D 1.1 Guidelines on system innovation, adapted to businesses

WP 1 Building a resilient European network to harness agri-food biomass and side-streams through systemic circular innovation

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EXECUTIVE SUMMARY

This document has the aim to explain the basic concepts of system innovation and how it can be used to support developments in de agri-food sector.

The food sector faces multiple, interconnected challenges: resource scarcity, food loss and waste, evolving consumer expectations, and increasing regulatory pressure for sustainability. Small and medium-sized enterprises (SMEs) in the agri-food sector are well-positioned to innovate, but structural, financial, and technological barriers often prevent the full uptake of circular and scalable solutions.

System Innovation (SI) offers a powerful framework to overcome these barriers. Unlike traditional innovation, which focuses on individual products or technologies, SI addresses multiple interdependent dimensions simultaneously – technological, behavioural, policy and governance, business and organizational, and value chain. By considering the system in its entirety, SMEs can develop solutions that are resilient, scalable, and capable of generating lasting impact.

Key insights from this report include:

- Thinking beyond technology: Non-technological innovations – such as changes in organizational models, consumer behaviour, or governance – can be as transformative as technical solutions.
- Assessing innovation readiness: Evaluating each dimension's maturity (from idea to scalable implementation) helps identify gaps, allocate resources efficiently, and plan effective next steps.
- Collaborating across the value chain: Engaging partners early – suppliers, customers, regulators, and research institutions – strengthens innovation outcomes and ensures alignment with broader systemic needs.
- Planning for iterative scaling: System innovation is inherently iterative. Continuous reflection, testing, and adaptation allow SMEs to refine solutions as challenges and opportunities evolve.
- Leveraging practical tools: Digital platforms such as SIRL (Systemic Innovation Readiness Level) can guide SMEs through self-assessment, monitor progress across dimensions, and support data-driven decision-making.

By adopting a systemic mindset, SMEs can identify leverage points, unlock new business opportunities, and create long-term value. System Innovation transforms complex challenges into opportunities for growth, sustainability, and meaningful impact within the food system.

In short: System Innovation is not just a way to improve products; it is a strategic approach to design, implement, and scale innovations that truly transform the food sector, benefiting businesses, consumers, and the environment alike.

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1 INTRODUCTION

The food sector is facing major challenges: resource scarcity, food loss and waste, changing consumer expectations, and increasing policy pressure for sustainability. The agri-food sector generates vast amounts of biomass and side-streams that remain underused. Fruit peels, seeds and processing residues are valuable resources that too often end up as waste instead of value.

European SMEs are ready to innovate and embrace circularity, yet structural, financial and technological barriers slow them down, preventing the uptake of upcycled ingredients, twin transitions and scalable circular solutions.

Solving these challenges requires more than technological improvements – it requires a systemic approach to innovation.

System innovation (SI) means developing solutions that address several interconnected dimensions – technical, behavioural, business, value chain and policy – to achieve real, scalable change. Rather than focusing on one product or technology, SI looks at the whole system in which food businesses operate.

For small and medium-sized enterprises (SMEs), adopting a system innovation mindset can open new opportunities: stronger collaborations, improved resilience, and more sustainable business models.

1.1 Purpose & objectives

The purpose of this document is to provide a short report detailing the basic concepts of system innovation, adapted and vulgarised for businesses. The concept of system innovation is essential to the development of the GRAPPA project. Any company wishing to develop a new service or product must take into account the various elements covered by the concept of the systemic approach. However, this approach may seem complex to those working in the field, so it is essential to provide them with a manual explaining it in terms that are relevant to their reality.

1.2 Scope of the report

The scope of this project is to produce a short report covering, on the one hand, the theory and general concepts of system innovation and, on the other hand, a more operational section enabling companies to implement the approach.

The deliverable is public and will be made available to all organizations wishing to develop an innovative project.

2 SYSTEM INNOVATION FOR SMEs

2.1 System innovation: theory & concepts

2.1.1 What is system innovation?

When people think about innovation, they often associate it with a new product or a breakthrough technology. However, innovation can take many other forms, including:

- New business models or strategic partnerships
- Changes in consumer or employee behaviour
- New policies, regulations, or governance mechanisms
- Social or cultural shifts in how food, waste, or sustainability are perceived

System innovation goes beyond isolated solutions. It is based on the idea that meaningful and lasting impact emerges when several types of innovation are developed and implemented together.

For example, a new technology delivers its full value only when it is supported by appropriate regulations, aligned business strategies, and evolving consumer habits. Addressing complex challenges therefore requires coordinated change across multiple dimensions of the system.

System innovation can be understood as an "innovation package": a combination of core and complementary innovations that reinforce one another and drive structural change rather than incremental improvement.

In this context, healthy innovation ecosystems—bringing together businesses, policymakers, researchers, and consumers—enable more holistic and effective problem-solving by tackling challenges from multiple angles simultaneously.

2.1.2 Why it matters for food SMEs

In the food industry, innovation efforts often focus primarily on technology—for example, new machinery, digital tools, or sensors. While these solutions can improve efficiency, they rarely unlock their full potential on their own.

In many cases, non-technological innovations—such as new ways of engaging consumers, shared logistics models, or cooperative approaches to waste reduction—can generate equal or even greater impact. These innovations reshape how businesses operate, collaborate, and create value.

Real-world examples illustrate this clearly:

- Online food retailing did not succeed solely because of digital platforms. It also relied on cultural change, particularly growing consumer trust in e-commerce, as well as organizational innovation, including optimized logistics and delivery systems.
- New food waste management systems are effective only when policy frameworks, consumer behaviour, and business practices evolve in parallel.

For food SMEs, system innovation provides a practical framework to navigate complexity and resource constraints. It helps companies to:

- Identify multiple leverage points for change beyond technology alone;
- Collaborate more effectively across the value chain;
- Scale innovations through partnerships rather than isolated efforts; and
- Build resilient, future-proof, and sustainable operations.

2.1.3 The Five Dimensions of System Innovation

System innovation requires looking beyond a single solution and understanding how an innovation interacts with the broader system in which it operates. To support this approach, system innovation can be analysed through five complementary dimensions.

Considering these five dimensions helps businesses move from isolated initiatives to scalable and resilient solutions. The more dimensions an innovation addresses, the higher its chances of adoption, impact, and long-term success.

Below is a practical overview of each dimension, illustrated with agri-food–relevant examples and guiding questions.

1. Technological Dimension

This dimension focuses on the tools, equipment, and digital solutions that enable change. Technology often acts as a catalyst, but it is rarely sufficient on its own.

Examples:

- Sensors for tracking food waste
- Renewable energy systems
- Smart packaging solutions
- Digital tools for food traceability

2. Behavioural Dimension

The behavioural dimension addresses the social and cultural factors that influence whether an innovation is accepted and effectively used. Even the best technical solution will fail if behaviours and habits do not evolve.

Examples:

- Consumer purchasing and consumption habits
- Employee practices on food handling or waste
- Social norms related to sustainability and food waste

3. Policy and Governance Dimension

This dimension relates to the regulatory and institutional framework surrounding an innovation. Policies can either enable innovation or create significant barriers.

Examples:

- Food safety and hygiene regulations
- Waste management and recycling laws
- Labelling and transparency requirements
- Support from local or regional authorities

4. Business and Organizational Dimension

This dimension focuses on how companies operate, organize themselves, and create value. System innovation often requires changes in internal processes and business models.

Examples:

- New business models (e.g. circular or service-based models)
- New supplier or customer relationships
- Staff training and skills development
- Strategic partnerships

5. Value Chain Dimension

The value chain dimension looks beyond individual companies to consider collaboration across the entire food system - and with actors in value chains beyond agri-food. Many system-level challenges can only be addressed collectively.

Examples:

- Cooperative distribution or shared logistics
- Joint waste valorisation initiatives
- Cross-sector partnerships for example between high value added sectors, like food, nutraceutical, feed, pet food & care, cosmetic, biosolutions for agriculture, ..

2.1.4 Measuring innovation readiness

Before scaling a new idea, it is essential to understand how "ready" each dimension of the innovation is. Assessing readiness helps ensure that all parts of the system are prepared for successful implementation, reducing risks and maximizing impact.

One practical approach is to use readiness levels – simple scales (for example, from 1 to 9) that indicate the maturity of each dimension:

- 1–3: Idea Phase – The concept is still being explored or tested.
- 4–6: Development Phase – Prototypes or pilot projects are in progress.
- 7–9: Implementation Phase – The solution has been proven and is ready for large-scale adoption.

Evaluating readiness across the five dimensions allows companies to:

- Identify gaps – for example, strong technology may be paired with low user adoption.
- Set realistic objectives – aligning expectations with maturity levels.
- Allocate resources effectively – focusing effort where it is most needed for successful scaling.

2.2 Applying system innovation in practice

2.2.1 Step-by-step systemic self-assessment

Several methodologies exist to support a systemic approach to innovation. One effective method is a self-assessment tool that allows you to explore your innovation idea through a systemic lens.

Key principle: This exercise works best when conducted collaboratively, involving internal teams and external partners. Bringing together diverse expertise helps address challenges more effectively and ensures a richer understanding of system-level interactions.

For each question, discuss internally or with partners, and record actions that could strengthen weaker areas of your innovation.

Step 1 – Identify innovation dimensions

- What is the main goal of your innovation?
- Which of the five dimensions (Technological, Behavioural, Policy & Governance, Business & Organization, Value Chain) are relevant to achieving this goal?
- For each dimension, what actions or innovations are already in place?
- Are there missing elements that could strengthen your innovation package?

Step 2 – Assess readiness (1-9 scale)

For each dimension, rate your current level of readiness:

- 1–3: Early idea phase
- 4–6: Testing or pilot phase
- 7–9: Proven and scalable

Then discuss:

- What must happen to reach the next level of readiness?
- Who needs to be involved to make that happen?
- What resources or partnerships are required?

Step 3 – Plan systemic actions

- How do the different dimensions influence each other?
  Example: consumer acceptance can directly affect market success.
- Where are the biggest bottlenecks or dependencies?
- What coordinated actions could move several dimensions forward simultaneously?

Step 4 – Monitor and adapt

- How will you track progress across the dimensions?
- How often will you revisit your assessment?
- What feedback loops or internal learning sessions can be created to refine the approach?

Using a digital tool to support the process

To make this practical assessment easier and more systematic, you can use digital tools specifically designed for systemic innovation readiness. One such example is the SIRL-tool (Systemic Innovation Readiness Level) – a tool that helps organisations structure and monitor their innovation development across all relevant dimensions. Though originally applied within research projects on systemic challenges such as food loss and waste, this type of tool can also support companies in tracking progress, identifying bottlenecks, and planning coordinated actions step by step.

Using a purpose-built tool like the SIRL-tool helps move the systemic assessment from an abstract exercise into a structured, repeatable process**,** enabling teams to visualise progress and make data-informed decisions about next steps.

2.3 Recommendations for SMEs

For SMEs pursuing systemic innovation, it is crucial to think beyond technology. Innovations in culture, governance, and behavior can be just as powerful in creating lasting impact. Engaging stakeholders early in the process is also essential: collaborating across the entire value chain ensures that different perspectives and expertise are considered, which strengthens the overall innovation package. Periodic reflection sessions are recommended to assess which dimensions of the innovation may be lagging and to identify areas requiring additional attention. Planning for scalability from the outset is equally important, as a system innovation is only truly successful if it can generate impact at scale. Finally, adopting a learning mindset is key: system innovation is inherently iterative, and companies should continuously test, learn, and adapt their approaches to respond effectively to emerging challenges and opportunities.

3 CONCLUSION

System innovation offers SMEs in the food sector a powerful framework to tackle complex sustainability challenges while simultaneously creating new business opportunities. By thinking systemically – considering not only technology but also behaviour, policy, organizational models, and the value chain – companies can develop solutions that are not only innovative but also resilient, scalable, and impactful across the entire food system.

Adopting a systemic approach encourages SMEs to look beyond isolated improvements and focus on how different elements of their operations and ecosystem interact. This perspective allows businesses to identify leverage points, anticipate risks, and align their strategies with broader societal, environmental, and regulatory trends. Importantly, it promotes collaboration across the value chain, fostering partnerships with suppliers, customers, policymakers, and research institutions, which are often essential to achieving systemic change.

System innovation is inherently iterative and learning oriented. Success depends on continuous reflection, monitoring, and adaptation, supported by tools and structured methodologies such as self-assessment frameworks or digital platforms like the SIRL-tool. By integrating these practices, SMEs can track progress, address gaps in readiness, and ensure that their innovations remain relevant and effective as markets, technologies, and policies evolve.

Ultimately, system innovation transforms the way SMEs approach growth and sustainability. It shifts the focus from short-term fixes to long-term value creation**,** not only for the business itself but also for society and the environment. Companies that embrace this mindset can become drivers of meaningful transformation in the food system, turning challenges such as food waste, resource scarcity, and changing consumer expectations into opportunities for innovation, competitive advantage, and positive impact.

By embedding systemic thinking into their strategy, SMEs can move from incremental improvements to truly transformative innovation, positioning themselves as leaders in a rapidly evolving, sustainability-driven food sector.

4 Sources

System Innovation Maturity Gaps

Tools for co-creation and systems thinking approach

https://sirl.app/

https://www.systemsinnovation.network/