

Material Flow Analysis in The Agri-Food Sector: Evidence from The Italian Beef Supply System

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Abstract

The Italian meat industry, accounting for more than 15% of the domestic agri-food value, represents a core business for the national economy, but requires huge amounts of natural resources and generates different typologies of waste. Indeed, as a part of the Farm to Fork Strategy, the European Commission aims to halve food waste by proposing legally binding targets by 2023 within circular models. The study proposes the Material Flow Analysis (MFA) methodology as a tool to measure and qualify resource and waste flows in the Italian beef system in each stage of the food supply chain, from agricultural to final consumption stage. In detail, MFA is applied to the entire Italian sector of beef (one-third of national slaughtered animals) consumed as packaged fresh product in 2020, during the Covid-19 pandemic. To collect data, bottom-up and top-down mixed approach are applied. Subsequently, MFA results are used to calculate the wastage-related losses in terms of embedded natural resources. The aim of the paper is to investigate how the beef industry can be enhanced through responsible production, acquisition, consumption and disposition, and how waste management can be effectively addressed and developed. In particular, the authors attempt to: (a) better understand the Italian beef supply chain metabolism, highlighting hidden and/or virtual material flows associated to the entire beef supply system; (b) promote households' education, suggesting awareness campaigns toward agri-food resilience and sustainability. In 2020, it results that the Italian meat industry slaughtered more than 1.15 Mt of bovine to produce approximately 0.29 Mt of fresh meat, 0.69 Mt of by-products and over 0.015 Mt of food waste at households, while 0.15 Mt of beef meat are destined to catering services and food industry (out-of-boundaries). In terms of hidden natural resources, it emerged that over 94 billion m³ of water, approximately 101,000 TJ of energy and over 11,500 t of PET and PE trays are required to sustain the beef system. This research is one of the few studies proposing MFA methodology as a tool to assess hidden resources and waste flows in the agri-food sector. This analysis shows its utility in terms of natural resources and waste quantitative evaluation, hidden flows accounting, and development of new educational strategies toward food waste minimization and sustainability.

Keywords: beef industry, material flow analysis, waste management