



“Trends Overview: strategic plans and analysis report. Circular Bioeconomy, Agriculture and Digitization»

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Bioeconomy since 2005

The Bioeconomy of the last 15 years draws on two main pillars:

- The potential of biological resources
- The integration of new knowledge stemming from various disciplines, linking it with biotechnologies and life Sciences

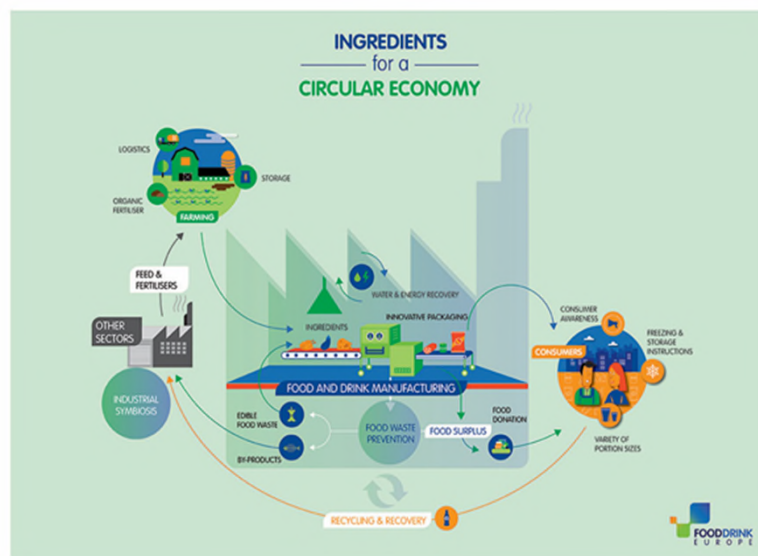
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Features of biological resources

The uniqueness of some remarkable features of biological resources makes them attractive for becoming the possible fundament of an economy:

- Their Renewability
- Their CO₂ -“ friendliness” or even sometimes carbon neutrality
- Their Re-use or multiuse , also in the format of cascades
- Their potentials for new, better functions in their products, like higher stability, longer life, stronger endurance, less or no toxicity, less water, more convenient haptic surfaces for users etc.

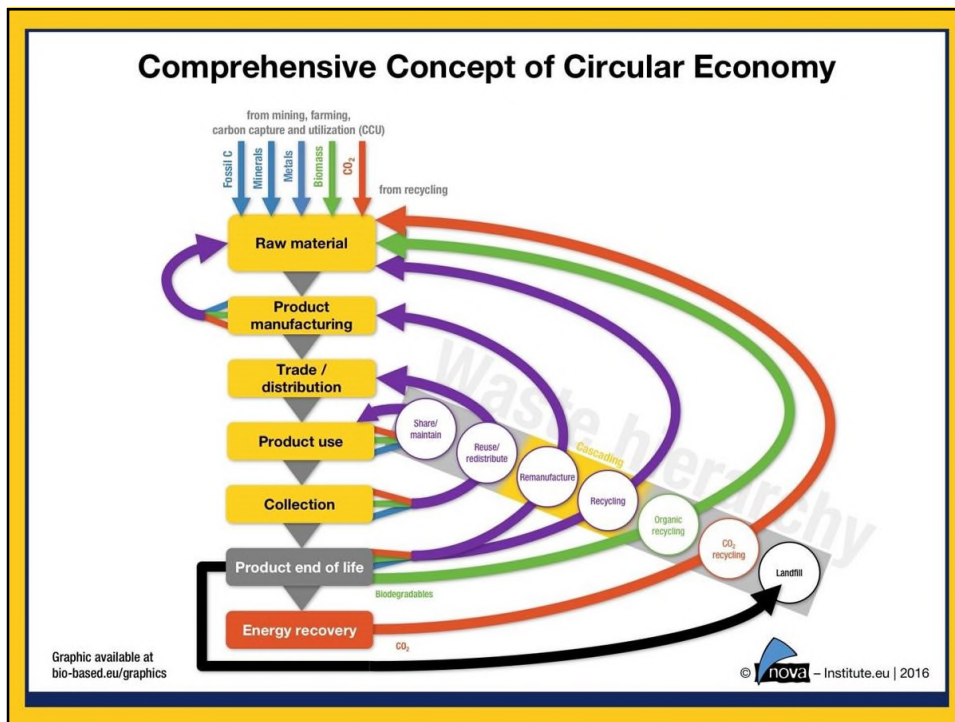
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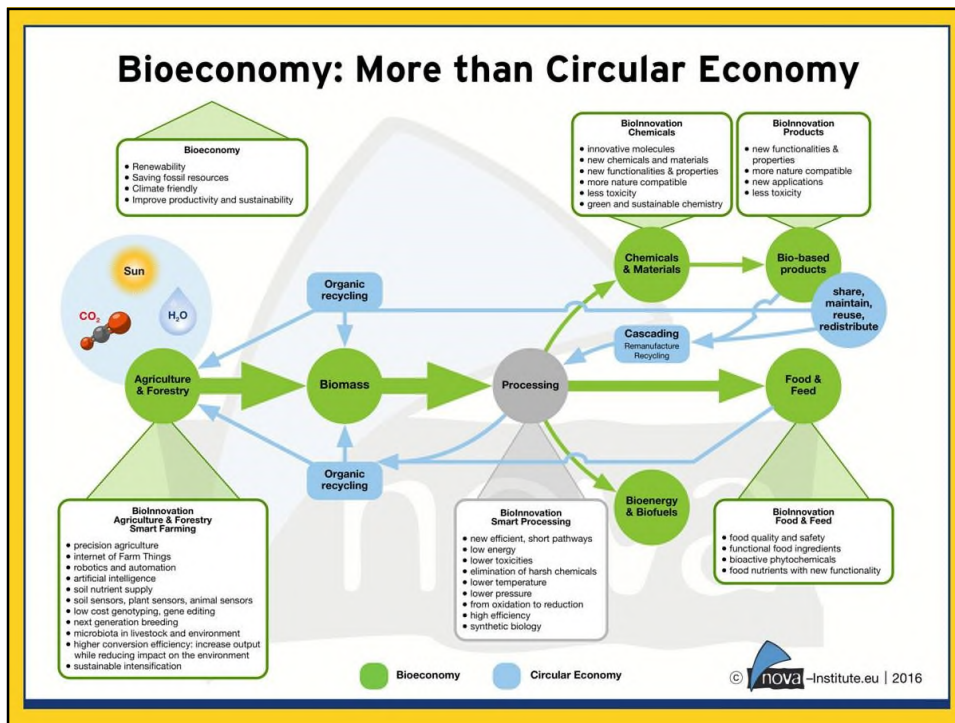
<https://circulareconomy.fooddrinkeurope.eu/library/>



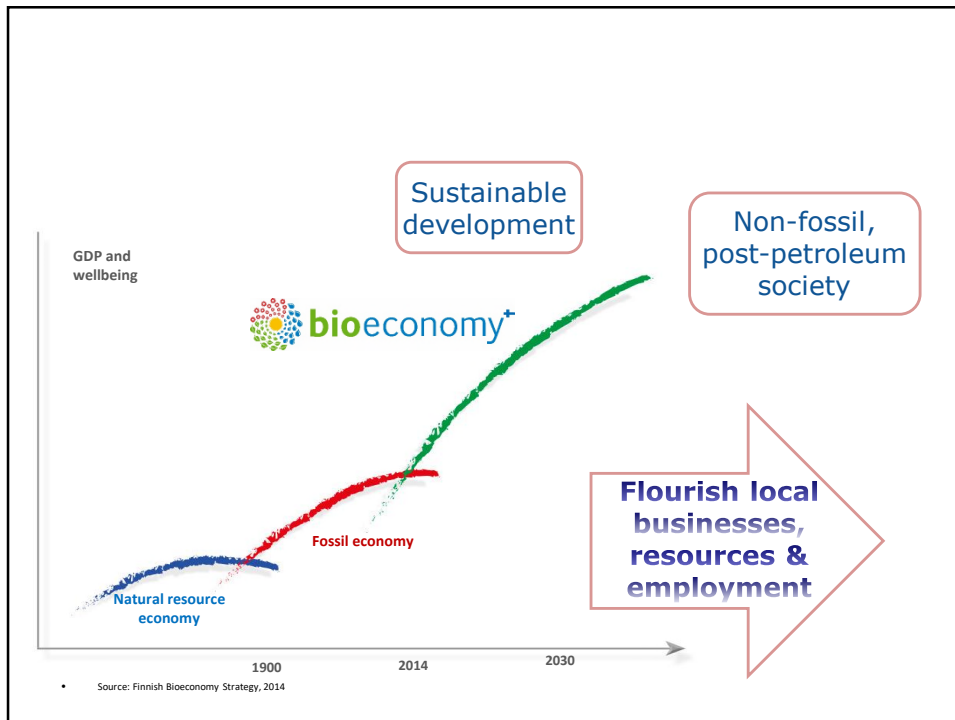
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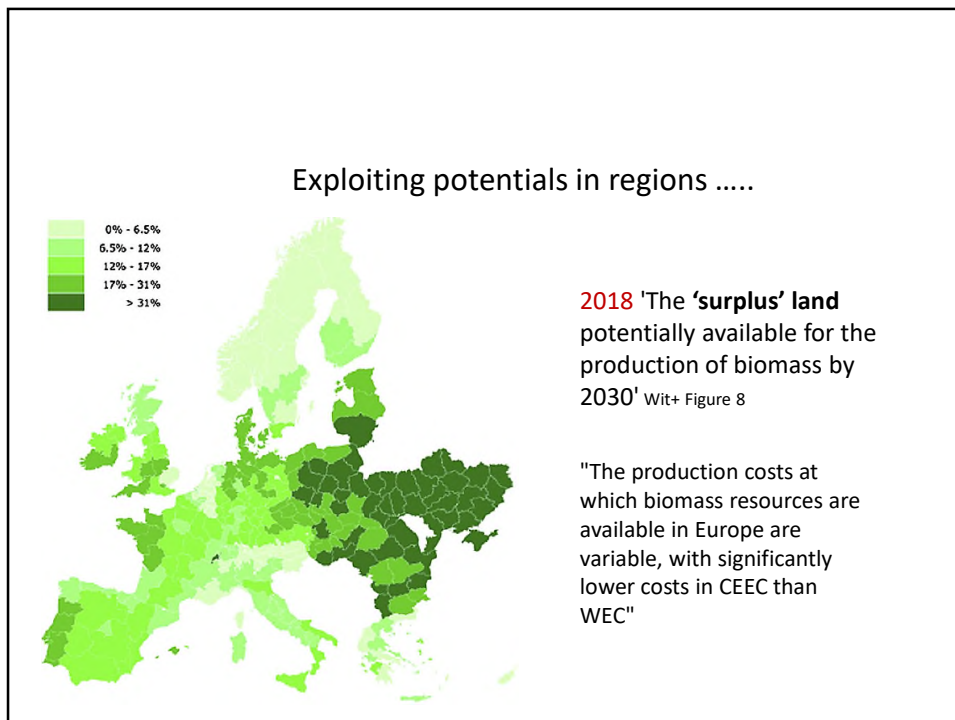
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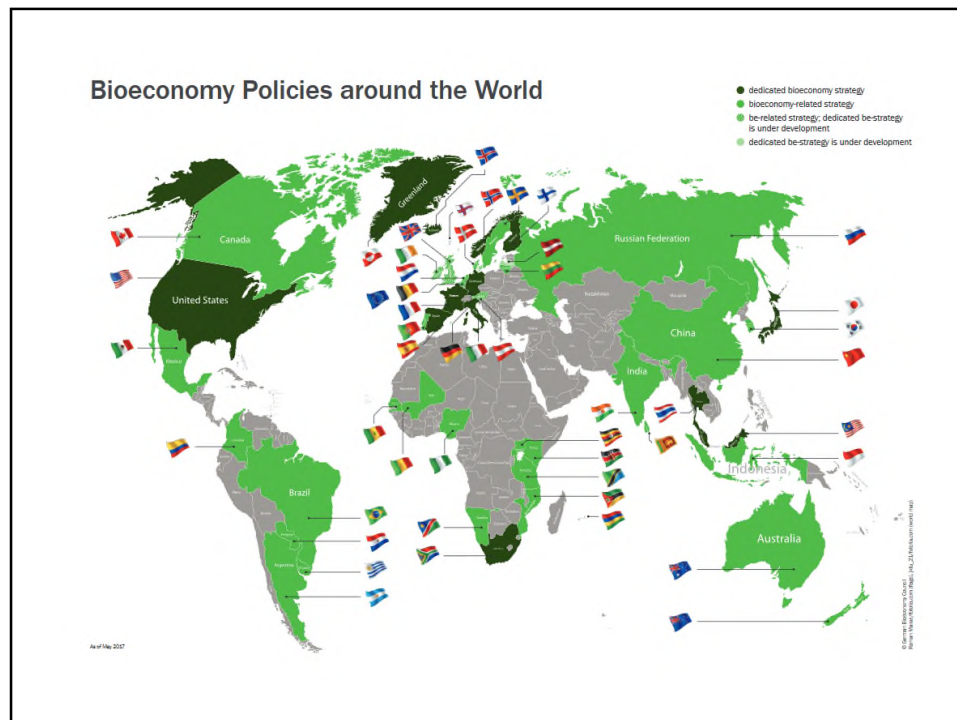


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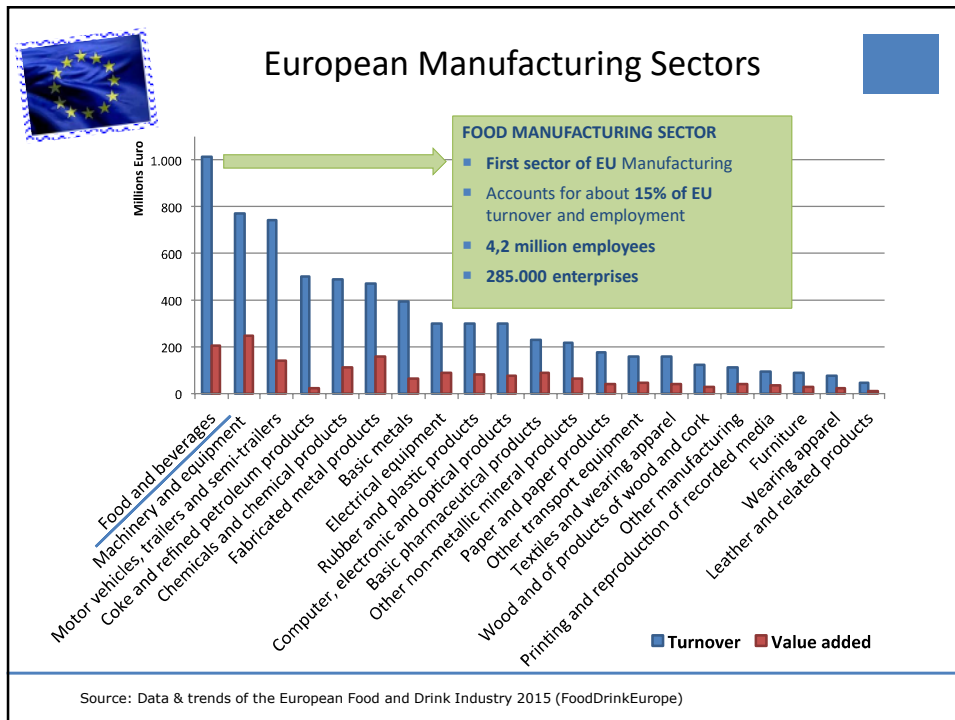
Present status of the bioeconomy

- About 50 states worldwide and half a dozen regions officially support the bioeconomy either via dedicated programmes, strategies, action plans, roadmaps etc. or via closely related political, programmatic and/ or strategic activities, the majority of them still in Europe.
- Many of these activities, however, are limited to biotechnology and/ or biofuels production and use.
- Today, almost 15 years after it's launch there is no more a single bioeconomy but there are many bioeconomies!
- This has an impact on the necessary frameworks, public funding, private investment and thematical content.

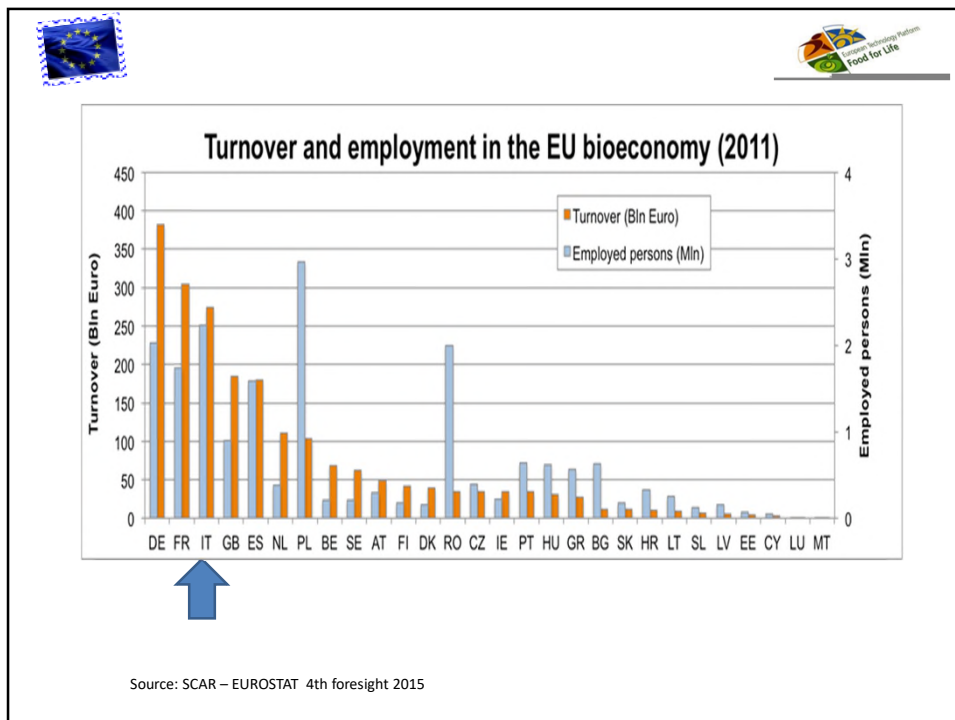
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2018 EU BIO-ECONOMY



EU bio-economy turnover of 2.980 billion € with 21 million employees.

Sector	Turnover (Billion €)	Employees (million)	Source
Food & Drink Industry	1.304	4.2	FoodDrinkEurope
Agriculture	473	11,0	COPA-COGECA
Fisheries	16	0.5	FAO
Paper, Leather etc.	470	1,9	CEPI
Forestry	371	2,0	CEI-BOIS
Others (build, textile, seeds, breeds.....)	250	1,2	CEFIC - CIVA
Bio-based materials	96	0,31	
<i>Chemistry</i>	80 (est)*	0,15 (est)*	USDA, Arthur D Little, Festel, McKinsey, CEFIC
<i>Enzymes</i>	6(est)*	0,005 (est)*	Amfep, Novozymes, Danisco/Genencor, DSM
<i>Biofuels</i>	10	0,15	EBB, eBio
Total	2.980	22	

Source: CE 2019

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FOOD SUPPLY CHAIN

Driving forces in the food supply chain: agriculture, the food and drink industry and retail

6%
Share of the food supply chain in EU gross value added

10%
Share of the food supply chain in EU employment

- In 2014, there were 24 million people employed in the food supply chain.
- The total turnover amounts to €3.9 trillion and the value added almost reaches €700 billion.
- Around 31 million professionals work in the extensive food supply chain across the EU, from agriculture and the input industry to food and drink services.

Structural overview of the food supply chain (2014)

	Agriculture	Food and drink industry	Wholesale of agricultural and food products	Food and drink retail ¹
Turnover (€ billion)	414	1,095	1,254	1,114
Value added (€ billion)	211	219	104	164
Number of employees (million)	11.2	4.2	1.9	6.3
Number of companies (1,000 units)	10,800	292	341	803

Employment in the extensive EU food supply chain (2014,%)



Turnover, value added, employees and companies in the food supply chain (2014,%)



- 1 Input industry
- 21 Food and drink retail
- 37 Agriculture
- 21 Food and drink services
- 6 Wholesale of agricultural and food products

Source: Eurostat (National Accounts, SRS, FSS, Economic Accounts for Agriculture)
¹ 2013 data except for the number of companies

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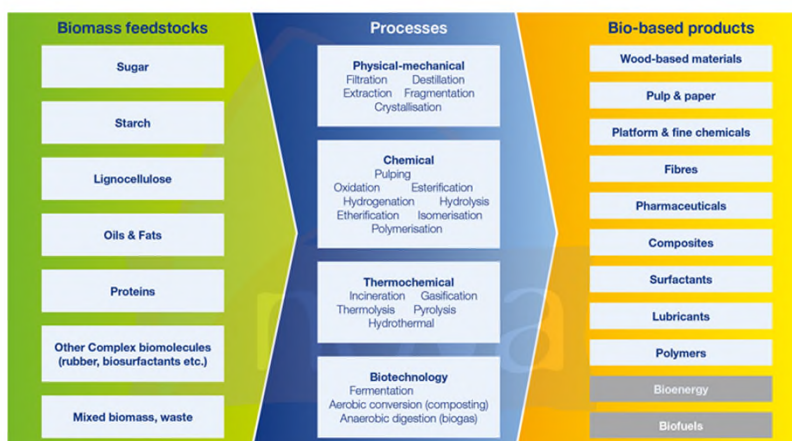
EU TOTAL FOOD CHAIN

Structural overview of the food chain, 2010



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Bio-based Economy: feedstocks, processes and products (without food & feed)



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New trends and business fields in Bioeconomy

- Industries broaden their portfolio of application more and more also to daily consumer goods, health care articles, cosmetics, cloths and garments. Examples go from biobased PET and PEF-bottles, shirts, eye-wear, shoeshine articles, rollers of longboards, hulls of ballpoints, toothbrushes, rubber tires and coatings for automotives and train coaches to biobased mortar and heat-damming , non flammable foams.
- Strong trend to interesting cross-border cooperation and industrial take-overs, where Japan, ROC and Canada get more and more active.

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What can be concluded from these recent industrial developments inside and outside Europe ?

- There is a growing number of biobased production lines for intermediates and platform molecules, all focused around the renewable “C” !
- There is a shift from science and research activities on the content of biological resources to more optimization of industrialized **processes** (hydrothermal, biological or combination of both).
- There is a shift from the cell factory to the real factory with the necessary growing attention on economics. This requires stronger attention also on elements of the back-end of value chains like norms, standards, marketing and consumer acceptance.

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What can be concluded from these recent industrial developments inside and outside Europe ? (cont.)

- In addition CO₂ turns out more and more to become a potential resource, as well as waste and proteins become important objects of the bioeconomy.
- The frontiers among chemical products, biofuels, proteins for food and other purposes as well as for the concrete attribution to diverse industrial application fields start to become „blurred“!
- This might reach a new dimension by a stronger use of big data in the future.

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What can be concluded from these recent industrial developments inside and outside Europe ? (cont.)

- There are strong private and sometimes private-public industrial investments in the U.S., in Canada (provinces of Alberta and Ontario, Australia with the provinces of Victoria and Queensland), China, but also in Europe (Bioproducts Mill by METSÄ Fibre in Änäkosti, Finland for 1,2 Mill. €).

An additional recent example: strong financial investments into production facilities for biobased PHA's (Polyhydroxialkanoate) to replace hydro-carbonbased Polymeres as base for Bioplastics between Italian and French companies, (Bio-on, CristalUnion, Novamont and Eridiana Sodana) as well as the recent cooperation between BASF and Avantium on biobased PEF bottles plus.

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Societal impacts

- Within societal strategic discussions on future and how to cope with global challenges, the bioeconomy only after 10 years has become a serious partner for dialogue with supporters of the **Global Sustainability Development** to achieve their goals and also with the followers of a circular economy.
- Growing awareness that achievement of **GSD** goals and also of implementation of the circular economy will only be possible by an increased use of biological resources. But how to do this scientifically based and evidenced?
- Bioeconomy is the biological power engine of the circular economy, not just an integral part of it! There is more and more talk about the sustainable circular Bioeconomy!
- And the EU Green Deal is coming!

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Changes and lessons learnt in the last 15 years with relevance to strategies and policies

- Biomass remains the primary natural resource of the bioeconomy, be it a carrier for energy or a modular part for chemicals, biochemicals, proteins or nutrients, etc..
- Recently, CO₂ is added to the portfolio of primary natural resources of the bioeconomy.
- Biorefineries will be the central production facilities of the bioeconomy. Their primary but not exhaustive feedstock will be biological waste resources and biomass: both of renewable nature.
- Carbonate processing facilities physically, hydrothermatically or biologically, like BIG-C (Germany, Belgium, Netherlands).

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Changes and lessons learnt (cont.)

- Recycability and/ or multiple reuse of biomass in diverse forms including cascades, will be a prime function along new value chains like „from fork to farm“ oder „farm to fork“, „gate to plate“ etc. . Recently, the potentials of resilience of biological resources are added to this discussion.
- Biotechnologies, in particular industrial biotechnology and focused new knowledge stemming from converted technologies, like nano-, info- or cognitive sciences will remain the technology drivers of this new form of economy.
- CRISPR Cas (genoma sequence) and NBTs will also play an important role in this context.

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Changes and lessons learnt (cont.)

- The joint potentials, but also joint interfaces and touching points among the digitalisation and the biologisation of our economy must be quickly further examined, made publicly aware to pressure groups and decision makers and , if possible, be translated into joined action plans and activities!
- This is not easy as digitalisation is more visible, less complex and less expensive than biologisation!
- There are other new trends emerging we must take into account:
 - potentials of resilience of biological resources,
 - aspects on health (“one health”) and
 - last but not least big data.

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BioEconomy : Cascade Principle The European AgriFood Matrix

	Food	By products	Micro-Macro Ingredients	Feed	BioMaterials Non Food	Compost Fertilizers	BioGas	BioFuels
Meat industry	X	X		X	-		X	
Feed industry		X		X	X	X	X	
Milk & dairy	X	X	X	X	X			
Vegetable processing	X	X	X	X		X	X	
Bread & bakery	X	X		X	X			X
Sweets & Candies	X		X				X	
Juices & concentrates	X	X	X	X			X	
Analcoholic beverage	X		X		X			
Alcoholic beverage	X	X	X	X	X			X

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The industry in a snapshot



Sources: Eurostat, IAH Research Centre, UN COMTRADE



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THE NATIONAL PICTURE

A key industry in the economies of the EU Member States

#1 employer

The food and drink industry is the biggest employer in manufacturing in half of the Member States

66%

Share of turnover of the EU's 5 largest food and drink producers

- The food and drink industry ranks among the top three manufacturing industries in terms of turnover and employment in most Member States.
- France, Germany, Italy, the UK and Spain are the largest EU food and drink producers by turnover.

Food and drink industry data as published by FoodDrinkEurope National Federations¹ (2015)

	Employment ranking in manufacturing	Turnover (€ billion)	Value added (€ billion)	Number of employees (1,000)	Number of companies
Austria	5	22.7	5.5	83.3	3,893
Belgium	1	48.6	8.1	88.5	4,452
Bulgaria	2	5.2	1.0	95.6	6,182
Croatia	1	5.3	1.2	61.0	2,256
Czech Republic	4	13.3	2.7	115.4	9,157
Denmark	2	25.4	4.5	61.6	1,607
Estonia	2	1.8	0.4	15.4	575
Finland	4	10.9	2.6	37.6	1,846
France	1	179.9	45.0	427.2	57,290
Germany ²	3	168.6	36.7	569.2	5,812
Greece ³	1	14.2	2.8	87.2	1,225
Hungary	1	11.5	2.0	106.6	6,812
Ireland	1	27.1	-	47.3	1,583
Italy	2	132.0	24.2	427.0	56,315
Latvia	1	1.7	0.4	23.7	1,120
Lithuania	1	4.0	0.8	44.1	1,609
Netherlands	1	70.0	11.3	128.6	6,065
Poland	1	55.6	9.9	417.5	14,534
Portugal	1	15.3	2.9	107.5	10,996
Romania	1	12.0	-	180.8	8,826
Slovakia ³	3	4.0	0.8	29.3	278
Slovenia	3	2.2	0.5	16.5	2,258
Spain	1	104.2	19.3	349.2	26,016
Sweden	4	18.1	4.5	50.5	4,240
United Kingdom	1	131.6	38.9	418.2	6,620

¹ Or by Eurostat (SIS)

² Companies with more than 20 employees

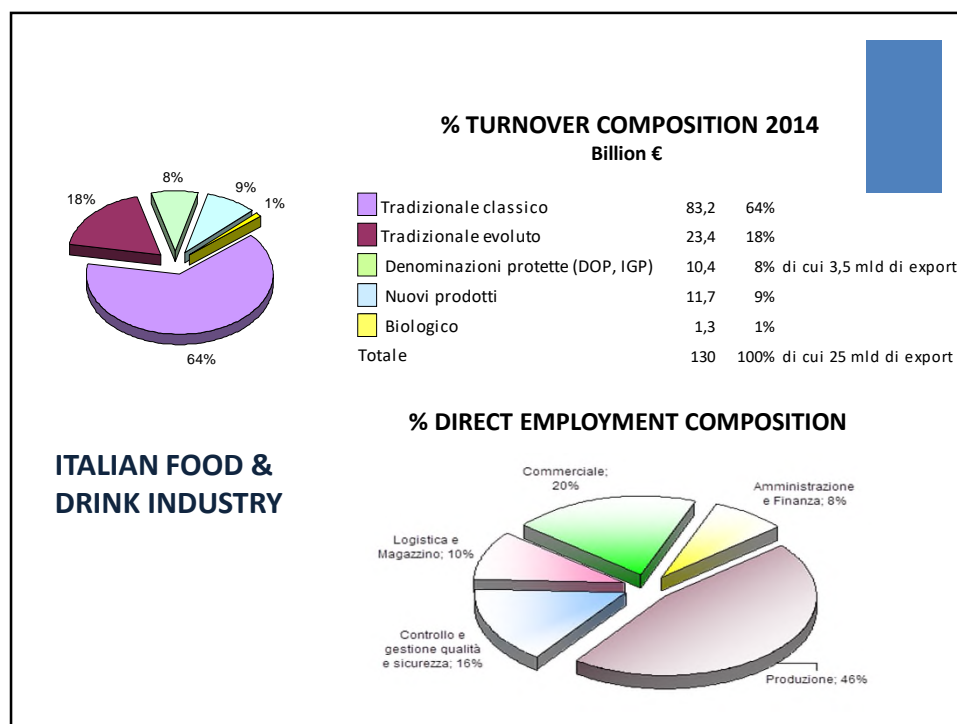
³ Small food and drink producers excluded

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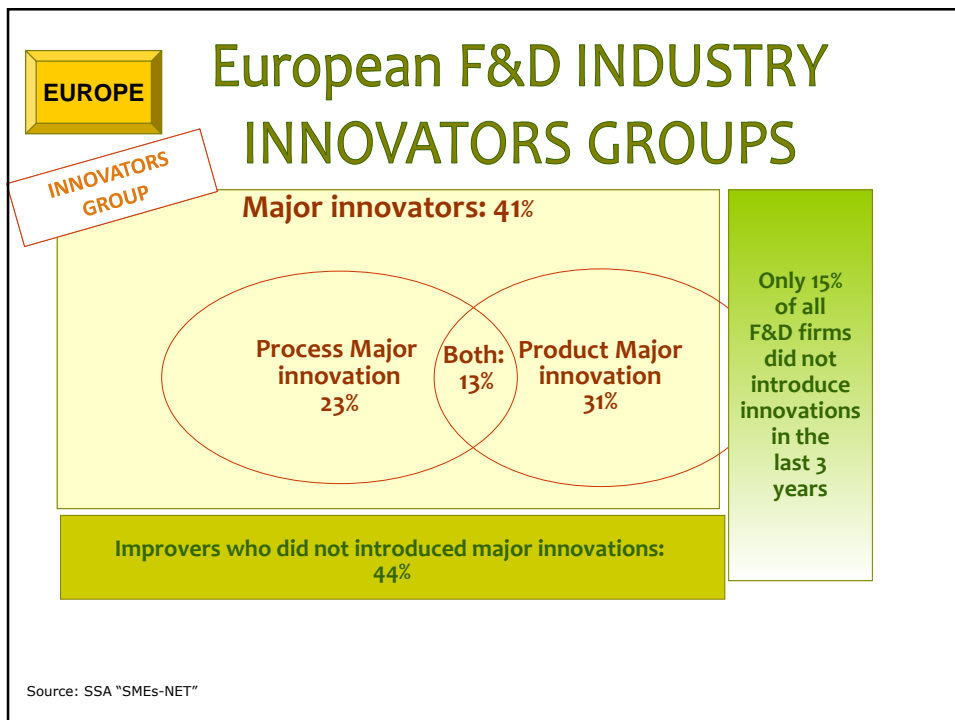
Italian Food Industry: 2011-2019 turnover

	2011 (Bil €)	2015 (Bil €)	2019 (Bil €)
FATTURATO (Valore)	124 (+2,3%)	133 (+2,4%)	144 (+2,5%)
PRODUZIONE (Quantità)	-0,3%	-0,9%	+0,5%
NUMERO IMPRESE INDUSTRIALI	6.957 (con oltre 9 addetti)	6.860 (con oltre 9 addetti)	6.810 (con oltre 9 addetti)
NUMERO ADDETTI	408.000	405.000	402.000
EXPORT	21,1 (+10,0%)	27,1 (+6,9%)	33,2 (+3,5%)
IMPORT	17,5 (+9,8%)	20,4 (+4,5%)	23,4 (+1,8%)
SALDO	4,6 (+7,0%)	6,7 (+19,7%)	9,8 (+26,2%)
TOTALE CONSUMI ALIMENTARI	206 (Variaz. Reale + 1,0%)	208 (Variaz. Reale -3%)	210 (Variaz. Reale + 0,3%)
POSIZIONE NELL'INDUSTRIA MANIFATTURIERA ITALIANA	2° posto (12%) dopo settore metalmeccanico	2° posto (14%) dopo settore metalmeccanico	2° posto (15%) dopo settore metalmeccanico

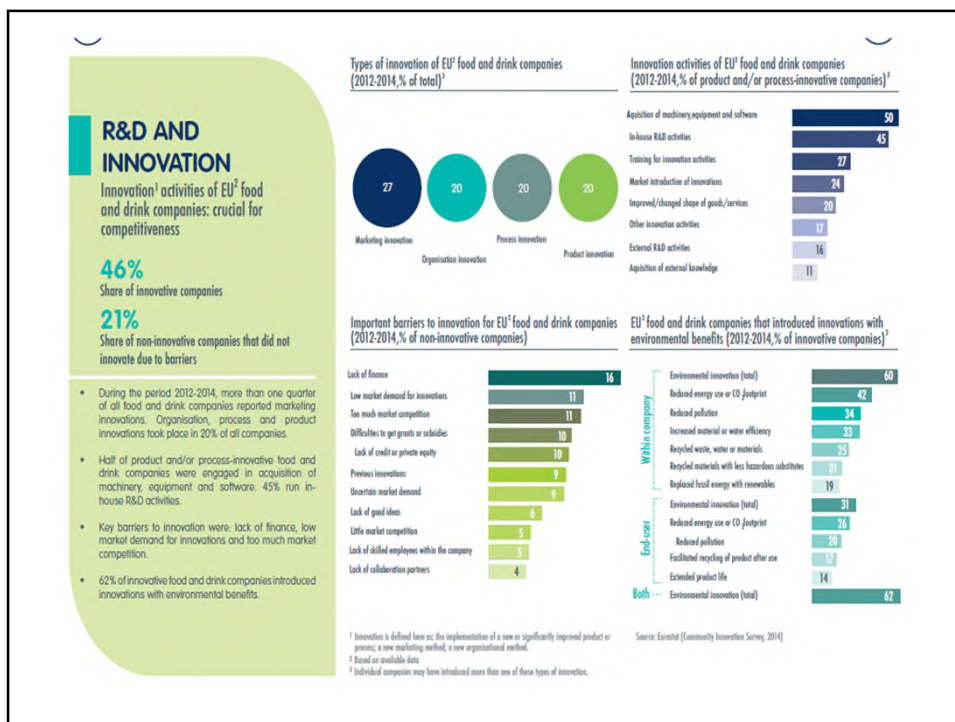
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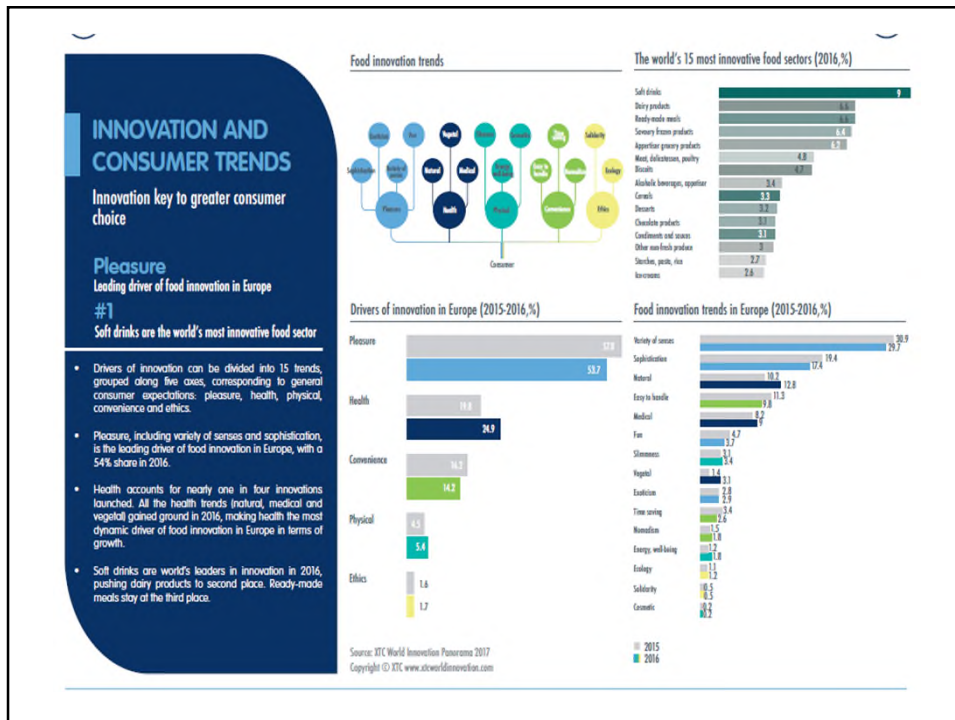
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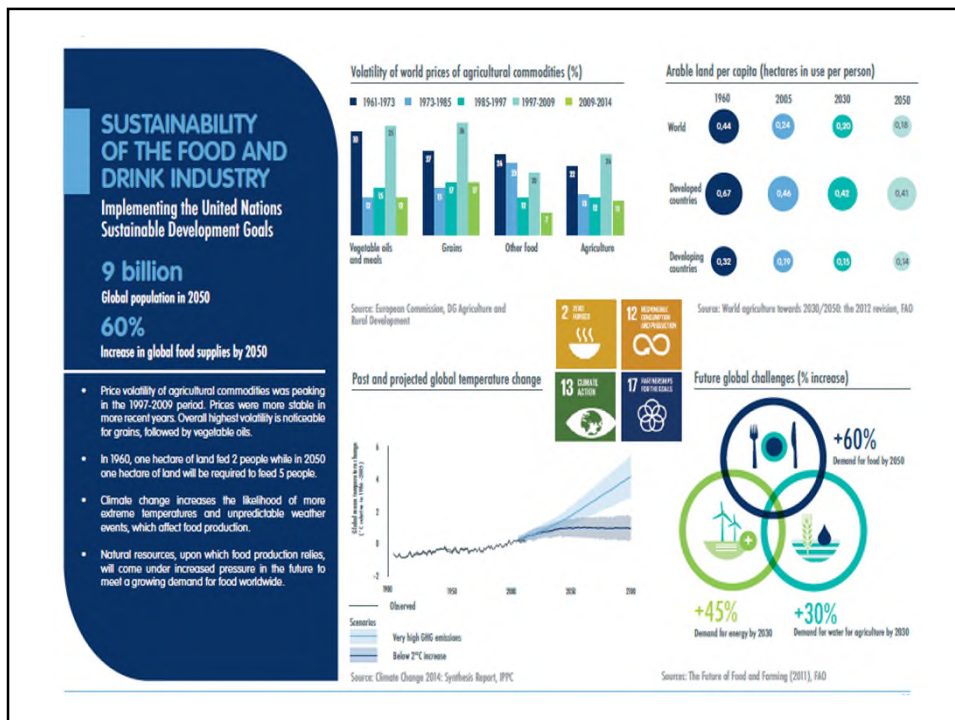
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European long-term priorities of The European Technology Platform Food for Life

- A more **competitive agri-food industry and chain** in Europe;
- **More innovation** in farming and food processing;
- **Farm for Tomorrow - Food Factory of the Future;**
- **Resource efficiency** in the Circular Bioeconomy
- **Improving added value of high quality foods**, traditional and PGI ;
- Dietary needs of the **elderly**, in **pregnancy**, in others target groups;
- Early **detection** of chemical and microbiological **hazards**;
- **Low cost and low scale processing**, **tech transfer** and networks for SMEs;
- Impact of food and drink **policies** in Europe (VAT, excise, access, comm.).



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36 Food for Life NTPs: think locally, act globally!



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F&D INDUSTRY FUTURE TRENDS 2030



- Wide variety of products, diversity.
- Convenience, ready to eat.
- Authenticity, Origin, Territory, Landscape, Narrative.
- Attention to specific nutritional needs.
- Tasty products, texture, density, colour, portion, pack.
- Products affordable in price/quality ratio, ingred. quality.
- Attention to specific needs: religious / ethnic / ethical .
- Attention to environment, sustainability, organic, no chem, naturalness, no waste , recovery, recycling.
- New occasions: brunches, aperos, happy hours, street food, catering, slow food, grazing, gastros.

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Challenges and responses for Food Manufacturers

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- | | | |
|--|--|---|
| <ul style="list-style-type: none"> ■ Scarcity in raw materials; ■ Globalization to manage; ■ Local food chains and markets enhanced; ■ Buyers and Retailers concentration; ■ New ways of consumption; ■ High stratification of consumption; ■ New glocal values: ethics, envi, ethnic, authentic, natural ...; ■ New nutritional and diet values; ■ New policies on food&drink: neo protect, neo prohibi, neo info; ■ New trade policies: Europe, Efta, Nafta, Asian, Ttip, Med, Mercosur. | | <ul style="list-style-type: none"> ■ Precision farming and sustainability; ■ Raw materials diversity; nutritional values ■ Low cost technologies and downscaling ■ Resource and manufacturing efficiency to improve; ■ Horizontal Innovation to be incorporated: new mats., ICT, process, pack, low scale technologies ■ From old to young generation of entrepreneurs; ■ Food Supply Chain and Collaborative Networks; ■ New distribution systems and business models; ■ Flexibility and differentiation to face new ways of consumption; |
|--|--|---|

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RANKING OF FIRST SIX COMPETENCES REQUIRED FROM THE ITALIAN AGRIFOOD SMEs TO TAKE GRADUATES

MULTIDISCIPLINAR TECHNICAL SKILLS	1°
MANAGERIAL & BUSINESS SKILLS	2°
MARKETING & COMMERCIAL SKILLS	3°
ICT SKILLS, OFFICE MANAGEMENT	4°
LEGAL AFFAIRS	5°
FLUENT KNOWLEDGE OF LANGUAGES	6°

Fonte: Elaboration and forecast Federalimentare on "Italian Food for Life" NTP data

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Milestones so far



FOOD 2030: Research & Innovation for Tomorrow's Nutrition & Food Systems
High-Level Event, 12-13 October 2016, Brussels



Harnessing Research and Innovation for FOOD 2030
Science Policy Dialogue, 16 October 2017, Brussels



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**Circular Economy
FOOD 2030 (16/10/ 2017)**

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- **Implementing a Food System Approach**
- **Strengthening R & I Policy Coherence and Coordination**
- **Reinforcing R & I Member States Policy Alignment**
- **Boosting R & I Investment and Market Uptake**
- **Improving R & I Take Up of Emerging Technologies and new Ways of doing Science**
- **Improving Data Gathering and Monitoring in Member States**
- **Measuring Food and Nutrition Security R & I Output and Impact**





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FOOD 2030
Research & Innovation
for tomorrow's
nutrition and food systems

Future-Proofing
our Food systems
through **research**
and **innovation**

#FOOD2030EU

Ecomondo, Rimini, 9 novembre 2017

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Political Opportunity

Juncker Priorities & Modern CAP

10 priorities

01	Strong basis for jobs, growth and innovation	06	A responsible and balanced Free trade Agreement with the United States
02	A connected digital single market	07	A Europe of justice and fundamental rights for all
03	A resilient Energy Union with a forward-looking climate change policy	08	Health & a new policy on migration
04	A digital and faster external market with a strengthened industrial base	09	Europe as a stronger global actor
05	A stronger and fairer Economic and Monetary Union (EMU)	10	A Union of Democratic Change

Sustainable Development Goals





COP21+



World Food Day 2017
**Climate is changing.
Food and agriculture are too.**



IPCC



The IPCC's priorities for the next six years: 1.5C, oceans, cities and food security

Research and Innovation

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FOOD 2030

EU R&I Policy Framework to future-proof our nutrition & food systems

R&I for future-proofing food systems



Future-proofing

By 2030

- Sustainable
- Resilient
- Responsible
- Diverse
- Competitive
- Inclusive

Priorities

- NUTRITION** for sustainable and healthy diets
- CLIMATE** smart and environmentally sustainable food systems
- CIRCULARITY** and resource efficiency of food systems
- INNOVATION** and empowerment of communities

Drivers

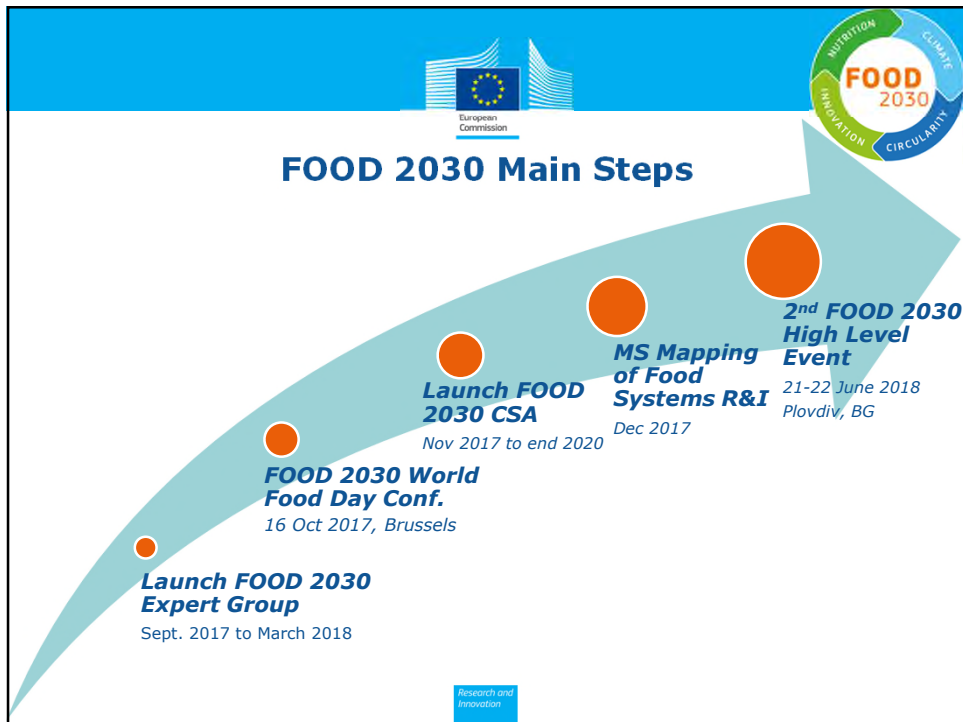
- Research breakthroughs**
- Innovation and Investment**
- Open Science**
- International collaboration**

#FOOD2030EU

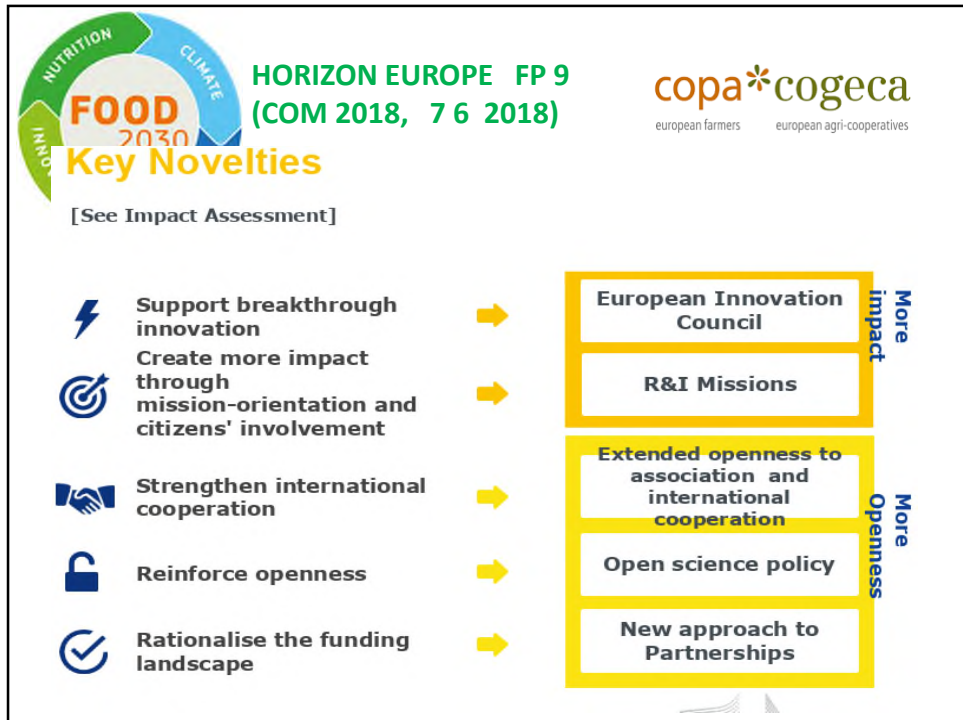
- Need for a systemic approach to future-proofing food systems by structuring, connecting and scaling-up R&I
- To provide evidence for policies and solutions (knowledge, methods, technologies, services, business models, etc.) addressing 4 priorities.

Research and Innovation


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HORIZON EUROPE FP 9
(COM 2018, 7 6 2018)



european farmers european agri-cooperatives


Budget



- **Open Science:**
- ERC 16,6 b;
- MSCA 6,8 b;
- research infrastructure 2,4 b.

- **Global Challenges and Industrial Competitiveness:**
- Health 7,7 b;
- Inclusive and Secure Society 2,8 b;
- Digital and Industry 15 b;
- Climate, Energy and Mobility 15 b;
- Food and Natural Resources 10 b;
- JRC 2,2 b;
- Missions (Artt. 7, 26) (10%).

- **Open Innovation:**
- EIC 10,5 b;
- European innovation ecos. 0,5 b;
- EIT 3 b.

- **Strengthening the European Research Area:**
- sharing excellence 1,7 b;
- reforming and enhancing the European R&I System 0,4 b.



ITALLIA MILANO 2015

all are in Bologna 2015

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European Innovation Partnership
'Agricultural Productivity and Sustainability'

funded by 

SHARING KNOWLEDGE • CONNECTING PEOPLE • TACKLING CHALLENGES

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INNOVATIVE FARMERS & AGRO-COOPERATIVES

- **Enhanced Knowledge Exchange**
 - - Farmers learning from farmers
 - - Farmers leading Innovation
 - - Links between conventional and organic systems
- **Green Growth;**
 - - Efficient use of resources
 - - Active management of natural resources
 - - Climate change mitigation and adaptation
 - - Closing the yield gap
 - - Improved agrifood system productivity
- **Fair and Competitive Value Chains**
 - - Collaboration across all sectors in the chain
 - - New strategy for value chains and new business models
- **Healthy Farming;**
 - - Integrated pest management
 - - dealing with emerging pests and diseases
 - - Enhancing biosecurity in housed livestock
 - - Plant and animal breeding for resilience and robustness



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Circ. economy:the European Way -Industry Hot Topics

- The food human axis: effect of ingredients, processing and way of consumption on human wellbeing;
- Low Scale Low Cost new technologies (ict, pilots, niches, efficiency ...)
- High quality stable and fresh food ready to eat with packaging extended shelf life;
- Consumer response to food price instability: from raw materials to retailers supplier;
- Valorization of genetic resources and technological improvements to increase the nutra-functional values of raw mat. and processed foods;
- New track systems and sustainable transportation and logistics, losses and waste reduction;
- Markers identification , integrity of varieties used in the production of traditional materials and food and DOP/IGP
- Sustainable production and new business models and value chains strategies
- Big data and digitization management



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THE ITALIAN STRATEGY: ROADMAP FOR INNOVATION AND RESEARCH

- **CL.A.N. has developed a Roadmap for Innovation and Research:** this task involved universities, public and private research bodies, food companies, district representatives, industry associations and training organisations, to prepare a shared strategic vision of prospective technology scenarios in the Food Industry.
- The document is structured around **six Technology Pillars** which are true strategic development axes of the agrifood industry:
 1. **Health and well-being throughout the entire lifecycle**
 2. **Food safety**
 3. **Production processes for improved food quality**
 4. **Sustainable and competitive food production**
 5. **Machinery for the food industry**
 6. **ICT in the agrifood industry and technology transfer tools**



Source: CLAN

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THANK YOU FOR YOUR ATTENTION !!!

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