Towards a regional supply chain for bio-based fertilizers produced from plant residues: technical and commercial feasibility study with the RUSTICA project

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Presented by :

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RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

Grant Agreement No. 101000527

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Global presentation of the RUSTICA PROJECT

RUSTICA in a nutshell

H2020 PROJECT

2021-2024

- foster the **technical validation, demonstration** and **implementation** of bio-based fertilizer and soil improvement production techniques
- focusing on waste from the fruit and vegetable agro-food system
- to **close nutrient cycles** on a regional level
- developments of **economically viable and environmentally sustainable alternatives** to mineral fertilizers with the same or improved agronomic value.

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Rationale RUSTICA

- Nutrient pollution
- Soil degradation
- Food waste : yearly 80 million tonnes of fruit and vegetables processing waste are generated in the EU

➔Invest in recovery of nutrients from food waste

➔Replace mineral fertilizer with bio-based alternative

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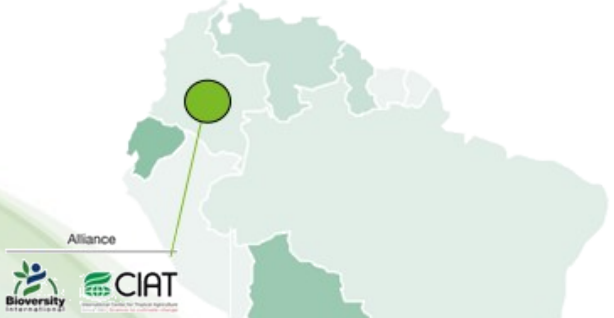
16 partners from 8 countries

Bundling academic and non-academic expertise across Europe



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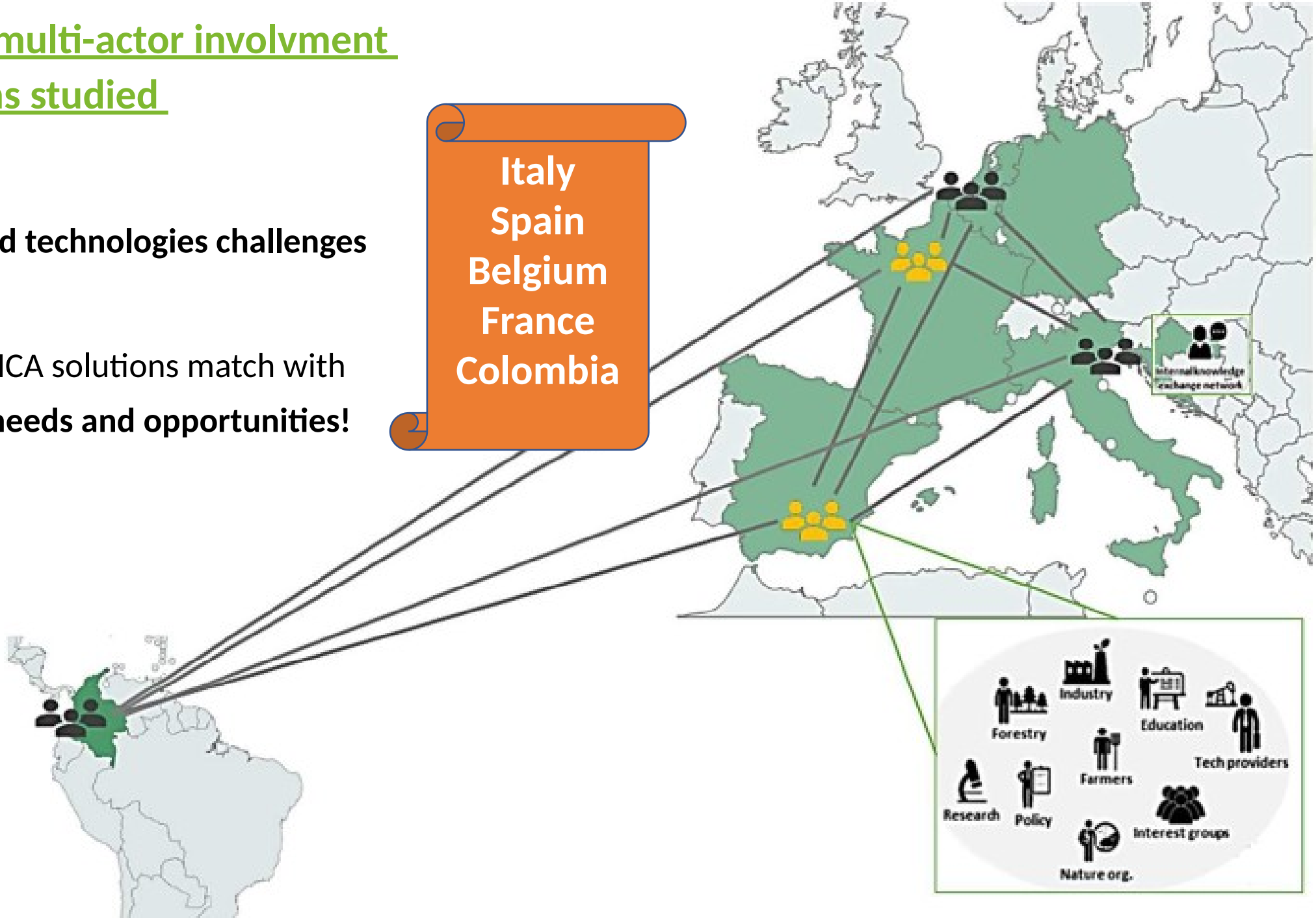
Completed by a multi-actor involvment in the five regions studied

*for both **market and technologies challenges**

*To make sure RUSTICA solutions match with **regional demands, needs and opportunities!**

Italy
Spain
Belgium
France
Colombia



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The multi-actors group in Pays de la Loire

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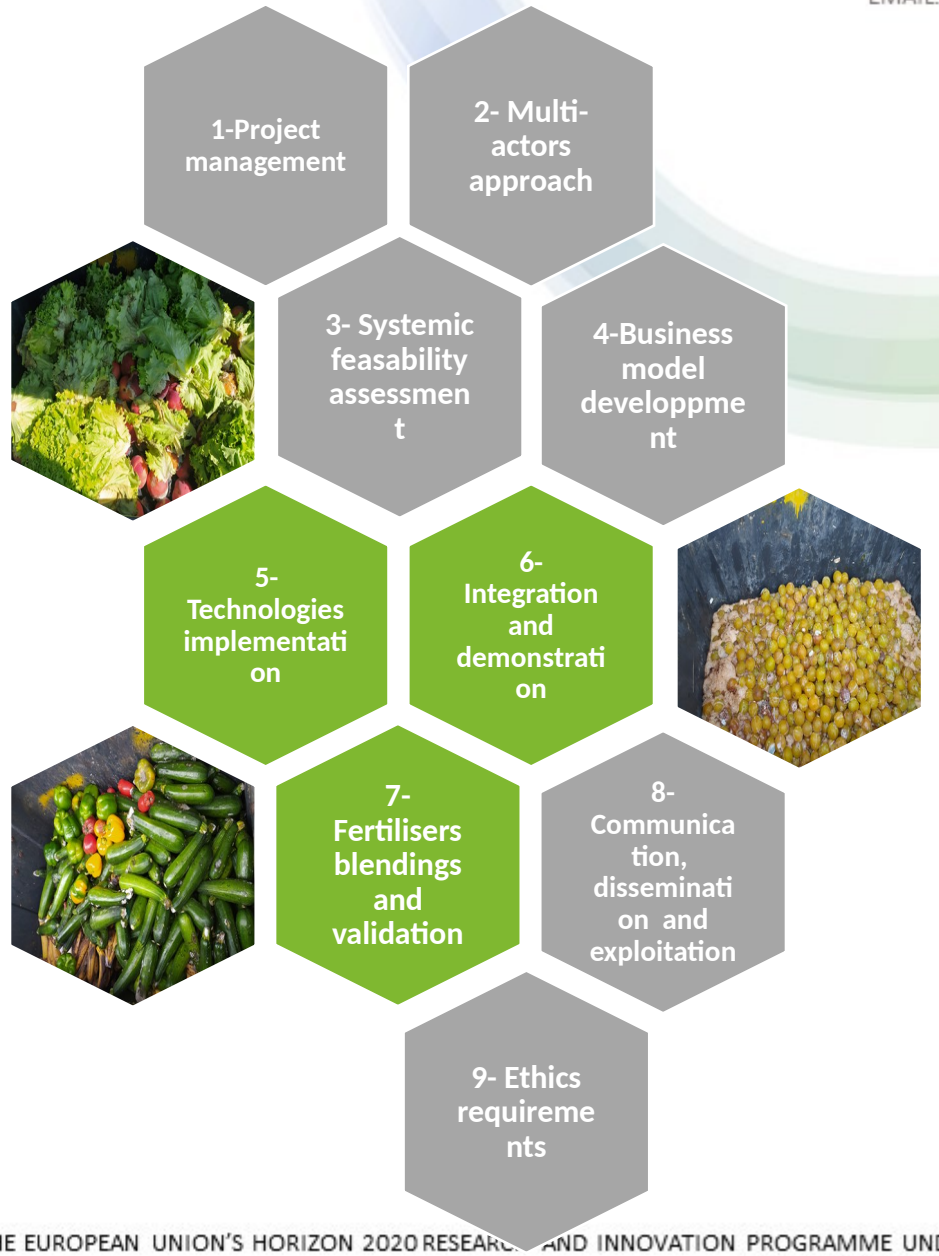
9 Work Package multi-skills



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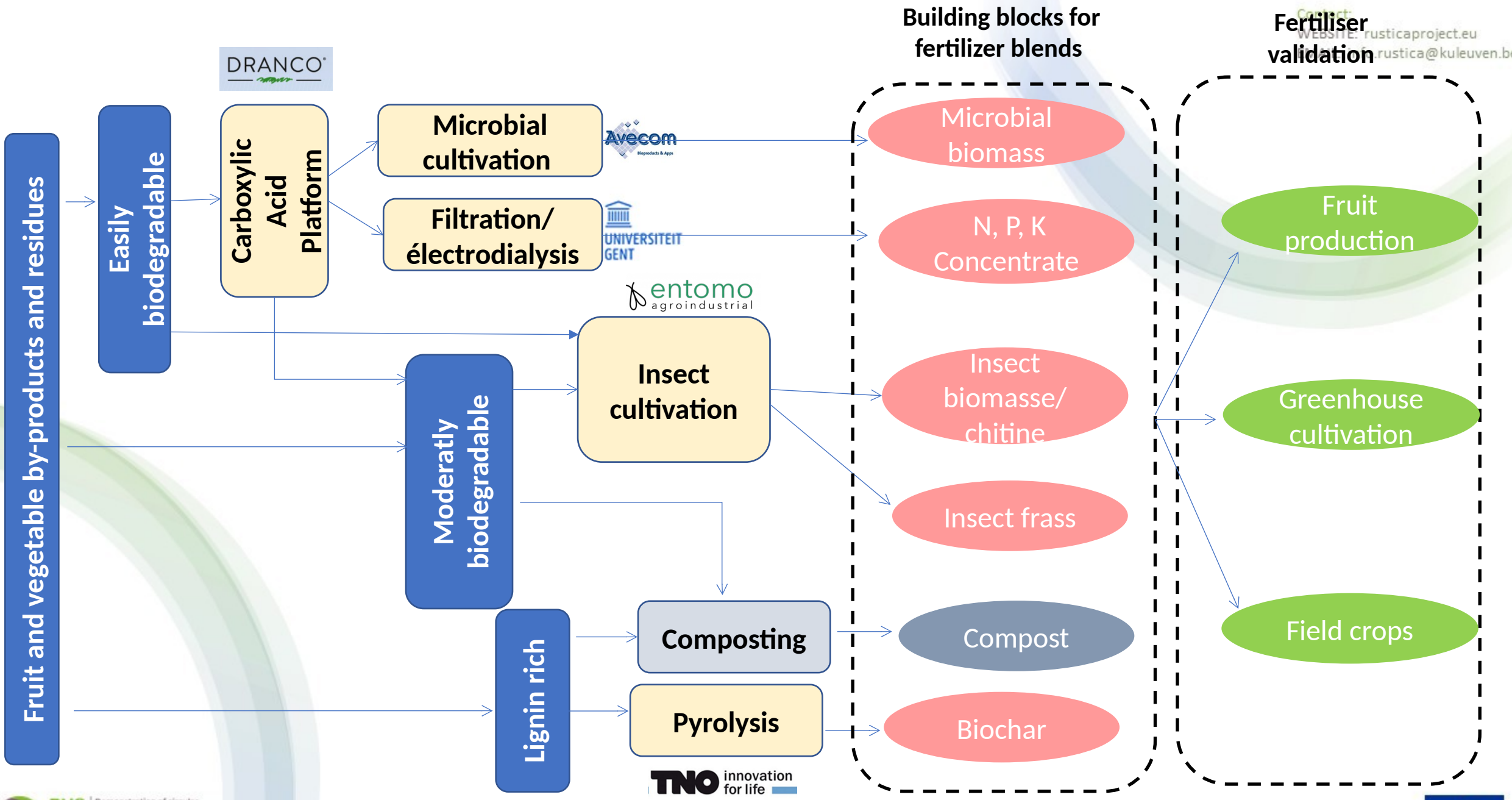
The five RUSTICA technologies



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From the fertilizer customer wish of the 5 regions to validating blends.

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Different stages

Production of building blocks by the 5 technologies
- On the Pilot units in Spain and Belgium

Caracterization of the building blocks
- Chemical and physical properties

Blends of building blocks
- Adapted to each region

Labs and pots trials Adaptation/validation of blends
- 15 prototypes tested

NEXT STAGE

Field trials

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Six building blocks for five main soil functionalities

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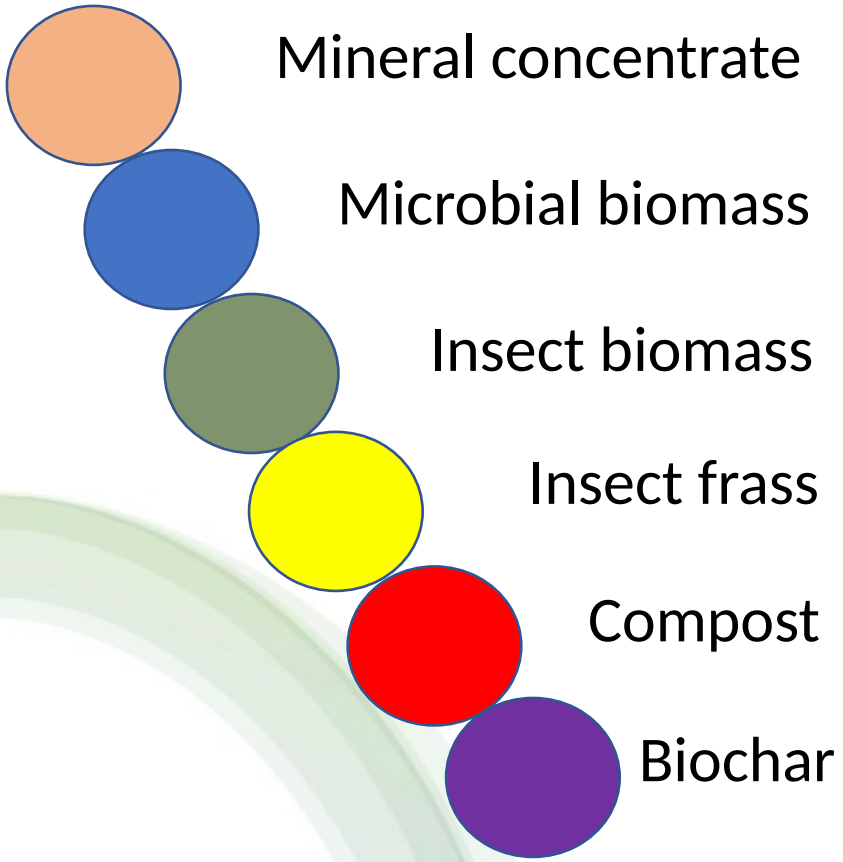

Mineral concentrate

Microbial biomass

Insect biomass

Insect frass

Compost

Biochar

Crop nutrition

Direct or via mineralisation

Soil life

Resilience, mineralisation, crop protection

Soil physics

Water retention, erosion, heavy metals

EcoSystem services

GHG-emission, Nitrate leakage, CO_2 -capture, biodiversity

Nutrient management and organic matter management in the soil

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Key characteristics of building blocks

Soil functionalities		Higher mineralisation	Higher resilience	Change in plant available nutrients	Higher water holding capacity	Lower erosi sensitivity CO_2 captur
Easy bio-degradable SOM	Microbial and insect biomass	+	+	+/-	-	-
Medium bio-degradable SOM	Insect frass	+	+	-	+/-	+/-
Recalcitrant SOM	Biochar	-	-	-	+	+
"Free" minerals	Mineral concentrate	-	-	+	-	-

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Characterization of the building blocks

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Chemical and physical analyses

Aims:

- Nutrient content (N,P, K etc.)
- Organic matter stability
- Toxic substances (heavy metals)
- Suitability for crop applications (EC)
- Variability in the composition

Soil addition

Aims:

- Evaluation of organic matter stability
- Impact on:
  - C and N mineralization
  - Nutrient availability
  - Soil microbial biomass content and activity
- N_2O emission
- CO_2 storage

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7-8 fertilizers/amendments experimented in the field of the 5 regions

Example : 3 fertilizers/amendments tested in the field in France (Pays de la Loire region)

	Composition du mélange (après 1 test en pots pour les mélanges solides)
Viticulture PdL-1 – solid – trials on grapes 4,3 T/ha **Arboriculture and market gardening PdL-1 - solid –** trials on lettuce 8,6 T/ha	Compost Biochar Biomasse microbienne Déjections d'insectes
Amendment PdL-3 - solid – trial in open field on 2 cover crops and after : beans	Compost Biochar
Soilless market gardening PdL-4 liquid – trials on cucumber **Tomato and cucumber production in heated and unheated greenhousesOpen field production**	Not possible at this time to produce the quantity of fertilizer needed for field trial. Rustica partners will do lab trials

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Business model

Business case development for RUSTICA

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Aim: to understand if **RBBF** is **technically** and **operationally feasible**, as well as **economically applicable** in the **RUSTICA regions**

Technical feasibility (WP5-WP7)

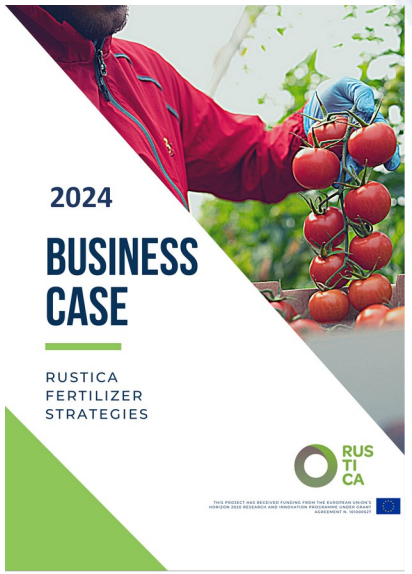
- Pilots and field experiments
  - Feedstock suitability
  - Soil fertility
  - Crop yield
  - Crop quality

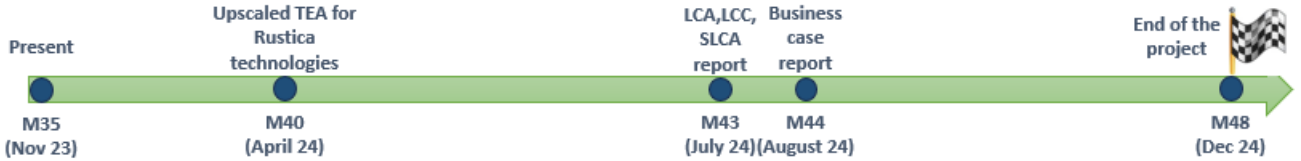
Operational (business) feasibility (WP4)

- Business model development:
  - Relevant market players and stakeholders
  - Required resources (facilities, equipment, materials, labour, transport, etc.)
  - Leverage points and bottlenecks

Economic feasibility (WP3)

- Net benefits/added value:
  - Required level of investment and operational costs
  - Return on investment (profitability and margins)
  - Other (environmental LCA, social, legal…)





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Business model development

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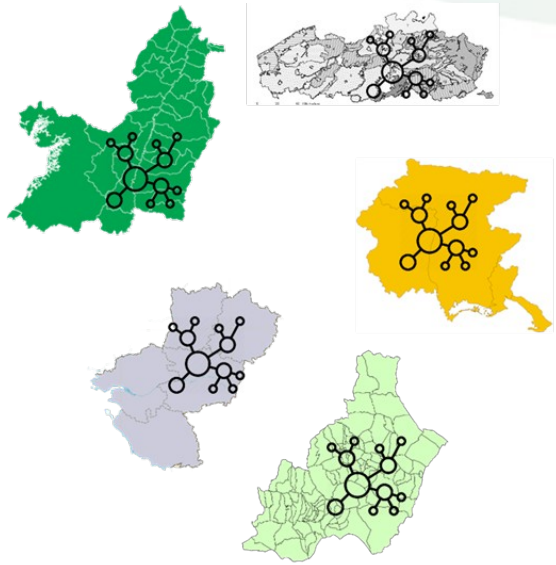
- **Key actors:** Who are the actors (names) likely to be involved in value creation? Who will be providing waste? Who will be processing waste? Who will be making RBBF?
- **Technologies & blends:** which technologies are available or needed for the region for the RBBF production?
- **Waste streams & quantities:** do each region have suitable and stable feedstock for building block production and what are the volumes?
- **Customers:** who are the potential users of RBBF?
- **Logistics structure:** what is the geographical distribution of key actors (locations) and Logistics requirements?



Product system description (value chain structure)

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Systemic feasibility study (WP3)

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A measure of the **potential** **environmental (LCA)** and **economic (LCC)** and **social (SLCA)** impacts associated with RUSTICA value chains

Rustica technologies

Environmental impacts (LCA)
- Use of resources (materials, energy, water, waste)
- Emission to air (e.g. GHGs, SO_2, NO_2, NO_x, VOCs)
- Emission to water and soil (e.g. N compounds, P compounds, heavy metals, chlorides, lead)

Economic impacts (LCC)
- Capital expenditures (e.g. land, building, equipment)
- Operational expenditures (e.g. labor, energy, materials)
- Other overheads (e.g. maintenance, insurance, tax)

Social impacts (SLCA)
- Workers (e.g. fair salary, H&S, discrimination)
- Consumers (e.g. product H&S, feedback mechanism, EoL responsibility)
- Local community (e.g. local employment, engagement)
- Society (e.g. technology development)
- Value chain actors (e.g. fair competition, promoting SR)

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Business model developpment

Blend code	Components	mass% (air dried weight)
PdL/1	Compost	
	Biochar	
	Micr. biomass	
	Insect frass	
PdL/3	Compost	
	Biochar	
PdL/4	Concentrate NPK	

Two types of fertilizers : solid and liquid

All the Rustica technologies useful to produce the building blocks but…

Some existing technologies in Pays de la Loire producing the building blocks

Which BM ?

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RUSTICA

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Rustica Project Consortium

(KU LEUVEN) University of Leuven
(OWS) Organic Waste Systems NV
(CRAPDL) Chambre Régionale d'Agriculture des Pays de la Loire
(BIO) BioSabor, S.A.T.
(CREA) Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria
(TEC) Fundacion para las Tecnologias Auxiliares de la Agricultura
(AVE) Avecom NV
(ENT) Entomo Consulting S.L.
(PAR) Particula Group d.o.o.
(WIED) Wiedemann GmbH
(IDC) IDConsortium SL
(CROP) Stichting CropEye
(EVILVO) Eigen Vermogen van het Instituut voor Landbouw, Visserij en Voedingsonderzoek
(TNO) The Netherland's Organisation of Applied Scientific Research
(UGENT) Universiteit Gent
(CIAT) Centro Internacional de Agricultura Tropical

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