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FAO Food Loss Index methodology and policy implications

In 2015, all 193 UN member countries agreed to halve global food losses and waste by the year 2030. In this article, we are going to explore why the first official study on food loss and waste (FLW) by Gustavsson *et al*. FAO, 2011 cannot be used as a reasonable basis for policymaking – even though it underlies Sustainable Development Goal (SDG) 12.3. Then we will look at the new proposal by the Food and Agriculture Organization of the United Nations (FAO), which aims to harmonise the methodology for FLW research employing the Food Loss Index (FLI). In particular, we are going to assess the suitability of the FLI as a tool for policymaking. We would like to highlight that although both papers have played an important role in raising awareness about the global problem of FLW and in encouraging further research, they do not solve such important issues as providing a unified definition of FLW, the aggregation of heterogeneous commodities within a single category, and the absence of a methodology and data, both of which are certainly needed for policymaking. The objective of the article is to start a discussion about those issues, as even the recent flagship FAO study (2019) openly presents such a dichotomy between on the one hand, the aggregated percentage number of the Food Loss Index and on the other hand, the call for specification and precision in shaping policy measures, based on cost/benefit analyses.

Keywords: food loss, waste, policy, methodology, SDG

JEL classification: Q18

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Received: 2 November 2020, Revised: 24 January 2021, Accepted: 28 January 2021.

Introduction

The number of publications on the topic of food loss and waste (FLW) has increased significantly since the first groundbreaking study commissioned by the Food and Agriculture Organization of the United Nations (FAO) in 2011 (FAO, 2011). This study informed the world community that about one third of world food production intended for human consumption was lost or wasted. This finding created the hope that worldwide food security and resource efficiency should and could be improved significantly by reducing FLW.

The importance of this issue is reflected in the Sustainable Development Goals (SDGs). SDG Target 12.3 calls 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, by 2030 (FAO, 2020). It is no surprise that the call was supported by all 193 member states of the UN.

The targeted reduction of FLW in SDG 12.3 is most likely based on the only figure, which was known at that time, namely, that one third of worldwide food production is lost or wasted. If policy makers on the national or international levels want to know whether their policy measures have contributed to achieving the defined target (to halve FLW by 2030), they have to be able to rely on clear and comparable information. This means that any new FLW-related study should use the same methodology as the first FAO study; if there is a convincing rationale for using a different methodology, it should be explained, or at least the question of whether the methodology of the first study would have led to a different finding should be discussed.

Moreover, policy recommendations should contain two necessary elements: first, the proposal, explaining how the objective may change due to a proposed policy; and second, the economic costs needed to achieve this objective. If a study only shows that the present situation could be improved but does not inform the reader what the costs might be, the benefit of introducing the recommendation is not proven. Of course, a necessary condition of a cost/benefit analysis is that the positive effect – the achievement of the objective – and the costs are measured in terms of the same metric.

The article is structured as follows: Section 2 highlights the existing disadvantages of the current FLW research overall, while Section 3 explores whether the first official FLW study (FAO, 2011) can be used as a reasonable source of information for policymaking. Section 4 reviews the new Food Loss Index (FLI) proposed by the FAO, which aims to harmonise the methodology used in research on FLW and the assessment thereof, while Section 5 argues that policies for reducing FLW effectively should target those spots within the supply chain where a cost/benefit analysis indicates a positive benefit. The last section concludes.

Issues with the Existing FLW-Research

The majority of available FLW-related studies focus on specific countries or regions and avoid presenting a worldwide picture. In this regard, the studies by the USDA Research Service and studies sponsored by the FAO stand out. However, their methodologies differ in many respects.

First, *the definition of FLW differs.* There are more than a hundred different definitions of 'food loss' and 'food waste' in the literature (Koester, 2014). Some studies include all stages of the supply chain in data collection, whereas others narrow their definition of the supply chain and neglect

losses in production at the farm level. There might be good reasons to define FLW differently, but the findings are not comparable. For example, see the three definitions referred to by Parfitt *et al.* (2010, p3065):

'(1) Wholesome edible material intended for human consumption, arising at any point in the Food Supply Chain (FSC) that is instead discarded, lost, degraded or consumed by pests.

(2) As (1) but including edible material that is intentionally fed to animals or is a by-product of food processing diverted away from the human food.

(3) As definitions (1) and (2) but including over-nutrition – the gap between the energy value of consumed food per capita and the energy value of food needed per capita.'

Monier *et al.* (2010, p7) use only the term *food waste* and define it as the following: 'fractions of "food and inedible parts of food removed from the food supply chain" to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bioenergy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea).' Buzby and Hyman (2012, p561) present the following definition: '... food loss is a subset of post-harvest losses (or post-production) and represents the edible amount of food available for human consumption but is not consumed. Food waste is a subset of food loss.'

On the one hand, this flexibility allows one to shape a definition which corresponds to the specific purposes and needs of one's particular research project. On the other hand, it makes it difficult to compare various papers, as the different authors' understanding of what constitutes FLW, what is included and what is not may vary drastically.

Second, most studies count as 'food' all items produced by farmers and *intended for human consumption*. Those product items which left the food chain due to rejection by customers or were used for feed due to low food prices, are considered as a loss. This also holds for food redistributed to food banks, even though it is a measure to fight hunger. Some studies calculate farm produce as a whole even if some parts of it are intended for non-food purposes.

Third, another very important problem is the *question of aggregation*. Products are defined in economic terms very narrowly. Products are only the same (i.e., they can be aggregated) if they have the same physical dimension (including quality), if they are at the same location and if they are evaluated at the same time. Grain at harvest time is not identical in economic terms to grain before the next harvest; a raw agricultural product such as potatoes cannot be aggregated with meat products in metric tons. Aggregation is also a problem when the FLW volumes are calculated in calories. The economic value of a product is not always only related to the calorie content. Many studies try to add up products along the supply chain and do not take into account that most food items are joint products, incorporating agricultural raw commodities, services added along the supply chain (e.g., transport, marketing, etc.), as well as by-products. Hence, aggregating different agricultural products as if they were comparable, or aggregating products with the same origin but at different stages of the supply chain, is not reasonable from an economic point of view.

Fourth, *valuation of FLW* is necessary to quantify the economic value. If instead a study just adds up the weights of individual lost food items, it does not inform its readers as to whether food loss reduction is an economic or a political problem. Moreover, to conduct a cost/benefit analysis, one needs to know the economic value of the loss. Very few FLW studies present such calculations. Some studies assume that the economic value of a discarded food item is identical to that of the food that is consumed. Such an assumption leads to an overestimation of FLW. Products discarded are, most of the time, inferior in quality or are leftovers on the plate because, for example, the consumer did not like parts of the meal, such as the fat of a steak.

Fifth, most studies convey the impression that reducing FLW depends only on goodwill, hence, *costs for FLW avoidance or reduction are not mentioned*. This also holds true for the FAO study (FAO, 2011). Furthermore, it is worth highlighting that SDG 12.3, which calls to halve FLW worldwide by 2030, does not even reflect avoidance costs. Actually, we have not seen any study on worldwide FLW that includes an assessment of avoidance costs. It is quite understandable that this information is not available as avoidance costs for each specific food item differ across countries, and these costs depend on whether the total loss and waste of each product can be avoided or whether only marginal changes can be made. In addition, it is important to know the aggregated avoidance costs across products within a country and across countries in order to learn what the net benefit would be if every country halved FLW by the year 2030.

To conclude this section, we advise policymakers to aim to obtain more specific data which may allow for the development of efficient policies for reducing FLW. It should be noted that each individual country should not aim at reducing FLW by the same percentage. The food production structure, the level of technologies, and the institutional frameworks, including domestic policies, differ significantly across countries. Therefore, the avoidance costs of FLW will likely differ across products and across countries. If the world community aims at reducing FLW efficiently, i.e., by taking into account avoidance costs, the percentage reduction of FLW should not be the same for each country but should be higher than the average for those countries where the expected net benefit is the highest.

There are some recent studies available, which assess the net benefit for specific focused policies; either on specific points of the supply chain or on specific products (e.g., see Sethi *et al.*, 2020). Such studies could contribute to an efficient reduction of specific FLW and of overall FLW.

FAO (2011) Report: Data Quality Issues

The FAO report of 2011 uses the definition of food loss and waste based on Parfitt *et al.* (2010): *'food losses'* refer to the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption. Food losses take place at production, postharvest and processing stages in the food supply chain. Food

losses occurring at the end of the food chain (retail and final consumption) are rather called *'food waste'*, which relates to retailers' and consumers' behaviour. This definition also highlights that FLW 'is measured only for products that are directed to human consumption, excluding feed and parts of products which are not edible.' (FAO, 2011).

It is worth mentioning that the FAO report itself highlights that 'due to lack of sufficient data, many assumptions on food waste levels ... had to be made' and calls for interpreting the results with great caution (FAO, 2011, p15). However, its findings nevertheless became the cornerstone of the FLW reduction discussion. That is why we think it is necessary to look at its methodology in more detail.

The starting point for compiling the data set is the FAO Food/Balance/Sheets (FBS) Data from national/regional FBS, together with the weight percentages of FLW; they were used to quantify the volumes of FLW for each region and commodity group separately (FAO, 2011, p3). The FAO has the mandate to collect data about food production and consumption and food security. The information is available in metric tons and in calories. FBS are set up for 152 countries out of the 193 UN member countries worldwide. Thus, it is obvious that this data set does not allow conclusions to be made about FLW worldwide; moreover, the data included in the FBS are objectively not very reliable – as well as the figure presented for FLW of the individual food products. The reason is that FBS data include estimates on FLW for each specified product. These data can be considered as expert estimates that may have significant standard errors. FAO (2011) started with this information and tried to improve the estimates based on a literature review and information from individuals working in specific product supply chains. However, data reliability remains an issue, and the numbers can hardly be considered as accurate estimates of global FLW.

The reliability of the FBS data has been assessed by a comparison with the Global Dietary Database (GDD): the authors concluded that 'for most food groups, FAO estimates substantially overestimated individual-based dietary intakes by 74.5% (vegetables) and 270% (whole grains), while underestimating beans and legumes (-50%) and nuts and seeds (-29%) ($P < 0.05$ for each)'. Furthermore, 'for all food groups and total energy, FAO estimates substantially exceeded or underestimated individual-based national surveys of individual intakes with significant variation depending on age, sex, region, and time.' (Del Gobbo *et al.,* 2015, p1038).

The FAO study, moreover, did not include a reasonable estimate of the benefits and costs involved in reducing FLW. In actual fact, the methodology was not adequate for delivering data needed for a comprehensive cost/benefit analysis. Quantities were added up and considered as the potential benefit which could be achieved. The aggregation problem had been completely ignored, and possible costs incurred for reducing the FLW were not taken into account. Nevertheless, this study was of high importance as it created an awareness about the food loss problem in a world where hunger is still widespread. Furthermore, the study did important work in presenting the FLW as an economic and ethical problem. However, the study's findings do not seem to offer a sufficient basis for the UN to set a quantitative target for FLW reduction in 2030.

Consequently, we can infer that any empirical assessment for checking whether the UN countries are on track to achieve the FLW reduction target for 2030 can hardly be based on the methodology used by FAO (2011). Moreover, the current SDG target might need to be reconsidered.

Food Loss Index Discussion

In 2015 the UN agreed to halve global food loss and waste by 2030. Reviewing the actual performance of instituted policies needs a careful diagnosis of the performance both in individual countries and worldwide. Hence, there is a strong need for a publication that will aim at clarifying the importance of specific assumptions and proposing a new methodology for further research. Without a harmonised measurement of FLW in individual countries, the 2015 UN agreement cannot become effective. The FAO obviously accepted this challenge. The mission of the FAO is 'helping to build a food-secure world for present and future generations'. Hence, the FAO is in charge of submitting proposals for harmonising alternative approaches. Indeed, in its flagship publication, 'The State of Food and Agriculture 2019', the FAO presented a new approach to be considered as a blueprint for further work on this topic. The FAO's publication is timely and more than welcome. However, for the competence of the FAO and the many consultants of the organisation to be accepted, a discussion about the output in the wider research community needs to happen.

Definition

In order to fulfil SDG 12.3, the FAO presented a new definition of FLW in 2019. According to the FAO, this new definition is supposed to become the common denominator for the majority of research and data-collection activities. The distinction between food loss and food waste has an important impact on the measured quantity of food loss. Let us have a closer look at the definitions:

'*Food loss* is all the crop, livestock and fish human-edible commodity quantities that, directly or indirectly, completely exit the post-harvest/slaughter/catch supply chain by being discarded, incinerated or otherwise disposed of, and do not re-enter in any other utilisation (such as animal feed, industrial use, etc.), up to, and excluding, the retail level. Losses that occur during storage, transportation and processing, as well as imported products, are therefore all included. Loss includes the commodity as a whole with its inedible parts.' (FAO, 2019, p10).

'*Waste* occurs from retail to the final consumption/demand stages. However, waste is not included in the FLI.' (FAO, 2019, p10).

As Figure 1 demonstrates, food products, like other tradable products, move along a specific supply chain. Loss of food can be found at all stages of the supply chain. The FAO definition of 2019 includes only losses that occur during stages 1-3, because food waste will be calculated separately as the Food Waste Index by UN Environment Programme (UNEP).

Figure 1: Example of a Food Supply Chain.
Source: Urutyan (2013, p4.)

Consequently, food loss is not identified along the whole supply chain; this marks a significant difference from other studies on food loss. Thus, the findings of the FAO study are not comparable to the findings of other studies. Moreover, this definition is not in line with the methodology used to define the UN target, which has been based on the actual food loss estimation of 30 percent of world production. Consequently, the use of the proposed definition in the first place would have resulted in a significantly lower estimation of food loss and, thus, the UN might have established a different number for the SDG 12.3.

The FAO considers only those products that leave the farm gate, although some other researchers take into account the losses in the fields due to inefficient use of inputs for increasing plant and animal production. It is known, for example, that there is a huge variance across farms in yields where generally large farms have higher crop yields than small farms. Hence, it may make sense to include this potential additional production in the calculation of food loss.

In addition, the FAO definition looks at the commodity as a whole with its edible and inedible parts. This raises the question whether it makes sense to include inedible parts of the commodity in FLW computations. If we take a pig as an example, according to the definition, we should consider it as a whole and ignore the fact that some parts of the animal may be used to produce non-food products, such as soap, concrete, or paint. (Koester *et al.,* 2013).

Food diverted to other economic uses, such as animal feed, biofuel, charity, etc., is no longer considered as food loss (FAO, 2019), which is a reasonable change. Although such diversion usually leads to the loss of resources anyway, it is an important measure to reduce FLW worldwide.

Methodology of the FLI

The FAO developed the FLI to monitor food losses to help meet the target set by SDG 12.3. The Index is supposed to provide information about food losses on a global level for a set of key commodities from harvest until retail and measures trends in percentage losses over time compared to the base period of 2015. Consequently, the FAO intends that the numerical value of the Index should urge the countries to develop policies to reduce losses at the national level and keep tracking the trends (FAO, 2019).

Any index is based on metric variables and their development over time. For simplicity's sake, any index shows the development of a specific basket over time. If there is more than one specific item in the basket, those items are aggregated. The Index can be explained in the following form: quantities are aggregated into an overall percentage at a national level (FAO, 2019). Hence, the FLI – contrary to the definition of food loss – does not provide information about the *quantity* of food loss and waste. Instead, it calculates the *value*. However, the value of loss is not necessarily equal to a certain share of food production. Sometimes, it is cheaper for a farmer to leave some crops in the field than try to sell it. Or, the price of some lost/discarded products, like small potatoes or spoiled apples, will be understandably lower than the price of the total production.

The commodities' economic value of loss is calculated in international dollars, meaning that the average country price in local currency is converted into international dollars using Purchasing Power Parity (PPP). The calculations are based on the assumption that 'markets operate efficiently in valuing the commodities' importance'. The FLI is based on the food loss percentages (FLP) for each commodity in the basket. Percentage points instead of physical quantities allow one to observe long-term trends and avoid year-to-year fluctuations (FAO, 2019).

The FLI can be calculated by the following formula (FAO, 2019, p125):

$$FLI_{it} = \frac{\sum_j l_{ijt} \cdot (q_{ijt_0} \cdot p_{jt_0})}{\sum_j l_{it0} \cdot (q_{ijt_0} \cdot p_{jt_0})} \cdot 100 \qquad (1)$$

In this formula:
l means losses
i means a country
t means a current period
t_0 means a base period
j means a basket of commodities
$(q_{ijt_0} \cdot p_{jt_0})$ means the value of production.

The Index changes over time if the value of the loss at constant prices changes. To calculate the FLI, individual countries had to choose top ten commodities by economic value within five commodity groups. Loss measured in physical terms of each food item had to be collected for the base year and the following years. These quantities were valued with a derived farm-gate price for 2015 in the base year and the following years.

Consequently, we can find the following weak points of the FLI:

a) The FLI assumes that the implicitly used value of the individual quantities is equal to the economic value of the loss. That can only be true if the economic value of discarded product items was equal to the economic value of produce at the farm gate. This assumption does not reflect reality.
b) Products moving along the supply chain change their economic value because other products and services

are added to the raw product. Using farm-gate prices for evaluation underestimates the economic value.

c) The quality of the discarded products is likely lower than the average quality of the consumed products. Consequently, the economic value of the discarded product may be overestimated.
d) It is misleading to assume that the FLI informs on the expected benefit of instituted policy measures. Reducing food loss needs resources in most cases. There is a gain on one side but resource costs or avoiding costs on the other side. These avoiding costs differ significantly from product to product.
e) The FAO uses international prices in US dollars for aggregation of the loss which implies that national farm-gate prices are related to world market prices. However, some of the farm products are not tradable due to high trading costs (transaction, transport and insurance costs). Moreover, the national exchange rate is not as assumed the real shadow price of the domestic currency. Hence, the estimated figure for the aggregate used in setting up the FLI provides no help for policy makers to find out what induced changes in selected products and stages of the supply chain might lead to the highest benefit.

Aggregation

Aggregation is the issue common to all indices. However, we would like to discuss it more in detail in relation to FLI as it has a potential to provide highly misleading data. In economics it is widely agreed that products can be aggregated only if they are identical from an economic point of view, namely quality, time and location. However, the FLI aggregates very dissimilar commodities. For instance, what information do we really get when yearly losses of meat, fish and vegetables are aggregated in the same percentage number on a national, international, or a global level? Individual commodities may also drastically change along the food supply chain, like wheat, flour and cake. Even moving from one stage to another on a supply chain leads to different products. The FAO itself claims that countries should disaggregate the FLI up to sub-national levels, points of the value chain, and even economic sectors (FAO, 2018).

However, overall, the FAO report does not deal explicitly with this problem. It mentions that the loss of individual products along the supply chain is aggregated by using producer prices. Using this procedure implies that the quality of a specific product does not change along the supply chain and that as a result, the discarded food has the same quality as the food item used for human consumption. This implicit assumption is not realistic. The quality of the food changes along the supply chain. The food leaving the farm gate is in most cases not ready for consumption. Therefore, the discarded food is often of lower quality than the food which has left the farm.

The FAO uses the same procedure for aggregating the loss of different products across different countries: it takes national farm-gate prices and converts them to world-market prices. The national average loss valued with national prices is transformed into International Dollars using the exchange rate. It implicitly assumes that the actual exchange rate in 2015 was the same throughout the year. One world-market price is used for each specific food item. This procedure does not accurately inform policymakers how to design a specific policy for improving food supply since it is based on flawed assumptions.

Currently there is no method that will make aggregation meaningful. Hence, it does not make sense to define policy objectives that aim to decrease the overall food loss by a certain percentage. The FAO seems to implicitly accept this reasoning. It calls for 'the exact measurement of the problem targeted, as well as precise monitoring and evaluation of the interventions' in policy measures (FAO, 2019).

Quality of Data

Another important issue related to the FLI calculation is, as the FAO itself points out, the scarcity of available country data. Its proportion 'amounts to a mere 4 percent of observations. The remaining data cells ... are estimations' (FAO, 2018, p36). In order to compensate for the lack of information, the FAO uses a two-sided approach (FAO, 2019):

1. The FAO has introduced guidelines concerning cost-effective methods countries can use to estimate food losses along the supply chain.
2. The FAO uses model-based loss estimates where data are not available in the short term.

The model is based on three sets of information (FAO, 2019):

1. officially reported loss data;
2. information obtained through a literature review of food losses; and
3. a dataset of possible explanatory variables taken from various international databases (International Energy Agency, the World Bank, FAO, etc.).

Let us take a closer look at a quick example. As mentioned above, the model is based on officially reported data; a literature review of food losses; and a list of variables. If we look at the Russian Federation, the official data about FLW here is provided by the Russian Federal State Statistics Service (Rosstat). Rosstat calculates the numbers based on the food balance method, which results in approximations considerably below real numbers. The drawbacks of the existing methodology are widely acknowledged; however, a better methodology does not exist. The literature shows that Russia lacks a comprehensive analysis of FLW along the food supply chain or an extensive country report. The only paper that provided some preliminary percentages of FLW was based on research carried out in 2019 by the Skolkovo Consumer Market Development Centre. However, the percentages are fully based on expert interviews and may only provide approximations and not concrete data. Thus, the only possibility left to build the model are explanatory variables.

Judging by this example, we can infer that the FAO model is unable to provide necessary information about concrete causes of food loss in specific countries or specific food supply chains (FAO, 2019), meaning that currently it is almost impossible to propose any political measures based

upon the FLI. This also poses the question about the reliability of the Index itself. Certainly, when more countries start sending their food-loss-related information, the Index will become more accurate. However, currently the FLI may over- or underestimate the global food losses and thus cannot be used for policy decisions.

Policy Dimension

Purposes of the FLI

According to the FAO, the double purpose of the FLI is to monitor SDG Target 12.3 and to provide information for policy makers to create effective polices intended to reduce food loss and waste (FAO, 2018). In this section, we are going to take a closer look at whether the FLI meets these intended goals.

In order to outline the measures to reduce food loss, decision makers should carry out a cost/benefit analysis to make sure that the measures are economically sensible, identify all stakeholders and calculate the winners and losers of those measures.

The current global FLI states that 14 per cent of food is lost along the FSC between post-harvest and retail stages, excluding retail. This number aggregates various heterogeneous commodities without taking into account their economic value along the FSC. Moreover, it is based on scarce information and is mainly an estimation. Even when compared with the next years' FLI in the future, we will not be able to tell whether positive trends in some countries can outweigh negative trends in other countries, or even how those trends will be reflected in the aggregated Index. Again, the FLI does not provide any data concerning costs and benefits of food loss reduction, economic value of losses and opportunity costs. Thus, the FLI gives no information that will help to achieve the SDG Target 12.3.

Cattaneo *et al.* (2020) propose that the following questions should be answered to formulate a FLW-related policy:

- Do we know how much food is lost or wasted?
- What are the causes of FLW?
- What interventions are best suited to address FLW and how should we target them? Should policymakers focus on loss, waste or both?
- What is the rationale for public intervention? How ambitious should we be in setting reduction targets?
- Are there trade-offs and unintended consequences of reducing FLW?

The FLI does not provide specific data on any of these questions. The FAO discusses specific policy measures supposed to reduce food loss, like climate-friendly cold storage in Morocco, an innovative pricing technology in Spain, simplified legislation for food donations in the European Union and so on (FAO, 2019). These measures seem very reasonable. However, none of them use aggregated data as set up by the FAO. Hence, why do we really need the Index to propose a policy?

Furthermore, the Index does not tell us whether food losses are the result of a market failure or a policy failure. Consequently, disaggregation is needed to find out where changes in policies or human behaviour are required. The FAO calls for the exact measurement of the targeted problem, as well as precise monitoring and evaluation of the interventions. In the flagship report (FAO, 2019), FAO provides a number of specific case studies related to FLW reduction, and all of them were based on well-defined hotspots of specific supply chains. This information is crucial as in some cases the avoidance costs might be higher than the economic value of the saved food. Some food loss might be unavoidable, like some storage losses or spoiled vegetables in the field due to the weather conditions or to incorrect forecast demand. However, none of these variables are reflected in the Index.

The FLI does not make clear connections with the broader issues usually associated with FLW reduction, like the increase in efficiency of the food system, improvement of food security and nutrition and contribution towards environmental sustainability. The relations between FLW reduction and food security may be more complicated than it seems at first sight. For example, the greater observability of aflatoxin contamination of maize will lead to the removal of the unsafe food from the supply chain. While this will increase food safety, it may also result in more food losses (Cattaneo *et al.,* 2020).

The influence of the measures to reduce food loss on the environment depends on the specific situation as well. For example, failure to maintain a cold chain – one of the major causes of food losses – may place more pressure on other resources. For example, refrigerators installed in trucks at the transportation stage of the FSC demand much more gas or diesel for the same route, thereby imposing supplementary financial and environmental pressures. Such information may be crucial for shaping a specific policy; however, it is not provided by the Food Loss Index.

Policy implications

To our mind, the greatest problem with the Index is its aggregation of the data. There are no arguments in favour of aggregating various commodities in different countries and adding up the results in the form of the same percentage point. If we accept that different (in economic terms) products cannot be aggregated in a reasonable manner, then it will mean that the information from the FLI cannot be used as the basis for a rational policy decision. Even if the Index number changes on a year-by-year basis, the Index does not provide information about the causes of the change, and, thus, cannot be used for instituting a target-oriented policy decision.

The Index does not inform about the avoidance costs of FLW reduction either. In order to create targeted policies to reduce food loss, policy makers should first try to identify those spots in the FSC where policy measures would most likely lead to a positive economic benefit (avoidance costs are smaller than the benefit of having reduced the food loss). If this statement is accepted, the task of the government will be to improve the economic efficiency of the economy. Thus, data collection can be helpful to identify hot spots where policy intervention may lead to greater overall gains. Of course,

inefficiency in production of raw food must also be targeted in the search for hot spots.

At the same time, in order to create effective policies for food loss reduction, decision-makers should know the overall costs and risks associated with reducing FLW. This statement is even supported by the FAO: 'Reducing food loss and waste generally entails costs, and suppliers and consumers will only undertake the necessary efforts if these are outweighed by the benefits.' (FAO, 2019, p17). Hence, the Index can only contribute to policy making if it informs about both the economic value of the losses and the economic value of the costs. It is obvious that both – the loss and the avoidance costs – have to be measured in the same metric. Moreover, as food losses are tightly connected to scarce resources, it is especially important to take into account the waste of those resources in other areas of the economy. In this case, the solution seems to be to identify specific spots of the supply chain where policymakers can contribute to resource savings (FAO, 2019).

The Index does not reflect the quality of the products along the FSC, as volume-based measures tend to ignore most of the services involved in delivering food to consumers, prices on different stages of the FSC, production costs or opportunity costs (Koester, 2020). The scarcity of information is another important issue, which leads to excessive estimations in the Index. Furthermore, the Index does not inform us whether food loss reduction will lead to a more efficient use of resources or whether more food will be available as a result.

The recommendation we have is to continue research about FLW along the FSC and collect as much detailed and disaggregated information as possible. This concerns all stakeholders from governmental organisations, to business, academia, NGOs etc. There are still whole regions where the FLW issue has not yet been taken into account, and consequently, there is no available data on food losses and waste from those parts of the world. However, calls for action should not be based on estimations only, as rigorous research and data collection will enable us to discover specific country-related issues. Consequently, we suggest – totally in line with the FAO – that policymaking on FLW reduction should be as specific and precise as possible. In this view, it is also important to remember that some food losses are unavoidable or make sense, as food loss reduction, in some cases, may demand more resources and cost more than the existing food losses.

Acknowledgement

The authors thank Eugenia V. Serova for her very helpful comments as well as the two reviewers who helped to improve the quality of the article.

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