

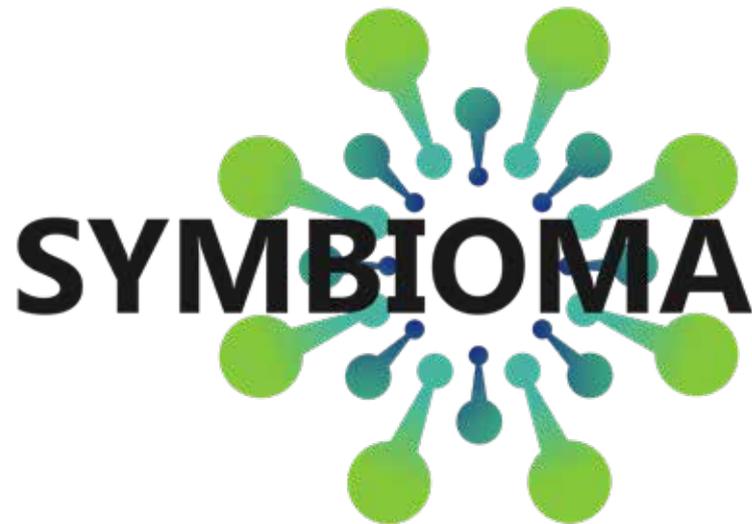


Northern Periphery and
Arctic Programme
2014-2020



EUROPEAN UNION

Investing in your future
European Regional Development Fund



Technology Innovations and Business Models for Valorisation of Industrial Waste Biomass in Sparsely Located Enterprises

Circular economy cases and their business models in Swedish potato industry

Dr. Wiebke Reim, Dr. Daria Sas

Contents

1 Potato processing	3
2 Potato industry and existing business models in Sweden	4
2.1 Case 1: Potato company	5
2.2 Case 2: Potato company	5
3 Future opportunities for waste handling	5
4 Bottlenecks / challenges for efficient waste handling	6
Acknowledgements	7

1 Potato processing

Potato is one of the most important agricultural crops for human consumption and high amount is produced worldwide every year. In particular, the EU produced about 60.7 million tons of potatoes (FAOSTAT, 2020)¹. Potato peel is currently considered a zero-value or rather low value by-product, which occurs in large amounts after industrial potato processing and can range from 15 to 40% of initial product mass, depending on the various peeling or processing methods.

Food waste utilization causes great concern in food industry in Europe and many scientific works and projects on this topic offer solutions and original approaches towards possible valorisation of potato peels (Sepelev and Galoburda, 2015).

2

Figure 1 represents a summary of the major wastes and by-products originating from the potatoes production and processing industry.

In Figure 2 is pictured a schematic process of potato processing and generated by-products with their most common current uses.

1 FAOSTAT 2020. FAOSTAT Crops. Available online: <http://www.fao.org/faostat/en/#home> (accessed on 9 January 2020).

2 Sepelev, I., & Galoburda, R. (2015). Industrial potato peel waste application in foodproduction: a review. *Research for Rural Development*, 1, 130-136.

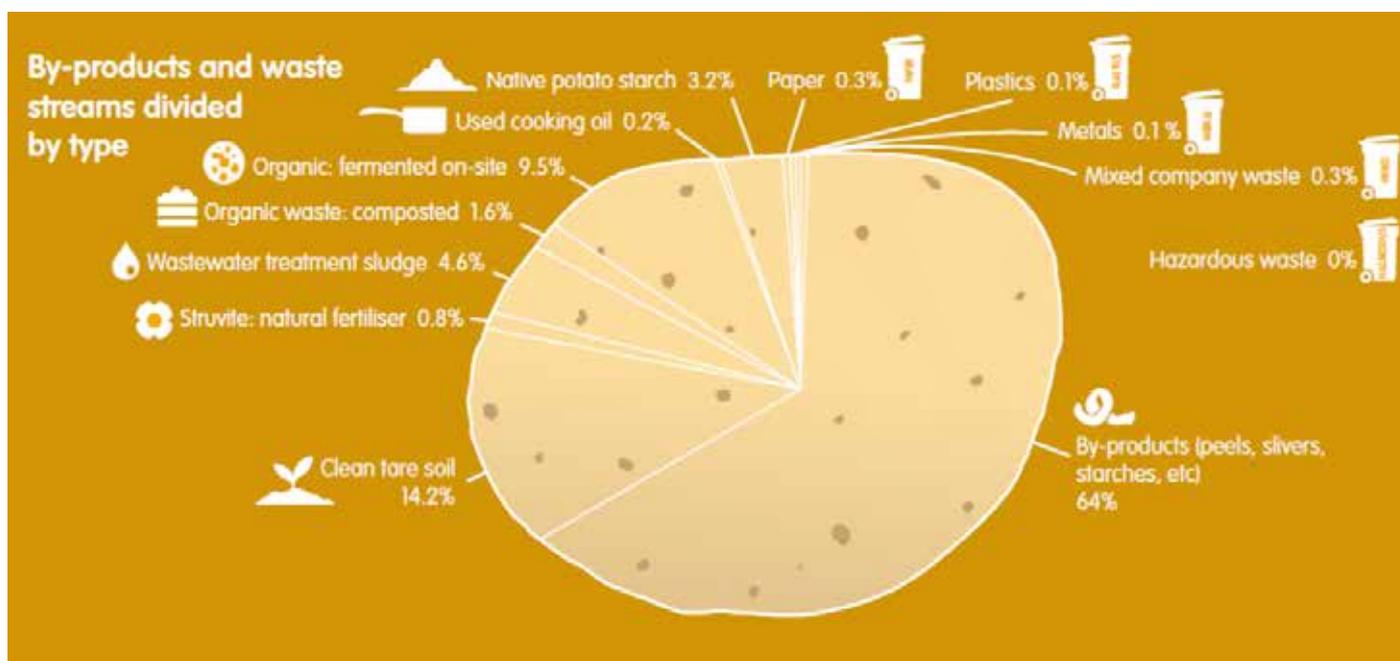


Figure 1. Schematic representation of the potato processing main wastes/by-products and the percentage composition of the different waste types (EUPPA, 2016).



POTATO PROCESSING AND GENERATED BY-PRODUCTS

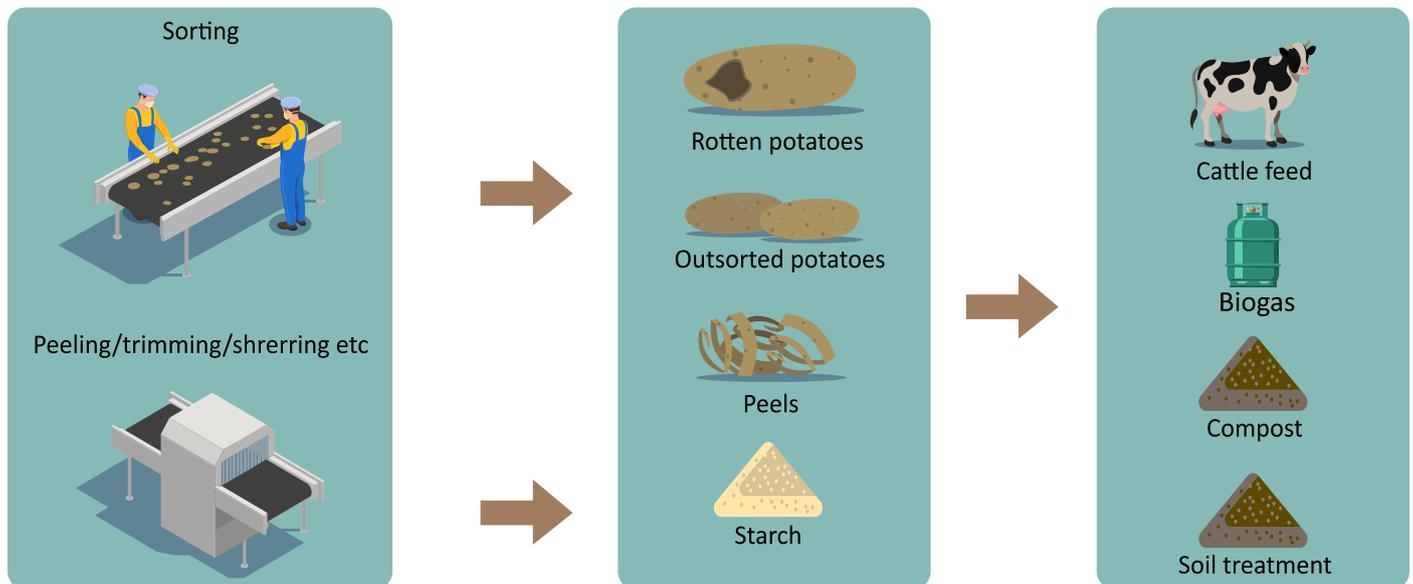


Figure 2 Schematic picture of potato processing and generated waste with it's common uses.

2 Potato industry and existing business models in Sweden

In Sweden, discarded potatoes intended for human consumption contribute about 50 000 tons of waste, which to a large extent unavoidable, with high water content, but rich in starch. Except potato that is left unharvested, these quantities occur at packaging and sorting facilities in the southernmost part of the country, although about 10% of the national production takes place north of Stockholm. Currently, these quantities are used for biogas production and, to some extent, animal feed. Potato starch production results in two main by-products: potato pulp, most often used as fodder, and potato juice, used as fertilizer or for biogas production. Swedish potato starch production is located to two plants in the south region around Kristianstad, where about 100 000 tons (wet weight) of potato juice and about 3 000 tons (wet weight) of potato pulp are produced. Potato juice contains nitrogen, phosphorous and potassium, and some of the juice is processed to fodder protein. Some of the potato pulp is processed to potato fibers for use in bakeries and meat processing (Engdahl, et al., 2011 in Torén et al., 2019)¹.

¹ Torén, J., Lorentzon, K., & Cintas, O. (2019). Food waste as a resource for bio-based chemicals and materials in Sweden.

Figure 3 shows available waste generated from potato production at 1000 m resolution. The data includes harvesting losses and fraction that needs to be left on the ground to avoid negative impact on soil organic carbon (Torén et al., 2019). The black rectangle in Figure 14 indicates the waste from potatoes production in the Swedish NPA area which is in a range between 50-100 tons (average values for crop production from 2013-17).

One of the interviewed potato companies which cultivates potatoes in 100ha of land, for example, generates 5 tons of waste of peeled potato skin in a week from 5-tons harvested potatoes. For washing potatoes, the company uses around 4000 m³ water in annually which is drained to the municipality sewage. Also, during the interview, the owner of the company mentioned that there is a need for more efficient way to handle potato peel rather than just dumping it on the field

Potatoes

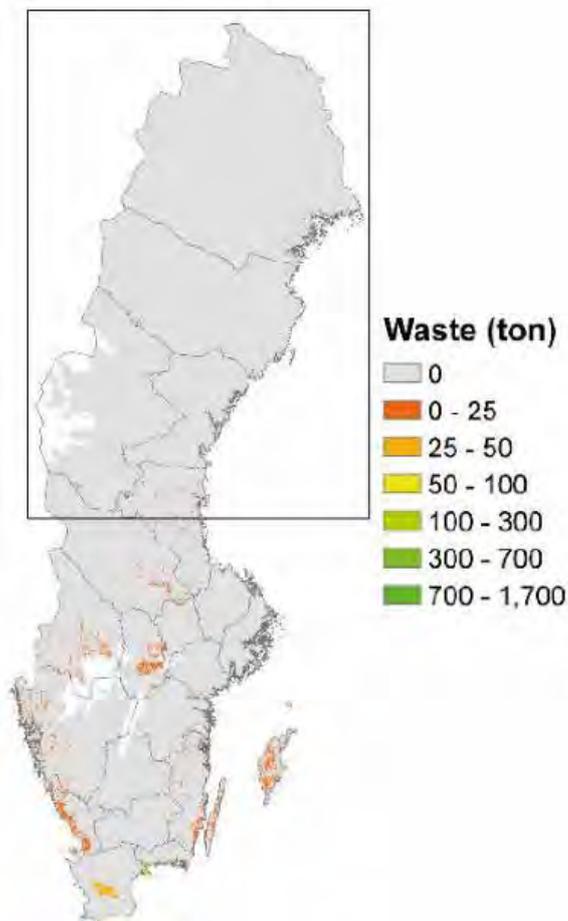


Figure 3 Estimates of waste generated from potatoes production (Torén et al., 2019)

2.1 Case 1: Potato company

A family business since 1950s that supplies the Swedish market with various types of potato products (fresh/washed/packed potatoes and sour creamy potatoes gratings). The company's four core values are tradition, innovation, quality, and authenticity. The company is located in a small town on the border between Sweden and Finland. The company buys fresh potatoes (with soil which is approximately 3% (w/w) from the local producers. The common way to utilizes the waste is by sending peeled skin to farmers. Usually the potato company is paid for logistics, which in overall lead to natural costs. The remaining soil is reuse by a neighbor company that offers soil.

2.2 Case 2: Potato company

A small local producer of potatoes with 6 employees. They take care of the whole production process starting with cultivation, harvesting, wash, peeling, packaging, and selling depending on the business models. Also, in different seasons and depending on their own cultivation process, the potato company buys from another potato wholesaler (which is located approx. 15 km from the potato company). The potato company has an agreement with local administration, nowadays they supply local schools, kindergarten and local restaurants and stores as well as sale to some companies that just pack potatoes and then sale further or produce readymade food. The most common way to handle the potato peeled skin (7-8 m³/ week) is to leave on the own field (ditched/dumped on their field). This way of waste handling has a negative cost effect because of the workforce needed and the lacking fertilizing effect of the waste.

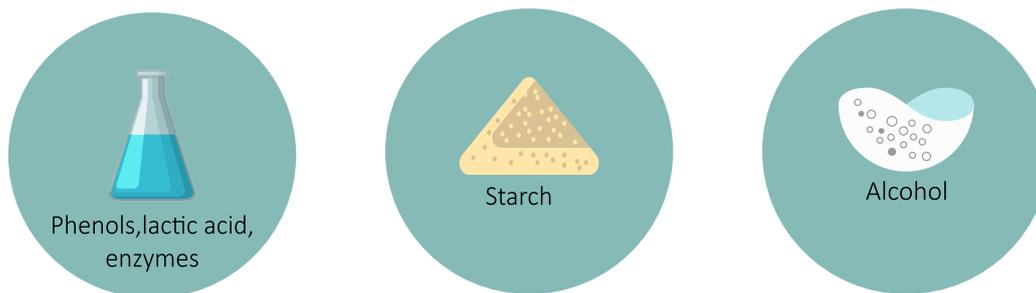
3 Future opportunities for waste handling

- There is rather a good and tight relationship between different potatoes companies and wholesaler since there are a few of them in the NPA region. Owners usually keep personal contacts to solve /handle various aspects/ problem/ lack of materials. A need for a local union/organisation that may help handling various aspects/problems as well as waste handling in more efficient manner.
- Potato peeled skin is not classified as waste but more of by-product.

POTATO BY-PRODUCT POSSIBILITIES



Example of valuables from by-products:



...that can be used e.g. in:



Figure 7 Possibilities of the potato industry by-products

4 Bottlenecks / challenges for efficient waste handling

- Big challenge to keep and develop potato business in NPA region due to lack of interest for younger generation in such businesses. In the last 10 years around 10-15 potato farms were gone from the market.
- The owners of potato farms are rather old, lack of young and innovative drivers. The knowledge about potatoes cultivation is decreasing due to lack of knowledge exchange.
- Lack of a common vision and closer collaboration from the local potato businesses.
- Lack of partnership relations with local Biogas factory. It is costly for potato companies to deliver and leave by-products/waste to the factory.

Acknowledgements

This report is produced with part funding of the European Union (EU) Northern Periphery and Arctic (NPA) Programme under the programme priority Axis 1- Innovation.
This is in the report for the WP 1 deliverable T 1.1.1 of the SYMBIOMA project (Technology Innovations and Business Models for Valorisation of Industrial Waste Biomass in Sparsely Located Enterprises. Case: Industrial Symbiosis for Valorisation of Waste Biomass from Food and Beverage Industries) (Project No. 352)

The project partners:

Lead partner



Centria University of Applied Sciences, Finland (CENTRIA)

Other partners



Institute of Technology Sligo, Ireland (ITSligo)



NIBIO
NORSK INSTITUTT FOR
BIOØKONOMI

Norwegian Institute of Bioeconomy Research,
Norway (NIBIO)



Bottenvikens Bryggeri Ab, Sweden (Bottenvikens)



Luleå University of Technology, Sweden (LUT)



Hermannin Winery Ltd, Finland (Hermannin)