

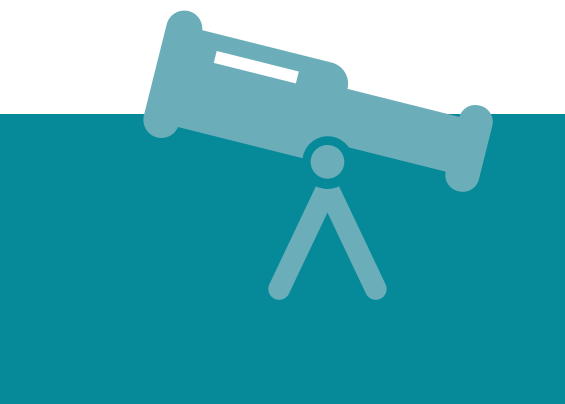
# Demands for temperature indicators suitable for mainstream consumer food packaging

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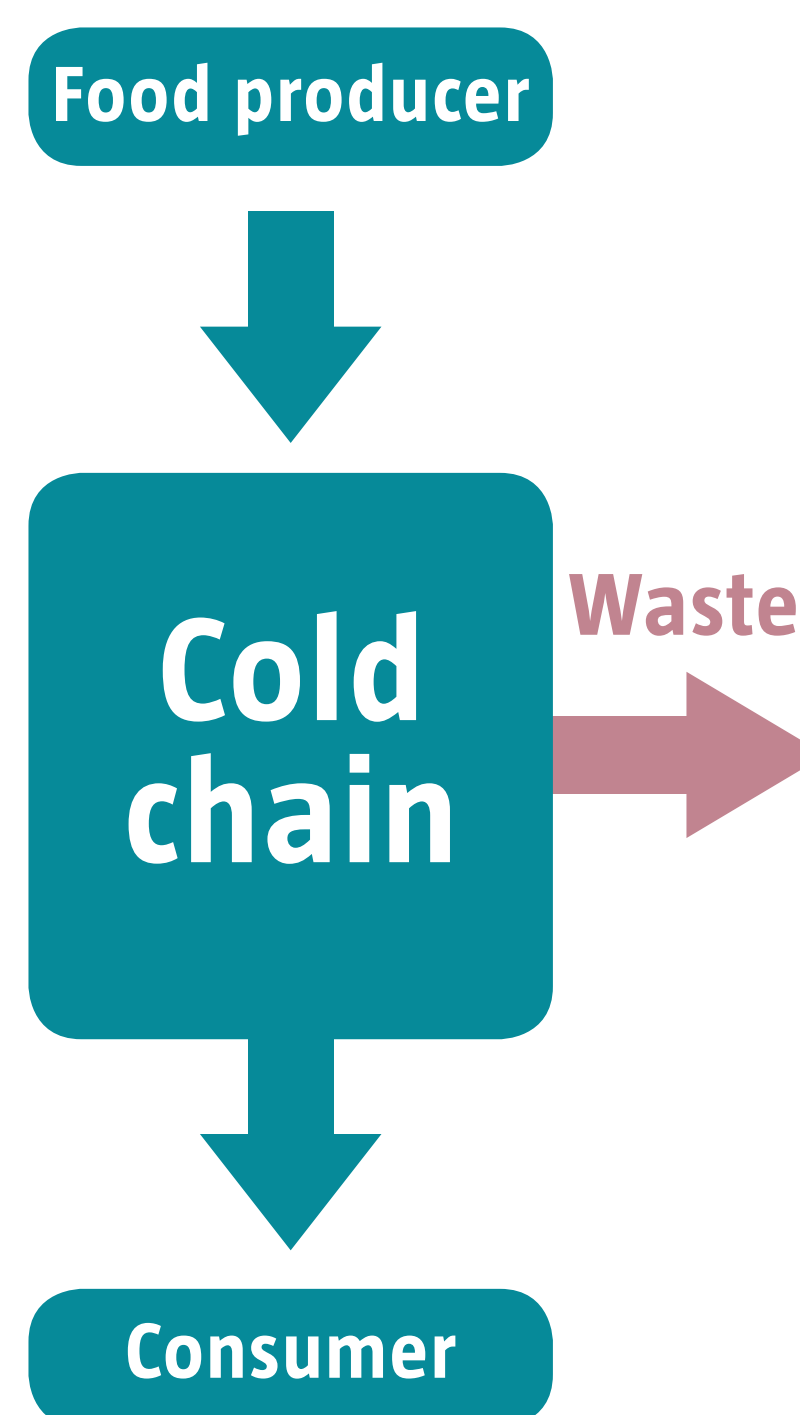


Cold chain protects the temperature sensitive products from spoilage and deterioration. Currently, the air temperature in storing rooms is maintained and controlled, but the temperature interrupts also called "temperature excursions" occurs during transfer between these rooms. While this occurs outside the cold chain, the temperature control and its history are commonly lost.

**60%** of food enters the cold chain.

**1/4** of this food is wasted, mostly due to temperature mistakes in the chain.

Food waste is responsible for environmental, economic and social consequences.



## Commodity goods in the dairy segment

- low-priced products,
- very large quantities,
- opportunity for printed functionalities.

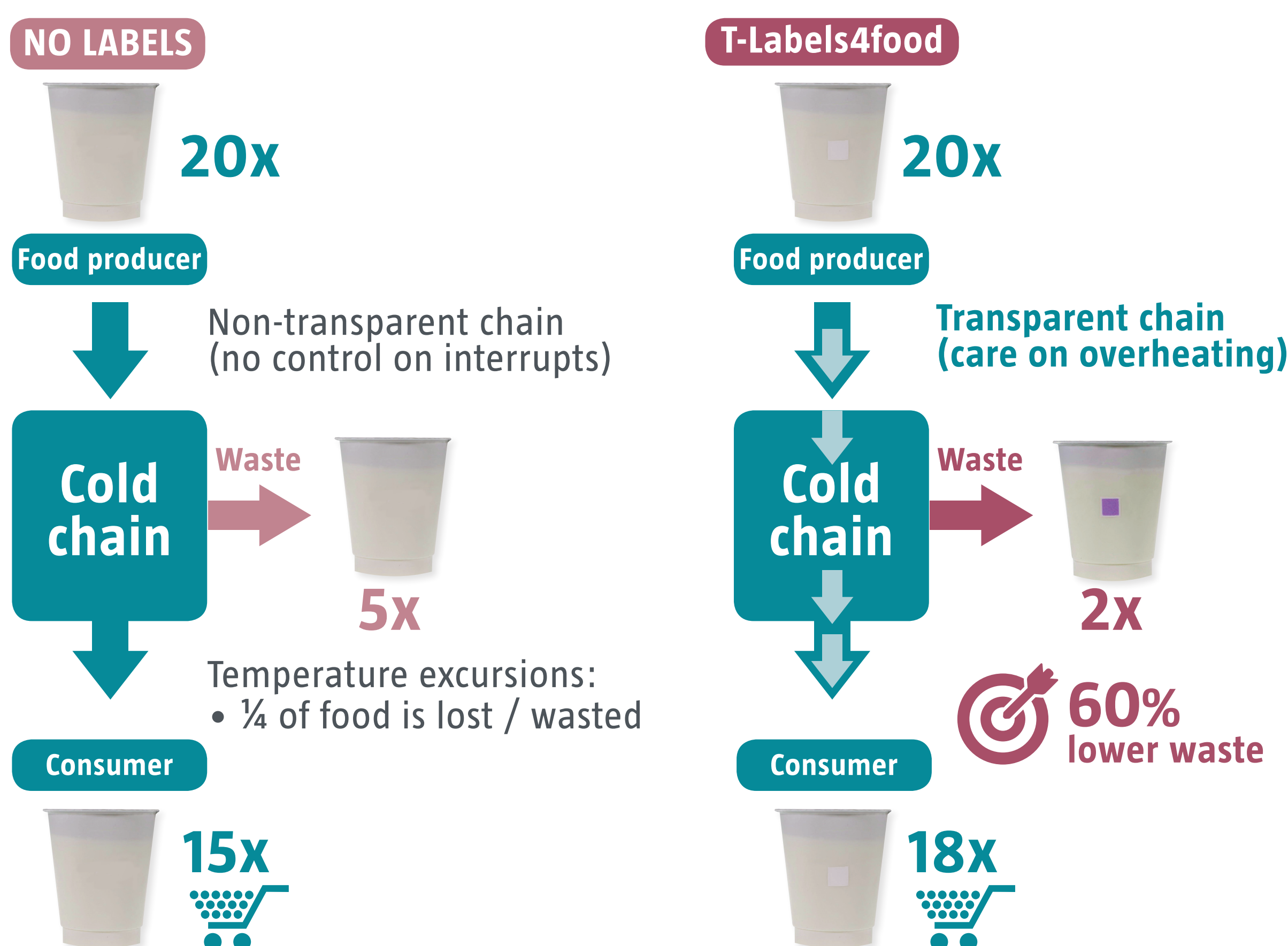
## The price increase of the new functionality should be justified with:

- healthier food, higher quality of food,
- building up trust and loyalty of consumers,
- less food waste,
- a higher level of sustainability of the cold chain.



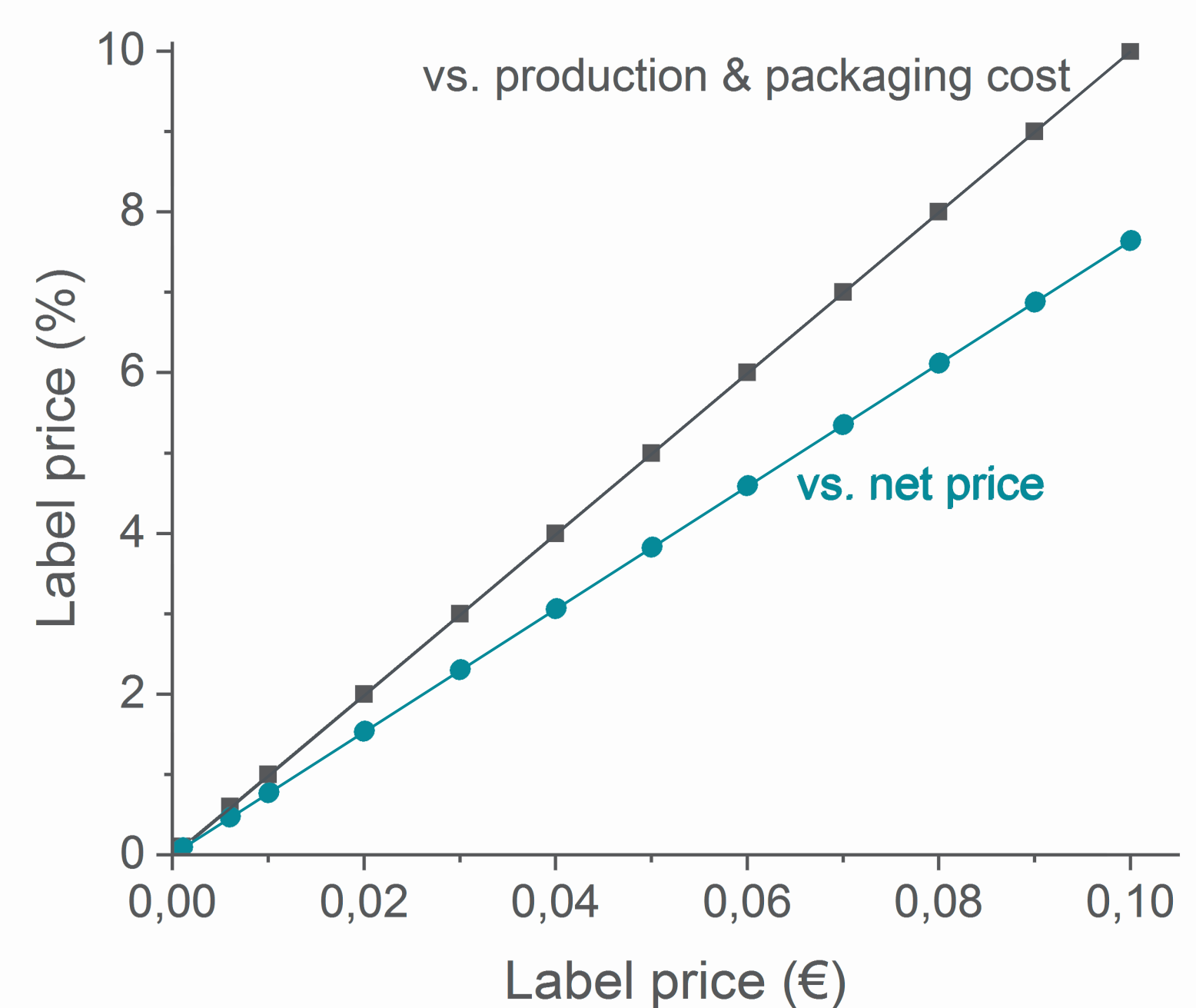
Monitoring the temperature of each individual product is an opportunity for intelligent packaging.

## PRINTED TEMPERATURE-SENSITIVE COLOUR CHANGING INDICATORS



## Barriers & threads

- **cost** - the added value must cover the cost of implementation;
- **suitable thermal properties:** different activation temperatures (food storage temperatures);
- **thin and flexible labels**
- **freedom-of-design, different size and shape**
- **environmental issues:**
  - acceptable for non-food contact side of packaging (but must be in good thermal contact with food),
  - fully recyclable with packagin.



Calculation is based on average data for dairy sector in Slovenia

- **2 million** inhabitants
- **3 major** manufacturers of dairy products
- lot of very many small producers
- over **10 million pieces** of yogurt/year

