



**Industrial Symbiosis: new shareable
foods and products and a circular
economies' map in Emilia-Romagna
region**

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Enterprises involved:

Barilla G. e R. F.lli S.p.A.

Consorzio Casalasco del Pomodoro



ALMA MATER STUDIORUM
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ENEA

Agenzia nazionale per le nuove tecnologie,
l'energia e lo sviluppo economico sostenibile



**SIMBIOSI INDUSTRIALE:
DUE NUOVI ALIMENTI DA SOTTOPRODOTTI E
UNA MAPPA DELLE RELATIVE ECONOMIE
CIRCOLARI IN EMILIA ROMAGNA**



Barilla
The Italian Food Company. Since 1877.

OBJECTIVES

Valorization of agri-food wastes

Technological innovation

RO1: Optimization of low-environmental impact co-milling and defatting technology



Co-milling
process

Defatting process
of durum wheat
bran

Screening LCA of technological
processes

New functional foods

System innovation

RO5: Dissemination of results

OBJECTIVES

Valorization of agri-food wastes

RO2: Development of new food products

Naturally **lycopene-enriched olive oil**

Defatted wheat bran and wheat germ oil

LCA of tomato and durum wheat bran waste valorization

RO4: Economical feasibility, strategic and operational marketing

System innovation

RO5: Dissemination of results

OBJECTIVES

Valorization of agri-food wastes

RO3: Implementation of tools for industrial symbiosis in the agri-food sector at regional level

Round
tables

Development of a Geographic
Information System (GIS)

Data
collection

Databases

Operation
manuals

Identification of synergies

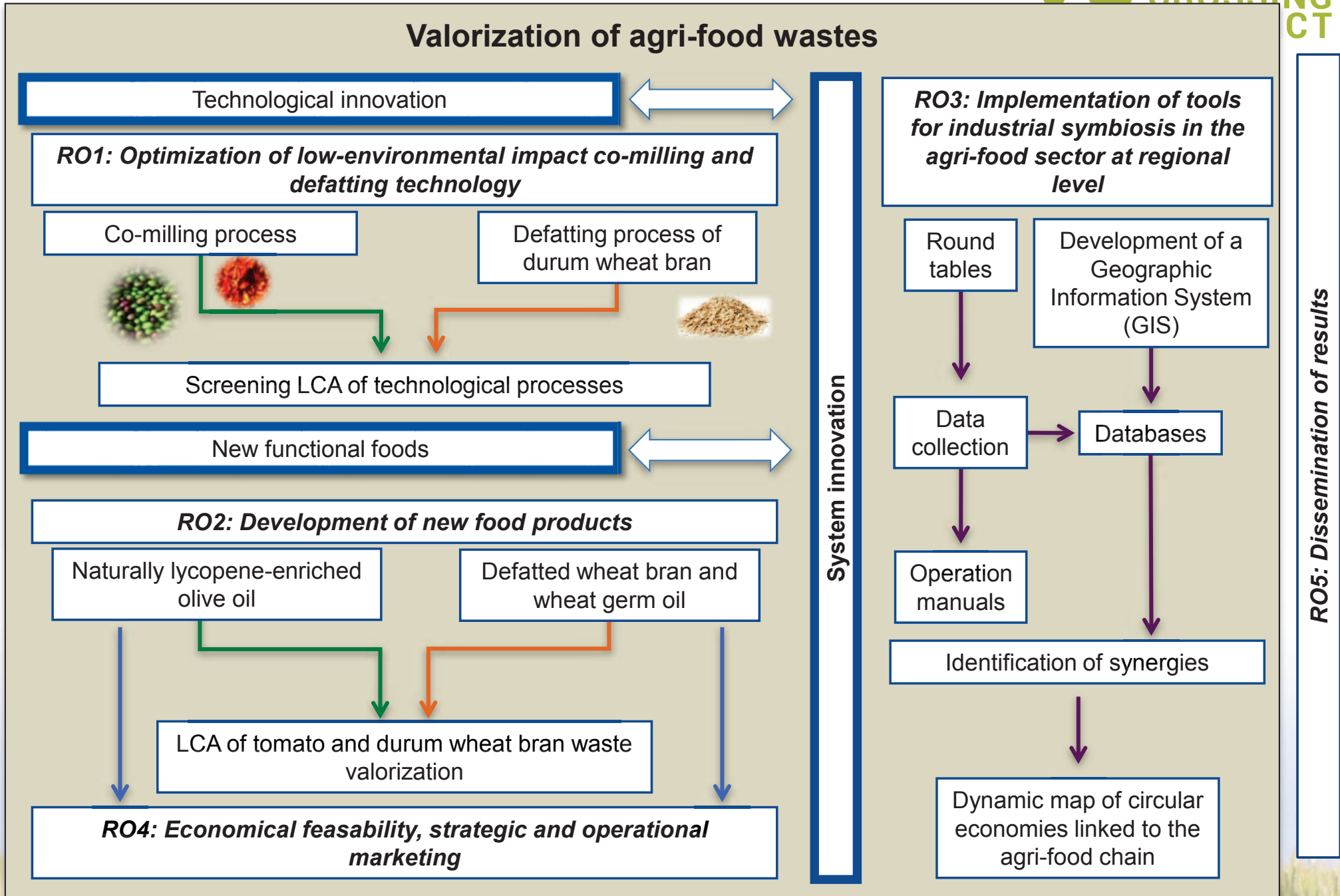
Dynamic map of circular economies
linked to the agri-food chain

System innovation

RO5: Dissemination of results

OBJECTIVES

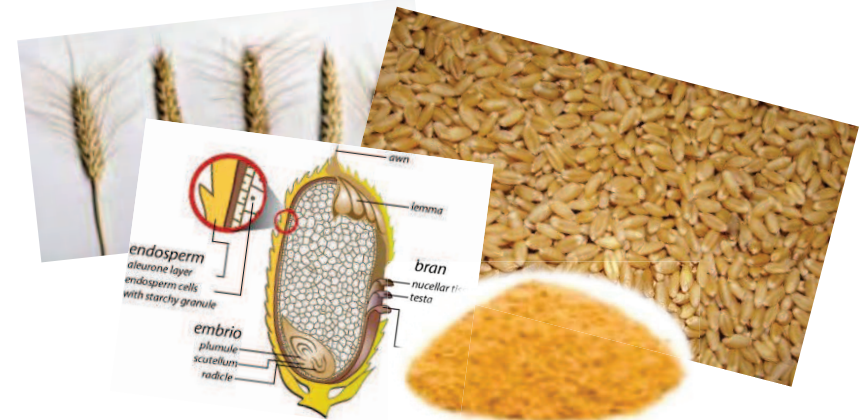
Valorization of agri-food wastes



ACTIVITY

Durum wheat bran supply chain

Wheat bran by-products were obtained by Barilla G. e R. F.lli S.p.A. Five different bran layers were selected, isolated according to their sieving mesh size during the flour milling.



Durum wheat bran



From each layer, the lipid fraction was extracted by Soxhlet procedure and the main lipid classes of each lipid extract, were also determined.



Defatted wheat bran



Wheat-germ oil

Determination of bran oil (germ oil) and defatted wheat bran quality

ACTIVITY

Determination of environmental sustainability (Life Cycle Assessment – LCA) **and economical sustainability** leading to:

- The environmental evaluation of the technologies for the valorisation of wheat bran and tomato by-products;
- The environmental optimization of the processing technologies;
- The LCA studies of the new products developed.



ACTIVITY

Industrial Symbiosis

The mapping methodology implemented in **Food Crossing District** includes five main steps:

- 1. Involvement** of the enterprises and network creation;
- 2. Development** of a **database** including enterprises' resource flows in input and in output;
- 3. Preliminary Screening** of the potential synergies between demand and offer of the mapped resources;
- 4. Implementation** of an **online platform**, available to the enterprises, to populate and manage the database;
- 5. Evaluation** of the **technological feasibility** and of the **regulation requirements** concerning the industrial symbiosis paths identified and development of the related Technical Reports.



INDUSTRIAL APPLICATIONS

Integrated and sustainable aqri-food supply chain

Industrial symbiosis → processed by-products through innovative technologies

Evaluation of the environmental sustainability of the by-products' valorization processes used in the two supply chains



Implementation of a geo-referenced and user-friendly software tool

Dynamic Map of circular economies

Oil and tomato supply chain

Description of co-milled oil:

Consumer acceptance
Naming/labeling

Durum wheat bran supply chain

Technology standardization for wheat bran defatting



Production at pre-industrial level



Functional food?



Marketing and promotion of developed products

Development of new products:

Wheat bran oil
Defatted wheat bran



FUTURE PERSPECTIVES

1) Analytical technological tree of characterization and **risk analysis**

2) Search of proper applications: food can **be or NOT be** again food



The use of a by product can be **highly risky** for the **environment** or for the **consumer**.
A SME alone could not have the resources to evaluate this risk.

FUTURE PERSPECTIVES



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Article

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Coffee Silverskin: Characterization, Possible Uses, and Safety Aspects

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Supporting Information

ABSTRACT: The reuse of coffee silverskin (CS), the main waste product of the coffee-roasting industry, could be an alternative to its environmental disposal. However, CS could also contain undesirable compounds, such as ochratoxin A (OTA) and phytosterol oxidation products (POPs). A study on the composition of CS (caffeine, moisture, dietary fibers, carbohydrates, and polyphenol contents) was carried out, with emphasis on OTA and POPs for safety reasons. The lipid fraction showed significant amounts of linoleic acid and phytosterols (7.0 and 12.1% of lipid fraction). Noticeable levels of POPs (114.11 mg/100 g CS) were found, and the phytosterol oxidation rate varied from 27.6 to 48.1%. The OTA content was 18.7–34.4 $\mu\text{g}/\text{kg}$ CS, which is about 3 times higher than the European Commission limits for coffee products. The results suggest that CS could be used as a source of cellulose and/or bioactive compounds; however, the contents of POPs and OTA might represent a risk for human safety if intended for human or livestock use.

KEYWORDS: *coffee silverskin, ochratoxin A, phytosterol oxidation products, lipid content, safety risk*

FUTURE PERSPECTIVES



3) Conduct applied research & development and a **peer to peer teaching** and **effective communication** around a **robust culture** on **industrial symbiosis**

4) Start an effective **EU network activity** to coordinate or be part of an **EU project** focusing on these key words: **food, industrial symbiosis, technology, analysis, sustainability, risk analysis, new products and market, social innovation, social sustainability.**

<http://www.oleumproject.eu/>



<http://www.plotina.eu>



Promoting gender balance and inclusion in research, innovation and training



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Thank you for your attention

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