

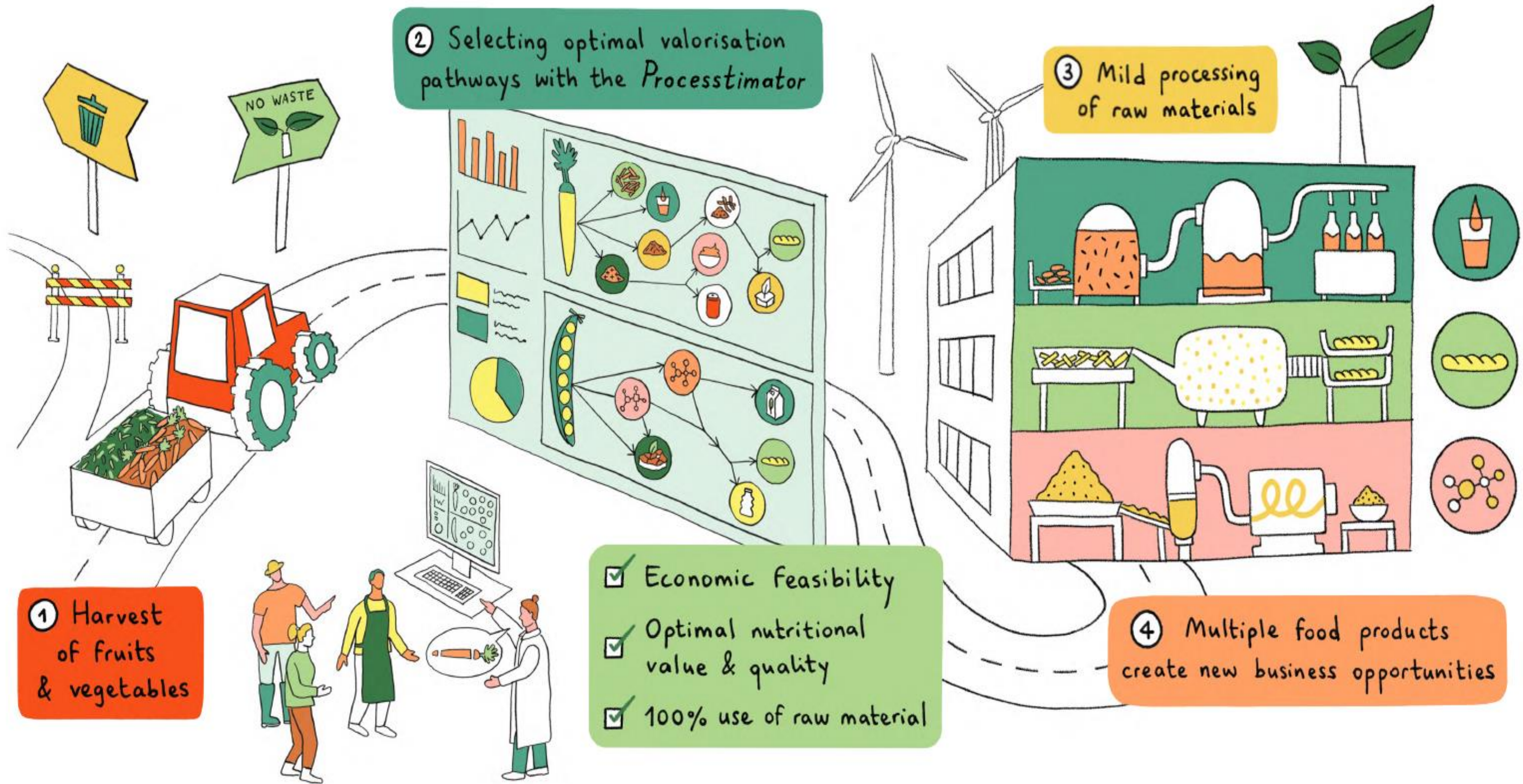


FOX Upcycling Side Streams

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Zero waste by upscaling fruit & vegetable side streams





Side streams of fruits and vegetables

- Materials are highly perishable, vary in volume, are seasonal available
- Materials contain valuable components
- High-valued upcycling requires component retention and functionality



[Food loss and waste - Wikipedia](#)



Upcycling of side streams



Food Circle 4
Upscaling plant side streams Noord-Brabant, NL



Green peas and carrot pomace



Mild processing technologies: high pressure, PEF, supercritical CO₂, mild thermal technologies

van Rijsingen **ingredients**
vegetables explored



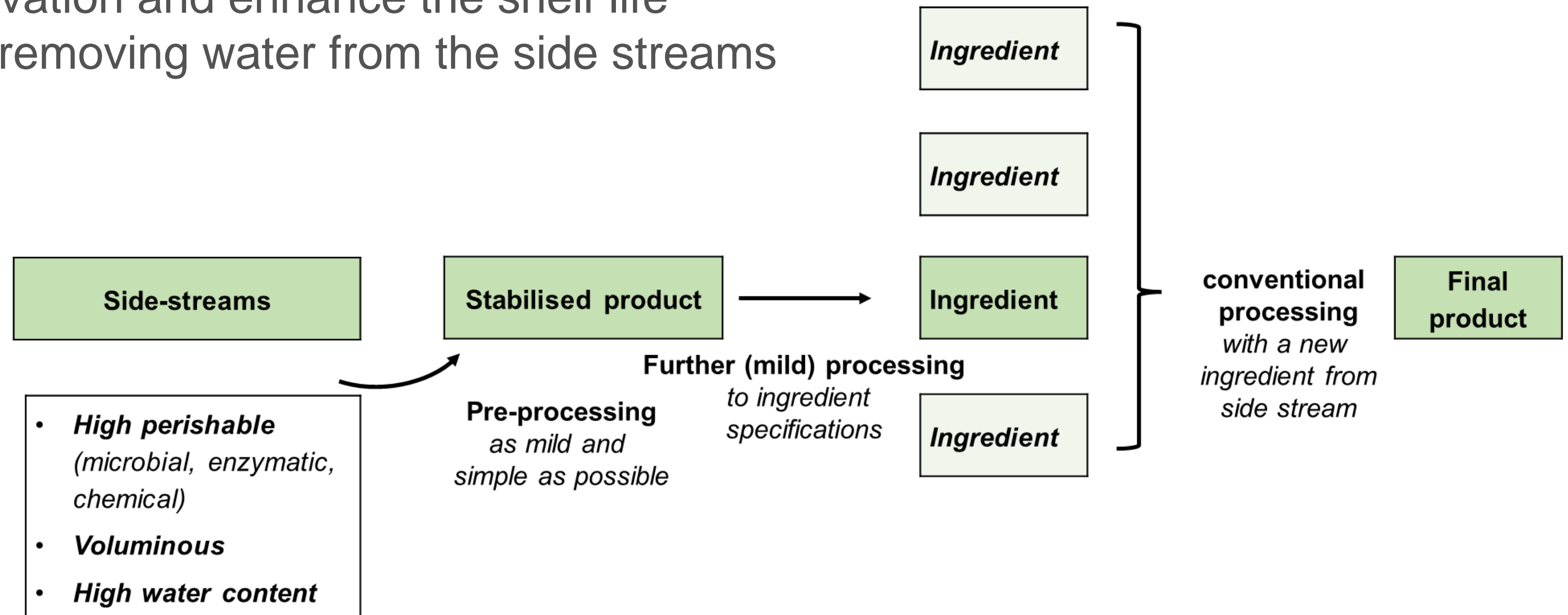


Upcycling of side streams

To avoid loss of the food-graded material we can **process these streams more sustainable options**: ingredients, food products or feed

Ingredients with good functionality: mild processing technologies

- Preserve natural ingredients responsible for quality attributes like taste, colour, texture and odour
- Provide microbial inactivation and enhance the shelf life
- Reduce the volume by removing water from the side streams

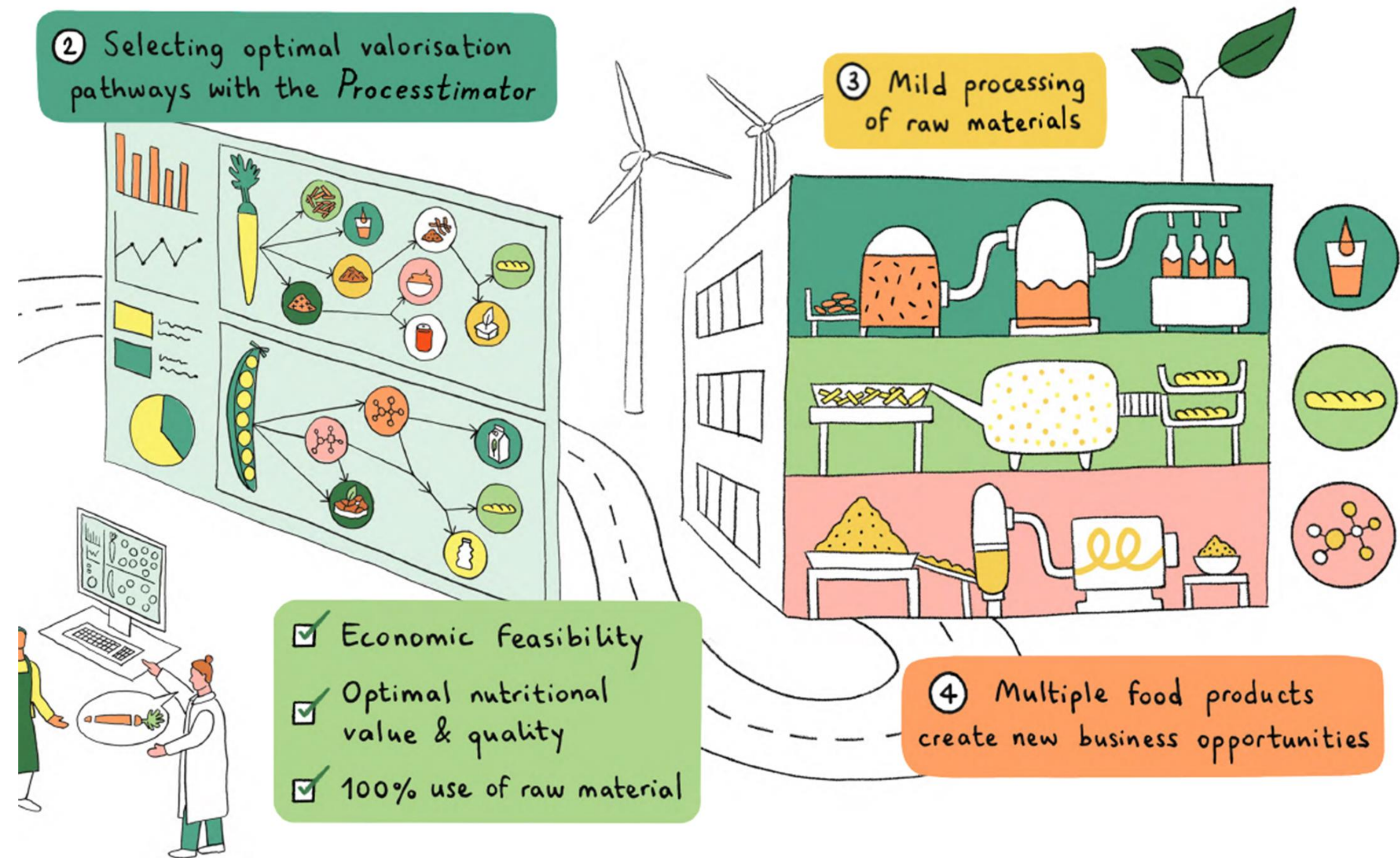




Upcycling of side streams

To avoid loss of the food-graded material we can process these streams more sustainable options: ingredients, food products or feed

- Which process steps to take?
- Which materials result? And what are their properties?
- Is this economically feasible?
- And a nett positive contribution to sustainability?





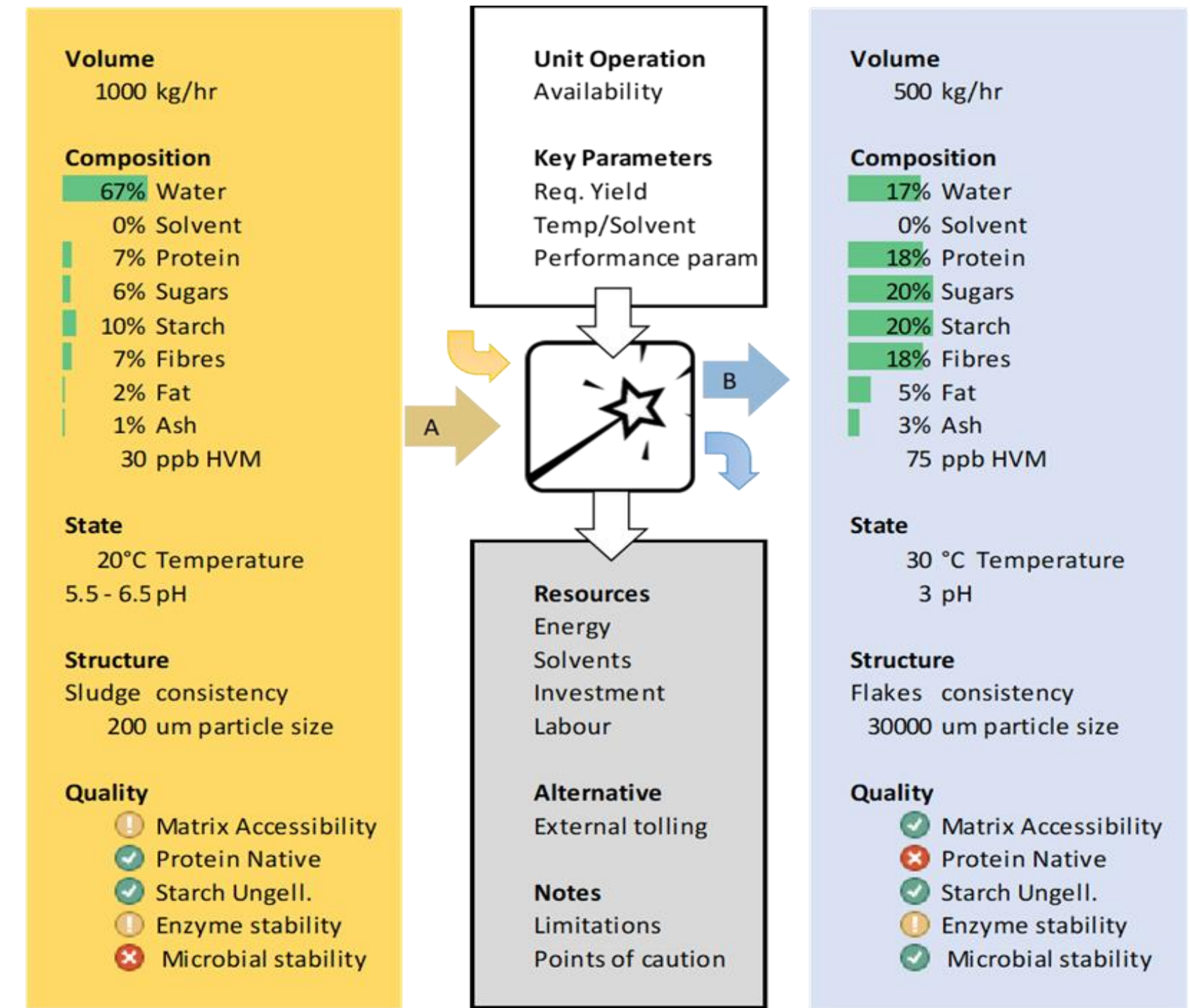
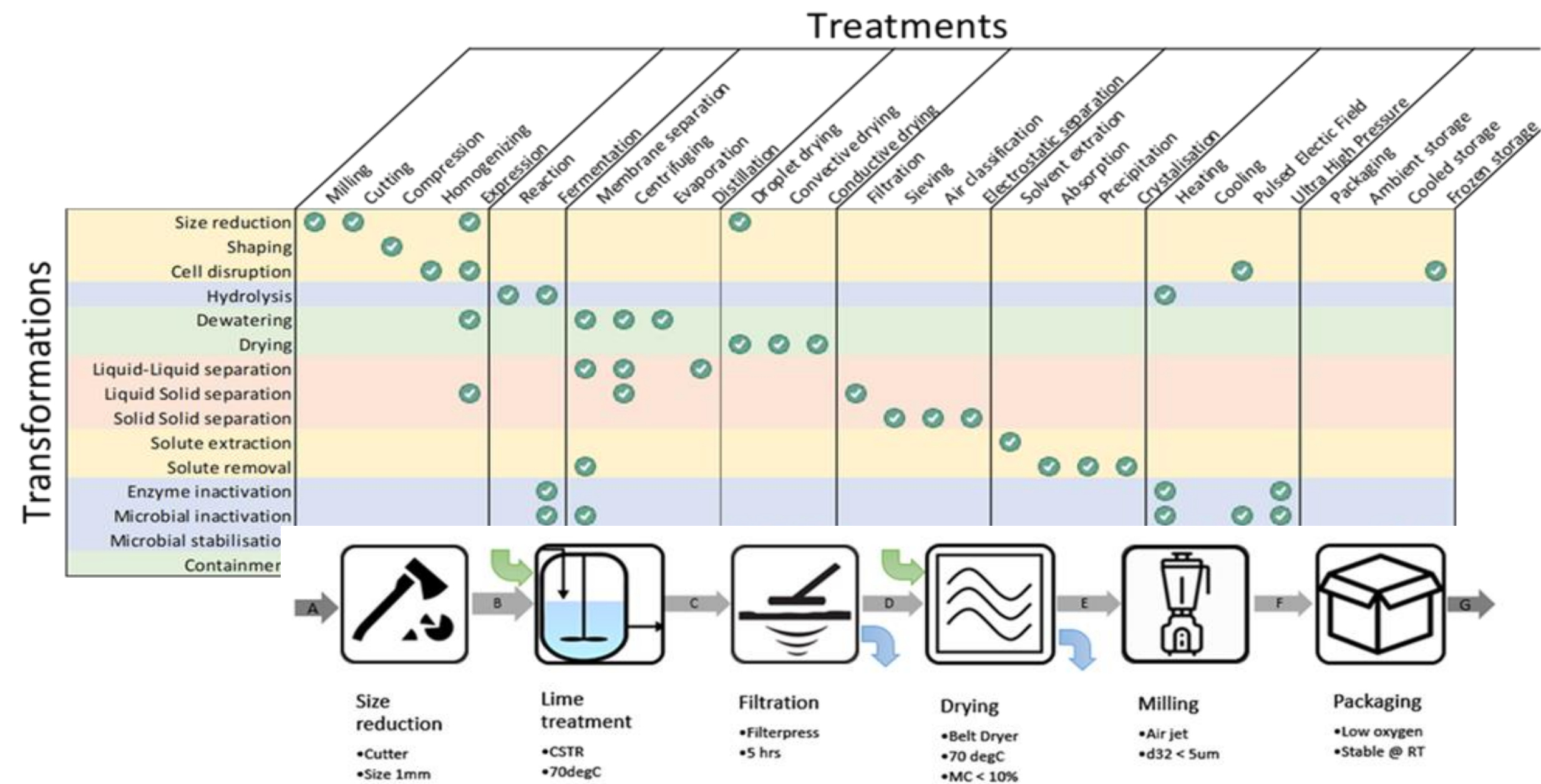
Processtimator

Design upcycling process for specific side stream (composition, occurrence, volume), end product and current use:

- Processing steps and equipment
- Processing costs and most relevant factors for costs
- Environmental impact (CO₂-equivalents)

While keeping track of:

- Composition of streams in macro nutrients and minor components of interest
- Structure
- Quality aspects

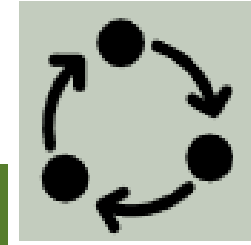




Processtimator



- Total use
(costs and benefits all fractions)
- Mild processing
(diverse (mild) processes available)
- Expert tool
(food technologists)



- Modular design
(coupling between processes, automatic updates)
- Advise on process choice
(suitability of processes for material)
- Coupling with relevant databases
(composition, feed value, processing costs)



- Multiple outputs
(costs, energy and water, quality properties, CO₂ footprint)
- Scenario analyses
(for example on input volumes, composition, yields)

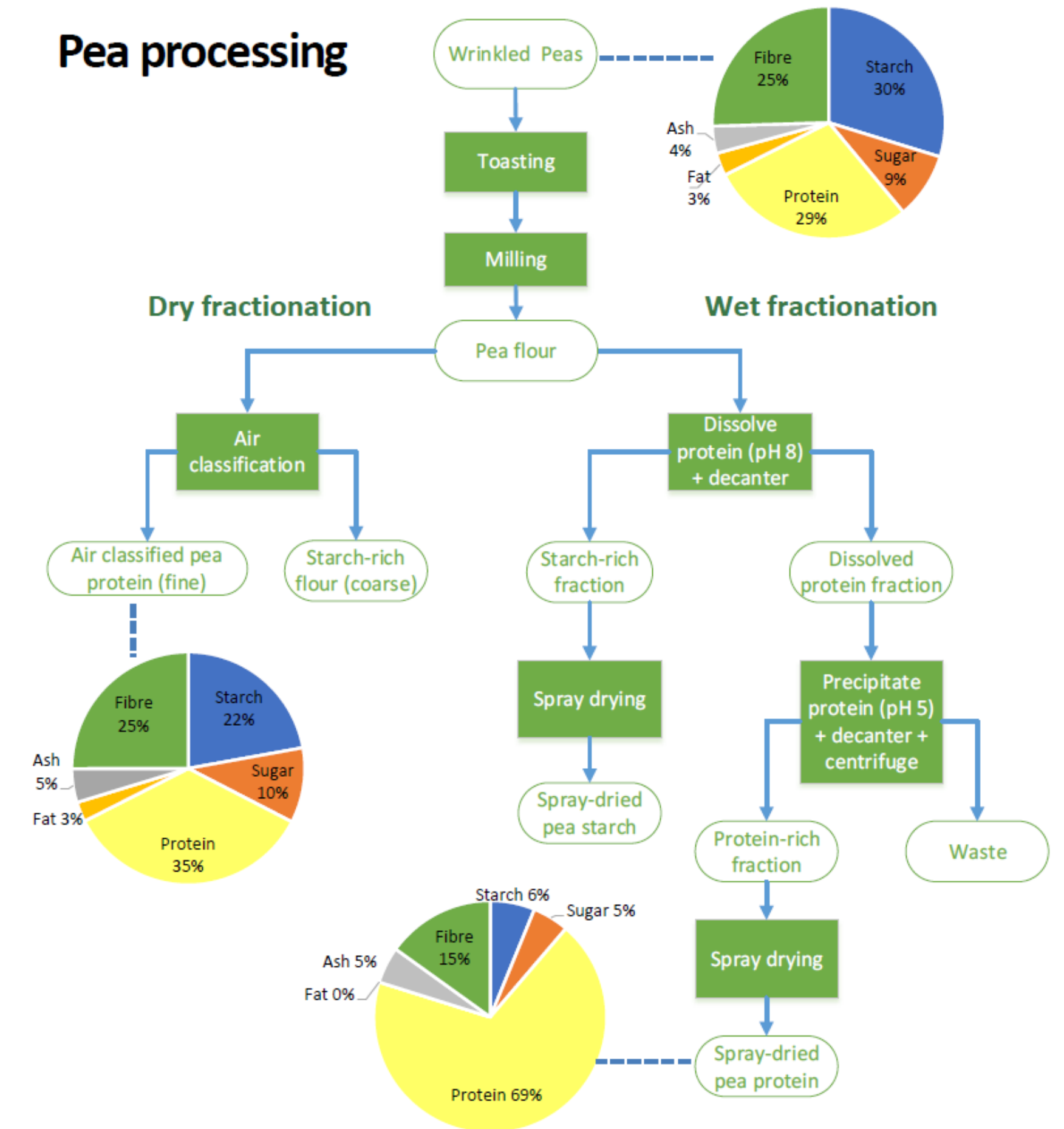


Movie peas demo

Upcycling of surplus green peas



Pea processing





Lessons learned

Upcycling of plant-based side streams can **improve the sustainability of food systems**

- This requires insights into possible processing pathways, given the side stream properties and intended application.
- Sustainability impact of upcycling options must not be considered (less than impact of current use, as feed or waste).
- Whether upcycling leads to a nett positive contribution to sustainability is case specific.

Cost estimate of the upcycling route is key to decide upon side stream management

- Cost estimation must take costs or profits from current use of the material into account.
- Costs breakdown enables well informed analyses of bottlenecks and risks.

Mild technologies are important to consider given their lower footprint (e.g. water end energy use) and lower impact on functional components

- Effects of technologies on functional properties must be analysed, since effects are product and matrix dependent.



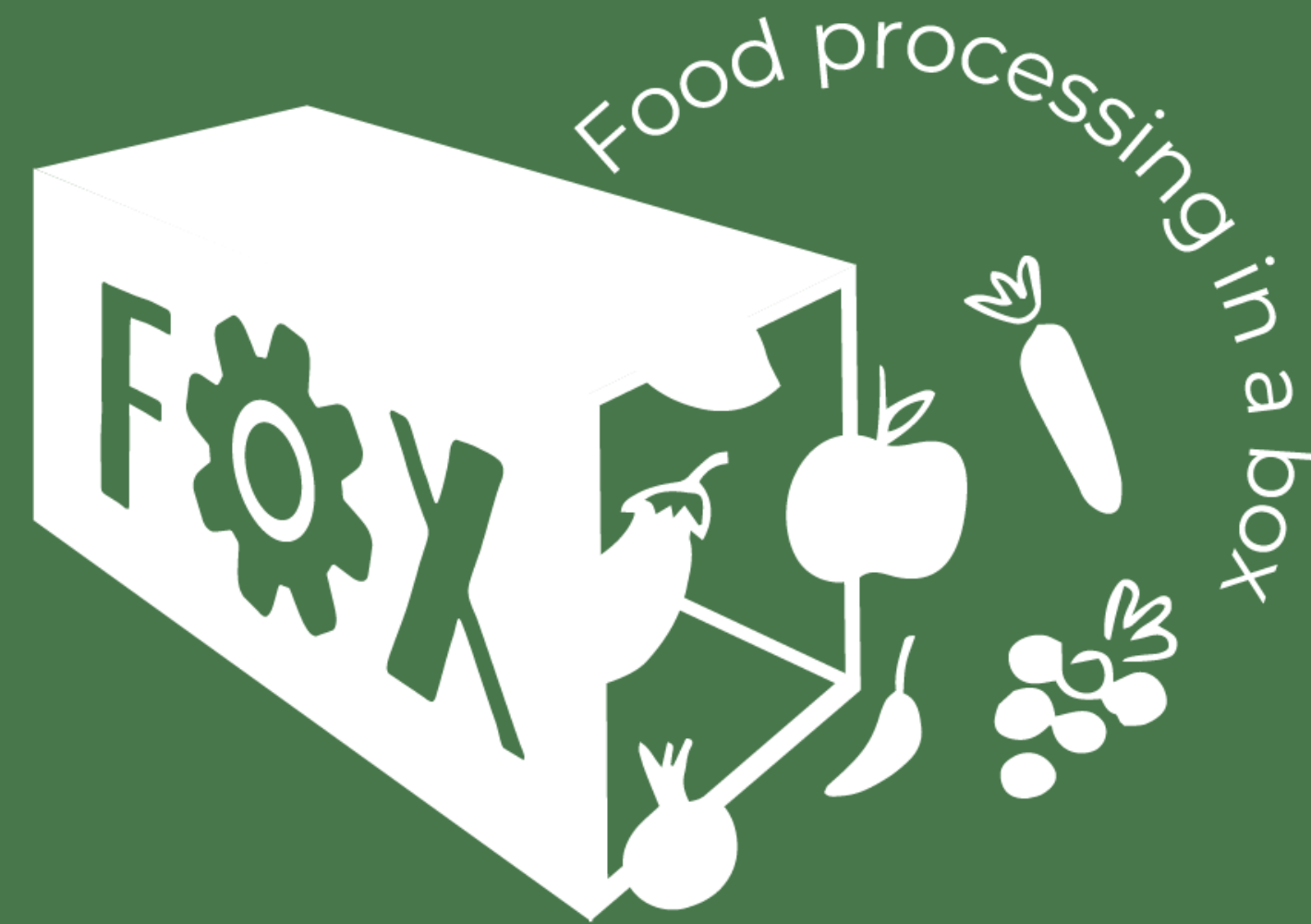
Practical recommendations

Improving resource use efficiency by **upcycling food side streams** may improve the **sustainability of food chains**.

The *Processtimator* aids companies by:

- **Selecting upcycling options** that are economically of interest and result in a nett positive contribution on sustainability
- Providing inside in **factors influencing the potential** of upcycling the most
- These results and insights are essential to encourage side stream owners and potential users in **stimulating total use** of valuable food materials.

- The tool can be employed by **food processing specialists** in short term advise studies with specific food chain stakeholders, as well as in longer term research looking into potential of total use in a broader perspective.



Innovative local processing
for a sustainable future

QUESTIONS?