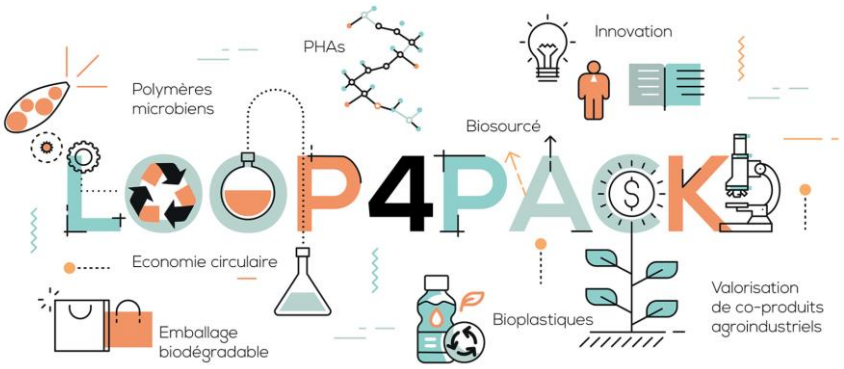

LOOP4PACK - Sustainable bioplastics from agro-industrial residues

to close the packaging loop

grant agreement N# ANR-19-CE43-0006

Start date of the project: 1/11/2019

Deliverable 4.1 :

Cartography of available feedstock resources

Planned delivery date (as in proposal): 1/05/2020 (M6)
Actual submission date: 17/06/2020 (M7)

Task: T4.2. Product/market assessment
Coordinator: Estelle Grousseau (Partner 1: UM), estelle.grousseau@umontpellier.fr
Task leader: Frédéric Merle (Partner 3 : Mc Cain/Euramaterials)

Dissemination level: PU (Public)
Version: V2

Table of content

1. Document Informations

1.1 Authors

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1.2 Revision history

Version	Date	Modified by	Comments
0	24/04/2020	Frédéric Merle	Internal version
1	17/06/2020	Pierre Gondé	V1 validated by task leader Pierre Gondé, sent to all partners
2	20/07/2022	Estelle Grousseau	Modification of dissemination level to Public for online publication on the project website and of the task leader Pierre Gondé => Frédéric Merle

1.3 Dissemination level

PU	Public	**X**
CO	Confidential, only for members of the consortium (including the ANR Services)	

2. Introduction

If the present market for bioplastics represents less than 2% of the total plastics market (348 million tons in 2017), technological developments and a growing demand for environmental friendly products (especially packaging) are boosting the current expansion of this sector. In 2012 only 1,7 million tons of biomass were processed into bio-based plastics compared to 7,2 in 2017, and, according to several studies double-digit growth rates are expected for the coming years. From a technical point of view, almost 90% of all plastics could be switched from fossil fuels to renewable sources, although some barriers are restraining their growth potential. If economic burden is probably the first obstacle to a widespread development, availability of biomass is another main obstruction. Even though the demand of bio-plastics is unlikely to generate high pressure on land availability to produce biomass, research organizations and industries are increasingly targeting agricultural residues and waste materials for the future production of bio-plastics with the idea of avoiding competition with food resources.

The aim of this study is to estimate volume, availability and characteristics of food industries transformation coproducts in the regions of the competitivity clusters EuraMaterials (former Matikem) and Agri-sud Ouest Territories (Haut de France –HDF-, Occitanie, Nouvelle Aquitaine. A special focus will be made on Mc Cain potatoes transformation byproducts.

Two recent studies14,69 from ADEME and Réséda on by-products and biomass residues available in France will serve as a basis for this analysis of current available feedstocks (residues, by products…)

Concerning the chemical characteristics of most of these coproducts, a spreadsheet synthesising data from Agrocycle European project will be attached to the Deliverable.

3. Mc Cain coproducts

McCain produces in its 3 French factories 600,000 tonnes / year of pre-fried frozen products (French fries) for a packaging consumption of 1,800 tonnes / year for the GMS France market.

The main co-products are :

- the potato peels from the steam peeling; 53,000 tonnes / year

- white starch from the potato cutting stage; 3000 tonnes / year, i.e. around 1500 tonnes of dry matter / year).

- Used oils from frying processes: 600 tonnes / year

These co-product flows are now oriented towards animal feed (potato peels), the paper industry (starch), and industrial fermenters for the production of biogas (peels + gray starch).

3.1 Focus on potato peels :

Product description

This product is a by-product of the potato processing industry which includes the peels and surface flesh of potatoes derived from steam peeling.
The product is delivered in bulk.

Product characteristics

Parameters	Base	Unit	Quantity %
Water	Total	%	75 à 93
Starch	Dry Matter	%	30 à 50
Crude fiber	Dry Matter	%	4,5 à 20
Total mineral matter	Dry Matter	%	4 à 15
Crude Protein	Dry Matter	%	12 à 25
Raw fat	Dry Matter	%	0,1 à 1.5
Raw cellulose	Dry Matter	%	4.5 à 20
Calcium (Ca)	Dry Matter	g/kg	1.5 à 3
Phosphorus (P)	Dry Matter	g/kg	1,5 à 4
Sodium (Na)	Dry Matter	g/kg	0.01 à 0.4
Potassium (K)	Dry Matter	g/kg	1 à 40
Starch	Dry Matter	%	30 à 50
PH	Average D/D+7/D+14		3.94

Usage

This steamed product can also be used as a food for mono or poly stomachs.

These instructions for use are given to us by the collection company:

- Liquid product, to be stored in tanks or to be sprayed on top of silage products (corn silage, dregs, grass, pulp...).
- Very long conservation (more than one year) because it is an acid product and sufficiently humid to avoid mould.
- Product to be used in pig feed (constituent of pig soups) or for cattle in association with more fibrous products.

Volumes	**Valorization**	**Benefit/cost**
Potato peel valorization 53000 T/year	Livestock feed, Transport, 2000 trucks per year	2000 trucks per year Evacuation cost between 150 and 250k€/year

3.2 Focus on starch

Product description

This product is a by-product of the potato processing industry resulting from centrifugation of the water after cutting the potatoes.

Product characteristics

The product is pure Starch according to Ifmas (Institut Français des Matriaux Agrosourcés) study dated novembre 2017

Data are for native purified potatoe starch (from "In vitro production of short-chain fatty acids from resistant starch by pig faecal inoculum" June 2013 Gianluca Guiberti and al.)

Parameters	Base	Unit	Quantity %
Water	Total	%	38 à 45
Starch	Dry Matter	%	96
Amylose	Dry Matter	%	45
Crude Protein	Dry Matter	%	0.17
Crude lipid	Dry Matter	%	0.53
Resistant Starch	Dry Matter	%	74%

Usage

Mainly used in paper industry and animal feeding

Type of coproducts	**Valorization**	**Benefit/cost**
Starch Valorization 3000T/ year	Paper industry Animal feeding	Profit : 425k€ / year

4. Review of main agricultural productions

4.1 Hauts de France

a. Context :

Main data show the main position of Hauts-de-France in the agricultural production :

- 2nd French cereal region
  - 14% of the national harvest
- 1st region of common wheat
  - 1 in 5 tonnes is produced in Hauts-de-France
- 1st growing region of protein crops
  - 17% of national surfaces
- 1st region of vegetables
  - Almost a quarter of French surfaces
  - 45% for canned vegetables
  - 90% for endive roots
- 1st beet region and 1st french sugar region
  - 1 in 2 French beets is produced in Hauts-de-France

- 10 of the 25 French sweets are located in Hauts-de-France
  - 1st region of potatoes
  - 2/3 of the potatoes are grown in Hauts-de-France
  - 7 out of 10 frozen fries are produced in Hauts-de-France

- 5th national ranking for the dairy sector
  - 10% of milk French production originate from the region

b. Volumes :

Cereals
Number of cultivated ha : 1 100 000
Production : 6 290 000 t
Production of soft wheat : 4 890 000 t
Production of corn : 312 600
2017 data

Milk
Number of liters : 23 M hl
Production of transformed products : No data available
2017 data

Oleaginous & Proteagenous
Number of cultivated ha : 200 000
Production of oleaginous : 600 000 t
Production of proteagenous : 130 000 t
2017 data

Beats
Number of cultivated ha : 195 400
Production : 16 500 000 t
2017 data

Vegetables
Number of cultivated ha : 48 200
Production : 1 000 000 t
2016 data

Patatoes
Number of cultivated ha : 97 800
Production : 4 000 000 t
Starch patatoes : 704 000 t
2017 data

4.2 Nouvelle Aquitaine

a. Context :

Nouvelle Aquitaine region shows the following strengths in terms of agricultural production :

- 1st region of grain corn and seed corn
  - 30% of national production

- 1st growing region of sunflower
  - More than 1 Million tonnes produced, together with Colza

- 1st French rank for the surface in fruit trees

- 2nd region for the production of vegetables

- 2nd region for wine production

b. *Volumes :*

Cereals
Number of cultivated ha : 1 300 000
Production : 3 980 000
Production of soft wheat : 3 000 000 t
Production of corn : 4 200 000 t
2018 data

Milk
Number of liters : 11,6 M hl
Production of transformed products : 312 000 t
2017 data

Oleaginous & Proteagenous
Number of cultivated ha : 435 000
Production of oleaginous : 1 000 000 t
Production of proteagenous : 150 000 t
2018 data

Wine grapes
Number of cultivated ha : 216 000
Production : 11,4 M hl
2018 data

Vegetables
Number of cultivated ha : 36 800
Production : 823 000 t
2018-2019 data

Fruits
Number of cultivated ha : 33 800
Production : 492 000 t
2017 data

4.3 Occitanie

a. Context :

The region is characterized by a contrasting climate and a great diversity of agricultural productions :

- Leading region for production of fruits and vegetables
  - 30% of national production with more than 1 Million tonnes produced
  - 2nd region for fruits
  - 3rd region for vegetables

- 1st growing region of sunflower
  - More than 1 Million tonnes produced, together with Colza

- 1st region for wine production
  - 2nd rank for cultivated surface
  - Includes 4 out of ten French wine basin

b. Volumes :

Cereals
Number of cultivated ha : 746 000
Production : 2 756 000 t
Production of soft wheat : 1 100 000 t
Production of corn : 1 110 000 t
2018 data

Milk
Number of liters : 9,92 M hl
Production of transformed products : 190 000 t
2018 data

Oleaginous & Proteagenous
Number of cultivated ha : 321 000
Production of oleaginous : 469 500 t
Production of proteagenous : 45 500 t
2018 data

Wine grapes
Number of cultivated ha : 270 800
Production : 15,5 M hl
2018 data

Vegetables
Number of cultivated ha : 36 100
Production : 478 000 t
2018 data

Fruits
Number of cultivated ha : 23 000
Production : 541 000 t
2018 data

5. Review of agrifood transformation industries

5.1 Hauts de France

a. Cereal and starch sector

Cereal cultivation makes use of half of the agricultural area, yet the location of operators is related to the basins of production and/or to areas of communication.
Cereal processing is becoming more and more segmented into sub-sectors and the region is in the top 3 rows for 6 specialties :

- starchy foods,
- cereals for breakfast
- pet food manufacturing
- beer
- industrial bakery products
- malt.

In primary processing, the manufacture of starch in Hauts de France dominates and weighs 75% of the national potential. **In primary processing 4 groups are present on the French territory** with 10 industrial sites including 5 in the Hauts-de-France region:

Cny Name	Location	Branch	Tonnage	Staff
ROQUETTE	LESTREM (62)	Cereal –starchy products	2.5 Mt Wheat and Corn 600 000 t Patatoes	> 2 000
CARGILL	HAUBOURDIN (59)	Cereal –starchy products	490 000 t Corn	From 250 to 500
ROQUETTE	VECQUEMONT (80)	Cereal –starchy products	Up to 1 000 000 T Patatoes	From 100 to 249
ROQUETTE	VIC SUR AISNES (02)	Cereal –starchy products	120 000 T Pies	From 100 to 249
ROQUETTE	BENHEIM (67)	Cereal –starchy products	500 000 t wheat and corn	From 100 to 249
TEREOS	NESLE (80)	Cereal –starchy products	170 000 t wheat	From 100 to 249

Major operators in starch primary transformation in Hauts-de-France Sources : EuraMaterials

The second transformation (industrial bakery and pastry, biscuit factory) occupies a preponderant place: simultaneous presence of abundant raw materials, from IF. (Foodstuffs Intermediaries (e.g. yeast), and consumers.

Cny Name	Location	Branch	Activity	Staff
MENISSEZ	FEIGNIES (59)	Céréales-boul.-biscuit.	Transformation	From 500 to 999
UNITED BISCUITS	NIEPPE (59)	Céréales-boul.-biscuit.	Transformation	From 250 to 500
BRIOCHE PASQUIER	VRON (80)	Céréales-boul.-biscuit.	Transformation	From 250 to 500
BRIOCHE PASQUIER	AUBIGNY-EN-ARTOIS (59)	Céréales-boul.-biscuit.	Transformation	From 250 to 500
CEREAL PARTNERS NESTLE	ITANCOURT (02)	Céréales	Transformation	From 250 to 500
BRIOCHE PASQUIER	AUBIGNY EN ARTOIS (62)	Céréales-boul.-biscuit.	Transformation	From 100 to 249

Major operators in cereal secondary transformation in Hauts-de-France Sources : EuraMaterials

b. Oilseeds sector

Hauts-de-France region includes numerous plants of processing and transformation of oilseeds

Cny Name	Location	Branch	Activity	Staff
LESIEUR	DUNKERQUE (59)	Oil	Refinery & transformation	From 100 to 249
OLEON AVRIL	VENETTE (60)	Oil	Refinery & transformation	From 100 to 249
STE IND DES OLEAGINEUX	ST LAURENT BLANGY	Oil	Refinery & transformation	From 100 to 249
HEINZ BENEDICTA	SECLIN (59)	Oil	Transformation	From 100 to 249

Major operators in oil primary and secondary transformation in H-D-F Sources : EuraMaterials

c. Sugar sector

A successful primary processing industry around 10 sugar factories (out of 25 established in France) :

7 out of 9 sugar factories of Tereos
2 out of 4 sugar factories of Saint Louis Sucre
1 out of 10 sugar factories of Cristal Union

Cny Name	Location	Branch	Activity	Staff
TEREOS FRANCE	LILLERS (62)	Sugar	Refinery & transformation	From 250 to 500
SAINT LOUIS SUCRE - SUDSUCKER	EPPEVILLE (80)	Sugar	Refinery & transformation	From 100 to 249
TEREOS FRANCE	BOIRY SAINTE RICTRUDE (62)	Sugar	Refinery & transformation	From 100 to 249
TEREOS FRANCE	ESCAUDOEUVRES (59)	Sugar	Refinery & transformation	From 100 to 249
TEREOS FRANCE	ORIGNY SAINTE BENOITE (02)	Sugar	Refinery & transformation	From 100 to 249

Major operators in sugar primary transformation in Hauts-de-France Sources : EuraMaterials

2nd transformation industries very present in the region Hauts de France is the national leader in confectionery (1/4 of national volumes) with all the major European manufacturers present and above all established in the Lille metropolis.

Chocolat The chocolate industry, another regional strong point, relies on imported sugar and cocoa and transformed in Dunkirk by Nord Cacao. Without counting the sugary drinks, industrial pastry, ice cream, dairy desserts…

Cny Name	Location	Branch	Activity	Staff
LAMY LUTTI	BONDUES (59)	Sucre et confiserie	Transformation	From 500 to 999
BOUQUET D'OR - CEMOI	VILLENEUVE D'ASCQ (59)	Sucre et confiserie	Transformation	From 250 to 500
HAAGEN DAZS	TILLOY-LES-MOFFLAINES (59)	Ice cream	Transformation	From 250 to 500
MONDELEZ	MARCQ EN BAROEUL	Sucre et confiserie	Transformation	From 100 to 249

Major operators in sugar secondary transformation in Hauts-de-France Sources : EuraMaterials

d. Patato sector

Hauts-de-France is the leading French region for potato processing

With 3 408 000 t of potatoes for consumption production

Cny Name	Location	Branch	Activity	Staff
MC CAIN	BETHUNE (62)	Patatoes	Transformation	
MC CAIN	HARNES (59)	Patatoes	Transformation	
INTERSNACK	MONTIGNY-LENGRAIN (02)	Patatoes	Transformation	From 250 to 500
SITPA NESTLE	ROSIERES EN SANTERRE (80)	Patatoes	Transformation	From 100 to 249

Major operators in consumer potatoes sector in Hauts-de-France Sources : EuraMaterials

e. Other vegetable sector

A leading region in the field of canned vegetables with a main operator, Bonduelle Group.

Cny Name	Location	Branch	Activity	Staff
BONDUELLE	ESTREES MONS (80)	Vegetables	Transformation	From 500 to 999
BONDUELLE	RENESCURE (59)	Vegetables	Transformation	From 250 to 500
BONDUELLE	VAULX-VRAUCOURT (62)	Vegetables	Transformation	From 250 to 500
FLORETTE / AGRIAL	RAILLENCOURT-STE-OLE (59)	Vegetables	Transformation	From 100 to 249
ARDO	VIOLAINES (62)	Vegetables	Transformation	From 100 to 249

Major operators in vegetable primary and secondary transformation (excluding potatoes) in Hauts-de-France Sources : EuraMaterials

f. Dairy sector

Activities the most represented in Hauts-de-France are the manufacture of liquid milk and fresh products, the manufacture of ice creamand sorbets and finally the manufacture of other dairy products such as milk powder.

Cny Name	Location	Branch	Activity	Staff
NESTLE GRAND FROID	ESTREES MONS (80)	Dairy products	Transformation	From 250 to 500
NOVANDIE	VIEIL-MOUTIER (62)	Dairy products	Transformation	From 250 to 500
HAAGEN DAZS ARRAS	TILLOY-LES-MOFFLAINES (62)	Dairy products	Transformation	From 250 to 500
INGREDIA	SAINT-POL-SUR-TERNOISE (62)	Dairy products	Transformation	From 250 to 500
LA CHARLOTTE	HESDIN-L'ABBE	Dairy products	Transformation	From 250 to 500

Major operators in dairy products primary and secondary transformation in H-D-F Sources : EuraMaterials

5.2 Nouvelle Aquitaine

a. Cereal sector

1st transformation :

In 2017, 503,000 tonnes of cereals were crushed in the 56 main mills of New Aquitaine for a production of 396,000 tonnes of flour.

2 corn plants in the 5 national factories Two companies located in Lot-et-Garonne (47) and Pyrénées-Atlantiques (64) produce cornmeal : **50,000 tonnes of local corn**, for the production of beer, breakfast cereals, aperitif biscuits or even polenta.

2nd transformation:

About half of the regional flour is intended for secondary grain processing companies (bread-making: bakeries and pastries)

Cny Name	Location	Branch	Activity	Staff
MONDELEZ FRANCE BISCUITS PRODUCTION SAS	CESTAS (33)	Cereal – bakery	Transformation	From 400 to 600
BLÉDINA	BRIVE (19)	Cereal	Transformation	From 400 to 600
MADEMOISELLE DESSERTS	CONDAT-SUR-TRINCOU (24)	Cereal – bakery	Transformation	From 400 to 600
MONDELEZ FRANCE BISCUITS PRODUCTION SAS	CESTAS (33)	Cereal – bakery	Transformation	From 400 to 600
SAINT MICHEL CHAMPAGNAC	CHAMPAGNAC DE BELAIR (24)	Cereal – bakery	Transformation	From 200 to 400
LA COMPAGNIE DU BISCUIT	PESSAC (33)	Cereal – bakery	Transformation	From 100 to 200
MADELEINE BIJOU	SAINT-IRIEIX-LA-PERCHE (87)	Cereal – bakery	Transformation	From 100 to 200

Major operators in cereal products secondary transformation in Nouvelle Aquitain
Sources : EuraMaterials

b. Oleaginous sector

The crushing factories are the primary outlet for oilseeds. The trituration process makes it possible to obtain oil on the one hand, the main recovery, and on the other hand oil cake. The extracted crude oil can be either "semi-refined" to be used for non-food purposes or "refined" for human consumption. The protein-rich meals are mainly intended for animal feed. The use in the state of the seeds, not crushed, is more marginal. They can be used as is in animal or human food

The crushing plants: Two companies stand out for their size , one located in Bassens in Gironde which grinds rapeseed and sunflower seeds and the other located in Sainte Livrade sur Lot in Lot et Garonne specializing in soybean crushing.

Cny Name	Location	Branch	Activity	Staff
AVRIL	BASSENS (47)	Oil	Refinery and Transformation	From 100 to 200
SOJA PRESS	STE LIVRADE SUR LOT. (47)	Oil	Transformation	From 100 to 200

Major operators in oil seeds products primary transformation in Nouvelle Aquitaine
Sources : EuraMaterials

c. Wine/distillery sector

The beverage sector is a flagship of new Aquitaine, the leading region for producing wines and brandies.

Cny Name	Location	Branch	Activity	Staff
LES GRANDS CHAIS DE France	LANDIRA (33)	Wine making	Transformation	From 400 to 600
SOCIÉTÉ JAS HENNESSY ET COMPAGNIE	COGNAC (16)	Distillery	Transformation	From 600 to 800
MARTEL & CO	COGNAC (16)	Distillery	Transformation	From 200 to 400
REMY MARTIN &CO	COGNAC (16)	Distillery	Transformation	From 200 to 400
BARDINET	BLANQUEFORT (33)	Distillery	Transformation	From 200 to 400
COURVOISIER	JARNAC (16)	Distillery	Transformation	From 200 to 400
CAMUS LA GRANDE MARQUE	COGNAC (16)	Distillery	Transformation	From 100 to 200

Major operators in wine and liquors production in Nouvelle Aquitaine *Sources : EuraMaterials*

d. Dairy sector

The dairy industry and in particular the cheese industry occupies the third place within the regional agri-food industries, the production of milk being very oriented towards the domestic market.

Around sixty establishments collecting or processing cow's milk are located in New Aquitaine. Two thirds of dairy establishments have an exclusive activity of manufacturing finished products.

Cny Name	Location	Branch	Activity	Staff
FROMAGERIES DES CHAUMES	JURANCON (64)	Dairy products	Transformation	From 200 to 400
AVI CHARENTE	AYTRE (17)	Dairy Products	Transformation	From 200 to 400
BONILAIT PROTEINES	CHASSENEUIL –DU-POITOU (88)	Dairy Products	Transformation	From 200 to 400
FROMAGERIE DE RIBLAIRE	SAINT-VARENT (79)	Dairy Products	Transformation	From 200 to 400
FROMAGERIES DES CHAUMES	ST ANTOINE DE BREUILH (24)	Dairy products	Transformation	From 100 to 200
CANDIA	LONS (64)	Dairy products	Transformation	From 100 to 200
PYRENEFROM	LARCEVEAU-ARROS-CIBITS (64)	Dairy products	Transformation	From 100 to 200
FRONERI VAYRES	VAYRES (33)	Dairy products	Transformation	From 100 to 200
COOPERATIVE LAITIERE DE LA SEVRE	CELLES-SUR-BELLE (79)	Dairy products	Transformation	From 100 to 200
LE PETIT BASQUE (SILL)	SAINT-MEDARD-D'EYRANS (33)	Dairy products	Transformation	From 100 to 200
CHAVEGRAND	MAISON-FEYNE (23)	Dairy products	Transformation	From 100 to 200

Major operators in dairy products primary and secondary transformation in Nouvelle Aquitaine
Sources : EuraMaterials

e. Vegetables and fruits sector

The production value of fruits and vegetables regional funds exceed one billion euros. It weighs 11% of the value of regional agricultural production. Within the transformation, the valuation industrial fruit puree, compote, jam accounts for 47% of the workforce of the segment, a little more than the industry vegetables (44%) fed by field crops (sweet corn, green beans in particular)

Cny Name	Location	Branch	Activity	Staff
MAÎTRE PRUNILLE	CASSENEUIL (47)	Fruits	Transformation	From 400 to 600
LUCIEN GEORGELIN	VIRAZEIL(47)	Fruits	Transformation	From 100 to 200
DELVERT	MALEMORT (19)	Fruits	Transformation	From 100 to 200

Major operators in fruits primary and secondary transformation Nouvelle Aquitaine
Sources : EuraMaterials

Cny Name	Location	Branch	Activity	Staff
SERTRAM	LABAHUT (40)	Vegetables	Transformation	From 400 to 600
SALOAL (BONDUEL LE)	BORDERE ET LAMENSANS (40)	Vegetables	Transformation	From 200 to 400
AQUITAINE LEGUMES SURGELES	SAINT-SEVER (19)	Vegetables	Transformation	From 100 to 200

Major operators in vegetable primary and secondary transformation in Nouvelle Aquitaine
Sources : EuraMaterials

5.3 Occitanie

a. Wine/distillery sector

The weight of viticulture in ex-Languedoc-Roussillon propels the beverage sector to the first place of the food industries of the new region.

Cny Name	Location	Branch	Activity	Staff
GROUPE INTERPRODUCTEURS COLLIOURE BANYULS	BANYULS (64)	Wine	Transformation	From 200 to 400
VINOVALI	SAINT SULPICE (81)	Wine	Transformation	From 200 to 400
ADVINI	ST-FELIX-DE-LODEZ (34)	Distillery	Transformation	From 200 to 400
UNION COOPERATIVE DE FONCALIEU	ARZENS (11)	Wine	Transformation	From 100 to 200
GASCOGNE PLAIMONT	ST MONS (66)	Wine	Transformation	From 100 to 200

Major operators in wine and liquors production in Occitanie *Sources : EuraMaterials*

b. Cereal sector

1st transformation :

The region benefits from an important fabric of flour mills with 52 mills processing cereals in flour. The brands Mie'Nutie (cooperative Arterris), Croustilot or Raspaillou are examples of a short circuit between grain farmers and consumers, which constitutes a growing trend.

Cny Name	Location	Branch	Activity	Staff
RAGT SEMENCES	RODEZ (12)	Cereal - bakery	First transformation	From 200 to 400
TOULOUSAINE DES FARINES/MERCIER CAPLA (ARTERRIS)	AUDE (11)	Cereal - bakery	First transformation	From 100 to 200

Major operators in cereal products primary transformation in Occitanie Sources : EuraMaterials

2nd transformation:

Besides the mills, the region has processing sectors mainly in industrial bakery, biscuit factory, pastry and popcorn.

Cny Name	Location	Branch	Activity	Staff
BUSCUITS POULT	MONTAUBAN (82)	Cereal - bakery	Transformation	From 400 to 600
NUTRITION ET SANTE	REVEL (31)	Cereal	Transformation	From 400 to 600
PROLAINAT (ANDROS)	BLANQUEFORT (32)	Cereal - bakery	Transformation	From 200 to 400
CURE GOURMANDE	FRONTIGNAN (34)	Cereal - bakery	Transformation	From 200 to 400
POPPIES BERLIDON	LAUDUN L'ARDOISE (30)	Cereal - bakery	Transformation	From 200 to 400
EUROPE DES PAINS	SAINT REMY (12)	Cereal - bakery	Transformation	From 100 to 200
L'EPI DU ROUERGUE	LA LOUBIERE (12)	Cereal - bakery	Transformation	From 100 to 200
NATAIS	BAZEUIL (32)	Cereal - bakery	Transformation	From 100 to 200

Major operators in cereal products secondary transformation in Occitanie Sources : EuraMaterials

c. Oleaginous sector

The crushing factories are the primary outlet for oilseeds. The trituration process makes it possible to obtain oil on the one hand, the main recovery, and on the other hand oil cake. The extracted crude oil can be either "semi-refined" to be used for non-food purposes or "refined" for human consumption. The protein-rich meals are mainly intended for animal feed. The use in the state of the seeds, not crushed, is more marginal. They can be used as is in animal or human food

The crushing plants: Two companies stand out for their size , one located in Bassens in Gironde which grinds rapeseed and sunflower seeds and the other located in Sainte Livrade sur Lot in Lot et Garonne specializing in soybean crushing.

Cny Name	Location	Branch	Activity	Staff
AVRIL	BASSENS (47)	Oil	Refinery and Transformation	From 100 to 200
SOJA PRESS	STE LIVRADE SUR LOT. (47)	Oil	Transformation	From 100 to 200

Major operators in oil seeds products primary transformation in Occitanie Sources : EuraMaterials

d. Dairy sector

Beside the regular reduction of volumes of milk collected, the sectors still represents a significant weight related to the manufacturing, processing and marketing of milk. In addition to the manufacture of cheeses there are a total of 240 establishments in this sector with major industrial actors.

Cny Name	Location	Branch	Activity	Staff
LES FROMAGERIES OCCITANES (SODIAL)	TOULOUSE (31)	Dairy products	Transformation	From 200 to 400
STE FROMAGERE DE RODEZ (LACTALIS)	RODEZ 512)	Dairy products	Transformation	From 200 to 400
STE FROMAGERE DU MASSEGROS (LACTALIS)	MASSEGROS CAUSSES GORGES (48)	Dairy products	Transformation	From 200 to 400
DANONE PRODUITS FRAIS FRANCE	VILLE-COMTAL-SUR-ARROS (32)	Dairy products	Transformation	From 100 to 200
SOC CAVES PRODUCTEURS REUNIS ROQUEFORT	ROQUEFORT SUR SOULZON (12)	Dairy products	Transformation	From 100 to 200
NUTRIBIO	MONTAUBAN (82)	Dairy products	Transformation	From 100 to 200
YEO FRAIS	TOULOUSE (31)	Dairy products	Transformation	From 100 to 200

Major operators in dairy products primary and secondary transformation in Occitanie
Sources : EuraMaterials

e. Vegetables and fruits sector

Each year, more than 560,000 tonnes of fruit and 410,000 vegetables are produced here. A tonnage which explains the presence on the territory of national leaders of the transformation.

Cny Name	Location	Branch	Activity	Staff
ANDROS	BIAIS SUR CERE (46)	Fruits	Transformation	> 1000
ST MAMET	VAUVERT (30)	Fruits	Transformation	From 200 to 400
CONSERVERIE LARROQUE DU LANGUEDOC	MONTAUBAN (82)	Fruits	Transformation	From 100 to 200

Major operators in fruits primary and secondary transformation Nouvelle Aquitaine
Sources : EuraMaterials

Cny Name	Location	Branch	Activity	Staff
FLORETTE FOOD SERVICE FRANCE	TOREILLES (66)	Vegetables	Transformation	From 200 to 400

Major operators in vegetable primary and secondary transformation in Nouvelle Aquitaine
Sources : EuraMaterials

6. Co products potential and availability

6.1 Potato starch and starch manufacture

The co-products of these sectors differ according to the raw materials used (common wheat, maize or potato), depending on the separation or processing procedures specific to each factory, and depending on the market.

Sector	Raw Material	Volume (National)	Co-products	Volume of Co-products	Loop4pack scope
Starch and Portatoe starch manufacturing	Wheat	3 Mt soft wheat	**Wheat gluten feed**	600 000 t	75% potential in **Hauts de France**
			Wheat bran	600 000 t	
	Potatoes	1 Mt	**Potatoe pulp**	100 000 t	
			Potato proteïn		
			Potatoe soluble (Protamylasis)		
	Corn	2 Mt	**Corn gluten feed**	500 000 t	
			Corn soluble		

Potatoe starch manufacturing coproducts (1) Sources : EuraMaterials adapted from Reseda Study

Co-products	Format	Valorization
Wheat gluten feed	87/88 % dry matter pellets	Feed for porc and cattle breeding
Wheat bran	Usually incorporated into wheat gluten feed	
Potatoe pulp	They are either marketed in the form of fresh pulp without further treatment, either after dehydration under pellet shape	Source of feed for all classes of livestock.
Potato proteïn	These proteins are valued in their form purified or incorporated into the pulp to enrich it with proteinaceous material	
Potatoe soluble (Protamylasis)	Obtained by evaporation of potato vegetation water	Spreading or fertilizing
Corn gluten feed	Sold in dehydrated form (87/88% dry matter)	Source of feed for all classes of livestock, very good nutritive value.
Corn soluble		Spreading or fertilizing

Potatoe starch manufacturing coproducts (2) Sources : EuraMaterials adapted from Reseda Study

In this sector, co-products are considered to be products in their own right: their valorisation fully participates in the economic balance of this sector.

6.2 Milling

In most of the regions producing soft wheat, milling activities have developed.

The French milling industry used 5 million tonnes of wheat in 2018. It uses almost all French common wheat: in 2018, 94.3% of the wheat used was French wheat.

Sector	Raw Material	Volume National	Co-products	Volume of Co-products	Loop4pack scope	Format	Valorization
Milling	**Wheat**	Wheat 5 Mt Flour 4,05 Mt	**Wheat Bran**	760 000 t (14% of transformed wheat)	**Nouvelle Aquitaine** 500 000 t **Occitanie** 360 000 t	The fragments of envelopes and also of grain particles can be pressed	Source of feed for all classes of livestock
			Remilling	380 000 t (7,1% of transformed wheat)			

Milling activity coproducts Sources : EuraMaterials adapted from Reseda Study

6.3 Oil seeds

The crushing industry produces oils and meals by pressing oilseeds and then solvent extraction. Twelve industrial sites exist in France, and some of them process more than 1 000 tonnes of rapeseed per day.

Sector	Raw Material	Volume National	Co-products	Volume of Co-products	Loop4pack scope
Oilseeds sector	Rapeseed	4,5 Mt	**Rapeseed oil cakes**	2 700 000 t 60% weight of raw material	**Nouvelle Aquitaine** 1Mt (90% Rapeseed and Sunflower) **Hauts de France** 677 000 t Rapeseed **Occitanie** 360 000 t Rapeseed 109 000 t Soybean
	Sunflower	1,1 Mt	**Sunflower oil cakes**	660 000 t 55% weight of raw material	
	Soybean	0,7 Mt	**Rapeseed oil cakes**	560 000 t 80% weight of raw material	

Oilseed manufacturing coproducts (1) Sources : EuraMaterials adapted from Reseda Study

Co-products	Format	Valorization
Rapeseed oil cakes	After desolvation, the rapeseed scales are granulated to give a cake containing 1 to 2% residual oil and 10 to 12% water.	Source of feed for all classes of livestock
Sunflower oil cakes	The cake after drying contains between 10 and 12% moisture. Cake represents about 55% of the weight of the seed.	
Rapeseed oil cakes	Corresponds, after extraction of the oil, to 80 % of the weight of the seeds of soy.	

Oilseed manufacturing coproducts (2) Sources : EuraMaterials adapted from Reseda Study

Three-quarters of the meal would be used in the manufacture of compound feeds, and a quarter consumed directly by the breeders (peyronnet, lacagne, le cadre, & pressenda 2014).

Work is underway on more profitable ways of recovering oilcake (extraction of oilseed cake, for example).

6.4 Sugar beet

Sector	Raw Material	Volume National	Co-products	Volume of Co-products	Loop4pack scope	Format	Valorization
Sugar Beet sector	**Beats**	34 M t	**Overpressed pulps**	475 000 t	**Hauts de France** 50 % of production	Dry matter 90%. It often comes in pellet form.	Animal Feed is the way to valorise almost all beet pulp
			Dried pulps	962 000 t		Dry matter 20-30% local valorization	
			Wet pulp	4 500 t		Dry matter 10% very local valorization	

Sugar beet coproducts (1) Sources : EuraMaterials adapted from Reseda Study

Co-products account for half of the volume of beets used. Their valorization is therefore an important issue for the sugar industry.

Industrial outlets are being developed for pulp, although they are still in the minority. opacifiers for the paper industry, insulation for the construction industry... This also concerns very low volumes.

6.5 Fruit and vegetable sector

The co-products of this sector are :

- Sorting deviations correspond to fruit and vegetables whose appearance or size do not meet the following requirements to marketing standards.

- Processing waste comes from canning, freezing, deep-freezing, freezing plants and fourth range.

These are elements that do not go into the final product (skins, pulps, etc.), damaged parts, non-consumable elements, etc.). Their composition is very variable and depends on the manufacturing process. This processing waste does not include washing water.

The total 1.1 Mt of vegetables processed by the industry generated 167.6 thousand tonnes of waste. Most of the production originated in the northern and western regions. The processing industries are located close to the production sites.

Sector	Raw Material	Volume National	Co-products	Volume of Co-products	Loop4pack scope	Valorization
Fruit and vegetables	Fruits	2,8 Mt	**Pomaces/processing watewater**	na	Fruits **Nouvelle Aquitaine & Occitanie** 1 Mt Vegetables 1Mt in **Hauts de France** 820 000t in NA 480 000 t in **Occitanie** Patatoes 57% in **Hauts de France**	Skins and pomaces are source of animal feedings
	Vegetables	5,6 Mt (1,1 Mt of transformed vegetables)	**Peels/skin**	167 000 t		Starch from patatoes wastewater may be used for paper industry
	+ Potatoes	6,95 Mt	**Processing waste water**	na		Source of feed for all classes of livestock.

Fruit and vegetable sector coproducts Sources : EuraMaterials adapted from Reseda Study

The by-products of the fruit and vegetable sectors are mainly used for animal feed, directly in breeding. These co-products can also be donated to associations, be spread or composted.

The co-products of the processed fruit and vegetable sectors are many and varied in nature. The volumes of these co-products are variable from year to year and not very predictable. Their valorisation is not very organised, and is done on a case-by-case basis, their transport costs being limited, their valorisation is not very predictable and is preferably done locally.

6.6 Wine sector

Sector	Raw Material	Volume National	Co-products	Volume of Co-products	Loop4pack scope	Valorization
Wine sector	Red and pink wine	25 740 000 hl	**Marc**	945 360 t	**Nouvelle Aquitaine and Occitanie** 30% of potential	Methanisation, composting or spreading
	White wine	11 700 000 hl	**Pomace and lees**	1 497 600 hl		Distillation, methanisation or composting
	Cognac Armagnac	9 360 000 hl	**Organic wastes**	9 360 000 t		

Wine processing coproducts Sources : EuraMaterials adapted from Reseda Study

Most of the by-products of this sector are valorised in the distilleries. Fifty distilleries, installed in the different French wine production areas, collect and valorise each year 850 000 t of grape marc and 1.4 million hectolitres of lees and lees. Thus, the majority of the co-products of the winemaking process is valorised in the distillery.

The remaining wine co-products are valorized by methanisation, composting or spreading. Since 2014, the regulations authorize the valorization of wine lees and grape marc by spreading, composting or methanization.

6.7 Dairy sector

In 2016, the dairy industry collected approximately 24.7 million tonnes of milk of all species combined.

This milk is used for the manufacture of different products dairy: cheeses, packaged milk, milk powder, creams, yoghurts and desserts, fats Dairy.

Sector	Raw Material	Volume National	Co-products	Volume of Co-products	Loop4pack scope	Valorization
Dairy sector	Milk	24,7 Mt	**Lactoserum**	1 136 000 t	In % of milk production : **Hauts de France** : 10% **Nouvelle Aquitaine** : 5% **Occitanie** : 4%	In the majority of cases, the whey is processed into a powder.
			Buttermilk	58 300 t		Buttermilk can be dried as buttermilk powder.

Dairy sector coproducts Sources : EuraMaterials adapted from Reseda Study

Co-products of the dairy industries are subject to Regulation (EC) No 1069/2009 on the common organisation of the market in milk and milk products animal by-products and products derived which requires constraints specific to their valuations.

Whey powder, skimmed milk or buttermilk powder are noble products, most often used in the food industry. These co-products can be directly valorized within the semi-skimmed milk, for example, can be used in the production of fresh cream or butter.

Animal feed also makes use of dairy by-products, in liquid or concentrated form directly in livestock farming, and in the form of powders (whey, buttermilk, skimmed milk) by industrialists of animal nutrition.

7. Conclusion

The study shows that besides Mc Cain industrial units located in the North of France and Belgium, Hauts-de-France, Nouvelle Aquitaine and Occitanie regions can provide large volumes of different types of coproducts originated from agro-industrial processing. This comes both from the diversity of agricultural productions and dynamism of food industries throughout these territories.

Some ways of valorization already exist, mostly for animal feeding and companies like Mc Cain are still looking for ways of valorization with better added value.

For the future production of PHA. Logistic issues have to be taken into account for the future location of manufacturing the final product, as close as possible to location of raw material. A multiple source of raw materials may be a good option if it does not result in extra logistics costs.

Finaly as a warning point, we must also take into consideration a potential raising demand for wastes and coproducts which may transform the residues into a valuable commodity and then increase its costs.

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