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Sustainability Assessment of Food Waste Prevention

Miss. Tasnim J. Malbari[1] and Miss. Ayesha Z. Takey[2]
Department of Chemistry
Anjuman Islam Janjira Degree College of Science, Murud-Janjira, Raigad[1,2]

Abstract:*The last few years, a lot of measures addressing food waste have been proposed and implemented. Recent literature reviews call for more evidence on the effectiveness or food waste reduction potential of these measures. Furthermore, very few information is available on the extent to which food waste measures have been evaluated based on their economic, environmental and social performance. This review closes this knowledge gap by looking at the methodologies currently used in literature to evaluate food waste prevention measures, using a pre-defined assessment framework with quantitative evaluation criteria. In total, evaluations were examined for 25 implemented measures with measured outcomes and 23 proposed measures with projected outcomes. The paper concludes that there is a great variety in how an evaluation is performed. Additionally, in many cases, economic, environmental, or social assessments are incomplete or missing, and efficiency is only seldom calculated. This is particularly true for implemented measures whereas proposed measures with projected outcomes tend to have a more thorough evaluation. This hampers practitioners and decision-makers to see which measures have worked in the past, and which ones to prioritize in the future.*

Keywords: Food Waste, Prevention, Measures, Evaluation, Performance, Effectiveness, Efficiency, Sustainability, etc.

I. INTRODUCTION

Food losses and wastes are generated throughout the food chain, from cultivation, over harvest, processing, storage and distribution up until the final consumption by private households and the food service sector. In 2011, the FAO provided a comprehensive overview of the amount of food losses and waste generated at global level. Globally, about 1.3 billion tons of edible food, or about one third of the mass of edible food produced for human consumption, is annually lost or wasted.

Based on the 2011 Food Balance Sheets, the FAO estimates that the annual global volume of food wastage generated has a carbon footprint of 3.6 Gt of CO2 eq (excluding land use change). If food wastage were a country, it would be the third largest emitter in the world.

In order to reduce or prevent food waste, many measures have been put forward of which a great deal of them has been implemented. To know which measures, provide the best opportunities and what actions are the most promising, a thorough evaluation of food waste interventions is needed.

For businesses, applying food waste prevention measures only makes sense if there is an economic incentive to do so. As preventing food waste comes at a cost, actors along the food chain could be expected to only implement a certain measure if the benefits resulting from saving food gone wasted outweigh the costs associated with the implementation of the measure.

II. METHODOLOGY

Food Waste Definition and Categorization of Food Waste Measures.

The definition of food waste used within this paper follows the definition proposed by the European FUSIONS project: “Food waste is any food, and inedible parts of food, removed from the food supply chain to be

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recovered or disposed (including composted, crops plowed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)".
The food supply chain hereby consists of a "connected series of activities used to produce, process, distribute and consume food," starting with raw materials and products ready for harvest or slaughter.
Thus, including those products that are in the end not harvested/slaughtered and for example left on the field.
Using this definition, food (or inedible parts of food) that is removed from the food supply chain and sent to animal feed, bio-material processing or other industrial uses is not considered as "food waste," but as "valorization and conversion."

Measures Preventing Food from becoming Food Waste

Category 1:

Avoidance measures aimed at reduction of food surplus at source, such as avoiding food overproduction and avoiding purchasing more than what is needed;

Category 2:

Redistribution or donation measures such as redirecting food surplus to people in need;

Category 3:

Valorization or conversion of food and inedible parts of food removed from the food supply chain, such as redirecting food waste to the bio-based industry or to animal feed;

Measures Managing Food Waste:

Category 4:

Recycling (anaerobic digestion or composting) and recovery (energy recovery) of food and inedible parts of food removed from the food supply chain in order to avoid landfilling.

III. LITERATURE REVIEW

The literature search was conducted the methodology used for the literature search is based on the rapid review approach as a less time-consuming alternative to a systematic review. The search and subsequent analysis followed a three-step approach Step 1 aimed at collecting measures dealing with food waste throughout the food chain, in order to get an insight in the measures that have been proposed in literature. In total, the search resulted in a collection of 88 sources (academic and gray literature) listing in total over 200 food waste prevention measures, with the majority of sources proposing or describing more than one measure. All found sources (with the exception of two studies) were published after 2010.
The search narrowed the sources to those studies or reports containing an evaluation of implemented or proposed measures to prevent food waste. In total, 39 sources were retained containing some sort of evaluation of one single measure or of combined measures. Combined measures hereby refer to measures applied and evaluated simultaneously or grouped into for example a voluntary agreement or a large-scale campaign.
During the process, the methodologies and criteria used for evaluating food waste measures were put against a predefined framework for evaluating measures.
The assessment done hereby focussed on the methodologies used in literature, rather than on identifying the best performing measure. Additionally, no attempt was made to evaluate the measures ourselves; only readily available information on the performance of the food waste measures was collected. The evaluation assessment itself comprised looking at the extent to which each of the evaluation criteria was taken into account.

IV. RESULT AND DISCUSSION

A wide range of measures was found, covering the various players and actors along the food chain from primary production, over storage and processing, retail and wholesale to private consumers and OoH consumption. To deal with the multitude of measures and/or descriptions of measures found, measures were organized and grouped based on the main theme or aspect the measures focus on. The "Food service - Portion sizes and side

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dishes" group.The literature search resulted in a list of 48 measures for which an evaluation could be found, out of the 48 (combined) measures, 25 refer to implemented single and combined measures.

The other 23 cases concern single interventions that have been proposed but have not necessarily been implemented and for which the evaluation data refers to projected (not measured) food waste reductions, complemented with foreseen (not measured) environmental, economic, and social impacts where applicable.

V. CONCLUSION

The evaluation criteria considered in the present paper are limited to quantitative criteria such as effectiveness, sustainability across three dimensions, and efficiency. Both effectiveness and sustainability across three dimensions are also taken up in the JRC reporting template for evaluating food waste prevention measures under the overarching heading of the evaluation criterion "efficiency".

It is not clear if specific efficiency calculations as considered within the context of the present paper are also to be reported within the JRC reporting template. The JRC template further includes the additional aspect of "outreach impact" as one of the sub-criteria for assessing efficiency of measures.

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