French Competitiveness Cluster
Industries and Agro-Resources

IAR
Industries & Agro-Ressources

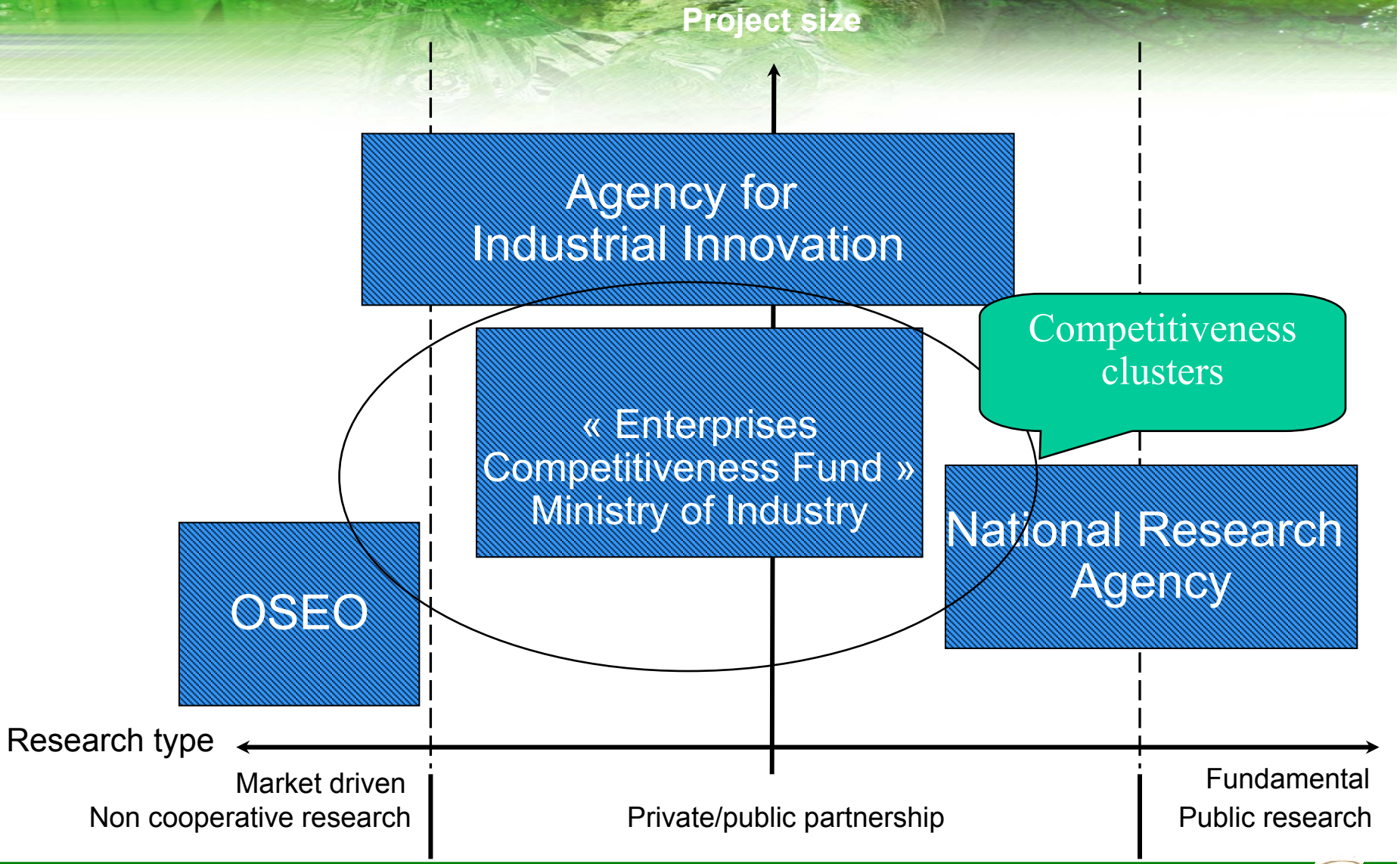
People, Plants, for ever.

Non-food valorization of agro-resources

RÉGION CHAMPAGNE ARDENNE

PICARDIE LA RÉGION

French supporting agencies for research and innovation projects



LES PÔLES DE COMPÉTITIVITÉ

MOTEURS DE CROISSANCE ET D'EMPLOI

Competitiveness Clusters in FRANCE

Clusters: the Government's Goals

- To strengthen France's **industrial competitiveness**
- To enhance economic development
- To strengthen the image of France as a leader in cutting edge technologies
- To **place enterprises at the centre of innovation process**
- To favour synergies with local R&D potentials in order to attract new investment and skills
- To involve local authorities on all aspects of development and projects

« A pole of competitiveness is defined as the combination on a given geographical area of companies, education centers, public and private R&D units, committed to a partnership process aimed at the creation of synergies around common innovative projects. »
Extract from the projects call " Poles of competitiveness "

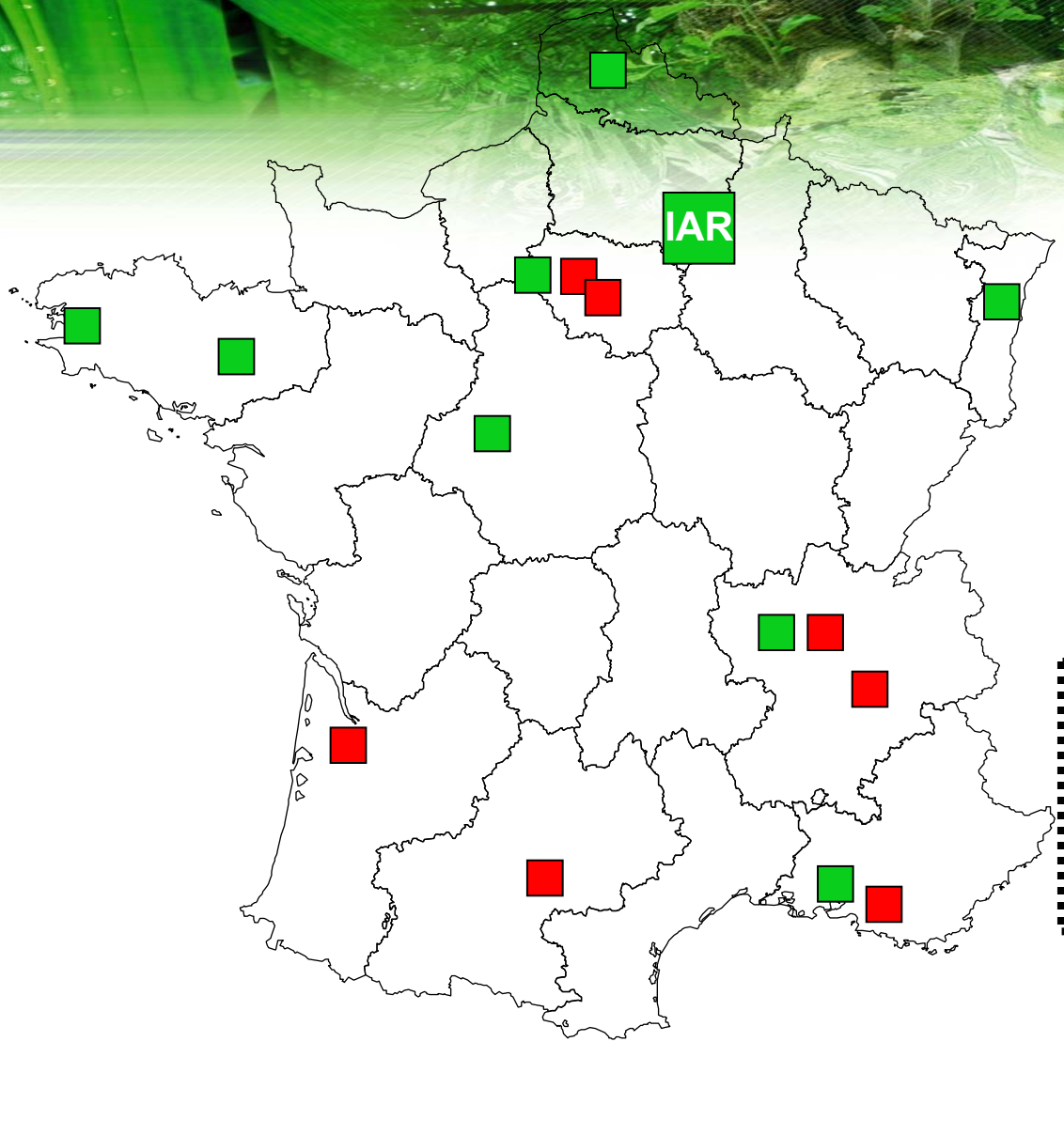
What is a Competitiveness cluster ?

- A **tight partnership** within a defined geographic area of companies, research centers, educational institutions and, in our case, **agriculture**

- A **network** of private-public, private-private and public-public partnerships committed to the **creation of synergies** for common **innovative projects**,

- A **research network**, which aims to reach the critical mass for international visibility.

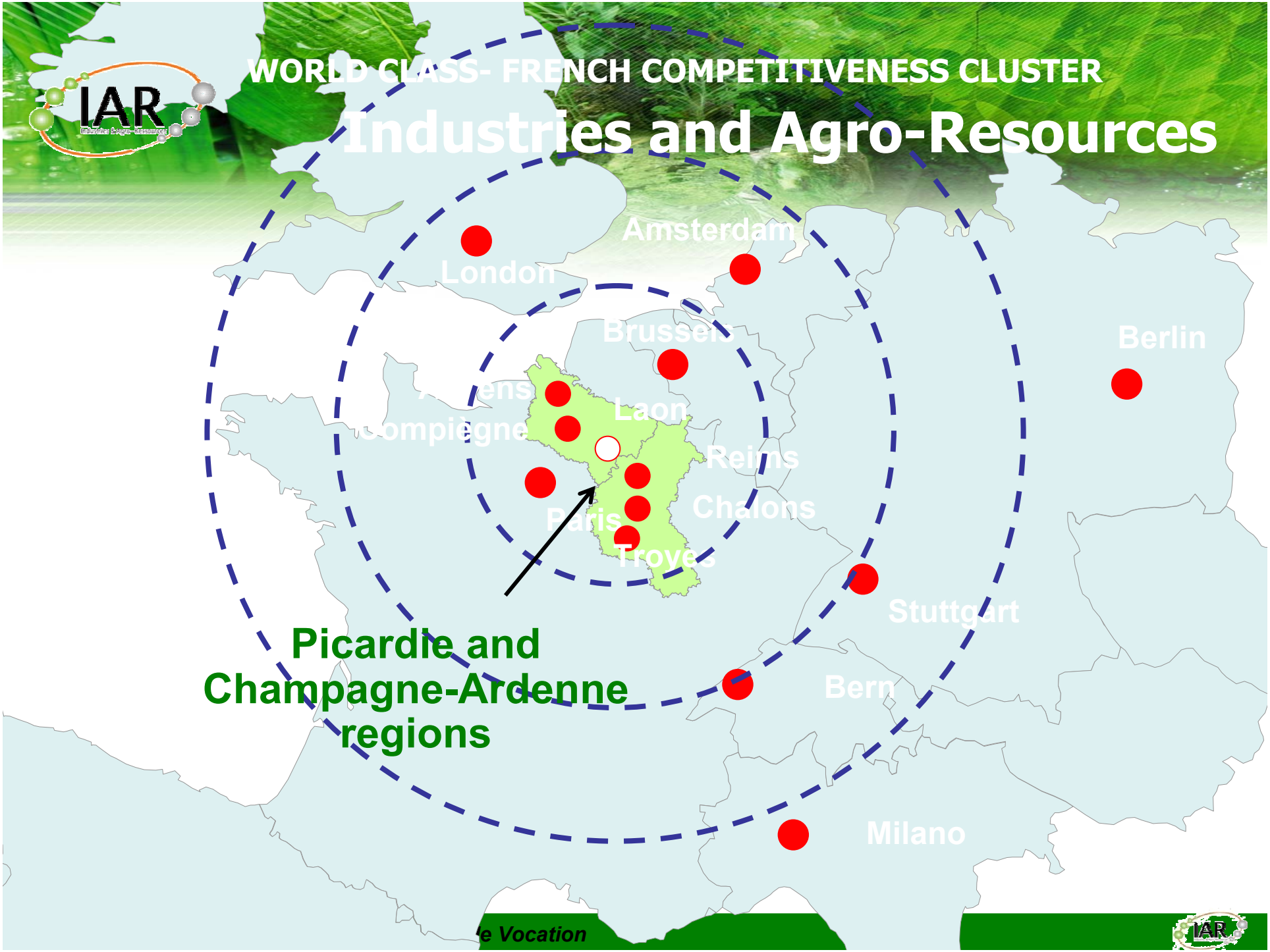
Sectorial French clusters cartography



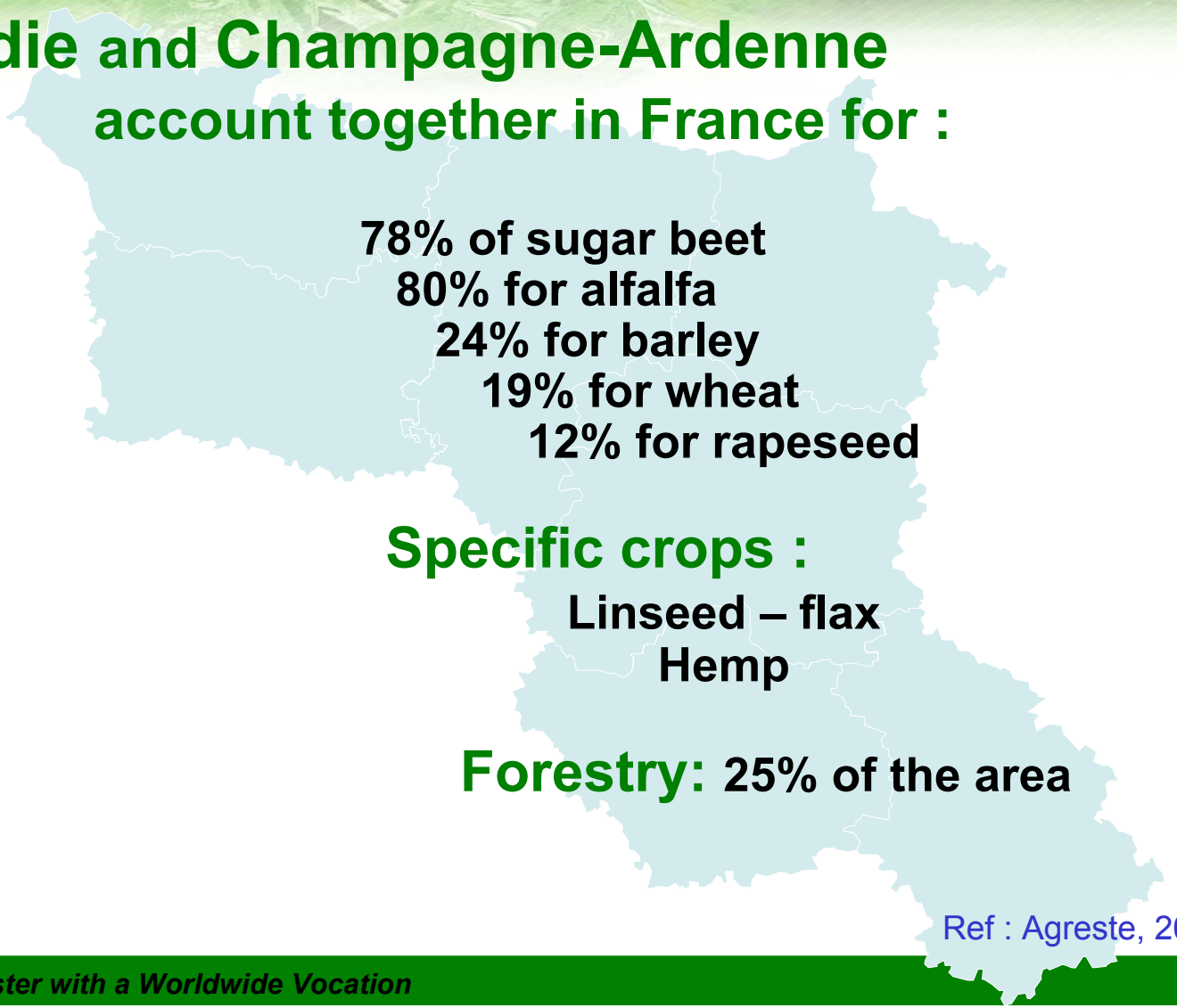
The 71 Competitiveness Clusters in France.
17 are global ones
54 are smaller and more specialized
On the basis of a regional approach, but some are linking 2 regions

Worldwide impact

Worldwide spread


WORLD CLASS- FRENCH COMPETITIVENESS CLUSTER
Industries and Agro-Resources
IAR
Amsterdam
London
Brussels
Berlin
Laon
Reims
Chalons
Paris
Troyes
Stuttgart
Bern
Milano
Picardie and
Champagne-Ardenne
regions
e Vocation
IAR

A major area for agricultural and biomass resources



Picardie and Champagne-Ardenne account together in France for :

78% of sugar beet
80% for alfalfa
24% for barley
19% for wheat
12% for rapeseed

Specific crops :

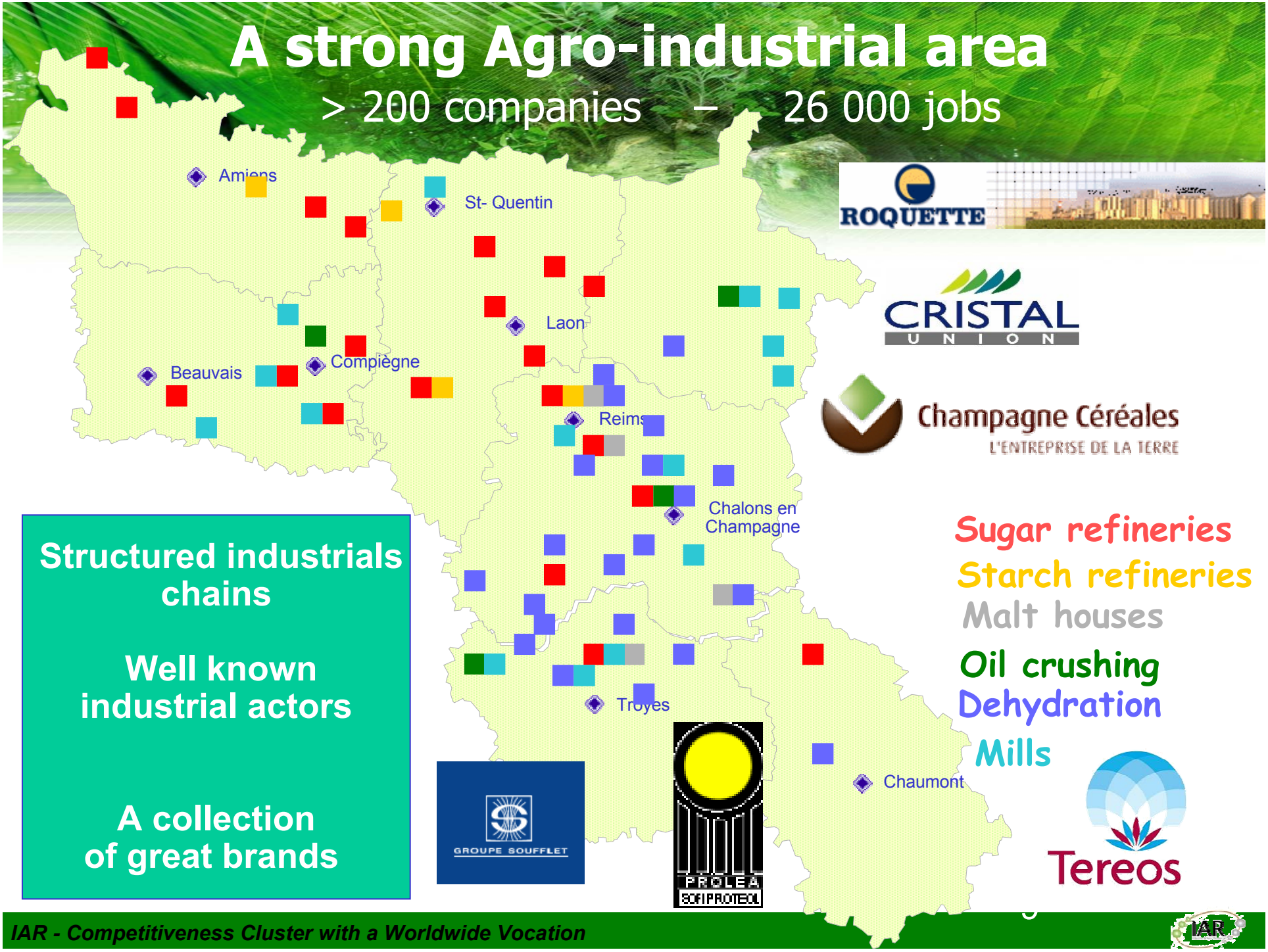
Linseed – flax
Hemp

Forestry: 25% of the area

Ref : Agreste, 2004

A strong Agro-industrial area

> 200 companies – 26 000 jobs



Structured industrials chains

Well known industrial actors

A collection of great brands

Sugar refineries

Starch refineries

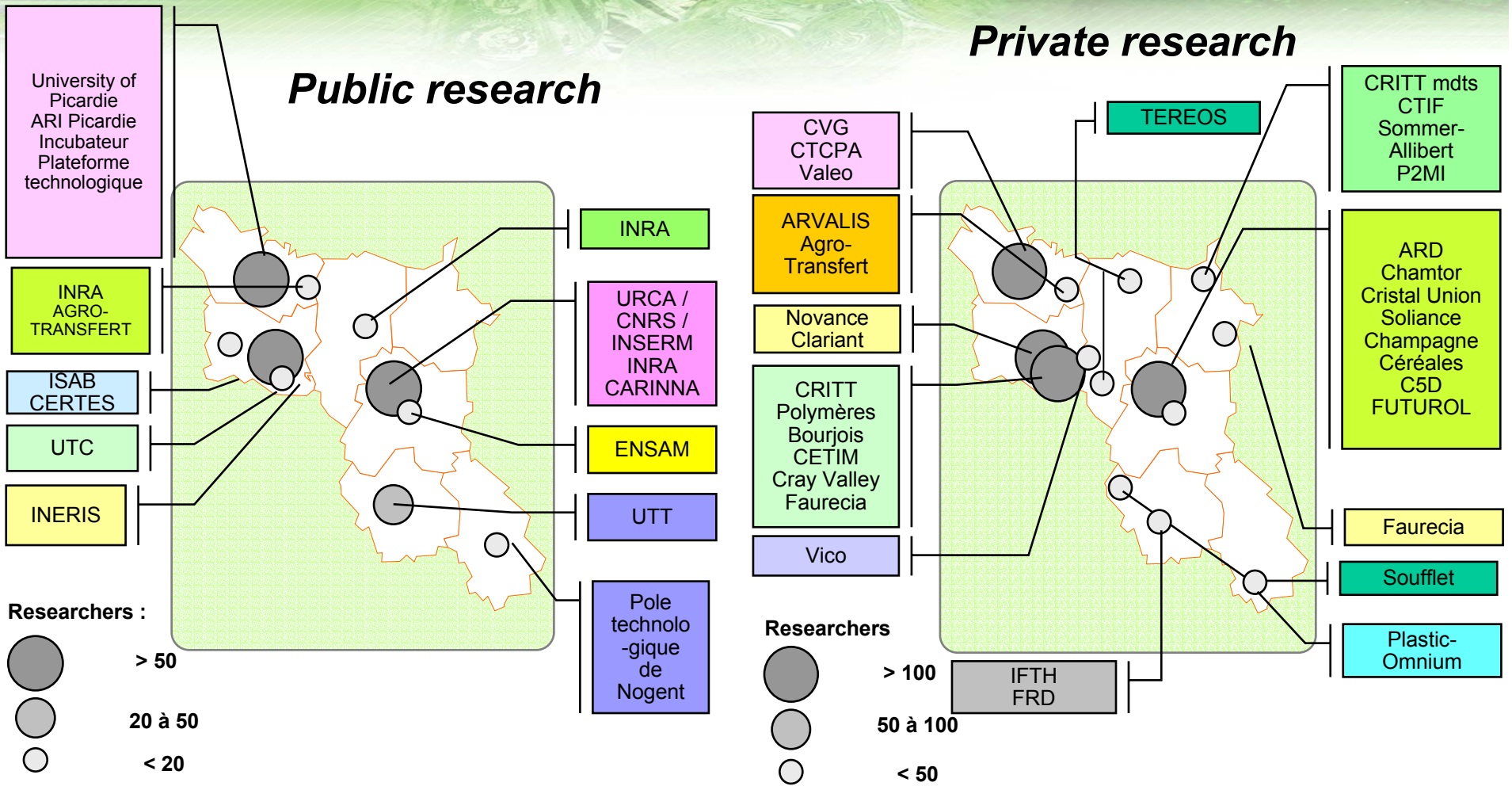
Malt houses

Oil crushing

Dehydration

Mills

The R&D areas : around 1000 researchers



+ Technopole NOVA (project) in Pomacle / Reims

Our members

Biomass producers (agriculture, viticulture and forestry)

10 Research and Technology Transfer centers

BIOREFINERY

Industrial and commercial firms

4 main Universities and other high schools

Our objectives

- To develop the attractiveness of the two Regions.

- To improve the **industry competitiveness** through R&D and **Innovation**.

- To replace oil based products by **bio-based products**, with respect to **sustainable development**.

- To develop **new outlets for agriculture** (non food valorization) and to **anticipate** forthcoming **agricultural mutations**.

New industrial needs – a biorefinery concept

Fossil energies prices increase

New environmental and climatic factors

Agriculture mutations

International competition

Industrial needs

BIOREFINERY – GREEN CHEMISTRY

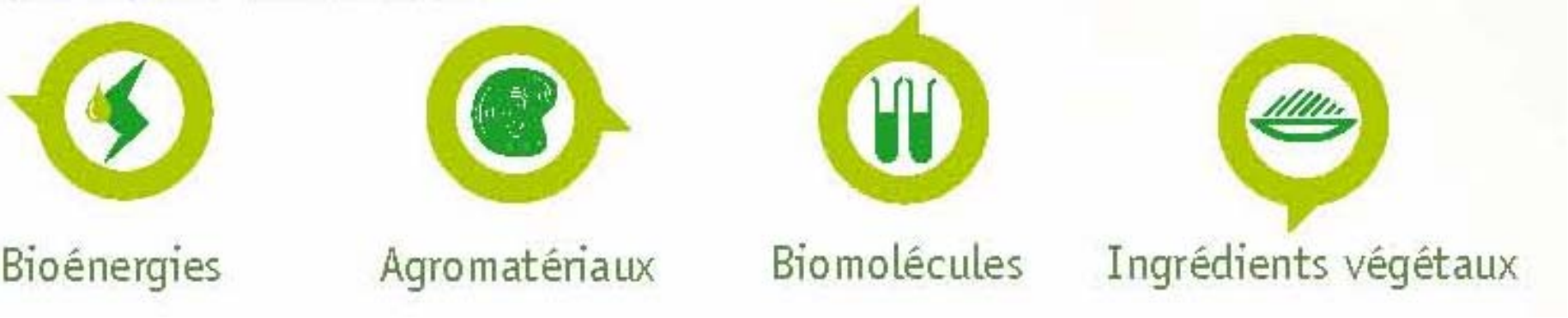
Biomolecules
Chemical intermediates, glue, Lubricants, surfactants

BioEnergies
Biofuels, biodiesel, bioethanol, electricity heat

AgroMaterials
Building, Paper, Textile, Plastics, Packaging

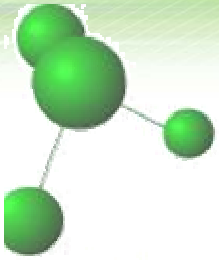
BioIngredients
Food Ingredients, Processing aids, nutraceutics

R&D projects on biorefineries



BIOMOLECULES

PHARMACEUTICAL
(vitamins, antibodies...)



CLEANING INDUSTRY

COSMETICS
(cream, shampoo...)

OIL & LUBRICANTS

SURFACTANTS

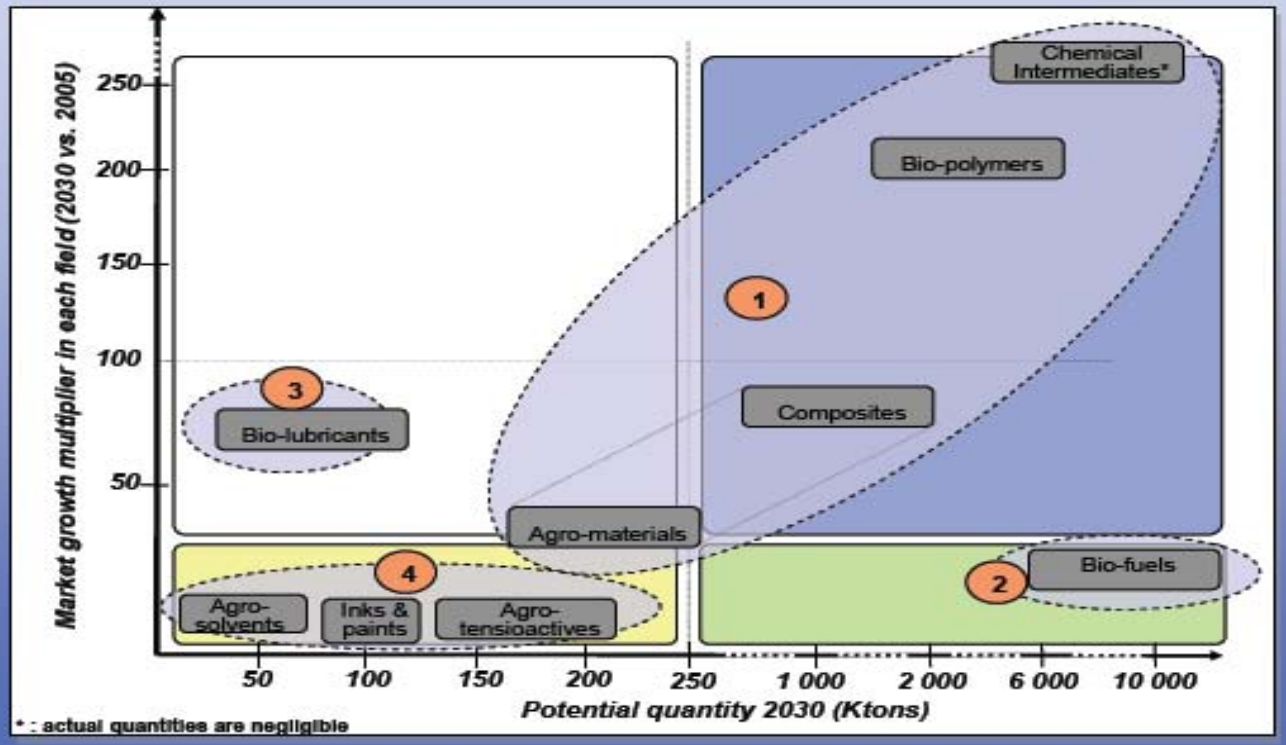
ALCOOLS & SOLVENTS

CHEMICAL INTERMEDIATES

Biobased Products : Markets

Growth multiplier factor / potential quantity – matrix (1/4)

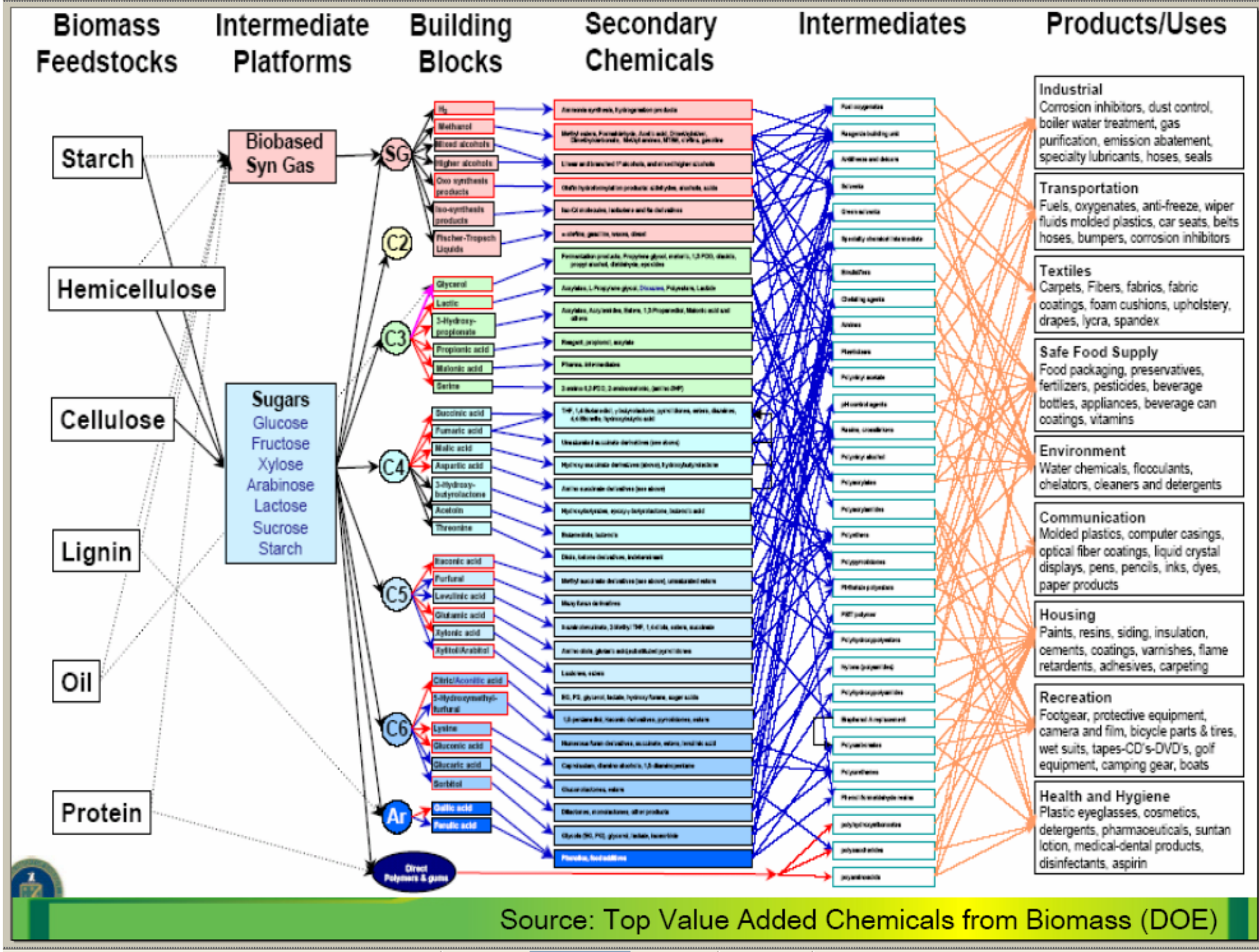
➔ Based on results from scenario 3, this matrix helps us to segment agro-industrial fields in 4 groups according to their growth dynamics and potential quantities.



1. High dynamics / high quantities
2. Middle dynamics / high quantities
3. High dynamics / middle quantities
4. Middle dynamics / weak to middle quantities

ALCIMED / ADEME-AGRICE

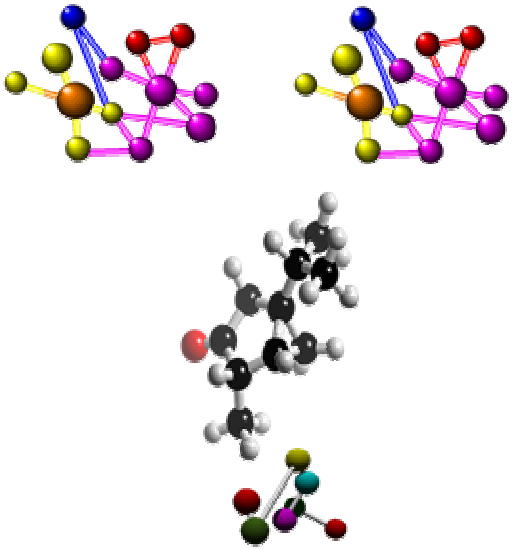
May 24, 2007

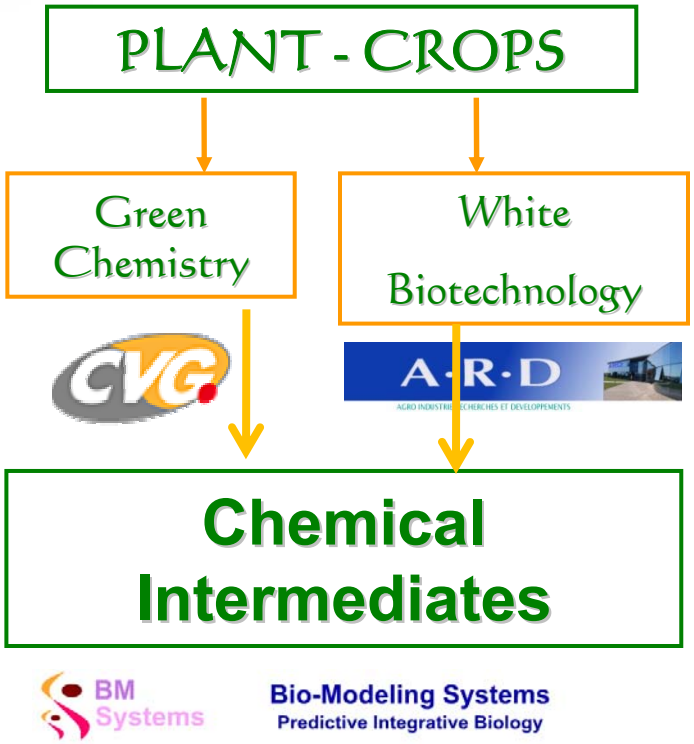


Source: Top Value Added Chemicals from Biomass (DOE)

SYNTHONS project
Developing Chemical intermediates

Development of 2 technological platforms to evaluate the feasibility of the industrial production of chemical intermediates from plants





90 % organic chemistry will be made from renewable resources in 2090 !

SYNTHONS project

A major collaborative industrial biotech research platform

A collaborative complementary team

- **A.R.D.:** (Agro-industries Research & Development) Industrial Biotech research company (organism modification, experimentations, scale-up, pilot,), controlled by the leading cooperatives of the agri-business in France, is the leading structure of the sector.
- **I.B.T.:** Troyes Institute of Biotechnologies (Intellectual property, biochemical, organism modification). Leading technological transfer institute.
- **BMSystems:** Predictive integrative Biology expertise.
- **C.V.G.:** Chemistry team leader based in Picardie for “green” sourcing research.

Three major European chemical companies

proposing their target molecules to the platform

- **L’Oréal**: World leader in the cosmetic market
- **Rhodia**: Major actor in the fine chemicals market (former Aventis fine chemicals)
- **Arkema**: Major actor in the chemistry market (former Total chemicals business)

SYNTHONS project : *CVG*

Plant-based innovation for industrial development

- **SERVICE PROVIDER FOR R&D IN**

  PLANT BIOMASS EXTRACTION, CRACKING and MODIFICATION

- **DEVELOPMENT OF TURNKEY INNOVATIVE PRODUCTS & PROCESSES FOR INDUSTRIAL COMPANIES**

L'innovation végétale
au service du développement industriel

SYNTHONS project : *CVG*

L'innovation végétale
au service du développement industriel

TOGETHER WITH OUR CUSTOMERS

in each step of the innovation process

Techno–economic studies & prospectives

- ✓ Market evaluation
- ✓ Techno-economics feasibility,
- ✓ Project design and follow-up.

R&D

- ✓ Development of innovative products & processes,
- ✓ Prefeasibility studies.

Scale up & technology transfer

- ✓ EXTRACTION
- ✓ SEPARATION
- ✓ DRYING
- ✓ EXTRUSION & REACTIVE EXTRUSION
- ✓ ANALYTICAL PLATFORM

SYNTHONS project : *CVG*

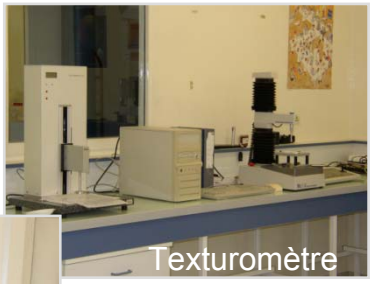
Labs and Pilot plants

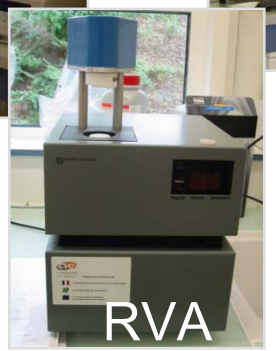
L'innovation végétale
au service du développement industriel

3000 m² buildings including 2500 m² labs & pilot plants

Analytic
Characterization


HPLC, HPIC, GC


Texturomètre


RVA


Rhéologie

Kit list :

- Analytic tools : GC, HPLC, HPIC, IR, UV
- Physical characterization tools : Rheology, texturometry, viscosity
- Method adjustments…

SYNTHONS project : *CVG*

Labs and Pilot plants

L'innovation végétale
au service du développement industriel

3000 m² buildings including 2500 m² labs & pilot plants

Biomass cracking & Pretreatment


Pilot plant


Flame proof area


10 / 15 m³ vessels

Kit list :

- Jacketed vessels from 5l to 15m³, flame proof & high pressure vessels …
- Decanters, disk stack centrifuges …
- Milling, extrusion …

SYNTHONS project : *CVG*

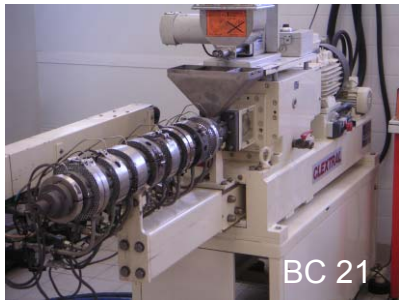
Labs and Pilot plants

L'innovation végétale
au service du développement industriel

3000 m² buildings including 2500 m² labs & pilot plants

Chemical or enzymic modification of biomass


EVOLUM 32


BC 21


BC 45

Equipment :

- Reactive Extrusion (BC 21, BC 45, EVOLUM 32) equipped with Hastelloy configuration for tough chemicals
- Pre industrial pyrolyser for process evaluation
- Chemical and enzymatic vessels including subcritical water experimentations


Pilot Pyrolyser

SYNTHONS project : *CVG*

Labs and Pilot plants

L'innovation végétale
au service du développement industriel

3000 m² buildings including 2500 m² labs & pilot plants

Purification
Concentration
Drying

Equipments :

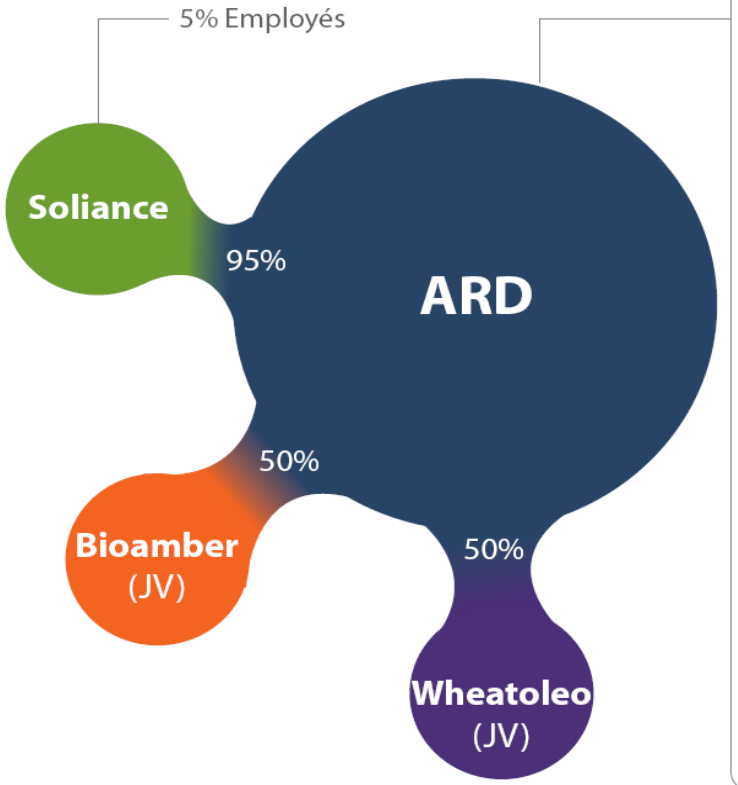
- Whole range of membranes up to 30 m²
- Precipitation & Cristallisation techniques
- Falling film evaporators (1 m³ /h & ATEX)
- Mono & multistages spraydryers (up to 100 l/hour)

SYNTHONS project : ARD

AGRO-INDUSTRIE RECHERCHE ET DEVELOPPEMENTS

SYNTHONS project : ARD

Stakeholders



53.44% CRD
Champagne Céréales - Groupe coopératif céréalier
(CA consolidé de 1,8 Md€)
Emc2, Nouricia, Champagne Colligny, Cohesis,
Cooperative agricole Juniville, SCA De Sézanne,
La Marnaise, Anglure, Cooperative agricole D'Esternay

17.82% Cristal Union
Groupe coopératif sucrier
Marque Daddy Sucre
(CA de 1,05 Md€)

15.7% Crédit Agricole du Nord Est
1er groupe bancaire
(21 millions de clients, dans 60 pays)

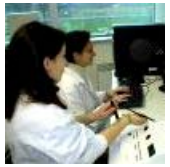
7.92% Chamtor
Appartient au groupe Champagne Céréales.
Valorise les débouchés concernant le blé
(CA de 85 Mn€)

4.18% LRD
Centre de Recherche sur la luzerne

0.94% Unigrains
Société financière spécialiste de l'agroalimentaire

SYNTHONS project : ARD

Labs and Pilot plants



71 people, in 7 teams:

1. Fractionation and pilot
2. White Biotechnologies
3. Green Chemistry
4. Agromaterials
5. Analytical Chemistry
6. Formulation
7. Environment

4 research teams

3 support teams

+ Maintenance

SYNTHONS project : ARD

Labs and Pilot plants

I. ANALYTICAL AND RESEARCH LABORATORIES


Analytic

Nitrogen


head space GC


HPLC


Potentiometry


Spectrophotometry


Biodegradabilitéy


Rheology


Tensiometry


Elisa Test

SYNTHONS project : ARD

Labs and Pilot plants

2.
TECHNOLOGICA
L HALL

SMB Chromatography

Micro pilot

Pilot

Evaporator

Atomisation

Filtration

Electrodialysis

Centrifugatoion

Dryer

SYNTHONS project : ARD

Labs and Pilot plants

3 . FERMENTATION LABORATORY

Fermentors :

2 x 2L5L 3 x 20L 1 x 100L

Micro- and ultrafiltration

Scaling up of fermentation processes from 2 litres up to 80 m³

SYNTHONS project : BMSystems

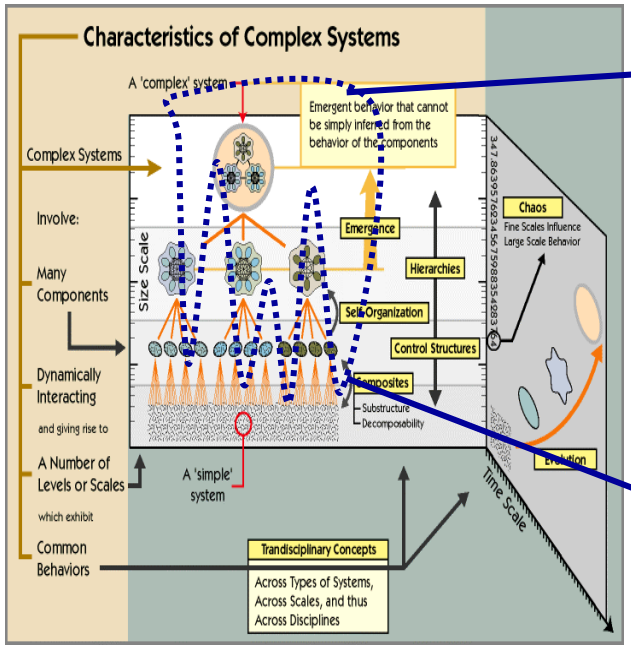
CADI™ Description

BM Systems — Bio-Modeling Systems — Predictive Integrative Biology

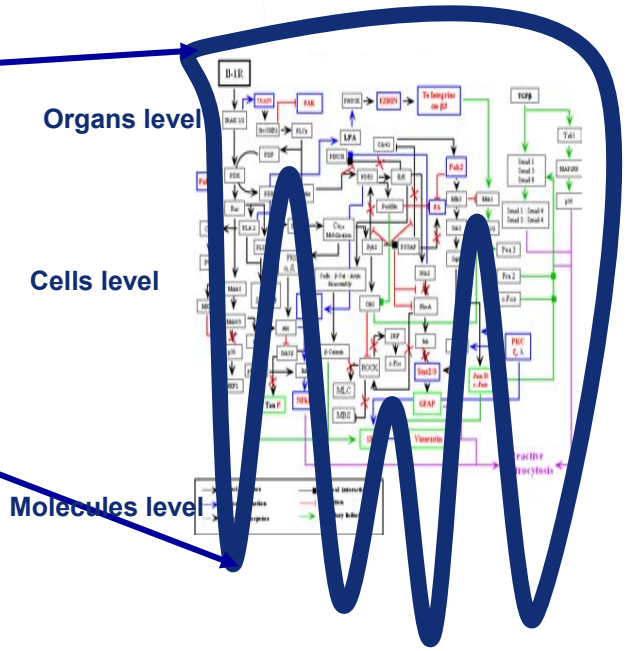
- **The CADI™ (Computer Assisted Deductive Integration)** proprietary modeling approach is the most efficient synergic process linking organic non-linear integration (Brain intelligence) and in-silico data processing power (collecting, structuring and manipulating data) to build validated biological interaction maps. CADI ™, based on negative selection concept, was invented in 2002 by Dr. François Iris, founder, Chairman and CSO ofBMS.

- **The CADI™ models**, belong to the non-mathematical holistic and heuristic class of models. They can describe the dynamics of a pathological process and/or the pathological mechanisms vs. control. They are surely not exact maps of the complex reality, but they are pertinent representations that gather the minimum knowledge and intelligence necessary to allow researchers to take the best possible decisions for the best possible results.

The complex system to study



A CADI™ model representing the system in a specific context



CADI™ models key facts:

- It is the minimum validated knowledge necessary to describe in detail a living process in a defined context
- It is a detailed map of inter-cellular and/or intra-cellular mechanisms associated with a biological status. It can describe the dynamics of a pathological process and/or the pathological status vs control.
- It is the most effective process to date to transform raw information into directly exploitable knowledge.
- It is the most efficient necessary step to define the contexts and the parameters to build local pertinent mathematical models

SYNTHONS project :
Three partners: One integrated platform

BM Systems

Bio-Modeling Systems
Predictive Integrative Biology

Team Competences gathered	*A.R.D.*	*BMSystems*	*IBT*
• Stat of the art survey,sourcing possibilities,	X		X
• Exploitation freedom	X		X
• CADI feasibility controls check		X	
• Micro-organisms selection	X	X	X
• First cost estimation	X	X	X
• **Production of the initial CADI model**		X	
• Modification protocols proposition:	X	X	X
• Option A: Optimization proposals without genetic modification	X	X	
• Option B: Genetic modifications proposals	X	X	
• Genetic modification realizations	X		X
• Experimental evaluation protocols design	X	X	
• Optimization of the interesting proposals		X	
• Experimentations	X		X
• Production of the CADI n+1 model and go to Option A or B (above)		X	
Teams experimental equipments available	***A.R.D.***	***BMSystems***	***IBT***
• CADI modeling tools (software, processes, methodology)		X	
• Molecular biology	X		X
• Microbiology	X		X
• Screening, clones selection, Genetic engineering	X		X
• Experimental validation:	X		
–Laboratory scale from 2l to 150l	X		
–Scale-up simple pilot up to 5 m3	X		
–Scale-up bio-production pilot from 10m3 to 40 m3	X		
–Works design, Industrial engineering	X		
–Estimation and industrial cost fine tuning	X		
–Molecules purification	X		

SYNTHONS project :
Facts and figures

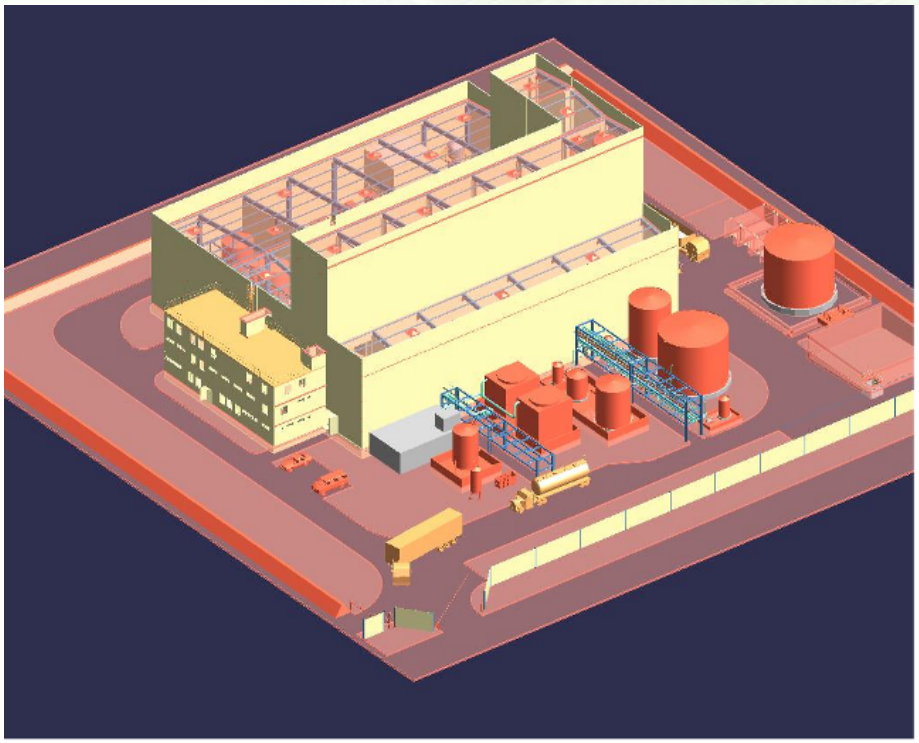
Synthons platform development (2 years)

- Creation of the leading French industrial biotech consortium mid 2006.
- I.A.R. Competitiveness Cluster accreditation and financing late 2006.
- Kick-off meeting early 2007.
- Construction of the first CADI models mid 2007.
- Identification of new pathways of interest late 2007.
- Start of the construction of the first modified micro-organisms early 2008.

Synthons platform success factors

- The integrated platform has been developed with the best experts in their respective field.
- Each partner spends its resources to improve its proprietary tools and processes and not to develop complementary competences a partner could provide.
- Each partner finances its costs and shares with the relevant partners the future returns.

White Biotech Demonstration Plateform



First molecule :

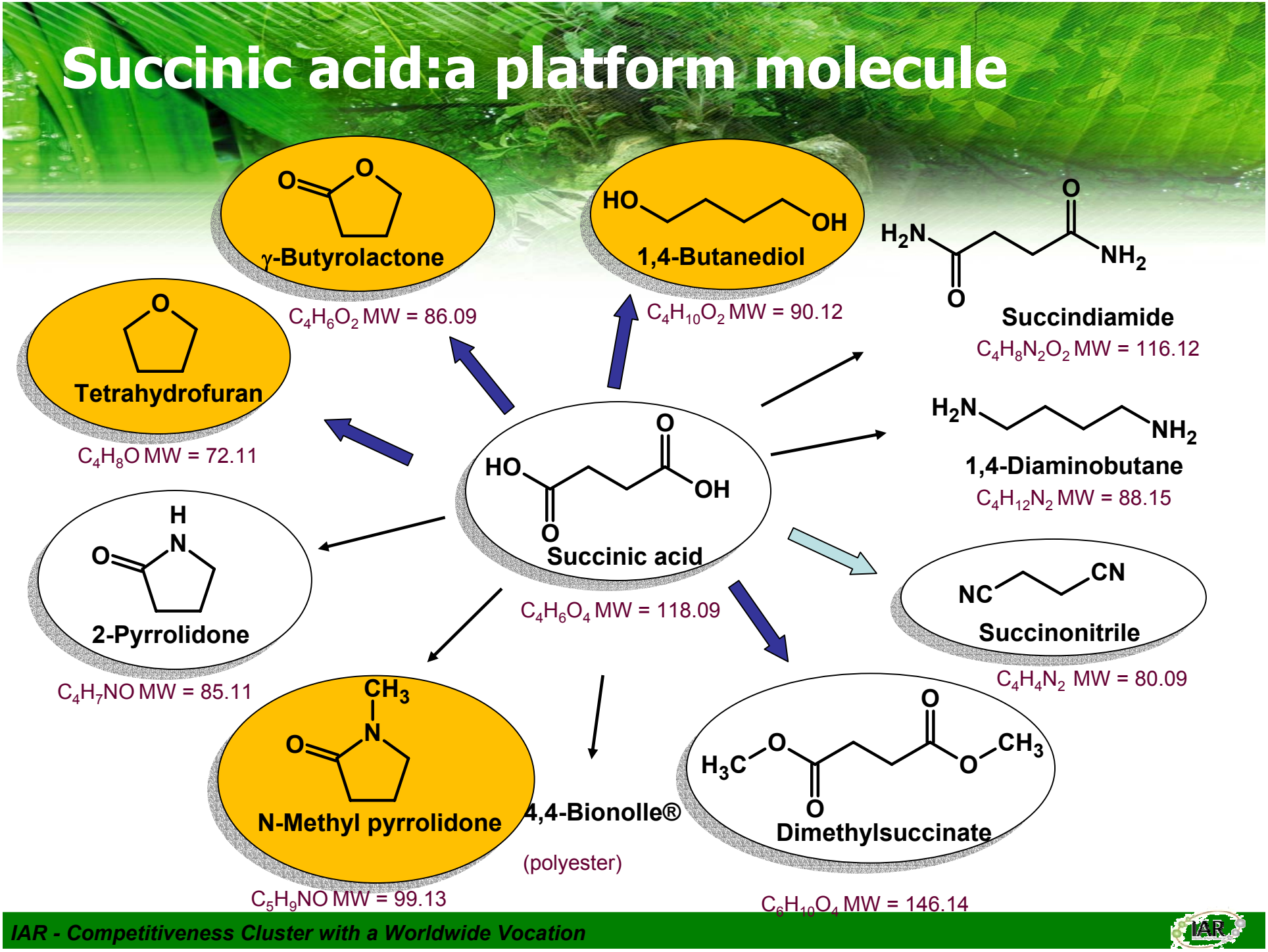
Succinic Acid

Joint-Venture with DNP

(Diversified Natural Product)

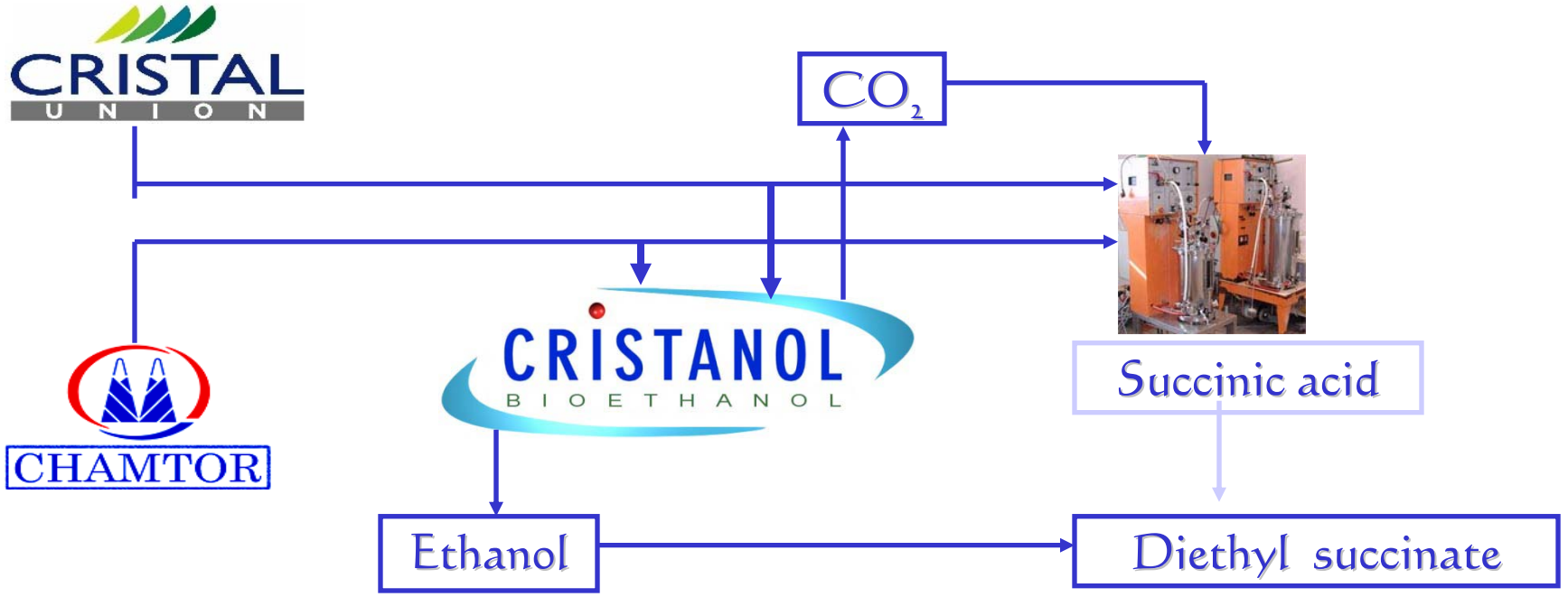
20 millions Euros Investment

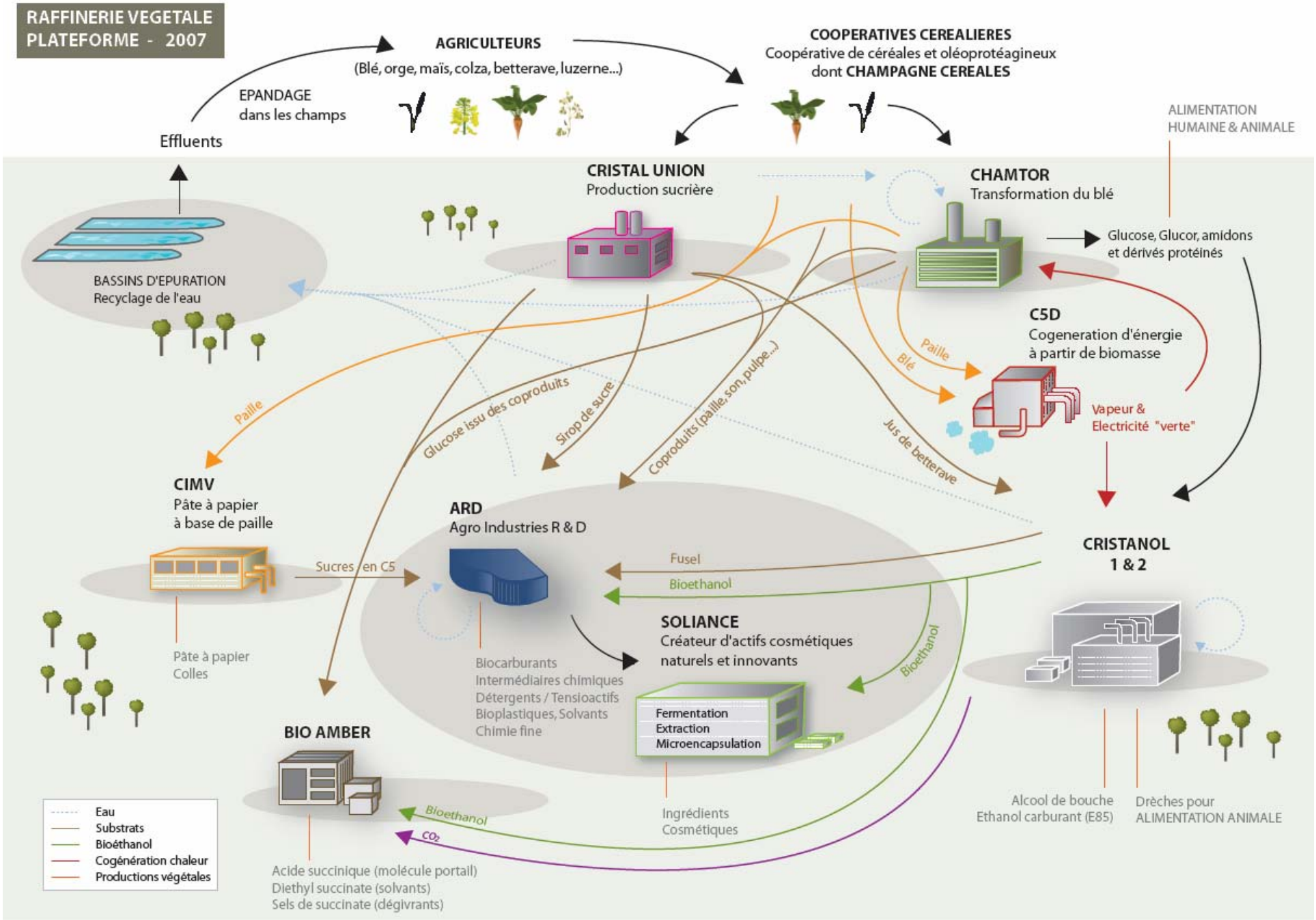
Succinic acid:a platform molecule

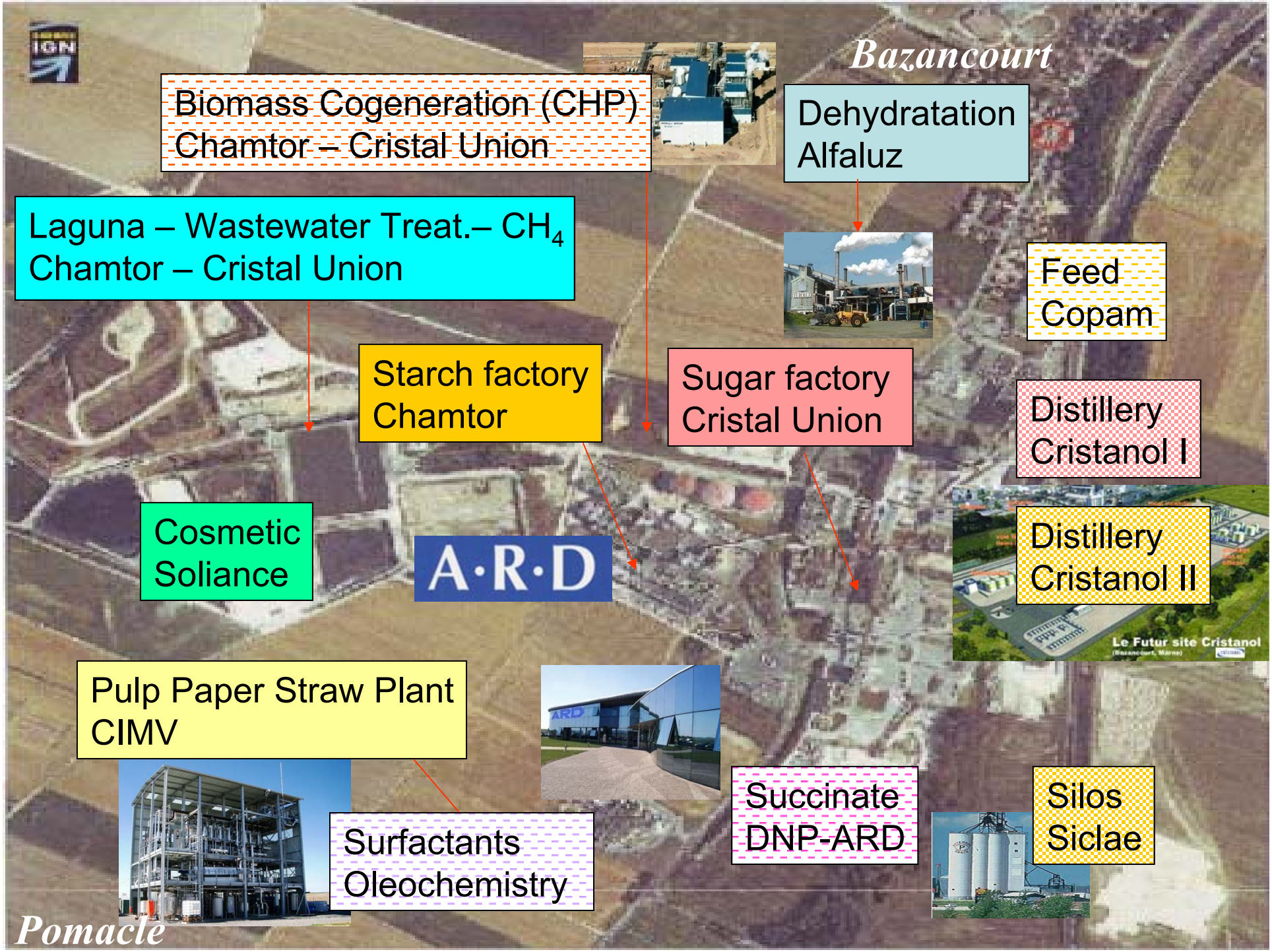


Succinic acid : a new step towards biorefinery

Integrating the succinate and the ethanol fermentations would decrease carbon lost as waste CO_2 and produce three commercial products; ethanol, Succinic acid and diethyl succinate within the same site.




RAFFINERIE VEGETALE
PLATEFORME - 2007
AGRICULTEURS
(Blé, orge, maïs, colza, betterave, luzerne...)
EPANDAGE
dans les champs
Effluents
COOPERATIVES CEREALIERES
Coopérative de céréales et oléoprotéagineux
dont CHAMPAGNE CEREALES
ALIMENTATION
HUMAINE & ANIMALE
CRISTAL UNION
Production sucrière
CHAMTOR
Transformation du blé
Glucose, Glucor, amidons
et dérivés protéinés
BASSINS D'EPURATION
Recyclage de l'eau
C5D
Cogeneration d'énergie
à partir de biomasse
Paille
Blé
Vapeur &
Electricité "verte"
Paille
Glucose issu des coproduits
Sirop de sucre
Coproduits (paille, son, pulpe...)
Jus de betterave
CIMV
Pâte à papier
à base de paille
ARD
Agro Industries R & D
CRISTANOL
1 & 2
Sucres en C5
Fusel
Bioethanol
Pâte à papier
Colles
Biocarburants
Intermédiaires chimiques
Détergents / Tensioactifs
Bioplastiques, Solvants
Chimie fine
SOLIANCE
Créateur d'actifs cosmétiques
naturels et innovants
Bioethanol
Fermentation
Extraction
Microencapsulation
BIO AMBER
Bioethanol
CO2
Ingrédients
Cosmétiques
Alcool de bouche
Ethanol carburant (E85)
Drèches pour
ALIMENTATION ANIMALE
Acide succinique (molécule portail)
Diethyl succinate (solvants)
Sels de succinate (dégivrants)
Eau
Substrats
Bioéthanol
Cogénération chaleur
Productions végétales


Bazancourt
Biomass Cogeneration (CHP)
Chamtor – Cristal Union
Dehydratation
Alfaluz
Laguna – Wastewater Treat.– CH_4
Chamtor – Cristal Union
Feed
Copam
Starch factory
Chamtor
Sugar factory
Cristal Union
Distillery
Cristanol I
Cosmetic
Soliance
A·R·D
Distillery
Cristanol II
Le Futur site Cristanol
Pulp Paper Straw Plant
CIMV
Surfactants
Oleochemistry
Succinate
DNP-ARD
Silos
Siclae
Pomacle

PROJECTS since 2005

- 72 projects labellized
- 49 projects financed
- Projects financed : 221 MEuros
- Public subsidies :30 to 40 %

International collaborations

1. **Objectives**
    1. Partnerships, especially with other clusters
    2. International Technological Partnerships for small and medium size companies
    3. To promote the scientific and technological image of the two regions

2. **Selection of countries**
    1. Europe
    2. ROW 1 : Canada, USA, **Japan**,
    3. ROW 2 : Brazil, India, China

3. **Involvement in international projects**

Conclusion

1. We organize and manage a **network** gathering **companies, agriculture, research and training** organisms**.**
2. We set up **industrial R&D projects** and **do project engineering**
3. We **evaluate** and **labelize RDT projects.**
4. We try to find the **best financing solutions** for RDT projects**.**
5. We **open new markets** for non food uses of plants**.**
6. We promote the scientific and technological image of the 2 regions**.**
7. We try to build a **vision of the future for agroindustrial products** (markets and technologies).
8. We develop **international collaborations**

Welcome in France
in Champagne Ardenne and Picardie !

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