

Abstract

Assessment of Eco-Efficiency in Galician Dairy Farms with a Focus on the Production of High Value-Added Products Such as Ice Cream [†]

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The food sector is responsible for approximately 25% of global greenhouse gas (GHG) emissions, with dairy production playing a significant role. As the global population approaches 10 billion by 2050, agricultural land is expected to expand by over 950 million hectares, intensifying environmental pressures. While sustainability efforts have primarily focused on the primary production stage, the industrial processing phase, particularly for high value-added products like ice cream, remains underexplored.

This study proposes an innovative methodology to assess eco-efficiency in the dairy value chain, focusing on the transformation of milk into ice cream. By combining Material Flow Analysis with Network Data Envelopment Analysis, the approach enables a holistic evaluation of both environmental and economic performance, identifying farms with strong transformation potential.

The analysis emphasizes standardization based on critical quality parameters, specifically protein and fat content, to determine their influence on the environmental and economic performance of ice cream production. While previous research has centered on the livestock phase, highlighting factors such as feed and animal welfare through tools like the Water–Energy–Food nexus and Life Cycle Assessment, this study extends the analysis to the industrial stage.

Expected outcomes include a comprehensive diagnosis of farm-level eco-efficiency, enabling the identification of optimal production profiles even at the individual animal level. The methodology will help reduce emissions and resource use, optimize farm profitability, and pinpoint key levers for improvement in feeding strategies, waste management, and input efficiency.

This dual environmental–economic perspective is essential to support the transition toward a more sustainable and competitive dairy sector, in line with circular economy principles.

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