Grant Agreement number: 101037031
Project acronym: FRONTSH1P
**Project title:** A FRONTrunner approach to Systemic circular, Holistic & Inclusive solutions for a new Paradigm of territorial circular economy
**Type of action:** Innovation Action (IA)

# ITALIAN REGIONAL ROADMAP: CAMPANIA REGION AND GAL IRPINIA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

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# Abbreviations

CCRI - Circular Cities and Regions Initiative
CE – Circular Economy
CEAP - Circular Economy Action Plan
CpEAP – CircuPuncture Economy Action Plan
CSS – Circular Systemic Solutions
CTC – Circular Territorial Cluster
ICT - information and communication technologies
LAP – Local Activity Place
LR – Lodzkie Region
NGO – Non-Governmental Organisation
RCT - Regional Cluster Team
SAT – self-assesment tool
SLOM – Stowarzyszenie Łódzki Obszar Metropolitalny (Lodz Metropolitan Area Association)
TRL - technology readiness level



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# STAGE I:
# Analysis of Conditions



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# 1 Stage 1: Analysis of Conditions

## 1.1 Characterization of CAMPANIA and GAL Irpinia

*Figure 1 Location of Campania*

Campania is one of the 20 Italian Regions; it is located in Southern Italy in the south-western portion of the Italian Peninsula (with the Tyrrhenian Sea to its west), its capital city is Naples. Campania has a population of 5,575,025 as of 2025, making it Italy's third most populous region, and, with an area of 13,590 km$^2$, its most densely populated region. Based on its GDP, Campania is also the most economically productive region in Southern Italy and the 7th most productive in Italy. It includes the metropolitan area of Napoli and the 4 provinces of Avellino, Benevento, Caserta and Salerno.

**Territorial Characterization of GAL Irpinia**

The GAL Irpinia's reference territory is located within the Province of Avellino. Specifically, it extends across three development systems (as identified by the Campania Territorial Plan): B4 - Valle Ufita, a system with a predominant rural-cultural focus; C1 - Alta Irpinia, a system with a predominant rural-manufacturing focus; and A12 - Terminio Cervialto, a system with a predominant naturalistic focus. The population within the area represented by GAL Irpinia is approximately 108.000 inhabitants, accounting for about 28% of the total population of the entire Province of Avellino [www.regione.campania.it]. (See *Figure 2)*



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GAL Irpinia is a Local Action Group (GAL) representing from local socio-economic interests, both public and private, who decided to join in a partnership to develop and implement participatory local development strategies. The primary objective is to foster the economic and social growth of the territory [https://www.galirpinia.it/].


*Figure 2 Comuni GAl Irpinia*

The economy of the area is primarily based on agriculture and livestock farming. Regarding the main agricultural crops, the region is particularly known for the cultivation of wheat, corn, and legumes. The GAL is distinguished by several excellent products, including the production of fine wines, with notable examples such as *Fiano di Avellino, Taurasi,* and *Greco di Tufo.* Additionally, the area boasts a long-standing tradition of excellence in the production of extra virgin olive oil and chestnuts.

As for livestock farming, the area is home to cattle and pig farms, with a strong tradition of artisanal meat processing. [https://fondoambiente.it/ ; http://www.irpiniadocg.it/]

**Circular Economy in Italy and in the GAL Irpinia Territory**

In Italy, the national strategy for the Circular Economy is outlined in the document *"Strategia Nazionale per l'Economia Circolare"* (2022), adopted within the broader framework of the National Recovery and Resilience Plan (NRRP – PNRR).

The Italian approach reflects the EU action plan and is structured around key thematic areas: sustainable production and consumption, waste prevention and management, and the



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promotion of secondary raw materials. Implementation operates on three levels: national, sectoral, and territorial. At the national level, legislation and incentives drive systemic change. At the sectoral level, priority is given to high-impact value chains such as agri-food, construction, textiles, plastics, and packaging.

At the territorial (micro) level, local development strategies are aligned with the principles of circularity, particularly in rural and inner areas.

Within this framework, Local Action Groups (GALs), such as GAL Irpinia, have integrated circular economy objectives into their Local Development Strategies (LDS), focusing on valorising local resources, reducing agri-food waste, promoting short supply chains, and encouraging the reuse of organic matter. Considering the agricultural and agri-food vocation of the area, particular attention is placed on CSS2 – Food and Feed, with actions supporting innovation in food processing and by-product valorisation. **Additionally, CSS3 – Water and Nutrients is relevant due to the presence of small production clusters related to agriculture and irrigation materials. These sectors offer strong potential for integrating circular solutions, particularly through eco-design, bioplastics, and organic waste and nutrient recovery initiatives.** [Source: MiTE, 2022; GAL Irpinia LDS 2023–2027; PNRR documents]

## 1.2 Characterisation of the food and feed industry

As mentioned in the previous paragraph, the GAL Irpinia area is distinguished by its excellence in agriculture, olive growing, and viticulture. For this reason, it is essential to implement best practices that help preserve biodiversity to ensure ecosystem resilience and species survival.

The area is characterised by a predominance of small and medium-sized farms engaged in sustainable and traditional agriculture. Key productions include high-quality wines (such as Fiano di Avellino, Taurasi, and Greco di Tufo), extra virgin olive oil, chestnuts, legumes, as well as staple crops like wheat and maize. Livestock farming, particularly cattle and pigs, plays a vital role in the local economy, supported by a strong tradition of artisanal meat and dairy processing. This agricultural profile aligns with national and regional priorities in circular economy strategies. Italy's National Strategy for the Circular Economy, embedded in the National Recovery and Resilience Plan (PNRR), emphasizes sustainable food systems, reduction of agri-food waste, and valorisation of local resources. At the territorial level, GALs like GAL Irpinia have begun implementing these principles through their Local Development Strategies. In this context, **CSS2 – Food and Feed** become highly relevant, given the potential for closing nutrient loops via organic by-product recovery, local feed production, and biodiversity preservation through germplasm conservation. Indeed, Campania is investing in



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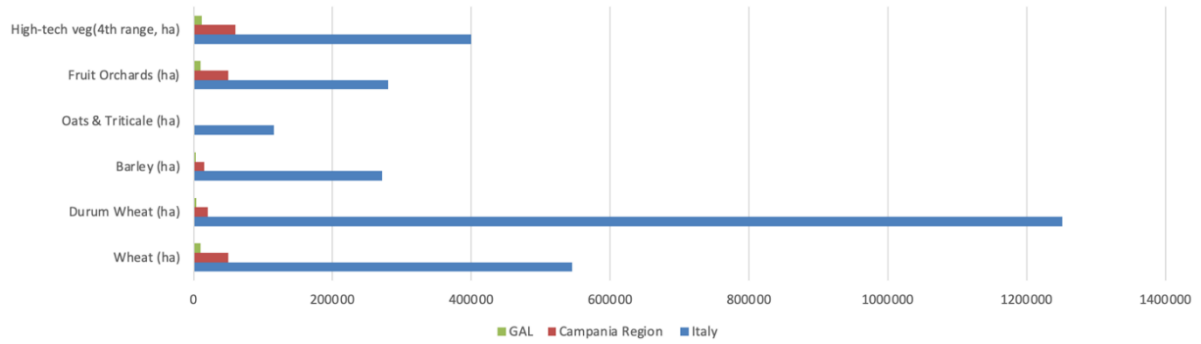
the safeguarding of native olive and grape cultivars—such as Ravece, Ogliarola Campana, Ritonnella, and Ruveia—further reinforcing resilience and sustainability. Although statistical data at the GAL level is limited, supporting evidence—including visual summaries of production volumes and agricultural typologies—confirms the region's readiness to serve as a pilot area for circular models in agri-food. Additionally, due to CSS2 and CSS3 sectors close relationship, **CSS3 – Water and Nutrients** may also be considered relevant, particularly in terms of promoting efficient water use, nutrient recycling, and sustainable irrigation technologies in synergy with local agricultural production chains.

*Table 1 Crop Production Data (2021–2023 average, Italy; estimates for Campania and GAL Irpinia)*

| Area | Cereals (% UAA) | Wheat (ha) | Durum Wheat (ha) | Barley (ha) | Oats & Triticale (ha) | Fruit Orchards (ha) | High-tech veg(4th range, ha) |
|---|---|---|---|---|---|---|---|
| Italy | 31% | 545000 | 1251000 | 272000 | 115550 | 280000 | 400000 |
| Campania Region | 28%* | 50000 | 20000 | 15000 | 5000* | 50000 | 60000 |
| GAL | 27%* | 10000 | 4000 | 3000 | 1000* | 10000 | 12000 |

* *Estimated data*




References:


- https://www.crea.gov.it
- https://www.oliveoiltimes.com/production/sustainability-biodiversity-good-for-business-this-campania-farmer-believes/
- https://agricoltura.regione.campania.it/PSR_2014_2020/]
- Faccini N, et. All 2023. Triticale in Italy. Biology (Basel).


**Primary animal production**

The GAL Irpinia territory is characterized by a rural and mountainous landscape, which fosters a strong tradition of livestock farming. Compared to the national average, Irpinia focuses more on small to medium-sized farms that prioritize quality and traditional methods over industrial scale. The main types of livestock in the area include cattle, sheep, goats, and pigs, with a strong emphasis on dairy production (notably for cheese such as caciocavallo and pecorino) and meat (especially lamb and pork).



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The following chart and table illustrate the estimated primary animal production in the GAL Irpinia area:

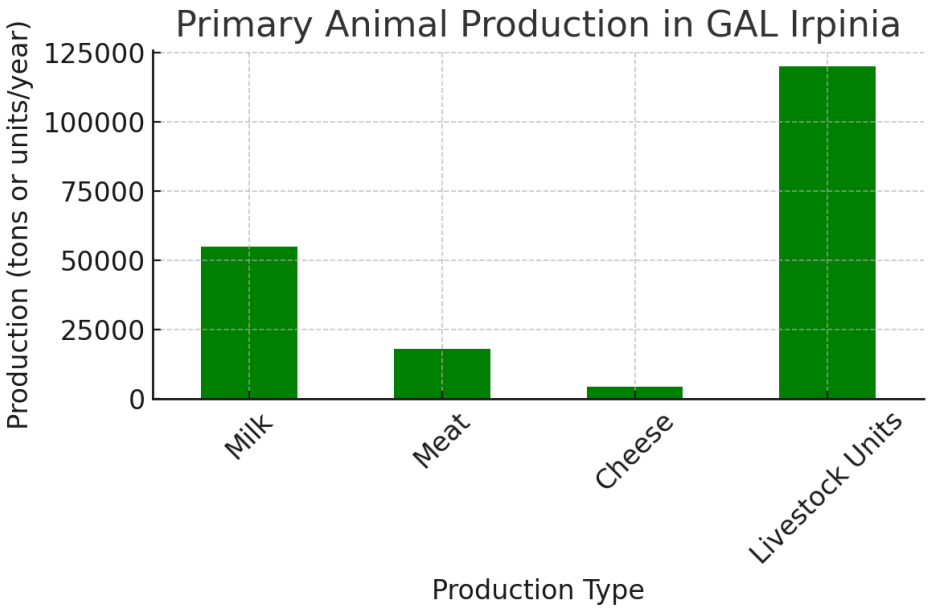


*Figure 3 Primary Animal Production in GAL Irpinia*

*Table 2 GAL Irpinia primary animal production per year*

| **Production Type** | **GAL Irpinia (tons or units/year)** |
|---|---|
| Milk | 55,000 |
| Meat | 18,000 |
| Cheese | 4,500 |
| Livestock Units | 120,000 |

Fishing and aquaculture are limited in the GAL Irpinia area due to its inland position, with activity mainly confined to small-scale freshwater aquaculture (primarily trout farming) and some marginal fishing in artificial lakes. The following chart and table show estimated aquaculture data for GAL Irpinia:



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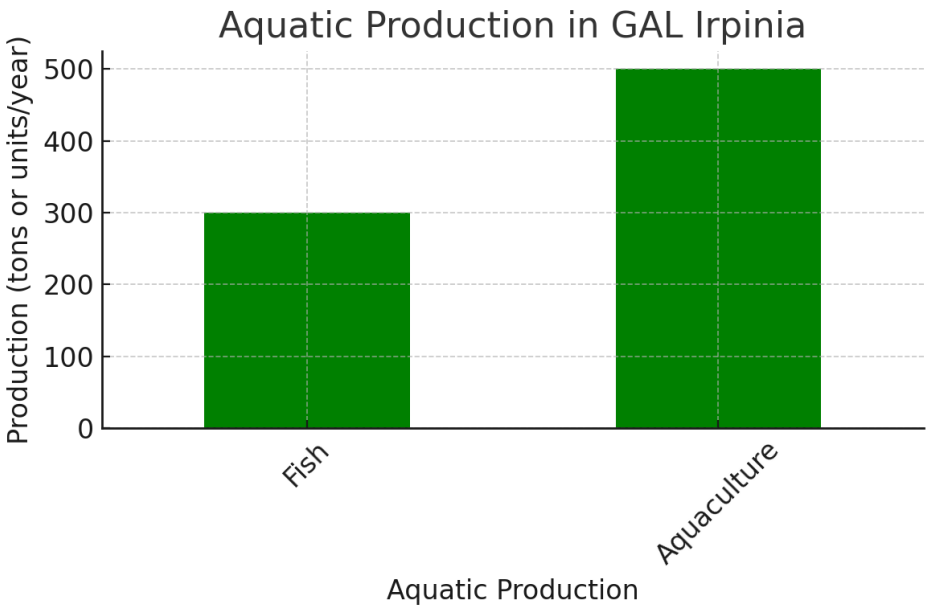


*Figure 4 Aquatic Production in GAL Irpinia*

*Table 3 GAL Irpinia Aquatic production per year*

| Aquatic Production | GAL Irpinia (tons/year) |
|---|---|
| Fish | 300 |
| Aquaculture | 500 |

A critical aspect of the animal production sector in Irpinia is the generation of organic waste, including manure, slaughter by-products, and dairy processing residues. These by-products, if not managed properly, pose environmental risks. Therefore, adopting circular economy principles is vital. This includes practices such as anaerobic digestion to produce biogas, composting for agricultural reuse, and recovering nutrients and water. Promoting cooperative models and local bioeconomy initiatives can help transform waste into valuable resources, supporting both environmental sustainability and rural economic development.

References:


- ISTAT (Italian National Institute of Statistics), 2023 Livestock and Aquaculture Reports.
- Regione Campania, 'Piano Sviluppo Rurale 2023'.


## 1.3 Characterisation of the water and nutrients sector

The economic activities with the highest turnover in the GAL Irpinia area are mainly related to agriculture and agri-food processing, followed by manufacturing and construction. Key sectors with relevance to water and nutrients include:



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- Food and beverage production (wine, dairy, preserved foods), which relies on clean water and nutrient recycling;
- Irrigation systems and water-efficient agricultural practices;
- Nutrient recovery from agricultural and food waste;
- Wastewater treatment and reuse technologies.

Although not always visible as a distinct industrial sector, the water and nutrients sector is increasingly strategic, linked to both environmental protection and innovation in agriculture. It includes activities classified under various ATECO codes such as 36 (Water collection, treatment and supply), 37 (Sewerage), and parts of 38 (Waste management).

Several companies and public utilities operate in wastewater treatment, irrigation technologies, and nutrient recovery. These include both SMEs and larger public-private consortia. Key municipalities active in this area include Carife, Lioni, Ariano Irpino, and Montella.

The use of advanced technologies such as phytoremediation, anaerobic digestion, and precision irrigation is expanding, particularly in rural and mountainous areas where traditional infrastructure may be limited.

The following graphs shows how the Campania region is the best southern Italy region in wate water and water reuse management.

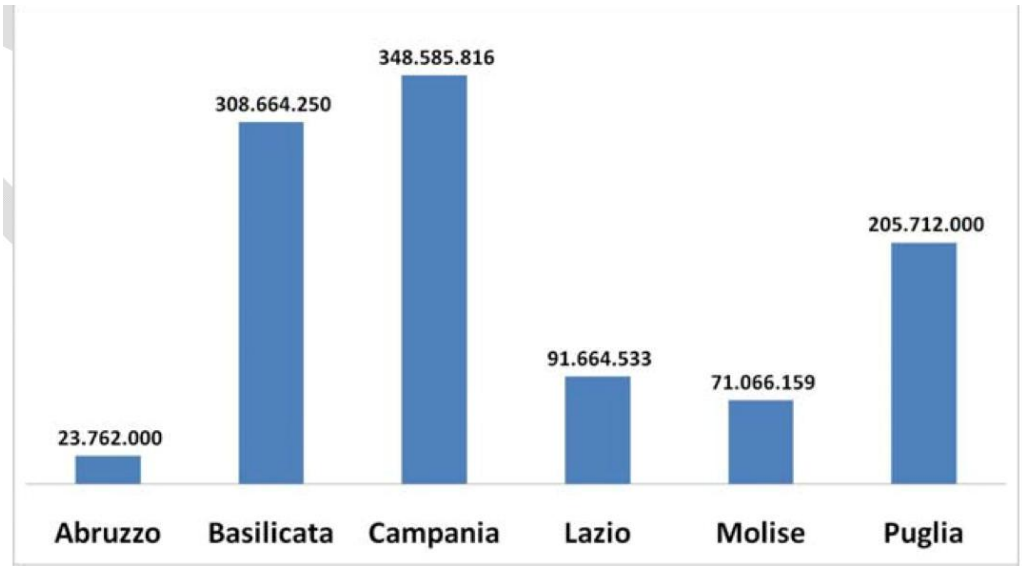


*Figure 5 Water waste and reuse management*

Reference: Tabella si sintesi regionale dei Consorzi di Bonifica – Fonte ANBI (*https://www.distrettoappenninomeridionale.it/images/_pdgAcque/I%20FASE/ELAB%20DI*



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*STRETTO/RELAZIONE%20GENERALE%20E%20ALLEGATI/Allegato%207%20%20Uso%20delle%20acque%20nel%20Sistema%20Agricolo.pdf?utm* )

## 1.4 Indicators

As in the rest of Italy, circular economy indicators at sub-regional level (such as in the GAL Irpinia area) are scarce or not directly available. The most relevant indicator currently published is the municipal wastewater treatment coverage rate (ISTAT, ISPRA), along with indicators related to water losses in distribution networks and nutrient pollution from agriculture (e.g. nitrates in groundwater).

For other indicators related to sustainable development in the water and nutrients sector, data are generally available at national or regional (Campania) level. Collaboration with ARPAC, ISTAT, or local water management authorities may be necessary to obtain granular data for monitoring.

A list of national indicators relevant to water management, nutrient recovery, and SDG targets (especially SDG 6 – Clean Water and Sanitation) is provided in **Annex I**. (https://www.istat.it/wp-content/uploads/2024/05/SDGs-2023-English-version-Ebook.pdf?utm , ISTAT).

## 1.5 List of projects implemented in the circular economy area

In recent years, several projects have been funded and continue to receive support to promote the circular economy in both the food and feed sectors, as well as in wastewater treatment and nutrient recovery. Below are some initiatives within the Province of Avellino, the area that encompasses the GAL Irpinia territory (Water and Nutrients) and some at Regione Campania level (Food & Feed)

### 1.5.1 List of projects in the Water and Nutrients sector

- **Phytoremediation plant in Carife** – A natural wastewater treatment system using aquatic plants and microorganisms. Managed by Multiservizi S.p.A., it treats over 6 million cubic meters of wastewater annually. [https://www.ottopagine.it/]

- **NUTRI-REUSE** – Nutrient recovery from agricultural runoff and wastewater for use in local fertilization cycles. Pilot tested in Campania (2023–2025).



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- **AQUA-AGRO** – Integration of precision irrigation systems and water reuse in vineyards and olive groves. Co-funded by the Ministry of Agriculture, started in 2022.

- **BIOLOOP H2O** – Development of closed-loop systems for water reuse in food processing plants. Partners include local cooperatives and universities.

- **WATER GUARD** – AI-based system for monitoring leaks and optimizing water distribution in rural networks. Under implementation in Irpinia Nord-Est (2024–2026)

### 1.5.2 List of projects in the Food and Feed sector

- **CARINA** – CARinata and CamelINA to boost the sustainable diversification in EU farming systems - Demo in Campania - The project focuses on new sustainable and diversified farming systems including 2 new oilseed crops, carinata and camelina, able to provide multiple low iLUC feedstocks for the bio-based economy. (2022–2026).

- **BRILIAN** – Circular Future for Rural Areas - The project focuses on the cultivation and use of low-input oil crops based on a circular approach in a regional pilot area. The raw materials produced are enhanced through sustainable processes, developing innovative agro-industrial supply chains for the production of bio-products with targeted applications. (2023–2027).

## 1.6 Analysis of barriers to implement a circular economy

The implementation of the Circular Economy takes place through circular business models. In particular, a circular transformation involves rethinking the value proposition, the value creation architecture, the revenue model, and the competitive strategy.

The German Economic Institute defines circular business models as follows: “Circular business models are business models that focus on enabling, closing, creating, or extending cycles while preserving value and conserving resources for as long as possible, while maintaining competitiveness.”

The economy is largely non-circular due to objective challenges that arise when companies attempt to adopt circular business models.



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The large-scale implementation of Circular Economy solutions faces several barriers, mainly due to the lack of reliable information that can quickly guide stakeholders toward the most sustainable choices. According to the specialized literature (Rizos et al., 2016), the barriers can be fundamentally classified as:

- **Corporate culture barriers**, stemming from resistance by management and employees toward "business-as-unusual" solutions.
- **Lack of capital**, a barrier created by the need for initial investments in innovative technologies and the costs associated with controlling and managing the supply chain;
- **Lack of adequate legislative support**;
- **Lack of information**, often due to corporate confidentiality and the lack of sharing successful paradigms;
- **Excessive administrative burden**, resulting from the need to produce reports, analyses, and other documents when accessing funding (regional, national, or European), often outsourced to external consultants, thereby incurring additional costs;
- **Lack of technical know-how**, often related to Linear Economy practices, which tend to be more cost-effective and easier to implement.

### 1.6.1 Barriers identified for CSS2 – Food and Feed

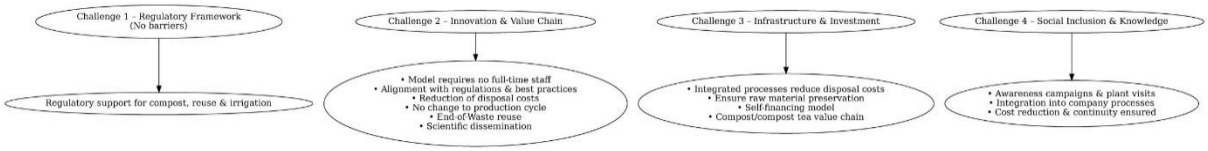


*Figure 6 Barriers identified for CSS2*

**Challenge 1 – Regulatory Framework**

The current regulatory context supports the proposed replication model for CSS2, as the technological solutions provided are regulated in the field of both recovery and reuse for irrigation and agricultural purposes (see Ministerial Decree 187/2005, Regulation EU 2024/1765). The regulatory framework also favors the use of natural organic fertilizers such as compost and compost tea. In conclusion, there are no regulatory barriers.

**Challenge 2 – Innovation, Product Design, and Value Chain**



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- **Lack of resources for innovation** – the technological solution proposed by GAL Irpinia within the replication model does not require full-time personnel.
- **Lack of motivation from companies to invest in local/sustainable products** – companies will align with the regulatory framework and best practices within the End-of-Waste approach.
- **Price factor associated with innovation** – the proposed technological solution is functional in reducing disposal costs for wastewater, liquid waste, and sludge. In terms of germplasm conservation, this guarantees continuity of activities.
- **Difficulty in modifying innovation-based processes** – the proposed solutions will not introduce changes to the production cycle of companies/businesses.
- **Traceability within value chains** – the value of the solutions translates into lower costs for businesses.
- **Use of waste for other purposes, such as water or soil treatment** – the proposed solutions foresee the end-of-waste status and reuse as secondary raw materials.
- **Mapping, analysis, and understanding of urban/regional metabolism to increase circularity and innovation (cross-pollination of ideas and opportunities)** – scientific dissemination activities will be promoted.
- **Lack of disruptive thinking and inertia to change** – scientific dissemination activities will be promoted.

**Challenge 3 – Infrastructure, Investment, Entrepreneurship**

- **Scale and continuous availability** – small companies may not be able to provide the scale and continuity of resources to be incorporated into other processes – this barrier is absent, as the proposed technological solution integrates and improves company management processes, leading to reduced waste disposal costs. Moreover, continuity over time will be ensured through raw material preservation.
- **Logistics, procurement of circular raw materials, waste disposal/treatment** – this barrier is absent, as the proposed technological solution integrates and improves company management processes, reducing waste disposal costs and ensuring continuity through raw material conservation.
- **Seasonality of production** – absent, as companies interested in replication must manage wastewater and waste issues on a daily basis.
- **Lack of resources** – the technological solution is self-financing as it reduces the cost of off-site water and waste disposal. The reuse of sludge as compost and/or compost tea helps create a value chain within the End-of-Waste framework.

**Challenge 4 – Social Inclusion, Awareness, and Knowledge**



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- **Lack of consumer literacy**: low consumer awareness regarding the use of natural systems for treating wastewater and waste – awareness will be raised through scientific dissemination and visits to existing plants.
- **Resistance of SMEs to innovation**: SMEs are accustomed to a linear economy; they are reluctant to experiment as it represents an additional investment – this barrier is absent, as the proposed technological solution integrates and improves company management processes, reduces waste disposal costs, and ensures continuity over time through raw material preservation.

### 1.6.2 Barriers identified for CSS3 – Water and Nutrients

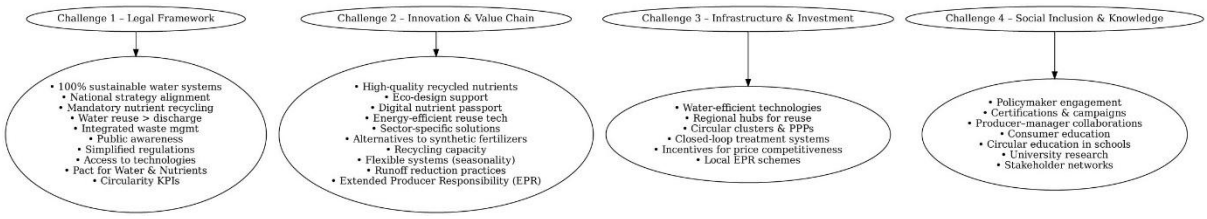


*Figure 7 Barriers identified for CSS3*

**Challenge 1: Legal framework**

- **100% sustainable water management** – Promote the design and implementation of water use systems that ensure full sustainability and compliance with EU water directives and national regulations.
- **National Strategy for the Circular Economy** – Ensure continuity and integration across regions (including Irpinia) in the implementation of the Strategia Nazionale per l'Economia Circolare, focusing on sustainable water and nutrient management, avoiding disruptions from government changes. Develop a coordinated regional-local strategy aligned with GAL Irpinia's sustainable development plans.
- **Mandatory nutrient recycling** – Consider legislative instruments to make nutrient recovery and reuse obligatory where feasible, especially in agriculture. Enforcement mechanisms must prevent greenwashing, based on ARERA and ISPRA guidelines.
- **Water reuse over discharge** – Increase investment in water treatment and reuse infrastructure to comply with Italy's Piano Nazionale di Gestione delle Acque, aiming to reduce freshwater extraction and pollution.
- **Management systems for nutrient-rich waste** – While some frameworks exist for organic waste, integrated management systems for nutrient recycling in agriculture and industry are needed, especially in regions like Irpinia.
- **Public awareness on water and nutrient conservation** – Develop and disseminate regional education campaigns tailored to local realities (schools, local authorities).



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- **Overregulation and compliance burdens** – Complex, overlapping national and EU regulations limit innovation in water and nutrient circularity. Simplification and clarification are needed, with input from local entities such as GAL Irpinia.
- **Technology for water and nutrient circularity** – Promote access to and deployment of advanced technologies for nutrient recovery and water reuse, especially in southern and rural regions.
- **Consumer literacy and PPP adaptation** – Adapt successful models like the Portuguese Water and Nutrient Pact to Italy (Italian Pact for Water and Nutrients), ensuring regional representation and action at the level of GALs.
- **Circularity metrics** – Establish standardized KPIs and measurement tools for water and nutrient circularity, integrated into GAL projects.

**Challenge 2: Innovation, product design and the value chain**

- **Quality of recycled nutrients** – Invest in improving nutrient recovery and processing infrastructure to produce high-quality recycled fertilizers aligned with national standards.
- **Eco-design** – Promote product and process designs that reduce water use and nutrient loss; support SMEs in Irpinia with guidance and incentives for eco-design in agriculture and industry.
- **Digital nutrient passport –** Prepare for the adoption of digital product passports (DPP) related to nutrient flows and water use, as planned under EU regulations, ensuring support for small producers.
- **Water reuse technologies** – Promote energy-efficient water-from-waste and nutrient recovery solutions in compliance with environmental regulations, ensuring minimal impact.
- **Sector-specific needs (e.g., agriculture, food)** – Address specific barriers to water and nutrient circularity in local agri-food businesses and clusters in Irpinia.
- **Alternatives to synthetic fertilizers** – Encourage life-cycle assessments (LCA) for bio-based nutrient sources and sustainable water treatments, following Italian and EU guidelines.
- **End-of-life for nutrient products** – Strengthen treatment and recycling capacity for nutrient-rich waste streams in southern Italy; improve sorting capabilities at the municipal level.
- **Seasonal agricultural sector** – Develop flexible systems for water and nutrient supply and reuse in Irpinia's agriculture, considering seasonal variability and best practices like shared irrigation and nutrient distribution systems.
- **Micro-nutrients and agricultural runoff** – Implement best practices to minimize nutrient runoff and micro-pollutants in agriculture; support valorization of nutrient-rich waste in local industries.



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- **Extended Producer Responsibility (EPR)** – Expand EPR systems to cover water and nutrient management products, considering small producers and rural contexts.

**Challenge 3: Infrastructure, investment, entrepreneurship**

- **Water-efficient technologies** – Prioritize the use of water-saving and nutrient recovery technologies in industrial and agricultural processes, especially in Irpinia's food and beverage sector.
- **Avoiding water resource depletion** – Develop regional hubs for water reuse and nutrient recycling to minimize environmental impact and costs.
- **Circular Economy Clusters** – Encourage cluster development in Irpinia to connect technology providers, water managers, and producers. Promote public-private partnerships through GAL-facilitated projects.
- **Water reuse systems** – Support innovation for closed-loop water treatment and reuse systems relevant to local environmental priorities.
- **Price competitiveness** – Address cost disparities between virgin and recycled water and nutrient inputs through national and regional incentives (e.g., tax credits or green public procurement).
- **EPR** – Further develop and enforce EPR schemes for water and nutrient-related products, with regional engagement via GALs to ensure local needs are met.

**Challenge 4: Social inclusion, awareness and knowledge**

- **Awareness among policymakers** – Engage local and regional authorities in dialogue to ensure legislation on water and nutrient circularity is feasible, effective, and locally adapted.
- **Quality perception of recycled water and nutrients** – Launch awareness campaigns and certifications to boost confidence in recycled-content products.
- **Promotion of recycled water and nutrients** – Facilitate collaborations between resource managers and producers to secure consistent, high-quality recycled feedstock.
- **Product and system recyclability awareness** – Promote labeling and consumer education to improve post-use water and nutrient recovery.
- **Circular Economy education** – Integrate water and nutrient circular economy principles into educational curricula and youth programmes supported by GAL Irpinia.
- **Academia partnerships** – Encourage research and experimentation on nutrient recovery, water treatment, and performance with universities in Campania.
- **Stakeholder engagement** – Foster a regional network of producers, resource managers, policymakers, and citizens to co-create solutions for water and nutrient circularity.



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## 1.7 Stakeholder and Supply Value Chain Analysis

The analysis has been performed at different scales, **Regional** and **Local** (GAL Irpinia).

The involvement and identification of stakeholder started with 2 regional level initiatives:

- The 2023 **EnergyMed**, **Conference Exhibition on Renewable Sources and Energy Efficiency**, in which the FRONTSH1P Project and approach has been first presented;
- The 2024 **GREEN MED Expo & Symposium** in a dedicated conference on June 13th, with the participation of a representative from the Circular Cities and Regions Initiative CCRI, the presentation of each of the CSSs and the direct involvement of the Campania Regional Authority.

Programs of the events are available in Annex 2.

The first identification of stakeholders at regional level included mainly **Research Centres** or **Universities** from the different provinces:

- **Agritech,** the National Research Center for Technology in Agriculture (with main office in Naples), CSS2;
- **CREA,** Council for Agricultural Research and Economics, the center on *Cereal and Industrial Crops* is located in Caserta, CSS2;
- **National Research Council,** their *Institute for Composite and Biomedical Materials IMCB* is located in Portici (NA), CSS2 - CSS3;
- **University of Naples Federico II** with its dedicated *University Task Force (TFdA) in Circular BioEconomy (BEC)*, CSS2 - CSS3;
- **University of Salerno** with its *Department of Chemistry and Biology*, CSS2 - CSS3.

The Campania Regional Authority has been interacting with the FRONTSH1P partners since the proposal stage, but did not actively participate in the activities.

A second step was related to the **GAL Irpinia** area, located in the Province of Avellino (Irpinia) and grouping 44 municipalities, 3 mountain communities, various public organizations and private enterprises (mainly SMEs) where different categories of local stakeholders were identified:

**Research Centres** or **Universities**

- **University of Naples Federico II**, the *Department of Agriculture* has its *Abellinum Enological Center* in Avellino, CSS2*;*



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- **Centro Diagnostico Baronia**, private research centre supporting R&D activities on environmental and waste management, biofiltration and bioremediation systems, CSS2 - CSS3.
- **National Biodiversity Future Center (NBFC)** a national initiative implementing a research action on *Biodiversity and Anthropogenic Impact in the Partenio regional Park*, CSS2.

**Government**

- **Città dell'Alta Irpinia,** a special aggregation of municipalities promoted by the Department for Cohesion Policies of the Presidency of the Council of Ministers, with the aim of supporting the potential of the territory and promote its sustainable development, CSS2 - CSS3.

**Civil Society**

- **Consorzio di Bonifica dell'Ufita**, a consortium dedicated to land reclamation and water management, CSS3;
- **Biodistretto d'Irpinia**, association operating in the province of Avellino, promoting sustainable development through organic farming and enhancement of the local natural and cultural resources, CSS2;
- **Confederazione Italiana Agricoltori** di Avellino, provincial charter of the national organization dedicated to the safeguard and promotion farmers, CSS2.
- **Federazione Provinciale Coltivatori Diretti** di Avellino, provincial charter of the largest association representing and assisting Italian agriculture, CSS2.
- **Alto Calore Servizi,** a public company that manages water collection, supply, and distribution services in the province of Avellino, CSS3.

**Business**

Many small businesses have been identified, mainly small farming business (CSS2), oil producing companies (CSS2, CSS3) and agronomists (CSS2).

## 1.8 Engagement of stakeholders

After the initial regional stakeholder identification and engagement actions, various activities have been organized at GAL Irpinia level, in different locations in Irpinia to have a wider local outreach, a final event will be performed in the last month of the Project.

| **Stakeholder engagement.** ***Activities*** | **Total Participants** | **Business** | **Academia/ Research Centres** | **Civil Society/ Governmental Agencies** |
|---|---|---|---|---|



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| | | | | |
|---|---|---|---|---|
| *1st General meeting* | 13 | 3 | 4 | 7 |
| *2nd Meeting – CSS2* | 17 | 17 | | |
| *3rd Meeting – CSS2* | 10 | 10 | | |
| *4th Meeting – CSS3* | 8 | 8 | | |
| *5th Meeting – CSS3* | *tbd* | *tbd* | *tbd* | *tbd* |

### 1.8.1 Dialogue Council

The first meeting in Grottaminarda was a general introductory meeting, with representatives of different stakeholder categories, that were originally identified as local Key Players.

A specific committee named "**L'Economia Circolare per crescere insieme**" – Circular Economy to grow together - was created. Such Committee, chaired by GAL Irpinia, will act as the core group of the local dialogue council.



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# Stage II: Resources & Missions Selection



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# 2 Stage 2: Resources & Missions Selection

The Campania Region, with its 6 million inhabitants, is one of the most densely populated regions in Southern Italy. While the coastal areas are well known for tourism, the inner areas of the region have a very important value for agriculture and environment. From a geographical point of view, the Campania region can be divided into two areas: one mountainous and one flat. The mountainous area includes the Campania Apennines, formed by a series of elevations and plateaus stretching across the provinces of Benevento, Avellino (Irpinia) and part of the province of Salerno (Cilento). It is an area very rich of waters, and thanks to the Calore river and its tributaries Ufita, Tammaro and Sabato it is the e largest hydrographic basin in southern Italy. The flat area is not a single surface, but is divided into two big plains. The northern one is bathed by the river Garigliano and by the river Volturno; such area surrounds the gulf of Naples and and Mount Vesuvius. The second plain pens onto the Gulf of Salerno and is bathed by the river Sele, also originated in Irpinia. There are several regional areas of excellence that will play a decisive role for investments related to green and digital transition and the Campania Region can offer a strong focus on innovative content, particularly related to sustainability. Campania is building its green transition on its focal areas: the conservation of its natural water assets, the agri-food sector, an ecosystem of innovation, the maritime economy, the aerospace district and tourism.

The Frontsh1p activities have been focusing in the **Irpinia province** and in particular on the municipalities associated with **GAL Irpinia**, characterized by a strong agricultural and agri-food vocation, with high-quality productions (DOCG wines, extra virgin olive oil, chestnuts, legumes, cereals, dairy) and a fragmented but valuable production fabric.

The priority areas for circular transition in the **GAL Irpinia** territory are in line with the main Regional focuses and will refer to:

- CSS2 – Food & Feed: valorization of agricultural and agri-food residues, sustainable management of livestock and dairy by-products, reduction of food waste, and industrial symbiosis.

- CSS3 – Water & Nutrients: integrated water resource management, nutrient recovery from wastewater and sludge, treatment technologies, and water reuse in agriculture.

The territory is ready to pilot circular models thanks to the presence of cooperatives, agri-food companies, local authorities, and Campania universities, but barriers remain at infrastructural, economic, and regulatory levels.



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**Territorial Profile**

- GAL Irpinia area: ~108.000 inhabitants (28% of Avellino Province population). Includes Valle Ufita, Alta Irpinia, and Terminio Cervialto systems.
- Economy: dominated by agriculture and livestock, with SMEs in manufacturing and agri-food transformation.
- Typical productions: Fiano di Avellino, Taurasi, Greco di Tufo wines; Ravece olive oil; Montella chestnuts; cereals and legumes.
- Livestock: cattle, pigs, sheep, and goats, with dairy (caciocavallo, pecorino) and meat production.

## 2.1 CSS Definition

### 2.1.1 CSS2 – Food & Feed

Agriculture is centered on wheat, maize, legumes, vineyards, and olive groves, with DOP/IGP products. Livestock counts 120,000 LU, producing ~55,000 tons milk, 18,000 tons meat, 4,500 tons cheese annually. Relevant residues include grape pomace, olive mill wastewater, cheese whey, meat by-products, and cereal residues.

**Possible application opportunities for CSS2:**

- Anaerobic digestion (biogas/biomethane)
- Composting and organic fertilizers
- Recovery of nutrients and feed ingredients
- Upcycling (fibers, extracts, biobased products)

**Identified Barriers for the implementation of CSS2:**

- Limited investment capacity of SMEs
- Territorial dispersion of productions
- Lack of collection and treatment infrastructures
- Low awareness and resistance to change



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### 2.1.2 CSS3 – Water & Nutrients

Key sectors: viticulture, dairy, fruit & vegetables, cereals. Water management is supported by consortia. Ongoing projects: Phytoremediation (Carife), NUTRI-REUSE, AQUA-AGRO, BIOLOOP H2O, WATER GUARD.

**Possible application opportunities for CSS3:**

- Wastewater treatment and reuse (phytoremediation)
- Nutrient recovery for fertilization
- Precision irrigation and smart monitoring systems
- Creation of water-nutrient clusters and PPPs

**Identified Barriers for the implementation of CSS3:**

- Complex and overlapping regulations
- Low public awareness on water reuse
- Limited adoption of advanced technologies in rural areas
- Cost competitiveness of virgin vs. recycled inputs

The entire reference value chain for both CSSs is summarized below:

- **Institutions** - Campania Region, Province of Avellino, municipalities (GAL Irpinia);
- **Consortia/Cooperatives** - Montella chestnuts, DOCG wine consortia, Ravece olive oil, dairy and cereals cooperatives;
- **Agri-food SMEs** - wineries, olive mills, dairies, cereal processors;
- **Water & Waste managers**: Multiservizi S.p.A., irrigation consortia, provincial waste companies;
- **Research & universities**: University of Naples Federico II, University of Salerno, University of Campania, CNR, CREA centres.

## 2.2 Combined SWOT Analysis related to the application of both CSS2 and CSS3

The analysis is based on overall regional regulations and strategies.

From a regulatory point of view, the Campania Region promulgated Regional Law n°14 in 2016 to establish an active undertaking geared towards the implementation of a model of



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circular economy, with associated aims of sustainable development and realization of the principles of a bioeconomy. Such Regional Law states that:

"*Campania Region assumes as a reference for its actions in the field of waste treatment the priorities established at European and National regulation:*

- ***prevention**, as a set of interventions aimed at reducing the production of waste at the source;*
- ***preparation for reuse**, aimed at promoting the reuse of products or components not to be considered waste;*
- ***recovery**, for purposes other than recycling, including energy production;*
- ***disposal**, as a residual and minimal system for non-treatable waste*

*The Campania Region recognizes the validity of the principles of the circular economy, whereby waste from a production and consumption process circulates as a new entry into the same or a different process, giving rise to a new model of production and consumption which aims at eliminating waste, through high-level innovative design of materials, reuse of goods, reconditioning of the product, regeneration of components."*

Additionally, *"the Region pursues the creation of a circular economy model through concrete actions and supports, also with reward criteria in the allocation of European, state and regional resources, scientific research aimed at the design and production of reusable, repairable and recyclable goods and research on materials used in production cycles in order to minimize the environmental effects of their production and their post-consumption management, helping to encourage the reduction of the use of virgin raw materials and the maintenance of resources within the production cycle as much as possible as long as possible, to offer consumers durable and innovative products capable of generating savings and improving the quality of life."*

The same law sets the following objectives:
a) at least 65% of separate waste collection
b) for each separated fraction, at least 70 % of material actually recovered.

From a strategic point of view, the **Smart Specialization Strategy** addressed the future innovation needs for the Region's economic development and has defined various technological trajectories specifically dedicated to circularity, some of those have been directly inspired also by the FRONTSH1P CSSs:

- Wastewater treatment using sustainable technologies; Innovative models and advanced technologies for waste treatment and recycling;
- Development of advanced digital technologies to support "industrial symbiosis"



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- Materials and components from Circular Systemic Solutions for green cities
- Enhancement of organic waste and sludge for the production of bioplastics and biochemicals

Based on these assumptions and taking into account the positive approach to circularity that, in principle, the Campania Region has declared, the following analysis refers to the possible application of and CCS2 and CSS3 in the GAL Irpinia territory, that can guide further replication on a wider regional scale.

**Strengths:**

- high-quality productions,
- strong agricultural tradition,
- local cooperation,
- pilot projects,
- Presence of universities and research.

**Weaknesses**:

- fragmented SMEs,
- limited investment capacity,
- insufficient infrastructures,
- lack of territorial data.

**Opportunities:**

- EU and national funds (PNRR, PSR),
- biomethane market,
- sustainable product demand,
- water reuse technologies.

**Threats:**

- climate change,
- international competition,
- negative perception of recycled products,
- complex regulatory framework.

Additional Resource Missions will be investigated, also beyond the project lifetime, applying the 4NO Filter approach in order to identify: Areas of NOT developed resources; Areas of NOT closed added value chains; Areas of NO adaptation to climate change and Areas of NO convergent activities.
Such approach, in a very densely and developed Region as Campania, is not always applicable but it is advisable and will be proposed for a wider Regional Circular Economy Action Plan of Campania.



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## 2.3 Conclusions

Irpinia, with GAL Irpinia as territorial facilitator, has the right conditions to be a piloting territory for CSS2 and CSS3 replication. The overall challenge lies in the coordination between institutions, enterprises, and research, taking into account access to financing, and the integration of innovation and tradition into practical circular models.

Ther activities will continue and the next steps will focus on:

- Mapping local agri-food by-products and wastewater streams;
- Piloting anaerobic digestion plants for grape pomace, olive wastewater and cheese whey;
- Promoting water-nutrient clusters with irrigation consortia and farmers;
- Promoting industrial symbiosis agreements between SMEs and treatment plants;
- Capacity building for SMEs and cooperatives on circular economy models and access to funding.

The following indicators will be used to assess the success of the local Irpinia actions:

- Tons of biowaste collected and exploited;
- Local biogas/biomethane production;
- % of treated and reused wastewater;
- Nutrients recovered and reintegrated in agriculture;
- Number of industrial symbiosis agreements;
- Number of SMEs engaged in pilot projects.



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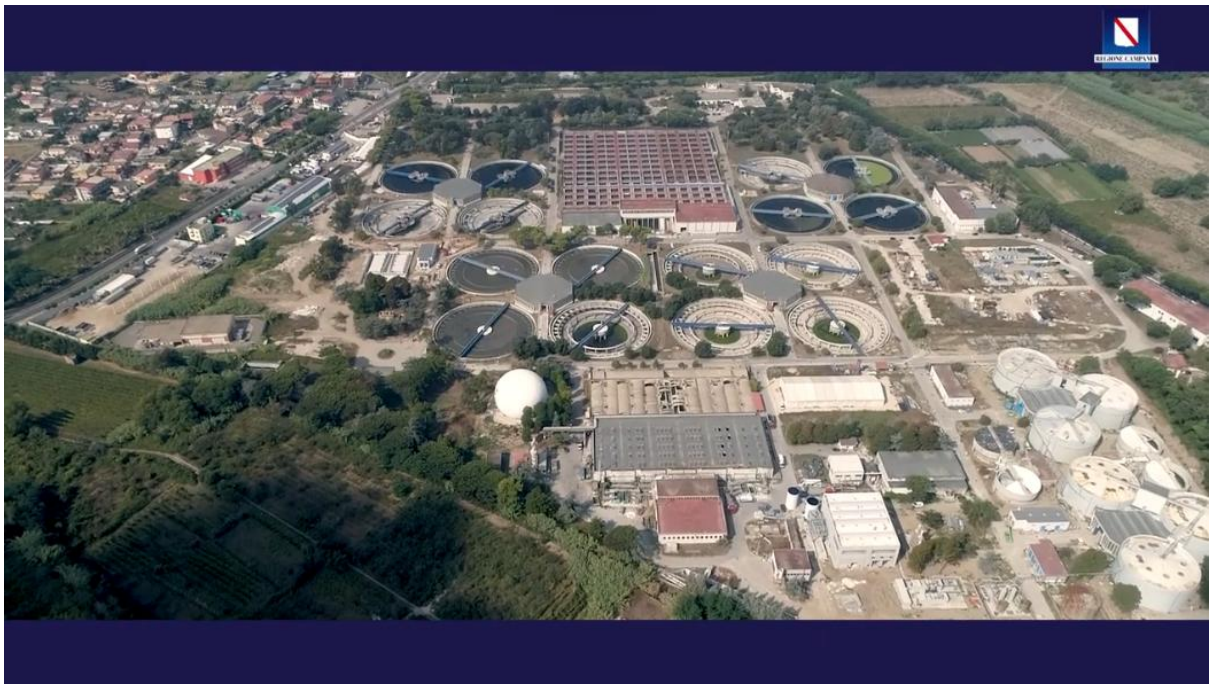
# STAGE III: CHALLENGES



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# 3 Stage 3: Challenges

The circular challenges identified in previously defined Resource Missions (Stage 2) emphasise sustainability, innovation and adaptability. Circular Challenges will often require circular innovative solutions, sometimes they will require circular systemic solutions (CSS). The catalogue of challenges is open and includes, for example:

1. legal framework
2. innovation, product design and value chain
3. infrastructure, investments, entrepreneurship
4. social inclusion, awareness, and knowledge

The implementation of circular challenges is a kind of 'circular acupuncture' targeting 'touch-shot' at key initiation points. It implies a point-of-care approach to intervening in different areas of resource management in the region. The identification of challenges responds to previously diagnosed potentials, barriers and incentives (see step one). Challenges can be interdependent, meaning that the implementation of one of the Circular Challenges in a Mission can affect the implementation status of other Missions.

The tables below describe the challenged identified in Campania Region – GAL Irpinia, for CSS2 and CSS3:

*Table 4 CSS2 Challenges*

| CSS 2<br>Food and Feed | |
|---|---|
| **Legal Framework** | |
| Regulatory and Legislative Reforms | Clarify the distinction between waste and end of waste (EoW) that can be used as secondary raw materials or for bioenergy production |
| | Update assessment standards for waste and end of waste (EoW) from pre-selected organic waste |
| | Ensure that input waste analyses and output waste streams, including impurities from all treatment facilities, comply with the EU Waste Framework Directive (2008/98/EC) and Directive (EU) 2018/851, and that records are maintained in the National Electronic Waste Traceability Registry (RENTRi). |
| | Establish Municipal Collection Centers (MCCs) to collect, sort and recycle municipal waste at source. |



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| | |
|---|---|
| Local Level | Bioactive composters: small-scale, proximity-based micro-plants for the recycling of green pruning and grass clippings. Develop local value chains that avoid costly transport and enable the recovery of these residues as end-of-waste products. |
| | Encourage knowledge sharing to improve collection efficiency by facilitating regular exchanges between regional and local departments. |
| Governance | Reduce waste treatment fees for companies that deliver waste to bioactive composters. |
| | Introduce fiscal incentives to support the construction of small-scale treatment plants across different categories. |
| **Awareness and Knowledge** | |
| Education | Encourage local communities through information campaigns and training initiatives to adopt circular approaches to organic waste management. |
| | Provide education and training programmes for local circular economy leaders on efficient municipal waste management. |
| | Promote 'Reduce, Reuse, Recycle' principles as educational activities in schools. |
| Information and Promotion | Carry out information campaigns on food and feed waste processing options, aligned with circular economy principles. |
| | Develop special awareness-raising programmes focused on food waste prevention and reduction. |
| | Develop and implement an ongoing social media campaign focused on organic waste management. |
| | Formulate proposals and measures to strengthen knowledge and communication on circular economy topics. |
| **Infrastructure** | |
| Infrastructural investments | Support capital investments for Municipal Collection Centers (MCCs) and small-scale treatment facilities. |
| **Financing** | |
| Governance | Promote the use of EU structural funds for initiatives that support the local circular value chain (e.g., Memorandum of Understanding between the Region of Campania and GAL Irpinia). |
| | Develop sustainability criteria for funding and implementing biomass projects by establishing multi-stakeholder working groups. |
| | Provide incentives to citizens through compensation schemes for those implementing home composting. |



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*Table 5 CSS3 Challenges*

| CSS 3<br>Water and Nutrients | |
|---|---|
| **Legal Framework** | |
| Regulatory and Legislative Reforms | Complete the legislative framework for local wastewater management to facilitate safe reuse and nutrient recovery. |
| | Reference Regulation (EU) 2020/741 as the basis for agricultural reuse of treated wastewater; ensure local implementation for agricultural applications from 26 June 2023 onwards. |
| | Develop a methodological framework to measure and monitor wastewater quality consistently across the territory. |
| | Define local standards for the reuse of treated water in agricultural applications, aligned with Italian and EU regulations. |
| Local Level | Support the deployment of phytopurification (constructed wetland) plants in agricultural areas not served by sewerage systems. |
| | Convert sludge dewatering beds at existing treatment plants into phyto-dehydration systems to reduce sludge volumes destined for landfill. |
| | Encourage knowledge sharing through regular exchanges among regional wastewater management agencies. |
| Governance | Support the deployment of phytopurification (constructed wetland) plants in agricultural areas not served by sewerage systems. |
| | Support the deployment of phytopurification (constructed wetland) plants in agricultural areas not served by sewerage systems. |
| **Awareness and Knowledge** | |
| Education | Encourage local communities through information campaigns and training initiatives to adopt circular approaches to organic waste management. |
| | Provide education and training programmes for local circular economy leaders on efficient municipal waste management. |
| | Promote 'Reduce, Reuse, Recycle' principles as educational activities in schools. |
| Information and Promotion | Carry out information campaigns on food and feed waste processing options, aligned with circular economy principles. |
| | Develop special awareness-raising programmes focused on food waste prevention and reduction. |
| | Develop and implement an ongoing social media campaign focused on organic waste management. |



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| | |
|---|---|
| | Formulate proposals and measures to strengthen knowledge and communication on circular economy topics. |
| **Infrastructure** | |
| Infrastructural investments | Support capital investments to construct consortium-based wastewater treatment plants employing phytodepuration technologies. |
| **Financing** | |
| Governance | Promote the use of EU structural funds for initiatives that support the local circular value chain (e.g., Memorandum of Understanding between the Region of Campania and GAL Irpinia). |
| | Develop sustainability criteria for funding and implementing biomass projects by establishing multi-stakeholder working groups. |
| | Provide incentives to citizens through compensation schemes for those implementing home composting. |



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# Stage IV:
# Action Plan





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# 4 Circular Economy Action Plan for Campania Region: GAL Irpinia - CircuPuncture Action Plan

Regional Law No. 14/2016 assigned to the **Campania Regional Authority**, among the others, the power to promote measures to reduce the quantity of waste, encouraging prevention, recovery of raw materials, and reuse, also with reference to the principles of the circular economy. In 2019 the Region formally launched the process of revising/updating the **Regional Plan for Special Waste Management** in order to equip itself with a planning tool adapted to the changed European regulatory framework, economic, social, and technological changes also taking into account updated data on waste production and regional plant requirements. Such regional plan also included the promotion of measures to reduce the quantity of waste, encouraging prevention, recovery of raw materials, and reuse, also with reference to the principles of the circular economy.

In 2020 the Region has decided to prepare a regional circular economy model for the efficient management of resources in the Campania Region and initiated a process of knowledge sharing with representatives from the academic and productive worlds to define a common direction and concrete actions in order to implement a circular economy model at the regional level. Such process led to the establishment of a Discussion and Contribution Table, chaired by the Vice President together with the Councilor for Productive Activities and Scientific Research, with the participation of the heads of the relevant regional structures, representatives of Campania universities, the National Research Council, Confindustria Campania and the Foundation for Sustainable Development that, through a prior collaboration agreement with the Campania Region, provided technical and scientific contributions to the development of the circular economy model for the Campania Region.

Such “Regional Round Table on the Circular Economy” produced a document describing a “Circular economy model for the efficient management of resources in the Campania Region”. Such a document included an analysis of the economic structure of the Campania Region for the definition of a circular economy model comprising detailed analysis on different sectors including: Agriculture and the Food Industry, Construction and Infrastructure Sector (including Wastewater Management) and other Industrial sectors; it also reported that with regard to the plant capacity dedicated to the treatment of individual separated fractions, there is a deficit in the treatment of organic waste, while in relation to wastewater management the region boasts a large number of wastewater treatment plants (473 plants), 65% of which are secondary or advanced level, nevertheless in specific rural areas the need for wastewater treatment is not fully satisfied.



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In the same year, the Campania Region expressed interest in the FRONTSH1P proposal and signed a Letter of Support expressing interest in evaluating a regional adaptation of the circular economy approach proposed by the FRONTSH1P Project.

During the FRONTSH1P project duration there has been a continuous interaction between the local partners involved in the replication activities in Campania and the Regional Authority. Such interaction led to the development of several joint initiatives, the latest of which, was the organization of the WP8 workshop at the GA in Naples (July 2025), when the region hosted the entire consortium and presented a formal Collaboration Agreement based on the results of FRONTSH1P (Executive Decree No. 307 of July 2, 2025).

The agreement was signed by Campania Region and GAL Irpinia and is aimed at an institutional collaboration agreement for activities involving the recovery of residual vegetal biomass outside the waste circuit as well as the treatment and reuse of civil wastewater in rural areas. Based on these premises, the Circular Economy Action Plan proposed hereafter focuses on the GAL Irpinia area and is referred specifically to the issues covered by the agreement and is based on the local adoption of the CircuPuncture methodology.

This **CircuPuncture Economy Action Plan for the GAL Irpinia** area is focusing on CSS2 and CSS3 and will be presented to the Campania Regional Authority to be used as a Guideline for the entire Campania Region Circular Economy Action Plan.

The Collaboration Agreement is the fundamental framework for the implementation of this process which consolidates the role of GAL Irpinia.

Since the GAL Irpinia area includes both small-scale urban centers and large rural areas predominantly devoted to agriculture and forestry, the approach will be differentiated and tailored to the characteristics of the territory. This means identifying tailor-made solutions: more advanced infrastructure and services in urban areas; community management models, and widespread facilities in rural areas.

## 4.1 CircuPuncture Economy Action Plan for GAL Irpinia

The GAL Irpinia area is characterized by a vast and diverse rural landscape, with a strong agricultural and forestry tradition. However, it is currently facing very specific challenges that require innovative solutions for the development of a circular economy.

These challenges are of technical, legislative and organizational nature: the fragmentation of agricultural and agri-food businesses, the lack of synergy between producers, processors, and researchers and, finally, the difficulties associated with the sustainable management of



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agricultural waste and residues. In addition to these critical issues, there are cultural and economic factors, as the benefits of the circular economy are not yet fully perceived by local businesses and communities.

From a geographical point of view, the extent and dispersion of rural settlements hinder the development of structured collaborations: the access to common infrastructure and services for the treatment of by-products and waste are more complex than in the rest of the region. Stakeholders are located at different points in the value chain—from primary production to processing and distribution—with the result that operations are still predominantly conducted according to traditional linear models.

Some local experiences are already showing signs of alignment with the principles of the circular economy, especially in sectors such as wine, olive oil and livestock farming, but these initiatives need to be strengthened through targeted incentives, local promotion activities, and demonstration pilot projects.

In this scenario, GAL Irpinia and the local administrations play a crucial role: although they cannot intervene directly in regulatory matters, they can promote sustainable practices, support processes of aggregation between companies and activate technical and organizational tools aimed at strengthening the competitiveness of supply chains. At the same time, they can stimulate the spread of a culture of sustainability through awareness-raising and training activities aimed at both agricultural entrepreneurs and citizens.

Seminars, workshops, and information campaigns are key levers for spreading practices such as reuse, recycling, and the valorization of agricultural and agri-food waste, contributing to a more sustainable and environmentally friendly lifestyle.

The feedback from the local stakeholders have identified three main challenges to assist the transition:

- the development and modernization of infrastructures for the treatment and recovery of residual plant biomass, sludge, and wastewater;
- the testing of phytoremediation and Phyto-dewatering systems on a local scale;
- the implementation of circular bioeconomy models in the most relevant agricultural supply chains.

Starting from those challenges, the plan is structured around a series of integrated and complementary actions aimed at enhancing local resources, reducing waste, and promoting innovative models for managing agricultural waste and effluents.



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Such actions must be supported by preliminary cross-cutting initiatives to stimulate local development and promote local circular bio-economies, thereby ensuring stakeholder involvement, knowledge dissemination, and the replicability of the proposed solutions.

## 4.2 Cross-cutting challenges to CSS2 – CSS3

To accompany and strengthen the implementation of the CircuPuncture Economy Action Plan, some cross-cutting actions have been identified: the **Implementation of the Collaboration Agreement**; **Local Community Outreach** and the **Development of Local Circular Bioeconomies**.

These actions respond to the need to ensure preliminary widespread involvement, active participation, and knowledge transfer between businesses, local authorities, plant operators, research centers, and citizens. The goal is to create a territorial ecosystem conducive to the adoption of innovative and sustainable solutions capable of generating long-term economic, environmental, and social benefits.

Territorial animation focuses on dialogue with potential beneficiaries, the establishment of local partnerships, and the promotion of participatory processes, in order to build solid networks and share common objectives.

The development of local circular bioeconomies aims to enhance the value of waste and wastewater flows, encouraging the testing of innovative solutions, the creation of demonstration plants, and the dissemination of replicable models, with the active involvement of businesses and rural communities.

Through these cross-cutting actions, GAL Irpinia strengthens its role as a territorial facilitator and consolidates the path towards a widespread, resilient circular economy rooted in the local rural fabric.



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| CSS 2<br>FOOD AND FEED | |
|---|---|
| **CSS 3<br>WASTE WATER AND NUTRIENTS** | |
| **LEGAL FRAMEWORK**<br>(Regional Level) | |
| C 1.1 **Collaboration Agreement for the application of the FRONTSH1P approach** | |
| **Coordinator** | Campania Regional Governement - Directorate-General for Integrated Water and Waste Cycle and Environmental Authorizations (DG 50.17.00) |
| **Implementation Parties** | GAL IRPINIA |
| **Timeframe** | July 2025 – december 2027 |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | - Promotion of the dissemination of best practices for Circular Economy<br>- Support local authorities in drafting municipal regulations<br>- Monitor, with the support of technical agencies, the operating conditions of local supply chains in order to promote a circular and sustainable local economy |
| **Indicators** | Implementation of the Circular Economy Action Plan in the GAL IRPINIA area according to the FRONTSH1P approach |
| **AWARENESS AND KNOWLEDGE** | |
| C 2.1 **Local community outreach** | |
| **Key actions** | 1. Mapping potential beneficiaries and stakeholders<br>2. Organization of informational and participatory meetings<br>3. Multi-channel communication and dissemination<br>4. Support for the establishment of partnerships and collaboration networks<br>5. Support for the establishment of partnerships and collaboration networks |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | - Avellino Provincial Federation of Direct Farmers<br>- Italian Confederation of Farmers, Avellino<br>- Local agricultural business associations<br>- Local authorities and wastewater treatment plant operators |
| **Timeframe** | 1. 0–3 months<br>2. 3 – 12 months<br>3. 6 – 18 months |



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| | |
|---|---|
| | 4. 0 - 36 months<br>5. 6–18 months |
| **Financing** | Regional Funding (POR2021-2017) |
| **Expected Results** | Preliminary widespread involvement, active participation, and knowledge transfer between businesses, local authorities, plant operators, research centers, and citizens |
| **Indicators** | Number of potential beneficiaries/stakeholders contacted<br>Number of workshops/meetings organized<br>Number of participants in events<br>Number of networking meetings facilitated by the LAG<br>Partnerships or collaboration networks formally established<br>Number of information materials produced and disseminated<br>Number of visits to the website or dedicated digital channels<br>Number of expressions of interest collected<br>Number of projects/proposals activated |
| **PARTICIPATION AND NETWORKING** | |
| C 3.1 **Development of local circular bioeconomies** | |
| **Key actions** | 1. Identification of priority waste and wastewater streams<br>2. Design the innovative solutions<br>3. Involvement of local businesses<br>4. Dissemination and capitalization of results |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | - Campania Region<br>- Local authorities and wastewater treatment plant operators<br>- Research institutions and universities<br>- Cooperatives and farmers' associations<br>- ICT companies and technical consultants |
| **Timeframe** | 1. 0–6 months<br>2. 6 – 12 months<br>3. 6 - 24 months<br>4. 18 - 36 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Cross-sectional analysis of agricultural waste streams<br>Development of projects<br>Creation of networks<br>Transforming projects into replicable and scalable models |
| **Indicators** | Number of supply chains analyzed and types of waste/effluents mapped<br>Number of innovative projects developed and presented |



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| | |
|---|---|
| | Number of partners involved in the design<br>Number of companies participating in bioeconomic partner ships<br>Number of new agreements or collaborations formalized<br>Number of workshops/seminars presenting the results<br>Number of participants in dissemination events<br>Number of replicable models/guidelines produced and shared |

*Table 6 Preliminary Cross-cutting actions and solutions related to CSS2 and CSS3*



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| CSS 2<br>FOOD AND FEED | |
|---|---|
| **AWARENESS AND KNOWLEDGE** | |
| C 2.1 **Ri.Agri (Riuso Agricolo)** | |
| **Key actions** | 1. Identification of supply chains and priority areas<br>2. Establishment of local partnerships (Operational Groups-GO) |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | - Operations Groups (GO)<br>- Provincial Federation of Direct Farmers Avellino<br>- Italian Farmers Confederation Avellino<br>- Agricultural enterprises |
| **Timeframe** | 1. 0 – 3 months<br>2. 2 – 6 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Facilitate the creation of GOs composed of agricultural companies, research institutions, consultants, ICT companies and civil society actors suitable for circular economy experiments in specific agriculture sectors |
| **Indicators** | Number of GOs established and active<br>Number of farms and other partners involved |
| **PARTICIPATION AND NETWORKING** | |
| C 3.1 **RI. AGRI. – Networking** | |
| **Key actions** | 1. Training and capacity building<br>2. Rural community involvement<br>3. Monitoring and feedback gathering |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | - Operations Groups (GO)<br>- Provincial Federation of Direct Farmers Avellino<br>- Italian Farmers Confederation Avellino<br>- Agricultural enterprises |
| **Timeframe** | 1. 5 –18 months<br>2. 5 – 18 months<br>3. 9 - 24 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) ~~Regional Funding (POR2021-2017)~~ |
| **Expected Results** | Raise awareness and involve local actors |
| **Indicators** | Number of workshops /training events and participants<br>Number of accesses to the dedicated website, publications and dissemination material distributed |



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| INFRASTRUCTURE SUPPORT | |
|---|---|
| C 4.1 **RI. AGRI. - Technical design and selection of innovative solutions** | |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | - Operations Groups (GO)<br>- Provincial Federation of Direct Farmers Avellino<br>- Italian Farmers Confederation Avellino<br>- Agricultural enterprises |
| **Timeframe** | 6 – 12 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Installation of innovative technologies in rural areas, for experimental and demonstration purposes |
| **Indicators** | Number of pilot plants or innovative solutions implemented<br>Amount of agricultural/waste waste recovered or reused (tonnes/year)<br>Percentage of waste reused compared to total produced) |
| **SUPPORT FOR CIRCULAR ENTREPRENEURSHIP** | |
| C 5.1 **RI. AGRI. – Financial Support** | |
| **Key actions** | 1. Tender activation and financial support<br>2. Capitalization and replicability |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | - Operations Groups (GO)<br>- Provincial Federation of Direct Farmers Avellino<br>- Italian Farmers Confederation Avellino<br>- Agricultural enterprises |
| **Timeframe** | 1. 4 – 12 months<br>2. 18 – 30 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Funding innovative plats, evaluation of impacts and replicability assessment |
| **Indicators** | Number of projects financed<br>Total amount of public resources allocated and % used<br>Number of enterprises reporting reduction in disposal costs |

*Table 7 Action and solutions related to CSS2, RiAgri*



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**CSS2 Ri.Agri (Riuso Agricolo – *Agricultural reuse*)**

The Ri.Agri Action fits into this context as part of a Community Project financed by GAL Irpinia and aimed at supporting private investments capable of activating rural development processes through circular economy practices. In a logic of environmental protection and sustainability, Ri.Agri promotes the valorisation and reuse of farm processing waste, in particular pruning mowing, reducing waste and negative impacts and supports the implementation of CSS2.

The action provides support to fully cover intervention costs, and up to the amount of **100,000.00 euros**, dedicated to the implementation of projects promoted by partnerships (Operational Groups) aimed at introducing and disseminating innovative bioeconomy processes, in particular in the olive, cereal, livestock and wine supply chains.

The direct beneficiaries are the Operational Groups, composed by:
- agricultural and forestry enterprises (individual or associated) based in the GAL Irpinia area;
- other enterprises operating in rural areas relevant to the achievement of the objectives;
- public bodies and private enterprises active in research and/or training;
- consulting providers;
- other actors in agriculture, food, forestry and civil society;
- enterprises operating in the ICT sector.

Through Ri.Agri and thanks to the agreement with the Campania Region, GAL Irpinia aims to transform innovative experiments and practices into models that can be replicated at a territorial level, strengthening the local cluster of the circular economy and contributing to the competitiveness of production chains, the reduction of environmental costs and the diffusion of a culture of sustainability.



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| CSS 3<br>WASTE WATER AND NUTRIENTS | |
|---|---|
| **AWARENESS AND KNOWLEDGE** | |
| C 2.1 **Wastewater Treatment - Phytoremediation – (DEPURFitodepurazione)** | |
| **Key actions** | Animation and capacity building |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Campania Region – DG Integrated water and waste cycle (co financing and technical support).<br>Beneficiary municipalities (construction and management of pilot plants).<br>Research bodies and technical advisers (design, monitoring and training).<br>Agricultural business associations (Coldiretti Avellino, CIA Avellino, rural cooperatives).<br>Local communities (citizens and businesses as indirect beneficiaries). |
| **Timeframe** | 6 – 18 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Workshops and seminars with municipalities, agricultural enterprises and associations; technical training for municipal staff on plant management |
| **Indicators** | Number of workshops and information meetings organized.<br>Number of information materials produced (brochures, newsletters, website).<br>Number of accesses to the dedicated section of the GAL site.<br>Number of events/events with focus on phytopurification. |
| **PARTICIPATION AND NETWORKING** | |
| C 3.1 **Wastewater Treatment – Involvement** | |
| **Key actions** | Involvement of local communities |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Beneficiary municipalities (construction and management of pilot plants).<br>Agricultural business associations (Coldiretti Avellino, CIA Avellino, rural cooperatives).<br>Local communities (citizens and businesses as indirect beneficiaries). |
| **Timeframe** | 6 – 12 months |



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|---|---|
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Information activities for citizens and administrators on environmental and economic benefits |
| **Indicators** | Number of participants in training/animation events.<br>Number of municipalities involved in pilot plants. |
| **INFRASTRUCTURE SUPPORT** | |
| C 4.1 **Depur – Pilot Plants** | |
| **Key actions** | 1. Identification of pilot sites<br>2. Technical and authorization design<br>3. Construction of pilot plants |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Campania Region – DG Integrated water and waste cycle (co financing and technical support).<br>Beneficiary municipalities (construction and management of pilot plants).<br>Research bodies and technical advisers (design, monitoring and training). |
| **Timeframe** | 1. 0 – 3 months<br>2. 2 – 6 months<br>3. 6 - 12 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Installation of innovative plants in rural municipalities not served by public sewerage |
| **Indicators** | Number of pilot plants built (target: 2).<br>Economic value of investments (270,000 €)<br>% of resources actually used compared to the allocation.<br>Total purification capacity of plants (equivalent inhabitants served). |
| **SUPPORT FOR CIRCULAR ENTREPRENEURSHIP** | |
| C 5.1 **Depur – Circularity Support** | |
| **Key actions** | 1. Monitoring of environmental performance<br>2. Capitalization and replicability |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Beneficiary municipalities (construction and management of pilot plants). |



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| | |
|---|---|
| | Agricultural business associations (Coldiretti Avellino, CIA Avellino, rural cooperatives).<br>Local communities (citizens and businesses as indirect beneficiaries). |
| **Timeframe** | 1. 6 – 12 months<br>2. 6 – 18 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) + Regional funding (PR FESR 2021 – 2027) |
| **Expected Results** | Increase the number of Municipalities declaring benefits in terms of reducing disposal costs; citizens/enterprises reporting positive perception on intervention; increase the satisfaction level of local administrators. |
| **Indicators** | Total purification capacity of plants (equivalent inhabitants served).<br>Quality of treated water compared to regulatory parameters (BOD, COD, nutrients).<br>Estimated amount of sludge/wastes recovered or reused (ton/year).<br>Reduction percentage of untreated wastewater.<br>Economic value of additional investments ( over the additional 10.19 M€ requested from the Region). |

*Table 8 . Actions and solutions related to CSS3, DEPUR - (Phytopurification)*

**CSS3 Wastewater Treatment - (Phytopurification)**

The DEPUR interventions are particularly necessary in inhabited rural areas not served by public sewerage, where the management of domestic wastewater takes place through watertight septic tanks and/or leaktight wells. From an administrative point of view, these methods do not constitute actual discharges, but are classified as temporary warehouses pursuant to article 183, paragraph 1, (m), of the Legislative Decree. 152/2006.
To prevent pollution phenomena and mismanagement of liquid waste produced by leak-proof wells and septic tanks (identified with EER code 20.03.04), GAL Irpinia has identified the Depur – Phytopurification action as part of the activities for the CircuPuncture Economy Action PLan.

The action is aimed at the implementation of CSS3 with 2 main objectives: to reduce the production of wastewaters and to prevent water and soil pollution. The action aims at funding the construction of two pilot phytopurification plants for the integrated valorisation of organic matrix waste and sludge from civil or similar waste water, delivered to sub-



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irrigation or surface water bodies. The systems adopted are based on phyto-remediation and bio-remediation techniques, exploiting the natural ability of vegetation and/or microorganisms (individual or in association with plants) to reduce, retain and remove potentially polluting organic and inorganic substances.

Each plant will have a value of 135,000 €, with direct beneficiaries the municipalities involved and indirect beneficiaries approximately 25 equivalent inhabitants for each pilot plant.
The action is integrated by the Collaboration Agreement between GAL Irpinia and the Campania Region: as part of this agreement, GAL has already submitted a request for funding to the Campania Region for a further 13 phytopurification plants, with a total value of 10,190,000 €, capable of serving approximately 1,700 equivalent inhabitants.



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| CSS 3<br>WASTE WATER AND NUTRIENTS | |
|---|---|
| **AWARENESS AND KNOWLEDGE** | |
| C 2.1 **Wastewarer Treatment – Sewage SludgeDEPUR(Fitodisidratazione)** | |
| **Key actions** | 1. Involvement of the local community<br>2. Training and technical support |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Municipalities– direct beneficiaries of the pilot projects.<br>Purification plant operators (consortia, integrated water service companies, in-house companies, etc.)<br>Research bodies and technical consultants<br>Agricultural associations and citizens |
| **Timeframe** | 1. 6 – 12 months<br>2. 6 – 12 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) |
| **Expected Results** | Awareness-raising towards citizens and stakeholders, training of municipal and management entities staff |
| **Indicators** | Number of participants in awareness events.<br>Number of technical meetings and workshops held. |
| **INFRASTRUCTURE SUPPORT** | |
| C 4.1 **Wastewater Treatment - Phytodehydration – Pilot Plants** | |
| **Key actions** | 1. Technical design of pilot plants<br>2. Construction and testing of the 5 pilot plants<br>3. Monitoring and evaluation |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Municipalities– direct beneficiaries of the pilot projects.<br>Purification plant operators<br>Research bodies and technical advisers. |
| **Timeframe** | 1. 3 – 6 months<br>2. 6 – 12 months<br>3. 12- 24 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) |
| **Expected Results** | Convert existing drying beds into phytodishydration basin |
| **Indicators** | Number of phytodehydration pilot plants activated.<br>Amount of sludge treated in pilot plants (tonnes/year).<br>Reduction percentage of sludge to landfill (target: -80%). |
| **SUPPORT FOR CIRCULAR ENTREPRENEURSHIP** | |
| C 5.1 **Wastewater Treatment - Phytodehydration – Circularity Support** | |
| **Key actions** | 1. Selection of sites and mapping of managing organizations<br>2. Collaboration agreements with managing organizations |



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| | 3. Capitalization and replicability |
| **Coordinator** | GAL IRPINIA |
| **Implementation Parties** | Municipalities– direct beneficiaries of the pilot projects.<br>Purification plant operators<br>Agricultural associations and citizens |
| **Timeframe** | 1. 0 – 3 months<br>2. 3 – 6 months<br>3. 18 – 36 months |
| **Financing** | GAL Irpinia Funds (CSR 2023 – 2027) ~~GAL Irpinia Funds + Regional Funding (POR2021-2017)~~ |
| **Expected Results** | Support Municipalities in reduction and management of sewage sludge |
| **Indicators** | Total amount of public resources used (€ 352,500.00).<br>% of allocated funding actually spent.<br>Number of beneficiary municipalities<br>N. of municipalities declaring reduction in disposal costs.<br>N. of Municipalities reporting direct environmental benefits. |

*Table 9 Actions and solutions related to CSS3, Wastewater treatment - (Phytodehydration)*



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**CSS3 Wastewater Treatment – Sewage Sludge - (Phytodehydration)**

An additional environmental issue in the GAL Irpinia territory is linked to the management of sewage sludge, which today represent a critical economic and management burden for rural municipalities. In many cases, the sludge produced is disposed of in landfill with significant costs and with a negative impact on the environment.

To meet these needs, the Plan foreseen the construction of 5 pilot phytodehydration plants, financed with a total budget of €352,500.00, intended for 5 municipalities in the area.
The interventions will allow a reduction of up to ’80% in the volumes of sludge to be disposed of in landfill, improving environmental sustainability and reducing management costs borne by local authorities.

The technology adopted involves the conversion of the existing drying beds of purification plants into vegetated basins (Phytodishydration). A phytodehydration plant is capable of operating for a period of at least 30 years, divided into cycles of 8-10 years.

- Start-up phase (1-2 years): mud loads are modulated according to plant development.
- Operation phase at full capacity (8-9 years): the sludge is introduced discontinuously (weekly cycles alternating with rest periods of 2-5 weeks).
- Final stage (about 1 year): Bed feeding is stopped to promote mineralization and prepare a new cycle.

These interventions represent a concrete strategy to reduce the environmental impact of sewage sludge and initiate sustainable management processes in rural communities.
Looking ahead, the possibility of developing a future research project aimed at valorising stabilized sludge as an agricultural soil improver is envisaged, in full compliance with regulations and with a view to a circular economy.



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# Annex 1

Selected indicators of sustainable development relating mainly to economic growth and circular economy in Italy.



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**TOOLBOX 2**

**Selected indicators of sustainable development relating mainly to economic growth and circular economy in Italy**

| Goal CDG | Goal SDG for Italy | Indicator (units) | To achieved by |
|---|---|---|---|
| Goal 1. No poverty | Reduce the intensity of poverty | 1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance | 2030 |
| | | 1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than **$1.25 a** day | 2030 |
| | | 1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions | 2030 |
| | | 1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions | 2030 |
| | | 1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programs and policies to end poverty in all its dimensions | 2030 |
| Goal 2. Zero hunger | Combat food and materia deprivation | 2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round | 2030 |
| | | 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment | 2030 |

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|---|---|---|---|
| | | 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality | 2030 |
| Goal 6. Clean water and sanitatione | invest in infrastructure and guarantee the right to water | 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations | 2030 |
| | | 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all | 2030 |
| | | 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally | 2030 |
| | | 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity | 2030 |
| | | | |
| Goal 7. Affordable and clean energy | renewables, the only energy sector not affected by the crisis | 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services | 2030 |
| | | 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix | 2030 |
| | | 7.3 By 2030, double the global rate of improvement in energy efficiency | 2030 |
| Goal 8. Decent work and economic growth | among the worst in the EU, an alarming picture worsened by the crisis | 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value | 2030 |
| | | 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training | 2020 |



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|---|---|---|---|
| | | 8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human traicking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms | 2025 |
| | | 8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors | |
| | | 8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries | |
| | | 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to inancial services | |
| | | 8.10 Strengthen the capacity of domestic inancial institutions to encourage and expand access to banking, insurance and inancial services for all | |
| **Goal 9. Industry, Innovation and Infrastructure** | digitalisation is necessary for every production sector | 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well- being, with a focus on affordable and equitable access for all | |
| | | 9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to inancial services, including affordable credit, and their integration into value chains and markets | |
| | | 9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020 | 2020 |
| | | 9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries | 2030 |



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| | | 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use eiciency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities | 2030 |
| | | 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending | 2030 |
| **Goal 11. Sustainable cities and communities** | aumentano abusivismo edilizio e sovraffollamento abitativo | 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums | 2030 |
| | | 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons | 2030 |
| | | 11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations | 2030 |
| | | 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management | 2030 |
| | | 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries | 2030 |
| | | 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource eiciency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels | 2020 |



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|---|---|---|---|
| | | 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities | 2030 |
| | | 11.a Support positive economic, social and environmental links between urban, peri- urban and rural areas by strengthening national and regional development planning | |
| | | 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage | |
| **Goal 12. Responsible consumption and production** | the circular economy improves waste recycling | 12.2 By 2030, achieve the sustainable management and eicient use of natural resources | 2030 |
| | | 12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses | 2030 |
| | | 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment | 2020 |
| | | 12.1 Implement the 10 Year Framework of Programs on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries | |
| | | 12.c Rationalize ineicient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities | |
| | | 12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products | |
| | | 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse | 2030 |
| | | 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle | |



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|---|---|---|---|
| | | 12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities | |
| **Goal 13. Climate action** | adapt national objectives to EU targets | 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries | |
| | | 13.2 Integrate climate change measures into national policies, strategies and planning | |
| **Goal 15. Life on land** | we need a national plan for the restoration of natural systems | 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements | 2020 |
| | | 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally | 2020 |
| | | 15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and loods, and strive to achieve a land degradation- neutral world | 2030 |
| | | 15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development | 2030 |
| | | 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species | 2020 |
| | | 15.a Mobilize and significantly increase inancial resources from all sources to conserve and sustainably use biodiversity and ecosystems | |
| | | 15.b Mobilize significant resources from all sources and at all levels to inance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation | |
| | | 15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed | |



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|---|---|---|---|
| | | 15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species | 2020 |
| | | 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts | 2020 |
| **Goal 16. Peace, justice and strong institutions** | regulate online communication, fairness and respect are needed | 16.1 Significantly reduce all forms of violence and related death rates everywhere | |
| | | 16.2 End abuse, exploitation, traicking and all forms of violence against and torture of children | |
| | | 16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all | |
| | | 16.4 By 2030, significantly reduce illicit inancial and arms lows, strengthen the recovery and return of stolen assets and combat all forms of organized crime | 2030 |
| | | 16.5 Substantially reduce corruption and bribery in all their forms | |
| | | 16.6 Develop effective, accountable and transparent institutions at all levels | |
| | | 16.9 By 2030, provide legal identity for all, including birth registration | 2030 |
| | | 16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements | |
| | | 16.b Promote and enforce non-discriminatory laws and policies for sustainable development | |
| **Goal 17. Partnerships for the goals** | | | |
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# Annex 2


*CONVEGNO*

**FRONTSH1P – Soluzioni Sistemiche Circolari per il recupero e la valorizzazione degli scarti: un nuovo paradigma di sviluppo territoriale basato sull'economia circolare**

***Giovedì 30 marzo 2023 – 14:30/16:30***

*Napoli > Mostra d'Oltremare > Padiglione 5 > Sala Mediterraneo*

***14:00 Registrazione partecipanti***

***14.30 Saluti***

***Intervengono***

- Carmine Pascale **STRESS,** Fabio Magrassi **STAM**
  ***Presentazione generale al progetto***
- Carlo Caligiuri **UNIBZ**
  ***Residui e scarti derivanti da imballaggi legnosi***
- Daniele Turati **NOVAMONT**
  ***Valorizzazione degli scarti urbani e agricoli per la riqualificazione territoriale attraverso coltivazioni a basso impatto***
- Alberto Reis **LNEG**
  ***Acque reflue urbane ed industriali***
- Carmine Pascale **STRESS**
  ***Scarti urbani ed industriali di plastica o gomma***
- Fabio Magrassi **STAM**
  ***Strumenti digitali per l'adozione estesa dell'economia Circolare***
- Carmine Pascale **STRESS**
  ***Azioni strategiche di replicazione - possibili applicazioni in Campania: Valorizzazione delle biomasse agricole* a cura di *GRADED***
- Fabio Magrassi **STAM**
  ***CCRI – La Circular Cities and Regions Initiative***

***16.15 Dibattito e Conclusioni***

Funded by the European Union in the framework of the Horizon 2020 Research and Innovation Programme under grant agreement No. 101037031

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031




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