

# The Potential of Valorising Food Processing By-Products in the EU

SUN Project Report I

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This report is based on the work presented in the scientific article 'Valorized food processing by-products in the EU: Finding the balance between safety, nutrition, and sustainability', published in *Sustainability*, written by Madhura Rao, Aalt Bast and Alie de Boer.

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## Introduction

Today, approximately 88 million tons of food is wasted in Europe every year. Some of this waste originates in the industrial processing of food, such as squeezing juice from oranges, or peeling carrots or tops from tomatoes in the production of processed foods. But when trying to keep more food and food ingredients in the food chain, food safety becomes an increasingly important aspect to consider.

In the European Union, food safety is regulated under the General Food Law (GFL). The GFL defines that food is considered unsafe if it is either injurious to health, or when it is unfit for human consumption. When food business operators want to valorise the by-streams that result from food production processes, this definition of unsafe food is important: even though inherently, a by-stream product may not be unsafe (because it is toxicologically or microbiologically safe when handled well), from a legislative perspective the product may not yet be considered safe. This means that the burden of proof is on food business operators to show that it is safe. For that purpose, it is essential to combine insights into food law, food safety, nutrition, and sustainability, to consider which by-streams have an interesting potential to be valorised for human food purposes.

## Valorising important by-products in the EU

In our publication, we have exemplified the valorisation opportunities of by-streams by selecting the top five sub-sectors that contribute to food waste generation at the processing stage:



*Spent grain*



*Fruits,  
vegetables,  
and tubers*



*Dairy*



*Meat and  
other animal  
products*



*Oil seed cakes  
and meals*

Next to economic and environmental sustainability considerations, our analysis shows two main considerations when determining whether a product can be valorised (see Figure 2 – Decision tree).

Firstly, the product and its processing need to be safe for human consumption. This means that microbiological safety aspects need to be studied, as well as chemical safety aspects. As exemplified when valorising brewer's spent grain (BSG), the moisture content of the product is very high (80%) which results in a high risk for the formation of different moulds. At the same time, chemical, toxic compounds (such as mepiquat) may be formed during the brewing process that need to be controlled well. Similar considerations are shown when valorising fruits, vegetables, and tubers: apple pomace may for example include the toxin amygdalin that is naturally found in apple seed, but also plant protection products such as neonicotinoids and arsenic-based pesticides on apple skins can be a source of concern while valorising such by-streams. Whereas potentially harmful substances may be found originally on the products, production methods may negatively impact the amount of these substances as well by further concentrating them.

Some of these aspects are covered by existing legislation, such as microbiologic criteria for foodstuffs that are covered in Commission Regulation (EC) No 2073/2005. This may still require adequate testing of such biological or chemical compounds expected to be in by-streams. In other cases, legislative requirements may not yet be in place. In these cases, it can be necessary to collect scientific insights about the exact composition of the product, as well as analytical data on potential biological or chemical contaminants for a by-stream, to establish safety of the potential product.

In case the product is not deemed safe for human consumption, valorisation opportunities may exist outside the human food supply chain. As described by Papargyropoulou et al. (2014)<sup>1</sup>, after prevention, re-use is the most favourable option to deal with food waste. However, less favourable other options may lay in recycling to animal feed or via composting, recovery to energy or disposal as landfill. Figure 1 shows the food waste hierarchy developed by by Papargyropoulou et al.

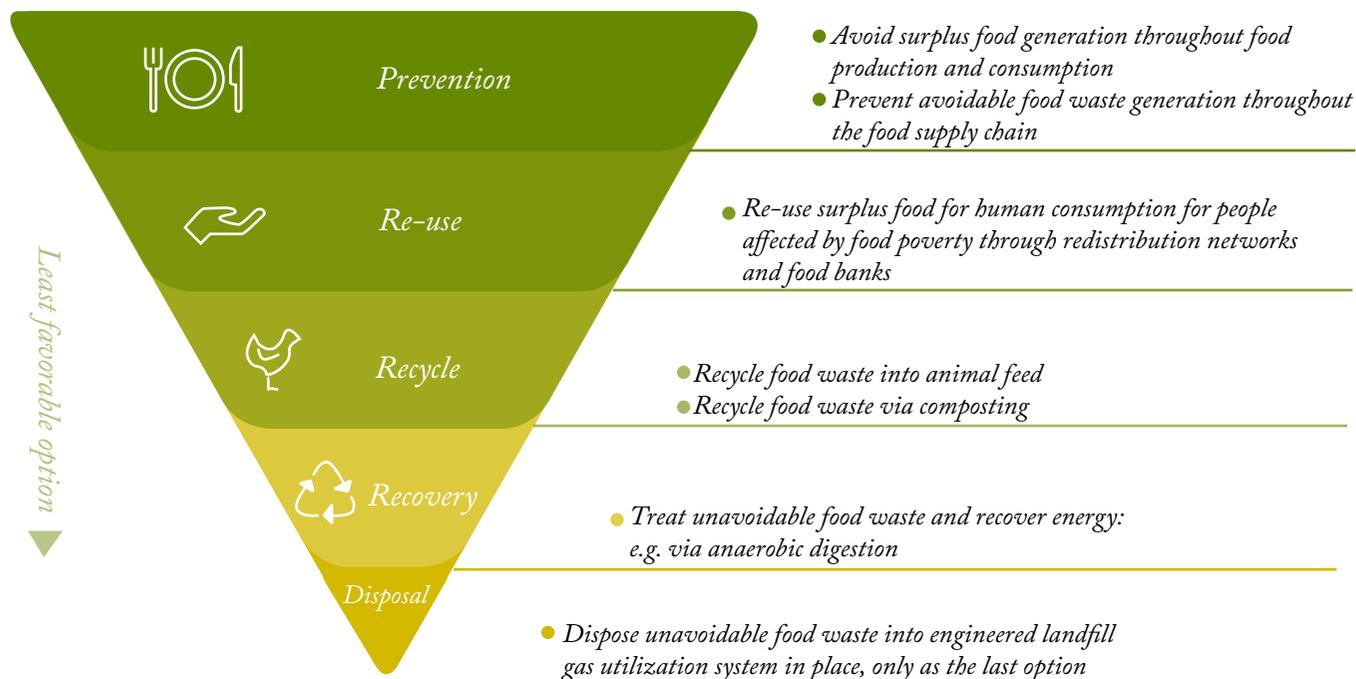


Figure 1. The food waste hierarchy.

Secondly, once it has been established that a product can be considered safe for human consumption, it is important to gain insights into whether the by-stream or by-product is nutritionally valuable. This may need to be studied by conducting scientific research into the exact composition of the product, gaining insights into valuable nutritional compounds that can support the development of a successful product or allow for valorising one ingredient from the by-stream. Functional ingredients from meat processing by-products, such as hypocholesterolemic and antioxidative peptides are good examples of such potential useful ingredients. From dairy production, whey has also been shown to be a useful protein that has successfully been launched as product targeting for example athletes, originating from by-streams.

<sup>1</sup> Papargyropoulou et al. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production* 76, 106-115.

## Decision tree

While there is no universal formula to determine whether safety, sustainability, and nutritional relevance can be ensured when valorizing a by-product, it is possible to consider each by-product on a case-by-case basis. Based on our analysis, we propose a decision tree. As shown in Figure 2, this decision tree can assist practitioners and businesses in deciding whether a food processing by-product should be valorized and retained in the food supply chain. The decision tree assumes that sustainability, safety, and nutritional quality are equally important in the valorization endeavor.

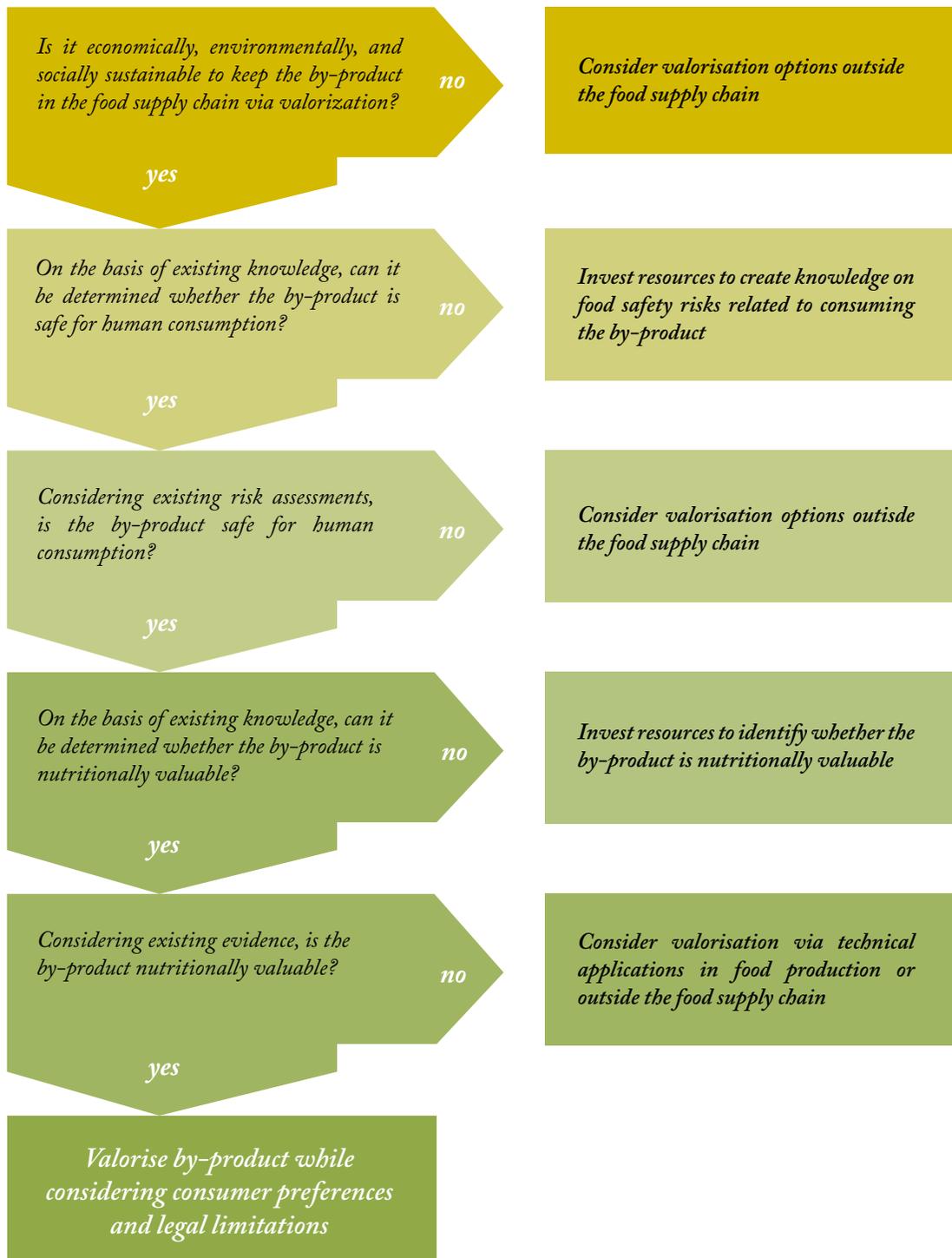


Figure 2. Decision tree for determining whether a by-stream has potential to be valorised.

## Conclusion and future outlook

Our analysis shows that consumers – especially those who are interested in sustainability and a circular economy – may be interested in purchasing foods and products containing ingredients that are derived from by-products of food processing. However, legislative requirements may still pose difficulties in fully accommodating the development of such products. Maximum levels are not yet set for certain contaminants in foodstuffs, maximum residue levels for pesticides, nor microbiological criteria for foodstuffs for by-products. It is therefore essential to carefully consider which potential substances may be found in by-streams during production.

First steps for such substance identification have been made by i.a. the EU's REFRESH project, as well the FoodWasteExplorer ([foodwasteexplorer.eu](http://foodwasteexplorer.eu)). These projects have been essential in getting more insights into what safety aspects should be considered for by-stream valorisation towards human food applications. But before this can result in advice for valorisation opportunities for specific by-streams, it is important to gain insights into the actual production processes that result in these by-streams and the products that are used in these processes. This will allow for gaining insights into what specific substances may present safety issues, what legislative aspects should be taken into consideration and whether specific nutritional quality aspects need to be controlled.



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