

Important aspects for a successful implementation of projects for the market uptake of circular fertilisers



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Table of Contents

Authors.....	2
1. Introduction	5
2. General recommendations.....	6
On mapping and selection of alternative fertilizer value chains.....	6
On circular fertilizer multi-assessment of impact.....	7
On bottlenecks for circular fertilizer market uptake	8
On co-creation with key stakeholders	9
On the dissemination, exploitation and co-creation of project results	10
On project management and clustering with fellow projects	10
3. Flagship resources	12

List of Acronyms

EU European Union

KPIs Key Performance Indicators

LCA Life Cycle Assessment

LCC Life Cycle Cost

R&D Research and Development

s-LCA Social Life Cycle Assessment

TRL Technology Readiness Level

1. Introduction

[FER-PLAY](#) and [NOVAFERT](#) are two Horizon Europe projects that kicked off in September 2022 and aim at fostering the **market uptake of circular fertilisers** through a series of actions, like fertiliser mapping and database creation^{1,2,3}, multi-assessment of the environmental⁴, social⁵, economic, upscaling⁶ and regulatory aspects⁷, stakeholder engagement and co-creation of guidelines for farmers, fertilizer producers, local administrations and policy makers⁸. Now approaching the finish line, these projects have collaborated to extract **key lessons learned and are eager to share recommendations with R&D project implementers and designers**. These insights serve as a foundation for the successful implementation of ongoing and future initiatives with similar objectives: promoting circular fertilizers for healthier soils and more resilient nutrient markets and agricultural sectors.

¹ FER-PLAY database, [link](#)

² NOVAFERT database, [link](#)

³ NOVAFERT ATLAS of EU nutrient oriented living labs, [link](#)

⁴ FER-PLAY D2.2, Extended executive summary [10.5281/zenodo.14824379](#)

⁵ FER-PLAY D2.2, Chapter on the assessment of social acceptance [10.5281/zenodo.14824379](#)

⁶ FER-PLAY D2.2, Chapter on the assessment of technical aspects and conditions for industrialisation [10.5281/zenodo.14824426](#)

⁷ FER-PLAY D2.2, Chapter on the assessment of the Regulatory Framework [10.5281/zenodo.14824300](#)

⁸ FER-PLAY's guidelines and recommendations [link](#)

2. General recommendations

- **Find a common vocabulary for these fertilisers.** Promoting circular bio-based fertilizers can be challenging when the community uses different terms to refer to the same product. This inconsistency can create confusion, leading audiences to perceive them as distinct categories of products. Some projects address them as *bio-based* or *organic fertilisers*, omitting their circularity, others do name them *circular fertilisers*, including a possible non-biological origin and others call them *alternative fertilisers*. In this article we will refer to all of them as circular fertilisers.
- **The upscale of production technologies is needed.** Technologies for nutrient recycling and for the production of circular fertilisers is generally at a low-medium technology readiness level (TRL), limiting the quantity of circular fertilisers available to create and test formulations.
- **The best of both worlds: mix circular with conventional fertilisers.** To accelerate the market uptake of circular fertilizers in the short term, we advocate for an approach that **integrates them with conventional fertilizers** while also **fostering local markets**. It is essential to raise awareness among users and consumers about how circular fertilizers enhance and stimulate soil functions when incorporated into plant nutrition practices.
- **Work to ensure quality.** Given the heterogeneity of secondary bio-based feedstocks, efforts should focus on implementing strict quality controls for both the feedstock and the circular fertilizer production process. This will help build confidence in product quality while ensuring consistency over time.
- **Develop formulations that enhance soil health.** Through the dissemination of project results, we identified strong interest in multi-ingredient fertilizers that help maintain and restore soil health. Testing protocols for novel fertilization solutions should demonstrate their positive impact on **soil health**, which is essential for long-term productivity and the provision of ecosystem services.

On mapping and selection of alternative fertilizer value chains

- **Make data available.** Accessing data on circular fertilizer value chains presents a significant challenge. Much of the information is dispersed across academic literature, while business-specific data is often protected by intellectual property rights. This fragmented landscape calls for a comprehensive, multidisciplinary approach to data collection. The conjoined efforts of several entities allowed to create the [FER-PLAY database](#), that provides data on production processes, logistics, regulatory and geographical specificities of 60+ circular fertiliser value chains. If additional data is needed, it should be sourced from academic literature, business data, grey literature, government reports, and industry white papers.
- **Don't forget to take into account geographical specificities.** Circular fertilizer value chains are often tied to local supply chains, production facilities, and regional market conditions. Mapping these value chains should incorporate geographic specificity to identify those that

align with local strengths and constraints. Engaging in dialogue with local stakeholders can provide invaluable insights.

- **Select wisely the most interesting circular fertilisers to perform in-depth multi-assessments.** Multi-topic assessments are resource-intensive, taking months to evaluate 5-10 value chains from economic, environmental, and social perspectives. When facing multiple value chains, it is strategic to select the most interesting ones for in-depth assessment and promotion. This selection process requires **careful consideration of criteria** to avoid excluding relevant chains. In some cases, co-creating the ranking with relevant stakeholder groups is more effective than dedicating resources solely to developing and optimizing complex selection methodologies from an academic standpoint.

On circular fertilizer multi-assessment of impact

- **Be mindful of methodology limitations and discuss results accordingly to avoid misleading conclusions.** There is a lack of robust, comprehensive, multi-assessment methods for evaluating the environmental and economic impact of circular fertilizers. Most widely endorsed assessment methodologies, such as Life Cycle Assessment (LCA), social LCA (s-LCA), and Life Cycle Cost (LCC), do not effectively model circular and complex systems. In general, these methodologies fail to account for key characteristics of circularity. Specifically, for circular fertilizers, they do not model variables such as edaphoclimatic conditions and soil management practices, the different forms of nutrients and carbon in both circular and non-renewable fertilizers, and other relevant factors. As a result, these models do not capture how the application of circular fertilizers can positively impact soil health and the environment. FER-PLAY project identified the LCA and LCC methodology shortfalls⁹ and NOVAFERT¹⁰ project worked on improving the methodologies.
- **Accept assumptions and approximations.** LCA, s-LCA and LCC need plenty of input data, often not available. **Data scarcity** implies that many assumptions and approximations have to be made. Make sure to **take into account this limitation when discussing results** that may not be a faithful reflection of reality.
- **Question the methods.** The outcome of the aforementioned scenario is that well applied LCA and LCC methodologies deliver a set of environmental, social and economic performances of circular fertilisers that are often worse than the conventional counterparts. Therefore, assessment implementers should question whether **the biggest advantages of circular fertilizers go unnoticed by current LCA/LCC methods.**
- **Deliver results in a form that is understandable by key stakeholders.** LCA, s-LCA, and LCC generate **complex results** that are often misunderstood by audiences unfamiliar with these methods and can be misused to support detrimental actions. Assessment evaluators must carefully craft conclusions, considering the wide range of factors that influence the results.

⁹ FER-PLAY D2.2, Extended executive summary [10.5281/zenodo.14824379](https://zenodo.org/record/14824379)

¹⁰ NOVAFERT LCA Methodology, [Link](#)

On bottlenecks for circular fertilizer market uptake

- **Raise the TRL and market hard.** Generally, the market for most circular fertilizers is not yet mature and is primarily developed at the regional level. Among the most evident barriers are **low production volumes**, which make circular fertilizers less attractive to distribution channels, and **end-users' concerns** regarding their safety and effectiveness. Additionally, some circular fertilizers have lower nutrient density, resulting in higher transport and field application costs compared to conventional, nutrient-dense alternatives. These barriers could be addressed by increasing the Technology Readiness Level (TRL) of nutrient recycling and conducting extensive marketing campaigns to dispel persistent misconceptions about their efficacy and safety. Currently, there is a significant lack of understanding among farmers and end-users regarding the benefits and availability of circular fertilizers.
- **Let's take circular fertilisers out of the valley of death.** Many nutrient and organic matter recovery technologies perish in the *valley of death*, due to the lack of either public or private investments for their upscale. Low TRL means insufficient quantities of circular fertilisers for reliable field tests on effectiveness and safety. Additionally, the production costs of CIRCULAR FERTILISERSs are often higher than those of conventional fertilizers, further reducing their attractiveness to producers and consumers and limiting market penetration and scalability. There's the need to advocate for funding lines with high budget to upscale production facilities from pilot scale to full-production scale, as well as to advocate for the creation of financing schemes that consider the necessary costs for preparing and executing the key steps of project upscale. Blend financing options where funding is complemented with loans and with project-specific payback periods enable the synchronization between financial resources at the start of the project and returns.¹¹
- **Bring evidence to revise the European and National regulatory frameworks.** The regulatory framework is inconsistent, as it both supports and hinders the commercialization and application of circular fertilizers. The Waste Framework Directive and the Fertilising Products Regulation present significant barriers to the adoption of circular fertilizers. Other regulatory instruments, such as the Nitrates Directive, the Sewage Sludge Directive, and the Organic Farming Regulation, should be refined to better support the uptake of circular fertilizers. At the national level, inconsistencies, delays, excessive strictness, and even a lack of ambition impede market adoption. More R&D projects should focus on providing evidence regarding the safety and potential risks of circular fertilizers, as well as delivering accurate recommendations to policymakers.
- **Develop financial incentives to make attractive the production and purchase of circular fertilisers.** The current policy frameworks often lack sufficient incentives, such as subsidies or tax benefits, to encourage the adoption of circular fertilisers. This absence of financial support discourages both producers and consumers from transitioning to circular fertiliser options.

¹¹ "Report on HOOP Policy Conference", https://hoopproject.eu/wp-content/uploads/2024/09/HOOP_D8.6_report_HOOP_cities_onference.pdf, page 19

- **Do we understand each other? Standardize metrics and terminology.** The lack of standardized metrics and terminologies across studies and industries complicates the comparison of products. This makes it essential to develop harmonized indicators for assessing the performance and potential of circular fertilizers.

On co-creation with key stakeholders

- **The R&D process is guided by insights from market-relevant stakeholders.** Since markets are driven by a synergy between proper demand and compelling offers, co-creation activities with end-users and producers of circular fertilizers are a crucial step in understanding the real needs and concerns of these stakeholder groups. However, achieving key performance indicators (KPIs) in terms of attendance at these activities is quite challenging.
- **Reward stakeholders for answering your surveys.** Identified stakeholders may already be receiving numerous surveys and may have no intention of dedicating their valuable time to the project's mission. As a result, collecting information becomes challenging, especially when no **compensation** is offered for their efforts. It is important to recognize this and ensure the project has a budget to acknowledge their collaboration. For example, stakeholders could be included in communication campaigns and have their travel costs covered for project events and conferences.
- **Implement creative strategies to boost stakeholder attendance at project initiatives.** It is crucial to avoid stakeholder fatigue, which is often caused by multiple activities with similar scopes promoted by different projects. It is advisable to **cluster with other initiatives** and organize joint events, webinars, and surveys. Additionally, events should be designed as opportunities to **present novel information and concepts that are of interest to the audience**. Bilateral discussions are key to understanding stakeholder needs and expectations, rather than simply presenting project findings. This approach ensures the project aligns more closely with their actual interests. To boost participation, creative strategies such as **raffles for high-value tools or services** can be effective.
- **Have stakeholder groups associations in the project consortium. Including stakeholder group associations** within the project consortium increases the likelihood of reaching the critical mass needed for relevant co-creation activities. However, certain **sensitive information**, such as details related to business models and technology intellectual property, is rarely accessible from companies and enterprises unless they are part of the consortium themselves.
- **Involve stakeholders according to their calendar.** When planning activities, consider the **availability** of the targeted stakeholder groups. For instance, olive crop farmers may not be available during the harvest period in early winter.
- **Catch stakeholders' attention with tailored communication. Tailor the messages** to each specific stakeholder groups, putting the **focus on the benefits** of the market uptake of circular fertilisers. Catching stakeholders' attention is essential to later structure regular exchange and engagement.

On the dissemination, exploitation and co-creation of project results

- **Dissemination of project results should target farmer assistance networks.** There is a **high interest**, especially among farmers, in the use of circular fertilisers. However, and due to the challenges addressed in this report, circular fertilisers are still not widely popular. One of the avenues is related to communication and dissemination, and lies with the need of developing a strong, trained and impartial extension network for assisting farmers and agronomists to adopt research and development, to innovate and change, and to keep their business profitable.
- **Demonstrative cases for trustworthiness.** Most times showcased results are on a small or lab scale, which is seldom convenient to raise confidence among project target audience. We therefore **need more demonstrative examples**. R&D projects should include large scale field trials and/or connect with living labs to facilitate knowledge exchange on good practices and results. Check out the example of [GreennoMed](#) and [Flanders](#) living labs.
- **Audience-friendly results...always!** To ensure the results are accessible and understandable to the target audience, project call topics should **require the delivery of results in a clear format, ideally in local languages**. When Coordination Support Actions are meant to assess products, processes or scientific results, we suggest *i)* either using the less complex tools applicable to the case, which results are easy to interpret by the wider audience (unlike those arising from LCAs, LCCs or similar methodologies) or *ii)* foresee the due amount of resources to curate results into easily understandable material.
- **Innovate on the way we reach the masses.** We need new, more agile approaches to engage broad stakeholder groups, such as citizens and consumers. It is essential to provide clear, straightforward written deliverables to help them understand the value and benefits of circular bio-based products. Additionally, their valuable feedback should be gathered through brief, topic-specific surveys.
- **Establish a clustering strategy with fellow projects.** To **reduce audience fatigue** and to **multiply the public**, it's essential to establish a "clustering strategy" and coordination between fellow projects. To enhance the effectiveness of dissemination and facilitate the achievement of individual project KPIs, joint result summaries, policy briefs, and/or policy recommendations should be considered.

On project management and clustering with fellow projects

- **Structure the collaboration at the Grant Agreement preparation phase.** Greater collaboration among EU projects is needed and should be **strategically planned and aligned**. Working together to offer combined or aggregated results, as well as coordinated co-creation activities, will be highly beneficial. Coordination teams across projects, including project coordinators and other technical experts, should be designated during the grant agreement preparation phase.
- **Reap what you sow.** We observed that the collaboration with projects funded under the same topics is feasible and fruitful and must be **equipped with the due resources**, like person

months and budget for events. Projects should appoint people in charge of reaching fellow projects, keeping them updated on their results and milestones, shaping the collaboration and following-up its development.

- **Be realistic on the reach of the collaboration.** Conjoined deliverables can be foreseen only if the projects rely on a perfect chronological overlap of the corresponding tasks, which is very seldom the case. Rather bet on joint publications, conferences, or public outreach activities that amplify visibility for all clustered projects. This is particularly useful when the scope is engaging with broader audiences and demonstrating collective impact to funding agencies.
- **Co-organise dissemination and co-creation events.** Shared events reduce duplication of efforts and resource expenditure by engaging stakeholders once on behalf of multiple projects. This consolidated approach is especially beneficial when stakeholders have limited availability. Co-hosted events also offer an opportunity for fellow projects to present their findings cohesively, emphasising the complementary nature of their work.
- **Respect intellectual property!** Intellectual property and confidentiality concerns often arise in clustered projects. To avoid conflicts, establish clear guidelines on data sharing, attribution, and IP management at the outset.

3. Flagship resources

FER-PLAY database <https://zenodo.org/records/11654776>

FER-PLAY Multi-assessment of impacts, trade-offs and framework conditions

- Extended Summary [10.5281/zenodo.14824286](https://zenodo.org/records/10.5281/zenodo.14824286),
- Chapter on the assessment of the regulatory framework [10.5281/zenodo.14824300](https://zenodo.org/records/10.5281/zenodo.14824300),
- Chapter on the assessment of social acceptance, [10.5281/zenodo.14824379](https://zenodo.org/records/10.5281/zenodo.14824379)
- Chapter on the assessment of technical aspects and conditions for industrialization, [10.5281/zenodo.14824426](https://zenodo.org/records/10.5281/zenodo.14824426)

More reports and papers on FER-PLAY Zenodo Community <https://zenodo.org/communities/fer-play-eu>

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