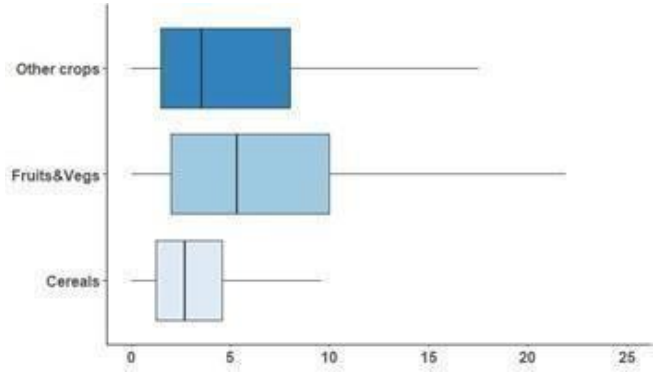

Figure 1: *Losses for major commodity groups*

Source taken from C. Fabi et al. (2020) [16], article "Improving Data on Food Losses and Waste: from theory to practice", Food Policy, Vol. 98, January 2021, 101934.

The meta-analysis also produced new and insightful evidence on the differences in losses across countries and confirms the pattern of higher losses in developing countries, a result which holds for the different product groups (Figure 2). For fruits and vegetables, for example, median losses are above 10% for Africa and Latin America, while they range between 5% and 10% for the other regions.

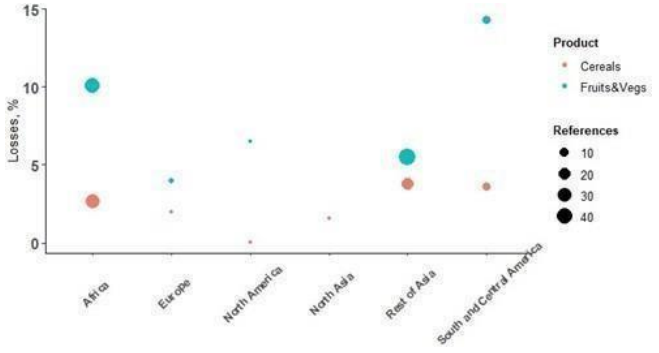

Figure 2: *Median losses for major commodity groups and regions*

Source taken from C. Fabi et al. (2020) [16], article "Improving Data on Food Losses and Waste: from theory to practice", Food Policy, Vol. 98, January 2021, 101934.

An interesting aspect of the meta-analysis, which our knowledge has been very little studied in the literature (mainly because of a lack of consistent time series), is the analysis of losses over time. The evidence provided by the authors indicates that losses oscillated between 2.2 and 5.0% since 2000 but that no clear trend in the reduction of losses can be established. The authors mention that the inertia of the agricultural sector, which tends to be characterized by a slower adoption rate of new technologies and the persistence of the major causes of food losses in developing countries (dysfunctional markets, difficult access to technologies) may explain this relative stability in losses. The authors compared the results of their meta- analysis to that of similar studies, starting with Xue et al. (2017) [15]. Despite some methodological differences, the two studies converge on several findings: they both suggest that the farm is the segment of the chain where most losses occur for crops compared to processing and distribution both studies also concur on the wider amplitude of losses for fruits and vegetables. The authors also argue that beyond the convergence on certain findings, the results presented in these two studies offers decision-makers evidence that can be used in a complementary way: while the quantitative estimates presented by Xue et al. (2017) [15] in terms of kg per capita are relevant for food insecurity analysis, the percentage losses presented in the article "Improving Data on Food Losses and Waste: from theory to practice" are valuable to assess the magnitude of the economic or technical inefficiencies across the value chain and the margins for reduction in losses for each segment of the chain.

The authors also compared their quantitative evidence to the findings presented in Affognon et al. (2015) [2], also based on a meta-analysis of more than 200 publications. While the ordering of the commodity groups according to losses is the same across both studies, the loss estimates are systematically and significantly higher in Affognon et al. (2015) [2]. One of the explanations of this difference given by the authors is the fact that most studies in Affognon et al. (2015) [2] focus on physical measurement, known to lead to higher loss estimates than declaration based methods (GSARS, 2017) [17]. The over representation of studies focusing on farm storage (46%), where losses tend to be higher than in other segments of the supply chain, may also explain the higher percentage losses. The authors also acknowledged the relevance of the statistical approach adopted by Affognon et al. (2015) [2], that used a random effects model to account for the heterogeneity in the studies in terms of target population and measurement methods. The statistical approach used in the meta-analysis presented in the article "Improving Data on Food Losses and Waste: from theory to practice" does not follow this rigorous procedure.

Policy Implications

Drawing on their analysis of the conceptual frameworks underpinning the measurement and analysis on losses, as well as on the findings of the meta-analysis, the authors of the article "Improving Data on Food Losses and Waste: from theory to practice" derive implications for the international community on the strategy and actions that could be followed to harmonize and improve measurement frameworks. According to the authors, the international community could play a key role in leveraging technical expertise to improve FLA measurements and, in parallel, in catering for more and better quality data.

In this direction, a Global Action Agenda setting the way forward was formulated by a group of international partners (Flanagan et al., 2019) [18] emphasizing private public partnership and the "10 × 20 × 30" initiative, where 10 large corporate players commit and engage with their own suppliers to do the same by 2030, thus generating a 'snow ball' effect on FLW reduction. From a pure data and statistical point of view, the authors fear that the acquired knowledge may not become openly available with the scale and detail level needed by other players, given the sensitivity of corporate data redlingshofer 201 [19] and the fact the existing evidence does not allow to scale up results at the national level.

The authors argue that the two-pronged approach proposed by FAO (2018) [11] would make a better use of the existing information and at the same time would contribute towards the enhancement of the quality of national level loss estimates. In the short run, this approach proposes to make the best use of existing information, for example through the establishment of common repositories of international organizations such as the World Bank, the APHLIS, the WRI and the FAO, where information could be shared, harmonized to the best extent possible, aggregated, and employed in the estimation of food losses. The meta-analysis presented by the authors, and the dataset on which it draws, goes in this direction. On the long run, the authors indicate that FAO (2018) [11] proposes to place the emphasis on the collection of basic ground-level data, leveraging resources from the public, the private sectors and the civil society to build national and regional capacities to collect better data. In addition to building on a range of existing initiatives, such as the WRI and APHLIS among others, the strategy proposed by FAO (2018) [11] is to focus on the generation of data on food losses particularly on the primary segments of the value chains. The authors indicate two large-scale technical assistance projects that may contribute to this objective: the "50 by 2030" Initiative [20] and the Global Strategy to Improve Agriculture and Rural Statistics [21]. Both initiatives propose a modular approach to data collection and propose to integrate as much as possible loss assessments to existing national agricultural or household surveys, increasing cost-efficiency and taking advantage of the data collected in the main surveys (on socio economic characteristics, etc.).

Finally, the authors sketch a possible strategy that could be followed by countries to generate sound and policy relevant information on food losses and waste. This strategy is based on two main components: firstly, to integrate data collection on losses to broader statistical operations to lower costs, maximize sustainability, improve cross-validation and expand analytical possibilities. Second, countries should strive to use agreed international standards in terms of definitions, meta-data and data collection methods, as this ensures data comparability and allows appropriate international comparisons. The authors finally stress the key role of the international community in fostering the transfer of innovative and best practices among countries, with a view to improve data quality and availability, reduce costs and improve transparency.

Conclusion

To conclude this review, it can be observed that the article "Improving Data on Food Losses and Waste: from theory to practice" provided a useful summary of the existing definitions and conceptual frameworks and their implications for operational measurement activities. This article provided evidence on the trade-offs associated with the different frameworks, particularly between the analytical grounding and the operational feasibility of the measurement. The operational solution proposed by this article is to start intervening on the most critical part of the value chain the farm where a substantive improvement in agricultural surveys can make a difference.

Finally, the article has provided suggestions on a possible strategy to maximize synergies for pushing ahead an international agenda for obtaining comparable and reliable data, articulated at the national level. In this strategy, the international community is argued to play a major role in fostering the exchange of best practices, in applying international standards and guidelines and in contributing to improve the availability and quality of data through large scale technical assistance activities, such as the Global Strategy to Improve Agriculture and Rural Statistics [21] and the 50 by 2030 Initiative [20]. At the national level, according to the authors, it is crucial to promote transparency and reduce costs by adopting innovative best practices. In this context, the authors insist on the importance for countries to integrate data collection on losses in wider statistical operations and to adopt harmonized standards and concepts.

In this perspective, the authors anticipate that more systematic, internationally comparable and coordinated data collection strategies will improve the evidence on FLW, also putting data in a socio-economic perspective that can facilitate their use in policy analysis. The authors stress the importance to avoid a polarization on, on the one hand, high income countries the EU and, on the other hand, low income countries (as in the case of the Global Strategy on Agricultural and Rural Statistics [21] and also the 50 by 2030 initiatives [20]). This creates a potential risk of leaving behind middle income countries, which certainly have a stake in FLW reduction, but do not necessarily have the resources to carry out extensive measurements.

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