



TOTAL UTILIZATION OF RAW MATERIALS IN FOOD SUPPLY CHAINS

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Circular Economy in the food industry

Preserving the value of resources (raw materials, water and energy) that go into producing food and drink products for as long as possible

Source: FoodDrinkEurope



Prevention



Resource efficiency



Environmental performance

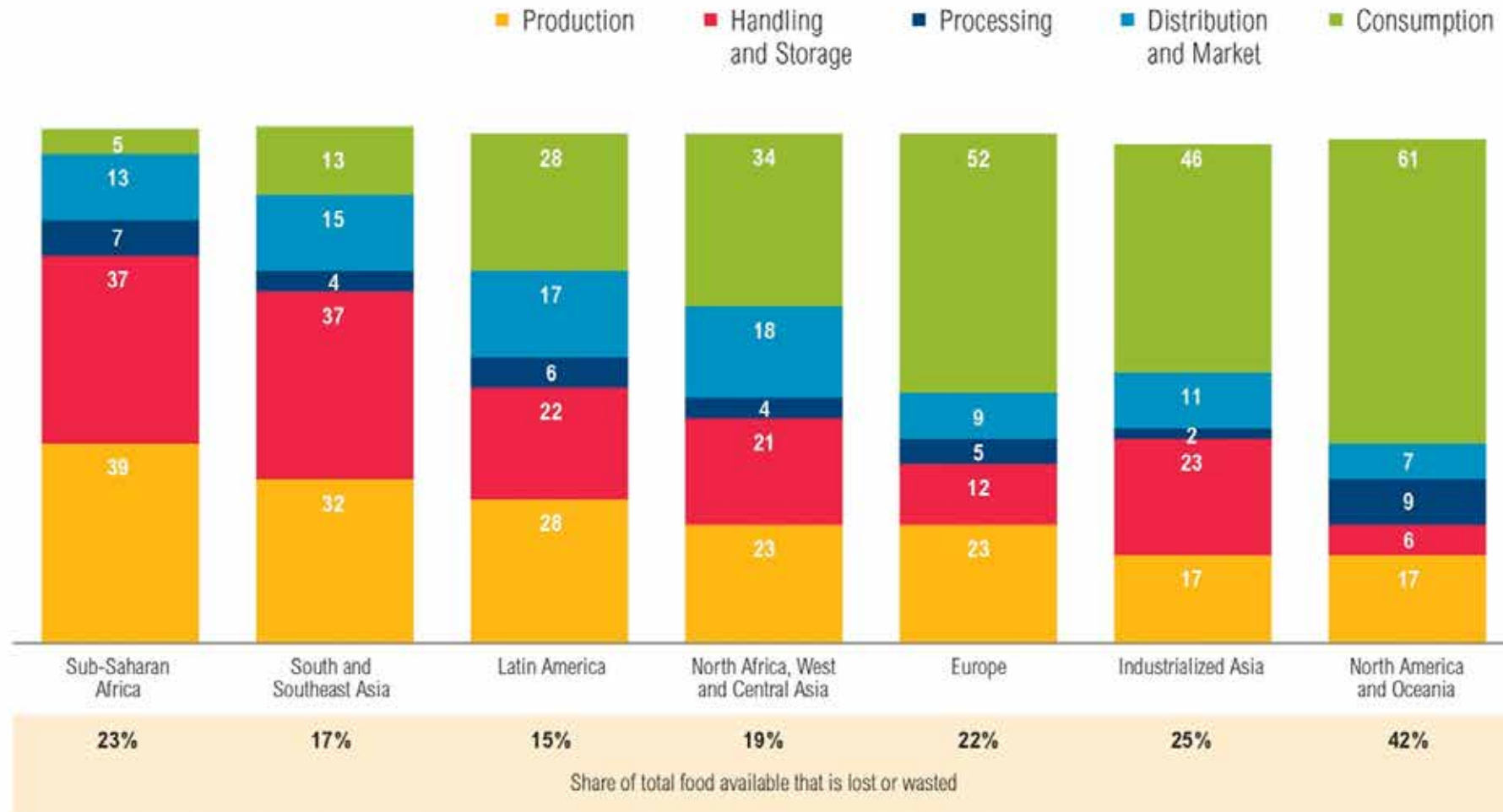


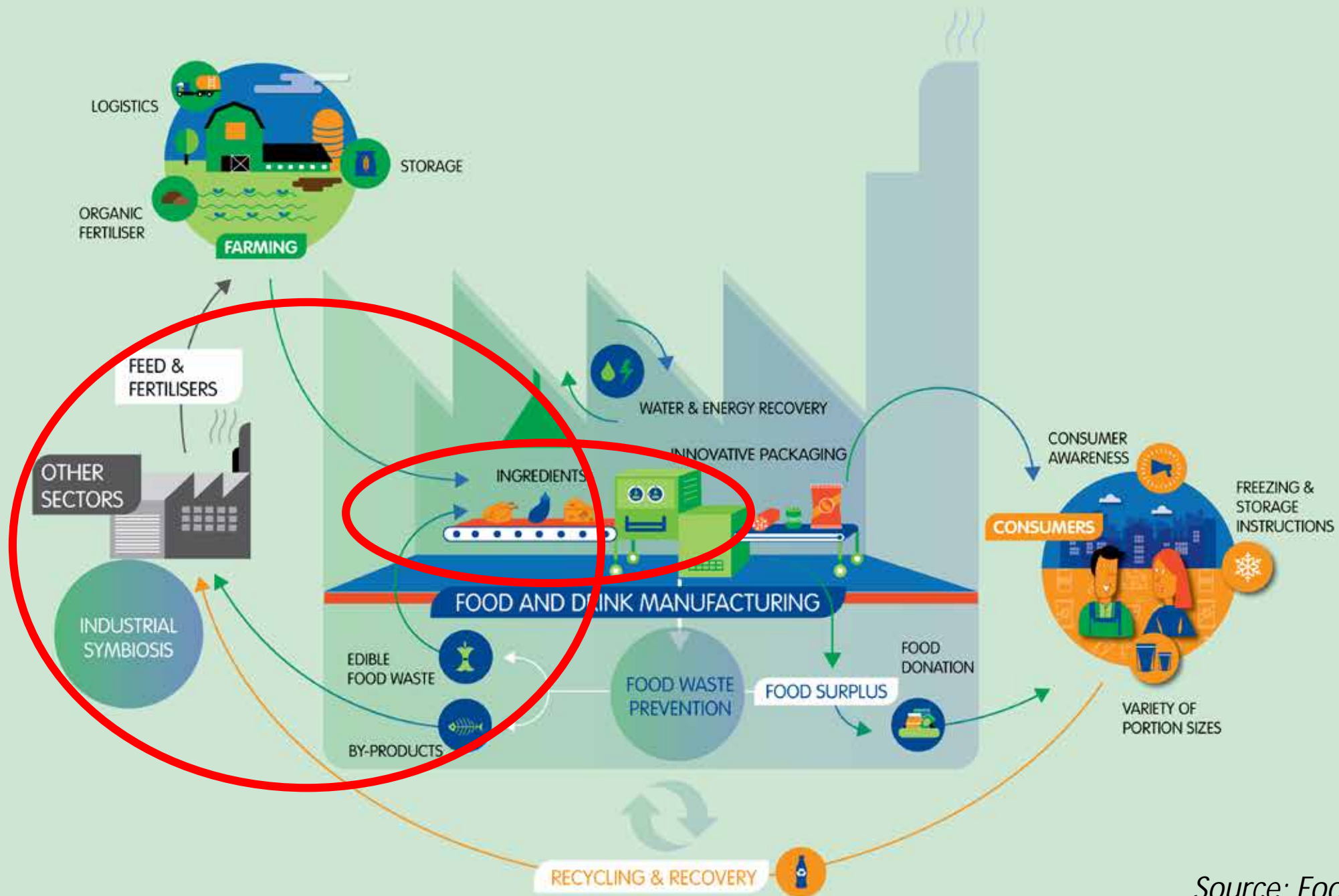
Sustainable sourcing



Consumer awareness

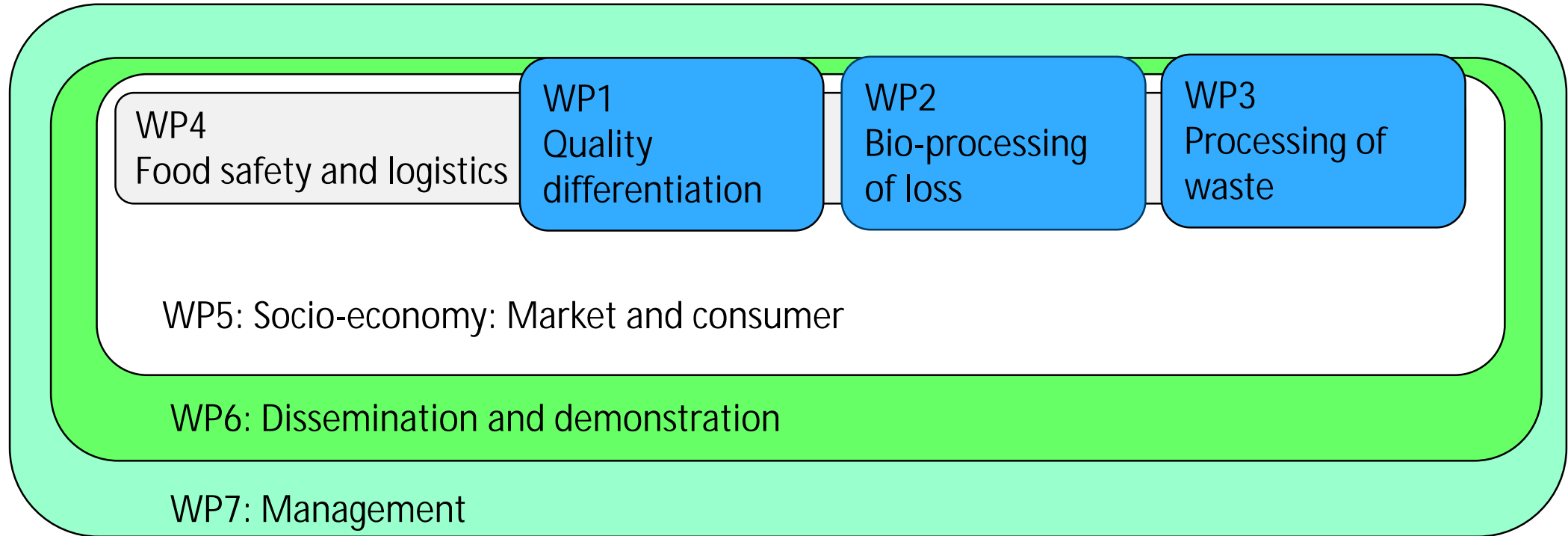
Global food loss and waste along the supply chain





Source: FoodDrinkEurope

CYCLE: Total utilization of raw materials in food supply chains





Chicken feathers for protein

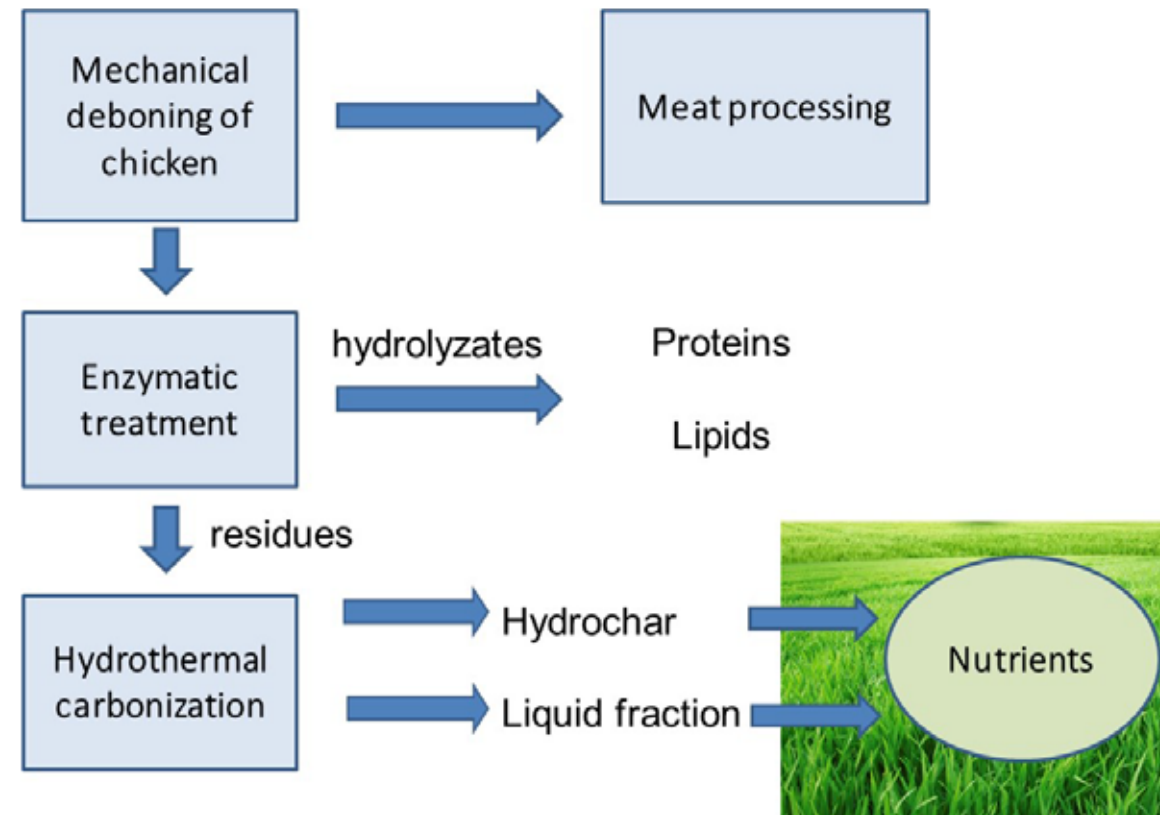
- Poultry feathers are poorly utilized due to low digestibility of the protein
- Developed gentle hydrolysis methods to produce feather meal with high digestibility and low losses of valuable amino acids as a feed ingredient for fish
- Sodium Sulphite treatment combined with pressure cooking gives high digestibility and low losses of valuable amino acids



Chicken feathers hydrolyzed with NaOH (upper row) or Na₂SO₃ (bottom row) after separation into liquid (left) and residual fraction (right).

Hydrothermal carbonization of poultry by-products

- By-products from mechanical deboning of chicken contain Phosphorus, which is one of the critical raw materials in EU
- Hydrothermal carbonization enables processing of industrial by-products into fertilizer/soil amendment products
- Results demonstrate that HTC can be used to process by-products from poultry industry



Eggshells for liming and nutrition

- Eggshells have a good liming effect, and also contain valuable macro- and micronutrients
- Recent feeding trials with minks conducted by Norilia revealed better uptake of calcium from eggshells than from normal lime
- Norwegian companies are considering how eggshells can best be used as a feed ingredient or as an ingredient for garden soils



Fish rest raw materials into protein and oil

Pelagic

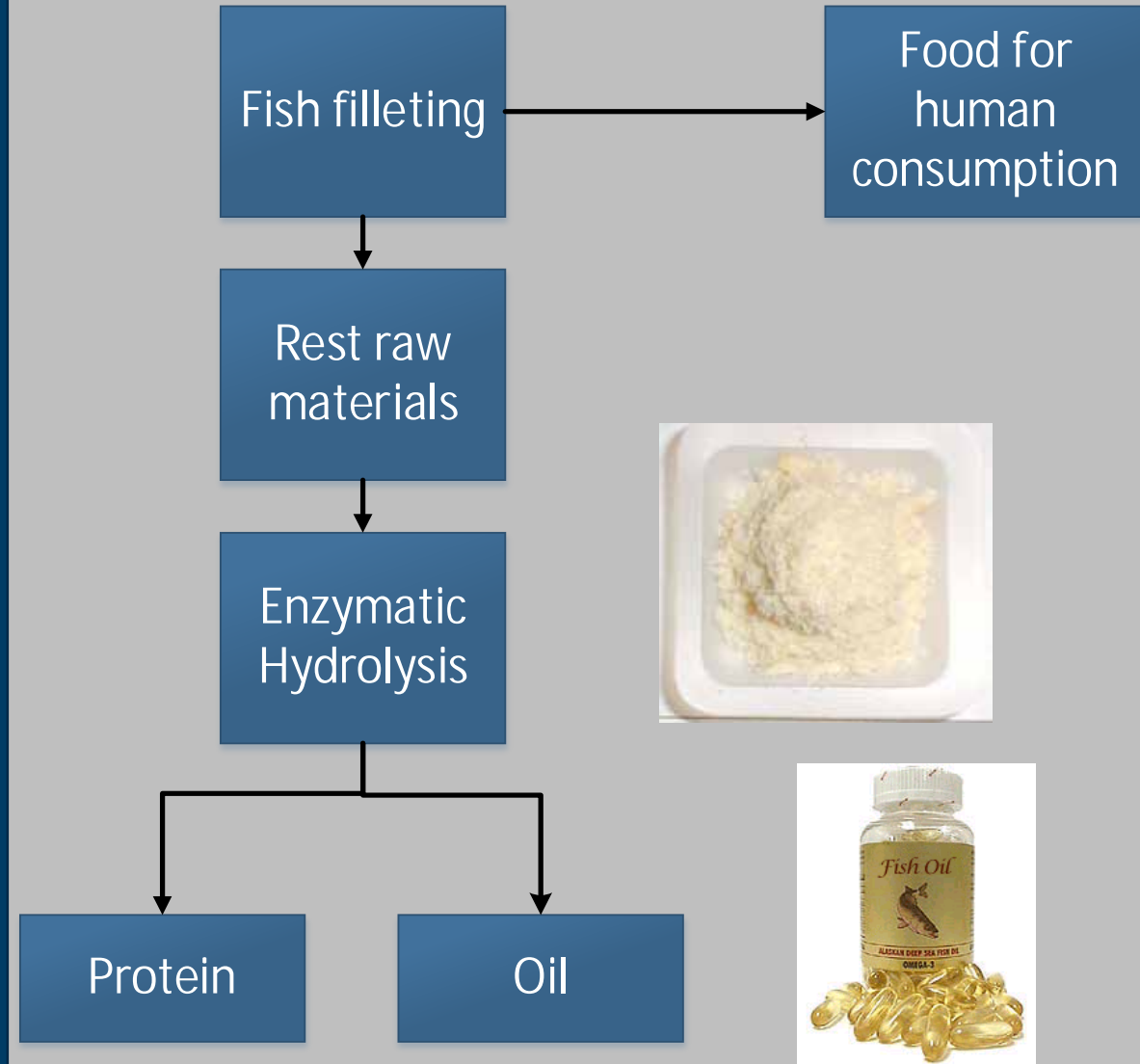
Aquaculture

Whitefish

100 %
utilization

91 %
utilization

48 %
utilization



Potential in the rest raw material



Whitefish rest raw materials
314 000 ton
(2015)



15 700 ton lipids



~ 31 million people could get their daily recommended intake (250 mg EPA + DHA) for a whole year



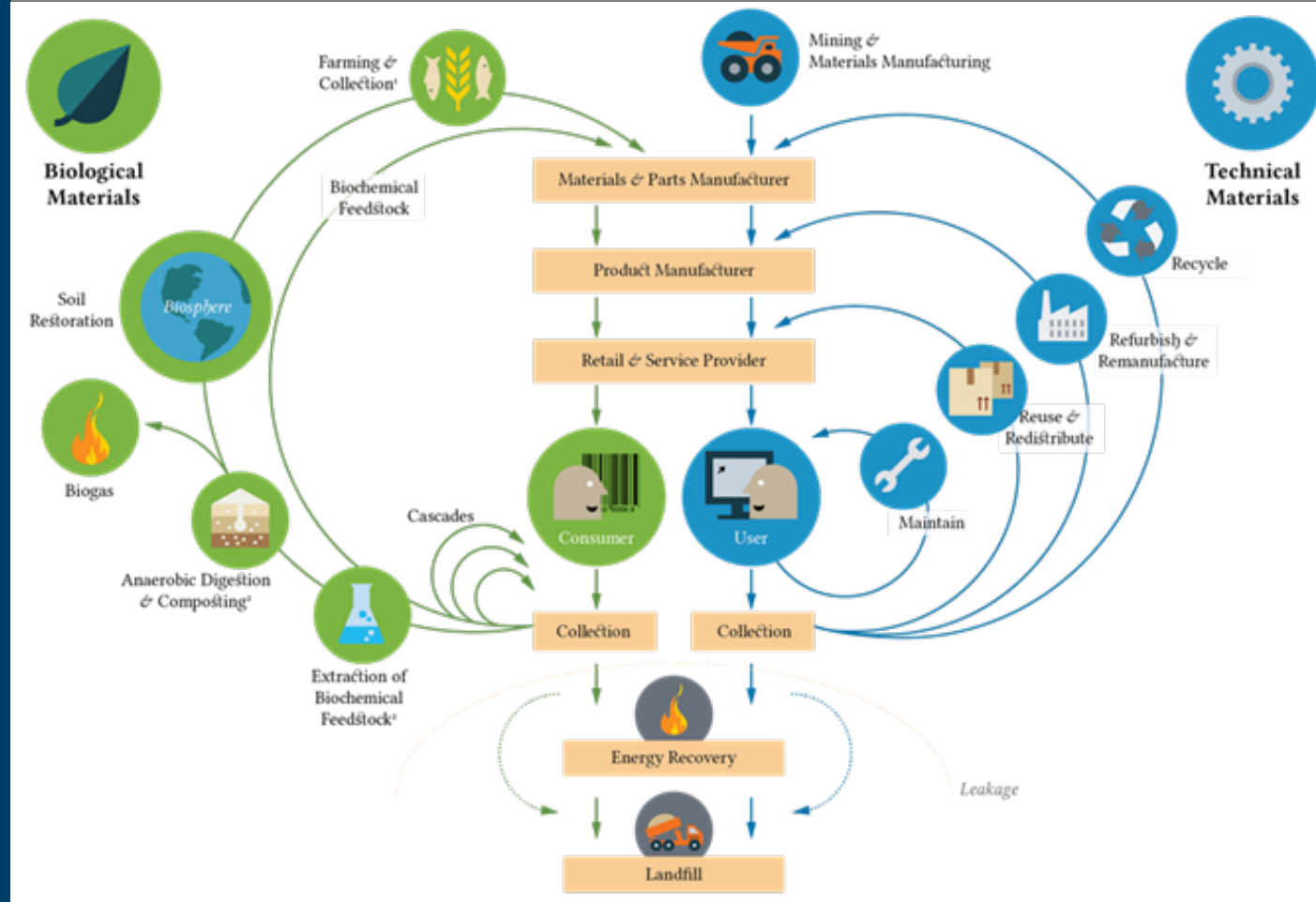
44 000 ton protein



~ 1.7 million people could get their daily requirement of proteins for a whole year

Circular Bioeconomy

- **REDUCE** losses in production and processing and waste in retail and consumption
- **REUSE** rest raw materials into value added products
- **RECYCLE** waste that cannot be avoided



Source: Ellen MacArthur Foundation

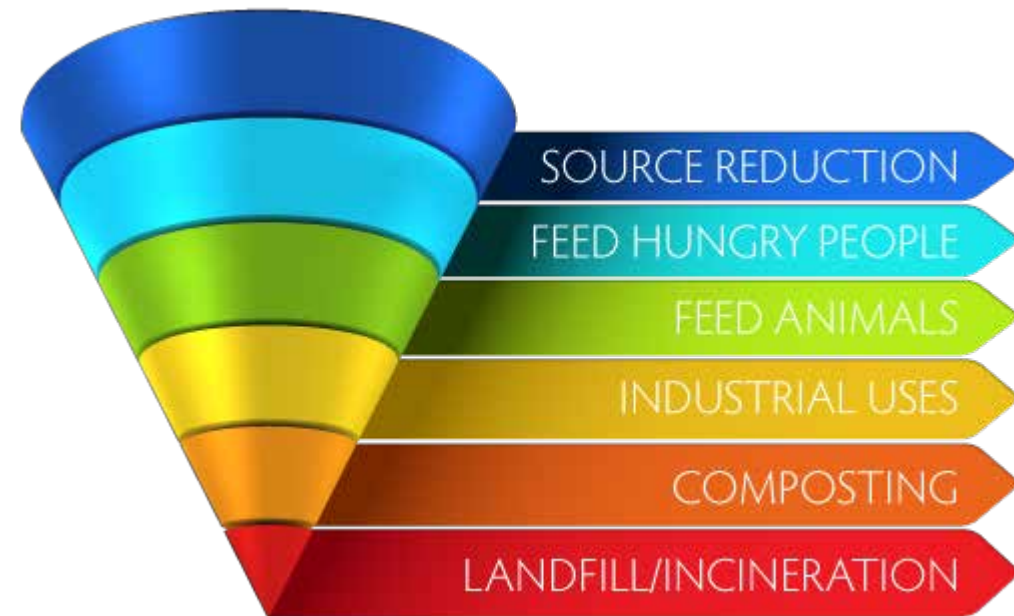
Thank you for your attention!

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Source: Food Waste Reduction Alliance



Technology for a better society