

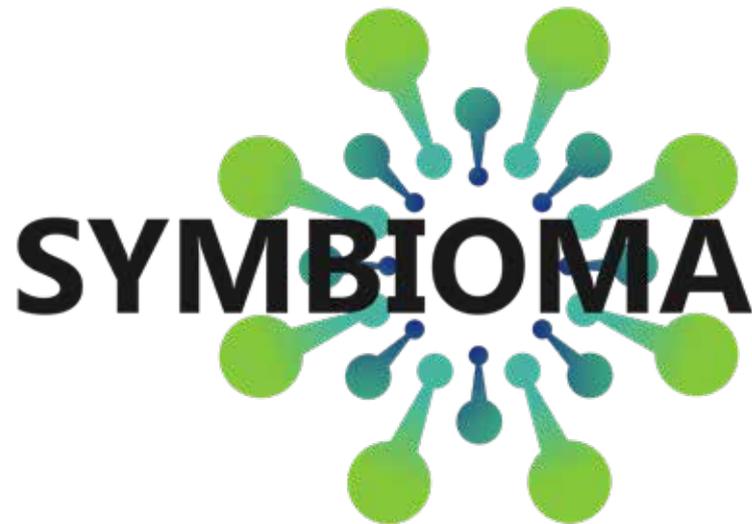


Northern Periphery and
Arctic Programme
2014–2020



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 Finnish potato industry

Dr. Egidija Rainosalo

Contents

1 Potato processing	3
2 Potato industry and existing business models in Finland	4
2.1 Case 1: Potato company	6
2.2 Case 2: Potato company	6
3 Future opportunities for waste handling:	6
4 Bottlenecks / challenges for efficient waste handling:	6
Acknowledgements	8

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 food production: a review. *Research for Rural Development*, 1, 130-136.

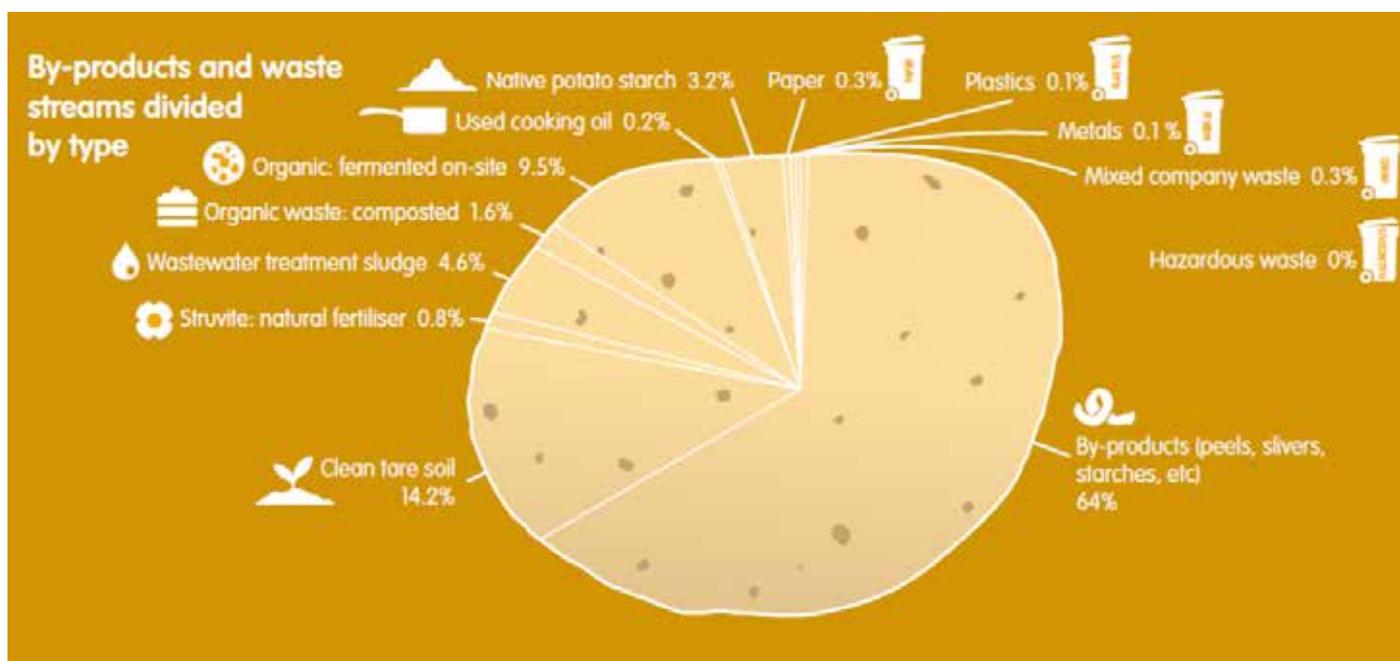


Figure 1. Schematic representation of the potato processing main wastes/by-products and the percentage composition of the different waste types (EUPPA, 2016).



POTATO PROCESSING AND GENERATED BY-PRODUCTS

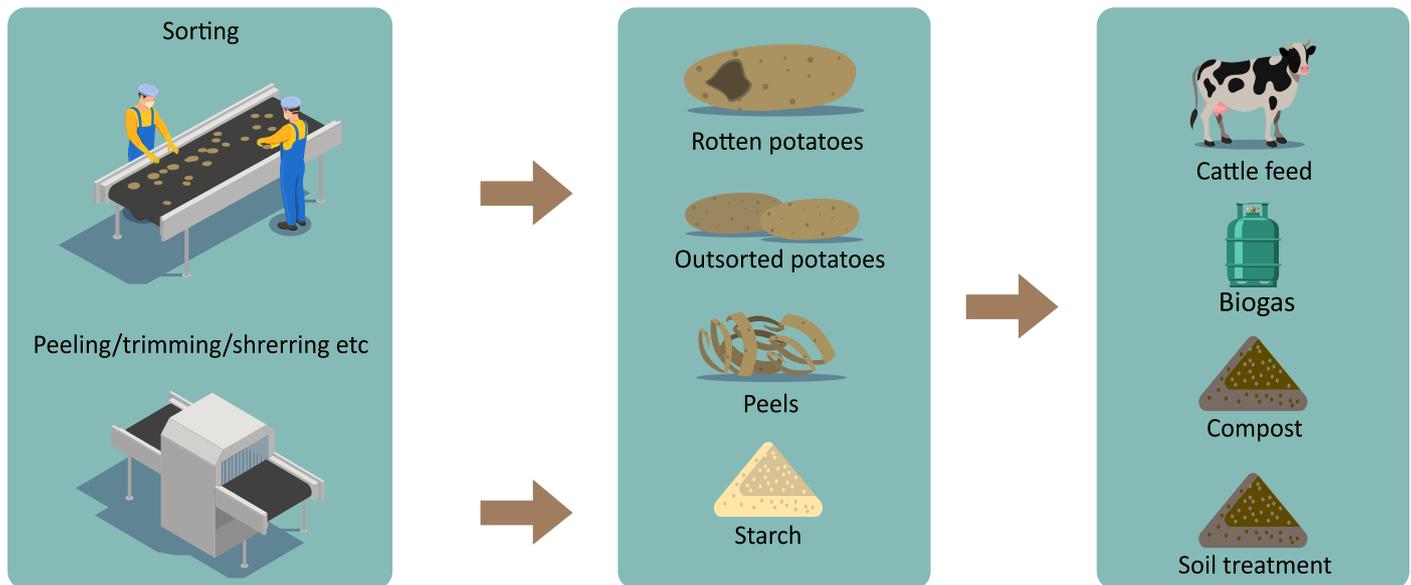


Figure 2 Schematic picture of potato processing and generated waste with it's common uses.

2 Potato industry and existing business models in Finland

In Finland, the total field area for growing potatoes in 2018 was 21 700 hectares (MTT, 2018):

- 9500 hectares was for growing potatoes for food consumption,
- 2950 hectares was for growing potatoes for potato industry and
- 6670 hectares was for growing starch potato.

In Finland Ostrobothnia and Northern Ostrobothnia (both are in NPA area) are main areas for growing potatoes: 3300 hectares in Northern Ostrobothnia and 5800 hectares in Ostrobothnia are reserved for growing potatoes (90 % of the total area reserved for growing potato in NPA area). Two thirds of the potatoes for food consumption and more than half of the potatoes for industrial use are grown in or near these areas. Also, about 70 % of the seed potatoes in Finland are grown in Northern Ostrobothnia (LUKE, 2020).¹

¹ LUKE article, 2020. <https://www.luke.fi/ruokafakta/en/field-crops/high-quality-seed-potatoproduction-area/> , Accessed 15.3.2020

Most of the potato crops in Finland goes either to potato packing facilities (seed or food potato) or to potato industry (companies that peel and/or precook potatoes or manufactures different potato products). Main potato industrial processors in NPA area are presented in Figure 2 below.

In a 2012 report (Ahokas et.al, 2012)², it was estimated that in Northern Ostrobothnia, side streams from potatoes packing facilities were 5300 tons, and from peeling facilities 1100 tons per annum. Since the area for growing potato in Ostrobothnia is almost twice the area in Northern Ostrobothnia one can cautiously estimate that side streams from packing facilities in Ostrobothnia are 10 000 tons and from peeling facilities 2000 ton per annum. Together these two areas produce as side streams approximately 15 000 tons of unprocessed potatoes, and 3000 tons of wet sludge of potato peels and greywater per annum.

² Ahokas M, et al. Perunan ja vihannesten sivuvirtojen arvokomponenttien hyötykäyttö. MTT raportti 67. 2012. <http://urn.fi/URN:ISBN:978-952-487-410-6>

POTATO PRODUCTS (snacks, starch etc.)	PRECOOKED AND/OR PEELED POTATOES	POTATO PACKAGING
		
		
		
		

Figure 3 Potato processors in NPA area in Finland.

In the NPA area there are two larger industrial operators that manufacture potato products, e.g. potato chips and other food products. Side streams from the larger of the two operators was reported to be 15 000 tons per annum, most of which was potato peels (Ahokas et.al, 2012)¹. All in all, one can roughly estimate that the amount of potato side streams in NPA area are 15 000 tons of unprocessed potatoes and 18 000 tons of potato peels and grey waters per annum.

Dry unprocessed potato side streams are utilized mainly in manufacturing industry. In Northern Ostrobothnia 85 % of the side streams from packing facilities (for Ostrobothnia figure is not known) is transported to one of the two larger industrial operators in the area to be used as raw material for potato flakes (Ahokas et.al, 2012). Wet sludges of potato peels and the grey water from the different facilities after reducing the water content, are either fed to the cattle or composted. Currently valuable components such as proteins, fibres etc. are not separated from the potato side streams. There are plans to establish biogas plant at one of the bigger facilities in the future.

¹ Ahokas M, et al. Perunnan ja vihannesten sivuvirtojen arvokomponenttien hyötykäyttö. MTT raportti 67. 2012. <http://urn.fi/URN:ISBN:978-952-487-410-6>

2.1 Case 1: Potato company

A company on a west coast of Northern Ostrobothnia grows potato, buys potatoes from the neighboring farmers and sells washed, peeled and readily cut potatoes. Their main customers are restaurants, institutional kitchens and wholesales. Last year company's revenue was over 1,2 million euros. By comparing industry revenues in the NPA area, company is quite small. Side streams from peeling and cutting potatoes is used as cattle feed or composted. On-site valorization of the side streams is not financially feasible.

2.2 Case 2: Potato company

Company is one of the two larger facilities in the area that uses potato to manufacture food products. Their customers are households and professional kitchens. Potato side streams from the company are the largest in the area. Most of the 15 000 tons of potato peels and other side streams per annum is fed to the cattle, company has plans for investments into biogas plant and increase energy self-sufficiency. Company's facilities are quite centrally located in the part of NPA area where most of the potatoes are grown. Currently 85 % of the unprocessed potato side streams from packing facilities located in Northern Ostrobothnia are transported and used by the company as raw material for potato flakes.

3 Future opportunities for waste handling:

- Currently, most of the potato peels and grey waters are utilized either as cattle feed or composted. Also, there are side streams of unprocessed potatoes from the packing facilities and possibly from retailers that are currently not well utilized. At the moment there are no operators that uses potato side streams as raw material for production of more valuable products, such as e.g. proteins, ethanol.

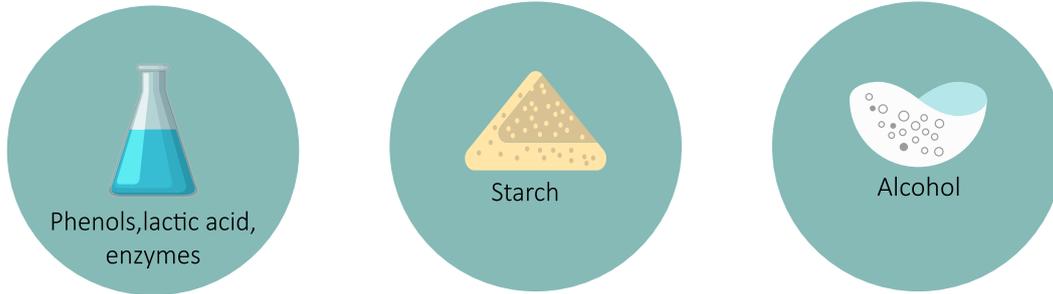
4 Bottlenecks / challenges for efficient waste handling:

- Northern Ostrobothnia and Ostrobothnia together is a large land area. Distances between different facilities that operate in the area are long. Most of the facilities that are involved in the potato industry are quite small. Therefore, investments in on-site valorization of the side streams are not justifiable. It will be a challenge to collect small side streams cost effectively from the facilities, that are spread over a wide land area.
- Selection of the location for the site of valorization is very important. Most of the dry unprocessed potato side streams in the area are used in manufacturing potato flakes. So, most abundantly available potato side streams are wet sludges of potato peels and grey waters. In order to reduce transportation costs most of the water from the side streams should most likely to be removed before transportation.

POTATO BY-PRODUCT POSSIBILITIES



Example of valuables from by-products:



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

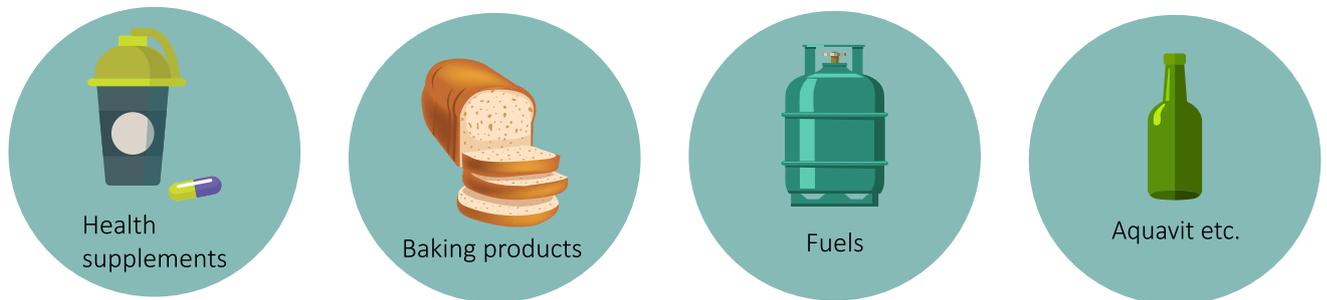
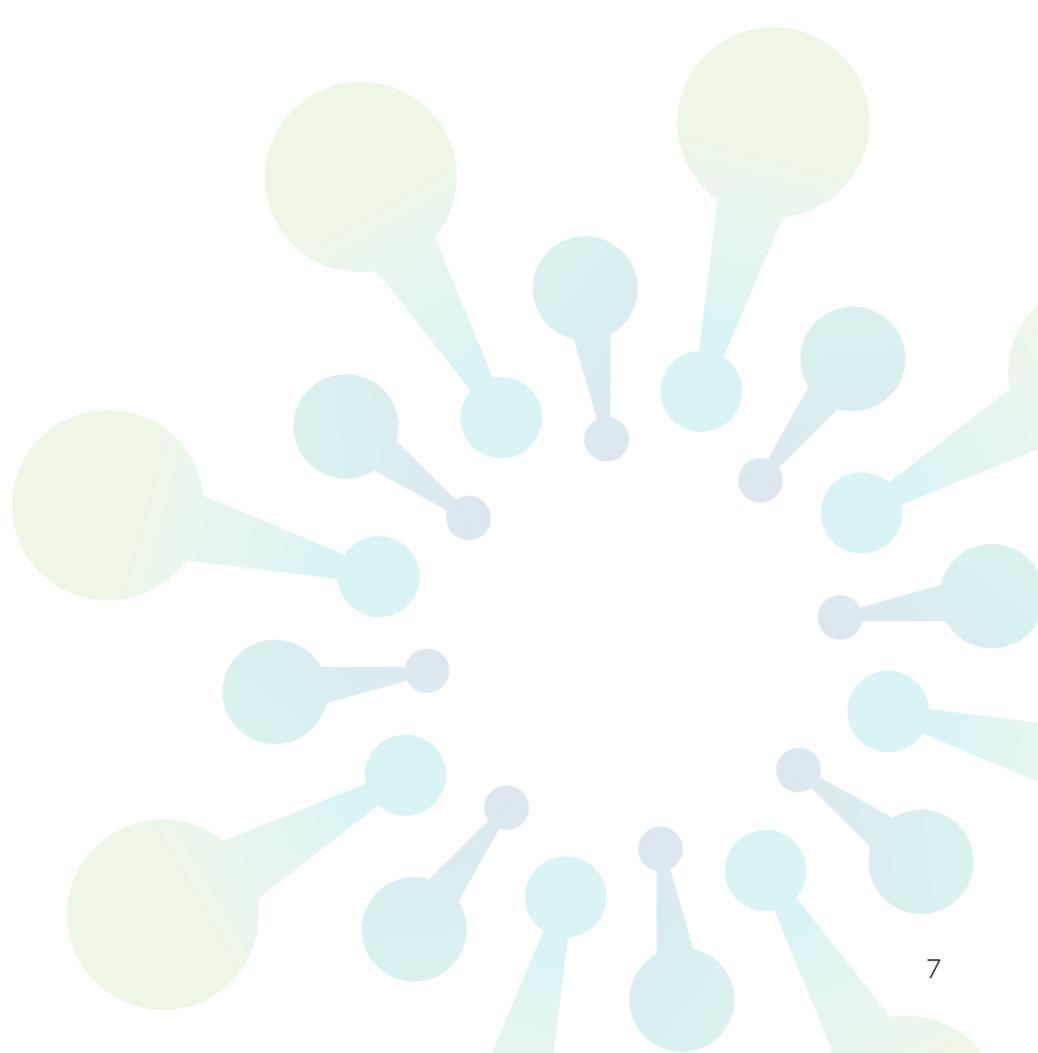


Figure 4 Possibilities of the potato industry by-products



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)