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1S1a Models and tools for estimating circularity of alternative food and agricultural systems

Navigating food waste utilization options to support a circular bioeconomy – A systematic review of existing decision support tools and frameworks

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Food loss and waste (FLW) represents a significant loss of resources and economic opportunity. Globally, it's estimated that more than one third of all food produced for human consumption is wasted. In the U.S., most of the food waste ends up in landfills, contributing to 14.1% of the country's greenhouse gas emissions (GHGs); and approximately 8% of the global GHGs are due to the FLW. Even though several biological FLW diversion cycles exist, it is challenging to determine the most appropriate pathway for a given context with optimal economic, environmental, and societal advantages. Economies of scale and cost-benefit analyses are available in the literature. However, there is still a need for a focused discussion and detailed analysis around the broader cost-benefit and sustainability analysis of waste utilization systems within the context of circular economy. Thus, the objectives of this study were to: 1) identify various food waste utilization pathways that could support a more circular bioeconomy, 2) evaluate existing decision support tools and/or frameworks with which food waste utilization could be optimized in terms of economic, environmental and/or social impacts, and 3) identify existing gaps and areas of need to improve decision making regarding food waste utilization. A systematic review was carried out using the Web of Science, Scopus, and Google Scholar databases. Initial search terms included: food waste, food loss, food loss and waste, bioeconomy, landfill, utilization, upcycl*, compost*, anaerobic digestion, fermentation. Reference lists were screened by food waste utilization categories and final products. A second screening was carried out to identify studies related to comparisons of food waste utilization pathways and or decision support tools including systematic reviews, life-cycle costing, life-cycle assessments, and system level modeling studies. The identified works were evaluated in terms of their scope, technological application, spatial and temporal variability, management systems. The results of this study will guide researchers, policymakers, and industry stakeholders to identify and close gaps in the assessment of viable food loss and waste utilization strategies.

Keywords: food lost and waste; utilization; circular economy; bioeconomy