SIXFOLD DELIVERABLE 1.3

Work Package 1 - D1.3 Updated Operational Handbook of the network of Living Labs

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1. Executive summary

This deliverable builds further on the Operational handbook of the network of Living Labs made during previous projects powered by SS4AF, namely Connsensys (GA n°822098) and S3FOOD (GA n°824769). It extends and deepens the network of Living Labs and emphasises on the 3 crucial questions: why, what and how.

Furthermore, the 'what's in it for whom' is described for all relevant stakeholders. The operational handbook of Living Labs update has been realized based on the efforts of the Sixfold partners and is a crucial part of the strategy of the Smart Solutions 4 Agri-Food Partnership1.

To support the digitalization of the European agri-food sector, the Smart Solutions 4 Agri-Food platform (SS4AF) envisaged the creation of a network of Living Labs, across Europe. Operational guidelines were made in the S3FOOD and Connsensys project for the creation of this Living Labs network. This first handbook described the methodology to set up a network of Living Labs to support the different phases in the innovation process. Based on the regional state of play and interviews of Living Labs performed within the Sixfold project, a review of these Operational guidelines focusses on the evolution and changes in the past years in the Agri-food sector as well as on the fast-paced innovations in the digital and technological environment. This review is framed for the further development of the network of Living Labs rather than for the creation of the network.

Three main questions answered in this Operational handbook are:
        I.Why is there a need for a network of Living Labs?
        II.What do we understand by a network of Living Labs?
        III.How do we maintain and strengthen an active network?

This operational handbook combines the Vision, Mission and Strategy of the network of Living Labs for the agrifood-sector with a focus on innovation via deep tech. It describes the different actions necessary to implement a cross-sectoral innovation ecosystem centered around the different Living Labs. It is also a living document that will evolve as the network grows.

2. Background

The food sector is highly diverse and has unique and pressing challenges, including labour shortage, food hygiene and safety concerns, as well as region- and sector-specific issues. Additionally, it is characterized by a large number of SMEs. Rather than being a single, uniform industry, the food sector consists of multiple product categories, each with its own distinct challenges.

The difficulties faced by agri-food companies and the challenges related to implementation of new technologies, are a key reason for establishing a network of Living Labs. Given the evolving innovation ecosystem and the central role of the Living Lab within it, there is a clear need for a cross-regional network that benefits all stakeholders.
Since no single region can implement solutions for all possible challenges, a network of Living Labs is essential to ensure SMEs have easy access to digital solutions.

> A Living Lab is an open access dynamic, innovation driven entity that facilitates and fosters collaborative innovation between different stakeholders in the industry 5.0 ecosystem, to develop, improve, test and validate deep tech innovations that offer solutions to specific challenges in the agri-food industry.

We performed a regional state of play by questionnaires and interviews with SMEs in food and deep tech as well as relevant RTO and policy makers and completed it with extensive interviews of the Living Labs. Insights and results from these activities conducted in the partner regions were analyzed and paved the way to update the Operational Handbook of the network of Living Labs. The handbook is set up as the further development of a network of Living Labs providing options and views on the "why", "what" and "how", but always with a clear mission: facilitating innovative deep tech solutions for SMEs of the agri-food sector. In this light, an important note is that a Living Lab is not necessarily a legal/single entity. It can simply be one of the roles that an entity has. For instance, a University of Applied Sciences can be the host of a Living Lab, but not necessarily have a legal entity for this specific Living Lab.

From this perspective the Operational Handbook can be seen as an approach that can be adopted to other industries. This document serves as the implementation of the long-term strategic vision of the Smart Solutions 4 Agri-food (SS4AF) Partnership: **setting up a European network of Living Labs as physical backbone for the Partnership.**

The Operational Handbook update is the result of work elaborated within the Connsensys, S3FOOD and Sixfold project and is realized with active feedback from 12 partners. The work includes updated data collection about Living Labs within the network, stakeholder analysis and strategy development. As such, all relevant stakeholders in the digital innovation ecosystem were involved and all aspects needed to lift the industry 5.0 transition of the European agri-food industry to a higher level are covered.

3. Vision - Why a network of Living Labs?

Based on multiple interactions with both the demand side – the food companies – and the supply side – the tech companies, the deep tech solution providers and integrators – it became clear that there is a need for collaboration, both cross-sectoral, regional and cross-regional, for the following reasons:

- SMEs encounter similar needs for deep tech solutions to tackle daily challenges all over Europe and in most cases not all answers can be found in their own region.
- Potential solutions are available across Europe that now might go undetected outside their own region.
- Several of the challenges are too big to solve alone.

The existence of both overarching needs and potential solutions as well as the need for collaboration warrant setting up a network of Living Labs. By leveraging a networked approach, Living Labs can create a 'safe' environment where they can reach beyond their immediate ecosystem —with the support of clusters operating at intra- and cross-regional levels—to tap into a broader knowledge base and access complementary expertise. This both widens and deepens the services offered and increases the innovation capacity of the ecosystem.

This cross-sectoral and regional collaboration allow for the European innovation ecosystem to develop further in offering state-of-the-art innovation services by making unique expertise and infrastructure from one region available to the others, which in turn enables a larger platform for collaborative innovation efforts and cross-border projects.

The SS4AF partnership plays a key role in facilitating and coordinating these cross-regional interactions. Several cross-regional projects have been initiated. In an attempt to further strengthen these collaborative efforts, governance and coordination mechanisms are needed that act beyond the project-level initiatives towards a structured approach in such activities as knowledge and best-practice sharing, joint programs and the common key-performance indicators.

Since the last Operational Handbook edition, regional collaboration between Living Labs has significantly increased as well. This has been particularly visible in the growing interaction between testing facilities and Living Labs in a specific region, often with clusters acting as facilitators.

Over time, these collaborations have fostered a trust-based environment within regional Living Lab networks. The benefits of these collaborations include exchange of knowledge and infrastructure within a region and creating a more complementary service level.

3.1 Food industry barriers and deep tech solutions

All over Europe, the agri-food industry is typically a small and medium sized enterprises (SMEs) driven sector. These food processing companies are all facing similar **barriers** like resource scarcity & efficient use due to climate change, strict regulation compliances focusing on traceability, quality and safety, increasing consumer demands and fast paced innovation. Deep tech solutions can provide **answers** to these challenges in many ways. 4 thematic priorities have been identified in the Sixfold project that are steps in the implementation of deep tech solutions: Sense, Think, Act and Connect.


THEMATIC PRIORITIES

1. **SENSE**: To ensure real-time monitoring of the quality of food products and the proper functioning of machines and production plants during processing it is of crucial importance that not only machine parameters but also product characteristics can be measured. This requires suitable **advanced sensing technologies** if commercially available or a soft sensor approach. The installation of these sensors requires an integrated approach of the technology and digital solution providers. As the food processing industry has specific working conditions and food safety requirements, this role often is taken up by specific partners being integration specialists.

2. **THINK:** Smart data capturing of food product quality characteristics is the first step in real-time monitoring, but making sense of the captured data is what makes it valuable. The step from data to usable information is facilitated with **artificial Intelligence technologies - augmented reality/virtual reality - digital twins, simulations, e.a.** These deep tech solutions are valuable instruments that help to understand patterns and models and allow going from data to information.

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3. **ACT:** Interpreted data have to be linked to process parameters, recipes or raw material quality characteristics. Only then it is possible to define actions to intervene and react upon the measured or captured data. Being able to go from data to action allows controlling your production process Examples of these are **Robotics & Autonomous systems, e.a.**

4. **CONNECT:** Interconnection between systems and equipment, lines, production units, plants and the full food value chain is required to have an overview of the broader story. Interconnectivity also brings data challenges with it to which **Distributed Ledger technology, (adversarial) interoperability, open standards, federated data systems**, e.a. bring solutions

As mentioned in the thematic priorities, different actors enter the new ecosystem for digital innovation, and they all need to work together to come up with the most optimal deep tech solutions for the challenges of the food industry.

3.2 Changing innovation ecosystem

In the past decade the food innovation ecosystem, with mainly R&D partners and process technology, has evolved to a more complex digital innovation system (Figure 1) in which not only deep tech solutions are part of the ecosystem but integrators are an indispensable part of the ecosystem. This additional partner helps to integrate the deep tech solutions and provides the required and specific translation for the food industry. These integration partners allow converting R&D (technology) to Deep tech solutions (generic sensor) to Integrations (modified sensor) within process technology.
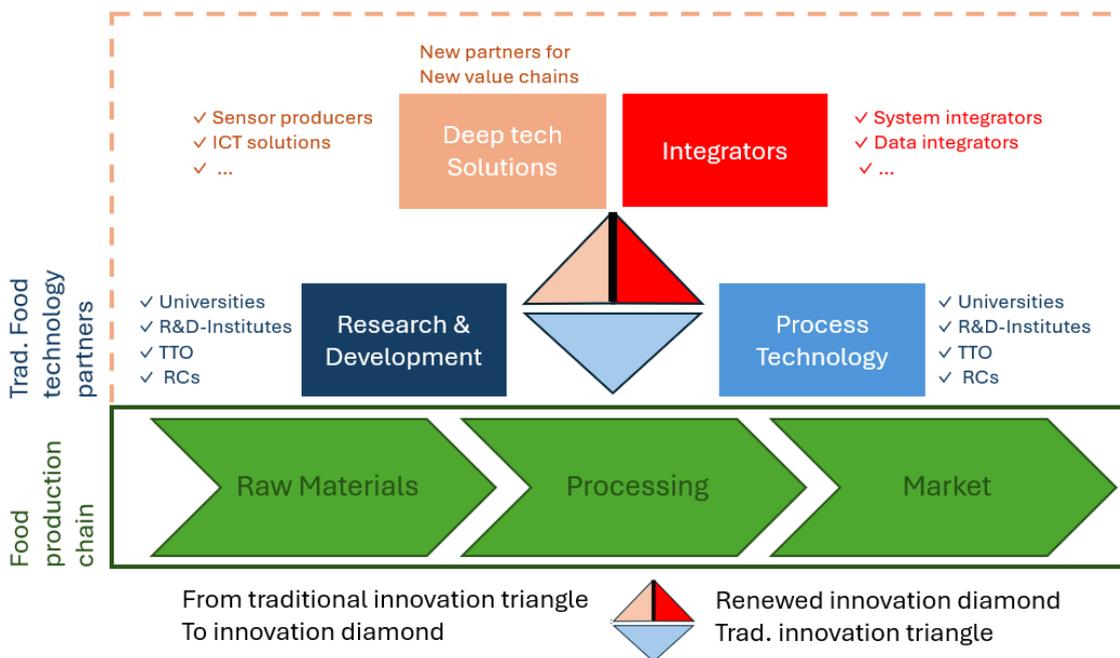
The integrated digital solutions innovation ecosystem in the Food industry

FIGURE 1. COMPLEX DIGITAL INNOVATION

As this complex system involves many partners connected to solve food companies' barriers, Living Labs who are deeply embedded in the ecosystem allow intertwining all necessary actors to enable cross sectoral collaboration and innovation towards developing new deep tech solutions for the food industry.

3.3 Living Labs at the centre of the innovation ecosystem

Living Labs are deeply embedded within their environments, shaped by the unique networks and stakeholders that surround them. This close connection enables them to be highly responsive to change and, in many cases, become powerful catalysts for positive transformation. Living Labs serve as a crucial bridge, linking the supply side of (deep) tech and integration solutions as well as innovations deriving directly from research with the demand side, companies within the agri-food chain that face real-world challenges. By facilitating collaboration between development, validation, and real-life implementation, Living Labs create a mutually beneficial environment for all stakeholders.

Positioned at the heart of the ecosystem, Living Labs foster cross-sectoral collaboration, driving the advancement of deep tech solutions for the food industry and ensuring innovation is both impactful and applicable in real-world settings.
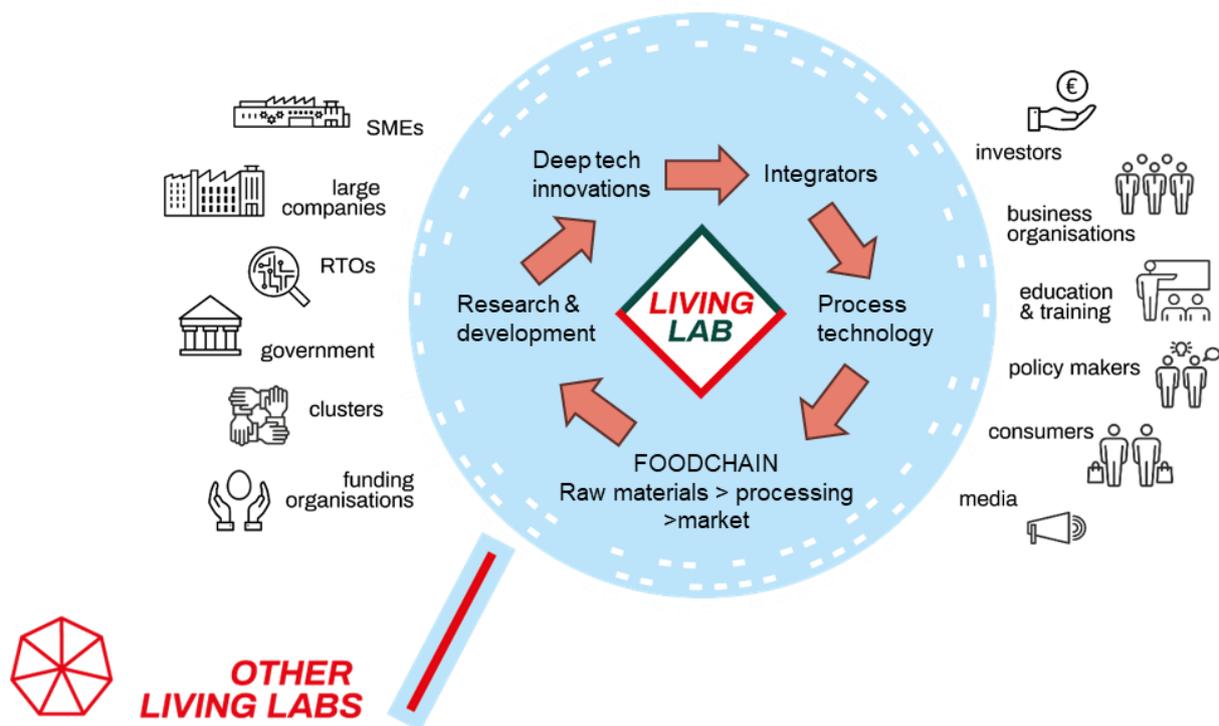
FIGURE 2. LIVING LABS AS INNOVATION HUBS FOSTERING CROSS-SECTORAL COLLABORATION, DRIVING THE ADVANCEMENT OF DEEP TECH SOLUTIONS FOR THE FOOD INDUSTRY

In this set-up, **cluster organizations** take up an important role i.e. connecting the actors, who are partly members and financiers of the cluster organizations as well and linking them to the Living Labs.
In addition, the roles and potential contributions of all the other stakeholders must be considered. These stakeholders create the necessary environment to facilitate the

implementation, dissemination and exploitation of innovative solutions. Without going into all details, the following groups and contributions play a vital role:

1. Policy makers on regional, national, and European levels implement policies, set guidelines and provide funding programs that help to stimulate innovations.
2. Branch associations and business organizations act as multipliers to raise awareness for challenges, trends and solutions and support companies to connect for projects.
3. Investors provide additional funds for the sometimes high and risky investments in innovative solutions.
4. Media supports communication and dissemination of innovative solutions to a broader public.

3.4 What's in it for whom

Living Labs play a crucial role in supporting companies to address the myriad of challenges related to implementing deep tech innovation in the agri-food sector. On the one hand they address important global challenges such as food security and climate change and on the other hand they must meet growing expectations of their users while facing small profit margins. A network of Living Labs is a great way to share learnings and overcome existing barriers together.

In the following section we will explore how different stakeholders can greatly profit from a network of Living Labs for deep tech innovations in agrifood.

For a Living Lab

Sharing experiences: Meeting people from other Living Labs as well as other partners from the SS4AF network can be such a relief! Other organisations face similar challenges and sharing your problems with a group of like-minded people does not only make you feel less alone but also leads to an exchange of ideas and a collection of best-practice examples that help to develop sustainable solutions not only for technologies but also for governance models and business plans.

Increased visibility: The network of SS4AF is well renown for developing deep tech solutions for agrifood throughout Europe. Being part of the network increases the visibility in the community and beyond and enables further networking and easy access to collaboration opportunities with stakeholders from the entire ecosystem of deep tech innovations in agrifood.

Access to new and happier customers: By sharing the expertise in the SS4AF network of Living Labs, each participating Living Lab will have the opportunity to access further customers who need their specific expertise also from other regions. Furthermore, Living Labs can ensure their regional partners get the help needed even if they cannot provide the necessary service themselves by forwarding them to Living Labs from other regions which have the relevant expertise.

Increased collaboration: Being part of the SS4AF network of Living Labs paves the way for new possibilities. The network provides opportunities to find like-minded or complementary stakeholders from all the participating regions to develop projects, technologies and solutions across the deep tech innovation system.

For a Food Company

Finding the best solution: Engaging with the SS4AF network of Living Labs means getting access to a large community that provides expertise, competences and solutions for a huge number of challenges. If a tailor-made solution is hard to develop on a regional scale, it can be tackled by collaborating between regions. The Living Labs provide a perfect space to get in touch with all relevant 4H stakeholders to facilitate innovation.

Safe learning environment: The SS4AF Living Lab community is a safe space where first experiences with new (deep) technologies can be made, and new and unconventional solutions can be explored.

For a Technology Provider

Understanding the market: By engaging in the SS4AF network of Living Labs, technology providers can get a broader view on the potential market and a better understanding of the needs and challenges food companies face now and in the future. The network acts as a safe space, creating an excellent opportunity to bridge the gap between the different stakeholders in the whole value chain by enhancing communication and looking outside the box.

Networking and collaboration opportunities: Multiple network opportunities make it easy to start collaboration with different stakeholders and get a good view on the current market as well as trends it is facing. Tech providers are sure to find sparring partners for the development of innovative solutions that create new market opportunities. This includes the possibilities to work with deep tech solution providers and integrators in a safe space to optimize existing solutions and create new ones.

For a Deep Tech Solution Provider

Bridging the knowledge gaps: Deep tech solution providers face the challenge that they need to know both the needs of the food processing industry as well as the ones that technology providers face to create solutions that really make a difference. The SS4AF Network provides the possibilities to dive deep into the food processing ecosystem and learn about the different stakeholders as well as the issues they face.

Exploring possibilities: Understanding and handling data is crucial for a deep tech solution provider. Food companies want their production plants to extract and provide data in a way that is easy to understand and helps to facilitate the view on processes and enhance the production. Living Labs provide opportunities for deep tech solution providers to experiment with data in a safe environment and are a safe space to share data and explore opportunities in a sand box together with partners from the whole value chain.

For an Integrator

Know your stakeholders: Integrators need to know it all. To be able to survive as a one-stop shop means they need to learn as much as possible about the food processing ecosystem to be able to address the challenges and needs of all stakeholders and provide innovative solutions. The SS4AF Network of Living Labs creates the opportunity to link with all 4H actors and discuss with open-minded people that want to shape the future of the food processing industry.

Developing new concepts: Living Labs are ideal places to start thinking out of the box. Integrators can find and develop innovative solutions and concepts in a safe space with stakeholders from all along the value chain. The SS4AF network connects people from all over Europe and highly encourages deep tech innovation. Test before invest infrastructures of the different Living Labs provide a wide range of opportunities for new endeavours.

For Regional authorities and policy makers

Collaboration beats competition: Competition and redundancy among EU regions hinder the achievement of critical scale in Europe. In contrast, collaboration between complementary regions is a more effective, efficient, and sustainable approach. By fostering synergies, EU regions can maximize their strengths and drive innovation in a way that benefits the entire ecosystem.

Improved coherence policy: The SS4AF Partnership, along with its network of Living Labs, was established to support regional strategies for deep tech innovation and the adoption of Industry 5.0 principles in the agri-food sector. This network unites all stakeholders in the digital innovation ecosystem to identify key investment priorities at regional, interregional, and European levels. Additionally, regional funding bodies will gain valuable decision-making support, ensuring more strategic and impactful resource allocation.

For cluster organisations

Cross-sectoral collaboration on a next level: Collaboration across sectors is fundamental to both ongoing and future initiatives. The SS4AF Partnership bridges food clusters with digital and technology clusters, fostering synergies to help their members effectively navigate the digital transformation. By joining forces, these clusters enable a more seamless and impactful shift toward deep tech innovations in the agri-food sector

New possibilities for support: Clusters play a vital role in providing business and technical assistance to their members. Through the SS4AF network, they gain access to expertise beyond their own regions, ensuring companies receive the support they need. Additionally, clusters help Living Labs connect with key stakeholders, strengthening collaboration across the ecosystem. As facilitators of digital innovation, they serve as the primary link between regional players and Living Labs.

Create a thriving deep tech innovation ecosystem: The SS4AF network is driving the development of a European-wide deep tech innovation ecosystem, accelerating the industry 5.0 transition in the agri-food sector. SS4AF partners can leverage this network to engage with key stakeholders and develop targeted initiatives. Thematic projects aligned with the SS4AF priorities will further strengthen and structure deep tech innovation efforts across regions.

For Research and Technology Organisations (RTOs)

Bridge the transfer gap: For Research and Technology organisations, collaborating with a network of Living Labs can make a real difference in terms of bringing research results and demonstrators into practice. Living Labs are the ideal place to work with stakeholders from food industry, technology and digital solutions providers as well as integrators hands-on in an open and trustful environment to evaluate and further develop prototypes until they reach market readiness. The SS4AF network provides excellent support structures and deeply encourages innovation.

Stay up to date and develop new ideas: Deep tech innovations in food processing develop on a fast scale. SS4AF and it's connected network of Living Labs is the perfect opportunity for RTOs to stay on track and learn everything about existing and future demands of the food processing industry. Also, like all other stakeholders, researchers can highly profit from the innovation network SS4AF provides to develop new solutions.

4. Mission – What services & guidelines?

Living Labs have been identified as safe environments where cross-sectoral collaboration can thrive, fostering the development of practical, innovative solutions.
By interconnecting them in a network, expertise in food production can be combined with deep-tech knowledge, facilitating knowledge exchange and problem-solving expertise for challenges of SMEs across Europe. The Living Labs network has a fundamental mission is to drive the adoption of innovative deep-tech solutions for SMEs in the agri-food sector.

This network of Living Labs serves as the backbone of the SS4AF Partnership, as one of the objectives of the Thematic Smart Specialisation Partnership *"Smart Solutions 4 Agri-food"* is setting-up a platform and supportive business ecosystem between agri-food and deep tech clusters, relevant RTOs and other stakeholders, to lower the barriers for agri-food companies – with a specific focus on SMEs - to access and implement the latest deep-tech solutions.

A thorough assessment of the needs of various stakeholders within the innovation ecosystem through interviews, surveys, and discussions with food companies, technology providers, digital solution providers and integrators allowed to define the possible offered services as well as the pre-requisites of the Living Labs.

4.1 Services

SERVICES OF LIVING LABS

Test before invest:
- **Technical support** on scale-up such as concept validation, prototyping, small series production
- **Testing and validation services** such as certification, product demonstration, product qualification
- **Strategic Research Development & Innovation (RDI)** such as joint pre-competitive R&D
- **Contract research** such as specific R&D, technology concept development, proof of concept
- **Offering technology infrastructure** such as renting equipment, low-rate commercial production or platform technology infrastructure

Skills and training:
- **Courses and workshops** for skill development
- Offering technological **infrastructure for educational purposes**

New or upcoming Living Lab facilities should focus on the most frequently used and asked services being **Contract research** and **Testing and validation** and only when all other services are implemented work on provision of skills and training, infrastructure for educational purposes and events as these services are less requested.

It is important to note that within the network not all Living Labs will have the same focus or offer the same portfolio of services in the defined categories, but rather will be complementary and as such address the needs of the different actors in the deep tech innovation ecosystem across Europe. That is why operating in a network is beneficial for Living Labs. In addition, Living Labs interested to join the network of Living Labs, but that are not yet offering one of the above mentioned services can benefit from the knowledge within and help from the Network to develop their services.

SERVICES OF THE NETWORKS

Besides the above mentioned services offered by Living Labs, there are 3 additional services crucial within the acceleration of innovations, that can be delivered by regional cluster partners within the SS4AF partnership.

- **Support to find investments:** this category of services may include: access to financial institutions and investors
- **Innovation ecosystem and networking**: No company can innovate alone. It will help companies greatly if they are brought into contact with other companies of their value chain, with innovators, or early adopters that want to test solutions. Events can support knowledge exchange and networking.
- **Shared knowledge base:** The SS4AF partnership holds a large, shared knowledge base on both expertise and financial possibilities that support above ecosystem services. This evolving knowledge base is captured in a Toolbox.

4.2 Basic guidelines for Living Labs

Entities that intend to enter the network of SS4AF Living Labs should own at least a basic set of competences and infrastructures. Table 1 serves as a guideline for new or established Living Labs and addresses basic principles which apply to Living Labs in the agrifood sector.

TABLE 1 GUIDELINES FOR LIVING LABS WITHIN THE FRAMEWORK OF SS4AF

	Living Lab
Digital and physical infrastructure	- For real-life testing an operational food pilot plant is needed - Infrastructure to allow for testing of industry 5.0 related technologies: - Digital infrastructure such as: WiFi, connectivity, dashboarding, standardized data collection systems, interoperability standards, and a robust data safety and cybersecurity plan.

	o Physical infrastructure such as: robotics, sensors, actuators, off-the-shelf components for prototyping, modular production units, security
Expertise and support	• Technical expertise: Availability of specialists in robotics, AI, photonics, automation, and food processing to support companies in integrating solutions. • Pilot plant operators: On-site support to manage processes and assist with testing and validation. • Business and investment support: Provide companies with insights on funding, ROI calculations, and -pathways for scaling their innovations.[2] • Facilitator for skills development and training: Act as a training hub for digitalization in the food industry, offering courses on data-driven food processing, automation, and AI integration.
Methodology and agreements	• Legal and IP agreements: Frameworks to formalize agreements on intellectual property, data ownership, and openness of results, ensuring clarity for all stakeholders. • Test-before-invest structures: Clear mechanisms for companies to validate innovations before making large-scale investments. • Methodology for testing with active user involvement: *see also co-creation methodology* • If applicable in case of a food production pilot: Clear protocols for food handling, processing, and validation in a test environment.
Prerequisites and mindset	• Provide open access for demonstration and testing, where 'open' does not mean 'for free'. The Living Lab can connect a specific fee to the services provided. Easy also means findable and with clarity for companies about the available infrastructure and expertise. • Be willing to collaborate with other Living Labs within the network across Europe to provide a complete service offering to the companies in the SS4AF partnership territorial scope. • The infrastructure should be flexible and modular, allowing for a wide range of testing scenarios. Future collaboration between Living Labs could involve sharing or exchanging minor infrastructure to extend capabilities.

It is also crucial to note that not all these requirements need to be present in one physical location or entity and that the competences and infrastructure present depends on the function of a Living Lab (for a Table of basic functions of Living Labs, see Annex). The full package can also be realized via regional cross-sectoral collaboration between different entities with their own specific expertise.
To foster an environment where Living Labs can learn from and complement each other, it is essential to establish a foundation of trust and safe collaboration.

Within the SS4AF network of Living Labs, creating a shared knowledge base with practical tools and best practices will enhance cross-learning and the exchange of methodologies. This approach will not only strengthen the collective expertise within the network but also drive efficiency, innovation, and seamless integration of deep tech solutions across different labs. This document contains a toolbox specifically for Living Labs that will be completed during the Sixfold project and remains a living document.

5. Strategy – How to strengthen the network?

To achieve the advanced deep tech transformation of the agri-food industry based on a network of Living Labs to facilitate cross sectoral collaboration, several actions are developed:

- Support agri-food SMEs in finding the best deep tech solutions for their daily challenges via **connecting and engaging** all stakeholders in the network
- Raise awareness and increase understanding of the possibilities within the network of Living Labs regarding deep tech transformation via branding and promotion
- Find **funding and financing** opportunities to support these collaborative innovation projects and facilitate the actual implementation.
- Position the Living Labs in the center of the innovation ecosystem as the perfect meeting place between concrete challenges and needs on the one hand and potential deep tech solution development on the other hand and define **operating principles** of the network for all stakeholders.

Based on the lessons learned from previous projects and cross-sectorial collaborations, the *5 step model* (Figure 3) is still the valuable tool that describes the innovation process from creating awareness, via building the trust zone, evaluation and validation implementation, to broad communication and dissemination to create leverage. As innovation methodologies evolve our 5 step model evolved as well with the inclusion of the co-creation methodology. This co-creative process is integral part of the innovation funnel and situates between the building trust zone and the validation track.
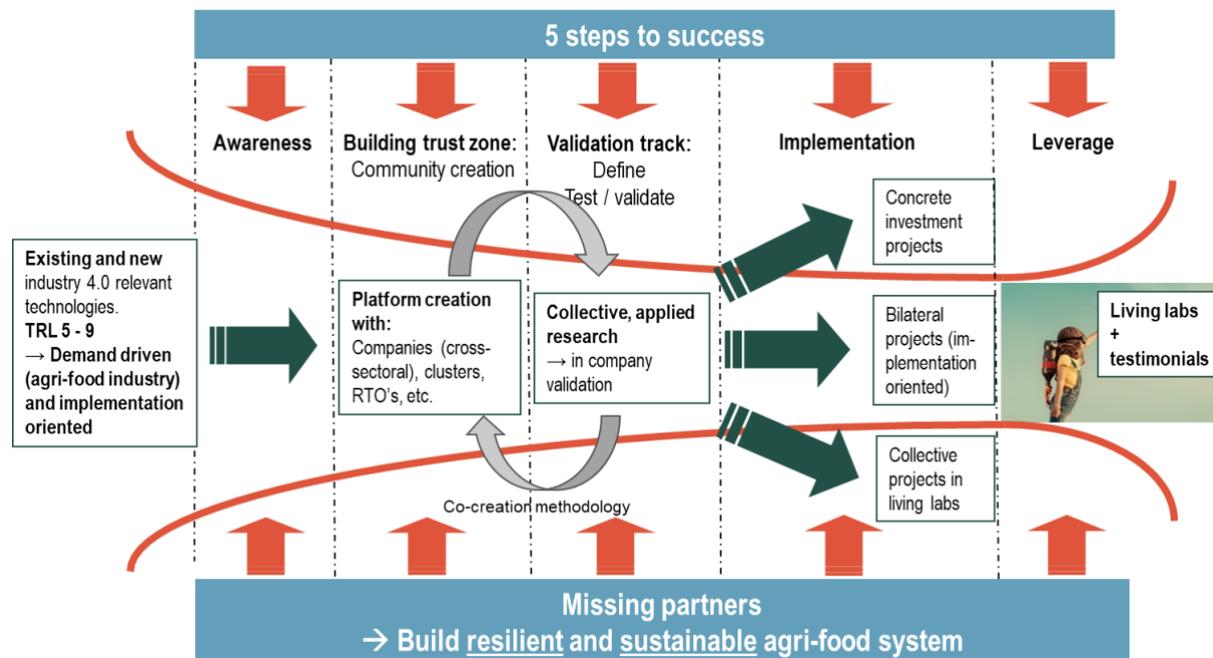

FIGURE 3. THE 5 STEP MODEL FOR CROSS – SECTORIAL INNOVATION

To achieve the implementation of deep tech solutions for SMEs of the agri-food sector the 5-step innovation process model

Step 1: Creating awareness is a continuous process that addresses all actors in the innovation ecosystem and is a first step in bridging the gap between the needs of the food industry and the potential deep tech solutions that are (being) developed.

Step 2: Building the trust zone between the involved sectors by creating a community that brings together companies and RTOs in a forum with focus on the digitalization for the agri-food industry. A trust zone will be built between the agri-food companies and the technology providers, so the agri-food companies know which support and solutions they can obtain and the technology and digital solution providers as well as the integrators understand the needs of the agri-food companies.

Step 3: Evaluation and validation of new technologies and solutions by a process to get from awareness to validation. This is a collaborative work in which common goals between all partners should be reached: demonstrate/test/feasibility checks of new technologies and deep tech solutions towards concrete investment projects. The process of validation gives insight into the specifications needed for industrial applications.

Step 4: Implementation of new technologies and solutions Close collaboration between the agri-food companies and the technology and digital solution providers will result in concrete investment projects in the agri-food companies and collective large-scale SME group projects linked to the livings labs. When needed, additional partners such as integrators and machine developers will be involved to make the jump from a stand-alone, validated device (demonstrator) to full integration in the production plant.

Between step 3 and Step 4 an iterative co-creative process takes place to ensure the development of applicable and user-oriented solutions. To do so, the design-thinking methodology is used to ensure the integration of the viewpoints and needs of all stakeholders (see 5.1 Connect and Engage for further description).

Step 5 Leverage - Integration, investments and realizations in the agri-food industry create visibility for all stakeholders and will help to attract new partners for newly defined validation and implementation tracks and new technologies, which is a supporting evolution to reinforce the funnel. Therefore demonstrations, training programs and study visits in the Living Labs, RTOs and frontrunner agri-food companies will be organized in collaboration with technology and digital providers. Furthermore, the activities, news, events, testimonials, success stories and concrete results will be distributed and disseminated via newsletters, presentations, etc. This will enable the cross-fertilization and speed up the learning process. Creating leverage also includes engaging and feeding input to policy makers and managing authorities of regional and European funds, to ensure the relevance and the likely translation of our strategy in practice.

In the next paragraphs several concrete actions are described to implement a perfect environment for cross sectoral innovation with the Living Labs in the center of the innovation ecosystem.

5.1 Connect and engage

Building a robust network of Living Labs across the EU aims to facilitate the implementation of deep tech within the agri-food sector. This network will support a dynamic and regionally embedded ecosystem thriving with deep tech innovations relevant for the agri-food industry. The network of Living Labs will in this way facilitate collaborative

knowledge exchange by actively engaging stakeholders from various regions and ensuring inclusivity and diversity in participation.

To raise awareness and enhance knowledge on the existing Living Labs for testing deep tech innovations in the agri-food industry and to exchange on best practices and different approaches, relevant stakeholders from across the quadruple helix, i.e., agri-food companies, (deep) tech innovators, integrators, cluster organizations, RTOs, regional regulators, Living Lab managers, are included in a co-creation process to identify and tackle innovation barriers to boost deep tech innovation in agrifood.

In our network we focus on the following steps to achieve a thriving community of Living Labs and their respective 4H stakeholders:

Physical interactions
Physical visits to Living Labs allow stakeholders from across the 4H and across participating regions to get acquainted with the Living Labs and the ecosystem of supportive organisations revolving around them and learn about the specific expertise and knowhow they can provide. Study visits facilitate one – on – one meeting between companies as well as interaction between different LL and between LL and companies and other stakeholders, such as RTOs, Cluster partners and regulators. This will help to create a base of trust and appreciation of the stakeholders within the agrifood innovation ecosystem

Exchanges in knowledge and competences
Intensive exchanges will increase knowledge on experimentation frameworks for testing innovations and more concretely on the capabilities of the individual Living Labs, how they are operated and managed, how the different Living Labs can complement and support each other, and what is lacking. Knowledge transfer is promoted via thematic seminars, workshops, training courses and demonstrations communicated within the network.
Workshops set-up within collaborative projects explore and find solutions for the Barrier Cases that hamper deep tech innovations in agrifood. They may include specific legal, regulatory, fiscal, technical, or operational hurdles and challenges.

Co-creation
Co-creation is used as a collaboration method to address the challenges and to build trust between the different stakeholders, encourage out-of-the-box thinking and take unexpected answers into account.

Design Thinking
The Design Thinking approach, with its basic principle to put the user first, is used to take different perspectives into account and address problems in an interactive and iterative way. The stages of Design Thinking are defined as follows:
        1. Empathize: Understanding user needs and contexts.
        2. Define: Making the problem statement(s) concrete.
        3. Ideate: Generating creative solutions.
        4. Prototype: Creating tangible representations of solutions.
        5. Test: Gathering feedback and refining the solution.

Projects
Projects will be initiated to develop applicable solutions allowing test before invest for both the agri-food companies as well as technology and digital solutions providers, deep tech solution providers, integrators and RTOs.

5.2 Branding and promotion

A structured branding and promotion strategy can substantially increase the visibility and impact of a Living Lab, thereby attracting a wide range of stakeholders and supporting the adoption of emerging innovations. The following guidelines provide a flexible framework for presenting a Living Lab as a trustworthy environment for testing, validating, and scaling new technologies or processes.

Profiling the Living Labs

Creation of Concise Fact Sheets
Fact sheets offer succinct overviews of a Living Lab's core competencies, key projects, and distinctive capabilities. By highlighting available expertise, potential collaborators—including companies, research institutions, and public agencies—can quickly determine how engagement may provide mutual benefits.

Implementation of an overview Map
A map can depict the specific locations and specializations of Living Labs and associated facilities. This resource is particularly helpful for users seeking to locate the most relevant services or environments. The map is embedded in the existing website of SS4AF and Sixfold and shared on broader innovation platforms.

Storytelling and Testimonials

Promotion of Cross-Sector Success Cases
Case studies or testimonials illustrate real-world outcomes of collaborations between innovators, end users, and Living Labs. Such examples generate credibility and strengthen proposals for future partnerships. Presenting these achievements through social media, newsletters, or industry conferences enhances engagement.

Enhancement of Internal Knowledge Exchange
Regular internal communication fosters the exchange of lessons learned, best practices, and partnership leads among Lab managers, staff, and affiliated organizations. A dedicated platform or forum for sharing such information can strengthen the capacity for ongoing innovation.

Events and Common Projects

Organization of Visits and Workshops
On-site activities, such as facility visits, workshops, or open demonstration days, allow stakeholders to observe Living Lab operations and engage in direct discussions on future collaboration. Participation in co-creation processes further builds trust and encourages project ideation.

Collaboration in Common Projects
Joint initiatives involving multiple Living Labs or external partners can address broad challenges, such as Industry 5.0 or digital transitions. These initiatives foster shared funding opportunities and widen the practical scope of offered services, thus enhancing a Lab's influence and impact.

Monitoring and Key Performance Indicators

The following metrics serve as potential indicators of effective branding and promotion:

Visibility and Engagement
- Website traffic and usage of interactive features
- Social media reach, including post engagement rates and event registrations

Stakeholder Interest
- Inquiries or proposals from potential collaborators
- Growth in partnerships or successfully completed projects

Event Outcomes
- Attendance and feedback from visits, workshops, or conferences
- New collaborations formed as a result of in-person engagements

Periodic review of these indicators allows for timely adjustments in communication and outreach tactics, maintaining relevance and appeal.

By employing concise fact sheets, highlighting competencies through mapping tools, prioritizing consistent messaging, showcasing verified success stories, and implementing effective measurement, a Living Lab can enhance its visibility and credibility among industry partners, solution providers, and research communities. Over time, these efforts are likely to strengthen stakeholder relationships, support innovation, and yield mutually beneficial results.

5.3 Funding and financing

To effectively support innovation at the SME level, it is essential to establish a strong financial backbone that enables both businesses and supporting infrastructures, such as Living Labs, to develop and scale new technologies. The SS4AF network, and specifically the project generation working group, plays a crucial role in facilitating access to funding and financing opportunities at regional, national, and European levels by leveraging its network of clusters, Living Labs, and strategic partners.

Funding and financing for SMEs

The priority is to ensure that SMEs have clear insights into available funding and financing mechanisms to support their innovation and scaling efforts.

Regional and national grant schemes
Clusters and regional partners will engage with local and national governments to identify relevant subsidies, innovation vouchers, and R&D tax incentives for SMEs.

European funding programs
The SS4AF partnership will help SMEs navigate European funding programs such as:
- EIC Accelerator (for high-risk, high-impact innovations).
- Eurostars (for SME-led transnational projects).
- Horizon Europe – Cluster 6 (food, bioeconomy, natural resources).
- Interreg and Digital Europe Program (for cross-border and digitalization projects)
- Interregional Innovation Investment (I3)

- Alternative financing sources: SS4AF clusters will actively connect SMEs with private investors, venture capital funds, and innovation loans, creating a bridge between businesses and financing institutions.

Funding and financing for Living Labs

The second focus is to secure funding for the Living Labs that serve as key enablers of innovation for SMEs and industry stakeholders.

European funding opportunities
- Horizon Europe: Supports Living Labs as key infrastructures for innovation.
- Digital Europe Program (DEP): Funds digital innovation hubs and test facilities.
- Interreg Europe & Interregional Innovation Investments (I3): Supports cross-border collaboration between Living Labs.
- EIT Manufacturing & EIT Food: Offers Living Labs project-based funding in industry-relevant innovation programs.

Regional and national investments
- SS4AF clusters will work with regional authorities to establish dedicated funding schemes for test facilities, pilot plants, and Living Labs.

Private-public partnerships
- By connecting Living Labs with corporate partners and venture funds, new business models (e.g., subscription-based access to testing facilities) can be explored.

Please note that the funding model also depends on the governance model of the Living Lab. Living Labs can be governed by SMEs or SME consortia, non-profit organizations or University/applied sciences.

5.4 Operating principles

Interaction and contribution

Next to the above-mentioned items, the success of a network of Living Labs depends to a large degree on defining a fair way of **interaction and contribution**. It has to be clear that the network is composed of independent organisations collaborating on a shared vision and sharing responsibilities. From this perspective a set of operating principles is necessary to set clear procedures and responsibilities for all shared activities.
As it became clear from the interaction and profiling of the Living Labs analysed for this update of Operational Handbook, their competences, backgrounds and organisational structures vary significantly. This can be seen as the clear added value of the network of Living Labs as the combination of diverse and partly complementary expertise allows the creation of synergies and joint services for the actors in the innovation ecosystem.

Knowledge transfer and collaborations

The operating principles for the network of Living Labs should **be targeted to (1) cross-sectoral knowledge transfer and to (2) cross-regional collaborations** between involved parties of the innovation eco-system. It has to be noted that these collaborations reach from activities on regional level, involving companies and one Living Lab to collaborative actions of a number of Living Labs in the network to align and improve their services for

partners. Taking this into account the operating principles should cover multiple interactions between different actors.

It is important to agree on and arrange an effective interaction between involved parties to guarantee an early stage involvement in relevant activities. In the same way, in-depth information on results and learnings from projects should be shared in the network. This way an aligned development of the network with growing interaction will be achieved.

On the other hand, it has to be clear as well, that specific innovation projects between selected parties are a matter of negotiations among involved actors. Consequently, the operating principles should restrain from overregulation with potential constraints for a dynamic development of collaborations. A good balance is needed to keep the necessary flexibility and to build the absolutely needed trust zone between involved actors.

Principles and commitment

In the end it can be summarized that the network of Living Labs needs operating principles that are more phrased like a **code of conduct or a memorandum of understanding**, instead of a very formal governance structure. As many of the involved Living Labs in the established network do collaborate with or are even members of the cluster organisations of the SS4AF, the network can benefit from the already existing governance structure of this Partnership.

SS4AF clusters will support the progress of the network, initiate and moderate interactions between the Living Labs as well as the other actors and stakeholders in the innovation ecosystem. They will also support the development of the operational principles in close dialogue with the Living Labs managers. This will be a process with continuous developments as innovation topics and thematic priorities as well as new partners will appear on the map. So, balancing out the need for rules with the necessary flexibility is at the core of the further development of the operating principles.

6. NEXT – Want to know more?

This document is a living document. During the Sixfold project study visits co-creation sessions are planned with all stakeholders of the Living Labs. The outcome of this work will allow reviewing the handbook & develop further its toolbox at the end of the project. Further information after the Sixfold project can be found on: https://ss4af.com/

ANNEX 1

LIVING LAB INTERVIEW

Dear Partner,

SIXFOLD unites partners from the 'Smart Sensors 4 Agri-food' Partnership, and its network of Living Labs with a clear aim,

Stimulating Innovation eXperiments in Food prOcessing Live Demonstrators.
(more about the Smart Sensors 4 Agrifood network of Living Labs can be found here: https://ss4af.com/network-of-living-labs)

SIXFOLD has the **ambition** to facilitate implementation of deep tech within the agri-food sector, by building a robust network of Living Labs across the EU.

*The **aim of the project** is to determine the barriers for implementation of innovative technologies and defining how living labs can help to remove these barriers. In this way Living Labs contribute to the acceleration of the digital, sustainable and resilient transition of the food industry.*

About the interview:
The list of questions below are a guideline during your interview/Survey with the Living Labs. The data collected are confidential and will only be used by the SIXFOLD partners to review the operational handbook of Living Labs.

Thank you for taking time to have an interview with the Living labs in your region!

In case of questions please contact your attributed partner, who transferred this survey to you, or karen.casier@flandersfood.com

Living Lab (LL) definition

A Living lab is a dynamic, innovation driven organisation that facilitates and fosters collaborative innovation between different stakeholders in the industry 5.0 ecosystem, to develop, improve, test and validate (deep tech) innovations to specific challenges in the agri-food industry.

Deep Tech definition

Deep tech is a classification of key-enabling INNOVATIONS /TECHNOLOGIES combining fields of science and engineering in the physical, biological and digital spheres with the potential of solving major societal challenges.

QUESTIONS to be addressed are:

1. Learn to know your LL
- What is the Mission and Vision of your LL
- What is your host organisation? Is your LL part of a larger organisation? (Legal entity)
- How is the Living Lab managed and why? (Governance)
- Where does the financing come from? (Finance & business plan)

2. Stakeholder management & communication
- Who as stakeholders are now involved in your LL?
- What is your main / most important stakeholder group?

- How do you collaborate with all your stakeholders?
- What is your stakeholder engagement strategy?

- Which values does your LL create for your stakeholders?
    - What interest do companies & stakeholders have?
    - How does a living lab benefit the companies or stakeholders?

- Do you have a communication plan for your Living Lab?
- How do you create awareness about your Living lab?

3. Capabilities & knowledge transfer
- What services do you offer / consider also deep tech innovations
- What services would you like to offer in the future and what is preventing you from offering them.
- Can you mention (deep tech) innovations in the agri-food industry that your LL is working with/on.
- What would you rather not do or let go of?
- Do you have the needed knowledge in-house or is it also provided in collaboration? Please give an example of a successful collaboration and (if any) unsuccessful collaboration.
- Why do you think these collaborations have been successful/unsuccessful? Please explain
- What good examples of Knowledge transfer can you name?

4. Barriers

- What barriers for implementation of deep tech in agri-food companies do you encounter/ anticipate?
- Are there barriers you were able to solve …
    - inhouse?
    - via collaborations or other?
- Please provide examples and explanation.
- Are there barriers you were NOT able to resolve? Please explain!!!!

5. Regulations & confidentiality

- What is the role of the regional/national regulators for your LL?
- Do you notice certain regulations stand in the way of innovation or its upscaling? Can you give examples.

- How do you deal with data that comes from testing? (GDPR, data sharing, data knowledge)
- Do you face problems dealing with IPR? Please explain.

6. Network of LL

- Do you cooperate with other LL? And how?
- Would you like to expand you network and work with other LL in deep-tech or agri-food?
- What would you like to learn from other LL?
- How can a network of LL related to food processing and/or deep-tech be valuable for you?

SWOT :

- What are the strengths of your LL?
- What are your unique selling points?
- What are your challenges?
- Successful cases: Please describe 2 successful cases (e.g. new technology, new product on market, etc) of your LL.

Final information: we will share the outcome of these overall interviews via a document/overview of the living labs.

Final question: Do you want to participate to the study visits and co-creation workshops we will organise during 2025?

EASY TO FILL IN DOCUMENT WITH QUESTIONS

1. Learn to know your LL

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> [empty box]

- What is your host organisation? Is your LL part of a larger organisation? (Legal entity)

> [empty box]

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> [empty box]

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> [empty box]

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Strengths	Weaknesses
Opportunities	Threats

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Goal is the have following overview per Living Lab

NAME		
address		
website	link	logo
Type of organization		
Mission		
Vision		
Host organisation		
Governance		
Finance & Business plan		
Stakeholder management & communication		
Stakeholders		
Collaboration method		
Engagement strategy		
Value creation		
Communication strategy		
Communication plan		
Capabilities & knowledge transfer		
Services offered		
Inhouse Knowledge		
Knowledge via collaboration		
Knowledge transfer		
Regulations & confidentiality		
Regulator's role		
Data management		
IPR challenges		
Network of LL		
Working with other LL		

STRENGTHS	WEAKNESSES
OPPORTUNITIES	**THREATHS**