

Chemistry for Bioeconomy and Circular economy



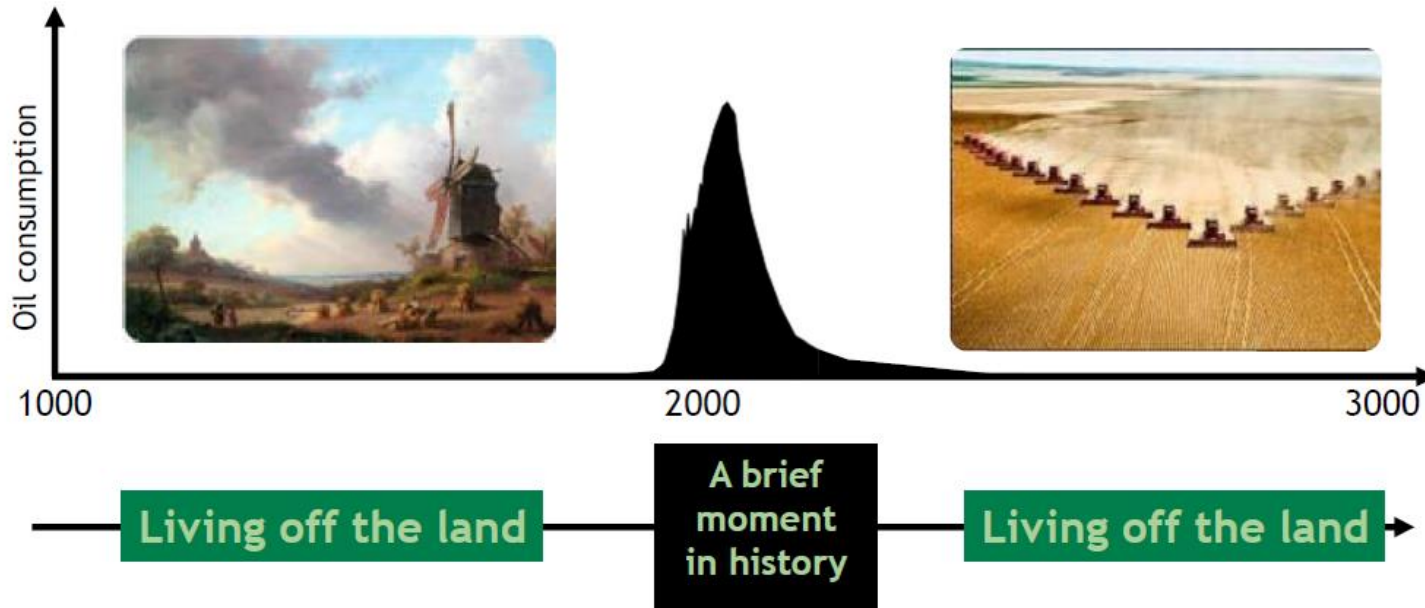


What is the bioeconomy?

An economy using biological resources from the land and sea, as well as waste, as inputs to food and feed, industrial and energy production.



The end of an era



The Oil age will end long before we run out of oil
And while running out, it will become much more expensive

“The Stone Age didn't end because we ran out of stones”, Yamani, 1973



Bio-based vs Oil-based

In times of historically low oil and coal prices a bioeconomy will only gradually emerge. In light of the COP 21 targets on GHG reduction, transition is a major urgency.

The IMF estimated the global subsidies on fossil fuels in 2015 at 5.3 trillion USD.



Towards the bioeconomy

"Europe needs to make the transition to a post-petroleum economy. Greater use of renewable resources is no longer just an option, it is a necessity. We must drive the transition from a fossil-based to a bio-based society with research and innovation as the motor. This is good for our environment, our food and energy security, and for Europe's competitiveness for the future."



Máire Geoghegan-Quinn

Past Commissioner for Research and Innovation



The European Strategy



The European Commission has adopted a strategy to shift the European economy towards greater and more sustainable use of renewable resources. The Commission's strategy and action plan,

"Innovating for Sustainable Growth: a Bioeconomy for Europe",

outlines a coherent, **cross-sectoral and interdisciplinary** approach to the issue. The goal is a more innovative and low-emissions economy, reconciling market demands while ensuring biodiversity and environmental protection..

EU objectives for 2020: inclusive, smart sustainable growth

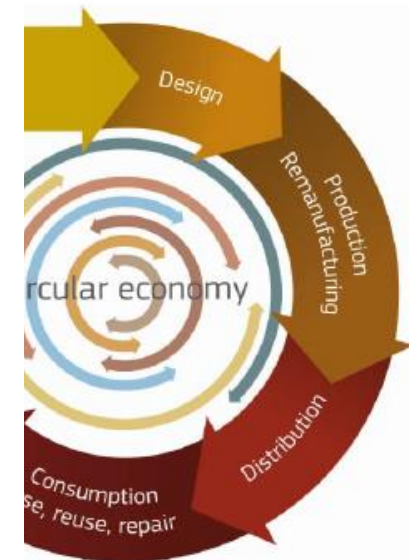


Brussels, 2.7.2014
COM(2014) 398 final

2014

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Towards a circular economy:
A zero waste programme for Europe



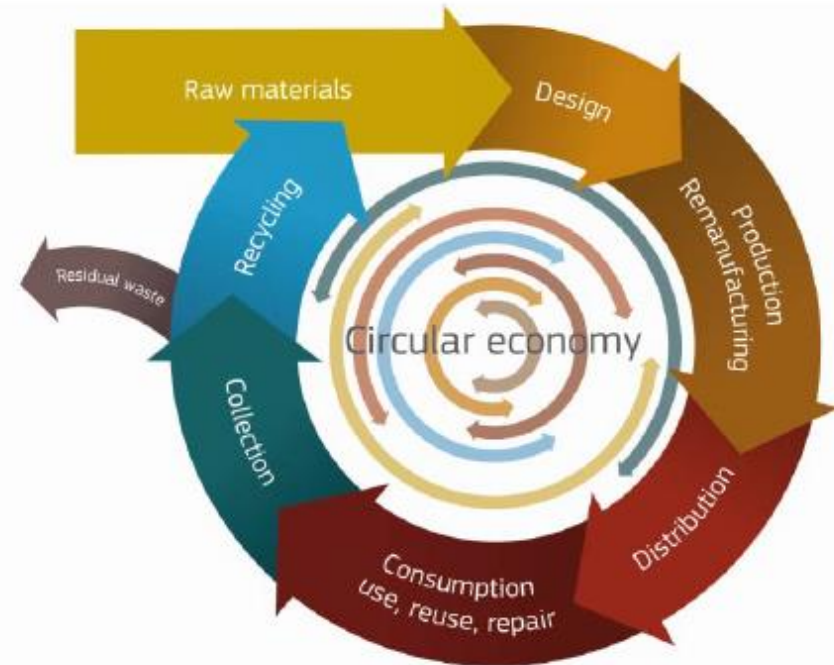


The BioCircular Economy

Bioeconomy is an integrated part of sustainable circular economy.

The European Circular Economy Package offers great opportunities to reuse the vast majority of all bio waste and (unexploited) biomass stocks by 2030.

This involves systemic and efficient approaches across sectors, particularly innovation policy measures that aim to optimise bio-economy value networks and minimise waste and loss.



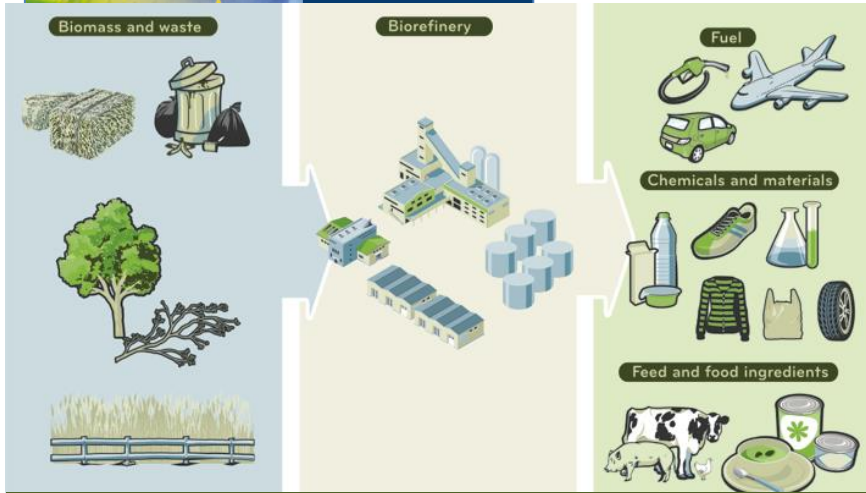


The bioeconomy: Manifesto of Utrecht

**4th EU Bioeconomy Stakeholders'
Conference, Utrecht (NL) 12-13 April 2016**
www.bioeconomyutrecht2016.eu

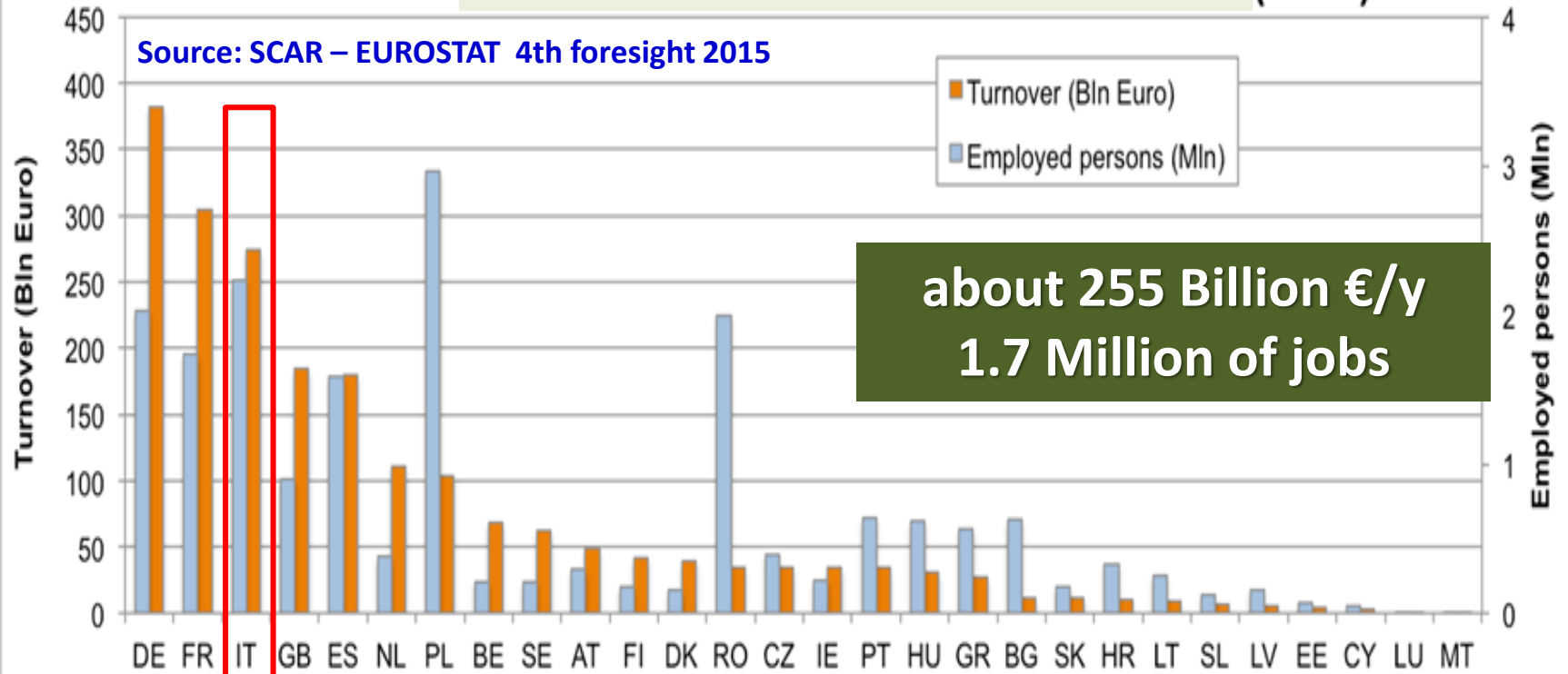
A European bioeconomy should contribute significantly to the goals formulated at COP 21 on greenhouse gas emission reductions, holding the global temperature rise below 2°C, using sustainable biomass in the most effective and efficient ways to produce food, materials, chemicals and energy.

Bioeconomy in Europe



In Europe: about 2.000 Bil €/y and 20.0 Mil of jobs

Bioeconomy in Italy: some figures

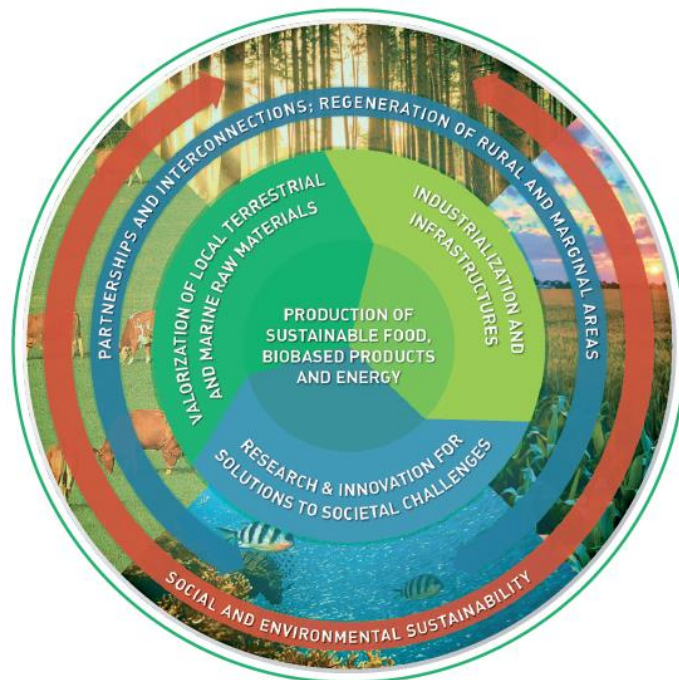


R&D:

- High participation in H2020 programs dealing with Bioeconomy
- Qualified R&I public/private actors
- Sometimes fragmented, limited infrastructures, few national funds

BIT

Bioeconomy in Italy



A unique opportunity to reconnect
ECONOMY, SOCIETY
and the **ENVIRONMENT**

*Promoted by:
Italian Presidency of
Council of Ministers*



Fabio Fava

*Italian Representative
for Horizon2020 SC2
and for the Joint
Technology Initiative
"Biobased Industry".*



Involved:

- Committee Productive Activities
- Regions Conference
- Agency for Territorial Cohesion



**CLUSTER
NAZIONALE BLUE
GROWTH**

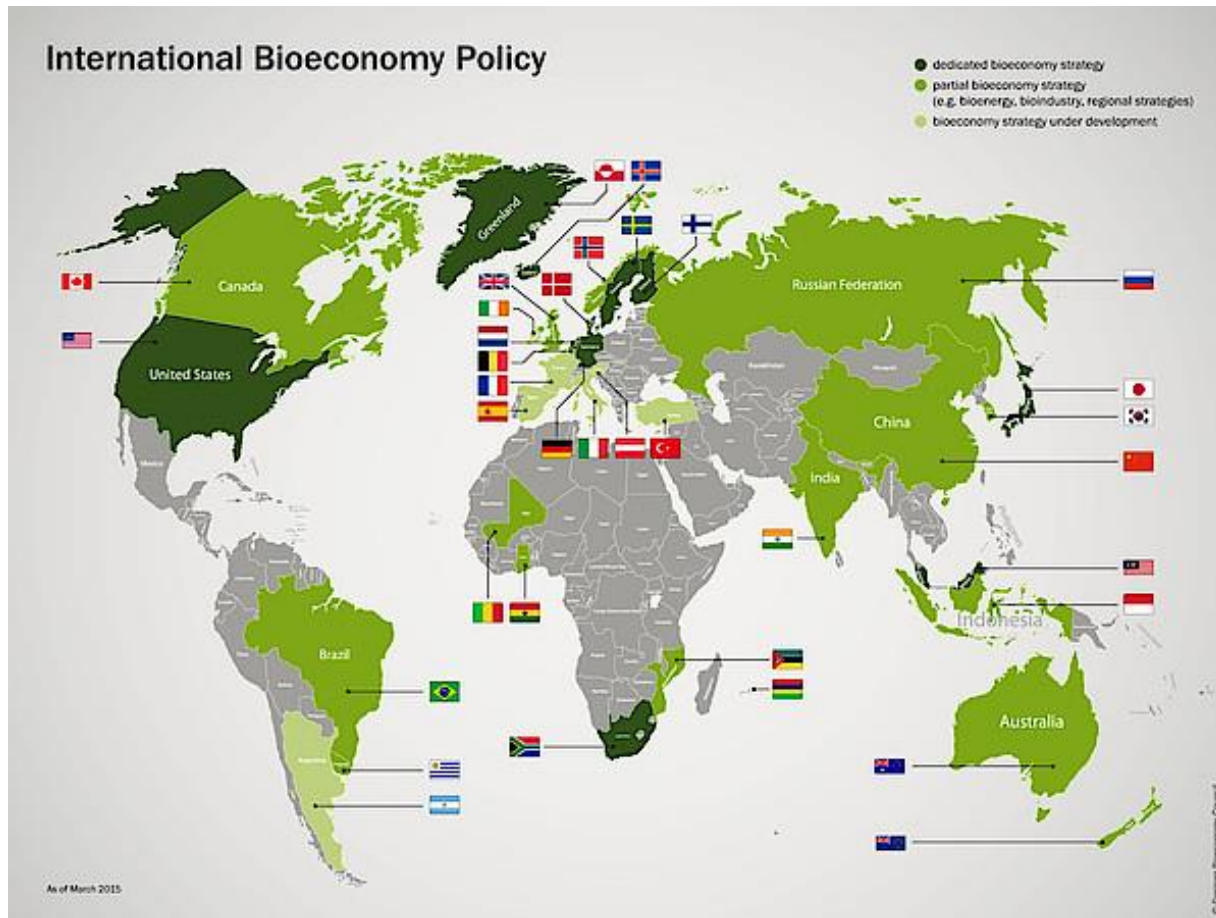


DRAFT AVAILABLE AT :

www.agenziacoesione.gov.it/it/Notizie_e_documenti/news/2016/novembre/Documento_0014

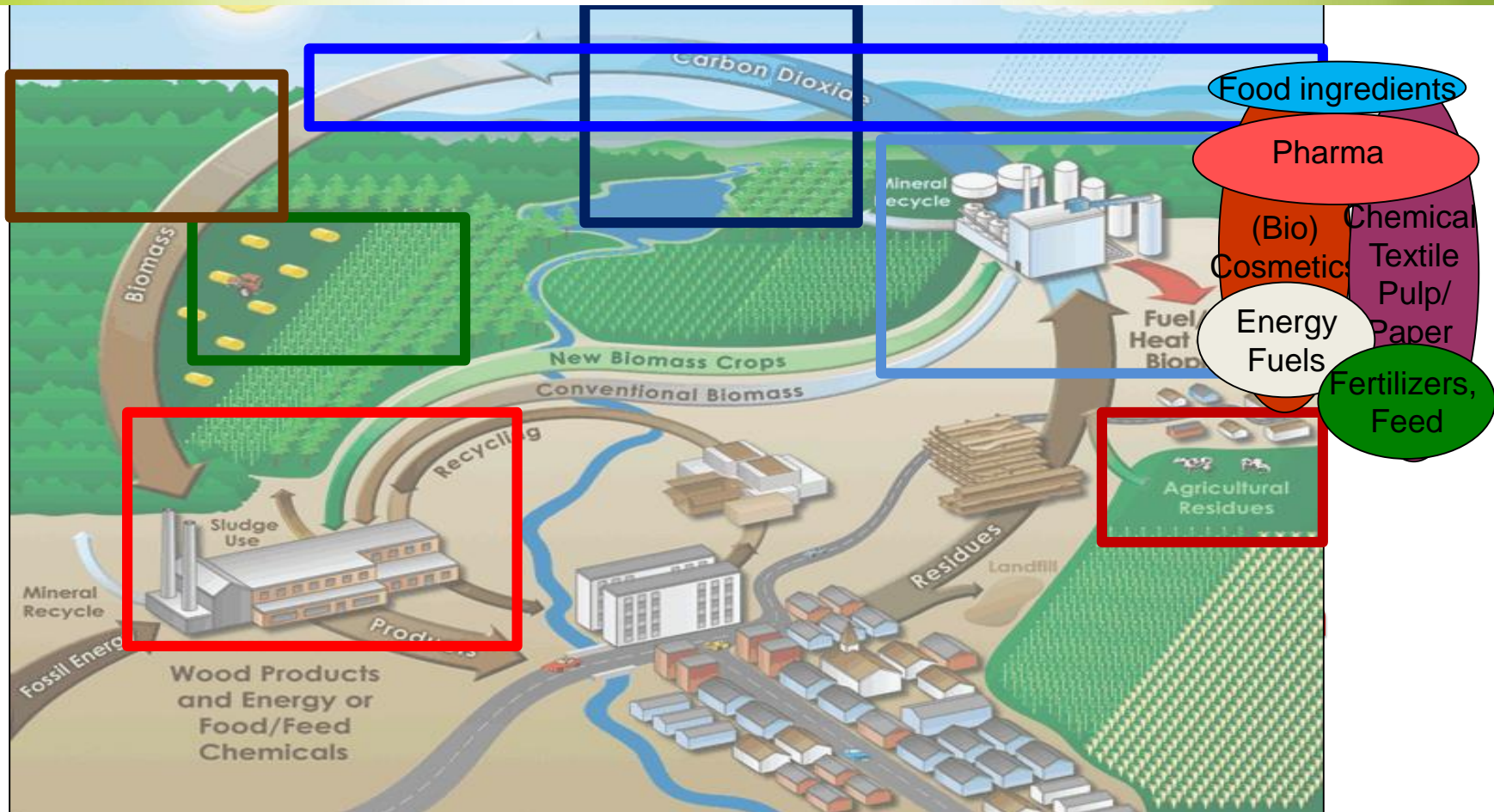


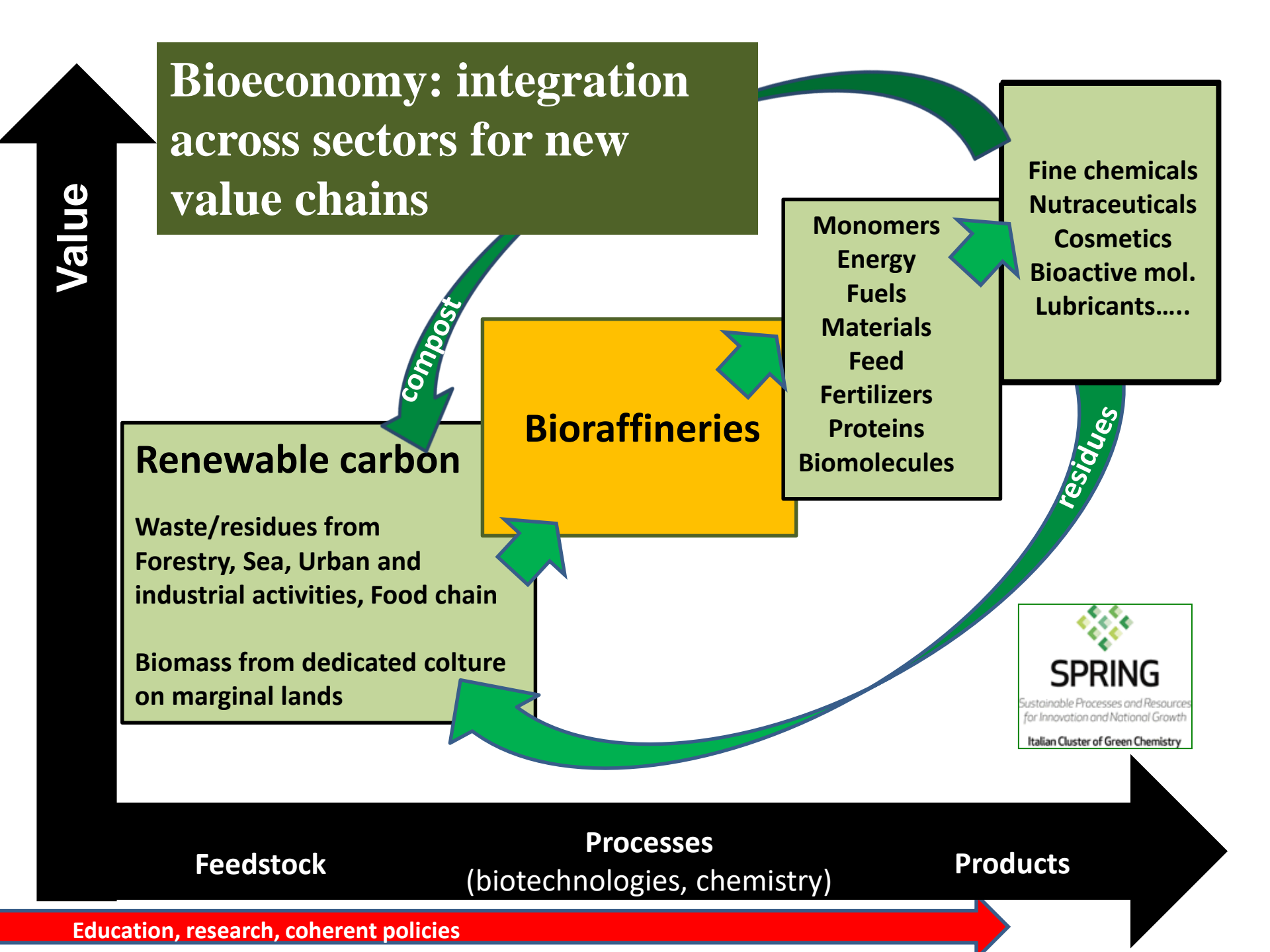
Bioeconomy policies in the world



https://www.youtube.com/watch?v=7O7pqs_NaEI

Territories and communities at the core of Integrated Biorefineries





La sfida che ci sta di fronte, quella per far ripartire l'economia, è una **rivoluzione industriale** che **rovescia il rapporto con il territorio**. Per oltre due secoli abbiamo assistito a una corsa a impianti sempre più grandi, con l'ambiente ridotto al ruolo di miniera e di discarica, con un inquinamento crescente, con una **contrapposizione sempre più evidente tra lavoro e salute**.

Catia Bastioli



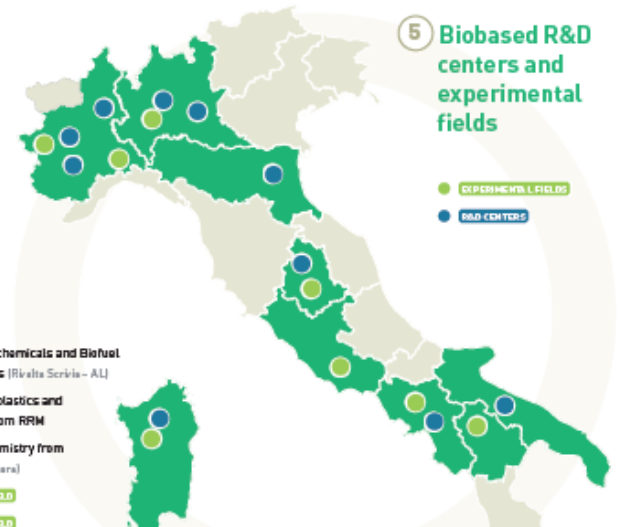
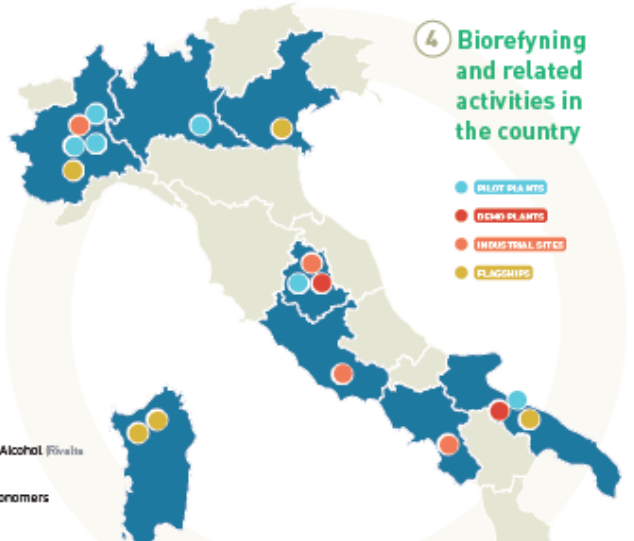
Non si può più progettare lo sviluppo a tavolino, con formule anonime da replicare, con poche varianti, in tutto il pianeta.

Utilizzare i materiali prodotti come soluzioni per risolvere problemi, fornire servizi, **aumentare la qualità della vita**, assicurando un vantaggio per tutti e una capacità competitiva per la **collettività**, che si riconosce nel progetto e si impegna per il suo successo.

Amministratore delegato di Novamont, presidente di Terna, presidente del Kyoto Club, presidente del Cluster Tecnologico Nazionale SPRING.

Italian Biorefineries

R&I Activities



Piemonte
PILOT PLANT Fatty Alcohol (Rivolta Scrivia - AL)
PILOT PLANT Biomonomers (Novara)
INDUSTRIAL PLANT Lignocellulosic Bioethanol (Crescentino - VC)
FLAGSHIP Succinic Acid (Cannara Spinozza - AL)

Lombardia
PILOT PLANT for Biobutadiene (Mantova)

Veneto
FLAGSHIP 14 BDO (Adria - RO)

Umbria
PILOT PLANT and **INDUSTRIAL PLANT** Oleaginous crops Biolubricants from (Terni)

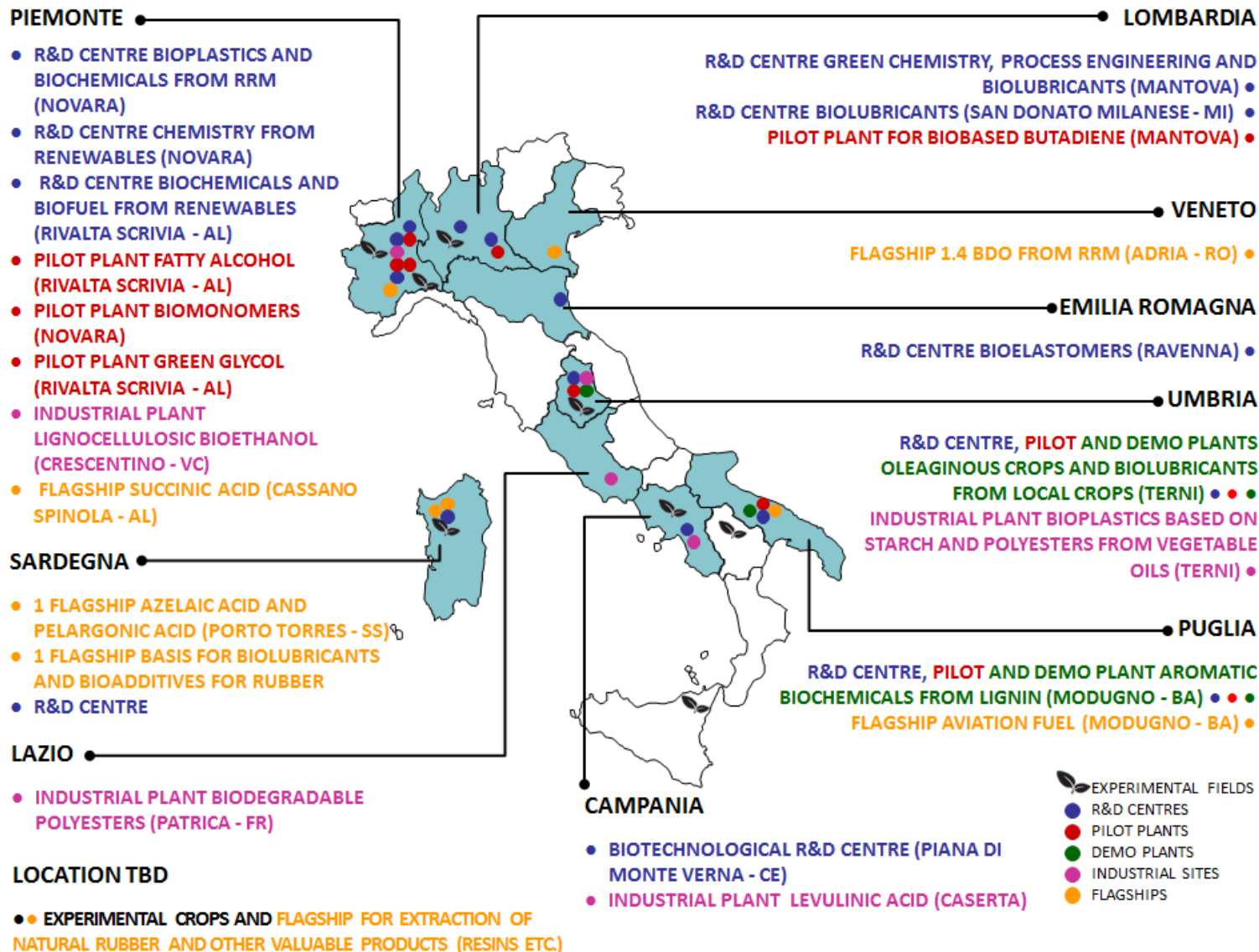
INDUSTRIAL PLANT based on Starch and from vegetable oils (Terni)

FLAGSHIP Aviation Fuel (Terni)

Piemonte
R&D CENTER Biochemicals and Biofuel from renewables (Rivolta Scrivia - AL)
R&D CENTER Bioplastics and Biochemicals from RAM
R&D CENTER Chemistry from renewables (Novara)
EXPERIMENTAL FIELD
EXPERIMENTAL FIELD

<h2>Employment</h2> <p>~ 105.000</p> <p>(Biopharma, biotextile, leather, bioenergy, biofuels, Biobased-chemicals and materials)</p>	<h2>Annual Turnover</h2> <p>~ € 27 Billion</p> <p>(Biopharma, biotextile, leather, bioenergy, biofuels, Biobased chemicals and materials)</p>
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After: Eurostat data and Banca Intesa





FEDERCHIMICA

ASSOBIOTEC

Italian Association for the Development of Biotechnology

Italian Bioeconomy





Porto Torres: From a traditional petrochemical site to an innovative biorefinery



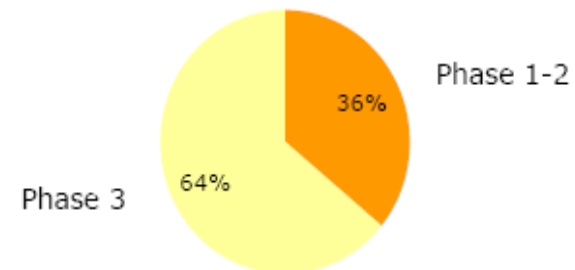
Porto Torres site reconversion project



- ❑ 7 plants in 3 phases
- ❑ 350,000 tons bio-based products (monomers, bio-plastics, bio-lubricants, oils for rubber industry, additives)
- ❑ New R&S centre
- ❑ More than 300 jobs

Investments

Overall JV investments: €500m
Equity capex >€100m





GF Biochemicals

FIRST COMPANY TO PRODUCE LEVULINIC ACID DIRECTLY FROM BIOMASS AT COMMERCIAL SCALE

Basics:

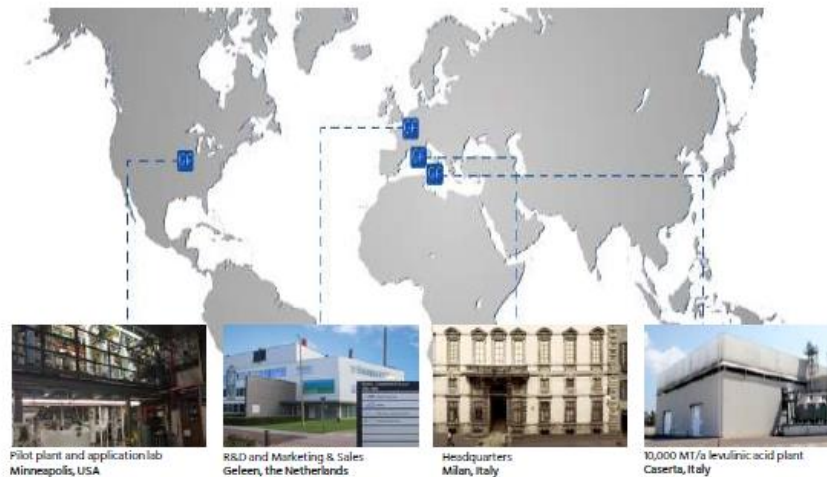
- > Proprietary technology portfolio
- > Production assets - Start-up phase
- > Experienced R&D, Engineering & Commercial team
- > Pilot plant and application laboratories

- > Established : 2008
- > Employees : 50

Our Mission:

Bringing levulinic acid to the market by technology innovation

Our locations:



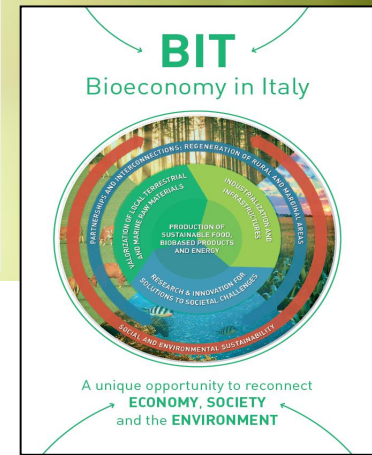


The Italian Bioeconomy seen from abroad

Italy plays an important role in the European bioeconomy. The whole agro-food value chain in Italy is worth €152 billion each year, employs more than 1.2 million workers and generates 10% of the national GDP, thus representing one of the largest European agro-food value chains. Furthermore, considering that the bioeconomy is not only about the agro-food value chain, the Italian industry is also at the forefront of both the research and the production of new bio-based products, such as bioplastics and second generation biofuels. The Italian government is aware of the benefits of a coordinated bioeconomy strategy and expressed interest in possibly hosting the annual Bioeconomy Stakeholders Conference in Italy in 2014.

Italian Bioeconomy Strategy: main priorities

- **Improve sustainability, productivity and quality of products**
- **More efficiently interconnections**
- **Creating locally rooted value chains**
- **Public and private stakeholders engagement**
- **Valorization of terrestrial/marine biodiversity,**
- **Ecosystem services within a circularity approach**
- **Regenerate marginal lands and dismissed industrial sites**
- **Growth of Bioeconomy in the Mediterranean area**
- **Wider social cohesion and political stability in the area**
- **Wider and more coherent political commitment**
- **Increase investments in R&I, SMEs, education, training, communication**
- **Coordination between regional, national and EU policies**
- **Better engagement of a public dialogue while boosting market development**

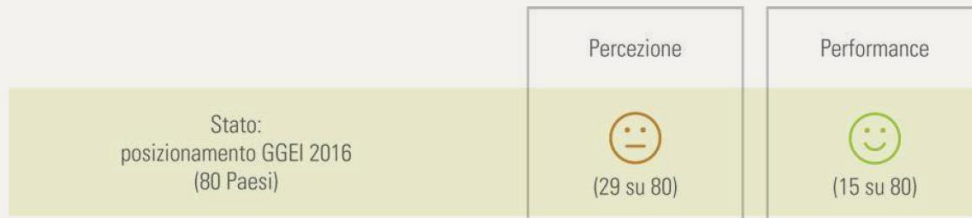


Increase Italian Bioeconomy turnover and jobs by 20% by 2030.

Uno sguardo allargato alla realtà italiana

3 RISULTATI GENERALI PER L'ITALIA

Figura 29 Posizionamento dell'Italia nel Global Green Economy Index™ (GGEI)



Per quanto riguarda la quota del consumo finale lordo (Cfl) soddisfatto con **fonti energetiche rinnovabili**, nel 2014 l'Italia - secondo i dati Eurostat - **ha raggiunto il 17,1%, superiore alla media europea del 16% e al 1° posto fra i cinque grandi Paesi europei**, seguita da Spagna (16,2 %), Francia (14,3%), Germania (13,8%) e Regno Unito (7%).

Nel riciclo dei rifiuti urbani l'Italia (dati 2014), col 42%, si colloca un punto percentuale sotto la media Ue28 e al 3° posto fra i cinque grandi Paesi europei



Uno sguardo allargato alla realtà italiana

Nel 2012 sono state riciclate in Italia circa 99 milioni di tonnellate di **rifiuti speciali**, pari al 76% dei rifiuti prodotti. **Rispetto ai cinque principali Paesi europei, l'Italia si colloca al primo posto.**

La produttività delle risorse, misurata come consumo interno di materiali per unità di Pil (in euro di Pil per chilogrammo di materiale consumato) - **colloca l'Italia al secondo posto**, con 3 euro al kg, meglio della media europea (2 €/kg).

Per quanto riguarda **l'ecoinnovazione** – (brevetti e le pubblicazioni, i benefici ambientali e i benefici socio economici in termini di occupazione, esportazioni e fatturato) - **l'Italia ha una posizione al di sopra della media europea, ma al 3° posto della classifica dei cinque grandi Paesi .**

Con 1,4 milioni di ettari coltivati con criteri biologici, pari all'11,2% della superficie agricola utilizzata, ben superiore alla media europea, **l'Italia si colloca in Europa al 2° posto**, dopo la Spagna.

L'Italia si colloca, ben al di sopra della media, **al 1° posto in Europa per prodotti agroalimentari certificati per qualità e tracciabilità**, che coinvolgono circa un quarto dell'intera produzione agricola nazionale, davanti a Francia, Spagna, Germania e Regno Unito.

Per quanto riguarda il consumo di suolo, col 7% l'Italia è in una condizione peggiore della media europea (4,3%), in 4° posizione fra i cinque grandi Paesi europei, e simile alla Germania (7,2%).

The Actors Boosting Italian Biorefineries and Bioeconomy



**CLUSTER NAZIONALE
BLUE GROWTH**

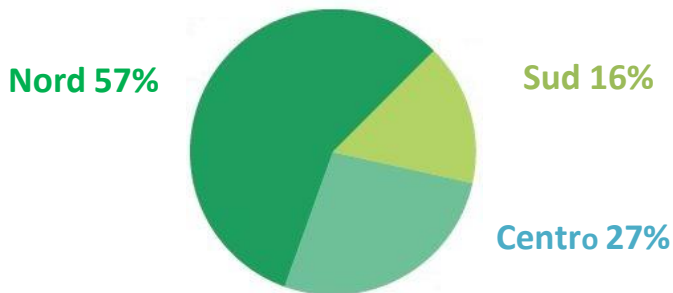
Mission :

- Overcoming fragmentation
- Public-private aggregations of stakeholders in a specific thematic area of strategic relevance for Italian industry
- Cooperation between public and private R&I

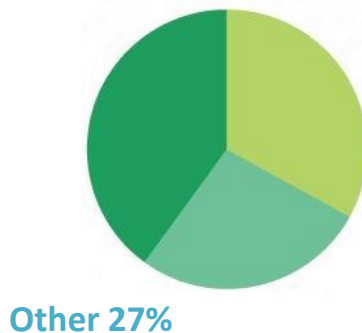
The National Technological Cluster on Green Chemistry



103 Members



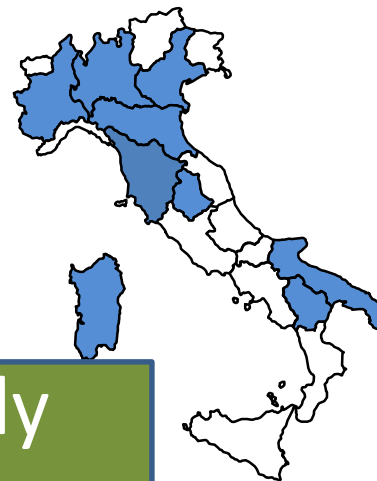
R&D 40%



Industry 33% (SMEs 39%)

- Multiple sectors represented:
- Chimica
 - Farmaceutica
 - Alimentare
 - Cosmetica
 - Plastiche
 - Fonti rinnovabili
 - Biotechnologie industriali
 - Trasformazione
 - Smaltimento

Founders

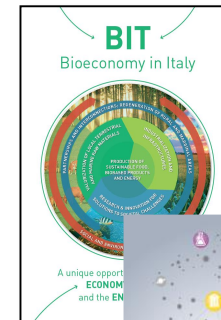
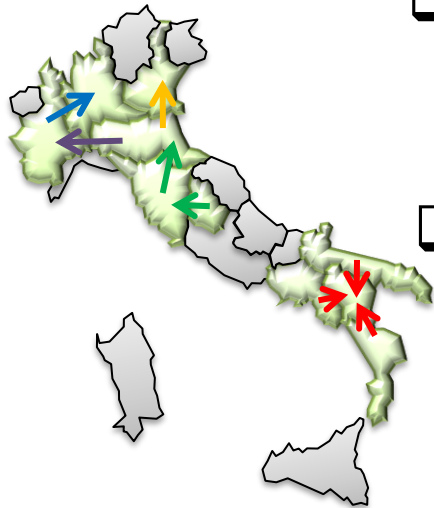


Regions formally involved

□ Interlocutor of National Institutions

□ Inspiring policies and strategies to support R&D

□ Promotion of territorial cooperation and macro-regional synergies



□ Identification of main national R&I needs

□ Promoting IT priorities inside EU funding programs

□ Promoting the participation of Italian public and private stakeholders in regional, national and EU funding programs

Bioeconomy in Europe

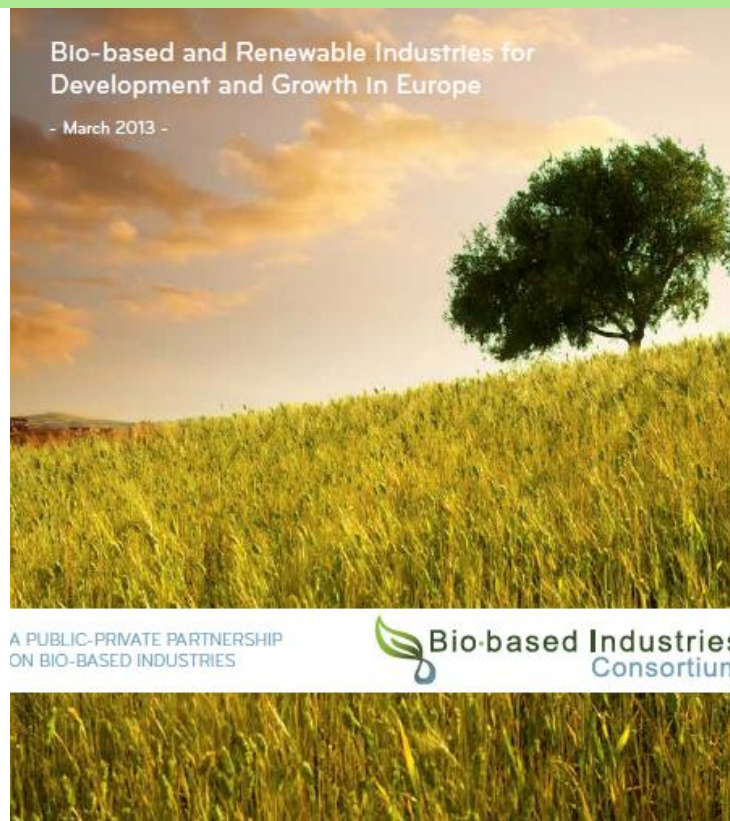


Come raggiungere una crescita intelligente, sostenibile ed inclusiva? Investendo in ricerca ed innovazione

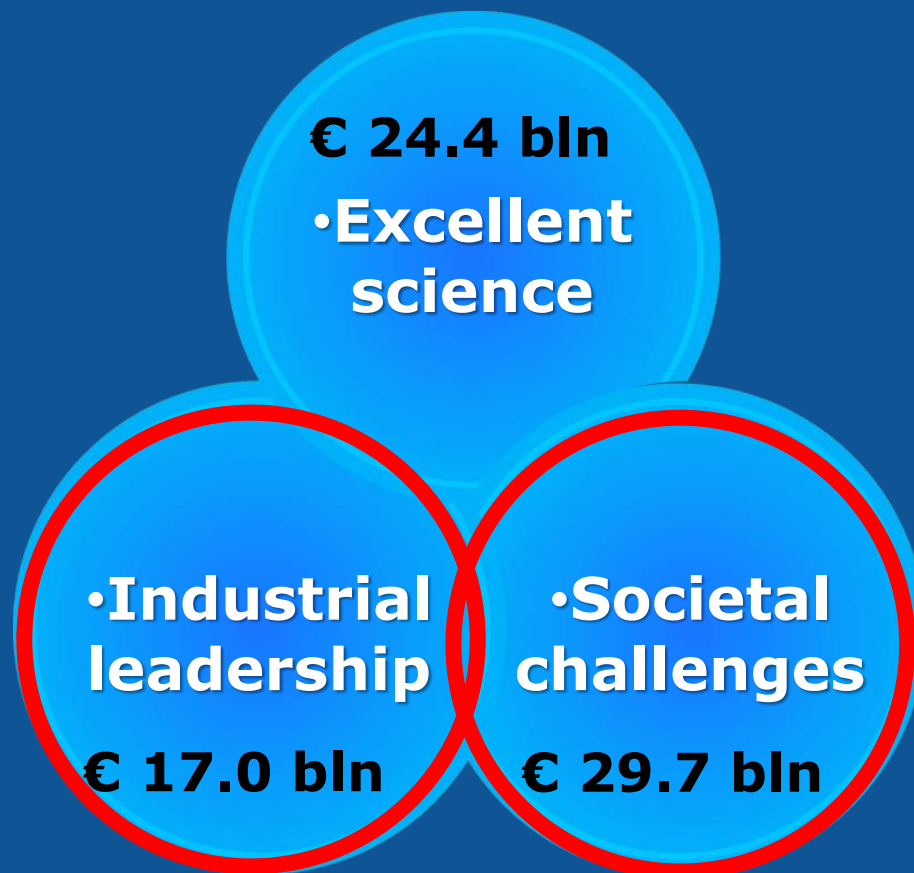
80 Miliardi € (2014-2020)

3.8 Miliardi € per i settori di ricerca della filiera bioeconomia

Specifici per l'innovazione dell'industria per la bio-economia: € 3.7 Miliardi (1/3 pubblico, 2/3 privato)



Horizon 2020, the EU Commission R&I funding programme (~79 Bil, 2014-2020)



Horizon 2020: three pillars

Horizon 2020, the EU Commission R&I funding programme (~79 Bil, 2014-2020)

Societal challenges



1. Health, demographic change and wellbeing (7.472 Bln)

2. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy (3.851 Bln)

3. Secure, clean and efficient energy (5.931 Bln)

4. Smart, green and integrated transport (6.339 Bln)

5. Climate action, resource efficiency and raw materials (3.081 Bln)

6. Inclusive, innovative and reflective societies (1.310 Bln)

7. Secure societies (1.695 Bln)

Societal Challenge 2 (Bioeconomy): ~3.8 Billion, 2014-2020



Budget: ~ 450 M €



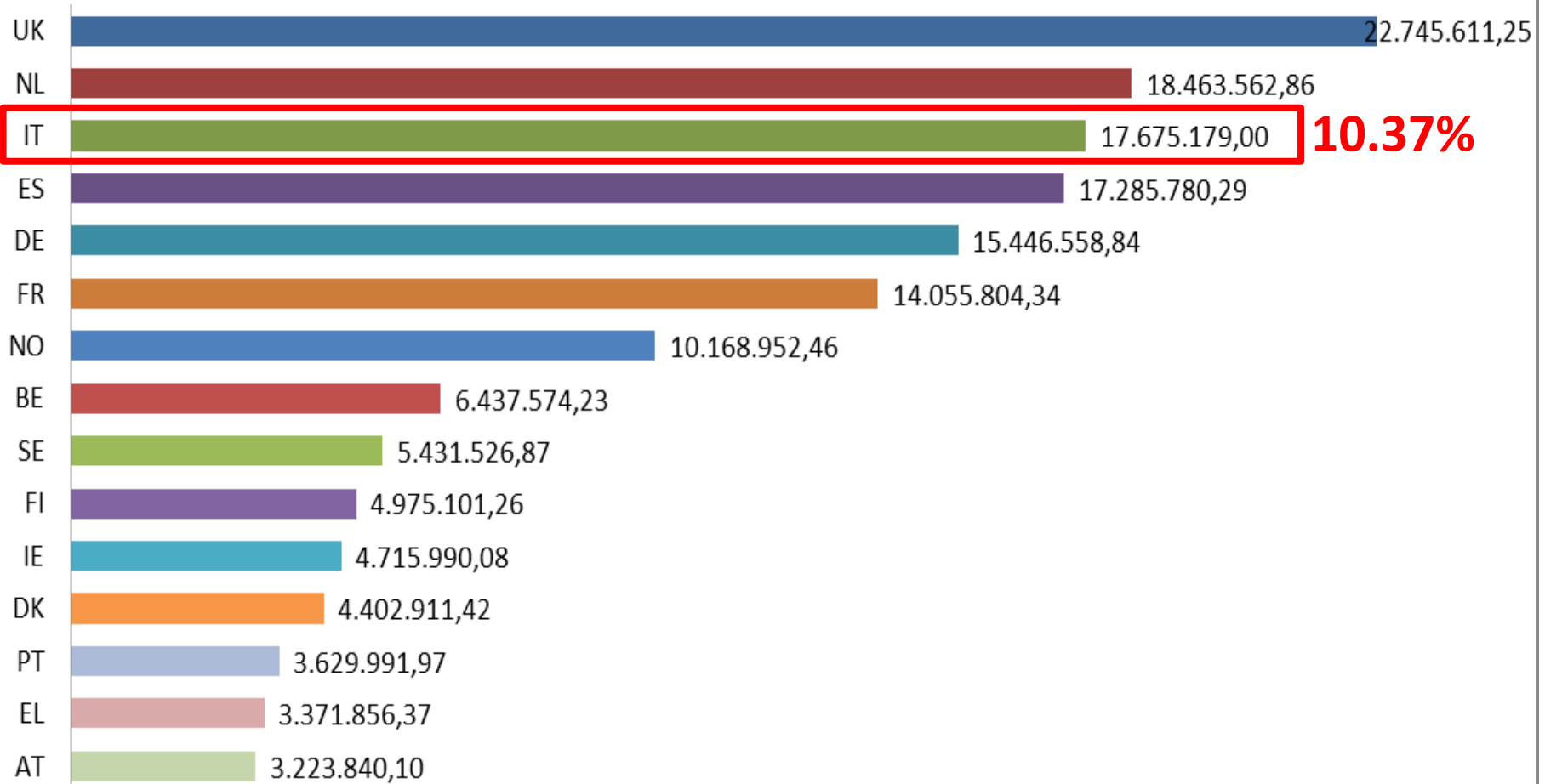
Budget: ~ 750 M €



Under preparation

IT participation in SC2 2015 calls (c)

Retained - Requested EU contribution



A Public-Private Partnership on Bio-Based Industries

Realising the European Bio-economy Potential

- Partners:



- European Union (via EC)



- Bio-based Industries Consortium (BIC)



€ 3.7 Billion (1/3 public, 2/3 private) 2014-2020

Supported by



<http://biconsortium.eu/>

<http://www.bbi-europe.eu/>

About BBI JU



Objectives

- De-risk investments;
- Organize the value chains;
- Reach critical mass of this “emerging” sector

The members of BIC

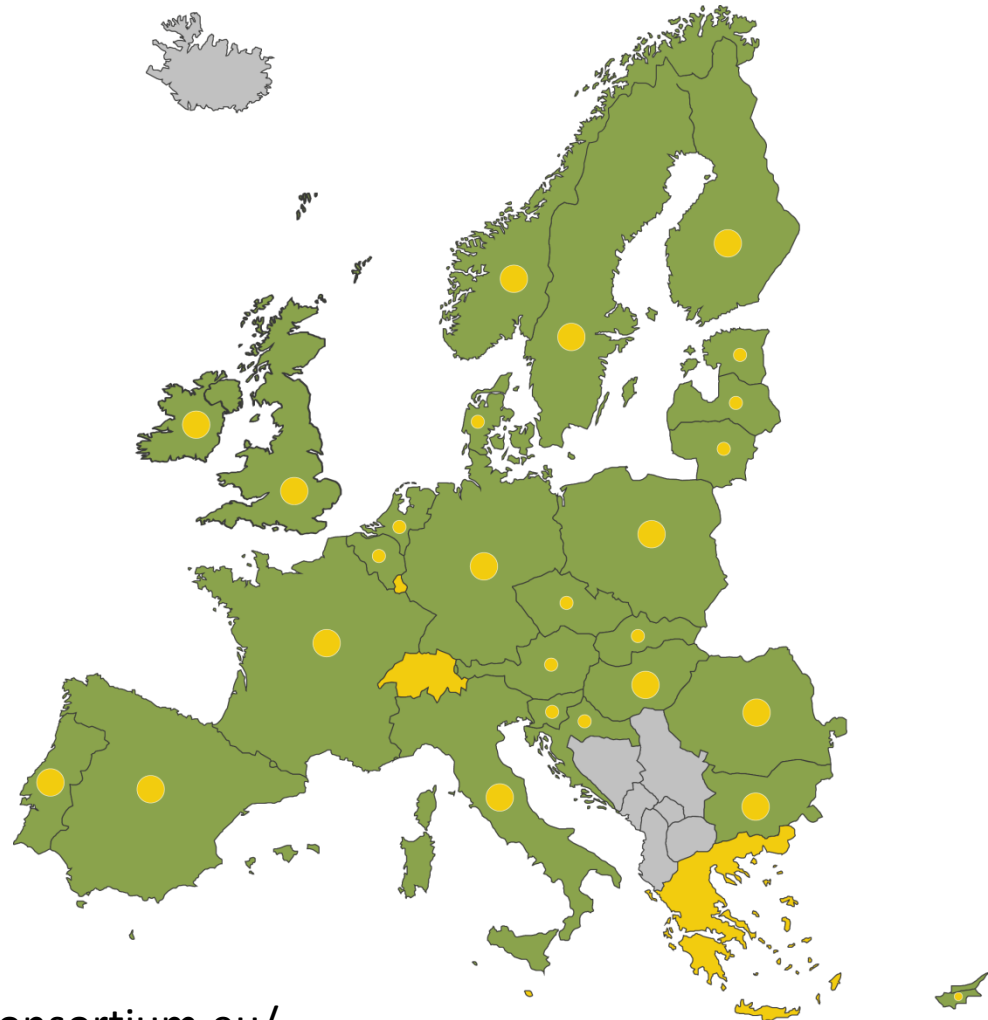
More than 200, from Agriculture, Agro-food, Forestry / Pulp and Paper, Biotechnology, Chemicals, Energy sectors

■ 77 Full members

- 43 Large industries
- 19 SMEs
- 15 Clusters

■ 142 Associate members

- 47 Universities
- 71 RTOs
- 10 European Associations
- 7 Associations
- 5 Technology platforms
- 1 Public institution
- 1 Bank



Italian partners of BIC (March 2016)

Full members

BioChemtex

GFBiochemicals Italy S.p.A.

Novamont

Soremartec - Gruppo Ferrero

ENI- Versalis

Associated members

SPRING



ENEA

National Interuniversity Consortium of Materials (INSTM)

Re-cord, University of Florence

Alma Mater Studiorum-Università di Bologna

Università Cattolica del Sacro Cuore

University of Modena and Reggio Emilia – Unimore

University of Naples "Federico II"

The focus



Feedstock

- Sustainable biomass supply
- and building new value chains

Biorefineries

- Efficient processing through R&D and upscaling in large-scale demo/flagship biorefineries

Markets, products and policies

- Developing markets for bio-based products and optimising policy frameworks

Strategic Innovation and Research Agenda (SIRA)

Bio-based and Renewable Industries for
Development and Growth In Europe

- March 2013 -

A PUBLIC-PRIVATE PARTNERSHIP
ON BIO-BASED INDUSTRIES

 Bio-based Industries
Consortium



The strategic Innovation & Research Agenda

Value Chain 1: Lignocellulosic

Value Chain 2: Forest-based

Value Chain 3: Agro-based

Value Chain 4: Organic waste

Value Chain 5: Energy, pulp and chemicals biorefineries



Italian presence in the funded proposals



Call 2014:

NOVAMONT, UNIBO, MATRICA, UNITO, FIAT, BARILLA,
AEP Polymer Srl (TS).

Call 2015.1:

BIOCHEMTEX , AGRICONSULTING SPA

Call 2015.2:

FVA SAS, **UNIBO**, CIAOTECH Srl, **GFBiochemicals Italy S.p.A.** (LEAD, IA) ,
NOVAMONT, LABORATORI ARCHA SRL, ARDAGH GROUP ITALY SRL, BARILLA,
CHIESA VIRGINIO, FEMTO ENGINEERING SRL, **INSTM**, MYCOPLAST, SSICA,
CENTRO EUROPEO PER I POLIMERI NANOSTRUTTURATI SCARL, **UNINA**
FEDERICO II, UNIPR, ARTERRA BIOSCIENCE SRL, CENTRO RICERCHE FIAT
SCPA, CNR, CONAIBO.

Research and innovation

Innovation: DEMO or FLAGSHIP

Coordination and support

BBI 2017.R1 – Valorisation of gaseous side streams from bio-based operations into chemical building blocks

BBI 2017.R2 – Innovative technologies for the pre-treatment and separation of lignocellulosic feedstock and complex composition streams into valuable fractions while maintaining key characteristics

BBI 2017.R3 – Exploiting extremophiles and extremozymes to broaden the processing conditions to convert biomass into high-value building blocks

BBI 2017.R4 – Proteins and other bioactive ingredients from side streams and residues

BBI 2017.R5 – Novel bio-based chemical precursors to improve the performance of mass consumption products

BBI 2017.R6 – Competitive biodegradable, compostable and/or recyclable bio-based plastics for a sustainable end-of-life phase

BBI 2017.R7 – Novel secondary bio-based chemicals without significant fossil-based counterparts but with high application potential

BBI 2017.D1 – Valorisation of liquid and solid side streams from bio-based operations into high added-value products to create new feedstock for bio-based products

BBI 2017.D2 – Integrated multi-valorisation of algae into advanced materials and high added-value additives

BBI 2017.D3 – Breakthrough primary bio-based chemicals without significant fossil-based counterparts but with high marketability

BBI 2017.D4 – Innovative bio-based fertilising products to increase the sustainability of fertilising practices in agriculture

BBI 2017.D5 – Advanced bio-based fibres and materials for large-volume applications

BBI 2017.F1 – Integrated ‘zero waste’ biorefinery utilising all fractions of the feedstock for production of chemicals and materials

BBI 2017.F2 – Large-scale production of proteins for food and feed applications from alternative, sustainable sources

BBI 2017.S1 – Establish cooperation and partnership with brand owners and consumer representatives to improve the market access of sustainable bio-based products

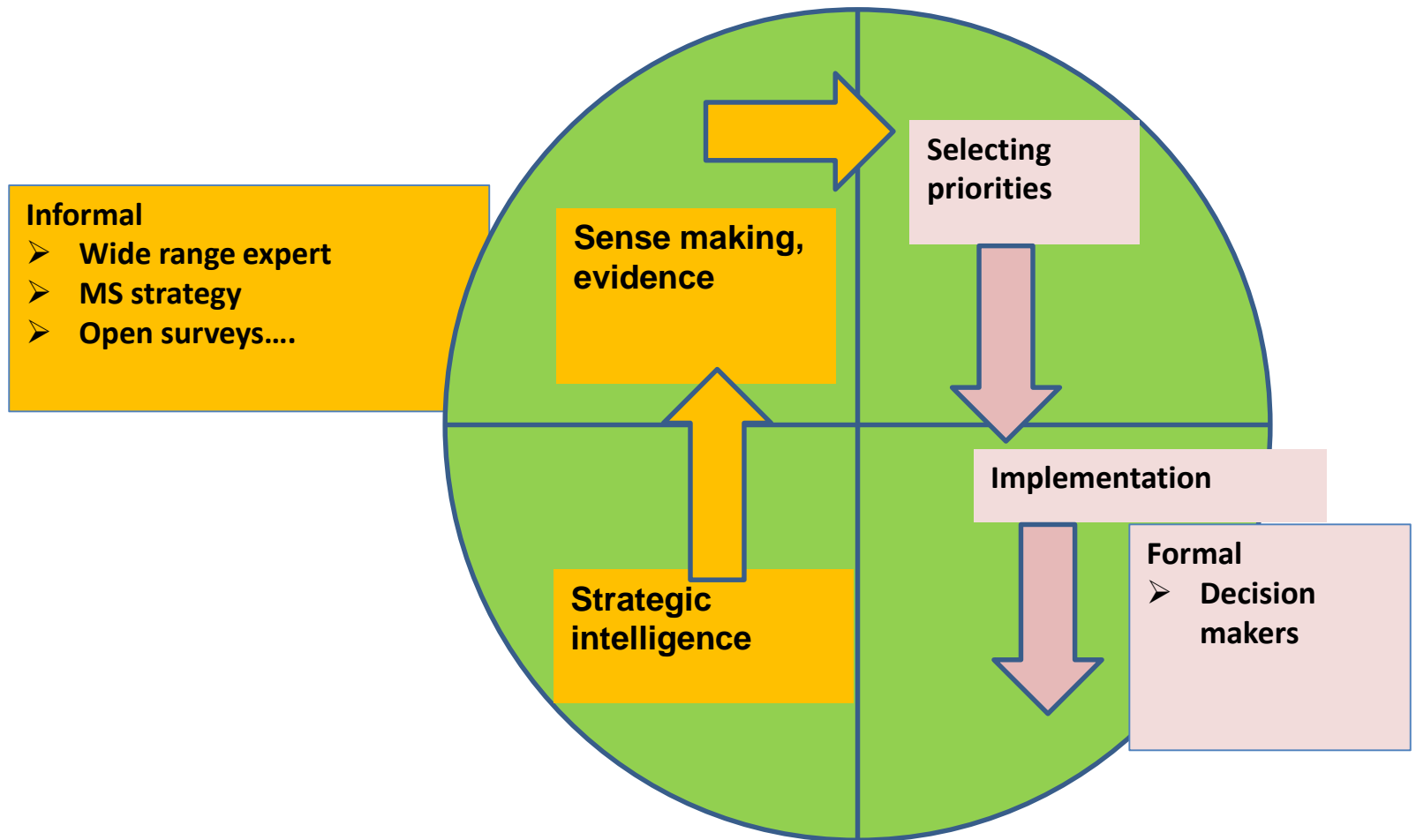
BBI 2017.S2 – Identify opportunities for ICT to increase the efficiency of biomass supply chains for the bio-based industry



ANNUAL WORK PLAN and Budget 2017

for the
Bio-Based Industries Joint Undertaking

The strategy of EU programming





New players for Bioeconomy? Bio-based bricks

The screenshot shows a web browser window displaying a blog post. The browser's address bar shows the URL: <http://ilbioeconomista.com/2015/06/24/the-lego-group-invests-in-new-bio-based-materials-to-make-bricks-and-packaging/>. The page header reads "THE FIRST BIOECONOMY BLOG - BIOECONOMY NEWS, POLITICS AND BUSINESS".

The main article title is "The LEGO Group invests in new bio-based materials to make bricks and packaging". It is dated "24 June 2015" and has "1 Vote".

The article features a photograph of the "World LEGO Tower in Milan @EXPO 2015", which is a tall, colorful structure made of LEGO bricks. Below the photo, the text reads: "The LEGO Group announced a significant investment of DKK 1 billion (approximately € 135 million) dedicated to research, development and implementation of new, sustainable, raw materials to manufacture LEGO® elements as well as packaging materials. The LEGO Group believes a new sustainable material must have an ever-lighter footprint than the material it replaces across key environmental and social impact areas".

On the right side of the page, there are sections for "RERUM CONCORDIA DISCORS", "FOLLOW BLOG VIA EMAIL" (with an email input field and an "ISCRIVITI" button), and "NEW E-BOOK" (featuring a red cover for "Inside the World Bioeconomy" by Mario Bonaccorsi, published by "Il Bioeconomista Publisher").

The Windows taskbar at the bottom shows the Start button, several application icons, and the system tray with the date "16/06/2015" and time "12:36".

The LEGO Group announced a significant investment of DKK 1 billion (approximately € 135 million) dedicated to research, development and implementation of new, sustainable, raw materials to manufacture LEGO® elements as well as packaging materials.