

# Environmental benefits of prevention and valorization strategies applied for surplus bread at retail in Sweden

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## Abstract

The estimated annual food waste at the retail level is 13 kg per capita (Environment 2021) in high-income countries. In Sweden, this translates to roughly 89 000 tonnes at retail level, of which around 15% is surplus bread (Hultén et al. 2024). Influenced by market competition and consumer demands, retailers prioritize keeping shelves well-stocked with a diverse array of products. Meanwhile, many retailers acknowledge that they are faced with a trade-off situation between the high availability of products and the environmental, social, and financial burdens related to food waste (Rosenlund et al. 2020; Riesenegger & Hübner 2022). Research suggests that retailers can play a vital role in food waste reduction, due to their unique opportunity to influence the prevention and valorization of waste at all stages of the food supply chain (Brancoli et al. 2019). This study focuses on the supplier-retailer interface of the bread supply chain in Sweden. In this context, the take-back agreement (TBA) is a common practice. This agreement holds the bakeries responsible for forecasting, ordering, delivering and placing products at retail level (Brancoli et al. 2020), while also being financially responsible for managing the surplus bread. This study aimed to map and quantify the surplus pathways for bread in Sweden, and from that assess the environmental impact of different prevention and valorization strategies. Material flow analysis (MFA) was used to map the different pathways, and life cycle assessment (LCA) was used to model and assess the impact of strategies fostering prevention and reduction. The base case scenario featuring the current TBA system was found to infer a 6% loss rate of bread at bakery level alongside an additional 9% loss at retail, of which the majority is directed towards the lower levels in the food waste hierarchy. This scenario was then compared with the environmental consequences of modifying or removing TBAs, which in turn allowed for alternative

business scenarios that were previously limited by TBA. Input data was collected through stakeholder dialogues in combination with company information accessible through interviews and environmental reports. Our main result illustrates the magnitude and surplus pathways of surplus bread in Sweden, addressing how and under what conditions, different prevention and valorization strategies can enable high-value recovery while maintaining feasibility and environmental benefits. Two of the most favorable scenarios were found to be the sharing of data among the supplier-retailer interface, alongside transferring retail ownership of surplus bread to retailers. The main results can be used as support by stakeholders and policymakers on how to prioritize different strategies, to provide actors with a clear view of the options they have, and the related benefits.

**Keywords:** Surplus bread, Food waste management, Life cycle assessment (LCA), Circular business models, Resource recovery.

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