

Importance of the end market

The impact of a product depends on where it is sold and consumed

One of the actions of the UN Food System Summit is to equip consumers and policymakers to make robust, evidence based choices. Life Cycle Assessment (LCA) is an important tool for providing evidence for sustainable, healthy diets, which is widely used to estimate the environmental impact and eco-efficiency of foods. The impact of farming and processing food is widely understood, but the role of end-market has not received attention, despite being the apex of the food system. This research was conducted as a part of VALUMICS project and evaluated the impact of end market on the eco-efficiency of butter, beef steak and salmon fillets produced in Europe.

Context: what is new in our research

There is great variation in the way LCA of food products is conducted, despite being governed by an International Standard (ISO 14040:2006) and a number of topic specific guidelines (known as ‘product category rules’). Relatively few studies have been published for the whole life cycle of a food chain (Figure 1).

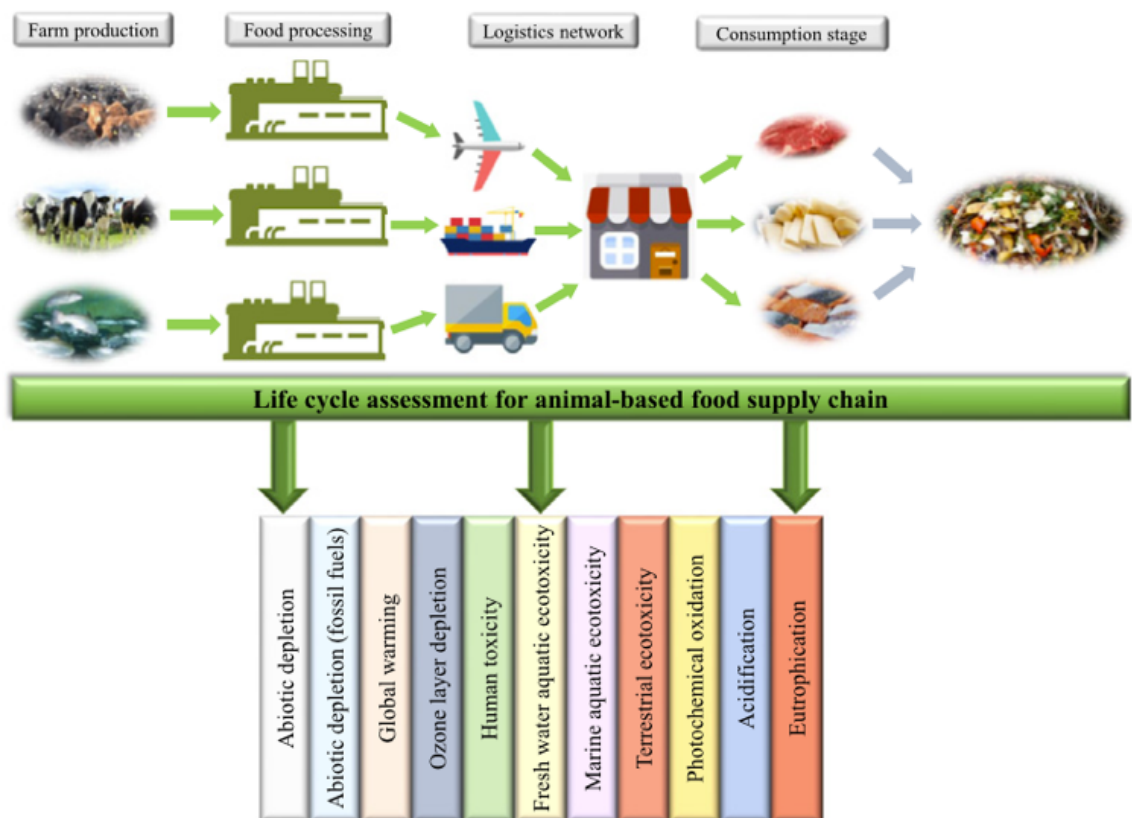


Figure 1. Schematic of the system model used. Three different markets were used at the consumption stage for each product.

Most have focused on production (farming) or manufacture (processing). An ‘average system’ is usually modelled, perhaps focusing on particular farms or factories. Dairy, meat and fish

products produced in Ireland and Norway are typically destined for export, so this research asked the question, does market matter when calculating the eco-efficiency of a food product? Irish butter was chosen because it is a processed consumer product (not an ingredient) with large domestic, European and international markets. Irish beef steak was chosen because it is a premium consumer product with little secondary processing, popular in export markets. Norwegian salmon fillets were chosen because Norway dominates the international market with this lightly processed salmon product. Each product was modelled from production to consumption and waste disposal, assuming three markets: domestic, European and International.

Markets: where does the food go?

Based on international trade data and market reports, the most important markets for each product were identified, along with transport requirements for supplying fresh product and likely wastage based on consumer surveys from each country:

Market impacts the supply chain

Market determines how the product is transported and used, including need for airfreight and the amount that is likely to be wasted.

National Markets

Irish Butter

Ireland
Truck
10% consumption waste

Irish Beef Steak

Ireland
Truck
6% consumption waste

Norwegian Salmon Fillet

Norway
Truck
7% consumption waste

European Markets

Irish Butter

Germany
Near shore shipping
8% consumption waste

Irish Beef Steak

United Kingdom
Near shore shipping
6% consumption waste

Norwegian Salmon Fillet

Denmark
Near shore shipping
7% consumption waste

International Markets

Irish Butter

Japan
Airfreighted
1% consumption waste

Irish Beef Steak

United States of America
Airfreighted
13% consumption waste

Norwegian Salmon Fillet

China
Airfreighted
7% consumption waste

Findings

Similar patterns were seen for all three food chains. Butter is used here to illustrate some of the key findings (Figure 2).

Impact of food waste reduction

Reducing the percentage wasted food will drive an important reduction in all impacts.

- A. Food waste in the end-market can have a discernable impact. Compare 10% waste in Ireland vs. 1% in Japan. Consumer behavior in the end market matters.
- B. Domestic and European markets can effectively be treated as similar. The influence of near short shipping and truck transport is similar.
- C. Airfreighting significantly changes the relative contribution of impact. The farm represents around 80% of impact for butter supplied to the domestic market, similar for the European market, but as low as 10% for some impacts for the global market.

Time critical supply of fresh product by airfreighting has a significant influence on the impact hotspots.

Impact of airfreighting

Airfreighting fresh product globally drives impact.

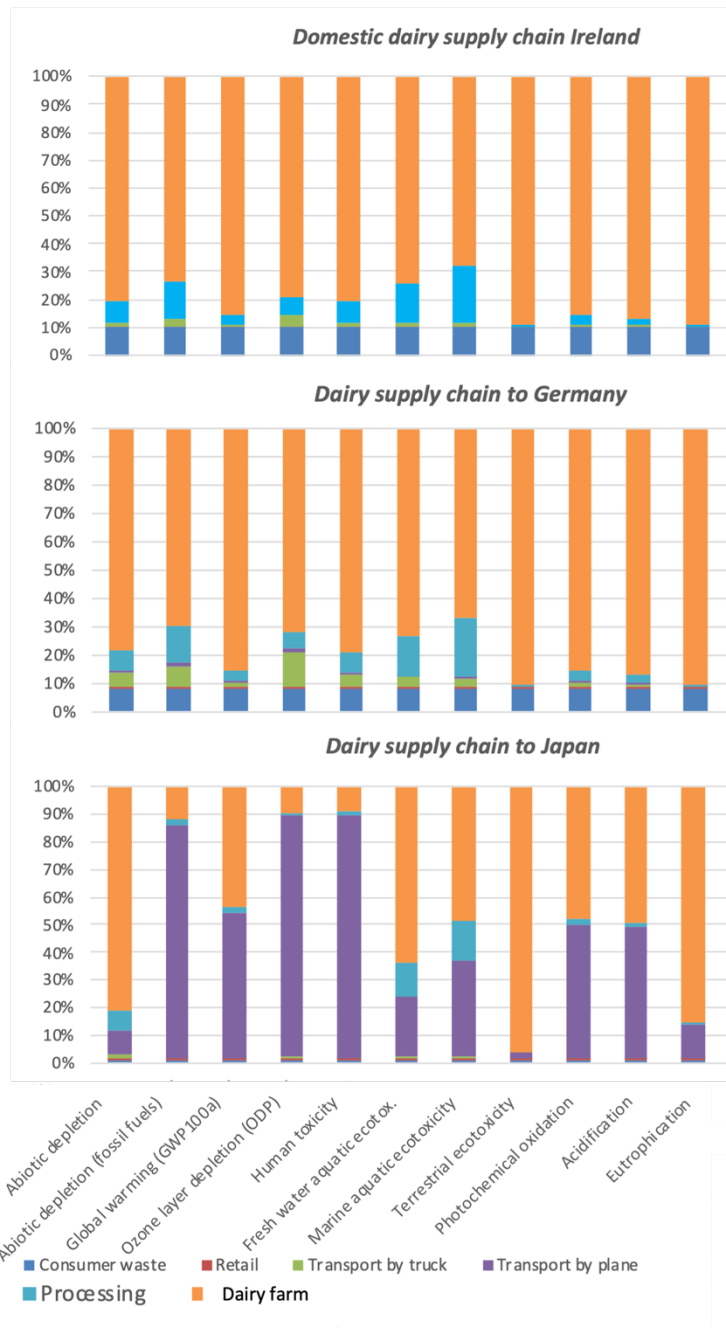


Figure 2 Change in impact distribution for 11 impact categories for different markets for Irish Butter.

Policy needs

The luxury of serving global markets by airfreighting fresh food needs policy attention.

Policy is needed to reduce wasted food.

Concluding remarks

The idea of encouraging consumers to buy sustainable, healthy food as part of a sustainable, healthy diet underpins the thinking behind the UN Food Systems Summit and recent research encouraging changes in diets.

Our research makes an important contribution to this discussion that policymakers need to be aware of. Assuming butter, beef steak and salmon fillets have the same impact, regardless of where they are consumed is untenable.

Studies that have focused on production of foods, processing of food and even full system assessment of foods can lead to poor policy if the impact of end market is not recognized. End market causes two important drivers of difference in eco-efficiency: rate of wasted food and type of transport.

The farm remains the greatest impact hotspot, but for some impact categories (e.g., abiotic depletion, ozone layer depletion and human toxicity), airfreighting can become the dominant hotspot.

The type of transport and distance matters for fresh food products. The luxury of being able to serve global markets comes with a high impact cost across almost all impact categories (terrestrial ecotoxicity is the least influenced).

All markets should be introducing policy and incentives to reduce wasted food to the minimum possible. The Japanese market shows that 1% waste is possible. All markets should be aiming for this level of waste in order to reduce the impact of the food system. Valorizing food waste cannot offset the impact of creating it in the first place (Oldfield et al., 2016).

Key sources for further information

This brief presents results from analysis reported in VALUMICS Deliverable D4.4 and published papers from the VALUMICS partners at University College Dublin, SINTEF Ocean and University of Iceland.

To discuss the research presented in this brief, please email Nick.Holden@ucd.ie

Deliverable report citations:

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Published scientific papers and articles:

Chen, W., Jafarzadeh, S., Thakur, M., Olafsdóttir, G., Mehta, S., Bogason, S., Holden, N.M. (2021). **Environmental impacts of animal-based food supply chains with market characteristics**. *Science of the Total Environment*, 782, 147077. <https://doi.org/10.1016/j.scitotenv.2021.147077>

Oldfield, T., White, E., Holden, N.M. (2016). **An environmental analysis of options for utilizing wasted food and food residue**. *Journal of Environmental Management*, 183, 826-835. [DOI:10.1016/j.jenvman.2016.09.035](https://doi.org/10.1016/j.jenvman.2016.09.035)

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