D3.3. Recommendations for Public Administrations

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List of Acronyms

PAYT	Pay-as-you-throw
RFID	Radio-frequency identification
WP	Work Package

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Keywords list

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- Circular fertilisers
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- Circular fertilisers value chains
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Executive summary

FER-PLAY is working to protect ecosystems, decrease EU dependence on fertiliser imports and improve resource efficiency through the promotion of circular fertilisers. The project maps and assesses circular fertilisers made from secondary raw materials and highlight their multiple benefits to foster their wide-scale production and application.

To support circular fertiliser production and use, FER-PLAY partners have facilitated collaboration between key stakeholders through various co-creation activities. Insights from collaborative events, working groups, and online meetings helped shape recommendations for improving circular fertiliser practices across Europe. Public authorities, agricultural associations, research centres, and other stakeholders explored best practices and identified obstacles to replicating successful strategies in their own regions, which are detailed in this report.

The headlines of these recommendations can be summarised as following:

- Effective upstream control of impurities in waste streams is more efficient than downstream treatments, as pollutants become more difficult and costly to remove once they enter the waste stream. This is crucial for maintaining waste quality, especially when transforming waste into valuable resources like circular fertilisers. Contaminated waste requires extensive treatment, reducing the economic and environmental benefits. The focus should be on controlling pollutants in urban wastewater and municipal bio-waste, as stakeholders identified source control as a critical challenge. Ensuring the quality of wastewater and bio-waste is essential for marketable nutrient recovery and sustainable waste management practices.

- Building a successful market for circular fertilisers requires the development of a robust bioeconomy value chain, as both are interdependent. Circular fertilisers, made from organic waste like industrial bio-waste, need efficient collection, processing, and transformation to become valuable products. A strong bioeconomy value chain supports innovations in recycling technologies and ensures the seamless management of resources from waste collection to fertiliser production and distribution. Regional governments play a crucial role in fostering these value chains by integrating bioeconomy into circular economy strategies. This approach aligns local economic, social, and environmental priorities, addressing challenges such as rural depopulation and climate change, while boosting competitiveness and sustainability.

- Public authorities play a vital role in promoting the use of circular fertilisers, essential for advancing a sustainable bioeconomy. On the one side, by leveraging national networks, they can exchange best practices and insights to enhance fertiliser adoption. Local engagement, like

organizing visits to production sites, helps build trust among farmers by demonstrating the entire production process, from waste collection to fertiliser creation. On the other side, if possible, they can modify the local regulatory framework to force the use of circular fertiliser and lead by example through green public procurement practices for the fertilisation of municipal landscaping that reinforce sustainability commitments. Additionally, partnering with other EU regions and participating in EU projects allows public authorities to access cutting-edge technologies and collaborate with key stakeholders, fostering the widespread adoption of circular fertilisers.

This deliverable will be disseminated to +100 members of ACR+ (from 22 European countries, including local authorities and city networks to NGOs, academics and private companies) through various channels of communication: publication on organisation website and social media accounts as well as weekly newsletter to members. Furthermore, the document shall be presented at the dissemination events that will be organised in December 2024 and January 2025 to local administrations and policy makers in scope of Work Package 4. ACR+ shall organise a workshop on December 2024 for 30 local and regional authorities and another in January 2025 for 20 decision makers from EU regions that shall be focused on the exploitation opportunities for alternative fertilisers production and use.

1. Introduction

FER-PLAY is a Horizon Europe project facilitating the uptake of alternative fertilisers, to protect ecosystems, decrease EU dependence on fertiliser imports, foster circularity and improve soil health. The project has mapped and assessed alternative fertilisers made from waste, wastewater and by-products, such as (such as manure, compost from bio-waste and struvite from sewage sludge treatment) and highlight their multiple benefits in order to promote their wide-scale production and use on field. The results of these project phases are available in D1.1 "Comprehensive overview on circular fertiliser value chains" and D2.2 "Multi-assessment of impacts, trade-offs and framework conditions of selected alternative fertiliser value chains"

Moreover, the project work plan foresees a dedicated Work Package to gather first-hand perspectives from key stakeholders regarding barriers and opportunities for circular fertilisers deployment following a co-creation approach. These activities were carried out from March 2023 to September 2024 with three target groups: end-users, producers and local administrations in a variety of EU countries that provided insights on the real needs of the value chain stakeholders. Their valuable feedbacks are integrated in the tailor-made guidelines D3.1 "Guidelines for fertiliser end-users", D3.2 "Guidelines for fertiliser producers" and in this this report, that focuses on the recommendations for regional and local government that are willing to foster the use of circular fertilisers.

Regional and local governments are public entities with a responsibility for providing solutions to local needs and challenges. Through supporting circular fertiliser production and use in their territories, regional or local governments can valorise local waste, wastewater and by-products streams in a sustainable manner, improve soil quality in the region, boost circular economy businesses and retain local talent and expertise. Therefore FER-PLAY partners have organised several co-creation activities targeting fertiliser producers, end-users and Public Authorities to facilitate collaboration between these key stakeholders. A list of the activities that were organized for the Public Authorities are in Methodology section of this document.

This report is designed to be reader-friendly, concise, and stand-alone, while also highlighting best practices and pointing to additional resources for further reading. The lay-out follows closely to each stage of circular fertiliser production: i) ensuring the availability of high-quality waste-streams for fertiliser production and raising public awareness for bio-waste separation, ii) developing businesses and a value chain and lastly iii) promoting the use of circular fertilisers.

2. Methodology

This report builds on the insights gathered during collaborative events with public regional and local authorities to explore the current status of circular fertilisers at various levels of governance and lessons learned from regions at the forefront of circular fertiliser production and use. Participants explored the potential to replicate these practices in their regions, identified obstacles, and proposed solutions. The recommendations were formulated based on the outcomes of the following events:

Working Groups with local authorities (organised by ACR+)

The working groups were held online on 07.11.23 and 07.09.24 with the participation of speakers from frontrunner regions in Europe who presented their best practices for valorising bio-waste streams, producing circular fertilisers and promoting circular fertiliser use in their respective regions**.** Participants were invited among Public Authorities, agricultural associations, research centres and universities, public utility companies and fertiliser producers[1]. Participants were engaged in discussing the replicability of these cases in their own regions and identifying the barriers preventing replication as well as possible solutions.

Online meetings with circular fertiliser producers (organized by EBA)

EBA organised 2 online meetings with 30 members of their network on 18.09.23 and 28.09.23. Another physical event was organised on 20.09.23. These events were attended by producers of circular fertilisers, Public Authorities, stakeholders from EU institutions and researchers. Technical, commercial and regulatory implications for circular fertilisers at EU regulatory level were discussed.

One-on-one interviews with Public Authorities

The outcomes from these events were further expanded through one-on-one interviews with Public Authorities on waste management, agriculture and economic development as well as researchers. The issues they have pointed out as well as the solutions they have offered outlined the presented recommendations that were further supplemented through literature review and screening of fellow project outcomes.

[1] The conclusions could be further reviewed in FER_PLAY Deliverable 3.4. “Preliminary outcomes from the co-creation process”

3. Recommendations for Local and Regional Public Authorities

3.1. Implementing Source Control

Upstream control of impurities in waste streams is significantly more effective than relying on downstream treatments for several reasons. Once pollutants are introduced into the waste stream and become diluted and mixed, they are much more difficult and costly to remove.

For instance, technologies designed to remove pollutants from wastewater removes valuable nutrients along with them. Therefore, preventing these contaminants from entering the waste stream in the first place is crucial for maintaining the quality of the waste, which is particularly important if waste streams are to be transformed into valuable resources, such as circular fertilisers. Contaminated waste cannot be easily repurposed without extensive treatment, which reduces the economic and environmental benefits of waste valorisation.

In this section two major waste streams are considered for this challenge, urban wastewater and municipal bio-waste, as both the participants to working groups and the relevant stakeholders interviewed for this deliverable pointed out source control as the most significant problem in these waste streams.

3.1.1. Urban Wastewater

The purity and thus the marketability and applicability of nutrient recovered from wastewater is critically depending on the quality of the water flow. All these recommendations are intended to increase the wastewater quality parameters.

Monitor and reduce non-domestic pollution

Discharges from industrial wastewater into the public grid is one of the most significant sources of micropollutants in urban wastewater. Removal of micropollutants in wastewater through conventional treatment systems is either not satisfactory or feasible[2] therefore as the limits for discharging micropollutants in urban wastewater is becoming stricter, monitoring these discharges

[2] RUN4LIFE Project Deliverable 4.3 “Assessment of a quality and safety of water reuse for industrial and agricultural application”

is even more crucial.[3] Ideally the monitoring should be conducted through independent 3rd party organisations or within the wastewater services of regional or local governments; the additional expenses caused by increased monitoring and reporting efforts could be partly covered by the producer responsibility system while digitalisation tools can simplify these efforts.

Make Information Transparent and Accessible

Wastewater treatment operators in the EU do not perform uniformly well, and information about monitoring and reporting methods is not always accessible to the public. Transparent information on monitored parameters, monitoring frequency, and key indicator values in discharged water and sludge could help improve oversight. Using smart monitoring techniques would assist Public Authorities in controlling operator performance and foster greater trust in the use of fertilisers produced from urban wastewaters.

Raise citizen awareness

Raising citizen awareness about the microplastic pollution where wastewater sludge is used for local agriculture can be an effective strategy. As the major source of microplastic pollution from household wastewater is through laundering textile products that contain plastic, Public Authorities can focus campaigning efforts in reducing the consumption of these textiles. A system that educates residents through events and informative materials about the benefits of choosing sustainable fabrics can enhance social acceptance.[4]

Lay a groundwork for water and nutrient recovery in new buildings

Domestic wastewater is a combination of several streams; yellow (urine), brown (faeces), black (urine + faeces), and grey wastewater (all wastewater except toilets; bathroom, kitchen and laundry). Most of the Nitrogen content will be found in yellow water while the majority of Phosphorus in black or brown water.[5]

As dividing the systems in existing buildings is not feasible, new urban blocks can be designed with segregated collection. In these systems domestic wastewater may be collected in three (yellow water/brown water/grey water) separate streams. Grey water which represents on average 75% of total volume, can be used for water recovery, while brown and yellow water can be used for fertiliser

[3] Proposal for a revised Urban Wastewater Treatment Directive by DG ENVI- October 2022
[4] P2GreeN Project Deliverable 5.5 - Report on results of actions for knowledge exchange and capacity building
[5] Reynoso-Cuevas, Liliana & Irigoyen-Campuzano, José & Torres-Castañon, Arturo & Bracamontes Ruelas, Alexis. (2024). Application of Advanced Oxidation Processes for Domestic and Industrial Wastewater Treatment. 10.5772/intechopen.1004636.

production.[6] Separating these streams in buildings and recovering the nutrients on site, would reduce the pollutant load in wastewater treatment systems and consequently in the water bodies receiving the discharged water from treatment systems. Water reclamation also becomes more cost effective as grey water has significantly less suspended solids than mixed wastewater, which lowers the energy costs for the operation of water reclamation technologies.

Separate treatment systems can be scaled and adapted more easily to the needs of specific communities or areas, allowing for more flexible and localized wastewater management solutions. Decentralized systems are often more cost-effective in rural or remote areas where extending centralized infrastructure is not practical or affordable.

It should be noted that for smooth operation of these systems citizen compliance is key; residents should be aware of how each separate system should be used and why it is important for the operations of the treatment system.

EXAMPLE FOR SEGRAGATED SYSTEMS: Fellow Project P2GREEN

P2GreeN is an innovation action funded by the EU, which runs between December 2022 to 2026. The project has 3 pilot sites where bio-based fertilisers derived from human sanitary waste are developed and tested.

In Swedish pilot, urine is separately collected and dried to produce nitrogen fertilisers in pellet form. The aim in P2GreeN is to collect 150 m³ of urine by the end of the project to develop a dry fertilizer that can be used with conventional farming equipment. **For more information see *P2Green website .***

Figure 1. P2GreeN Project – Swedish Pilot [7]

[6] Beler Baykal, B. (2019). Recycling/reusing grey water and yellow water (human urine): motivations, perspectives and reflections into the future. In DESALINATION AND WATER TREATMENT (Vol. 172, pp. 212–223). Elsevier BV. https://doi.org/10.5004/dwt.2019.24667

[7] https://p2green.eu/pilot-regions/

EXAMPLE OF GOOD PRACTICE: **“Helsinborg, 3 Pipe System”**

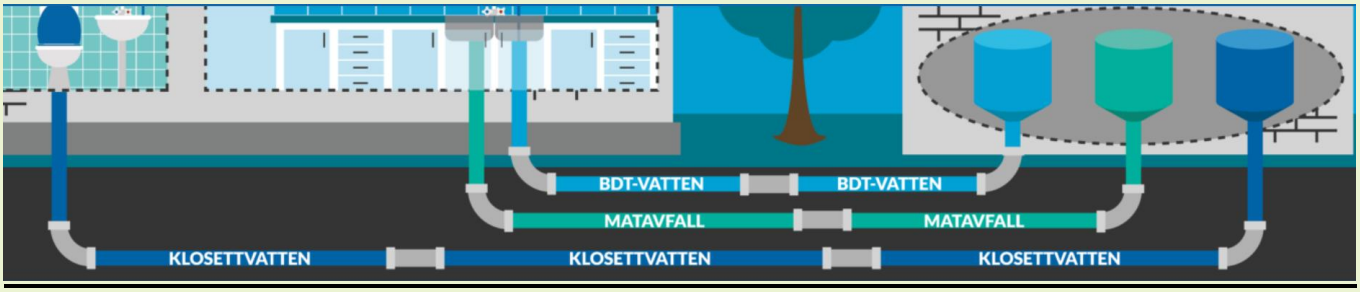

Figure 2. The three pipes separately collecting the kitchen food waste, grey water and black water from the toilets in the district of Oceanhamnen. Image credit; NSVA [8]

In 2013, the municipality of Helsingborg decided to develop a new neighbourhood, Oceanhamnen, and implemented an innovative 3-pipe wastewater system inspired by successful models in Germany and the Netherlands. This decision was part of an environmental initiative where NSVA, a non-profit public water utility played a key role. The system, operating through the RecoLab facility, uniquely recycles resources from sewage and food waste, aligning with the city's sustainability goals.

The 3-pipe system separates grey water, black water, and organic waste, significantly enhancing the production of biogas and the recovery of valuable nutrients like phosphorus and nitrogen for agricultural purposes. Compared to conventional sewage treatment plants, this system is more efficient and environmentally friendly, reducing climate-impacting emissions, minimising water use, and effectively removing medicinal residues. Despite its benefits, the system faced challenges, particularly in educating residents on using the food waste grinder and ensuring proper installation of vacuum toilets to avoid noise issues.

Despite these hurdles, the project was deemed a success, leading Helsingborg to plan similar implementations in other districts, with the city of Visby following suit. Key learnings emphasise the importance of clear communication about the system's operation and benefits to ensure smooth adoption by residents. The system's ability to produce clean water makes it a promising solution for areas facing water scarcity, potentially even providing safe drinking water.[9]

[8] https://projekt.nsva.se/kommuner/helsingborg/tre-ror-ut/for-boende-i-oceanhamnen/
[9] https://environment.ec.europa.eu/topics/urban-environment/european-green-capital-award/inspiration/helsingborg-3-pipe-wastewater-system_en

3.1.2. Municipal Bio-waste

Enhancing both the quantity and quality of separately collected bio-waste is crucial for generating high-quality compost and digestate. However, although the EU has mandated the separate collection of bio-waste by municipalities across all member states since the start of 2024, the implementation has been inconsistent across different countries and regions.

There is no one-size-fits-all solution for bio-waste collection; each region has different practices, strengths and needs that should be evaluated when designing a bio-waste collection program. The principles outlined in this section may serve as a guiding framework for regional governments who are setting up or fine-tuning their bio-waste collection systems.

3.1.2.1. Design a pilot program

Running a pilot program before launching a region or city-wide new bio-waste collection system or adjusting the existing one is particularly useful to receive feedback from the public and fine-tuning to find the optimal system for your city.

1. Run a survey to determine the important factors for the residents to increase their willingness to sort their bio-waste; this could include questions such as:
    a. the manner of collection system (door-to-door, drop-off points; recycling centres…)
    b. the frequency of bio-waste collection
    c. collection tools (bins, bags…)
2. Run the pilot programme in a block of households; announce the program in advance to the citizen through various communication channels to reach a wider public. Give further information on how the household waste should be sorted and the collection schedule while distributing the collection tools (bins, bags).
3. Evaluate the results and run a final survey to receive feedback from residents.

EXAMPLE OF GOOD PRACTICE: "Pilot programme for kitchen waste collection by Partizánske/Slovenia"

Figure 3. Pilot programme in Šípok housing estate; door-to-door collection with caddies[10]. Image credit; Noviny Tempo

To find the most suitable system for separate bio-waste collection for the residents of Partizánske, a pilot programme was launched in the Šípok housing estate with the collaboration of Priatelia Zeme – SPZ (part of Friends of the Earth International).

This trial took place in 8 apartment blocks, each containing 12 households. Every household received an introduction to the system along with a starter pack, which included a 10-liter kitchen caddy, a roll of compostable bags, and a leaflet. The trial lasted for a month, from April 19 to May 13, 2021, with kitchen waste collected twice a week.

Coordinators of the Pilot Project employed several methods of communication for promoting bio-waste separation. During the distribution of collection tools, an informant explained the collection system and its benefits to households, showing them how to use the collection tools. A registration officer scanned the unique QR code on each caddy to link it to the correct household. The starter packs were handed out by technical support, and each household representative signed to confirm they received the pack.

Posters were put up at the entrances of each apartment block, showing when the collection would start in different areas. Articles about the pilot program, the launch of the collection initiative, and the initial results were published in the local weekly, TEMPO. Reports were

[10] https://novinytempo.sk/partizanske-spustilo-pilotny-projekt-zberu-kuchynskeho-odpadu-kosik-staci-vylozit-pred-dvere-bytu/

broadcast on Municipal Television Partizánske (MTP), featuring discussions on kitchen bio-waste collection. Workshops were held for school children and summer camp participants. Additionally, a dedicated subpage was created on the municipality website to provide detailed information about household kitchen waste collection.[11]

Inspection of the bags revealed promising results; bags contained mostly vegetable, fruit and baked goods showing that the residents had gained a good understanding of compost. Pilot program validated the effectiveness of the waste collection system as well as providing the Public Authorities with relevant feedback.[12]

For further reading see *LIFEBIOBEST Country Factsheets*.

3.1.2.2. Make separating bio-waste convenient and appealing

Though frontrunner regions and cities in Europe with successful bio-waste collection programs have different approaches, these are observed to be most common practices[13]:

1. Door-to-door collection systems are the most applied system for bio-waste collection in urban settings, for the convenience offered to citizens. This system delivers the highest quantity and quality of bio-waste collected.

2. Food waste is sorted in the kitchen with ventilated kitchen caddies with a compostable liner. Availability of larger bins risks the collection of green waste or other types of waste.

3. Individual bins that are linked to one household deliver least impurity; in communal bins residents are less likely to be motivated to sort their waste well. Accountability on the other hand is a good driver.

4. Bio-waste is collected more frequently than residual waste. This is one of the most effective strategies to encourage people to sort their waste since bio-waste in general deteriorates far more quickly causing odour problems. In frontrunner regions in Europe, bio-waste is collected on average three times (South Europe) or two times (North Europe) more than residual waste with an increase in summer months. This is especially prominent in touristic cities.

[11] https://zerowasteeurope.eu/wp-content/uploads/2024/06/LIFE-BIOBEST-Country-Factsheets-Partizanske.pdf

[12] https://novinytempo.sk/skusobny-zber-odpadu-z-kuchyn-je-v-partizanskom-v-plnom-prude-za-tyzden-vyzbierali-274-kil/

[13] https://zerowasteeurope.eu/library/guideline-on-the-separate-collection-of-bio-waste/

5. In urban settings the bio-waste collection generally includes only kitchen waste and green waste is collected separately. As green waste changes volume significantly throughout the year, separating the collection of kitchen waste from green waste allows for better planning for the collection of these separate streams.

6. In rural areas with disperse populations home and community composting is encouraged.

7. It is cheaper for the residents to dispose of bio-waste than it is to dispose of residual waste; this is mostly achieved by pay-as-you-throw system backed by landfill or incineration taxes of the Member States or regional governments.

FURTHER READING: Fellow Project LIFEBIOBEST

Figure 4. Guidelines for Public Authorities by LIFEBIOBEST Project.

The LIFE BIOBEST project has published guidelines for local and regional authorities to adapt bio-waste management models to their specific context, offering feasible Best Practices and management instruments to promote efficient collection and subsequent recycling of bio-waste into quality compost and digestate.

The LIFE BIOBEST project aims to find and validate the best practices and tools for managing bio-waste, from its creation to its treatment, to produce high-quality compost and digestate. The project has also set key performance indicators (KPIs) based on existing data and experiences. Through meetings with experts in the field, the project worked on solutions to overcome technical, regulatory, economic, and environmental challenges, making it easier to adopt these best practices widely.[14]

[14] https://zerowasteeurope.eu/project/life-biobest/#about

3.1.2.3. Economic incentives: “carrot or stick”

Encouraging waste separation can be challenging since it frequently regarded as an extra effort in households; people may resist or be slow to adopt new habits. To address this, governments or local authorities often introduce economic incentives or penalties as a strategy to motivate and engage the public. Economic incentives, such as tax reductions, rebates, or discounts on waste collection services, can make the effort of separating bio-waste more appealing. When households see a direct financial benefit from participating, they may be more likely to adopt the practice willingly and incorporate it into their daily lives.

On the other hand, penalties for non-compliance, such as fines or higher waste disposal fees for those who do not separate bio-waste properly (too many impurities are present), create a financial disincentive for ignoring the guidelines. These penalties can serve as a strong motivator for households to start and continue separating their bio-waste.

Pay-as-you-throw (PAYT) based collection fees are the economic instrument that is most frequently employed by frontrunner regions in bio-waste separation in EU. In these systems, waste producers pay for waste collection based on how much waste they produce, with lower or no fees for recyclables that are sorted correctly. PAYT systems generally help increase recycling rates, thus reducing residual waste volumes and can be employed in different levels:

- Advanced PAYT systems give a clear and direct economic incentive right when waste is generated. For example, waste collectors might weigh the waste containers during pick-up, so people are charged based on the weight of the waste they produce. Another example is sack-based systems, where citizens buy bio-waste bags from the municipality or service provider in a reduced rate than the price of residual waste bags.

- Basic PAYT systems are simpler and typically charge based on the size of the waste container and sometimes how often it is collected. These systems may allow households to choose the number or size of containers for mixed waste when they sign up for the service. These systems are considered to be less effective to achieve low contaminants in the collected bio-waste especially when the containers are shared by different households. [15]

Together, these economic tools aim to not only initiate participation but also ensure that households remain consistent in their efforts over time. By linking the separation of bio-waste to financial consequences, authorities can help transform it from a perceived burden into a routine,

[15] https://www.eea.europa.eu/publications/economic-instruments-and-separate-collection

especially when the practice of collecting bio-waste more frequently than residual waste is also applied.

3.1.2.4. Monitor during collection

Contaminants in bio-waste can reduce the quality of compost and hinder recycling efforts. By monitoring bio-waste during collection, regional authorities and waste management companies can ensure proper execution of the collection systems. Data collected through these monitoring techniques can be further analysed to identify trends, patterns, and areas of improvement. Feedback mechanisms can then be implemented to educate residents on proper sorting practices, address contamination issues, and optimize collection routes.

Individual composting bins distributed per household results facilitates inspection and monitoring efforts and allow several techniques can be employed to ensure proper sorting:

- **Visual Inspection:** Collection personnel can visually inspect waste bins to check if bio-waste is separated correctly. This method allows for quick identification of any contamination or improper sorting.
- **RFID Technology:** Radio-frequency identification (RFID) tags can be attached to waste bins to track and monitor the disposal of bio-waste. RFID technology enables real-time tracking and can provide data on collection routes and bin contents allowing the service providers to track the source of contamination or identify it on the spot.
- **Barcode Scanning:** Similarly to RFID tags, barcodes on waste bins or bags can be scanned during collection to track the type of waste being disposed of. This data can be used to monitor the segregation of bio-waste from other waste streams.

EXAMPLE OF GOOD PRACTICE: “Ecopatrol Krk” As the Krk Island switched to door-to-door collection, municipality’s utility company PONIKVE established an “eco-patrol”. The 7 green educators of the patrol have an educational role in the community, helping to encourage proper waste sorting. Every day, the patrol members travel around the island to check the contents of different bins outside homes. They give advice and information about the door-to-door waste collection system. Each bin has a radio frequency identification (RFID) chip, which allows the patrol to identify who owns it. When they find sorting mistakes, they make a list of the incorrect items and can offer tips to the people responsible. The employees of PONIKVE find this method to more effective than issuing fines. [16]

[16] Personal communication

3.1.2.5. Ensure operator performance

The setup and upkeep of bio-waste systems depend on whether the service is run publicly, privately, or through a public-private partnership. When municipalities outsource waste management to private companies, roles and responsibilities can become unclear, making it essential to clearly define them along with goals in public-private partnerships and tenders. Bio-waste collection should be designed from the beginning with the intention of using the collected biomass as an input for fertiliser production and hence the importance of monitoring and removing impurities should be underlined in the agreements made with private organisations.

Therefore, Public Authorities should develop control and monitoring systems and include ways to update contracts if needed to improve the service. When waste services are privatized, public involvement may be limited, affecting how the service is managed and monitored. Bringing services back under public control can remove the barriers associated with monitoring and improving the quality of the collected and treated bio-waste and offer greater flexibility to meet management needs[17].

Another method is contracts based on performance; Performance-based contracting in waste management is designed to ensure that cost savings do not come at the expense of performance. This approach involves setting clear performance standards and linking payments to the achievement of specific targets, which are measured through predefined indicators. Presence of expert personnel employed by municipality is crucial to set the right targets and avoid making unsatisfactory agreements with private organisations. By aligning contractor incentives with desired outcomes, such as moving waste management up the waste hierarchy and promoting resource efficiency, municipalities can avoid the inefficiencies that often arise in traditional contracts where cost-saving measures may lead to subpar service delivery.

Key characteristics of performance-based contracts include the definition of objectives and indicators, the collection of data to assess performance, and the use of incentives or penalties to influence contractor behaviour. [18]

This approach allows local authorities to monitor and improve environmental performance while maintaining flexibility in funding. By directly linking contractor revenues to environmental outcomes, municipalities can foster better waste management practices, ultimately supporting the development of a circular economy without imposing additional financial burdens on Public Authorities.

[17] LIFEBIOBEST Deliverable 3.2. Guideline on governance and economic incentives
[18] https://greenbestpractice.jrc.ec.europa.eu/node/99

Participants in this study also highlighted the importance of treating bio-waste locally within city or regional limits -rather than relying on a centralised system- to better track operator performance and use the produced compost locally. In some cases, local farmers showed more interest in the compost because they could engage directly with waste treatment operators through local channels.

3.2. Engaging Public Participation

Communication and monitoring efforts are inherently more manageable for municipal bio-waste than for wastewater. After all, it is considerably more challenging to track what individuals dispose of into the sewage system. However, the strategies for raising public awareness share many similarities in both contexts:

3.2.1. Inform the public: what happens with their bio-waste?

People are more likely to invest time and effort into separating their waste when they understand that their actions have a meaningful impact. Effective communication on the importance of separating bio-waste is essential to raise general awareness that bio-waste is a valuable resource, capable of producing compost and biogas.

A study conducted by the World Bank in Estonia supports this notion, revealing that participants believe it is important to inform the public about the reasons for waste separation and to assure them that their efforts are not in vain.[19] The study found that more than 50% of respondents would be motivated to sort their bio-waste if they knew it would be composted or used for biogas production.

To increase the separate collection of bio-waste, it is important to make the system more transparent and to share information about the methods used to process bio-waste. By doing so, people will be more inclined to participate, knowing that their contributions are making a difference.

Similarly, residents are more likely to pay attention to the contents of household products they use if the community benefits from water or nutrient recovery in wastewater treatment systems. Campaigns to raise awareness are particularly important for contaminants that are not removed from conventional treatment systems such as forever chemicals or microplastic pollution.

[19] https://treasource.eu/wp-content/uploads/2023/09/TREASoURcE-D6.1.-Workshop-report-including-local-CE-conditions-analysis.pdf

EXAMPLE OF GOOD practice: "Communication and engagement campaigns by PONIKVE KRK"

Figure 5. Leaflet in 8 languages explaining the waste sorting system in Krk. Image credit: PONIKVE KRK

Ponikve Krk - Eko Otok Krk, is the Krk Island's public waste management company. The company has initiated its first waste sorting campaign in 2005 as their previous landfill was full. A feasibility plan was drawn that projected the concerns about the cost of transporting their waste to the mainland. The local authorities agreed that managing their waste locally is more financially secure, so the new plan (sorting waste in 5 fractions; bio-waste, paper, plastic, glass, and residual waste) was set into action.

Since then, the company has run an extensive communication campaign to encourage sorting kitchen waste targeting both residents and visitors to the island with success.

- News on local radio stations, newspapers and social media platforms to announce new waste collection system
- Calendars with collection schedule and leaflets explaining bio-waste sorting in different languages that was distributed along with the compost bins.
- Accounting the influx of visitors during tourist season, over 50,000 leaflets explaining the waste sorting system in 8 languages are distributed to apartments, agencies, camping sites, and hotels.

- Annual compost give-away event: Residents can visit the composting plant to receive 80 litres of compost and tour the facility. Over 7,000 bags are distributed during this event with a growing number of residents showing interest.[20]

Figure 6. An educational container for drawing attention to plastic pollution. Image credit: PONIKVE KRK[21]

- Educational visits to schools by the Islands green educators inform students about the importance of bio-waste sorting. Students take home information to share with their families, helping to spread awareness beyond the classroom.
- Permanent exhibitions such as the shipping container placed in busy locations with the aim of drawing attention to marine plastic pollution. These displays, available in several languages, also inform visitors about proper waste sorting practices.

[20] https://www.ponikve.hr/objava/termini-podjele-komposta
[21] https://www.ponikve.hr/objava/edukativni-kontejner-baska-ribarski-dani

3.2.2. Run campaigns tailored to your target audience

By monitoring the quality of the waste collected in individual bins or collective containers Public Authorities can gather data to identify problems and make a connection with the demographic profiles. By identifying the weak link, Public Authorities can then design communication strategies that will appeal to the target audience. For instance, in areas with diverse spoken languages, visual campaigns would deliver better results while in rural areas with dispersed population physical events such as neighbourhood gathering would be more effective.

EXAMPLE OF GOOD PRACTICE: "Don't Be A Strybjorn" Campaign By Sysav

Figure 7. "Don't be a Styrbjörn" Campaign on a garbage truck. Image credit: SYSAV[22]

According to a survey ordered by Avfall Sverige[23], young adults was found to be the demographic with the greatest potential for improvement in sorting packaging waste; 15% of the young adults surveyed found it difficult or very difficult to determine what type of packaging waste should go where and lacked the motivation to find it out. Based on this result, SYSAV, waste management operator for the municipalities in south of Sweden, decided to run a campaign targeting young adults.

[22] Image taken from SYSAVS's admission video to EWWR 2023 Awards- https://www.youtube.com/watch?v=Rv1f-nrNipo

[23] According to results from May 2024; https://www.avfallsverige.se/aktuellt/nyheter/kunskapen-om-kallsortering-okar/

The company hired 2 comedians to write 3 scripts to remove the confusion around plastic recycling and the character “Styrbjorn” was born. Styrbjorn is a middle-aged student living in a dormitory with his fellow students and sharing his pearls of wisdom regarding waste sorting with them. Each video addresses one of “sorting myths” in a humorous way to appeal young adults.

The campaign garnered more than two million views on social media and was featured on garbage trucks, bus stops, and large screens.[24]

3.3. Creating a Value Chain for Circular Fertilisers

Building a market for circular fertilisers is closely tied to the development of a robust bioeconomy value chain because the two are mutually reinforcing. Circular fertilisers are typically derived from wastewater or organic waste materials, such as agricultural residues, food waste, or green waste which need to be efficiently collected, processed, and transformed into valuable products. A well-functioning bioeconomy value chain ensures that these resources are effectively managed, from waste collection to processing and distribution, creating a seamless flow of materials that can be converted into high-quality fertilisers. Moreover, a strong bioeconomy value chain supports innovation in recycling technologies and sustainable agricultural practices, ensuring that circular fertilisers meet the nutrient needs of crops while minimizing environmental impact. Without a vital bioeconomy value chain, the logistics, quality control, and market acceptance of circular fertilise rs would be challenging, hindering the growth and sustainability of this market.[25]

Regional governments can play a pivotal role in developing bioeconomy chains by integrating it as a core component of the circular economy strategy, with Public Authorities taking a leading role in its development and coordination. In European regions, the promotion of bioeconomy is influenced by various drivers, including regional resources, active use of biological materials, industrial expertise, and external factors such as political decisions aimed at boosting competitiveness and economic growth. The development of the bioeconomy also serves as a response to challenges like rural depopulation, climate change, and the need to reduce dependence on imported raw materials, aligning with broader objectives like the UN Sustainable Development Goals.

Authorities must establish a hierarchy of objectives that balance food security, climate action, and natural resource management while addressing the competing demands for biomass. This

[24] https://www.sysav.se/om-oss/press-och-media/nyheter/skansk-besserwisser-finalist-i-avfallsvarldens-eurovision/
[25] https://rusticaproject.eu/wp-content/uploads/2023/01/PA11_Regional-business-sheets.pdf

political vision and leadership are necessary to align bioeconomy initiatives with the economic, social, and environmental priorities of the region, ensuring long-term sustainability and broad-based benefits. [26]

3.3.1. Assess your case: map industrial biowaste and local needs

The first step for regional governments is to identify and prioritize the specific needs and resources of their territory. This involves assessing soil properties, water availability, and organic matter content, which are essential for determining suitable agricultural practices and bioeconomy initiatives. For instance, regions rich in nitrogen may benefit from digestate processing technologies that produce marketable biofertilisers that can be transported out of the region, thereby transforming surplus nutrients into valuable resources. Or adapting water and nutrient recovery systems to wastewater management can be more advantageous for arid regions in South of Europe. By aligning bioeconomy actions with local agricultural strengths, municipalities can maximize resource utilization and promote sustainable practices.

A successful bioeconomy action plan requires collaboration among diverse stakeholders, including farmers, researchers, private companies, and policymakers. Workshops and dialogues among these groups can facilitate the exchange of ideas, helping to align ambitions and foster innovation. Engaging stakeholders ensures that the action plan reflects the collective goals of the community, thereby increasing the likelihood of successful implementation. For example, involving biogas companies, biomass and district heating providers, and fertiliser producers helps optimize logistical chains, overcome technological barriers, and ensure a balanced and contaminant-free production process.

Regional governments must also consider the logistical and profitability challenges that may hinder the efficient utilization of side streams in agriculture. Many farms produce side streams that are small in quantity, seasonal, and may lack suitable buyers. By identifying key players and regional characteristics that influence these challenges, governments can develop cooperative structures for biogas production and other circular economy initiatives. Facilitated public sector support is crucial in overcoming these barriers, enabling the establishment of stable markets for outputs that can defray operational costs and incentivise quality improvements.

[26] https://www.acrplus.org/en/activities/publications/technical-reports/2891-the-governance-of-circular-bioeconomy-practices-and-lessons-learnt-from-european-regions

FER-PLAY DATABASE: check the available data for the bio-waste streams in your region

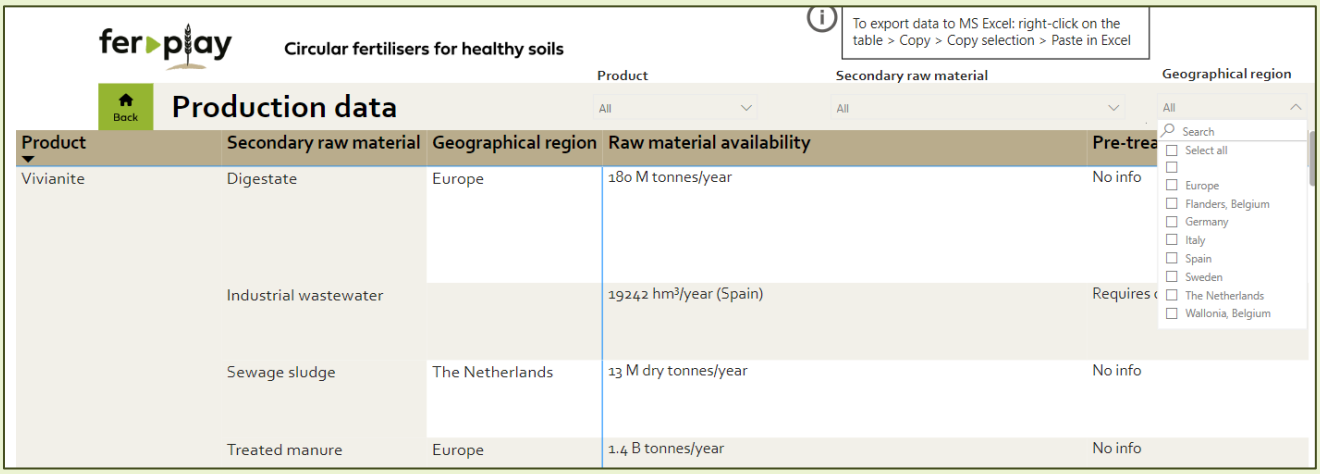

Figure 8. FER-PLAY Database

FER-PLAY partners collected available data from value chains derived from seven secondary raw materials (biological by-products, bio-waste, digestate, industrial wastewater, sewage sludge, treated manure and urban wastewater) to form a database that can be consulted while mapping the available waste streams and the fertilising products that can be produced per region or country.

The database provides a comprehensive overview on alternative fertiliser value chains at EU level, covering all phases of alternative fertilisers' life cycle (from secondary raw material production to field application), showing data and figures of alternative fertilising value chains and end products.[27]

[27] https://fer-play.eu/resources/#1675863959450-3b58785e-842e

EXAMPLE OF GOOD PRACTICE: "Bioeconomy Development in Castilla y León"

Figure 9. Brochure of Biogas Regions project - Promotion of biogas production and its market development through local and regional partners.

The project was based on the guidelines set out in the framework of the European Biomass Action Plan to implement biogas production in 7 European regions, one of which was Castilla y León.

Regional Government of Castilla y León has been actively developing its biogas strategy for a long time; the regional government was a partner of BiogasRegions Project from 2007 to 2010 which was aiming at developing a strategic strategy and action plan in each partner region to foster biogas production.[28]

Building on the knowledge and technology transfer with other regions in Europe, in 2019 Castilla Y Leon set up the **Regional Bioeconomy Working Group** representing regional policymakers, technological centres, university and private sector. The group has recognized biofertilisers as a regional priority, highlighted the importance of Bioeconomy Territorial Plans and Best Practices, and implemented capacity-building initiatives for businesses.

Furthermore, a dedicated **Regional Working Group for Biogas/Biomethane** was established to expedite the implementation of the Biogas Roadmap, aiming to eliminate barriers. The

[28] Biogas Action Project, Project Deliverable 2.1 Compilation of reports and tools for regional biogas deployment https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5aa96cdd8&appId=PPGMS

group's findings and progress were shared and discussed with stakeholders at the Biogas Fair in October 2023

Bioeconomy Forum of Castilla y León was also held in October 2023[29]; a dedicated thematic session on biofertilisers was conducted with stakeholders (working groups coordinated by representatives from the agricultural and agri-food sectors, bioenergy, forestry, circular economy and habitat) to analyse options, barriers, and future developments across the entire food-water-nutrient value chain. This included not only centralized treatment methods like digestate use but also local options such as fertigation, which is gaining importance specifically in arid regions.

Several fertiliser manufacturers in the region showed interest in producing biofertilisers due to anticipated supply restrictions for certain critical raw materials and rising gas prices. Thus, the regional government additionally initiated discussions to involve them in the process.

3.3.2. Connect your stakeholders

Connecting stakeholders is essential for developing a successful bioeconomy market, as it ensures a reliable and efficient supply chain for both inputs and outputs. A thriving bioeconomy depends on the consistent availability and quality of biomass, which can only be achieved through collaboration among various parties, including biomass producers, circular businesses, biogas companies, and agricultural sectors.

Identifying and linking regional biomass producers with circular businesses is crucial for maintaining a steady flow of materials needed for bio-based products. Digital markets are therefore a useful tool for supply chain management connecting the sellers of biomass to buyers in their region. Promoting the availability or the development of such markets during bioeconomy forums or workshops would boost biomass valorisation.

Stabilizing the market for bioeconomy outputs is equally important. This stability can help reduce bio-waste processing costs and incentivize continuous improvements in product quality. Engaging farmers and agricultural producers is vital to aligning the supply of bio-based fertilisers with market demand, promoting efficient resource use and better synchronization of production cycles.

[29] https://www.miteco.gob.es/es/ceneam/formacion-ambiental/congresos/foro-bioeconomia-cyl.html

EXAMPLE OF GOOD PRACTICE: "Digital Market for Biomass" / Fellow Project TREASOURCE

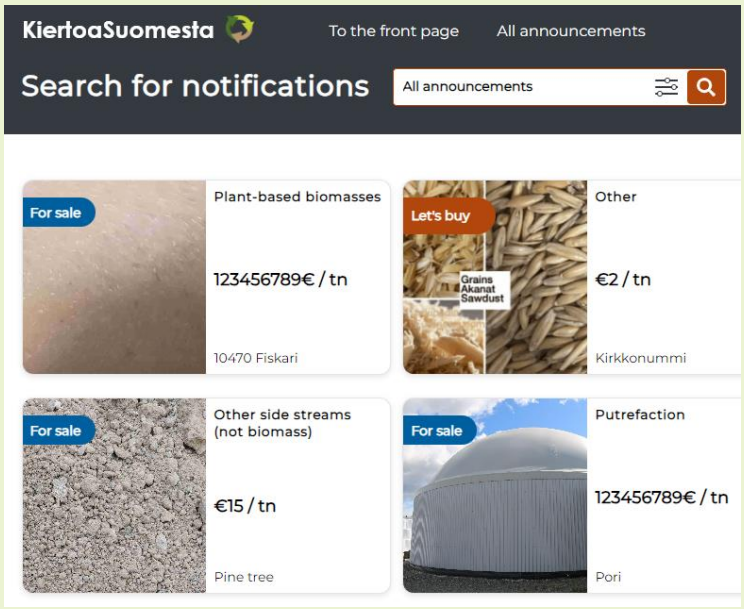

Figure 10. Biomass available for purchase or sell in KiertoaSuomestra[30]

The TREASoURcE project has developed and launched a digital marketplace called KiertoaSuomesta.fi (CircularFinland.fi) for biobased by-products and waste streams.[31] This free platform facilitates connections between sellers and buyers of these materials, targeting companies in agriculture, forestry, and food processing, as well as industries that utilize raw materials and the public sector.

The goal of KiertoaSuomesta.fi is to create new business opportunities for primary producers by providing an easy way for farms to generate extra income through the sale of waste and by-products streams, while also supplying industrial operators with new raw materials. Additionally, the platform can be used to list contracting services and facilitate feed trade. The development of the marketplace has been shaped by various workshops, online surveys, and interviews with diverse user groups, primarily farmers and the processing industry. The Project is aiming to replicate the model for other partnering regions to improve local circularity.

For further reading, see ***TREASoURcE Replication Handbook*** with Best Practice examples

[30] Translated into English by Google auto-translate. https://app.kiertoasuomesta.fi/explore
[31] https://treasource.eu/circularfinland-digital-marketplace-now-open/

3.3.3. Maximise the profitability of biomass valorisation through industrial symbiosis

The business model for maximizing biomass value should prioritize the most sustainable uses of agricultural residues, such as food processing (e.g., juices or soups) and the creation of bioproducts like bioplastics or cosmetics (see figure below). After these high-value products are extracted, the remaining biomass can be converted into biofertilisers or used for energy production. For instance, farmers could sell their surplus biomass to a company that produces juice, and the leftover pulp could then be transformed to a fertiliser, which could be returned to their fields, creating a circular system that enhances both sustainability and profitability.

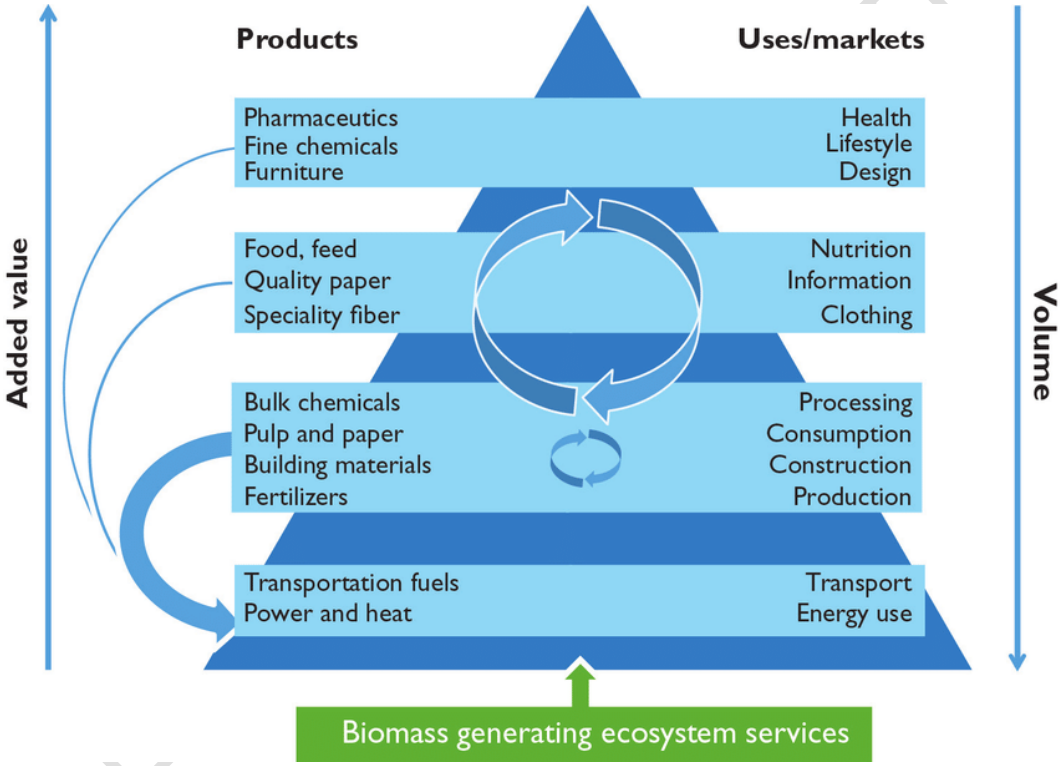

Figure 11. Biomass value pyramid for a circular bioeconomy[32]

Forming clusters or cooperatives can help match biomass suppliers with those who need it, ensuring a more consistent and reliable supply chain. Such collaboration is essential for overcoming logistical challenges and ensuring that side streams are efficiently utilized, even when they are small or seasonal.[33]

[32] Finnish Environment Institute Reports of The Finnish Environment Institute 13 | 2017 Renewal of forest-based manufacturing towards a sustainable circular bioeconomy -
[33] https://rusticaproject.eu/wp-content/uploads/2023/01/PA11_Regional-business-sheets.pdf

In addition, regional characteristics and key players must be considered when planning circular economy entities. Public sector support is vital at various levels to facilitate the development of these structures, such as biogas production cooperatives.

Fellow Project RUSTICA

The project aims to explore new uses and business opportunities for currently unused biobased side streams and waste, with the goal of powering local economies through a circular bioeconomy. By collaborating with key actors in the sector, the project identifies and shares new opportunities to advance the circular bioeconomy. Active communication efforts are planned to disseminate knowledge about these possibilities.

A rural-urban symbiosis model will be developed to strengthen local circular economies, specifically creating value chains for fruit and vegetable waste, leading to the development of new business models for biobased fertilisers.[34]

[34] https://rusticaproject.eu/market-business-development/

EXAMPLE OF GOOD PRACTICE: “Bioeconomy Hub ECO3- FINLAND”

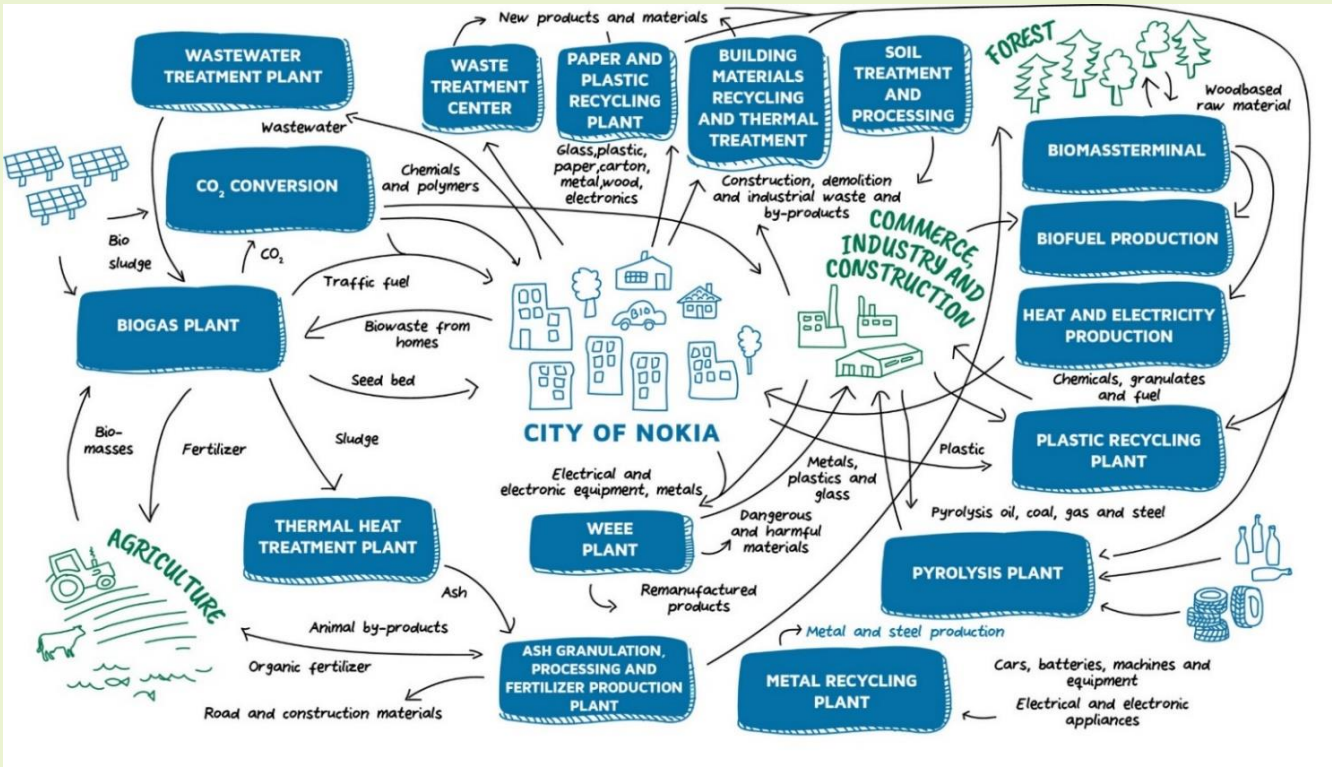

Figure 12. Diagram of the ECO3 concept connecting nutrient, wood, and energy cycles[35]

ECO3 is a bioeconomy hub in Nokia, Finland, focused on advancing bio and circular practices at an industrial scale. It has been developed by Verte Oy and the City of Nokia, in collaboration with 18 companies within the area and an external network of various companies and universities. ECO3 embodies an industrial ecosystem, utilizing a development concept that fosters industrial synergy to enhance nutrient, wood, and energy cycles, while improving material flow between companies and regional stakeholders.

Companies at the hub have the opportunity to receive aid in finding business and collaboration partners, networking opportunities and company visits, and cooperation with public administration and authorities as regional authorities such as The Council of Tampere Region and the Economic Development Agency of Tampere Region are cooperating partners.[36]

[35] https://eco3.fi/en/nutrient-cycle/circular-economy-diagram/
[36] https://eco3.fi/en/partners/

3.3.4. Support start-ups

Supporting start-up companies is vital for developing a robust regional bioeconomy market, as these new businesses often drive innovation and sustainability in the industry. Start-ups, particularly those focused on eco-friendly solutions such as circular fertilisers, face numerous challenges, including navigating complex legislation, obtaining necessary certifications, and securing financial resources. Providing targeted support to these companies is essential for overcoming these hurdles and ensuring their success.

Legislative support

Circular fertilisers can be derived from various waste streams and exist in multiple forms, whether mineral, organic, or organo-mineral. They can be used in both organic and conventional farming systems. Navigating the multitude of regulations governing these products is a costly and time-consuming process that many start-ups cannot afford. This legislative complexity often translates into high staff costs, creating an additional barrier to market entry for circular fertilisers. By offering counselling services and expert guidance on regulatory compliance, regions can help start-ups overcome these challenges and reduce the financial burden associated with them.

Financial incentives

Financial support is another crucial aspect of fostering a thriving start-up ecosystem in the bioeconomy. Securing certifications and validating new technologies to bring products to market can be prohibitively expensive for small businesses. Providing extra financial aid, such as grants or subsidies, can help these companies manage these costs. Additionally, offering tax incentives for businesses involved in the circular fertiliser value chain can further stimulate growth and innovation in this sector. These financial supports not only ease the burden on start-ups but also make the region more attractive to eco-friendly businesses.

Forming clusters

In addition to financial and regulatory assistance, start-ups benefit from initiatives that promote collaboration and networking. Clustering eco-friendly companies together fosters collaboration, allowing businesses to share resources, knowledge, and technology. This collaborative environment can accelerate innovation and help start-ups develop more effective and sustainable solutions. Moreover, promoting the impact of successful projects can attract new entrepreneurs to the region, further strengthening the local bioeconomy.

Business counselling

Counselling services are also essential for helping start-ups navigate the complexities of starting a circular business. Providing guidance on business planning, market entry strategies, and

financial management can significantly improve the chances of success for new companies. By offering these services, regions can help start-ups build solid foundations and increase their resilience in the competitive market.

3.4. Promote Circular Fertiliser Use in Your Region

Public authorities play a critical role in promoting the use of circular fertilisers within their regions, which is a key strategy for fostering a sustainable bioeconomy. By leveraging existing networks, engaging with local stakeholders, and setting examples through their own actions, Public Authorities can significantly enhance the adoption and trust in circular fertilisers.

Use your network

One of the most effective ways for Public Authorities to promote circular fertilisers is by utilizing their national networks. In countries like France, where each region has a Chamber of Agriculture, these institutions can engage with each other to share experiences and best practices related to new fertilisers. This institutional homogeneity allows for the exchange of valuable insights, ensuring that regions can learn from one another's successes and challenges. By consulting with counterparts in other regions, Public Authorities can build a stronger, more informed approach to promoting circular fertilisers.

Visit production sites

Local engagement is equally important. If the Public Authority itself is involved in producing fertilisers, organizing visits to production sites for farmer organizations can be a powerful tool. These visits allow farmers to see the entire production process, from waste collection to fertiliser creation, which helps to alleviate concerns about impurities and build trust. The concept of "local waste turned into local fertiliser" resonates strongly with farmers, who are more likely to trust and adopt fertilisers if they can witness the production process firsthand. Once convinced, leaders of farmer associations can independently organize events to showcase these new methods to their members, which often carries more weight and credibility among the farming community.

Localizing waste management is another crucial strategy. Ensuring that farmers can trace the origin of the inputs used in their compost and know who to contact in their region fosters transparency and trust. Regional collaborations become easier when there is clarity about who is responsible for waste management, enabling more effective promotion and adoption of circular fertilisers.

Lead by example with green public procurement

Public authorities can also lead by example by prioritizing the use of circular fertilisers in municipal landscaping projects and other public initiatives, they can demonstrate their commitment to sustainability. Purchasing fertilisers from local producers and openly advertising these actions not only supports the regional economy but also helps reduce the municipality's carbon footprint and enhancing its public image.

FER-PLAY Deliverable 2.2 - Social acceptance study with end-users[37]

The uptake of circular fertilisers by end-users, particularly farmers, is influenced by a range of drivers and barriers. One of the significant barriers is the cost and availability of organic fertilisers, such as compost and spent mushroom compost. Despite the potential environmental benefits, farmers find these circular options less accessible and often more expensive than traditional synthetic fertilisers, which limits their widespread adoption.

Farmers' perceptions of political institutions further complicate the adoption of circular fertilisers. Many farmers view current political structures as unreliable, contributing to their reluctance to engage with new regulatory frameworks or participate in policy development. This is reflected in the low percentage of farmers who actively check legal levels and the general dissatisfaction with the communication channels between policymakers and farmers. Moreover, the negative perception of bureaucratic control and the slow progress in implementing supportive laws exacerbate the problem.

However, there is a recognition among farmers of the benefits of circular fertilisers, especially when these products align with their existing practices and machinery. Encouraging the use of circular fertilisers may require building trust in political institutions, enhancing communication, and ensuring that these alternatives are as economically viable and accessible as their synthetic counterparts.

For further reading on the subject please refer to FER-PLAY Deliverable 2.2. "Multi-assessment of impacts, trade-offs and framework conditions".

Partnering with other EU regions

Direct involvement in European Union projects related to circular fertilisers is another strategic move. By becoming a partner in such projects, Public Authorities gain access to the latest

[37] https://fer-play.eu/resources/#1684766582013-ddd5323e-5bfe

technological developments, exchange knowledge and experience with other regions and can play a pivotal role in bringing relevant stakeholders together. Collaborating with universities, farmers, and producers helps identify the specific agricultural and economic needs of the region, leading to the development of tailored action plans. This collaboration is essential for the widespread adoption of new technologies and practices.

EXAMPLE CIRCULAR FERTILISER PROMOTION: Fellow Project: FERTIMANURE

Figure 13. Field visit to Spanish pilot of FERTIMANURE Project with Catalan Minister for Climate Change, Food and Rural Agenda.[38]

FERTIMANURE Project develops, integrates, tests and validates innovative Nutrient Management Strategies to efficiently recover mineral nutrients and other relevant products with agronomic value, from animal manure.

As project partner, the Catalan Ministry for Climate Change, Food and Rural Agenda was involved in organising demonstration events and connected farmers, other administrations and stakeholders to amplify the results and achievements of the project. Another project partner, The French Chambers of Agriculture has similarly connected relevant stakeholders to identify their needs and disseminate project results through events thereby aiding the promotion of circular fertilisers in the region.[39]

For further reading on project results and achievements, see FERTIMANURE website.

[38] https://www.fertimanure.eu/en/news/consult/50
[39] https://www.fertimanure.eu/en/news/consult/81

4. Conclusions

The FER-PLAY project underscores the importance of adopting circular fertilisers to promote sustainability, reduce reliance on imported resources, and support a circular economy. Through a collaborative approach involving key stakeholders such as producers, end-users, and public authorities, the project has successfully identified both the opportunities and challenges associated with circular fertiliser production and use. A major takeaway from the findings is that controlling the quality of waste streams at the source, such as urban wastewater and bio-waste, is crucial for ensuring that these materials can be effectively transformed into valuable fertilisers. Upstream control, transparent monitoring, and the use of advanced technologies can help improve the efficiency and trustworthiness of wastewater treatment systems. Industrial biowaste streams have a great recycling potential within industrial symbiosis schemes.

Public authorities play a central role in advancing the bioeconomy by fostering regional cooperation, engaging stakeholders, and creating policy frameworks that support circular fertiliser production. By integrating bioeconomy initiatives into their broader circular economy strategies, regional governments can enhance local agricultural practices, address environmental challenges, and support the development of sustainable value chains. Additionally, public engagement and clear communication are essential to build trust and encourage citizen participation in waste sorting and the use of circular products. Ultimately, a combined effort between governments, industries, and the public is necessary to unlock the full potential of circular fertilisers and move towards a more sustainable future.

fer play

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