Driving SME Sustainability and Circular Innovation: Strategies, Tools, and Advocacy for a Resilient Future

2nd Workshop

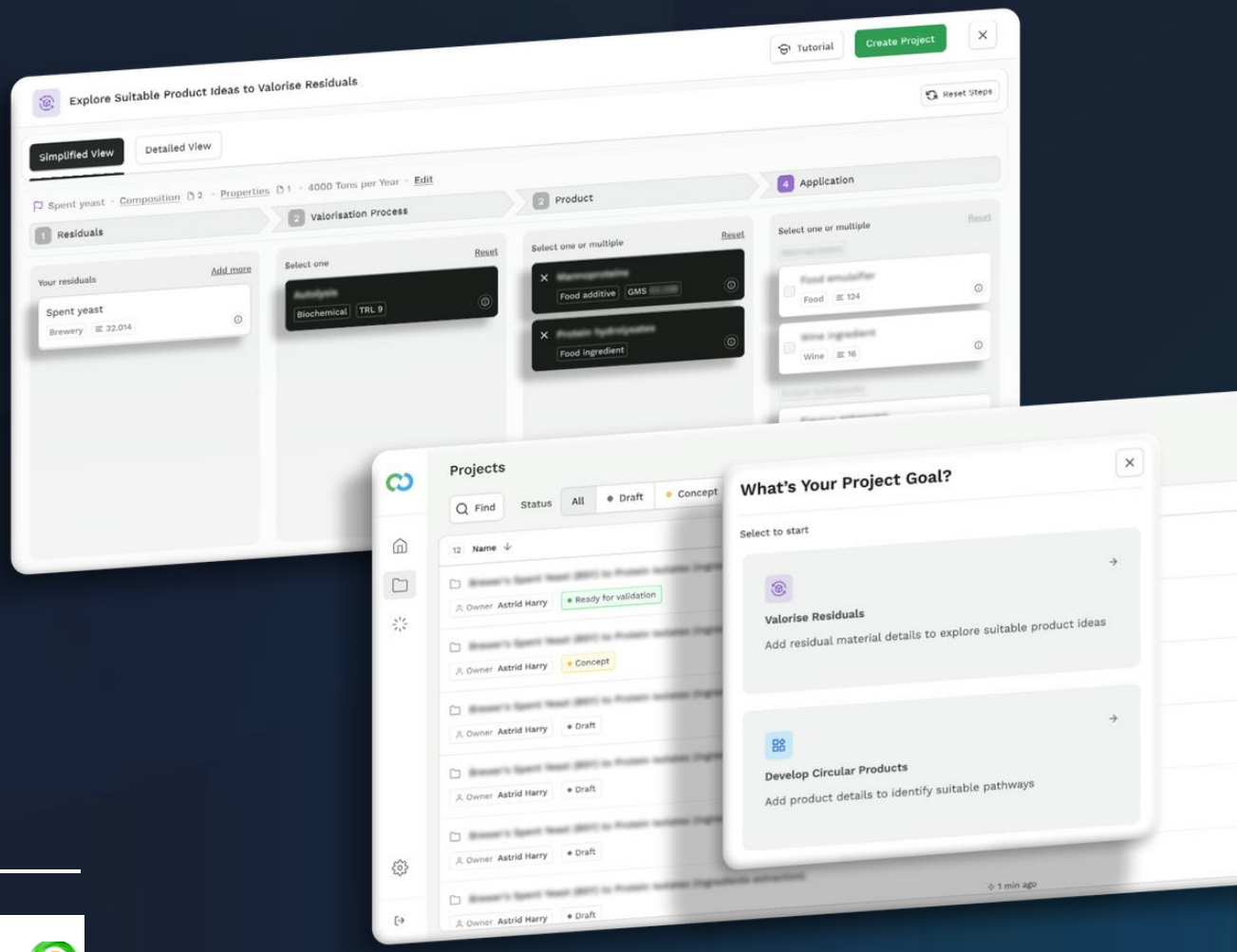
03.04.2025

Funded by the European Union Grant Agreement No 101135166

vcg.ai®

VALUE CHAIN GENERATOR

AI development of circular & biobased products and business models



EIC Accelerator

CYBER ONE
DER HIGHTECH AWARD BADEN-WÜRTTEMBERG

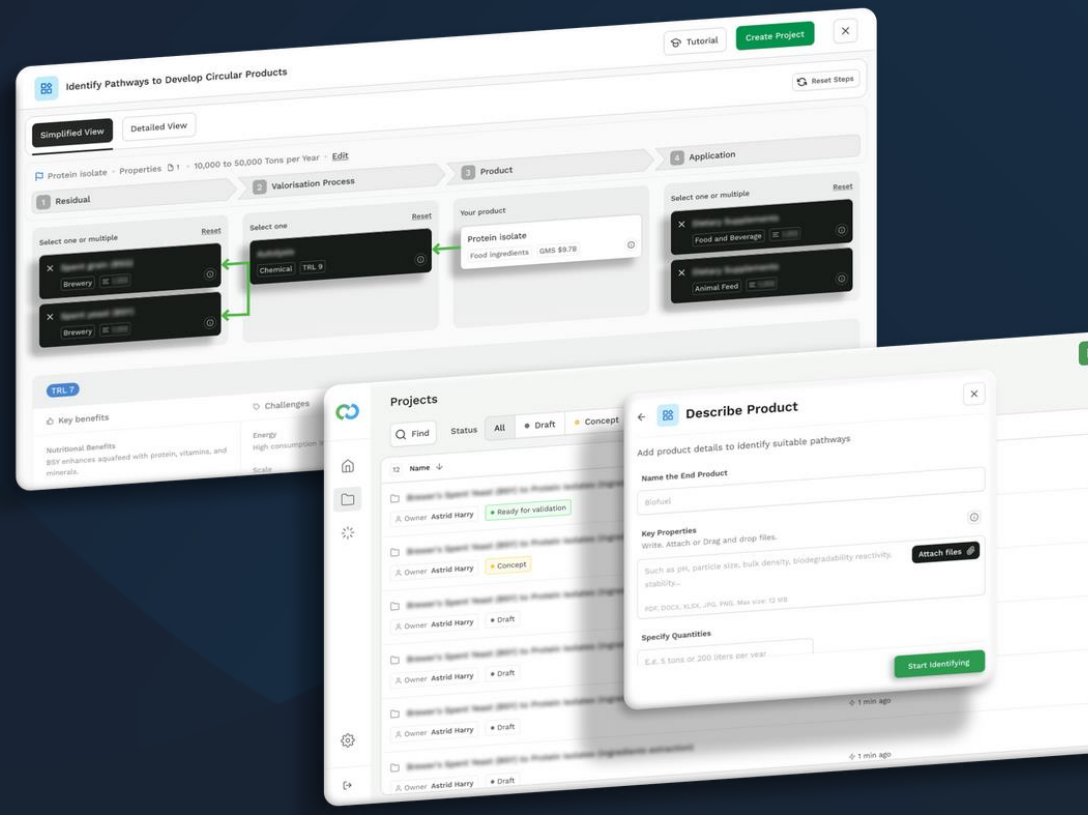
#FRAME OF HELP

CIRCULAR SPC

DEVELOP TECHNICALLY FEASIBLE & PROFITABLE CIRCULAR SOLUTIONS

vcg.ai
VALUE CHAIN GENERATOR

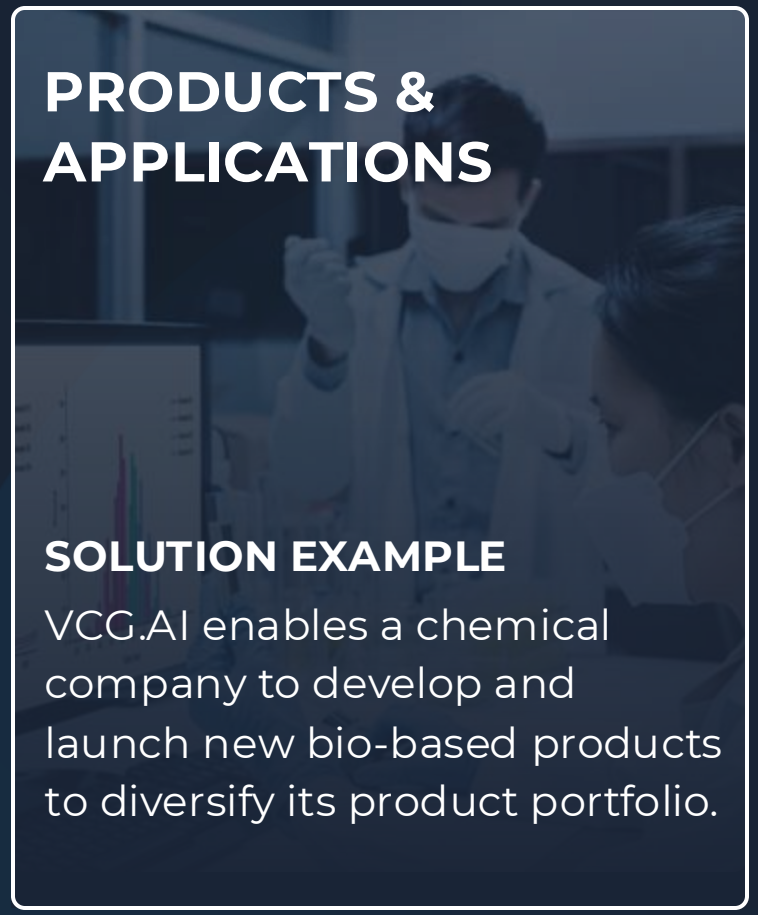
AI to develop circular solutions based on the latest technological and scientific advances combined with material, market, and feedstock availability intelligence.



A COMPETITIVE EDGE WITH SPECIALISED AI

With more than 5 million of the latest patents, technologies, scientific publications, market reports, LCAs, and other data sources, you can realise circularity with global intelligence at your fingertips.

VCG.AI
SCOPE OF OUR SOLUTIONS



PRODUCTS & APPLICATIONS

SOLUTION EXAMPLE

VCG.AI enables a chemical company to develop and launch new bio-based products to diversify its product portfolio.

TECH & MARKET MONITORING

SOLUTION EXAMPLE

VCG.AI monitors the tech landscape and market dynamics for a major recycling company in Scandinavia.

FEEDSTOCK SOURCING

SOLUTION EXAMPLE

VCG.AI supports project implementation by providing reliable feedstock sourcing, meeting quantity & quality requirements.

TECHNOLOGY LANDSCAPE ANALYSIS & MONITORING
TECH ADVANCEMENTS & MARKET OPPORTUNITES

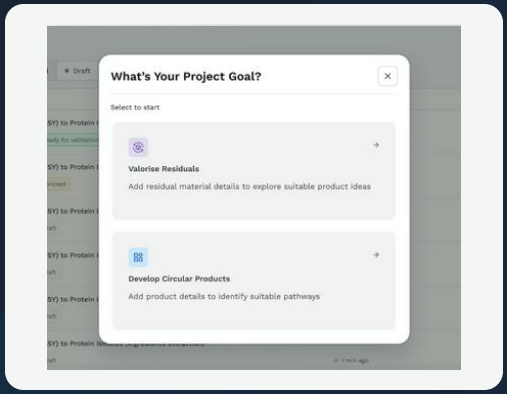
Analyse the current state of technology readiness & advancements across feedstocks, processes, products and applications for data-driven strategic development.

Monitor the IP landscape, technology developers, projects (pilot, demo, industrial scale), market dynamics and the latest scientific publications.

ACCELERATE PRODUCT DEVELOPMENT WITH AI

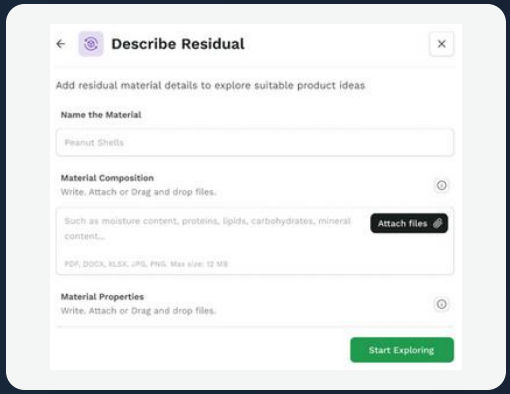
DEVELOP PATHWAYS TO YOUR TARGET PRODUCTS

Analyse all possible combinations of feedstocks, processes, products & applications based on the latest technological advancements and market trends.



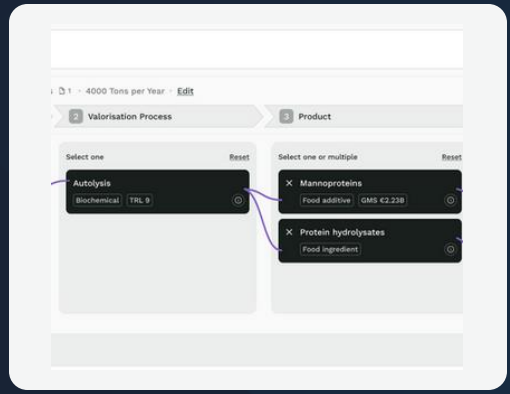
1. CHOOSE YOUR STARTING POINT

Start with the feedstock, target product, or market application, based on your challenges & goals.



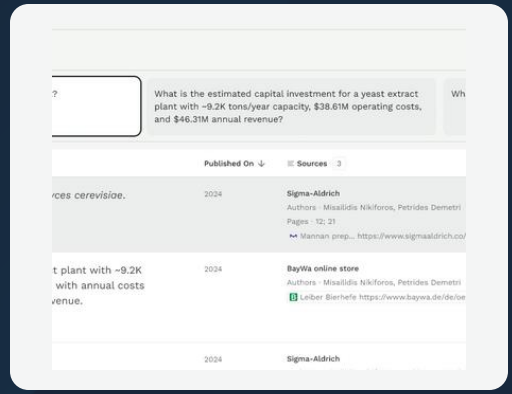
2. ADD SPECIFIC CRITERIA

Add key details, such as material properties and quantities, to refine solutions from the start.



3. DISCOVER POSSIBLE SOLUTIONS

Analyse feedstocks, processing technologies, and product applications based on the latest data.



4. CUSTOM ASSESSMENTS

Dive deep into key feedstock and process parameters, IP landscape, sustainability and more.

FEEDSTOCK SOURCING
BIO-BASED FEEDSTOCK PORTFOLIO ACROSS EUROPE

WE SOURCE THE OPTIMAL FEEDSTOCK FOR SUCCESSFUL PROCESSING

VCG.AI has a portfolio of verified bio-based feedstock suppliers across Europe, ensuring the right feedstock is sourced for your needs.

Additionally, VCG.AI uses data about 3.5 million companies and predictive models to comprehensively assess feedstock availability in any region, enabling optimal site and supplier selection.

+4.5 mio tonnes

annually of bio-based feedstock supply available in our portfolio today

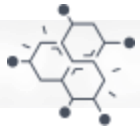
PARTNERS & CLIENTS
EUROPE AND BEYOND

F&B Company

Chemical Company

Retail Chain

Global Brewery



Fertilisers Producer

Chemie Cluster Bayern

Fraunhofer

SINTEF

15 countries

where VCG.AI is already deployed

+300,000 tonnes

of renewable feedstock sourced for projects already in development

vcg.ai®
VALUE CHAIN GENERATOR

Customised demo

VCG.AI’s overview of demo analysis done based on clients’s request.

DEMO SCOPE & OBJECTIVE
FERMENTATION OF ORGANIC WASTE FOR CHEMICALS

Data on the complete value chain

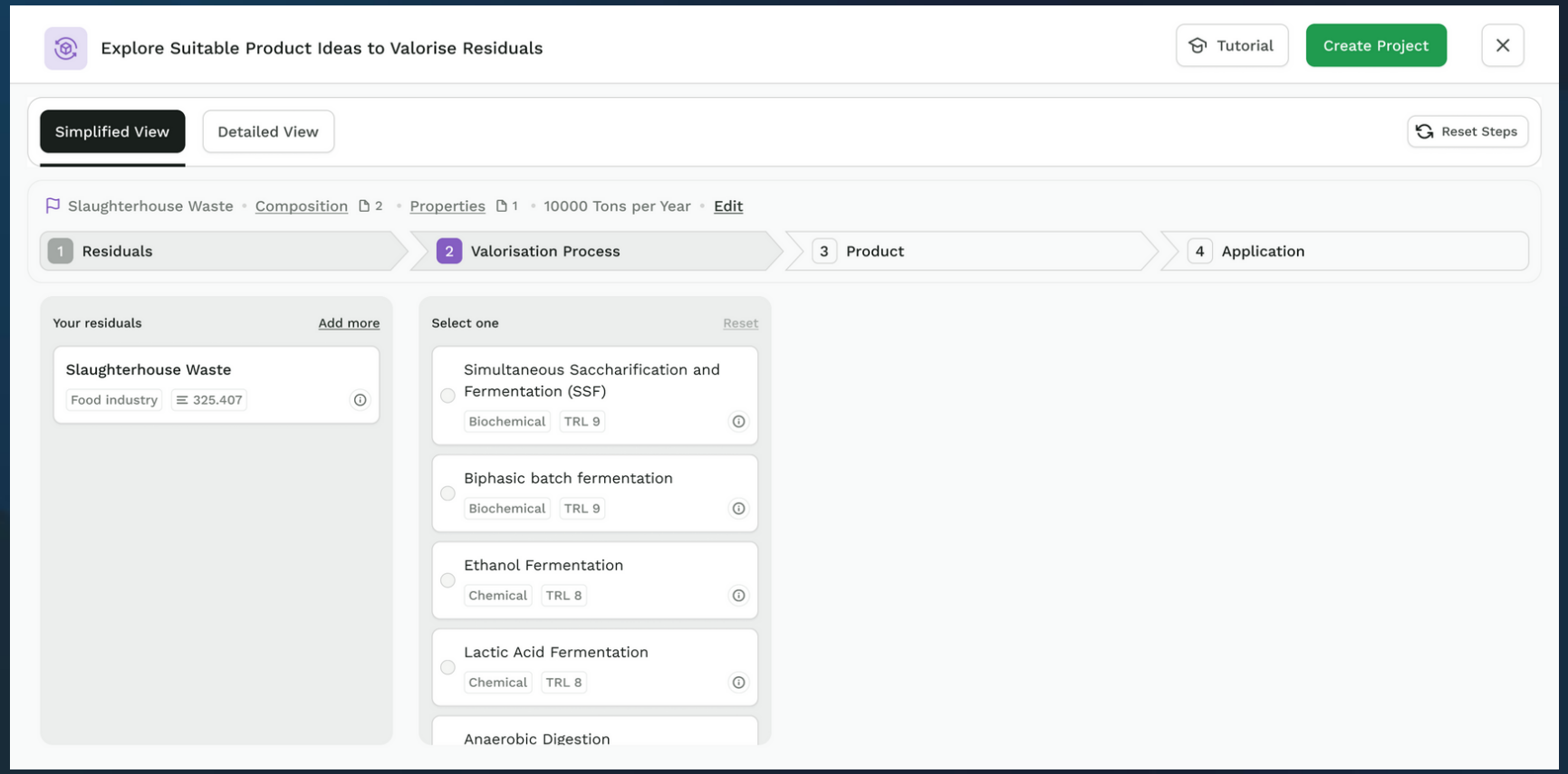
This demo is focused on: **Fermentation of organic waste to produce chemicals.**

This demo is focused on **Slaughterhouse Waste (SHW)**

The following **data were analysed**

- Technical value chain concepts
- Technology landscape and TRL analysis
- IP landscape
- Scientific publications landscape
- Start-ups and new technologies scenario
- Company reports
- EU project reports

TECHNICAL VALUE CHAIN SOLUTIONS
RESIDUALS / VALORISATION PROCESSES



5 types of Fermentation processes

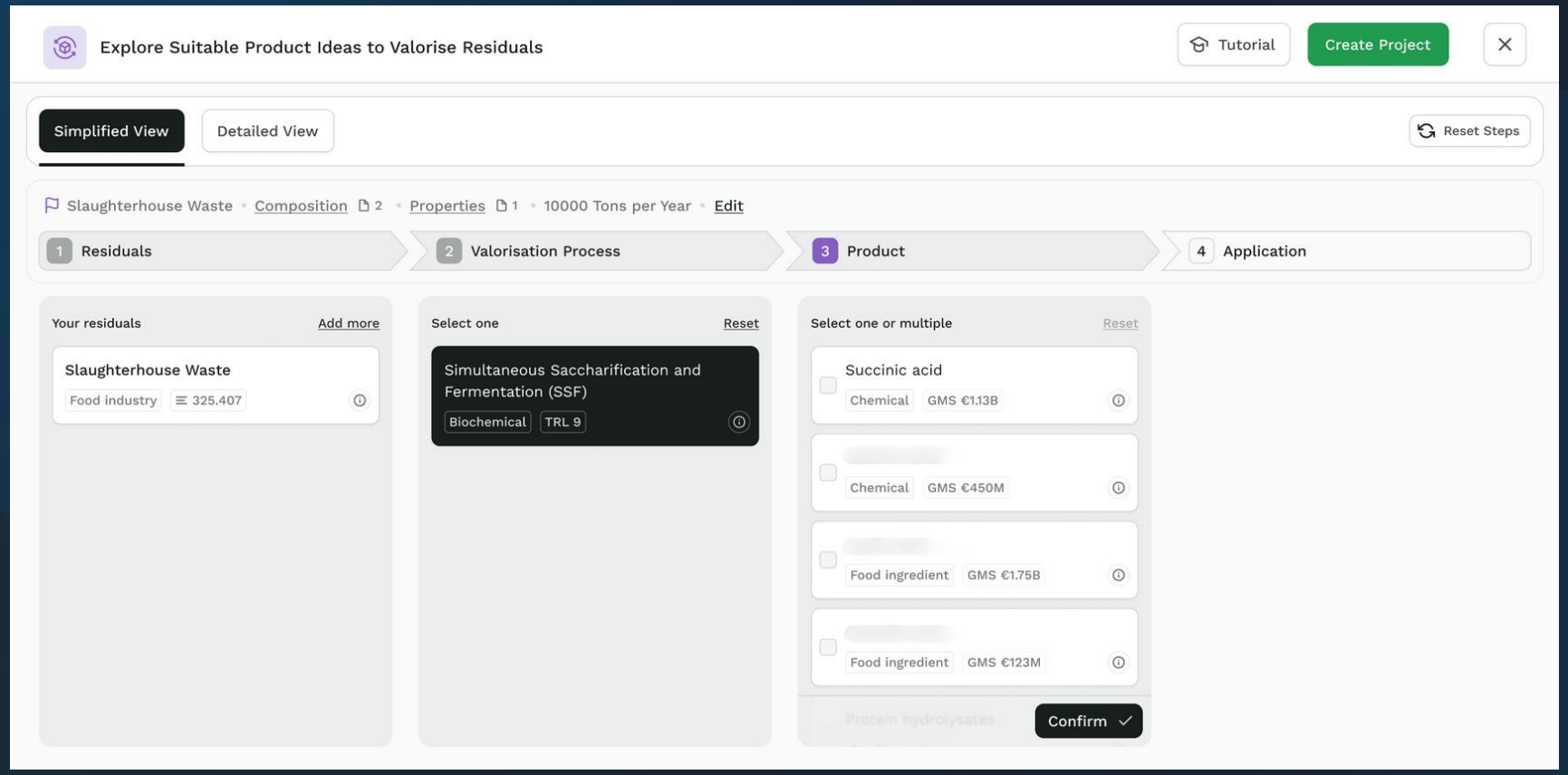
Technical details

Process:
Simultaneous Saccharification and Fermentation (SSF)

Pre-treatment:

1. Thermal/Thermochemical Methods
2. Chemical Methods
3. Biological Methods
4. Mechanical Methods
5. Combined/Hybrid Methods

TECHNICAL VALUE CHAIN SOLUTIONS
PRODUCTS



12 Different Chemical Products

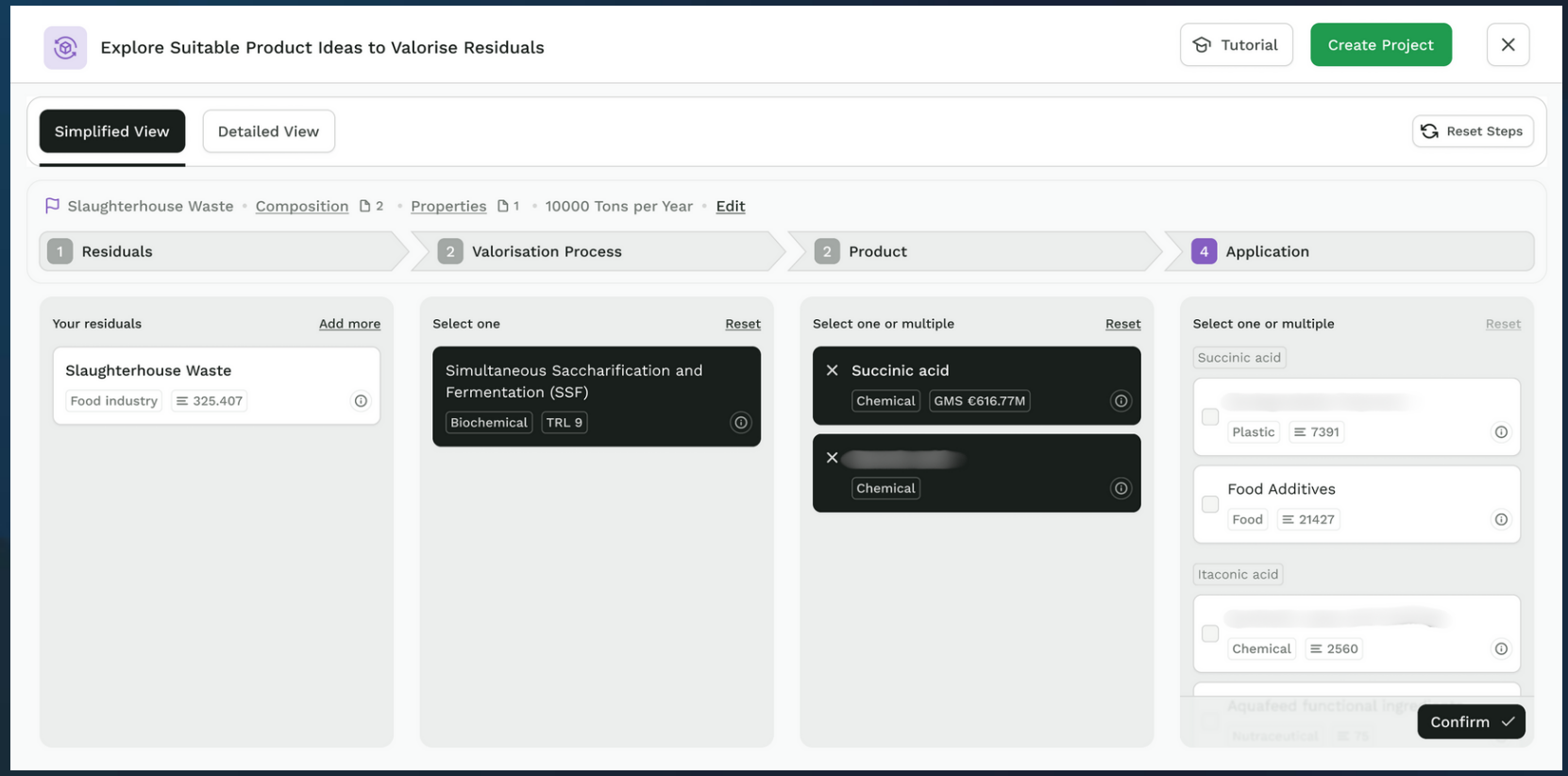
from Simultaneous Saccharification and Fermentation (SSF)

Product types include

- Sugar Alcohols (Polyols)
- Organic Acids
- Alcohols and Biofuels
- Amino Acids

The Global Market Size for these products ranges from $118.4 Bn to $144.7 Bn/year.

TECHNICAL VALUE CHAIN SOLUTIONS
APPLICATIONS

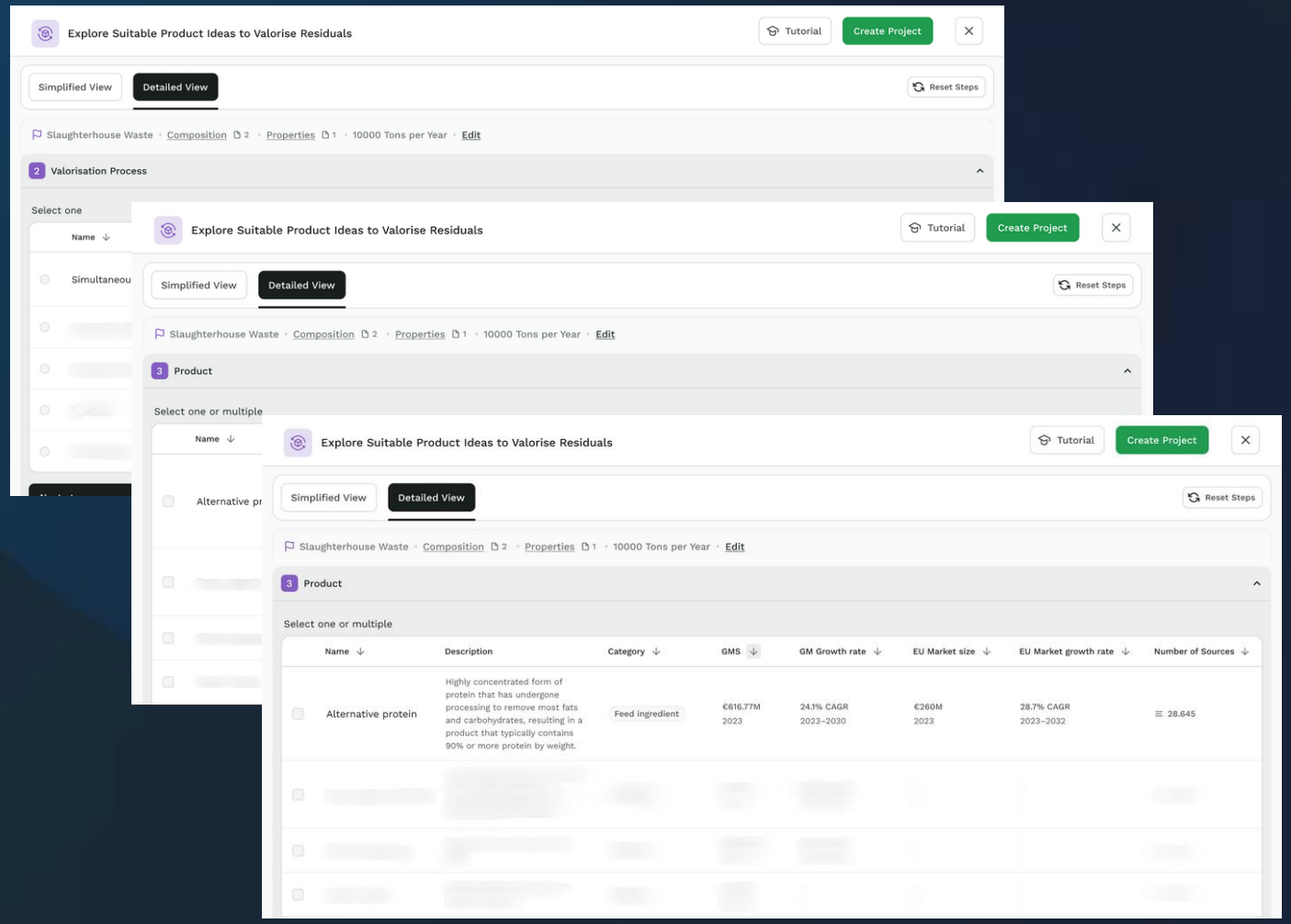


36 End-market Applications
in the following sectors

- Food & Beverage Industry
- Pharmaceutical & Healthcare Industry
- Personal Care & Cosmetics
- Cleaning & Household Products
- Industrial & Chemical Manufacturing
- Energy & Biofuels
- Animal Feed & Agriculture

Price point for the Applications ranges from €4,5-14/kg to €55-75/kg.

TECHNICAL VALUE CHAIN SOLUTIONS
DETAILED VIEW

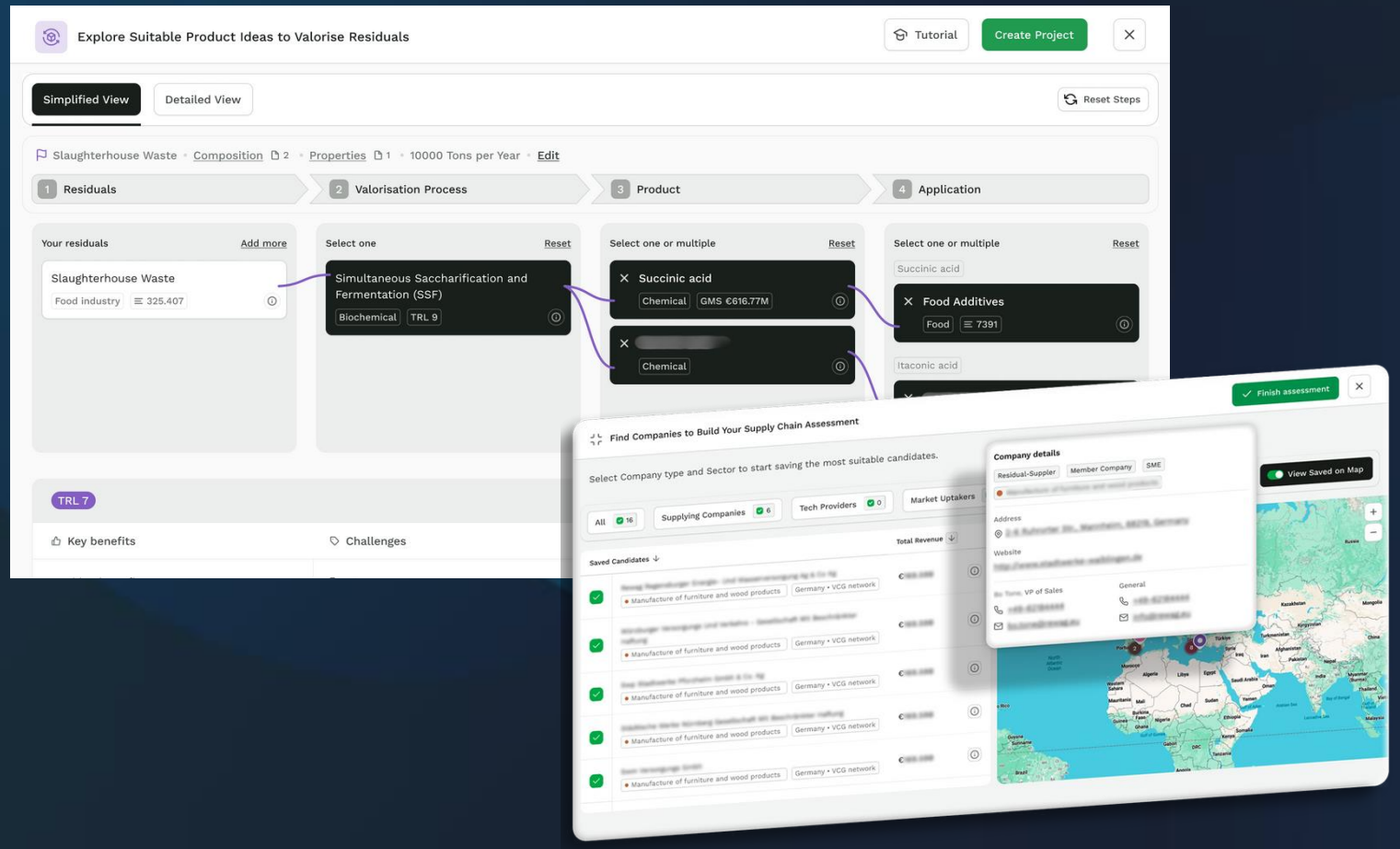


Detailed View

for in-depth information of each step in the value chain, with insights like:

- **Technology Readiness Level** (TRL)
- **Process yeilds & other parameters**
- **Material compositions**
- **Number of Data Sources**
- **Number of Patents**
- **Market Prices**: Provides estimated pricing for these products when derived from beer spent grain, measured in kg, liters, or any other relevant unit depending on the sector.
- **& more...**

TECHNICAL VALUE CHAIN SOLUTIONS
LINKED VALUE CHAIN

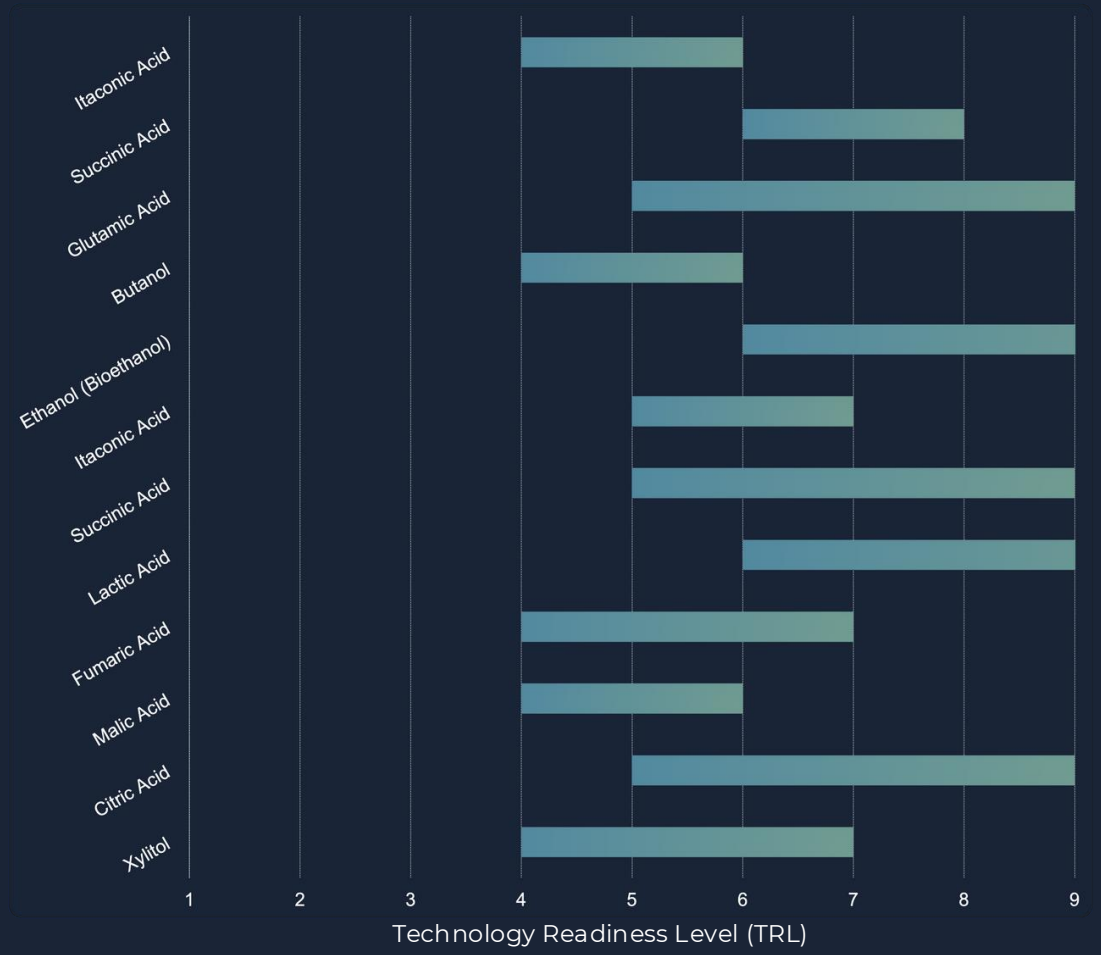


+220k companies

mapped across Europe in the relevant sectors

- Waste generators
- Processing companies
- Chemical producers
- Potential buyers of the products in each market application

TECHNOLOGY READINESS LANDSCAPE



Products range from TRL 4 to 9

They are used to develop a variety of Products

- Xylitol (**TRL 4 - 7**)
- Citric Acid (**TRL 5 - 9**)
- Malic Acid (**TRL 4 - 6**)
- Fumaric Acid (**TRL 4 - 7**)
- Lactic Acid (**TRL 6 - 9**)
- Succinic Acid (**TRL 5 - 8**)
- Itaconic Acid (**TRL 5 - 6**)
- Ethanol (Bioethanol) (**TRL 6 - 9**)
- Butanol (**TRL 4 - 6**)
- Glutamic Acid (**TRL 5 - 9**)
- Succinic Acid (**TRL 6 - 8**)
- Itaconic Acid (**TRL 4 - 7**)

HINTS FROM STARTUPS AND SCALEUPS SCENARIO

Startup major trends in SHW valorisation

- Organic Acids Production
- Collagen and Gelatin Extraction
- Biofertilizer Development
- Lipid Recovery and Biodiesel
- Protein Hydrolysates and Animal Feed
- Biogas Production

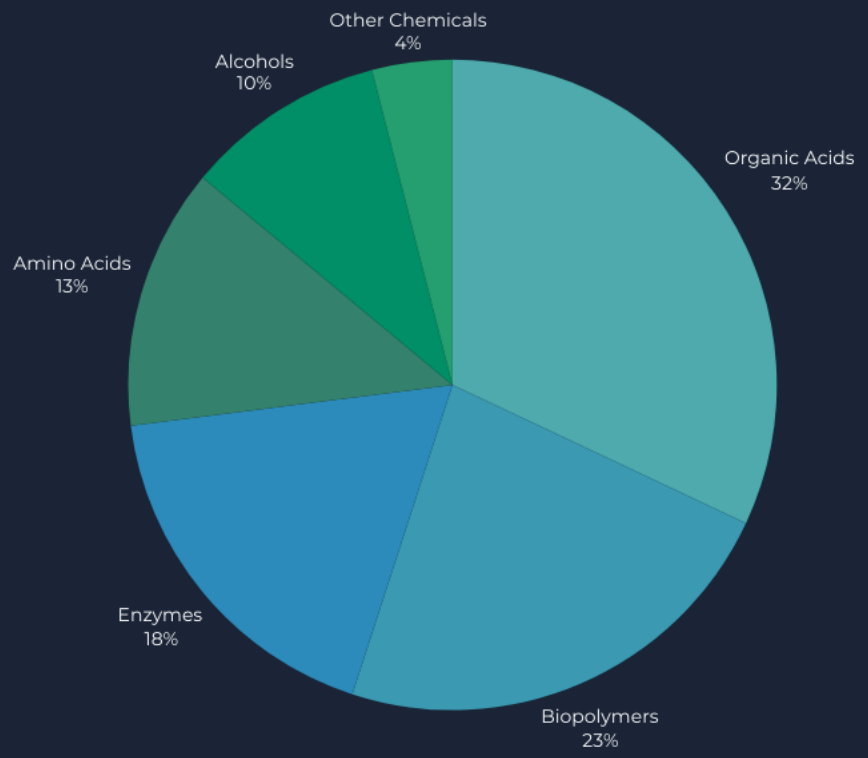
5 core technologies

- **Biotechnology & Enzymatic Processes** → Protein and Fibre Extraction
- **Fermentation & Microbial Solutions** → Production of Alternative Proteins
- **Food Ingredients from Upcycling** → High Protein Flours and Functional Additives
- **Sustainable Packaging** → Bioplastics and Biodegradable Materials
- **Circular Economy Solutions** → Soil improvers and organic fertilisers

Examples:

- ÄIO (Estonia): Converts SHW into sustainable fat substitutes for food and cosmetics through fermentation. Raised €1M.

PATENTS LANDSCAPE



3795 new PATENTS

regarding the technologies to **produce chemicals through the fermentation of SHW**.

6 different types of chemicals

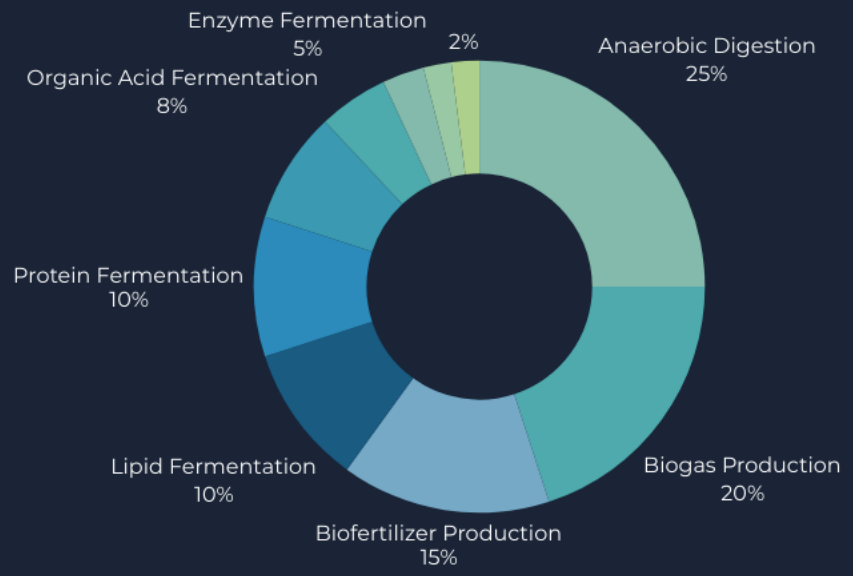
- Organic Acids
- Biopolymers
- Enzymes
- Amino Acids
- Alcohols
- Other Chemicals

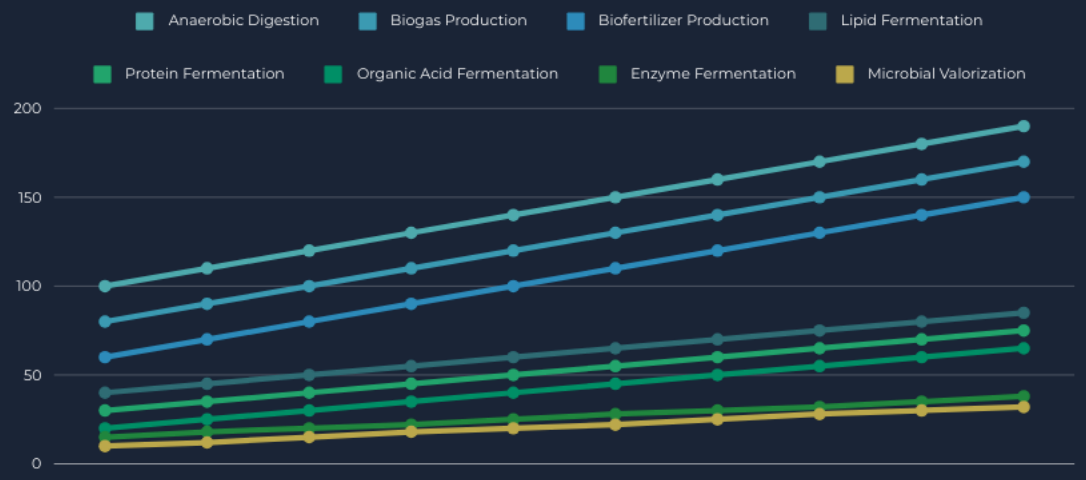
9 different trends

in the analysed patents, like:

- Specific Waste Stream Valorization
- Advanced Fermentation Technologies
- Integration with Other Technologies
- Bioproducts production
- Circular Economy implementation
- Enzymatic Fermentation development
- Microbial Fermentation Implementation.
- Advanced Pretreatment.
- Bioraffinery Concepts.

SCIENTIFIC PUBLICATION LANDSCAPE





+3.000 QUALITY PUBLICATIONS
on SHW VALORISATION **IN THE LAST DECADE**, WITH AN **ACCELERATING TREND**

8 major applICATION SECTORS

- Anaerobic Digestion
- Biogas Production
- Biofertilizer Production
- Lipid Fermentation
- Protein Fermentation
- Organic Acid Fermentation
- Enzyme Fermentation
- Microbial Valorization

8 DOMINANT TRENDS

- Anaerobic Digestion Optimization
- Biogas Upgrading
- Biofertilizer Formulation
- Lipid Fermentation for Biofuels
- Protein Hydrolysate Production
- Organic Acid Fermentation Optimization
- Enzyme-Assisted Waste Degradation
- Microbial Waste Transformation

Yeast-2-value

Greenfield investment into upcycling of brewer’s spent yeast into high-value ingredients for Belgium

Prepared by
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Gašper Božič
Business Development Associate

BREWER'S SPENT YEAST

UNDER-UTILISED, OFTEN WASTED

Brewery spent yeast

Rich in nutrients, represents over 10% of by-products generated by breweries

Soil additive

Sold as low value wet animal feed

Used as feedstock for biogas production

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INNOVATIVE CIRCULAR SOLUTIONS

BREWER SPENT YEAST INTO HIGHER VALUE PRODUCTS

FEEDSTOCK

Brewer's spent yeast

Brasserie Dupont, Brasserie de Silly, Brouwerij Timmermans, Brouwerij Roman , Het Anker, BOOB BROUWERIJ, Brouwerij van Eecke, Brouwerij de Ryck

10+

PROCESSING

Mechanical separation, ingredient extraction

GEA Group
Biorigin
Chr. Hansen

3

MARKET

B-glucans

Active peptides

Puratos
IFF Benelux, Corbion, Kemin
L'Oréal, Henkel
Aveve, Dumoulin, Arvesta

10+

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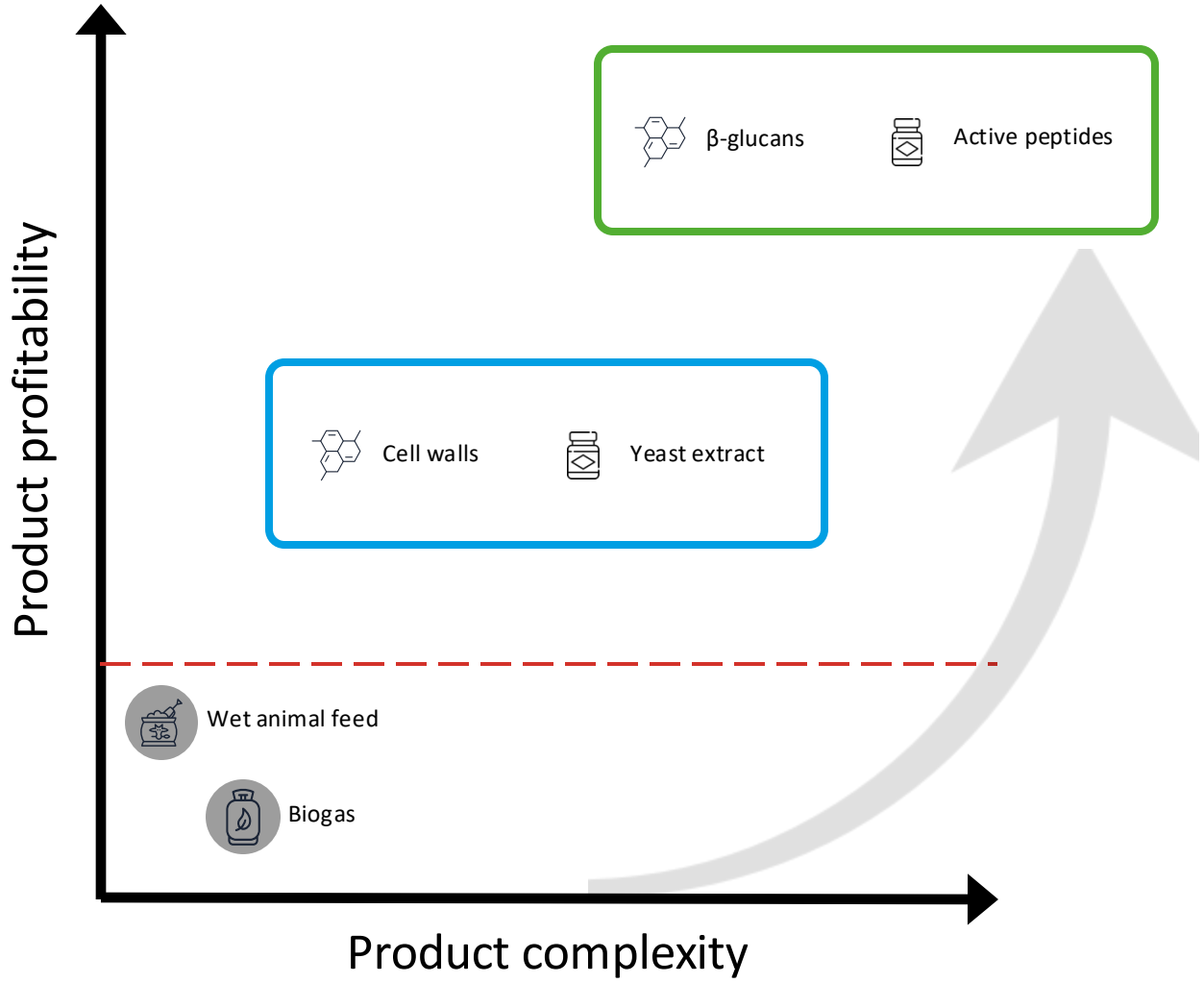
AIMING FOR HIGH VALUE-ADDED MARKETS



Current innovations allow for the extraction of β-glucans & active peptides as the highest value valorisation at industrial scale.

Extraction of Cell walls and yeast extract represents a step towards in unlocking part of the higher value possibilities of BSY with high production volume requirements.

BSY application in wet animal feed and biogas production is a lowest value-add treatment, still commonly applied across the industry.

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MARKETS AND INDUSTRY APPLICATIONS

β-glucans

Market price: 7.500 - 10.000 €/MT

Market CAGR: 8% (2023-2030)

Market (global) size: 1.1 billion (by 2030)

Active peptides

Market price: 12.500 - 15.000 €/MT

Market CAGR: 10,11% (2024-2030)

Market (global) size: 10 billion (by 2030)

Pet food & feed

Chemical

Pharmaceutical

F&B

Cosmetics

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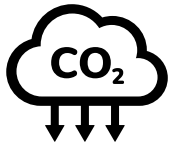
ENVIRONMENTAL SUSTAINABILITY

PROTEIN COMPARISON TABLE

	Brewery's yeast	Pea protein	Beef protein
Water required		30x more	250x more
GHG emitted		10x more	80x more

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EXAMPLE FROM THE INDUSTRY

LEIBER (DE) - GROWTH & EXPANSION

Revenue in 2019

116mio €

Workforce in 2019

+250

2003	2009	2017	2024	..
Opens Polish subsidiary	Opens Russian subsidiary	Expands existing capacity	Enters Spain by taking over ABN	Plans to expand in the US

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Whey-2-value

Greenfield investment into upcycling of the dairy industry’s by-products into high-value ingredients for Belgium

Prepared by
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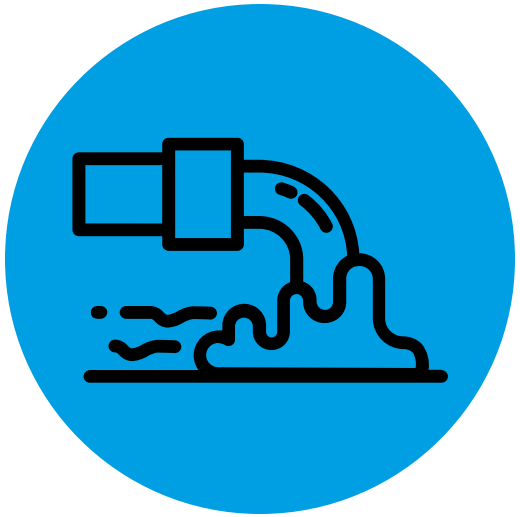
Gašper Božič
Business Development Associate

WHEY & DAIRY PERMEATES

UNDER-UTILISED, OFTEN WASTED



Sweet whey & permeates

Major by-products of dairy processing, generated during cheese and yogurt production.

Lower value products

Released in the environment

Used as feedstock for biogas production

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INNOVATIVE CIRCULAR SOLUTIONS

DAIRY BY-PRODUCTS INTO HIGHER VALUE PRODUCTS

FEEDSTOCK

Sweet & sour whey

AGRAL, Corman, Eurofit, Chimay Fromages, Castle Dairy, Capra, Pur Natur, De Zuivelarij, Yakult

10+

PROCESSING

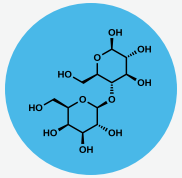
Physicochemical process

Membrane separation, Ultrafiltration

GEA Group
Tetra Pak
Chr. Hansen

3

MARKET



Pharma-grade lactose

Protein concentrate (WPC)

Pharma: GSK, Baxter, Pfizer, Catalent
Nutrition/Sports: Ferrero, Mondelez, Nestlé
Infant Formula: Hero, Danone, Nutricia

10+

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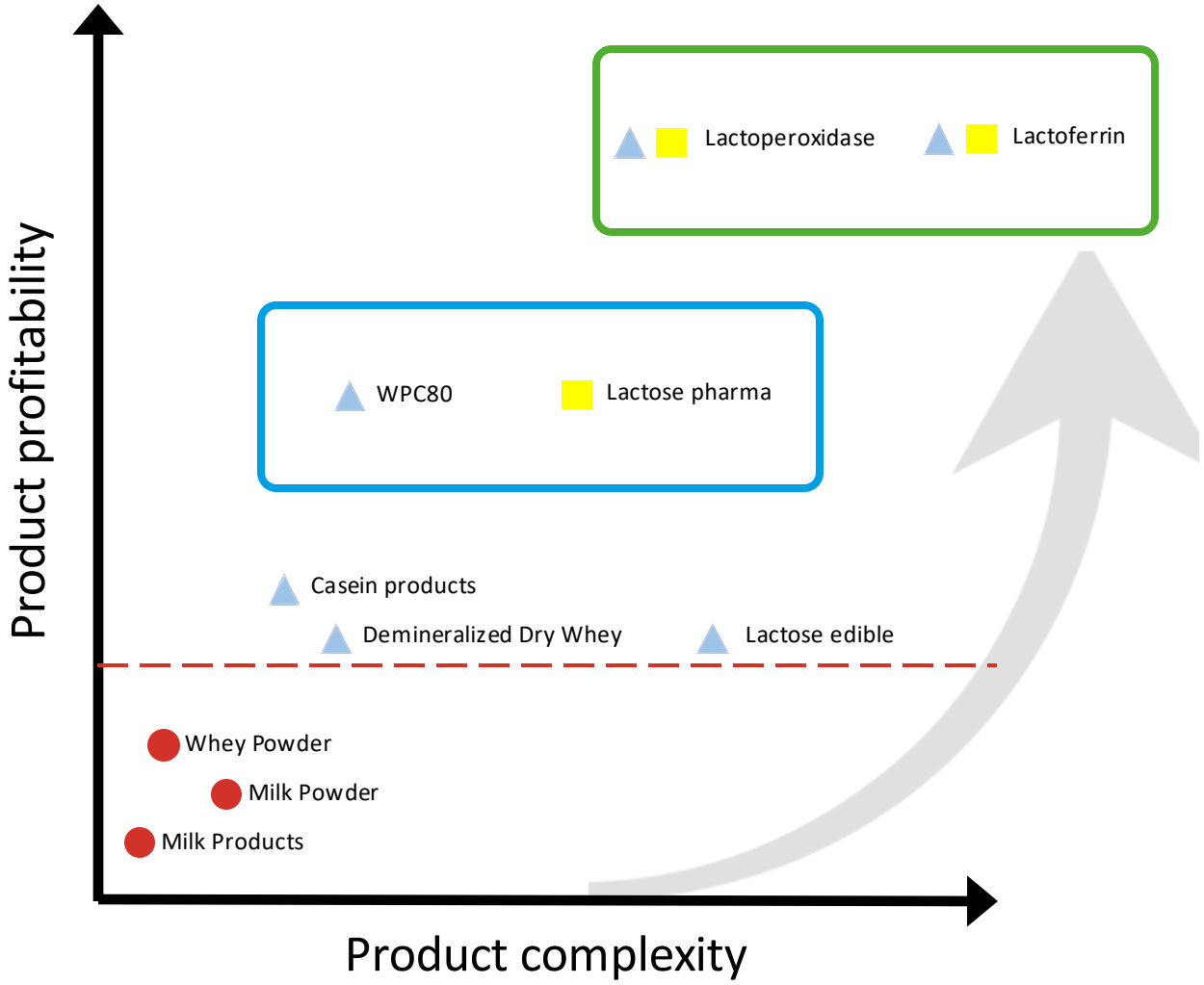
AIMING FOR HIGH VALUE-ADDED MARKETS



The process allows for technological upgrades and adaptation to produce highest value products.

Extraction of WPC80 and pharmaceutical grade lactose is a proven process, that allows a profitable valorisation of dairy industry by-products at industrial scale.

- Products for the food industry
- Products for the pharmaceutical industry
- Traditional dairy products

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MARKETS AND INDUSTRY APPLICATIONS

WPC80

Market price: 11.000 - 14.000 €/MT

Market CAGR: 10,5% (2022-2030)

Global market size (WPC): 14.3 billion (by 2031)

"Pharma-grade" lactose

Market price: 2.000 - 2.500 €/MT

Market CAGR: 5,2% (2024-2032)

Global market size: 3.2 billion (by 2027)

Confectionary

Nutrition

Pharmaceutical

F&B

Cosmetics

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EXAMPLE FROM THE INDUSTRY

SERUM ITALIA - PRODUCTION OF PROTEINS (NO LACTOSE)

Year 2021	
Revenues	**52,5 mio. €**
Net Income	**6,2 mio. €**

EBITDA % = 15.1%

ROA* = 24.2%

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ENVIRONMENTAL SUSTAINABILITY

IMPACT ON MULTIPLE LAYERS

Reduced costs, logistics and CO2 emissions

Local processing instead of transport abroad, 9,000+ tonnes less CO2 emissions/year

Sustainable source of protein and lactose

40 times less CO2 emissions/kg protein compared to beef

Development and long-term competitiveness

Higher added value for by-products of the dairy industry in Belgium

Funded by the European Union Grant Agreement No 101135166

vcg.ai®

VALUE CHAIN GENERATOR

Let’s accelerate the development of the circular economy together!

Contact Us

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