SMAR3TS

Staff Mobility to Action Resilient, Restorative, and Regenerative Transitions & Societies

Funded by
the European Union

I3X – Guiding Principles

SMAR3TS

- Innovate3X-Igniting Impactful Initiatives, or I3X, should aim to accelerate the understanding/scoping of a challenge (technological, market, societal etc), and the emergence/development of possible solutions. This can be interpreted as e.g. increased technological or societal readiness, once the I3X is completed.
- I3X should have a sufficient scale and scope (i.e. not being too narrowly-defined), and should require multi/cross/inter/trans disciplinary capabilities.
- I3X should align to the core concepts of SMAR3TS – Resilience, Restoration, Regeneration (either R or all Rs).
- I3X should align to (at least) one WP – WPs are the main coordination mechanism of the project, hence I3X should be connected to WPs.
- Any partner can initiate an I3X. Yet, shaping the I3X should be done collectively, and in collaboration with WP leader and SMAR3TS Team.
- At this stage, we are looking for initial I3X, which will be further defined during the Kick Off Meeting – and where engagement across the consortium will be assessed.
- Overall, it is expected that each I3X will lead and enable about 10 person-months of secondment, across the consortium (i.e. not only between the initiator of the I3X and possible contributors), possibly more.
- I3X will serve as guiding instruments for secondments, as well as for events (i.e. hackathons, workshops, showcase)

I3X – About the initiator

Name of Organization: LUT University
Research Group/Department: Research Group in the field of Industrial Engineering and Management
Country: Finland

1. Background info

Short description of your organization:

LUT University (Kouvola, Finland)

Website: https://www.lut.fi/en/about-us/campuses-and-regional-units/lut-kouvola

2. Research Group/Company Department

Short description: The Kouvola Research & Innovation Unit at LUT University operates in the Kymenlaakso region — a strategic hub for bioeconomy, logistics, food-system transformation and sustainable industrial innovation.

Research group / department: Industrial Engineering and Management.
The Kouvola unit bridges industry, municipalities and research to co-design regenerative food systems, circular materials and resilient regional ecosystems.

Contact info: Dr. Kateryna Kryzhanivska, kateryna.kryzhanivska@lut.fi
Prof. Marko Torkkeli, marko.torkkeli@lut.fi

3. Expertise and available technologies within SMAR3TS project

1. ***Expertise*** *of your research group/department and available technologies:*

The following expertise, methodologies and technological assets are available to support the implementation of this I3X:

1. Circular Bioeconomy & Food Systems Expertise
2. Food Technology & Novel Protein Development
3. Sustainable Packaging & Bio-based Materials
4. Regional Food Logistics and Supply Chains
5. Digital & Data-Driven Food Systems
6. Sustainability Assessment & Decision Support
7. Business, Policy & Innovation Dynamics
8. Regional Development & Community Engagement

4. Examples of strategically relevant Innovate-3X Initiatives

The following initiatives illustrate how the **I3X: Regenerative Food Systems for Boosting Climate Resilience in Regions** can be implemented through **concrete, high-impact innovation actions**.

1. Climate-resilient regional protein platform
Development of a **regional protein hub** using **plant-based, microbial and fermentation-based proteins** produced from **forestry and food-industry side-streams** in Kymenlaakso, focusing on:
Low-carbon protein production; Use of local biomass; Nutrition and food security; Market-ready protein ingredients. **Strategic value:** Reducing dependency on imported protein while strengthening **regional resilience and climate mitigation**.

2. Bio-based and biodegradable packaging pilot
Creation of **bio-based food packaging** derived from **wood fibres and food side-streams**, tested in **local food and logistics companies**. **Focus on:** Circular materials; Food safety and shelf-life; Compostable and recyclable solutions; Industrial scalability **Strategic value:** Supporting the EU shift away from fossil plastics while enabling **sustainable food logistics**.
-> See continuation on the next page

I3X – About the initiator

Name of Organization: LUT University
Research Group/Department: Research Group in the field of Industrial Engineering and Management
Country: UK

SMAR3TS

4. Examples of strategically relevant Innovate-3X Initiatives

3. Food-waste-to-food innovation hub
Establishment of a **regional system** to recover food surplus from **retail, food service and processors** and convert it into **new food products, ingredients and animal feed**.
Focus on: Waste prevention; Upcycling and safety; New business models; Social and environmental impact. **Strategic value:** Cutting emissions and costs while improving **nutrition access and circularity**.

4. Climate-resilient food logistics demonstrator
Design and testing of **shorter, smarter food supply chains** linking **local producers, processors, logistics hubs and consumers** using **digital tracking and forecasting tools**.
Focus on: Supply-chain resilience; Low-carbon logistics; Food traceability; Crisis preparedness. **Strategic value:** Building food-system stability under climate and geopolitical shocks.

5. Regenerative food system living lab
Creation of a **regional living lab** where **farmers, food companies, municipalities, logistics operators and researchers** co-develop **climate-ready food solutions**.
Focus on: Stakeholder co-creation; Pilot projects; Social acceptance; Market validation. **Strategic value: Supporting the Kymenlaakso region in becoming a European testbed for regenerative food systems**.

I3X – Alignment to R3 and to WPs

SMAR3TS domains:

1) ***Specify here:*** *one or several SMAR3TS domains that are relevant to the work of your organization/research and innovation team.*

This I3X is aligned primarily with the **Nutrition** work package.

2) ***Specify here:*** *alignment of the work of your organization/research and innovation team with one or several SMAR3TS focus areas on Resilience, Restoration, and Regeneration. Share examples.*

This I3X aims to contribute to:

Resilience: By strengthening regional- and national-level food systems' robustness under climate, economic, and security shocks, through digital and collaborative innovation.
Restoration: By reducing emissions and environmental degradation in food production and materials.
Regeneration: By rebuilding regional capacity for circular, low-carbon and equitable food systems that support long-term wellbeing.

I3X Description

1) Innovate3X: Next-generation proteins for resilient and regenerative food systems (LUT University – Kouvola, Finland)

1. Description of Current Stage

Across Europe and within the Kymenlaakso region, multiple innovative technologies and initiatives related to sustainable food, bioeconomy, logistics and materials already exist. These include **novel protein technologies, bio-based packaging, food-waste recovery systems, digital supply-chain tools and regional bioeconomy platforms.** However, these developments are currently fragmented, operating in separate value chains, pilot projects and institutional silos.

Most solutions remain at pilot or early implementation stage, and few are integrated into coherent, region-wide food systems that can deliver climate resilience, nutritional security and circularity at scale. While technical components are available, system-level integration, governance models, business cases and policy alignment are still missing.

The Kymenlaakso region offers strong infrastructure, industrial capacity and biomass resources, but these assets are not yet fully coordinated into a regenerative regional food system. There is therefore a clear need to move from isolated innovations to integrated, climate-ready food ecosystems that combine production, processing, packaging, logistics and waste valorisation.

This I3X is positioned at the critical transition point between experimentation and deployment. Its objective is to connect existing technologies, actors and data into regional pilots and scalable models that can be replicated across Europe under the SMAR3TS framework.

2. Necessary skills and capabilities, across disciplines:

To engage with this work requirements include:

- **Food systems and nutrition science**, including understanding of how food production, processing and consumption influence health, sustainability and resilience
- **Food technology and bioprocessing**, including fermentation, protein extraction, ingredient formulation and safety
- **Bioeconomy and biomass utilisation**, particularly the valorisation of forestry and food-industry side-streams
- **Sustainable materials and packaging**, including bio-based, biodegradable and circular food-contact materials
- **Logistics and supply-chain design**, especially for regional, low-carbon and crisis-resilient food systems
- **Digital tools and data**, including traceability, forecasting, digital twins and platform development
- **Sustainability assessment**, such as life-cycle analysis, carbon and resource footprinting, and impact evaluation
- **Business models and market development**, including scaling, investment readiness and value-chain coordination
- **Policy and regulatory understanding**, especially related to food safety, circular economy and climate adaptation
- **Stakeholder engagement and ecosystem building**, working with industry, municipalities, SMEs, civil society and research partners

3. Examples of challenges that need to be addressed

Specify here: *Please outline which challenges remain unresolved. You may answer in bullet points.*

- **High vulnerability of food systems to climate shocks:** Heatwaves, floods, droughts and energy disruptions increasingly threaten food production, logistics and affordability across Europe and in the Kymenlaakso region.
- **Dependence on long, fragile, and carbon-intensive supply chains:** Regional food systems remain heavily reliant on global imports and just-in-time logistics that are poorly adapted to crisis conditions.
- **Unsustainable protein production:** Conventional protein systems drive emissions, land use and biodiversity loss, while alternatives struggle to reach scale and affordability.
- **Large volumes of food and biomass waste:** Significant amounts of edible food and nutrient-rich side-streams are lost due to inefficient collection, processing and valorisation systems.
- **Plastic and packaging pollution:** Food packaging remains largely fossil-based, contributing to waste, emissions and environmental harm.
- **Fragmented innovation and governance:** Technologies, companies, public authorities and research operate in silos, preventing system-level transformation.
- **Regulatory and market barriers:** New food products, bio-based materials and circular business models face complex approval processes and unclear market pathways.
- **Limited data and system-level intelligence:** Food systems lack integrated data, digital tools and forecasting models to manage risks and optimise resilience.