# From food waste to innovative bio-based products

#### Dr. Johanna Buchert

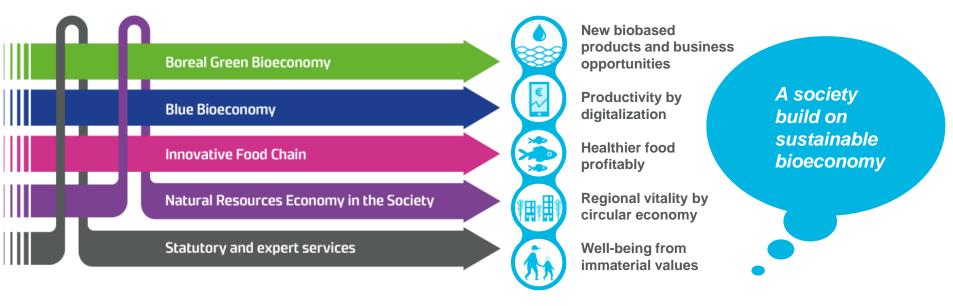
Executive vice president, research Natural resources institute Finland (Luke)



## Natural Resources Institute Finland (Luke)

is a research organisation under the Finnish Ministry of Agriculture and Forestry

Our expertise creates innovative solutions for bioeconomy and sustainable growth and well-being



**120** м€

**Turnover** 

100 м€

Research & customer portfolio

20 M€

Statutory and expert services

**25** 

Locations in Finland

HQ in Helsinki

1300

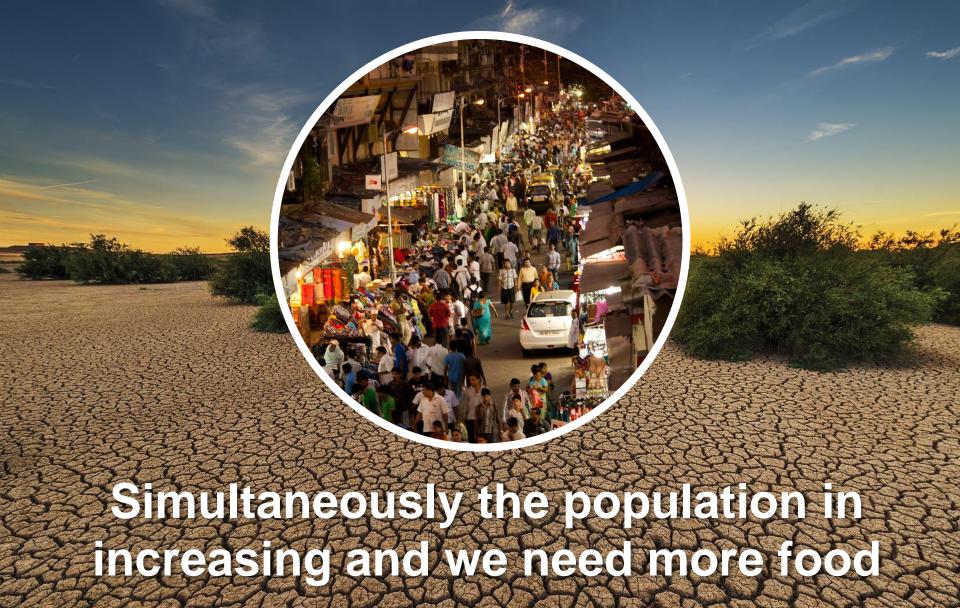
**Employees** 

50 professors 650 researchers 300 other experts 300 research support staff 2015

Founded in merger of three research institutes





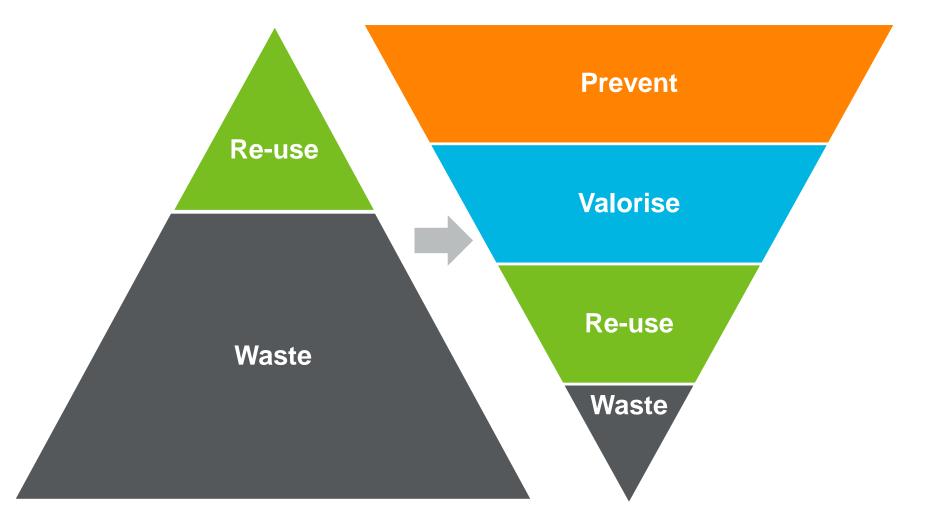




Edible food waste in the Finnish food chain -400 – 500 million kg per year 12 % 30 % 20 % 400-500 milj.kg 18 %

Katajajuuri, J.-M. et al. 2014. Food waste in the Finnish food chain. J. Cleaner Prod. 73: 322–329.

LUONNONVARAKESKUS





# EU has invested huge amount of money on waste conversion RDI –business still in infancy

- Low volume streams
- High water content
- Logistics
- Heterogenity
- Microbial stability
- Safety



- Value co-creation
- Market opportunities
- Industrial symbioses
- Branding
- Consumer awareness





# Innovative processing as tool – learn from other bioeconomy sectors

Pre-processing Factory scale distributed systems centralized systems Microbial processing Concentration Enzymatic processing Thermal Advanced matrix processing deconstruction methods (ILS, DES) Hydrolysis Microbial cell factories



## Household waste processing:

Partially distributed - partially centralized



Preprocessing on-site or during transport







Final fractionation/ conversion centralized

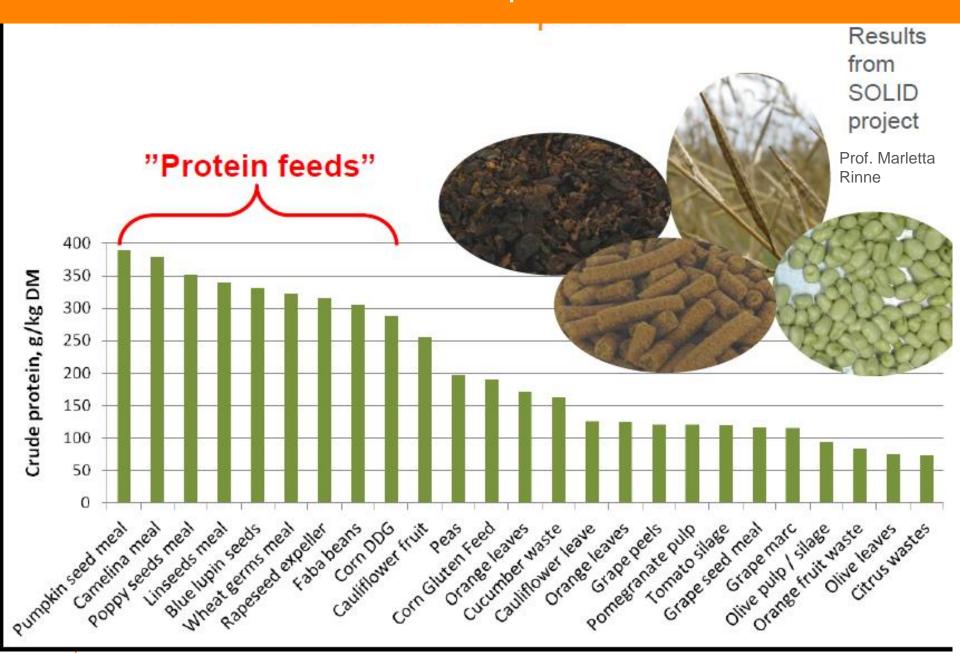




## Vegetable waste has technological potential



### Food waste as protein feed



# Lignin is unexploited dietary fibre component -present in cereal waste (e.g. BSG)





Animal Feed Science and Technology 144 (2008) 175-184

www.elsevier.com/locate/anifeedsci

#### Review

Purified lignin: Nutritional and health impacts on farm animals—A review

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# Potential applications of antioxidant lignins from

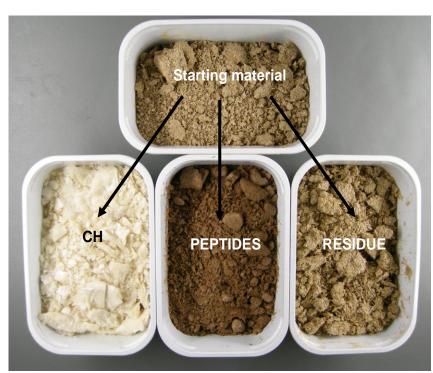
M.P. Vinardell\*, V. Ugartondo, M. Mitjans

Dep. Fisiologia, Facultat de Farmàcia, Universitat de Barcelona, Av. Joan XXIII s/n, 08028 Barcelona, Spain ARTICLE INFO

Keywords: Antioxidant Eye irritation Skin irritation Applications

Interest in the physiological role of bioactive compounds present in plants has increased dramatically over the last decade. Of particular interest in relation to human health are lignins and lignans that are widely distributed within the plant kingdom.

Lignins have been demonstrated as antioxidants, acting as free radical scavengers. This agrans have even demonstrated as anticondum, acting as tree nation scavengers. In In this work we have studied the potential antioxidant and action of industrial lies obtained from different sources: bagasse, lignosulfonate cu



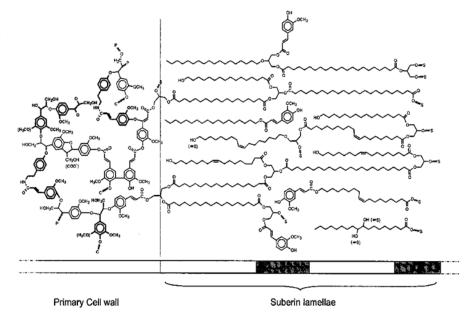
Ref. Forssell et al. 2011 "Enzyme-aided fractionation of brewers' spent grain in pilot scale"



# Suberin or cutin – can it be exploited as fat mimick or barrier material packaging

- Berry and fruit skin
- Potato peels
- Natural polyester, hydrophobic protective layer
- Main role to as natural barrier
- Polyester similar to wine cork stoppers

Foto: Dr. Risto Korpinen, Luke





# Insects as tools to valorize low-grade waste to food and feed - what about regulation and consumer perception?





**Novel protein sources** for food security ScenoProt 2015-2020,



Insects in the Food Chain, 2015-2017



### THE WALL STREET JOURNAL.

WSJ.com

### The Six-Legged Meat of the Future

Insects are nutritious and easy to raise without harming the environment. They also have a nice nutty taste

By MARCEL DICKE and ARNOLD VAN HUIS



# Urban bioeconomy and new soil-free food production concepts are coming

- In-house food production
- Small-scale circular bioeconomy
- Industrial symbiosis

Silmusalaatti Ref. Kauppalehti 29.12.2015





### What is needed

- Research and innovation
  - On-line-analysis on chemical/ macromolecular properties
  - Advanced sorting and pretreatment technologies
  - Novel biomass deconstruction/ fractionation methods
    - exploiingt knowledge from other sectors
  - Piloting
- New business models and industrial symbioses
  - Combination of small scale and large scale industries
  - Active SMEs
  - Venture capitalists





