Agropolis International & its research ecosystem towards Innovation in food systems

AL INVEST VERDE

AGROPOLIS INTERNATIONAL

MÉDIATION SCIENCES-SOCIÉTÉS

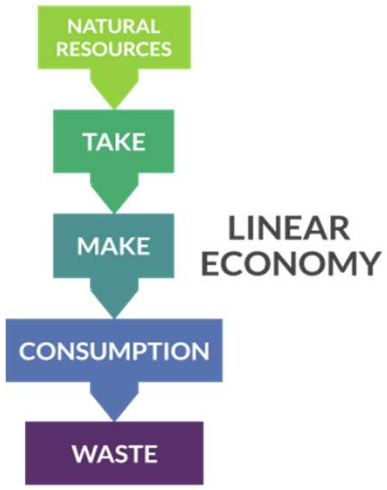
AGRICULTURE ALIMENTATION BIODIVERSITÉ ENVIRONNEMENT

Santiago, May 2023

Circular economy

Circular economy, a paradigm shift!

- **The concept of Circular Economy (CE) emerged to promote a planet that does not generate any waste (World Economic Forum, 2018).**
- **On the contrary, it builds a virtuous cycle where natural resources, materials and assets are not disposed of, but rather recycled, recovered and reused, in order to optimize their utility and minimize risks in the system (Wilde, et al., 2016).**

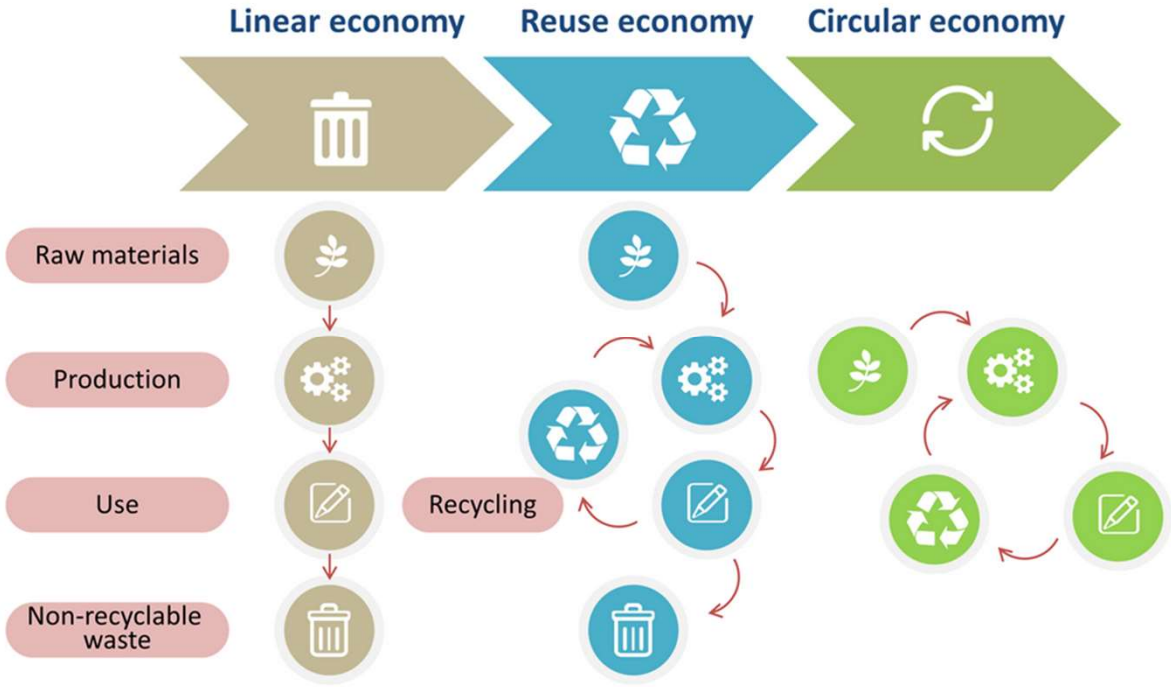


Multistakeholders approach

- The circular economy represents a new socio-economic paradigm for policymakers and a wide range of stakeholders. **The circular economy is about economics, innovation and competitiveness.**
- **To maximize the utility and value of resources at all times**, promoting more efficient, sustainable and regenerative productive systems.
- It goes beyond waste management and recycling and **implies changes in production and consumption models, eco-design and integrated planning.**
- Industry, universities and governments can spur innovation to deal with the consequences of the accumulated legacy waste of the Anthropocene (such as plastic in the oceans)

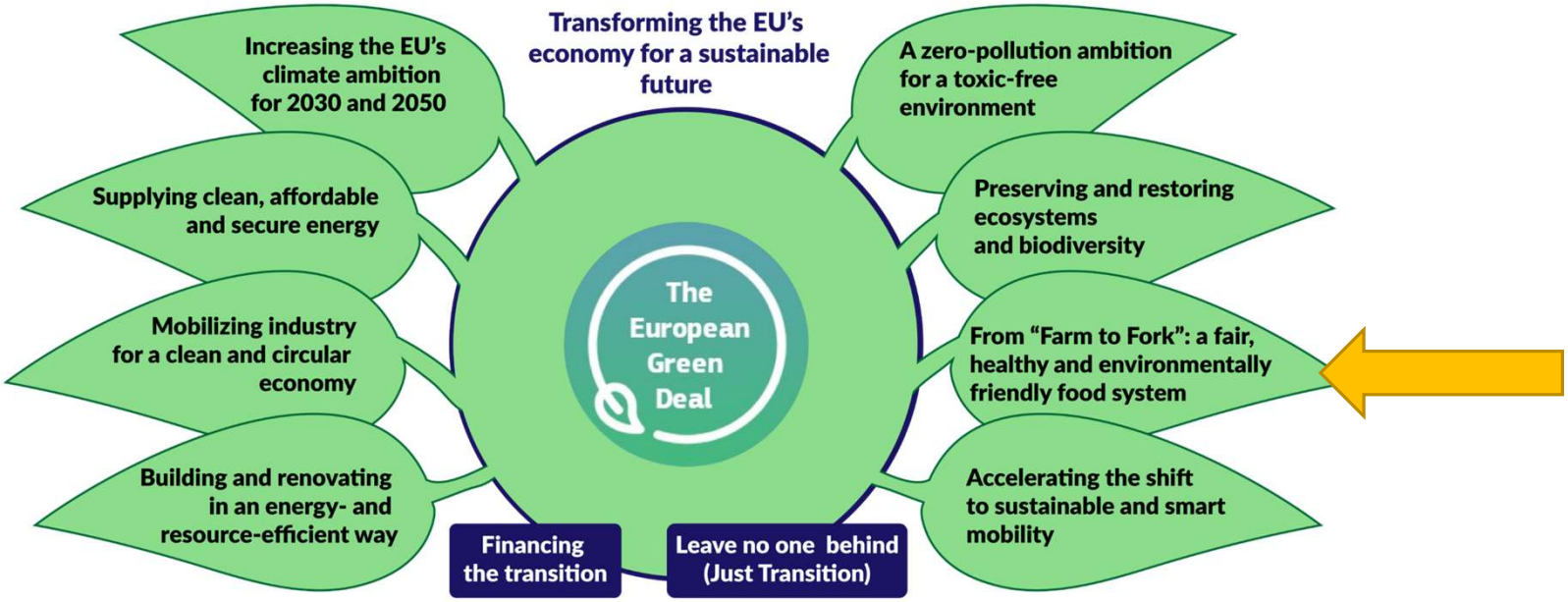
Gradual process

I. International experience shows that the transition to a circular economy in the sector must be a gradual process that requires, above all**, the commitment and willingness of the actors involved**, thus building a common agenda, prioritizing the issues where there is the greatest opportunity to add value.



In Europe… The Green deal

To achieve a carbon-neutral, sustainable, toxic-free and fully circular economy by 2050.



The European Green Deal includes more than 50 policy initiatives and will be funded with more than 1 trillion euros.

Farm to Fork

The Farm to Fork Strategy aims to accelerate our transition to a sustainable food system that should:

- **have a neutral or positive environmental impact**
- **help to mitigate climate change and adapt to its impacts**
- **reverse the loss of biodiversity**
- **ensure food security, nutrition and public health, making sure that everyone has access to sufficient, safe, nutritious, sustainable food**
- **preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector and promoting fair trade**

- **EC indicated targets, by 2030: to reduce the use and risk of chemical pesticides by 50% and the use of more hazardous pesticides by 50%, to reduce the use of fertilizers by at least 20%, and to increase organic production to achieve 25% of the EU's agricultural land use**

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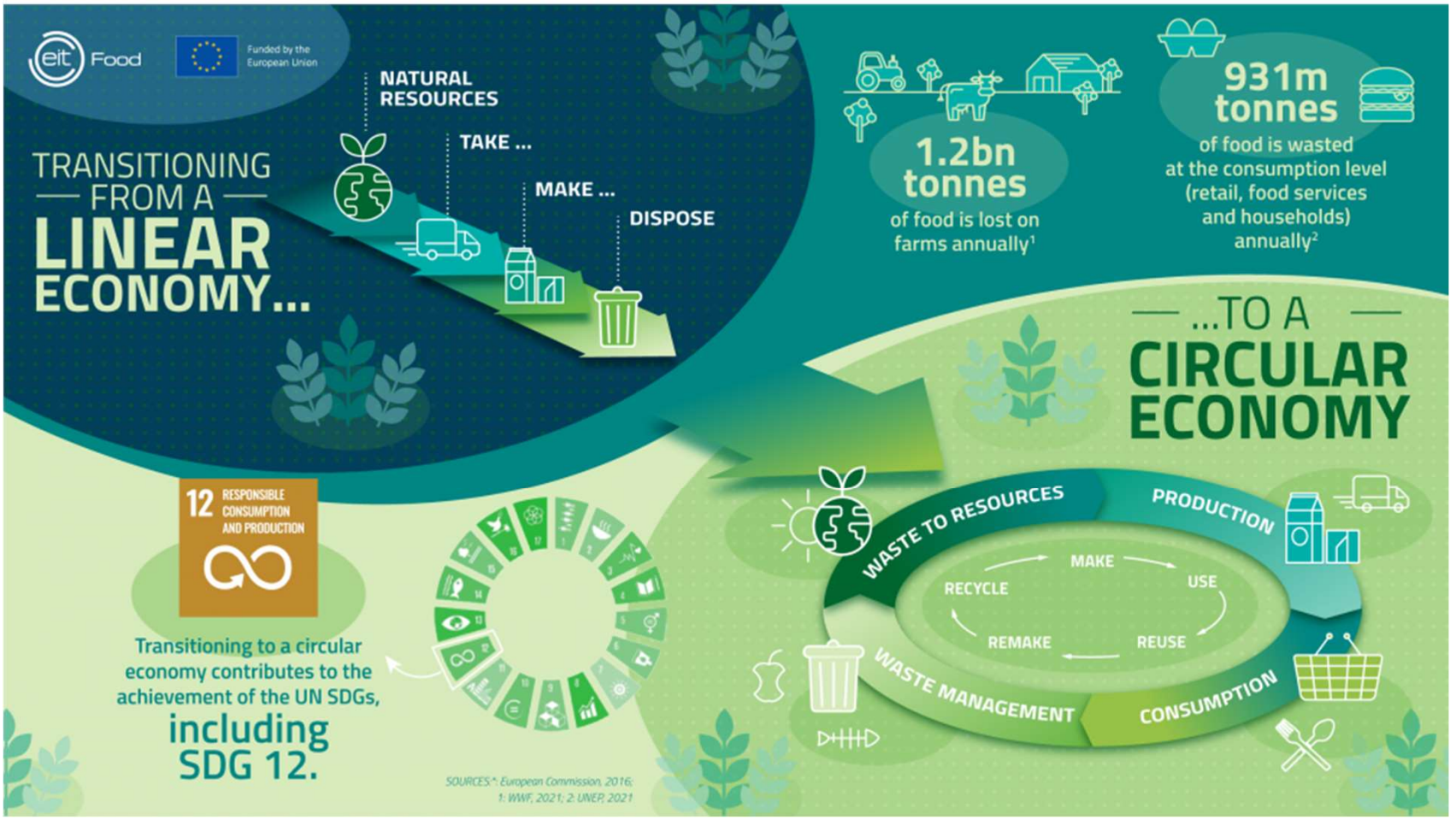
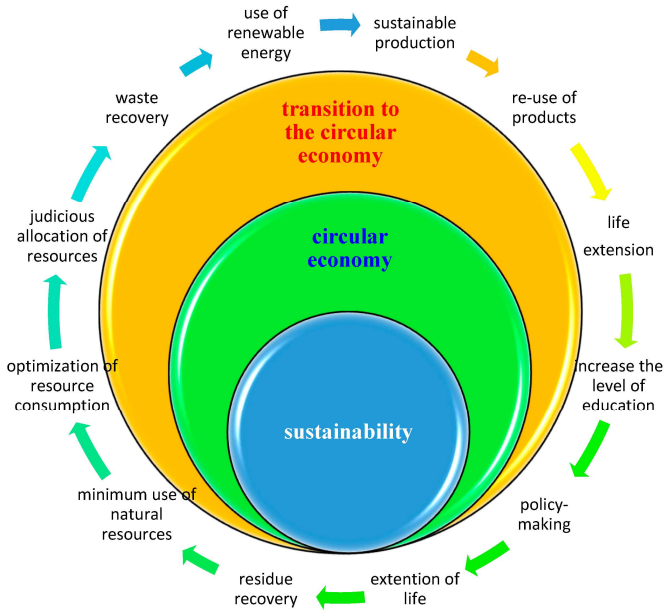


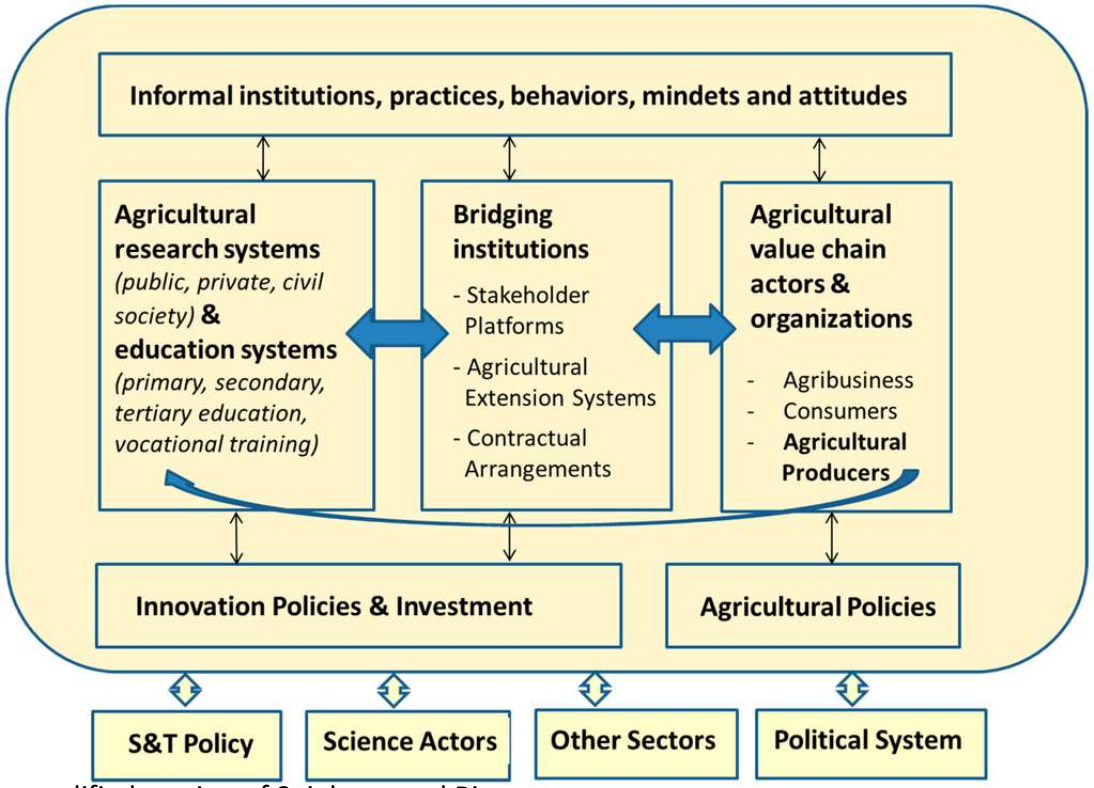
Innovation and partnership towards CE Transition

The sustainability of the economy is attributed to the implementation of the circular economy by accelerating the transition to it and promoting its key elements at the level of the economic, social, environmental, and technological pillars.



The transition requires partnership and innovation, which creates an appropriate framework for sharing knowledge and experiences towards redesigning the current supply chain, namely raw material supply, production, processing, packaging, storage, and distribution

Agricultural Innovation system



modified version of Spielman and Birner

Capacity to innovate must be promoted at multiple levels: the individual level, the organizational level and the policy level (enabling environment).

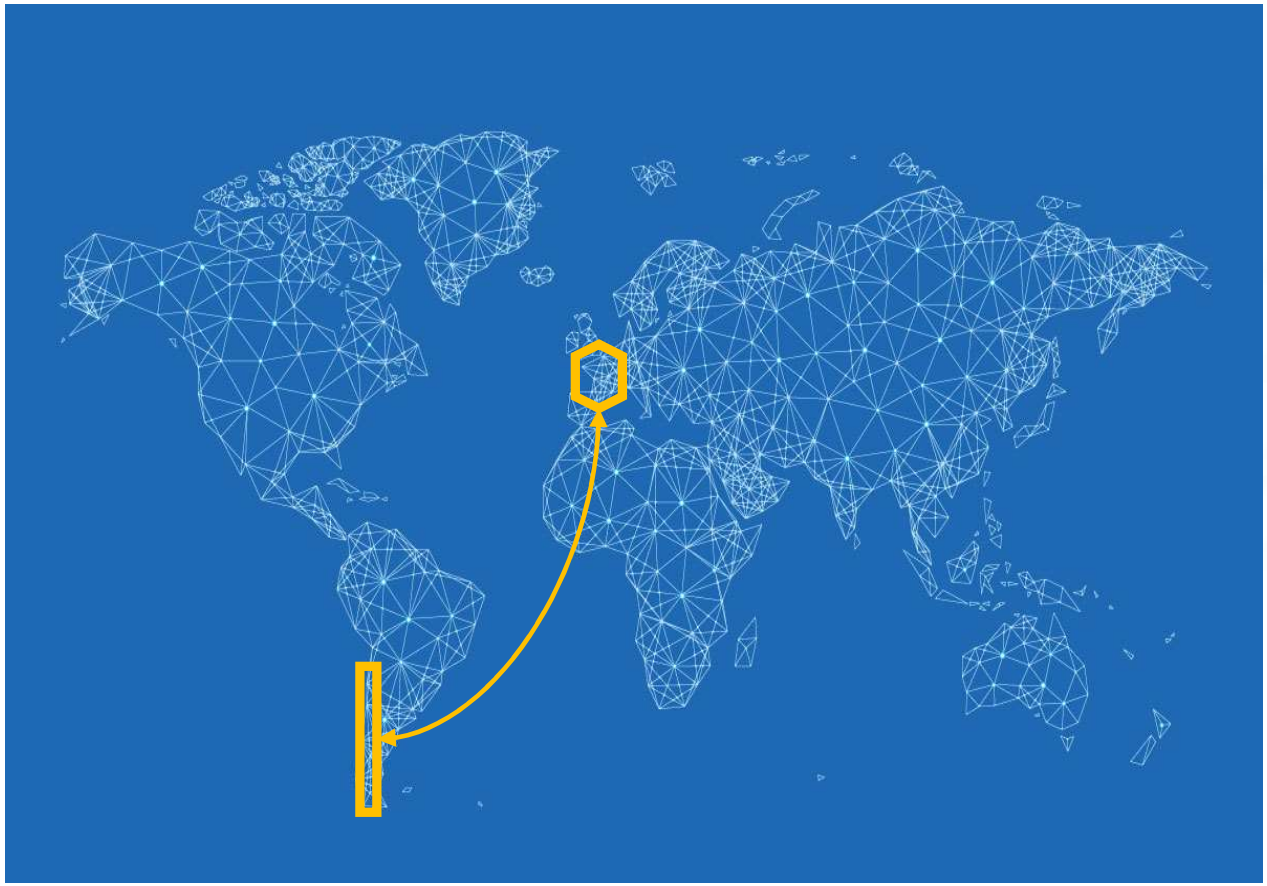
Individual innovation capacity development requires investment in education and training.

Organizational capacity development of producers and other community-based organizations needs to be developed to enable small-scale farmers to collectively act and innovate. Such organizations can facilitate producers' access to knowledge sources, inputs and markets.

Well-functioning enabling environment that comprises policies and rules that govern the mandates and operations of research and extension organizations and their engagement with other actors in the system is vital for individuals and organizations to perform more effectively

Agropolis International & its innovative ecosystem

Montpellier:
an outstanding scientific ecosystem in agro-environmental sciences with a strong international scope



Montpellier, a long university & scientific tradition

1593

12th century

1842

Agropolis International

Agropolis International is a scientific cluster, located in Montpellier, promoting French scientific expertise in the fields of agriculture, food, biodiversity, and environment.

It also links with tropical and Mediterranean areas, monitoring partnerships and facilitating joint projects with the major international, European or national organisations involved in Global South development.

Innovation at different level

Research organisations

- CIRAD, IRD, INRAE, …

Higher education organisations

- Institut Agro, UM, …

Organisation which support Innovation

- ASOI, SATT, BIC

A shared objectives…

How to build a better tomorrow?
How to address social challenges that are essentials for our future?

By designing a more ecologically innovative agriculture, and more secure & safer food.

Research organisation: a exemple CIRAD

UNDERSTANDING
biological systems, from molecule to ecosystem

Biological Systems Department (BIOS)
9 research units

ANALYSING
the practices and performance of farming systems, from plot to farm

Tropical Production and Processing Systems Department (PERSYST)
10 research units

SUPPORTING
players in rural areas, from a local to a global level

Environment and Societies Department (ES)
10 research units

From gene… to governance

From gene… to governance

Expertise encompasses the following fields:

- production and productivity within the context of the agroecological transition;
- crop protection;
- genetic improvement;
- food and non-food product processing;
- sustainable sourcing;
- adapting value chains to climate change;
- multi-criteria performance assessment (LCA - life cycle assessment);
- building markets and standards that reward sustainable production and social responsibility within value chains;
- and academic and technical training for value chain stakeholders.

Expertise in more 15 commodities chains

Animal production
Banana and plantain
Cocoa
Coconut
Coffee
Cotton
Dairy
Forest resources
Fruit and vegetables
Oil palm
Rice
Roots and tubers
Rubber
Sorghum
Sugarcane

Top-level research infrastructures

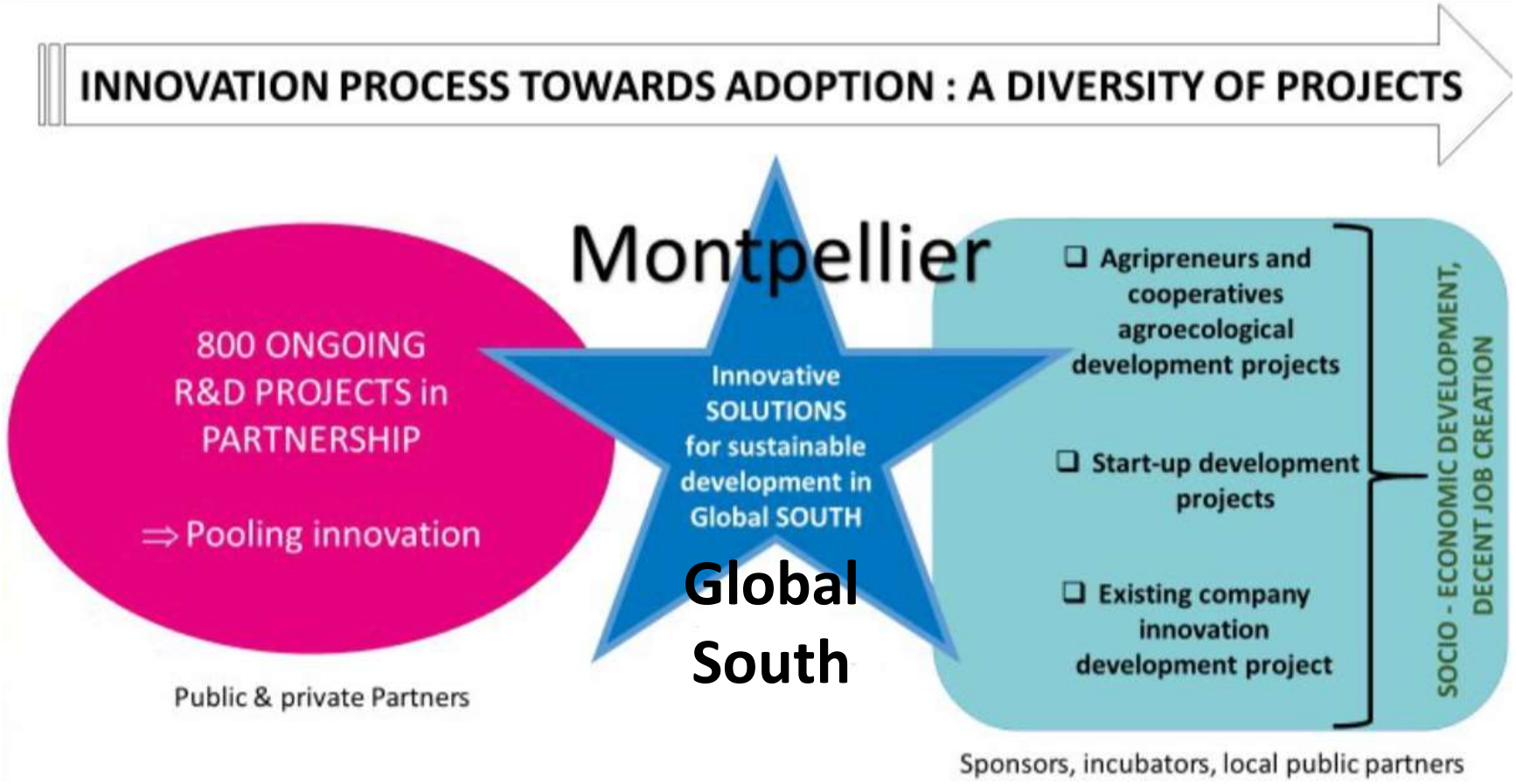
Top-level research Infrastructures, equipment and reference laboratories to benefit to our partners from Global South

- spread across four sites, covering almost 20 hectares in total
- in all, 53 buildings totalling 59 000 m2, including 3820 m2 of greenhouses and 1500 m2 of technology halls.

Remarkable facilities:

- **Technical platforms and laboratories:** a regional genotyping platform (GPTR), rhizoscope, a histology and plant cell imaging platform (PHIV), a sensorial analysis laboratory and animal health laboratories
- **Technology halls:** agrifood technology and biomass energy
- **Experimental greenhouses:** the Abiophen greenhouse, devoted to climate change research
- **A quarantine facility:** Visacane, for sugarcane
- **A teaching greenhouse**: Meditrop, to promote agrobiodiversity
- **Genetic resource collections:** Agropolis Resource Centre for Crop Conservation, Adaptation and Diversity

Adoption of innovation



AxLR, SATT Occitanie Méditerranée

Overall objectives: to enhance the value of academic research and improve the process of technology transfer to the socio-economic world.

I. To promote the expertise and results of academic laboratories in the Mediterranean area of France's Occitanie region.

II. To help turn inventions into innovations to create products and services that meet industry and commercial needs.

III. To work alongside academic researchers, helping to build, fund, and drive the development of inventions in their "maturation" phase. Collaborate extensively with industry companies and investors.

IV. With its portfolio of technology opportunities for companies, SATT AxLR brings excellence right from its laboratories to overcome technology barriers and facilitate business growth.

AxLR, SATT

HEALTH & BIOTECHNOLOGY

AGRONOMICS, ECOLOGY & ENVIRONMENT

MATHEMATICS, INFORMATICS, SYSTEM PHYSICS

CHEMISTRY & MATERIALS

HUMAN & SOCIAL SCIENCES

- Innovative project evaluation
- Intellectual property strategy
- Technical maturation for projects
- Innovation marketing
- Contract negotiation and finalization
- Company creation

SATT: Services & Key figures

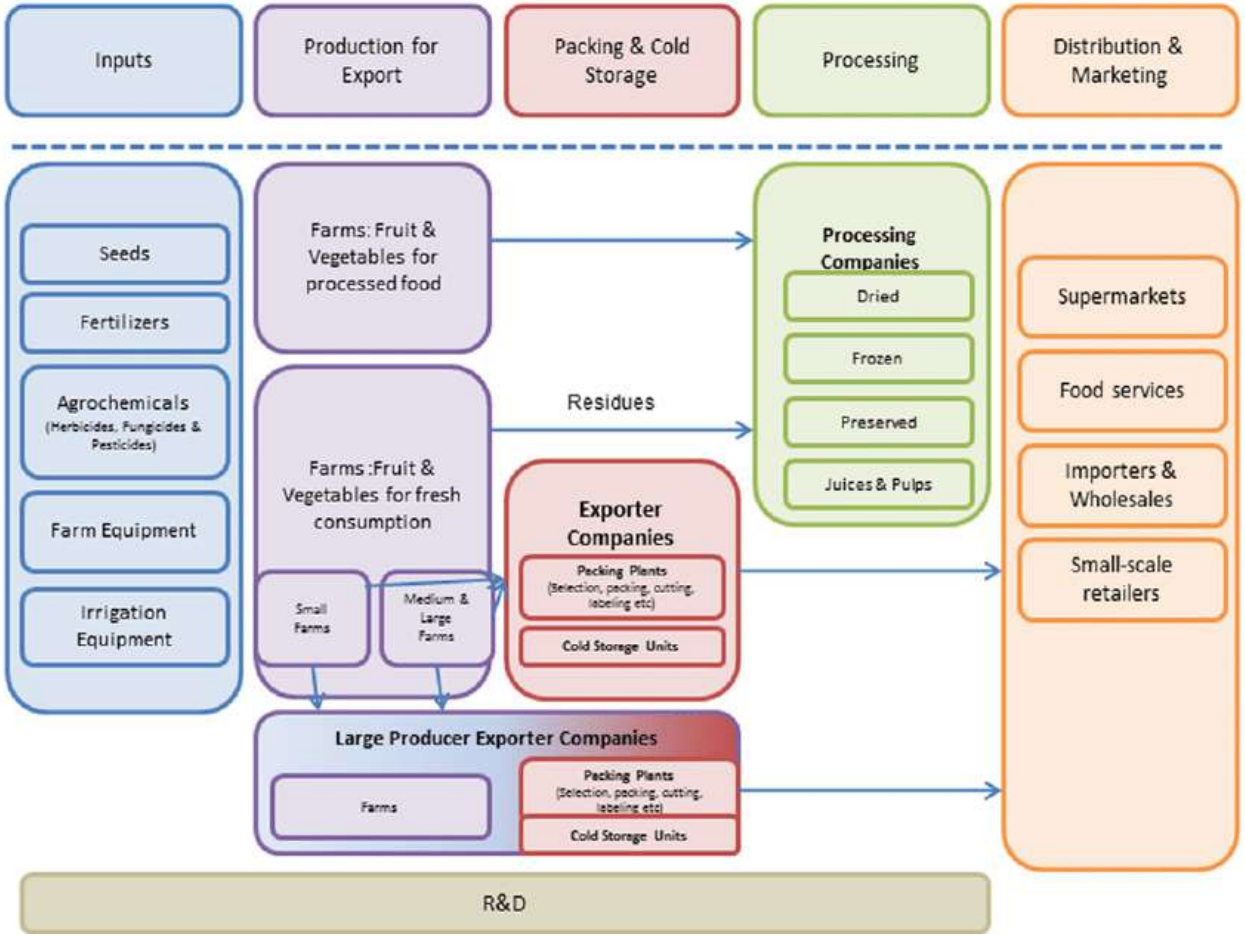
1165 projects evaluated	171 innovation programs launched	47M€ invested	116 contracts for transfers to companies	95 startups assisted	370 patents filed

Coming back to the fruits…

Fruits are high added-value products with high nutritional value, rich in vitamins, minerals, fibre and unique natural molecules. They are also drivers for social development and create numerous jobs. This puts them at the heart of global food security, public health and poverty alleviation issues.

Stakes in fruits value chain in Chile

To be established by AL INVEST VERDE – Fruiticola project



UMR AGAP

The capacity to produce improved planting material suited to different and changing growing conditions is an absolute priority in order to reduce the environmental impact of farming systems and boost their sustainability.

To create new breeding methodologies and innovative planting material, UMR AGAP is working to understand the factors behind plant development and their adaptation to environmental constraints, analysing the organization and diversity of genomes, and studying agro-biodiversity. It combines the biological sciences and social sciences in order to broaden the range of disciplines called upon and gain a clearer understanding of how crops are domesticated. Genomics, bio-informatics, ecophysiology and mathematical modelling are used to study the relations between genetic diversity, agronomic performance and response to breeding.

Architecture and flowering of fruit species (AFEF)

Fruit tree production faces numerous threats and ongoing changes, regarding global warming and the need for new agronomic practices.

Ongoing climatic changes are suspected to lead to unappropriated blooming periods, lacks of pollination, and due to strong genotype x environment interactions to irregular cropping that may provoke changes in cultivation areas or in appropriate cultivar for a given zone. Moreover, while orchards are still more and more dense, societal demand leads to orientate new research towards new agronomic practices such as Agro-Ecology and towards the selection of new varieties with high cropping value and adapted to their environment, especially regarding their floral phenology.

In this context, AFEF team study and model the genetic determinisms of key traits that are challenging for selecting innovative material: phenology, cropping regularity, tree architecture.

FruitFlow: Predicting and tuning seasonal responses of apple and peach to improve orchard yield and climate change resilience

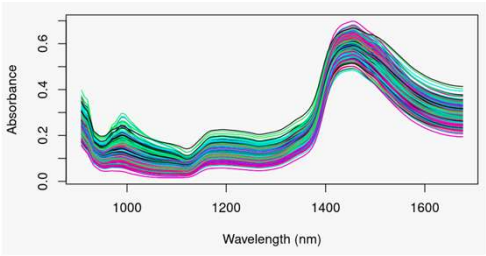
Environmental signals such as winter and spring temperatures that control dormancy and the growth / flowering cycles of fruit trees are altered by climate change, threatening crop production. However, our ability to produce new cultivars is limited by our lack of knowledge about the underlying mechanisms and their genetic variation in collections of diversity. The FruitFlow project brings together an international consortium of five research centers and three companies to address these questions about two important fruit species: apple and peach.

The main objective is the development of climate-smart technologies to predict and promote flowering and fruit production and attenuate the negative impact of global warming on agricultural sustainability and food security

Description

- will develop tools for predicting apple and peach phenology using statistical and artificial intelligence methods applied to high throughput phenotyping data
- will identify and characterize natural substances to adapt the period of flowering fruit trees
- identify favorable alleles and molecular markers to assist breeding programs

Project OASIs



Testing the use of phenomic and genomic tools to select progenies within integration crosses, i.e. between iconic and resistant grapevine varieties. In this context, the final goal is to select individuals **which display the characteristics of their iconic parental variety while being resistant to diseases.**

- **Objectives**

Development of decision-making tools to accelerate breeding in the context of grapevine integration crosses.

- **Description**

Phenomic analyses mainly consist of the use of near-infrared spectroscopy (NIRS) to discriminate progenies given their distance to their parents. These analyses will be performed on different tissues (leaves, wood, clusters) and with different types of equipment, including handheld micro-spectrometers. Considering genomics, we will look for polymorphisms (SNP) that display selection signatures related to the selection goals. These methodologies will first be tested with a semi-diallel mating design of 10 crosses from 5 parents and for which many data are readily available (WP1). Then, we will specifically test these tools within the integration crosses from the following wine regions: Cognac, Champagne, and Côtes-du-Rhône within WP2 and WP3. Finally, WP4 will ensure the good coordination of tasks within the project.

- **Team**

Diversité, adaptation et amélioration de la vigne (DAAV)

UR HORTYS

Agroecological Functioning and Performances of Horticultural Systems

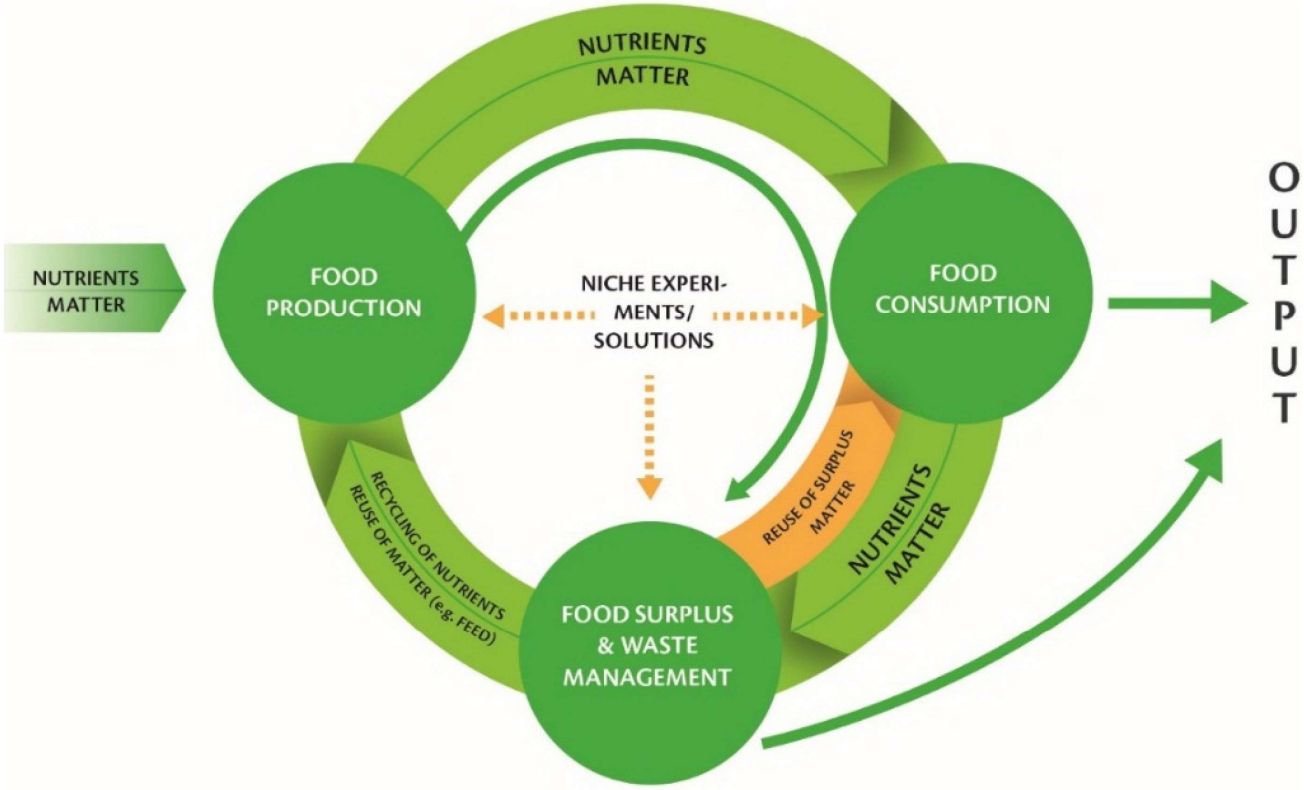
Horticulture is seen as an essential factor in food security and safety and health worldwide. Horticultural systems are also a major source of income and jobs for the poorest populations in tropical areas. In this context, is it possible to ensure high, sustainable production of safe, quality fruit and vegetables? The aim of UR HortSys is to establish the principles of agroecology of tropical horticultural systems with a view to developing sustainable cropping systems, in partnership with local players.

UMR MOISA

Montpellier Interdisciplinary center on Sustainable Agri-food systems (social and nutritional sciences)

UMR MOISA comprises around a hundred people working on the social sciences (economics, management/marketing, sociology, and political science). It aims to understand how the practices of stakeholders in value chains and institutional mechanisms influence food security and safety, and the sustainability of agriculture and food.

Muchas gracias



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Artifial intelligence

I. Traditional agricultural methods are not sufficient to address the huge demand of the growing population. This prompts farmers and agricultural companies to find new methods to improve productivity and reduce waste· Artificial intelligence (AI) can be applied in the technological evolution of the agricultural industry as it can be used in crop yield and price forecasts, intelligent spraying, predictive insights, agriculture robots, crop and soil monitoring, and disease diagnosis

II. **The use of AI in agriculture can be categorized into two types: AI software and AI robots**

III. **]. AI robots are used in various activities such as crop scouting, pest and weed management, harvesting, spraying, pruning, milking, phenotyping, and sorting**

IV. **]. Most of these robots are still in the early stages of development, and very few have reached the commercial scale. AI can be used in drones and self-driving tractors. Drones are useful in spraying water, pesticides, and herbicides on fields and mapping farms and arable fields, whereas self-driving tractors are still in the early stages of development and have not been used commercially**

V. **]. Farmers use AI in applications and software to determine the health or illness of plants and to provide recommendations**

VI. **]. One of the examples of using IT in agriculture is the 365FarmNet software (an international platform developed in 2013) currently operating in 25 countries, of which Poland is one of the leaders in terms of the number of users/area of farms managed. In the food industry, many waste management startups use AI, such as Winnow (UK), Wasteless (Israel), Gamaya (Switzerland), Greyparrot (UK), and The 77 Lab (USA)**