Framework for waste prevention and valorisation

The case of bread waste in Sweden

Pedro Brancoli

Senior Lecturer

pedro.brancoli@hb.se

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THE FOOD SYSTEM

Impact of agriculture

- N, P biogeochemical flows
- Biosphere integrity
- Climate change

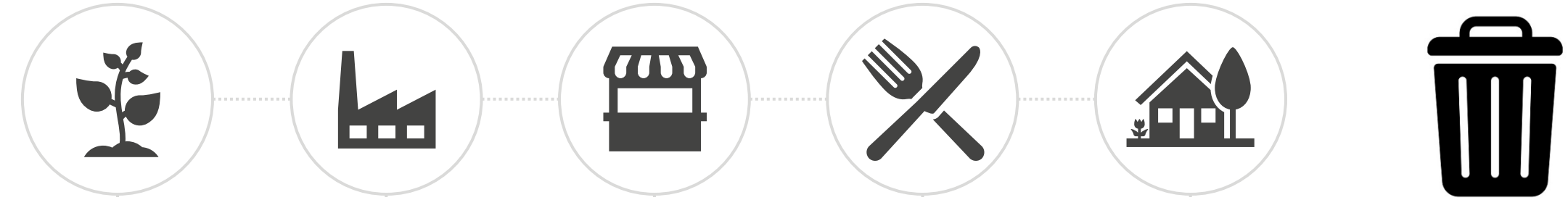
FAO estimates 35% - 50% increase to feed a growing population reaching 9.8 billion people by 2050

THE FOOD WASTE PROBLEM

SWEDEN
1 308 000 tonnes per year
133 kg per person per year

14% FOOD LOSS

17% FOOD WASTE



Agricultural production

Processing and manufacturing

Wholesale and retail

Food services

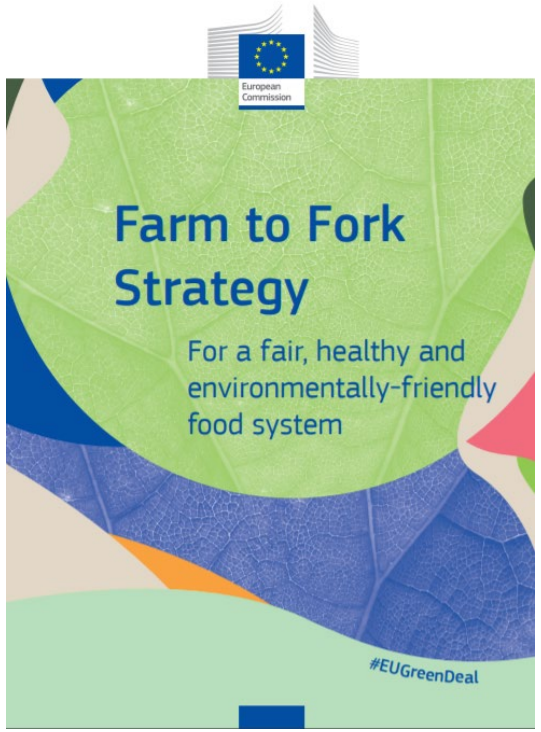
Households

THE FOOD WASTE PROBLEM

Agenda 2030

TARGET 12.3

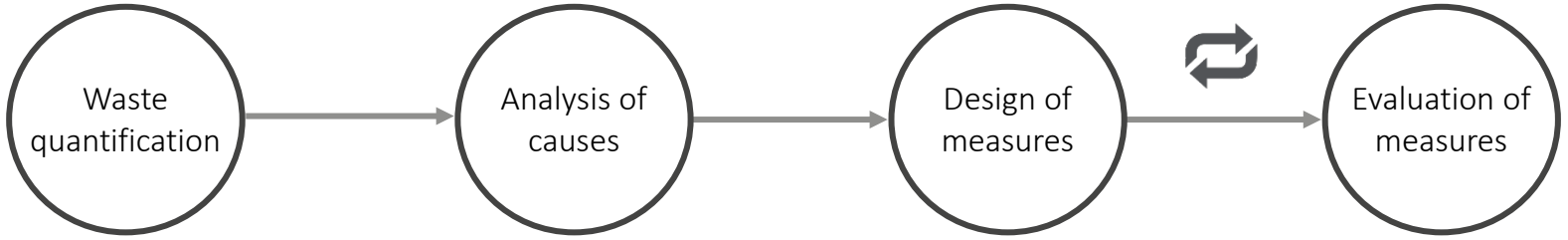
By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses



RESEARCH GOAL

– Development and evaluation of food waste prevention and valorisation measures

RESEARCH FRAMEWORK



Food waste prevention and valorisation

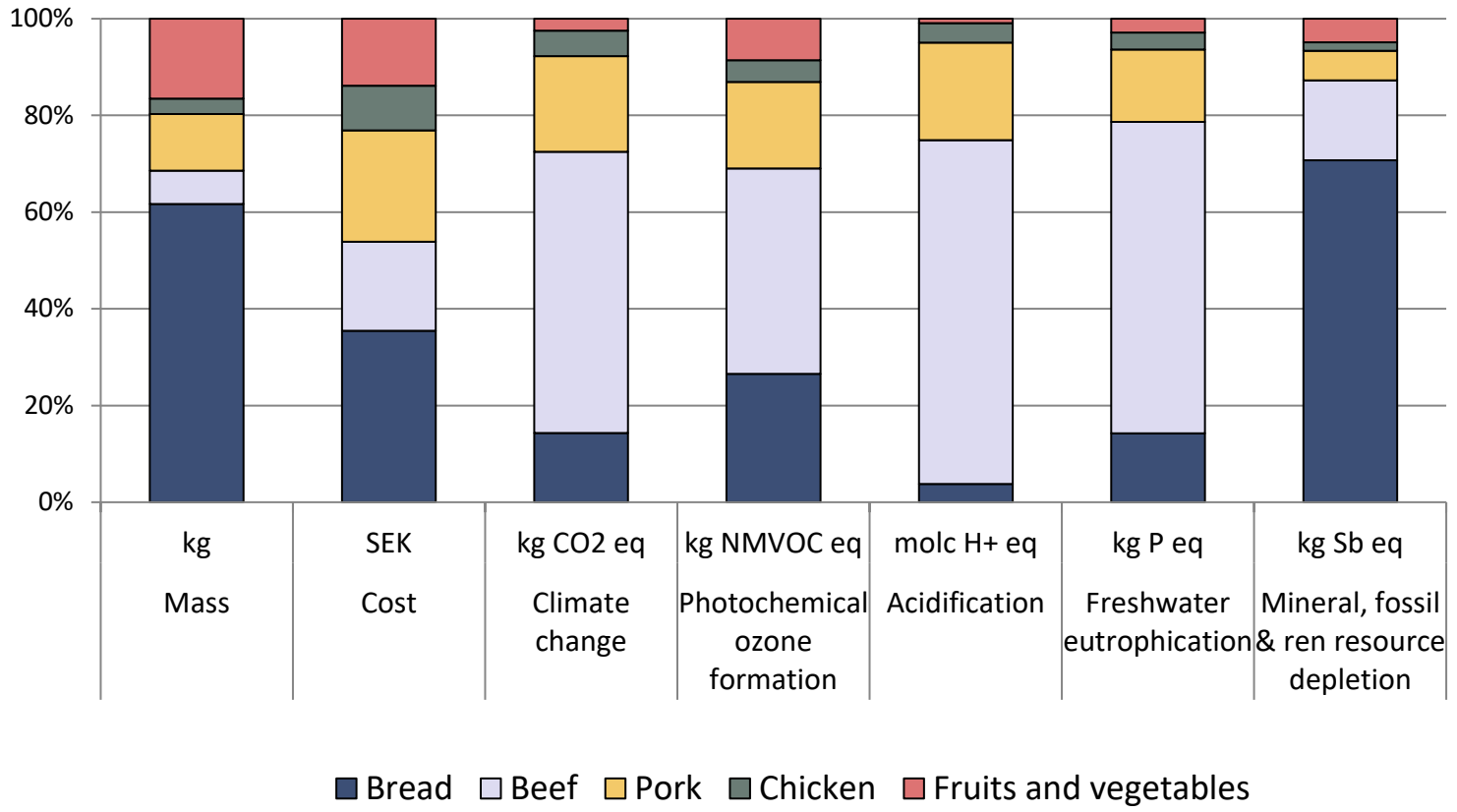
Waste quantification
LCA

Statistical analysis

LCA

FOOD WASTE QUANTIFICATION IN RETAIL

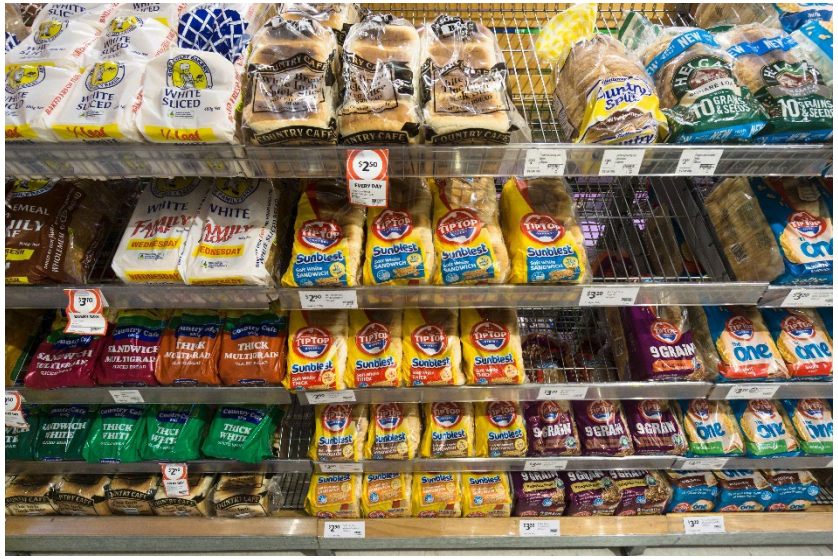
- Identification of hotspots and products with high potential for prevention
- Defining and prioritizing prevention and valorization efforts
- Support improvements in economic efficiency and environmental sustainability.



THE SWEDISH BREAD SUPPLY CHAIN

BREAD CATEGORIES

PRE-PACKAGED BREAD



BAKE-OFF PRODUCTS

THE SWEDISH BREAD SUPPLY CHAIN

TBA for pre-packaged bread

Bakeries are mainly responsible for:

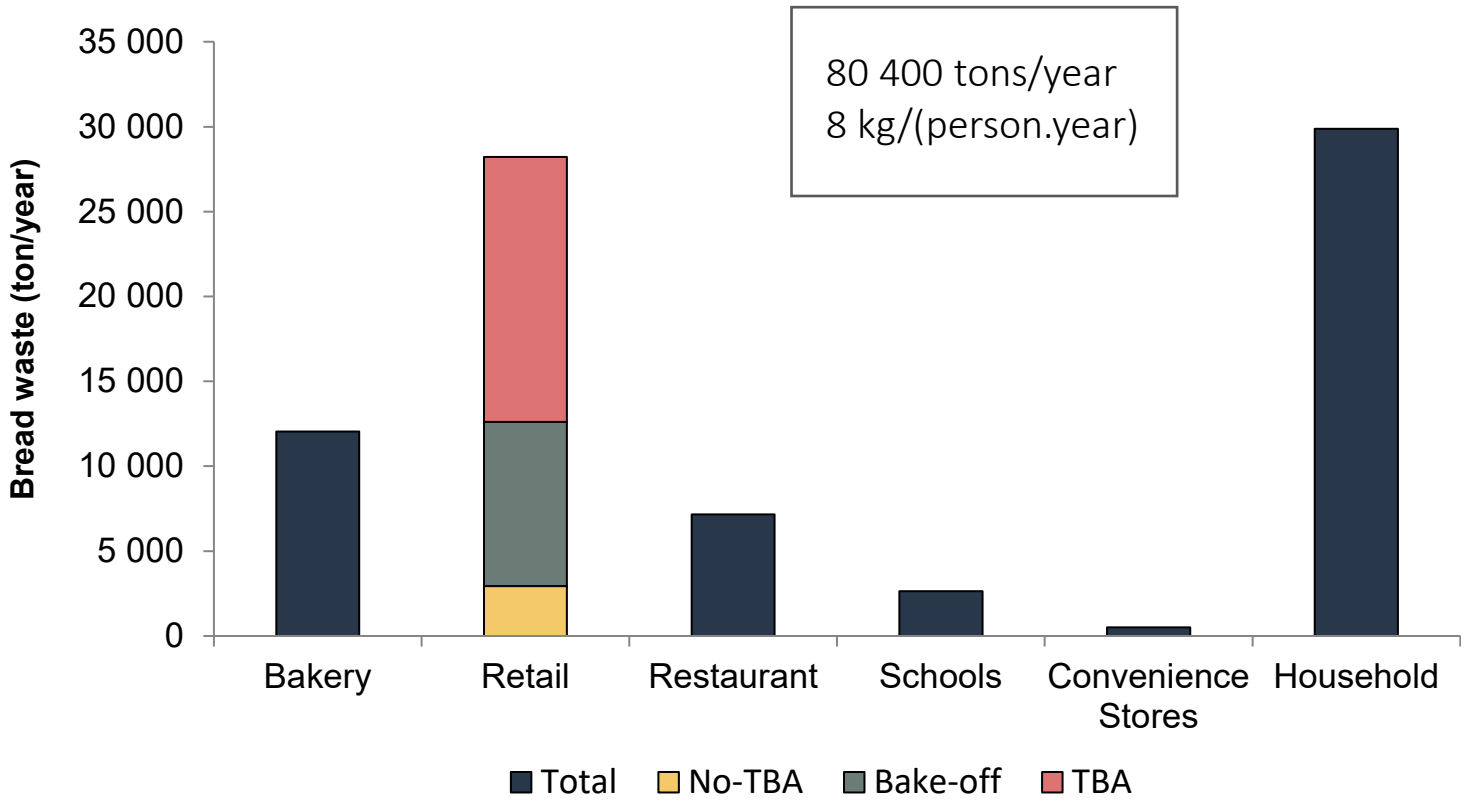
- Ordering activities
  - Forecasting, transportation, product placement
- Financially responsible for unsold products
- Collection of unsold products
- End of life
  - Prevention, valorisation or waste management

BREAD SURPLUS QUANTIFICATION

Quantification at macro level

- To propose and prioritise prevention and valorisation measures

Data for risk factors indicators



RISK FACTORS FOR PRE-PACKAGED BREAD WASTE

Low coefficients of determination for loss rates and

- sales
- shelf life
- package size

Significant differences in loss rates at product level for TBA and no TBA products

- 19% TBA products
- 13% no TBA products

TBAs

- Low incentives to retailers to reduce waste
- Pressure to keep shelves full
- Inaccurate forecasting
- Last-in first-out scheme
- Hinder promotions
- Distribution routes

THE SWEDISH BREAD SUPPLY CHAIN

TBA model

Bakeries are mainly responsible for:

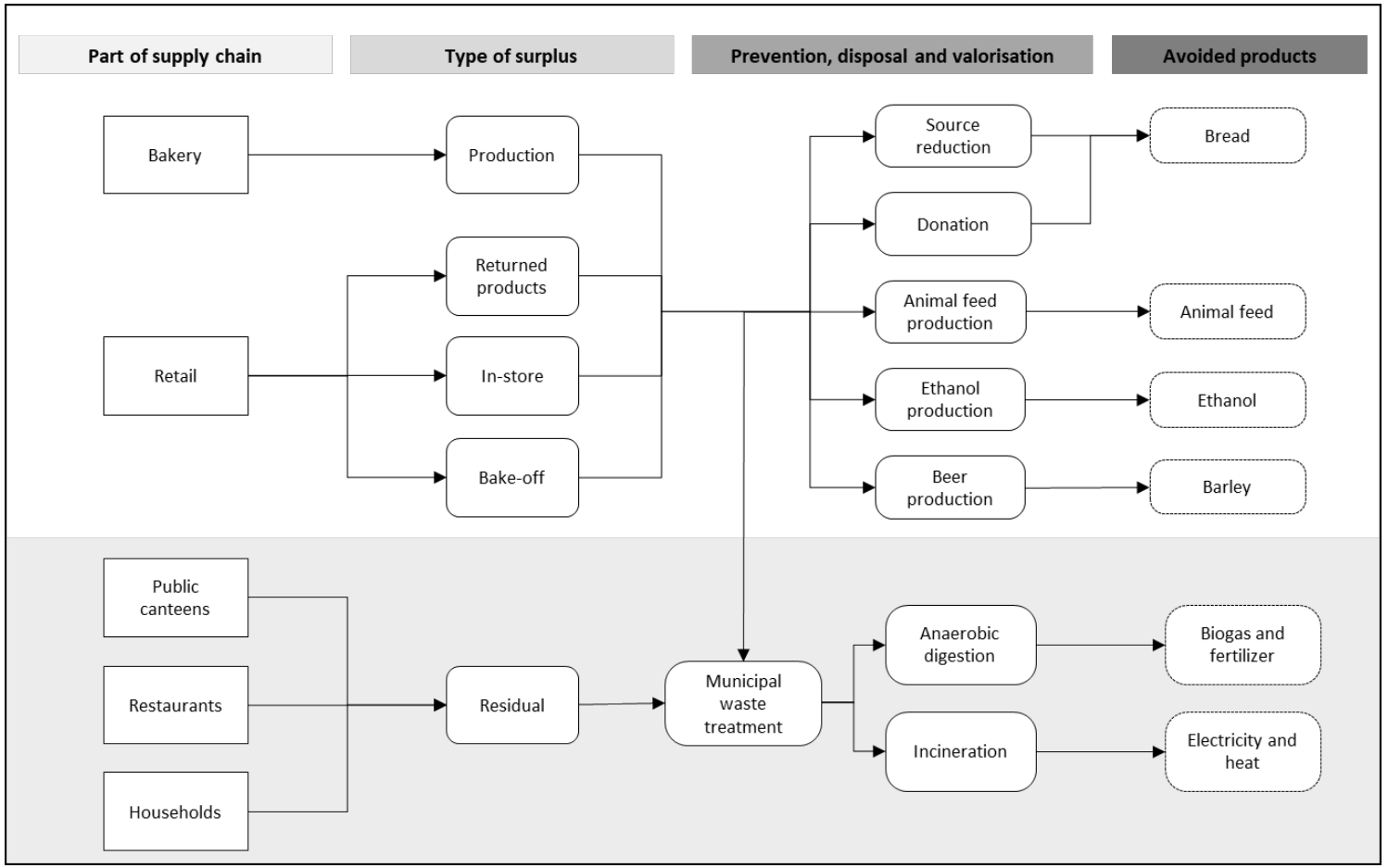
RISK

- Ordering activities
  - Forecasting, transportation, product placement
- Financially responsible for unsold products

OPPORTUNITY

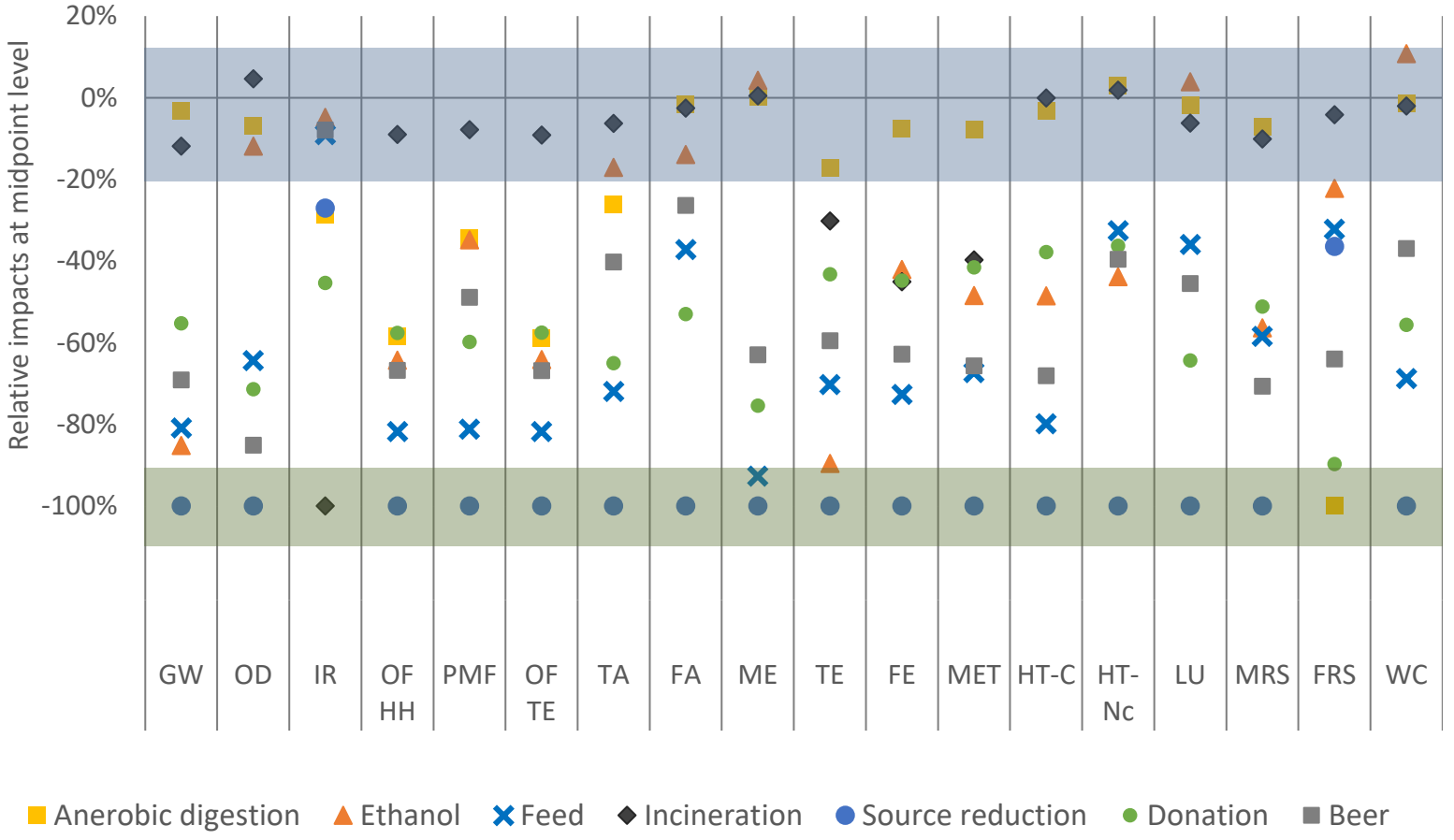
- Collection of unsold products
- End of life
  - Prevention, valorisation or waste management

MAP OF PREVENTION AND VALORISATION PATHWAYS



- Are those pathways better than the current waste management in relation to their environmental impacts?
- What are the constrains for their implementation?

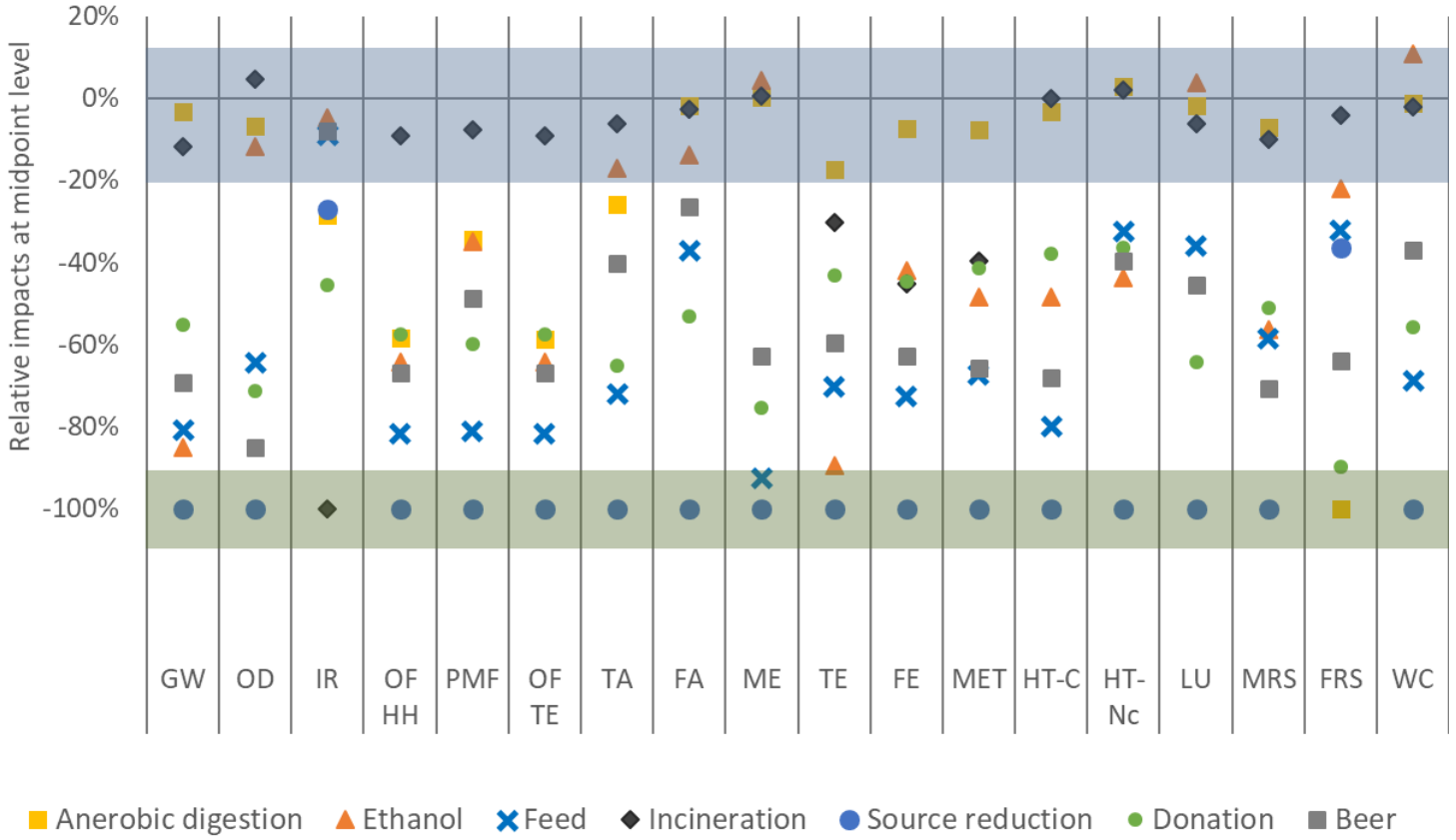
EVALUATION



IMPACT CATEGORIES

- Global warming (GW)
- Stratospheric ozone depletion (OD)
- Ionizing radiation (IR)
- Ozone formation, Human health (OF, HH)
- Fine particulate matter formation (PMF)
- Ozone formation terrestrial ecosystems (OF, TE)
- Terrestrial acidification (TA)
- Freshwater eutrophication (FA)
- Marine eutrophication (ME)
- Terrestrial ecotoxicity (TE)
- Freshwater ecotoxicity (FE)
- Marine ecotoxicity (MET)
- Human carcinogenic toxicity (HT-C)
- Human non-carcinogenic toxicity (HT-Nc)
- Land use (LU)
- Mineral resource scarcity (MRS)
- Fossil resource scarcity (FRS)
- Water consumption (WC)

EVALUATION



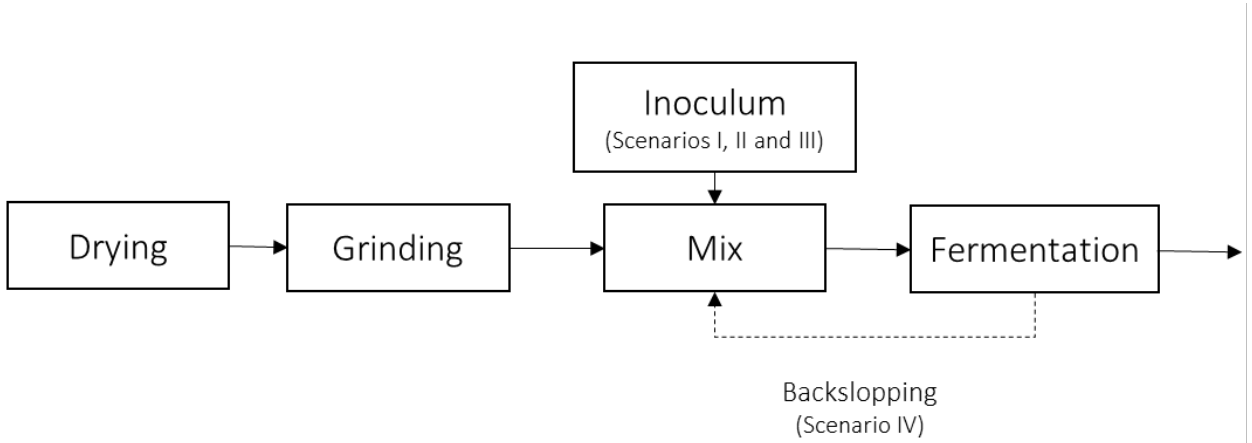
Food waste hierarchy

- Trade-off between impact categories
- Availability of infrastructure

Current valorisation pathways

- Limited infrastructure
- Primary function as food

THE FUNGI BURGER

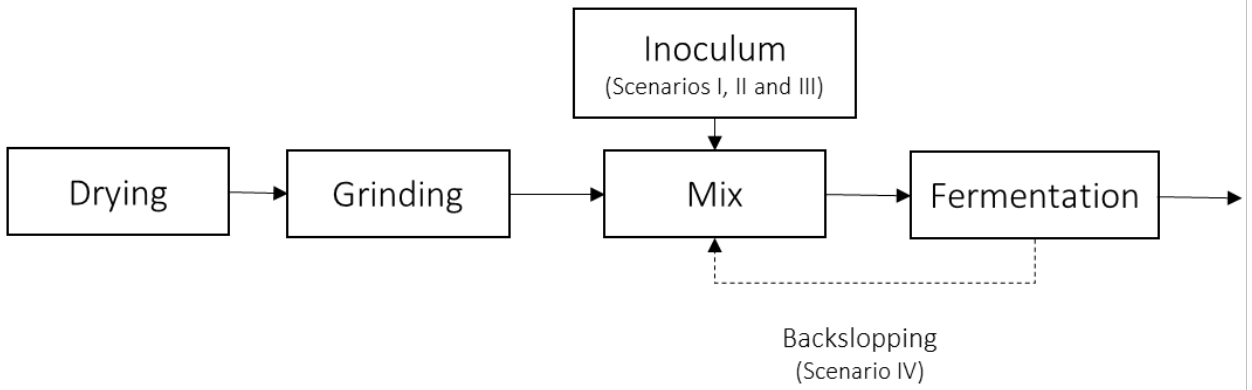


LCA AND DEVELOPMENT OF THE FUNGAL BURGER

- Integrate environmental considerations in the early stages of the technology development

RELEVANT ASPECTS

- Environmental impact
- Protein content
- Lag phase
- Morphology
- Contamination



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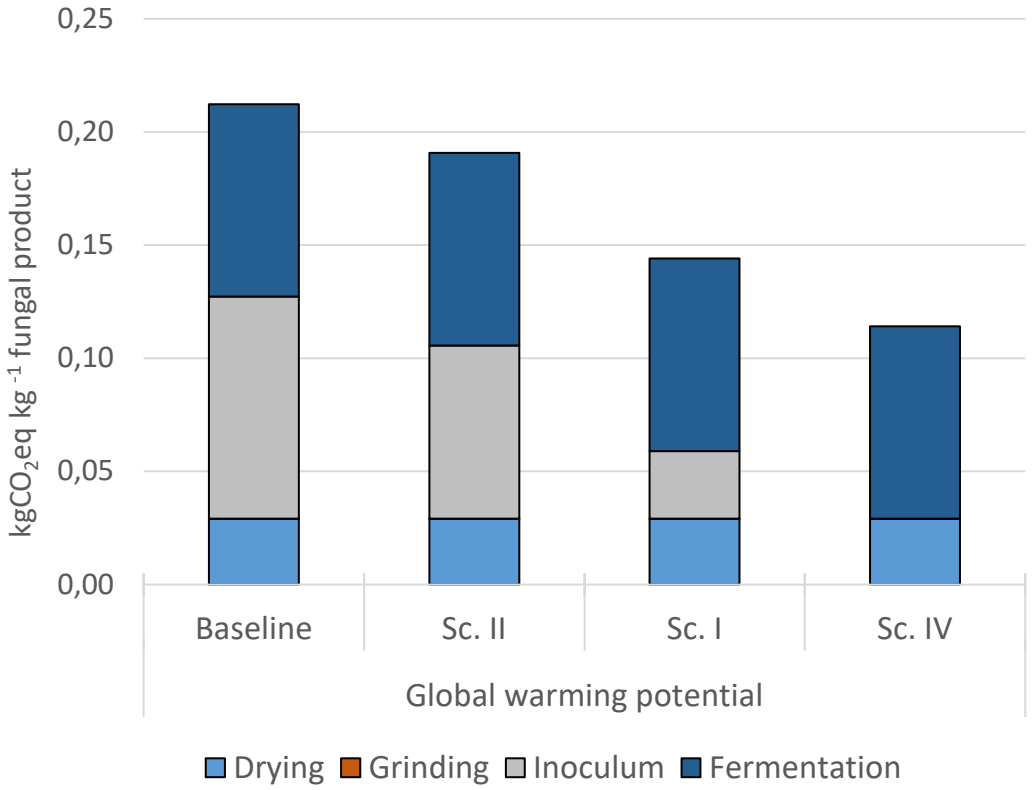

CONCLUSIONS

- Importance of prioritizing food products with high environmental impact and economic costs
- Bread is a key waste fraction to be addressed to reach the government's targets for food waste reduction.
- Bread supply chain has high potential to transitioning to circularity
    - TBAs as a risk factor and opportunity for bread surplus valorisation
    - Valorisation pathways effectively reduces the environmental impacts
    - The benefits are sensitive to the transportation distance
- Fungal burger as a novel pathway for surplus bread valorisation
    - Low technology readiness level of the technology requires further development
    - Inoculum and fermentation as a hotspot

THANK YOU!

Pedro.Brancoli@hb.se

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