BIO-BASED INDUSTRIES
Public-Private Partnership

Lígia O. Martins
Scientific Committee of BBI-JTI

Industrial biotechnology (known also as white biotechnology) is the application of biotechnology for industrial purposes.

- fine and bulk chemicals
- pharmaceuticals
- bio-colorants
- solvents
- bio-plastics
- vitamins
- food additives
- bio-pesticides
- bio-fuels: bio-ethanol and bio-diesel

Towards a bio-based society

Eco-efficient use of resources

New bio-based products and polymers

Using enzymes and microorganisms

Europe strengths

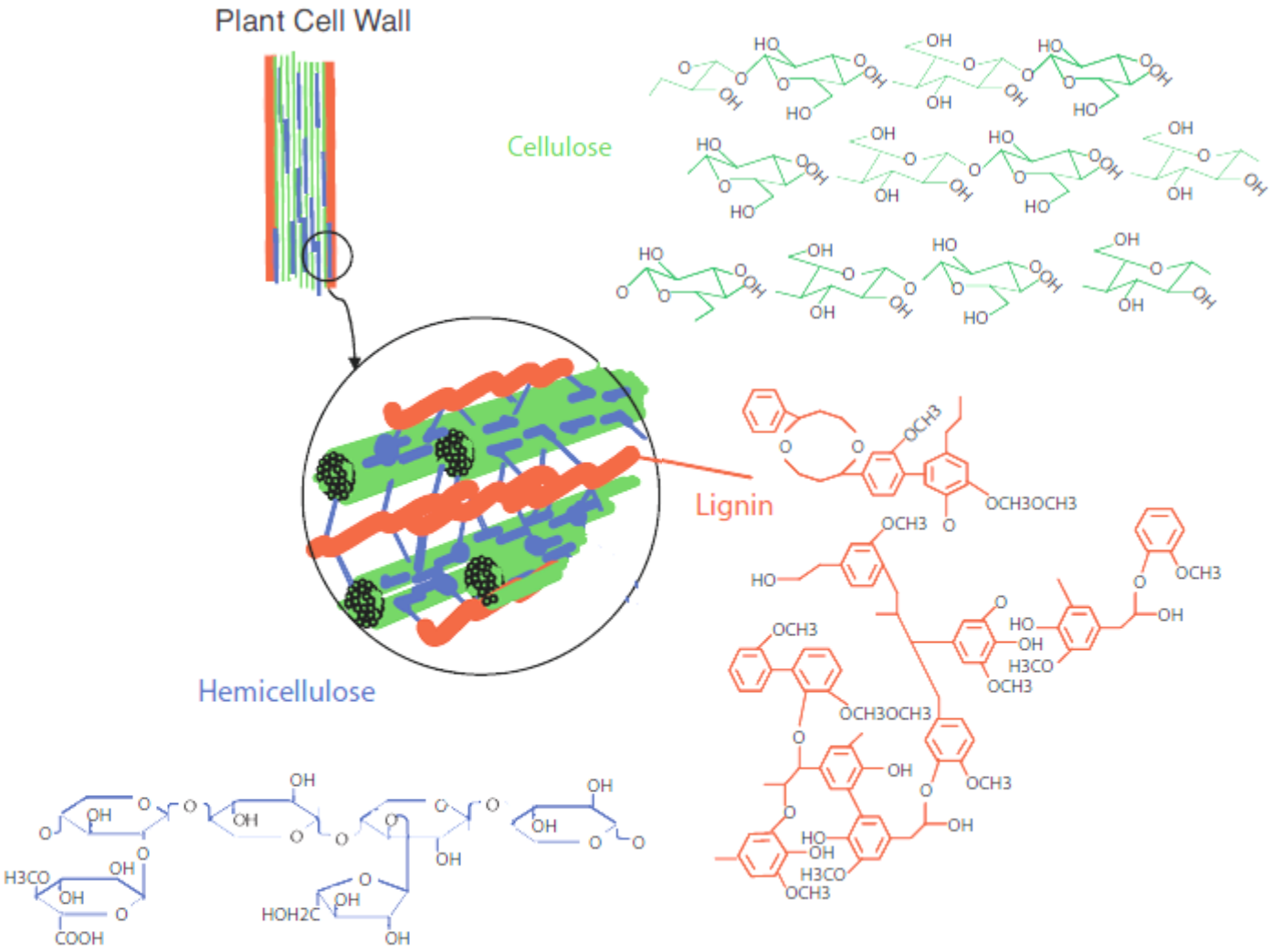
- Europe has the world's largest chemical industry
- European scientists and industries (e.g. enzymes) are world leaders
- The concept of Sustainable Development is well advanced in Europe
- Established white biotechnology products such as detergent enzymes have been generally accepted by society
- The recent expansion of the EU provide a large increase in agricultural biomass suitable as an industrial raw material
- EU Directives were implemented for the promotion of biofuels or other renewable fuels

Fonte: BBI

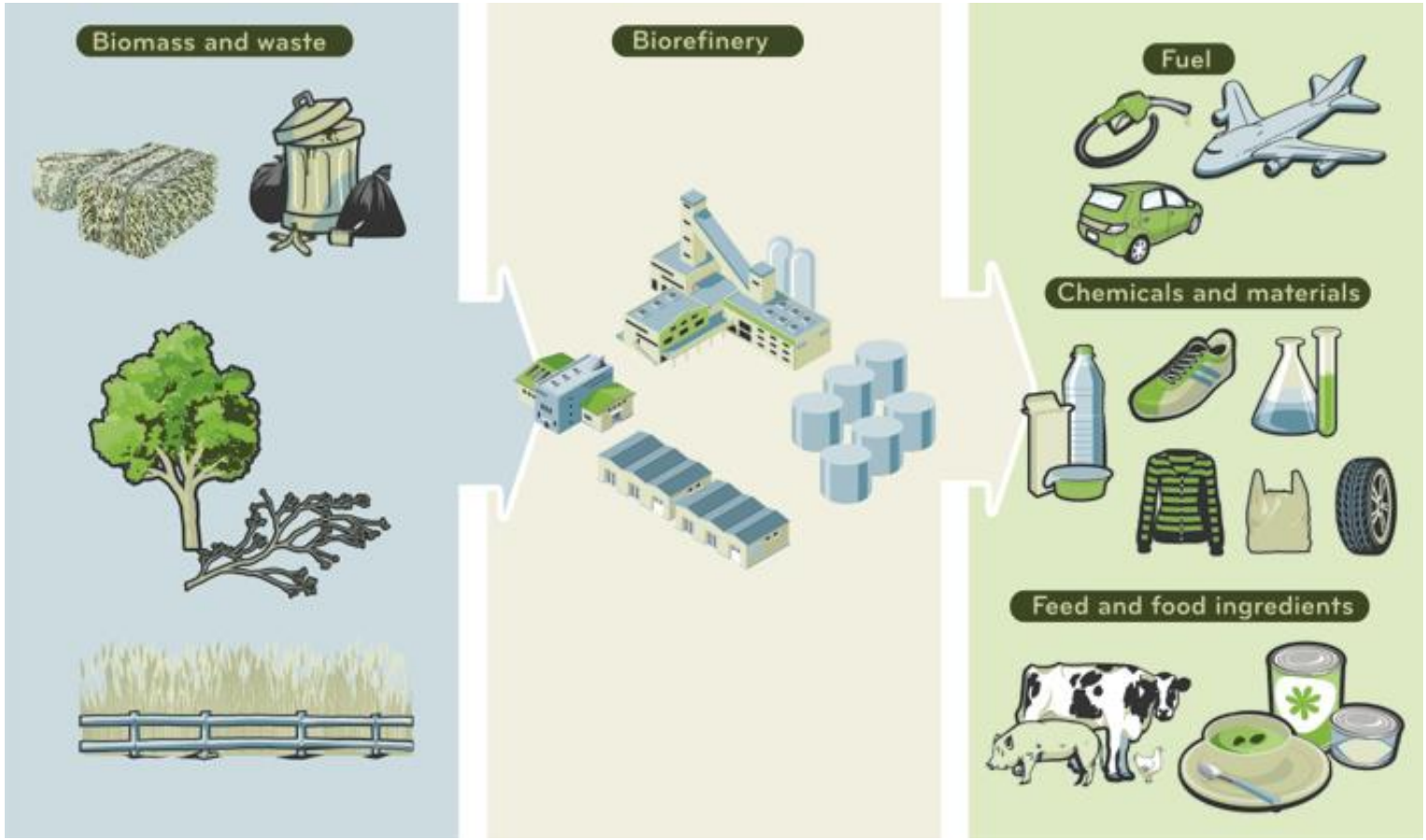
Lead the transition towards a post-petroleum society

Places sustainability, smart & efficient use of resources at the heart of industrial, business & social activities.

Ligninocellulosic material



Bio-based economy concept



Fonte: BBI

What's in it for Europe?

Growth

- A global bio-based market estimated at €200 billion by 2020

Jobs

- 1 million jobs between 2010 and 2030 mainly in rural areas

Energy and Products

- To produce food, feed, chemicals, materials and fuels locally

Climate

- GHG emissions reduction of ~50% compared to fossil alternatives

Fonte: BBI

A Public-Private Partnership on Bio-Based Industries

Realising the European Bio-economy Potential

Fonte: BBI

LO Martins
15th July 14

Joint Technology Initiative on Bio-based Industries

Feedstock	• Fostering a sustainable biomass supply and building new value chains
Biorefineries	• Optimising efficient processing through R&D and up-scaling in large-scale demo/flagship biorefineries
Markets, products and policies	• Developing markets for bio-based products and optimising policy frameworks

Fonte: BBI

WP2014: Five Value Chains

Fonte: BBI

Strategic Innovation & Research Agenda

- **Value Chain 1**: **From lignocellulosic feedstock to advanced biofuels, bio-based chemicals & biomaterials**
  feedstock and technology base for the next generation of fuels, chemicals and materials
- **Value Chain 2: Next generation forest-based value chains**
  utilisation of the full potential of forestry biomass by improved mobilisation for new added value products and markets
- **Value Chain 3**: **Next generation agro-based value chains**
  highest sustainability and added value by improved agricultural production for new added value products and markets
- **Value Chain 4**: **New value chains from (organic) waste**
  from waste problems to economic opportunities by realising sustainable technologies to convert waste into valuable products
- **Value Chain 5**: **Integrated energy, pulp and chemicals biorefineries**
  sustainable bio-energy production, by backwards integration with biorefinery operations isolating higher added value components

Fonte: BBI

- Partners: **European Commission** and **Biobased Industries Consortium** (BIC);
- Budget: **€ 3.705 billion** (about 75% from industry)
- Implementation:
  - Principles of **openness, transparency** and **excellence**;
  - Horizon 2020 rules for participation

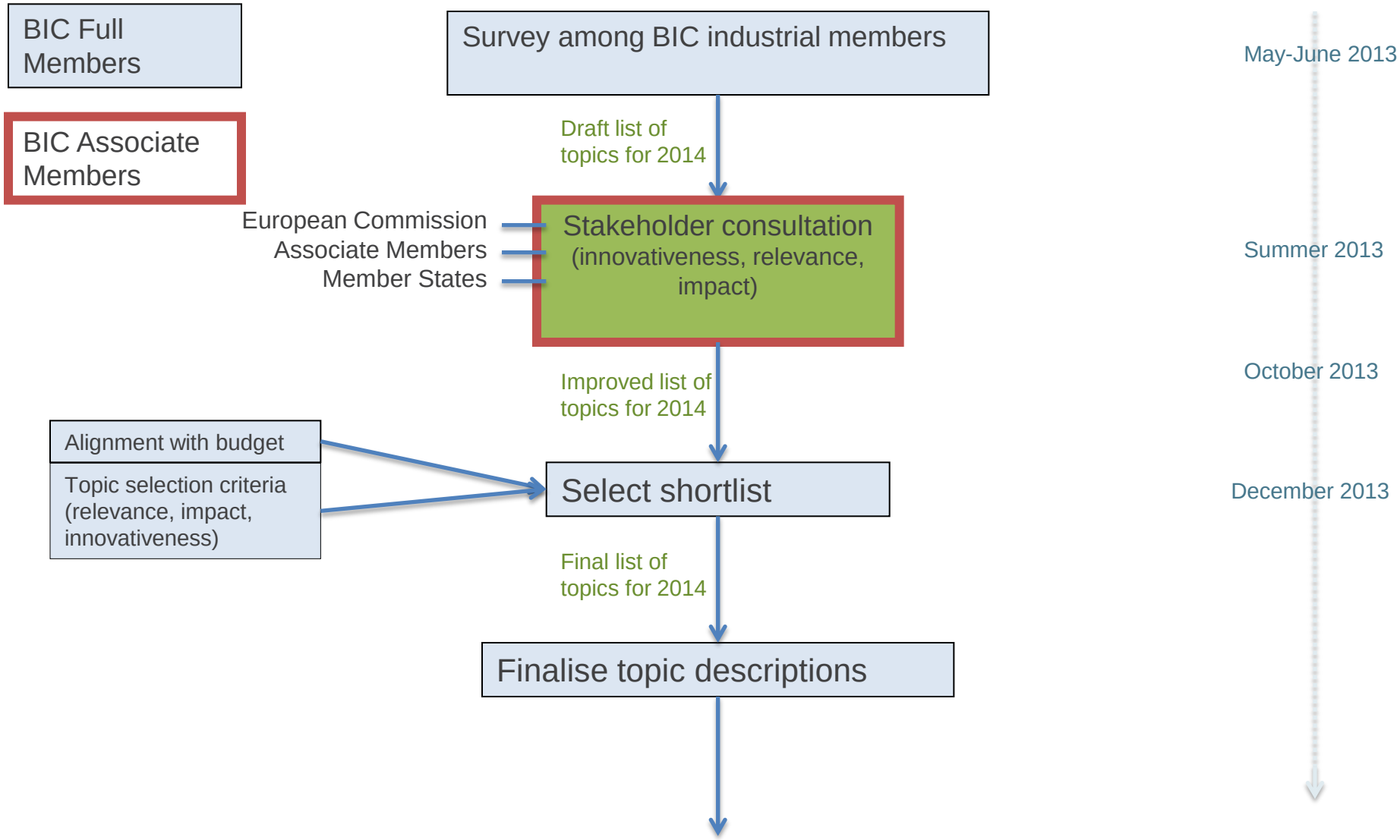
- Objectives: **New bio-based value chains** for Europe based on **2nd generation biorefineries**.

Fonte: BBI

THE WORK PROGRAMME 2014

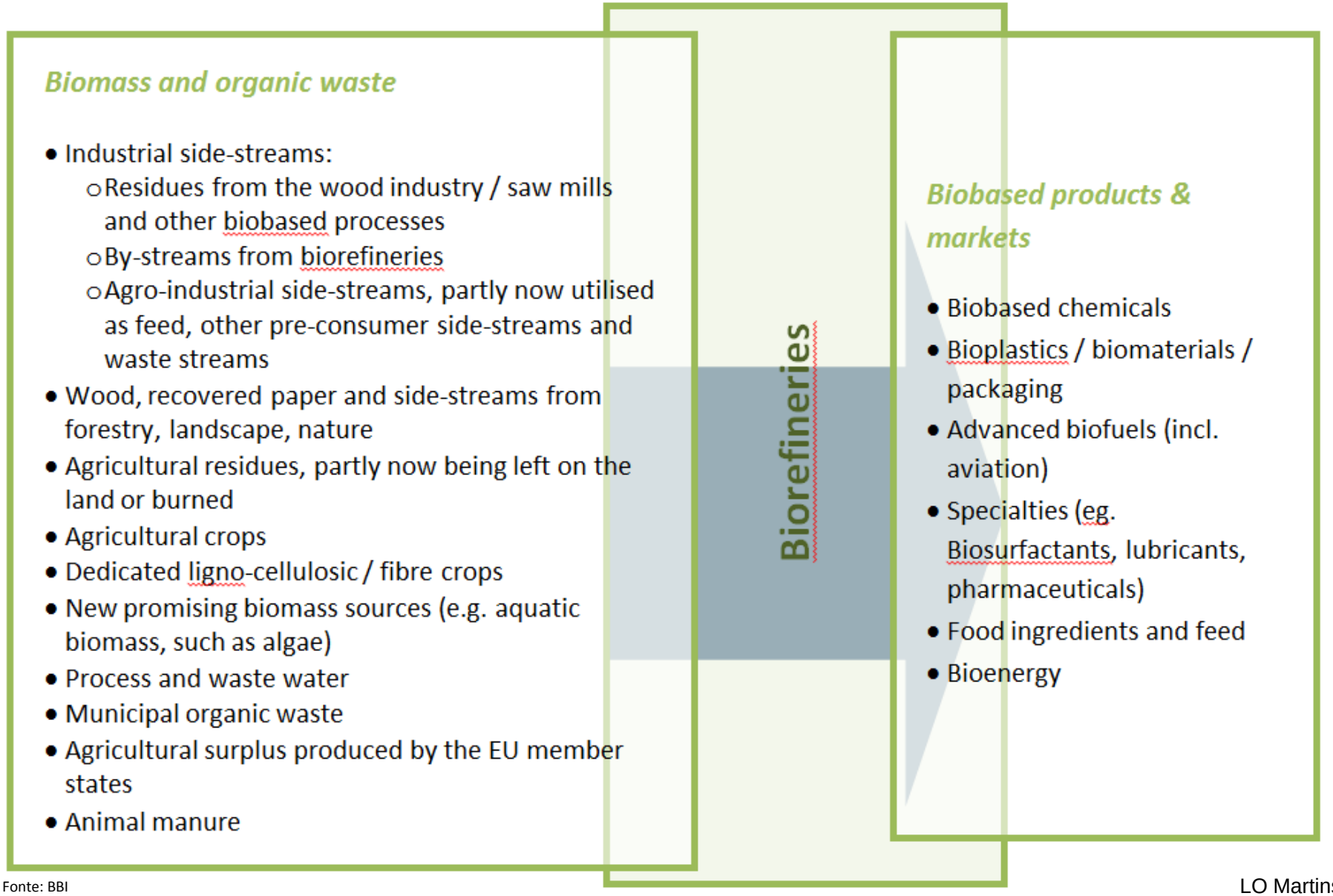
LO Martins
15th July 14

WP2014: Procedure



Fonte: BBI

Strategic Innovation & Research Agenda



Fonte: BBI

WP2014: 3 Priority areas

Fostering high potential initiatives

Demonstration and Flagship initiatives, aimed in the short- and medium-term

- doubling the fraction of bio-based chemicals produced in Europe
- increasing by 5 the market share of bio-based polymers and composites
- increasing by 3 the value of products from agro-food residues

E.g. activities that foster valorisation of lignocellulosic materials, streams and by-streams from existing biorefineries; large scale centralised conversion of manure demonstrating the cost-efficient isolation of added-value biochemicals

Ensuring medium- and long-term sustainable biorefinery approaches

R&I activities focused on

- increasing biomass mobilisation by 10%,
- reducing imports of protein for feed and fertilizers components by 15% and 10% by 2020

E.g. activities focusing on the valorisation of nutrients and proteins, and the mobilisation and valorisation of readily accessible, yet underutilised resources. This includes developing new added-value products from available cellulose and lignin, and isolating sugars from side streams from pulp mills.

Fonte: BBI

WP2014: 3 Priority areas

Addressing high impact / complex long-term issues:

R&I activities focused on

- achieving a secure and sustainable supply of lignocellulosic biomass
- meeting the 15% target increase in waste and by-product utilization by 2020

E.g. R&I activities that develop technologies for valorisation of heterogeneous waste streams, and cost and energy-efficient technologies for separation of lignocellulose into its individual components. These issues specifically tackle the challenge of organic waste valorisation.

Fonte: BBI

WP2014: 2 Types of Actions

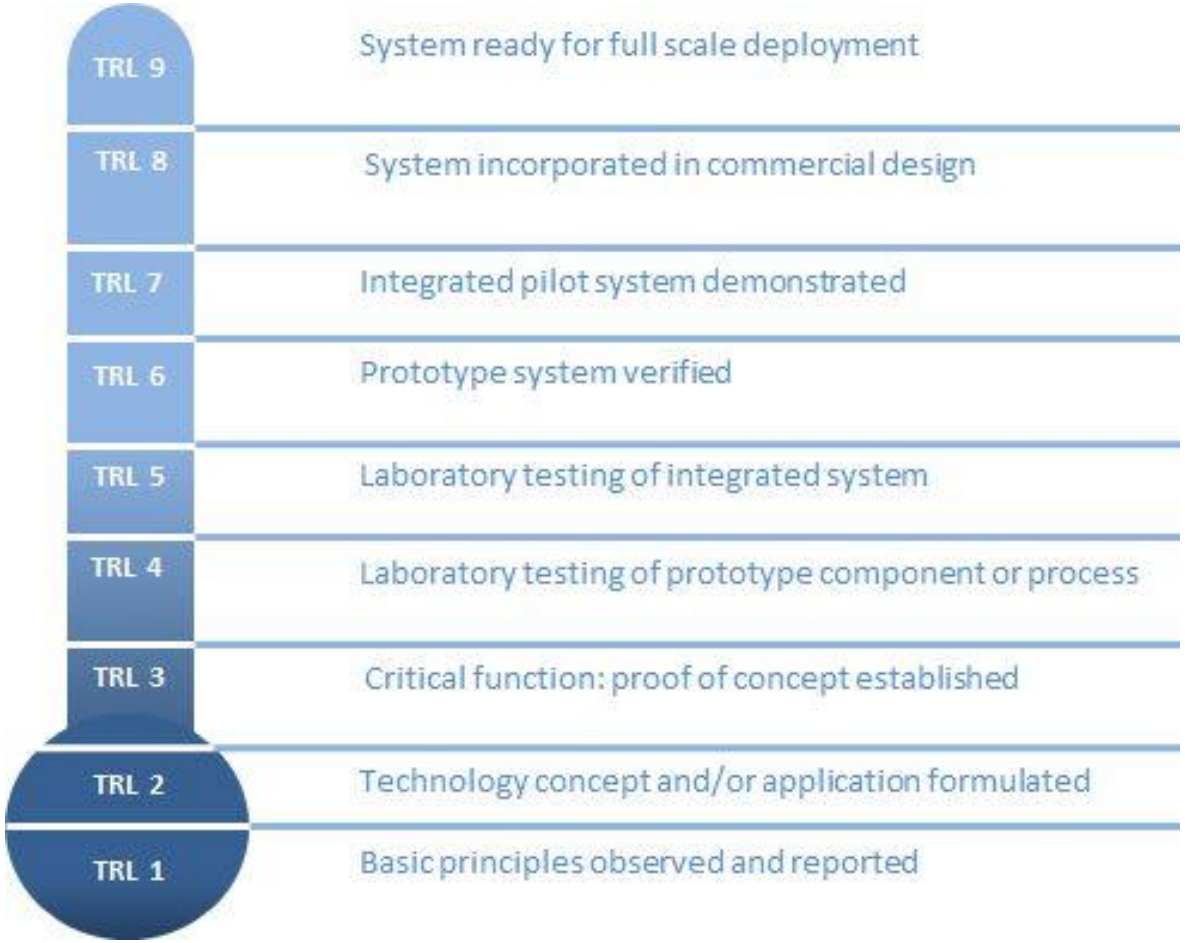
- 2 types of Actions are foreseen:

  - **Research and Innovation actions**
    - **R&D projects**, *focussed on solving specific technological bottlenecks acting as a barrier on a value chain*

  - **Innovation Actions**
    - **Value Chain Demonstration projects**, *addressing a full value chain from growth/procurement of feedstock to end product(s), establishing a new production process and demonstrating its viability for full scale replication*
    - **Flagship projects**, *developing a first-of-its-kind industrial facility by addressing the complete value chain from feedstock to end product(s)*

Fonte: BBI

WP2014: Technology readiness level (TRLs)



Flagship project TRL 8

Demo projects TRL 6-7

R&I projects up to TRL 5

WP2014: TRLs

Technology Readiness Levels		PPP funding category	Scale*
9	Actual system proven (successful operation, production of final product/service)	**Commercial - no funding**	Commercial scale (After flagship project or 'replication' of existing plant)
8	Whole process demonstration completed at scale and product qualified through test	**Innovation action - Flagship**	*Comparable to commercial scale/ **1st-of-a-kind in Europe**
7	Process demonstration in operational environment (integration) at demo scale	**Innovation action - Demo**	*Small production unit/ demo scale
6	Sub-system or process step demonstration in relevant environment		
5	Pilot - Process step validation in relevant environment (separate process steps)	**R&I action**	"On the ground" equipments
4	Process validation in laboratory environment	**R&I actions**	"On the bench" equipments

* Scale varies strongly with the sector, process or product, and thus scale of project must be compared with existing production of same product (with e.g. different feedstock) or comparable product or production system.

Fonte: BBI

LO Martins
15th July 14

WP2014: 16 Topics

BBI VC1.R1 – 2014

Efficient pre-treatment of lignocellulosic residues to advanced bio-based chemicals and biomaterials

Development of mild, sustainable processes aimed at **fractionating** lignocellulosic feedstock into sugars and lignin fractions

total eligible budget between EUR 5 and 8 million

- ✓ pretreatment yield of at least 80% on biomass
- ✓ GHG emission reduction of at least 30% (over the whole value chain compared to conventional products)

Fonte: BBI

BBI VC2.R2 – 2014

New sustainable pulping technologies

Development of new Deep Eutectic **Solvents**-based pulping technologies to isolate cellulose, lignin and hemicellulose from wood and other lignocellulosic sources

total eligible budget at least EUR 2 million

- ✓ 40% energy reduction compared to traditional pulping processes.
- ✓ reducing by 50% of investment costs as compared to current pulping installations

Fonte: BBI

BBI VC2.R3 – 2014

New products from sustainable cellulose pulp exploitation

Development of innovative cellulose **dissolution** processes and concomitant technologies enabling the production of cellulose based products with innovative properties

total eligible budget of between EUR 5 and 8 million

- ✓ a reduction of at least 10% of investment and operating costs of newly developed cellulose dissolving processes as compared to conventional ones.

Fonte: BBI

BBI VC2.R4 – 2014

Fibres and polymers from lignin

Development of **separation, purification and conversion** processes for the production of fully bio-based added value products from lignin-based side streams of the pulp and paper industry

total eligible budget at least EUR 2 million

- ✓ at least 4 new bio-based materials (chemicals, resins and precursor materials for biopolymers)
- ✓ a 5 times cost decrease with respect to conventional carbon fibres
- ✓ GHG emission reduction by at least 20%

Fonte: BBI

BBI VC2.R5 – 2014

Sugars from effluents of the pulping process and discharged fibres

Development of processes to **isolate** a stream of sugars from spent pulping liquors (from sulphite and Kraft pulping) or discharged fibers, for further conversion into carbohydrate derivatives via chemical or biochemical routes

total eligible budget at least EUR 2 million

- ✓ value increase by 2 to 3 times (when using discharged fibre streams)
- ✓ sugar separation rate of at least 50% (when processing liquor), + at least 4 times value increase compared to the energy value of liquor
- ✓ technological validation of at least 3 new biobased chemical building blocks

Fonte: BBI

BBI VC3.R6 – 2014

Fermentation processes to obtain biosurfactants and specialty carbohydrates from agricultural and agro-industrial streams

Development of cost-efficient and sustainable **fermentation** processes to obtain tailor-made biosurfactants and specialty carbohydrates from agricultural and agro-industrial streams.

total eligible budget at least EUR 2 million

- ✓ 20-fold reduction in price range of speciality carbohydrates and increase of the supply from the kg scale to the hundreds of tons scale

Fonte: BBI

BBI VC3.R7 – 2014

Protein products from plant residues

Development of industrially viable processing concepts for the valorisation of **protein** products from plant residues fulfilling market requirements in the food segment using animal proteins as benchmark.

total eligible budget at least EUR 2 million

- ✓ increasing the value of the protein fraction by at least 100%.
- ✓ conversion rate of at least 30 % of the protein fractions in processed streams to high-value products suitable for human consumption, with a protein content at least 40%.
- ✓ technological validation of at least 3 food products based on the recovered plant-based proteins, ready for demonstration.

Fonte: BBI

BBI VC3.R8 – 2014

Bioactive compounds from meso-organism's bioconversion

Development of breakthrough approaches to obtain sustainable bioactive compounds from agro-based residues through **bioconversion** of meso-organisms, mild recovery, functionalization and activation. Research should focus on high value products, rather than commodities.

total eligible budget at least EUR 2 million

- ✓ bioactive compounds with a 10% increase in bioactivity with respect to similar products and a 25% reduction in environmental impact as compared to conventional fatty acid or chitosan production

Fonte: BBI

BBI VC4.R9 – 2014

Valuable products from heterogeneous biowaste streams

Development of **pre-treatment, extraction, conversion** and separation technologies for the processing of full heterogeneous biowaste streams into valuable chemical building blocks and substrates suitable for biotechnological conversion into new bioproducts.

total eligible budget at least EUR 2 million

- ✓ Reducing of the CO_2 footprint of at least 20% with respect to currently available technologies.
- ✓ Achieving technological validation of at least 2 new bio-based products.

Fonte: BBI

BBI VC4.R10 – 2014

Nutrient recovery from biobased waste streams and residues

Development of dedicated recovery processes for nutrients from **biowaste** streams and bioresidues rich in plant nutrients. Upgrading of recovered nutrients to new sustainable fertilisers by a cost-effective combination of specific organic and mineral components.

total eligible budget at least EUR 2 million

- ✓ CO_2 footprint reduction of at least 20% with respect to currently available technologies
- ✓ technological validation of fertilisers with at least 15% concentration of the overall volume when using recycled nutrients and at least 70% availability to plants
- ✓ Substitution of at least 10% of nitrogen and phosphorus with recycled components in commercial fertilisers.

Fonte: BBI

BBI VC1.D1 – 2014

Lignocellulosic residues to (di)carboxylic acids, diols and

Demonstration of the integration of biotechnological, biochemical and chemical processes for the conversion of lignocelullosic residues into fermentable sugars, then into (di)carboxylic acids, diols (e.g. butanediol) and polyols and further into bio-based materials as final products.

total eligible budget at least EUR 8 million

- ✓ Improved conversion and yield compared to currently available production processes
- ✓ A least 3 bio-based materials, with favourable competition with oil-based counterparts price-, environmental- and performance-wise, and with at least 70 % bio-based content, and less than 2.3 kg CO2eq/kg emission.

Fonte: BBI

BBI VC1.D2 – 2014

Chemical building blocks and value-added materials through integrated processing of wood

Demonstration of efficient and sustainable processes for disintegration of wood into sugars and lignin and to further conversion of both fractions into high added value products, building where relevant on existing infrastructure.

total eligible budget at least EUR 8 million

- ✓ cellulosic/hemi-cellulosic-based products with and at least 2 -3 times higher value than current products
- ✓ Lignin-based products with a value which is at least 3 - 4 times higher than current lignin energy value
- ✓ at least a 75% conversion rate into value added products

Fonte: BBI

BBI VC2.D3 – 2014

Advanced products from lignin and cellulose streams of the pulp and paper industry

Demonstration of the production of at least two product ranges: one based on isolation and application of lignin and one based on the production and application of light weight foam-formed cellulose.

total eligible budget at least EUR 8 million

- ✓ cellulose based light weight structures exhibiting high strength, matching the performance of competing conventional products, with at least a 20% reduction in energy and raw material consumption
- ✓ elimination of Na_2SO_4 emissions during lignin isolation
- ✓ Lignin based bioproducts with a value of at least 10 times the current value of black liquor when burned for energy

Fonte: BBI

BBI VC3.D4 – 2014

Functional additives from residues from the agro-food industry

Demonstrate the production of high added value functional additives from a side stream of the agro food industry, building where possible on existing infrastructure.

total eligible budget at least EUR 8 million

- ✓ Integrated process with more than 40% of the agro-food side stream to be valorized to high added value additives
- ✓ Products with a 5 times higher value than the current applications of the side stream

Fonte: BBI

BBI VC4.D5 – 2014

Cost efficient manure valorisation on large scale

Demonstration of the techno-economic feasibility of a manure valorisation process, by centralised cascading processing into added-value biochemicals, including biogas.

total eligible budget at least EUR 8 million

- ✓ reducing GHG emissions of manure by 30% as compared to conventional processes.
- ✓ turning negative value of manure into positive one, thus creating extra revenues for livestock industry currently coping with the manure as a costly problem.

Fonte: BBI

BBI VC3.F1 – 2014

Added value products from underutilised agricultural

Demonstration of the sustainable conversion of currently underutilised agricultural streams from a local integrated supply chain into bio-chemical intermediates, and their subsequent processing into end-products at industrial scale.

total eligible budget at least EUR 25 million

- ✓ new products with more than 70% bio-based content and less than 2.3 kg CO_2 eq/kg emission
- ✓ products with a 3 times higher value than the current application of feedstock side streams

Fonte: BBI


Thank you
BIO-BASED INDUSTRIES
Public-Private Partnership

Fonte: BBI