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Transforming Food Systems

An Exploratory Research Journey on the EU Green Transition

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Vol. I

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CONTENTS

ABSTRACT

This report examines barriers and enablers shaping the transformation of European food systems and synthesises insights from a participatory exploration of potential pathways toward more sustainable, resilient and equitable food systems. It draws on an international multi-stakeholder workshop that combined futures thinking, systems analysis and participatory design to explore how change may unfold across production, consumption, governance and market domains.

The study uses a combination of methods, including scenario building with an adapted Futures Wheel, the identification of barriers and enablers, and stakeholder role mapping through the Berkana Two Loops framework. These approaches were applied to explore desirable future states, identify systemic constraints and opportunities, and clarify how different actors may support or hinder transformation. Two complementary visions were developed: one centred on a rapid protein transition driven by innovation and environmental price signals, and another focused on universal access to healthy, local and nutrient-dense food through educational and community-based measures. Across both visions, the analysis highlights the importance of coherent and stable policy frameworks, strong food literacy and skills, adaptive and reflexive governance, reliable data infrastructures, targeted finance and participatory approaches. Common barriers include cultural attachment to prevailing diets, fragmented governance, uneven economic impacts, investment risk, skills shortages and mis- and disinformation.

The mapping of stakeholder roles shows that transformative change depends on how pioneers, intermediaries, institutional stewards and incumbent actors interact, and on the ability to reduce resistance and build shared ownership. The report also identifies methodological limitations and the need for stronger evidence integration and complementarity with quantitative analysis. Overall, the findings underline the importance of coherent, cross-domain strategies to advance sustainable food system transitions.

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EXECUTIVE SUMMARY

Europe's food systems sit at the intersection of climate, environmental sustainability, public health and social equity. Transforming them remains a central priority for the European Commission, reflected in the European Green Deal and the *Farm to Fork Strategy* as key policy drivers for sustainable food systems, and in the Commission's 2024–2029 political agenda, which emphasises "*Sustaining quality of life through food security, water and nature*" by "*Building a competitive and resilient agriculture and food system and safeguarding biodiversity to support farmers and healthy food for citizens*". **Yet advancing this transformation remains challenging. Food systems are highly interconnected and context-dependent**: production practices, consumption patterns, economic incentives, and social and environmental objectives interact differently across Member States, shaped by diverse agricultural models, dietary cultures, socio-economic structures and policy priorities. **Without mechanisms that connect these domains, transitions often unfold unevenly and are slowed by institutional silos, competing interests and short-term pressures.**

To explore how the EU can move from ambition to implementation, the Joint Research Centre (JRC) of the European Commission and the University of Bologna convened an **international multi-stakeholder workshop blending systems thinking, futures exploration and design-driven approaches**. The workshop brought together practitioners, policymakers, researchers, entrepreneurs and civil society representatives to co-create desirable food system futures and stress-test what it would take to achieve them. **Participants examined how policy, markets, culture and technology might co-evolve, and surfaced leverage points, barriers, enablers and role-specific contributions to guide strategic action.**

Two contrasting yet complementary visions emerged from the scenario-building process. Scenario A depicts a rapid shift towards low-impact proteins, marked by sharp reductions in animal products and accelerated deployment of alternative proteins, supported by innovation, standards, investment and environmental price signals to reduce footprints while maintaining affordability. Scenario B describes a "glocal" model that guarantees universal access to nutrient-dense, culturally grounded food through measures such as a Universal Basic Nutrition Income, targeted taxation, strengthened community infrastructures and enhanced food literacy.

Despite their differences, the scenarios converged on several systemic enablers of progress: coherent and stable policy frameworks; strengthened food education and skills; adaptive and reflexive governance mechanisms that support innovation while safeguarding standards; trusted data and certification systems; targeted finance for early-stage and high-capital investments; and participatory governance that builds legitimacy and social licence. **Participants also identified cross-cutting barriers**, including cultural attachment to prevailing diets, fragmented or inconsistent regulations across levels, investment risk and short political cycles, skills shortages, and persistent mis- and disinformation.

The workshop further underscored the importance of actor roles and interactions in shaping the direction and pace of change. Transformative pathways rely on how "**pioneers**" generate alternatives, how "**bridge-builders**" translate and connect ideas across sectors, how "**institutional stewards**" embed and scale emerging practices, and how actors defending the dominant model can be brought into transition processes through credible pathways and safeguards. Engaging across this spectrum is essential to reduce resistance and build shared ownership.
The exercise also pointed to methodological challenges. Participatory futures approaches were valuable in surfacing insights and fostering collective sense-making, but future applications would benefit from **deeper integration of scientific evidence, greater iteration time and stronger complementarities with quantitative analysis** to assess the robustness and distributional impacts of proposed pathways. The work further demonstrated that system- and future-thinking methods in multi-actor settings add practical value to science for policy, helping to align diverse actors on direction, reveal sequencing and trade-offs, and support the translation of high-level ambitions into implementable pathways.

The workshop demonstrated that Europe's food system transformation will not be unlocked by isolated measures but by coherent, cross-sector strategies that align technological innovation, cultural change, economic incentives and governance reforms. Achieving this requires long-term policy consistency, investment in skills and infrastructures, and inclusive processes that cultivate shared agency among actors with diverse interests. The insights generated here offer direction for shaping such a transition, highlighting where coordinated efforts can accelerate progress toward sustainable, resilient and equitable food systems in the EU.

Key messages

1. **Systemic, futures-oriented approaches are useful for navigating complexity, but their design strongly shapes the quality of insights:** Combining systems thinking, futures methods and participatory co-creation helps navigate complexity, reveal interdependencies and trade-offs across the food system, and support more coherent and anticipatory policy discussions. To maximise their value, future applications should integrate scientific evidence more deeply, allow for greater iteration and complement qualitative exploration with quantitative assessments.
2. **Contrasting but complementary transition pathways highlight strategic choices:** The scenario exercise showed that more innovation- and market-driven approaches and more social-equity- and community-centred models each deliver different benefits and trade-offs for food system transformation. In practice, strategies will need context-specific combinations of instruments rather than a single blueprint pathway.
3. **Socio-cultural change remains a major bottleneck:** Food identities, habits and perceptions strongly shape the acceptability of measures such as taxes, dietary shifts or alternative proteins, making cultural change and social acceptance as crucial as technological or regulatory solutions.
4. **Fairness, affordability and social impacts must be central in transition pathways:** Environmental improvements alone are not sufficient - policies must ensure that healthier and more sustainable diets remain accessible, that vulnerable groups are not disproportionately affected, and that workers and regions facing structural change receive targeted support.
5. **Governance coherence and long-term orientation are prerequisites for progress:** Fragmented responsibilities, inconsistent sectoral policies and short political cycles hinder transformation; more stable long-term goals and cross-sector coordination are required across agriculture, health, social and trade domains, with governance arrangements that can adapt as learning and conditions evolve.
6. **Targeted investment and innovation are key enablers of change:** Scaling sustainable practices and food products requires sustained investment in infrastructures, business models and both technological and social/institutional innovations - from alternative proteins and regenerative farming to new welfare and procurement models.
7. **Food literacy and skills are powerful levers across the system:** Strengthening nutrition, cooking and sustainability skills across schools, communities and relevant professional sectors empowers citizens and practitioners to adopt and promote healthier and more sustainable choices.
8. **Stakeholder roles and relationships shape transition dynamics:** Transformative change depends on how different actors interact: “pioneers” generate and test alternatives; “bridge-builders” translate and connect ideas across domains; and “institutional stewards” embed and scale emerging practices. Actors protecting the dominant model require credible transition paths and safeguards to shift from resisting to supporting change. Effective strategies must engage all these roles to reduce resistance and build shared ownership of the transition.

Looking ahead

This report forms the first volume of the series ***An Exploratory Research Journey on the EU Green Transition***, which investigates systemic transformations in three key domains: **food systems**, **urban environments** and **green innovation**. Together, the series aims to generate actionable insights on system triggers that can accelerate paradigm shifts across sectors central to Europe’s environmental sustainability and competitiveness. The work underscores the importance of **experimentation** and **learning-by-doing**: transitions cannot be fully planned in advance, but must evolve through iterative processes supported by **co-creation**, **reflexive governance** and **context-sensitive solutions**.

01. Introduction

The need for food system transformation

Workshop objectives

> It is vital that European agriculture can continue supplying the **quantities** and **qualities** of agricultural goods needed **within planetary boundaries**

Strategic Dialogue on the Future of EU Agriculture, presented on the 4th September 2024.

1.1 The need for food system transformation

The **transformation of food systems is essential to address pressing challenges** such as environmental degradation, climate change, health crises, and social inequalities. Given their central role in human and planetary well-being, food systems are instrumental in advancing global sustainable development objectives like the **Sustainable Development Goals** (SDGs) of the 2030 Agenda in an integrated manner (Borchardt et al. 2024).
As **complex systems**, they interact with multiple dimensions of sustainability, spanning environmental, economic, social, and governance aspects. Their interconnections create both **opportunities and challenges for sustainable development**, with progress in one domain often shaped by synergies and trade-offs in others.

Current food systems are characterized by **unsustainable production and consumption patterns** that significantly contribute to biodiversity loss, soil degradation, water scarcity, and a third of global greenhouse gas emissions (Béné, 2022; Clark et al., 2020; Springmann et al., 2018). These challenges are compounded by the **misalignment of market mechanisms**, which fail to **internalize the external costs** of food production and consumption, thereby reinforcing lock-ins and slowing systemic change (FAO 2023). For a brief overview of how food systems are understood in this report and how they relate to key EU policy frameworks, see Box 1.

☞ In this report and in the workshop it builds on, the focus is primarily on the **transformation of food-related activities and outcomes in a European context**, while recognising that European food systems are deeply embedded in global value chains and biophysical systems. **International trade** and **geopolitical dynamics**, the wider **bioeconomy** and interactions with other resource systems such as energy and water were considered insofar as they emerged from the thematic seeds and group discussions, including potential implications for producers and consumers outside Europe. These aspects were not analysed systematically or through quantitative modelling. The **system boundaries** of the exercise are therefore **permeable**: cross-border and cross-sector linkages are taken into account where participants perceived them as salient, while the core emphasis remains on **levers for changing how food is produced, processed, distributed and consumed in and for Europe**. Rather than providing a comprehensive assessment of all possible trade-offs, the workshop methods were designed to qualitatively **surface perceived synergies**, **tensions** and **unintended consequences** across environmental, social, economic and governance dimensions.
Yet the transformation of European food systems must contend with the fact that **multiple system dimensions** such as ecological conditions, technological innovation trajectories, economic structures, social practices and policy frameworks evolve in parallel and are often poorly aligned. While food systems exhibit strong **interdependencies** across these domains, the strategies and instruments that influence them frequently remain organized along sectoral lines, shaped by **diverse national priorities and institutional mandates**. This misalignment makes it difficult to coordinate changes in production practices, consumption patterns, fiscal incentives and social measures, all of which jointly determine the direction and speed of food system transformation. It also limits the **ability of policymakers and stakeholders to anticipate** how interventions in one part of the system may trigger ripple effects elsewhere. Addressing this calls for approaches that can explore **system-wide impacts**, reveal interdependencies and examine how multiple levers of change interact over time, thereby supporting more coherent and equitable transformation pathways.

☞ **A holistic food system perspective is therefore needed to redesign the structures, rules and goals that shape system behaviour** and to ensure that interventions account for connections across production, consumption, markets and governance. Approaches grounded in systems thinking, futures methods and participatory co-creation are well suited to this task, as they help explore system-wide impacts, anticipate ripple effects and identify leverage points for change. By enabling stakeholders to look beyond sectoral boundaries and build shared insights, these approaches strengthen both strategic alignment and the practical operationalisation of food system transformation.

1.2 Workshop objectives

To address these challenges in a concrete and collaborative way, the **Joint Research Centre**, together with the **University of Bologna**, convened a multi-actor workshop as part of its exploratory research activity on green transition governance (Box 2). The workshop was designed to **explore transformative pathways for sustainable food systems** in Europe by fostering interdisciplinary collaboration and co-creation among policymakers, scientists, industry representatives, and civil society. To achieve this, a set of objectives was established to **guide the exploration of these pathways**

Box 1. **Food systems: definition and EU policy context**

Food systems encompass all the activities and actors involved in producing, processing, distributing, retailing, consuming and disposing of food, together with the environmental, economic, social and cultural conditions that shape these activities. They are inherently systemic and complex: farmers, firms, public authorities, civil society and consumers interact across multiple governance levels, from local to global, and decisions in one part of the system can trigger indirect and sometimes unexpected effects elsewhere.
Food systems are also strongly place-based. They are shaped by local environmental conditions, available natural resources, cultural traditions, social norms and economic structures, which means that similar interventions can play out very differently across territories. This combination of interdependence and context-specificity makes food systems both a major driver of environmental pressures and health outcomes, and a key arena for shaping livelihoods and territorial development. **Food system transformation, in this perspective, refers not only to incremental improvements in single sectors, but to deeper changes in practices, infrastructures, institutions, behaviours and power relations that reorient the system towards sustainability, resilience and equity**.

At EU level, this systemic lens underpins several major policy agendas. The **European Green Deal** continues to provide long-term direction for aligning economic activity with climate and environmental objectives, while adjustments under the current Commission reflect a broader emphasis on competitiveness, resilience and quality of life. Within this landscape, the ***Farm to Fork Strategy*** and related initiatives on sustainable food systems, agriculture and nutrition seek to link production, processing, retail and consumption with health and environmental goals. These are complemented by ongoing structural reforms of the **Common Agricultural Policy**, which aim to progressively shift agricultural support and production patterns in line with climate and environmental objectives, as well as by broader strategic debates on the future of agriculture and food, including the long-term Vision for Agriculture and Food. More recently, frameworks such as the ***Competitiveness Compass*** have highlighted the need to strengthen Europe's strategic capabilities, productivity and economic resilience, which also has implications for food systems in terms of innovation, investment, value-chain performance and the ability to compete fairly in global markets. Across these processes, there is a growing recognition that a food systems perspective is needed and that progress will depend on managing trade-offs and synergies across sectors, policy domains and governance levels.

and ensure a comprehensive understanding of the challenges and opportunities involved.

These objectives directly respond to the need identified above: enabling stakeholders to engage with the systemic nature of food system transformation, explore interdependencies, and identify leverage points that are not visible through sectoral analysis alone. In the context of governing food system transformations, working with future visions and associated pathways is important because it allows policymakers and stakeholders to explore how different directions of change could play out across multiple levers, anticipate potential trade-offs and synergies, and surface where existing governance arrangements or coordination mechanisms may be insufficient or misaligned.

One key objective was to (**1**) **examine diverse future visions for sustainable food systems**, focusing on how they address pressing challenges such as biodiversity loss, climate change, social inequalities, and diet-related health issues. These visions considered the roles of various stakeholders and explored the interplay between governance levels, including both top-down and bottom-up approaches, to identify opportunities for alignment and integration.

A second objective was to (**2**) **identify key barriers, enablers and stakeholder roles that would shape the implementation of these visions, and to sketch how different constellations of instruments and actors might contribute to change in practice**. This involved mapping factors that impede or facilitate progress and clarifying how responsibilities and capacities are distributed across stakeholders, with the aim of helping to ground emerging pathways in practical, context-specific considerations.

The final objective was to (**3**) **bring these findings together within a systemic perspective that highlights interactions between various elements of the food system**. By examining how these elements influence one another and contribute to broader systemic dynamics, the workshop sought to offer an integrated understanding of key processes, tensions and leverage points involved in driving sustainable food system transformation.

☞ From a **policy and decision-making perspective**, bringing **future visions**, **operational pathways** and **stakeholder roles** together in this way helps actors working across different domains and sectors of the food system anticipate potential trade-offs and synergies, explore how combinations of existing and emerging enablers could contribute to more sustainable system configurations, and identify strategic areas where coordination and alignment efforts can have the greatest impact. This integration supports the **development of cohesive strategies that address the complexity of socio-ecological systems while fostering transformative change aligned with Europe's green transition goals.**

Box 2. **GREEN TEA: an Exploratory Research Activity at the JRC**

The international workshop is part of a series of Science for Policy co-cration sessions conducted as part of the **JRC Exploratory Research Activities** (ERA) programme. These Activities aim to address complex and emerging challenges through short, self-contained studies and initiatives, such as expert workshops and conferences, that foster innovative and exploratory approaches to problem-solving.

The GREEN Transition Exploratory Activity (**GREEN TEA**) consisted of **three workshops** aiming at bridging gaps in EU green transition policies' implementation by fostering interdisciplinary dialogue and **co-creation** among policymakers, EU institutions, scientists, industry representatives, private sector, and civil society. By exploring transformational pathways across three key domains - **food systems, urban green transitions, and green innovation** - the workshops aimed to develop **integrated narratives that can inform policy recommendations and practical actions to advance the EU's green transition**. The exploratory nature of the workshop stemmed from their innovative **combination of tools and methods** from design, futures, and systems thinking within a multistakeholder setting.

The workshop series was conducted in collaboration with three **Italian lead universities**, namely *Università di Bologna* (food system, 2 October 2024), *Politecnico di Torino* (urban green transitions, 24 October 2024), and *Università Bocconi in Milano* (green innovation, 11 February 2025). The workshop underpinning this report titled "Exploring Future Pathways for a Sustainable Food System Transformation", was carried out in collaboration with the University of Bologna, specifically the Department of Agricultural and Food Sciences. This report is the first volume of the series "**An Exploratory Research Journey on the EU Green Transition**, the outcome of the GREEN TEA Exploratory Research Activity.

02. Methodology

Workshop composition

Working Tables

Part 1: Scenario Building

Part 2: Identifying barriers, enablers and relevant stakeholders

Part 3: Emergent system and the Berkana two loop model

> **Foresight** is a discipline based on the fundamental premise that the **future is open and cannot be predicted**, but that it can be shaped by **actions in the present.**

Matti, M., Jensen, K., Bontoux, L., Goran, P., Pistocchi, A., & Salvi, M. (2023). **Towards a fair and sustainable Europe 2050: Social and economic choices in sustainability transitions**. *Publications Office of the European Union*.

Given the need to navigate system-wide interactions, anticipate unintended consequences and integrate diverse perspectives, the workshop applied a **combination of methodological approaches suited to complex transformation processes**. Futures methods were used to explore **uncertainty** and **long-term implications**; systems thinking helped identify **interdependencies** and leverage points; and participatory design and co-creation methods supported the development of **actionable pathways** among actors with different mandates and knowledge bases.

The workshop was structured in three parts. Together, these three components operationalise the workshop objectives outlined in **Section 1.2** by moving from systemic **future visions** (Part 1), to **barriers, enablers and stakeholder** roles (Part 2), and finally to their positioning within broader **transition dynamics** (Part 3).

Part 1 focused on **scenario building**, using an adapted version of the futures wheel to explore the systemic implications of different thematic seeds. This step responded to the need to understand **system-wide interactions** and potential ripple effects by making visible **first- and higher-order impacts** across everyday life and the food value chain.

Part 2 involved **identifying barriers and enablers related to the developed scenarios**, as well as mapping relevant stakeholders connected to these pathways. This helped translate broad visions into more operational insights on where change is constrained or supported in practice, and which actors influence key levers of transformation.

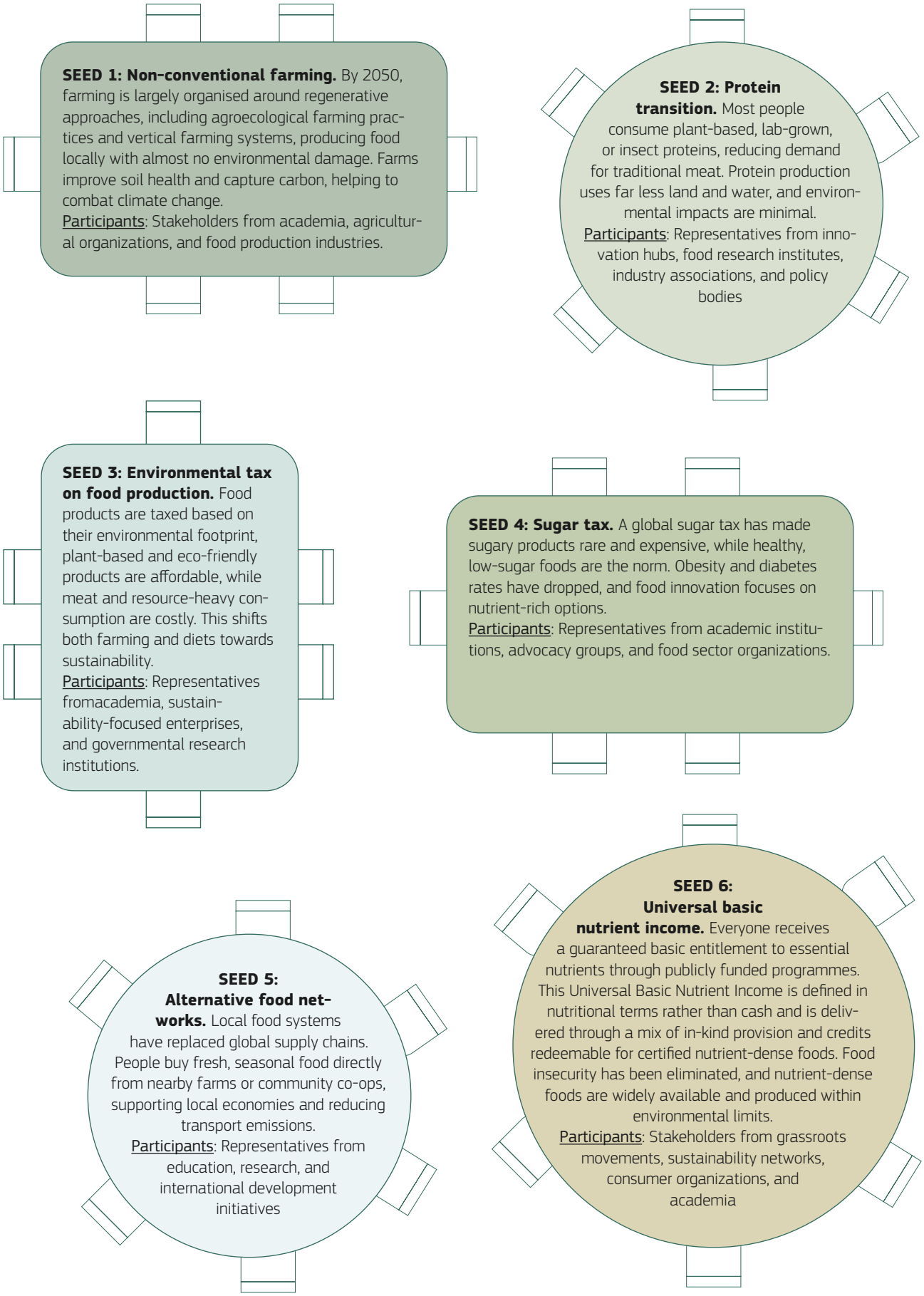
Part 3 centered on **positioning these stakeholders within the Berkana Institute's Two Loops model**, offering a framework for understanding their roles in stabilizing or enabling the transition from existing to emergent food systems. This final step directly addressed the **governance and implementation** dimension of the problem by clarifying how different actors contribute to, resist or can be supported in processes of systemic change.

2.1 Workshop composition

The workshop brought together a diverse group of stakeholders, including representatives from **universities** and **research organisations**, European and national public bodies, business and innovation actors, and civil society organisations active in food systems. Participants included, among others, experts from **academia** (e.g. University of Bologna, Wageningen University, University of Helsinki, Politecnico di Torino), **EU and international networks and agencies** (e.g. JRC, EFSA, Agroecology Europe, UN SDSN), **business and innovation actors** (e.g. EIT Food, Scottish Wholesale Association, Naked Innovations, BeAmaz) and **consumer**, youth and food movement organisations (e.g. Slow Food, Altroconsumo, Rural Youth Europe, school feeding initiatives). Participants were not pre-selected for specific seeds, but were allocated to groups in a way that **sought to balance different types of expertise and experience relevant to European food systems**.

The workshop was held as a full-day, in-person event at the Department of Agricultural and Food Sciences of the University of Bologna. Discussions took place in **facilitated small-group sessions**, guided by shared templates and plenary debriefs to structure exchanges and systematically document results. The conversations were grounded primarily in **participants' professional knowledge**, **practical experience** and **familiarity** with existing evidence and policy frameworks; the workshop was designed as an exploratory, co-creative process to generate insights on possible transformation pathways. The implications of this participant composition and format for the scope and transferability of the findings are further reflected in the discussion and limitations section.

Figure 1. Working tables and pre-defined scenarios (Seeds).



Source: Authors' elaboration.

2.2 Working tables

Participants were divided into **six groups** based on **six thematic seeds**, each focused on a specific topic related to different **enablers**, **tools** or **instruments** of sustainable food system transformations (Figure **1**). The seeds were designed as illustrative **entry points** that collectively span key levers debated in the food systems literature and practice, including **changes in production practices**, **shifts in protein consumption**, **environmental and health-related food taxation**, **alternative food networks** and **demand-side social protection instruments** (Blakely et al., 2020; Bonnet et al., 2018; Duluins & Baret, 2024; Ewert et al., 2023; Gori & Castellini, 2023). In the context of the latter, **Universal Basic Nutrient Income** (**UBNI**) was included as an emerging, exploratory concept inspired by ongoing work by **Dark Matter Labs** and their partners in Sweden, where UBNI is being prototyped as a policy instrument that links true-cost-based food repricing, welfare infrastructure and long-term food system preparedness within planetary boundaries (Dark Matter Labs, 2024).
Rather than providing an exhaustive or representative set of interventions, the seeds were selected to **reflect this diversity** while deliberately introducing more experimental ideas to stimulate reflection beyond familiar sectoral or disciplinary frames.

2.3 Part 1: Scenario building

The scenario-building exercise was structured in two steps using the **Futures Wheel**, a participatory method for exploring the **potential consequences of changes, decisions, or interventions**. This tool, widely used in systems thinking and futures studies, enables participants to **map out broader implications of potential interventions** and to identify trade-offs, synergies, and systemic ripple effects. For the purpose of this workshop, the method was inspired by the work of the **Rapid Transition Lab**[1] and adapted to focus specifically on food system transformation. Participants were encouraged to consider both **immediate (first-order) effects** and their implications for citizens' everyday lives, as well as the **broader impacts** across different elements of the food value chain (Figure **2**).

In the first step of the exercise, each of the six groups was assigned a **thematic "seed"**—defined as an emerging **trend**, **innovation**, or **initiative** that currently exists at the margins of the food system but holds potential to contribute to **more sustainable and healthy food systems in Europe**. Participants were asked to imagine the mature state of their assigned seed in the year 2050 and to describe what a food system shaped by that seed might look like. Building on this vision, they then populated the Futures Wheel by identifying and organizing its expected effects across societal and value chain dimensions.

Following this, the six groups were merged into two macro-groups: **macro-group A** (combining groups 1, 2, and 3) and **macro-group B** (combining groups 4, 5, and 6). In these new groupings, participants were invited to **integrate their seed-based scenarios** by identifying points of convergence, complementarity, and potential tensions (Figure **2**). This merging process expanded the scope of the original discussions, enabling the creation of **more holistic and systemic future scenarios** that reflected multiple dimensions of the food system. Working in macro-groups also exposed participants to seeds they had not worked on initially, fostering cross-pollination between different strands of expertise and allowing them to negotiate a shared understanding of possible future configurations.

This tailored approach ensured that **discussions were grounded in practical and tangible outcomes**, in line with the workshop's objective of exploring actionable pathways for food system transformation. The structured yet exploratory nature of the Futures Wheel allowed participants to **collaboratively examine challenges and opportunities** associated with their assigned seeds, while identifying **potential trade-offs, synergies, and areas requiring further attention**. By grounding abstract ideas in plausible contexts and mapping associated barriers, enablers, and stakeholder roles, the exercise laid the **foundation for the following stages of the workshop**. Its value lay in its ability to support systems thinking, foster interdisciplinary dialogue, and help participants **co-create coherent and integrated strategies** for sustainable food system transformation.

2.4 Part 2: Identifying barriers, enablers, and relevant stakeholders

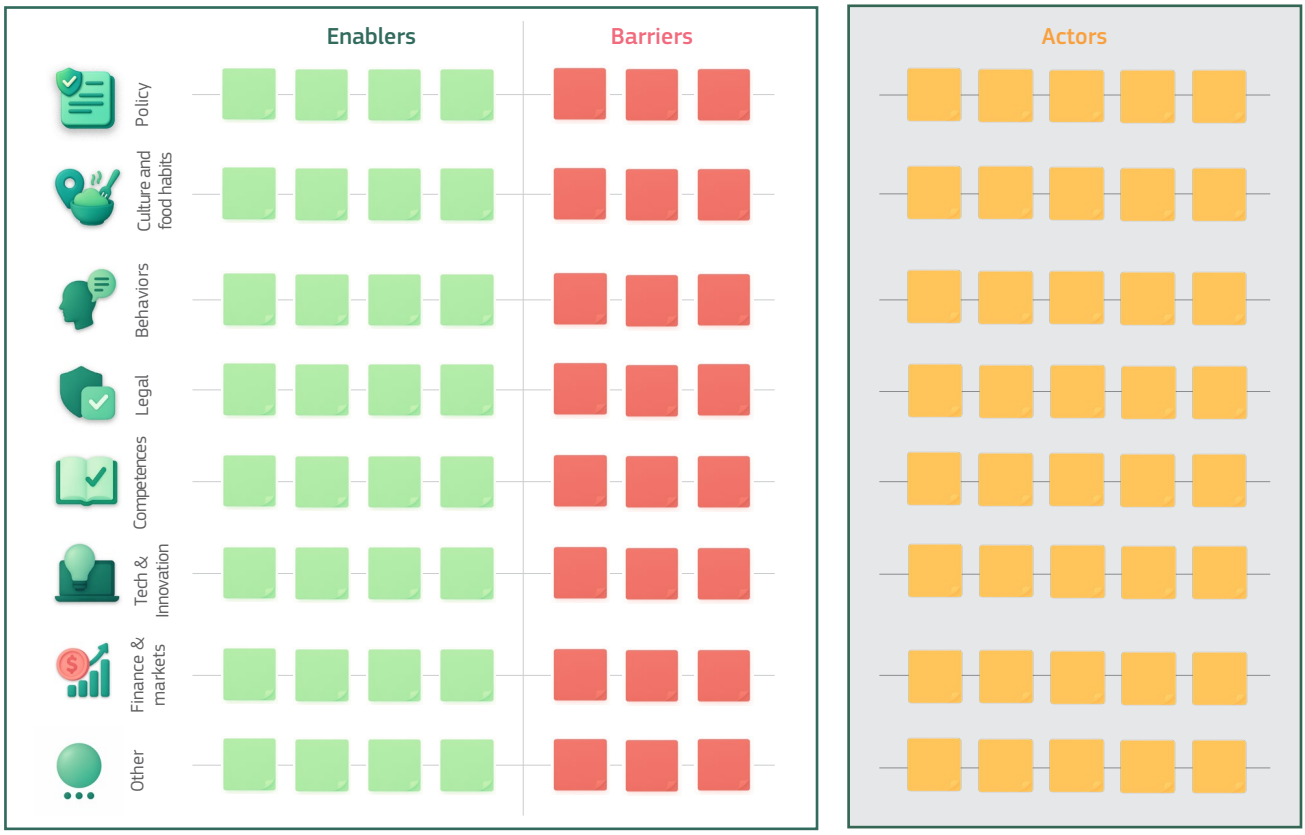
In the second part of the workshop, participants worked within macro-groups to identify **key barriers and enablers associated with the seeds** contributing to their merged scenario (Figure **3**).

[1] Online, available here.

Figure 2. Adapted version of the "Futures Wheel" encompassing effects on STEEPLE domains and food value chain implications.

Source: Authors' elaboration.

Figure 3. Barriers and enablers associated with each seed contributing to their merged scenario



Source: Authors' elaboration.

The aim was to **prioritize the most impactful barriers and enablers per seed**, generating a focused overview that linked specific challenges and opportunities with the actors most likely to influence them. Discussions were structured around a set of **predefined layers**, including policy and regulation, culture and food habits, behaviors, finance and markets, competencies, legal frameworks, technology and innovation, as well as a category for other relevant factors. For each seed, participants examined which factors might **support or hinder its development and integration** into a sustainable future food system. Alongside this analysis, participants identified **the stakeholders most relevant** to each barrier or enabler - such as governments, companies, NGOs, communities, and consumers - and considered their roles in **either advancing or obstructing transformation**.

2.5 Part 3: Emergent system and the Berkana two loop model

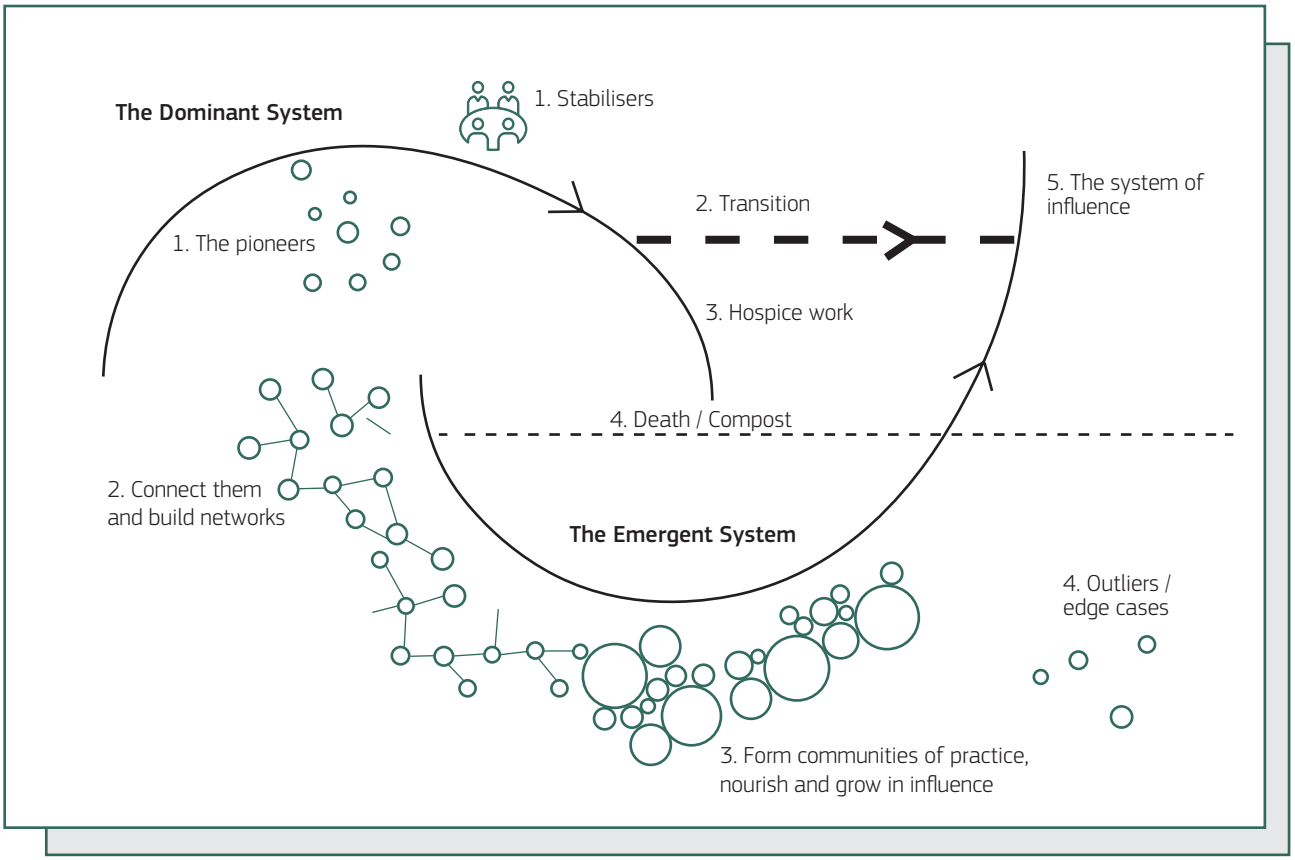
In the final part of the workshop, participants **mapped stakeholders** in relation to systemic change using the **Berkana Institute's Two Loops model**. This framework helps visualize how systems evolve over time by depicting the parallel decline of dominant systems and the emergence of alternative ones. It distinguishes between two **overlapping trajectories**: the first loop represents the **incumbent system** as it approaches its limits and begins to decline; the second loop illustrates the gradual **emergence of new paradigms**, practices, and innovations that can replace or transform the existing system (Figure **4**). In practice, food systems consist of multiple overlapping regimes and subsystems rather than a single, monolithic "**dominant system**". In the workshop, the Two Loops model was therefore used as a heuristic to think about relative positions and roles in ongoing transition dynamics, rather than as a literal depiction of one system inevitably moving towards an "**end state**" (often labeled "**hospice**" or "**death**" in the original model).

The model highlights **different types of actors** involved in transitions. **Pioneers** experiment with alternative approaches, often outside the mainstream; **bridge-builders** connect these pioneers to more established actors and structures, helping to scale or legitimize new ideas; **institutional stewards** work from within existing systems to introduce incremental change; and **protectors** of the old system resist transformation due to uncertainty or vested interests.

By mapping these roles and their interactions, the model supports a **better understanding of how change unfolds** - and where targeted interventions may help **accelerate** it.
In the workshop, participants used this model to position the **previously identified stakeholders** in relation to the food system transition. This mapping exercise helped illuminate how different actors **contribute to - or resist - change**, and where leverage points might exist to support more sustainable pathways. Importantly, the exercise **did not assume that incumbent arrangements must simply disappear**; it also considered how elements of existing systems might be maintained, repurposed or combined with emergent practices as part of plural transition trajectories. The exercise directly supported the goal of **embedding stakeholder insights within a systemic framework**, emphasizing the importance of interdependencies between structures, behaviors, and actors across phases of transition.

The workshop combined these elements in a structured sequence to **guide participants from identifying systemic impacts to building future scenarios**, mapping barriers and enablers, and locating key stakeholders within a transition framework. Thematic groups began by exploring their assigned seeds using the Futures Wheel, generating insights **into potential impacts and interdependencies**. These insights formed the foundation for the scenario-building phase, in which participants were merged into two macro-groups (A and B) to co-develop broader, integrative future visions for sustainable food systems.
The **scenarios** were then deepened through analysis of the **most significant barriers**, enablers, and stakeholder dynamics.
Finally, participants used the Two Loops model to **map stakeholder roles across the phases of systemic transformation**, helping to contextualize strategies for change.
Within this process, some steps (such as the formulation of macro-group visions) aimed at **convergence on shared narratives**, while others (such as the Futures Wheel and the mapping of barriers and enablers) were **explicitly designed to collect a range of possible effects and viewpoints**; the results presented in the following sections therefore combine elements of both shared orientations and diversity of perspectives.

Figure 4. Berkana Institute's Two-loops model.



*Source: Authors' elaboration based on Stewarding Loss on **Medium**.*

Achterwehr, Germany by Matthew

03. Results

Futures Wheel analysis: thematic insights

Macro-group A Non-conventional Farming, Protein Transition, and Environmental tax

Macro-group B Sugar Tax, Alternative Food Networks, and Universal Basic Nutrient Income

Scenario building: future visions for sustainable food systems

An EU with less animal produce and more alternative proteins supported by environmental taxes (Macro-group A)

Going glocal - A universal income for nutrient-dense healthy and local food (Macro-group B)

Barriers and enablers for systemic transformation

Macro-group A: challenges and opportunities

Macro-group B: challenges and opportunities

Stakeholders and their role in the transition

Overarching transition strategies

Pioneering Change and Securing Public Support: A Strategy for Food System Transition

Empowering Local Actors and Building Trust:
A Community-Driven Strategy for Food System Transition

> A fundamental **change** needs to happen on many levels... The **transition** is just as much a **cultural** and a **social** transition as a green one

European Commission (2022). "**New European Bauhaus Compass**". https://new-european-bauhaus.europa.eu/

This chapter presents the findings of the workshop in a structured and detailed sequence, reflecting the progression from **impact** identification to **visioning**, stakeholder **mapping**, and **strategy** development. It begins with an analysis of Futures Wheel outcomes for each **thematic group** (**seeds**), clustered in **two macro-groups** to synthesize key insights across thematic areas.

Macro-group A (*Non-conventional Farming*, *Protein Transition*, and *Environmental Taxation*) and **Macro-group B** (*Sugar Tax*, *Alternative Food Networks*, and *Universal Basic Nutrient Income*) are examined separately, highlighting the **first-order impacts**, implications for **everyday life**, and effects along the **food value chain**.

Following this, the **scenario-building outcomes** are presented, outlining the integrated future visions developed by each macro-group. We then shift from **visioning and future reflections** toward an operationalization of these visions by examining **barriers and enablers**, identifying key constraints and opportunities that shape the feasibility of transformation pathways. The chapter then presents the **stakeholder roles** identified in the discussions, describing how different actors were mapped within the transition process.

Finally, all preceding insights are brought together in the **overarching transition strategies**, summarizing the integrated pathways formulated during the workshop within each macro-group. The chapter concludes with reflections from **student participants**, offering additional perspectives on the findings and discussions.

3.1 Futures Wheel analysis: thematic insights

The outcomes of the Futures Wheel exercises are organized by thematic group, presenting findings on first-order effects, their implications for citizens' everyday life, and their impacts along the food value chain. To facilitate a broader synthesis, the results are structured according to the two macro-groups: **Macro-group A** (Non-conventional Farming, Protein Transition, and Environmental Taxation) and **Macro-group B** (Sugar Tax, Alternative Food Networks, and Universal Basic Nutrient Income). This division allows for a more integrated understanding of the systemic interdependencies and emerging patterns within each set of themes.

The **tables** that follow summarise the first-order effects identified by participants for each seed, together with the **associated implications** for everyday life and the food value chain as they emerged in the discussions. They **do not represent a complete or rigorously tested picture** of all possible consequences, but rather a structured documentation of the main elements raised during the workshop. In practice, despite guidance to imagine a mature 2050 state in which the seed is widely implemented, participants at times **moved fluidly between describing characteristics of that future state and anticipated dynamics along the transition towards it**. As a result, some entries reflect perceived barriers and reactions during the transition process rather than effects of a fully implemented seed. For the same reason, not every seed **generated entries under all possible domains** (e.g. health), and the absence of a given dimension in a table should not be interpreted as **evidence that no such effects exist**. This applies both to the listed first-order effects and to their everyday-life and value-chain implications and should be borne in mind when interpreting the tables.

3.1.1 **Macro-group A** Non-conventional Farming, Protein Transition, and Environmental tax

Seed 1: Non-conventional farming practices.
By 2050, farming is largely organised around regenerative approaches, including agroecological farming practices and vertical farming systems, producing food locally with almost no environmental damage. Farms improve soil health and capture carbon, helping to combat climate change.

Table 1. First-order effects - Non-conventional farming practices.

Dimension	Effects
Social	- The challenge of introducing agroecological practices even among older, skeptical farmers. These farmers are often focused on productivity and may resist innovation, especially if they are accustomed to conventional methods. - If policy frameworks and educational initia-tives are implemented, the transition towards agroecological practices could unify farming practices, making sustainable methods more accessible and integrated across different farming systems. - Encouraging alignment through policy could help overcome resistance and foster a broader shift toward sustainability.
Economic	- Certification of farms as organic or regenerative may increase costs, resulting in higher food prices – e.g., if costs are offset by grants or government aid, they could still present a barrier to wider adoption. Long-term economic benefits (e.g., improved soil health and reduced environmental damage) may offer cost savings over time. There is a need for a balance between short-term costs and long-term benefits.
Technological	- The transition to regenerative agriculture will require adequate technological and educa-tional support. Large-scale knowledge transfer will be critical, especially for farmers less familiar with these new techniques. Systems (e.g., through digital platforms, training pro-grams) that can disseminate knowledge and support farmers in adopting these practices are relevant. - Collaboration between government and industry could play a key role in making these tools accessible to all farmers, ensuring that regenerative ag-riculture does not remain a niche practice but effectively becomes part of the system.
Legal	- Regulatory frameworks are needed to certify regenerative farming practices. The potential for "greenwashing" was raised, where some farms might claim sustainability without truly embracing the principles. - Strict certification standards would be essential to maintain credibility, but these could raise operational costs for farmers. This challenge might differ between countries. Some national policies might support conventional agriculture. In contrast, increased openness to innovation in international markets (rather than at the national level), where sustainability is seen as a competitive advantage.
Environmental	- Some emphasis on the positive impacts of regenerative farming methods (e.g., improved soil health, carbon capture), contributing to climate change mitigation. - The transition could also improve the visual landscape of farming, making fields more aesthetically pleasing, thus enhancing public perception of sustainable agriculture. - Environmental benefits (e.g. reduced reliance on harmful substances; and the restoration of ecosystems) were considered key in promoting the adoption of regenerative methods.
Ethical	- The transition requires collective action. Collaboration among stakeholders along the entire supply chain (farmers, consumers, policymakers) is crucial to ensure successful adoption. Without consensus among all partners, efforts to implement new methods could slow down, raising questions about equity and inclusion in the agricultural community.

Source: Authors' elaboration.

i. First-order effects. The **first-round discussion** focused on the possible **first-order effects** of the thematic seed, considering insights from experts in agriculture, policy, life cycle assessment (LCA), and sustainability (Table **1**).

ii. Everyday life effects. The group explored the effects of the 2050 thematic seed on everyday life. One of the central insights focused on **consumer awareness and labelling**. Participants highlighted the potential for developing targeted measures leading to the creation of **new labels** for regenerative products. Such labelling would help consumers make informed choices, while **eco-design principles** implemented within supply chains could further enhance production systems and consolidate unconventional farming practices.

Environmental impacts and trade-offs were also extensively discussed. **Regenerative farming** systems were generally seen as having a reduced environmental impact, particularly in relation to land use. However, participants noted that such benefits often involve trade-offs, notably **lower yields**. **Soil health** was identified as a critical factor, especially its function in carbon storage and its role as a carbon sink. **Funding initiatives** supporting regenerative practices were recognized as increasingly vital for fostering a sustainable economy.

Regarding **input reduction and profitability**, the group observed that **agroecological approaches** typically involve a decrease in certain inputs. While beneficial for environmental sustainability, this reduction negatively impacts **profitability**, posing a significant challenge for farmers transitioning to regenerative practices. The discussion also touched upon **vertical farming**, where the high energy demands of the systems were noted. Addressing this issue, the participants stressed the need for a balanced approach, coupling input reduction with innovations aimed at boosting productivity through eco-design strategies.

Cultural and economic reflections raised concerns about the **risk of regenerative products** becoming exclusive commodities accessible mainly to a "cultural elite," similar to trends observed with organic and bio products. Such exclusivity could lead to **higher prices**, impeding accessibility and global competitiveness. To mitigate this risk, a strong understanding of consumer needs and preferences was deemed essential, aiming to support the broader adoption of regenerative practices without alienating average consumers.

The emergence of regenerative practices was also linked to **new education and research opportunities**. Participants noted that academia could expand into this field, with the potential development of new degree programs focused on sustainable agriculture. At the same time, they stressed the need to address **reduced productivity** challenges, suggesting a greater emphasis on promoting seasonal production as a more compatible approach with regenerative farming principles.

Finally, discussions on **technology and waste management** underscored the role of new agricultural technologies, such as organic waste collection systems. These innovations could contribute to waste reduction, and recycling organic waste into fertilizers could enhance local sustainability efforts, strengthen **circular economy practices**, and further minimize environmental impacts.

ii. Value-chain effects. The group examined the effects that the transition towards the 2050 thematic seed would have on the food value chain.

A critical starting point identified was the role of **food waste reduction** in promoting **regenerative practices**. Raising public awareness around food waste was seen as essential to leveraging consumer consciousness and encouraging more sustainable consumption habits.

Participants emphasized that **consumers must be recognized as active players** who influence the food system through their purchasing decisions. Rather than relying on fear-based messaging, **education efforts** should focus on empowering consumers to understand the impact of their choices on the supply chain and to actively contribute to building more sustainable food systems.

The shift towards **local and responsible consumption** was another key aspect discussed. Participants noted that this transition aligns closely with **SDG 12**, which promotes responsible consumption and production. Encouraging local food systems could foster the creation of food niches within specific territories, reducing reliance on exports. In doing so, regions would be able to develop their unique **agricultural identities**, supporting more sustainable and **community-focused food production** models while minimizing environmental impacts.

Value distribution along the supply chain emerged as a significant concern. The group observed that the initial stages of production, often bearing the highest costs, are typically penalized as prices

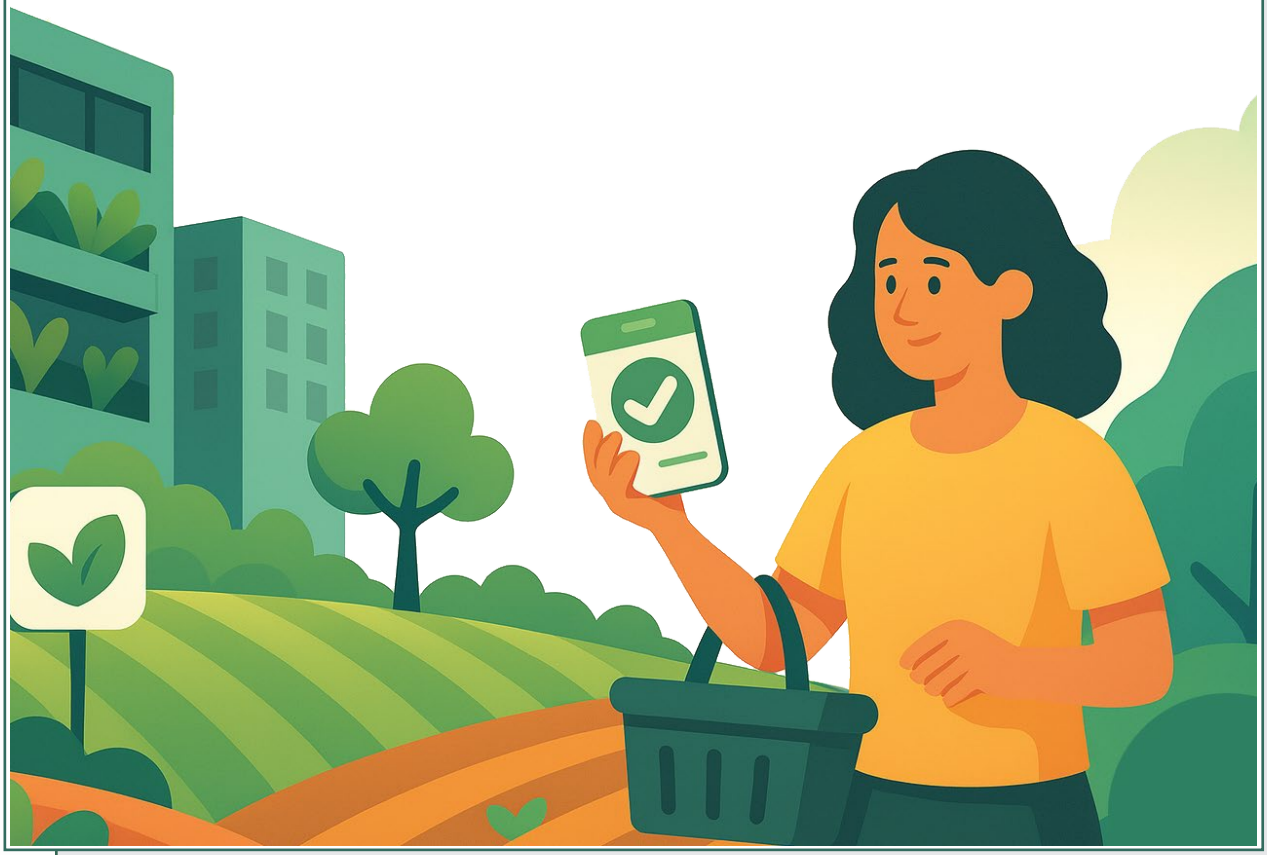
become compressed further down the chain. Ensuring that all actors, from farmers to consumers, receive a **fair return on their contributions** was deemed critical for creating a sustainable system that remains globally competitive.

Achieving this balance, according to participants, requires compatibility with global trade rules and reciprocal agreements. The **European Green Deal** was highlighted as an important framework for promoting fairness in agricultural value chains, although the group stressed that **more robust controls and regulations** are needed to ensure all actors operate under comparable standards.

Policymaking was identified as a key lever for regulating costs and sustainability impacts across the food supply chain. Participants emphasized that simply adding up sustainability costs at each stage could result in product prices becoming unaffordable for many consumers. Thus, there is a pressing need for policies that **facilitate a more equitable distribution of responsibilities and costs** across the supply chain, preventing any single actor from bearing a disproportionate burden. Although the **Common Agricultural Policy** (CAP) is beginning to incentivize agroecological systems that meet certain sustainability standards, the group agreed that further policy support will be crucial for managing the transition towards more sustainable practices.

Finally, the discussion turned to **education and institutional involvement**. Educational institutions, particularly through their influence on school canteens, were seen as pivotal in fostering a

The emerging vision for the group is: ***Sustainable farming methods*** *such as agroecology, vertical farming, and regenerative agriculture will reduce agriculture's* ***environmental impact*** *by optimizing land use and enhancing biodiversity. Certifications will manage the* ***transition*** *from conventional methods, ensuring* ***accountability*** *and* ***transparency****.* ***Consumers*** *will play a central role by influencing sustainable practices through their purchasing decisions, with* ***product prices*** *reflecting their environmental and social* ***true value****.*



culture of sustainability. By reformulating diets and emphasizing nutritional quality, schools could integrate sustainability principles into everyday practices, thereby influencing not only students but society at large. Participants suggested that educational initiatives should focus on **setting small, manageable steps toward sustainability**, an approach that was viewed as more effective and less overwhelming than setting large, abstract goals. This incremental strategy aligns with broader transition management approaches advocated within the EGD.

Seed 2: Protein transition. *Most people consume plant-based, lab-grown, or insect proteins, reducing demand for traditional meat. Protein production uses far less land and water, and environmental impacts are minimal.*

i. First-order effects. The discussion focused on the possible first-order effects of the thematic seed (Table **2**).

ii. Everyday life effects. The group explored how the envisioned 2050 protein transition might affect daily life for consumers.

Socially, participants anticipated a diversification of culinary experiences. The growing demand for alternative proteins would likely lead to the emergence of **new recipes and restaurants**, broadening food choices both at home and in public dining. **Supermarkets** would adapt by reorganizing shelves and expanding their selection of **plant-based** products, making these options more visible and accessible to consumers. Participants also underlined that such a transition would both depend on, and contribute to, **shifts in social norms and consumer values**, with environmental and health considerations playing a greater role in food choices. In this context, changes in education, for example through school curricula and food education initiatives, were seen as important to help new generations engage with protein choices in a more conscious and informed way.

However, **taste** was identified as a potential **barrier** to consumer engagement. The flavours and textures of protein alternatives often differ from those of traditional meats, and widespread acceptance may hinge on how effectively these alternatives replicate familiar sensory experiences. Despite this challenge, the shift could foster a broader improvement in food and cooking literacy. **Plant-based cooking** typically requires greater skill and creativity to ensure meals remain varied and nutritionally balanced, encouraging consumers to engage more actively with **food preparation**.

Participants also highlighted the potential for positive shifts in **food waste patterns**. Animal products, especially meat, are highly perishable and contribute significantly to food waste when they spoil. In contrast, many plant-based products tend to have longer shelf lives, which could lead to reductions in overall household food waste.

Nonetheless, the transition would not be without **cultural challenges**. Altering traditional meals — in terms of taste, presentation, and form — may prove to be one of the most difficult steps for consumers. Such changes touch on deeper cultural norms and emotional attachments to specific dishes, making the process of dietary change complex and multidimensional. These challenges intersect with both **economic** and **environmental** concerns, reinforcing the cross-cutting nature of food system transitions.

From a regulatory and consumer adaptation perspective, new methods of **labelling, packaging, and preserving plant-based foods** would need to be developed to ensure freshness and safety. These changes would require updated legal standards and increased consumer awareness to navigate the evolving food landscape.

The **price** of conventional meat products would likely rise as they become less common, making them increasingly rare and expensive. While this trend could accelerate the adoption of alternative proteins, it also raises **equity concerns**, as lower-income groups may face reduced access to high-quality protein sources unless affordability is addressed.

Technologically, the adoption of alternative proteins would necessitate **updates** in household cooking methods and equipment. Ensuring a smooth transition would depend on how easily consumers can incorporate new tools and cooking practices into their daily routines without creating unnecessary complexity or burden.

Finally, the group discussed **anticipated changes in environmental labeling**. Whereas food labels have traditionally emphasized nutritional content or general sustainability certifications, the transition to alternative proteins could bring a stronger focus on transparently **communicating** the environmental footprint of food products. New metrics would likely be developed to reflect the specific impacts of various protein sources, further empowering consumers to make choices aligned with environmental sustainability.

Table 2. First-order effects - Protein transition.

Dimension	Effects
Social	- Shifts in food identity were seen as both a precondition and an outcome of the transition. As plant-based and alternative proteins become mainstream, the cultural meaning of "proper meals" and "real protein" would gradually change. - Food is deeply tied to heritage and tradition, so this seed could alter personal and collective identities, as well as culinary customs worldwide. Encouraging alignment through policy could help overcome resistance and foster a broader shift toward sustainability.
Economic	- A marked drop in meat demand would force significant restructuring in livestock and meat-processing regions. The group did not assume full veganisation but a rise in alternative proteins and flexitarian diets, which could still lead to uncertainty, job losses and economic shifts, alongside new opportunities in emerging protein sectors. - Livestock farming supports many economically vulnerable groups; without targeted support and just-transition measures, declining demand could accelerate rural decline and community dispersal. Industry is expected to expand alternative protein products, with public support possibly needed to ensure they remain affordable and accessible beyond niche markets.
Technological	- Experts agree on the needs for innovation and support to research in this field to develop products and technologies which are in line with the new needs of the populations. - There would be need for new types of machineries for crops to grow and face different environments
Health	Participants agreed that reducing red and processed meat in favour of plant-based and alternative proteins aligns with dietary guidelines and can lower non-communicable disease risks. However, poorly planned diets or heavy use of ultra-processed alternatives may create nutrient gaps, reinforcing the need for guidance and food literacy.
Environmental	- A large-scale protein transition could significantly reduce greenhouse gas emissions, land use and water use compared with diets high in red and processed meat. However, the environmental performance of different protein sources is not directly comparable: plant-based, lab-grown and animal proteins have distinct footprints per unit of protein or amino acids. This raises the question of whether assessments should focus more on nutritional value (e.g. amino acids delivered) rather than product weight alone. - Land-use considerations present a complex challenge. Not all land is suitable for agriculture, and if animal farming were to be reduced or eliminated, it could have negative consequences, as for example this could impact management of marginal areas which are usually maintained through livestock pastures. Some areas used for grazing may not be appropriate for crop cultivation. At the same time, livestock farming provides livelihoods for many economically vulnerable groups. Reductions could therefore intensify rural decline and community dispersal, showing that the issue spans both environmental and socio-economic dimension.
Political	Restructuring of livestock and meat-processing sectors could lead to job losses in rural areas and, without support measures, increase rural decline and political tension.

Source: Authors' elaboration.

iii. Value-chain effects. One of the key social effects anticipated was a **major shift in taste preferences, food options, and cooking skills**.

From a **value-chain** perspective, participants anticipated that a sustained protein transition would stimulate **innovation along the chain**, including research, product development and marketing of new protein-rich foods. This was seen as broadening the available product portfolio and providing concrete options that make value-driven dietary change more feasible. Such a shift would necessitate corresponding changes in **education systems** to help new generations understand their food choices in a more conscious and informed way. The transition could also spark the **discovery and commercialization** of entirely new food types, broadening the culinary landscape.

From an **economic** perspective, **communication and marketing** were identified as crucial tools for enabling the transition to alternative proteins. A **strong emphasis on labelling** and branding would be necessary to guide consumers toward plant-based or lab-grown alternatives and help reframe how these products are perceived.

As demand for alternative proteins grows, the supply side must evolve in tandem. This evolution will likely require significant **shifts in agricultural practices**, such as cultivating new crop varieties and expanding the use of **lab-grown food** technologies.

However, participants noted **uncertainty** around the future direction of the market. A key question is whether the food sector should continue **replicating tastes** and forms of conventional meat or embrace entirely new flavours and culinary experiences. While the latter may offer prospects, consumer adaptation will likely take time.

Additionally, the idea of imposing a **substantial tax on meat** was discussed as a possible lever to influence dietary behaviour. Nonetheless, participants emphasized that any transition of this magnitude will demand **long-term investment** strategies. These should aim to support gradual changes in consumer habits while ensuring that small businesses and producers feel **secure in the future viability** of their operations. Building confidence that the shift toward alternative proteins will remain a sound business opportunity over the next 5, 10, or 15 years is essential.

Economically, a global transition to plant-based proteins would also reshape **import and export dynamics**. As production models change, new trade relationships may emerge, and countries previously reliant on exporting meat or animal feed may need to adapt to new economic realities and market configurations.

Technological progress will play a central role in supporting this transition. **Innovations** will be needed not only to produce **plant-based proteins** but also to improve their taste, texture, and visual appeal, making them more attractive to mainstream consumers. Advances in processing techniques must be coupled with **strategic marketing** to build consumer confidence and acceptance. In parallel, **breakthroughs in biotechnology** — such as the development of drought-resistant plant varieties — could help ensure that protein crops are more resilient in the face of escalating climate challenges.

The environmental implications of a protein transition were also widely discussed. One expected outcome is a reduced **need for animal feed** production, freeing up agricultural land that could be repurposed for biodiversity conservation. Moreover, decreasing reliance on animal farming may help reduce **monoculture practices**, paving the way for more diverse and sustainable agricultural systems. Additionally, with fewer refrigerated logistics required for transporting perishable meat products, there is potential for a meaningful **reduction in carbon emissions** from the food supply chain.

On the political front, **food security and global food justice** emerged as key concerns. Resources currently used for animal feed could be redirected toward addressing hunger and **improving food access** in underserved regions.

However, realizing the full societal benefits of this transition will require a **more equitable distribution** of power within the food industry. Participants warned that if a **small number of large producers** dominate the market for alternative proteins, they could limit competition and stifle innovation. A more balanced distribution of influence among producers is essential for fostering a dynamic and inclusive food system.

Finally, the group stressed the need for new **regulations** that address food safety, storage, conservation, and waste management. As alternative protein sources become more prevalent, food disposal methods may also need to evolve, given the different characteristics of these new products. A comprehensive regulatory framework will be essential to ensure public health, environmental protection, and smooth market functioning in the years ahead.

The emerging vision for the group is: *The protein transition involves moving from a meat-based diet to more sustainable protein sources like **plant-based proteins**, **cultured meat**, and **insects**. While challenging, it presents opportunities for **innovation**, creating **new industries** and **products**. **Consumer education** is essential to convey the health and environmental benefits of alternative proteins. This transition is also linked to **nutritional values**, with nutritionists and food scientists shaping new dietary guidelines. Reducing **land-intensive animal farming** will lower the food system's **environmental footprint** and open new job and business opportunities.*

Seed 3: Environmental tax on food production. *Food products are taxed based on their environmental footprint, with plant–based and eco–friendly products affordable, while meat and resource–heavy items are costly. This shifts both farming and diets towards sustainability.*

i. First-order effects. The discussion focused on the possible first-order effects of the thematic seed (Table **3**).

Table 3. First-order effects - Environmental tax on food products.

Dimension	Effects
Social	- Restriction of food options for less financially stable people. Possible mental health consequences. - Research to ensure that plant-based protein is nutritious and healthy for humans. - Need for an alternative health-wise: people will eat less because meat is not available, and nutrition will be endangered. - A possible incentive to buy raw materials (if cheaper). This would impact preparation times, most probably primarily for women (usually in charge of food preparation at the household level). This would create a gender-differentiated impact.
Economic	- The introduction of such tax could have a big economic impact. One of the first effects would be an increase in prices for consumers. Low-income or vulnerable people would be affected first. Changes in diets could take place, making poor people resort more to vegetables and environmentally sustainable and therefore economically accessible foods. - The legal cost of establishing the threshold of sustainable food, and other thresholds (e.g., how much meat should a product contain to be taxed?). - The consequences of an environmental tax should be addressed in a holistic perspective, especially from a supply chain point of view: the impact should not touch only consumers, producers, or retailers, it should be horizontally distributed and bearable for all stakeholders. - New human resources need; a new generation of workers able to work with new technologies and ready to put practices in change. Hence, a need for monetary investments. - In highly meat-based economies, an environmental tax on food could generate major labour market shocks, affecting both meat-processing and animal-feed industries. The design of such a tax would therefore need to be differentiated across contexts.
Technological	- An interesting financial instrument to support the transition to a more sustainable technological system, for example by enabling the acquisition of climate-aware technologies and tools.
Other	- Expert support should be made available for people to adapt to new nutrition sources, therefore education and, where possible, individual support should be incentivised for all.

Source: Authors' elaboration.

The emerging vision for the group is: ***Environmental taxes*** *are a* ***powerful tool*** *for governments to promote sustainable products and penalize harmful practices. These taxes can help raise funds for education and innovation while* ***incentivizing greener production*** *methods. However, they must be introduced* ***gradually****, with public awareness and preparation, to avoid overwhelming consumers and businesses.*

3.1.2 **Macro-group B** Sugar Tax, Alternative Food Networks, and Universal Basic Nutrient Income

Seed 4: Sugar tax. *A global sugar tax has made sugary products rare and expensive, while healthy, low-sugar foods are the norm. Obesity and diabetes rates have dropped, and food innovation focuses on nutrient-rich options.*

i. First-order effects. The discussion focused on the possible first-order effects of the thematic seed (Table **4**).

ii. Everyday life effects. The group discussed a range of potential **health-related consequences** arising from the implementation of a sugar tax. One anticipated outcome is the increased use of sugar substitutes in industrially processed foods, such as jams and baked goods. While this might reduce sugar consumption, it could also lead to a higher intake of **chemical preservatives and artificial sweeteners**, raising concerns about unintended health impacts. Psychological effects were also considered, as sugar is often perceived as a comfort food and stress-reliever. Reducing its availability or increasing its cost could contribute to psychological stress and foster consumer resentment. Furthermore, participants highlighted the possibility that individuals might **compensate** for reduced sugar intake by increasing their overall **food consumption**, potentially leading to unintended dietary imbalances. Changes in the fitness and wellness industries were also foreseen, as public awareness around sugar consumption grows and the sector adapts by offering new products and services aligned with low-sugar lifestyles.

Socio-cultural implications were also widely discussed. Participants noted that consumers might perceive government interventions such as a sugar tax as **restricting** their personal freedom of choice, fostering scepticism and resistance. Cultural habits, particularly those related to children's lives and traditions like birthday celebrations centred around sugary treats, could be disrupted, requiring broader cultural adaptations.

The group emphasized the need for **compensatory measures** to ensure that low-income individuals maintain access to affordable **calorie sources**, warning that without such support, sugar taxes could exacerbate existing inequalities in food access. Nevertheless, participants also anticipated a rise in consumer awareness about added sugars in food products, alongside a growing trend toward low-sugar foods becoming fashionable and more widely accepted, helping to reshape broader dietary norms over time.

iii. Value-chain effects. The group explored how a transition towards reduced sugar consumption could reshape the food value chain by 2050. **Marketing and communication** efforts were seen as critical levers for change, with companies expected to lead targeted awareness campaigns aimed at educating consumers about the importance of lowering sugar intake.

Improved food labelling, specifically highlighting sugar content, was identified as a key strategy for both raising consumer awareness and reducing resistance to price increases for sugary products.

In the **food retail and service** sectors, clear labelling would become essential for supporting consumer choice, while active engagement with restaurants and supermarkets would be crucial for promoting new, healthier products and introducing more diverse flavour profiles.

Education also emerged as a pivotal area, with programs targeting children, teachers, and canteen staff expected to integrate healthy food practices into schools and other public institutions, fostering early and sustained changes in consumption habits.

On the **production and processing** side, agricultural shifts were anticipated as sugar beet and sugar cane farming could decline in both developed and developing countries. Farmers may increasingly transition to **alternative crops**, supported by the adoption of more sustainable agricultural practices. Industrial food processing would also undergo substantial adaptations, particularly for shelf-stable products that have traditionally relied on sugar for preservation, requiring **reformulation of ingredients** and recipes.

In **food preparation**, traditional recipes may be rediscovered and adapted as consumers adjust to new product offerings. Ensuring compatibility with existing industrial production chains would be essential for a smooth and economically viable transition. Finally, participants noted that reduced sugar content could lead to **increased food perishability**, given sugar's preservative function. This would necessitate innovations in food preservation technologies and could drive a bifurcation of supply chains, with some moving towards more localized production models and others becoming increasingly industrialized to manage new logistical challenges.

Table 4. First-order effects - Sugar tax.

Dimension	Effects
Social & Political	- Government policies will significantly impact citizens' lives, potentially causing resistance to these changes. The healthcare sector may face challenges due to potential health issues from sugar substitutes. - A sugar tax alone may not effectively reduce diabetes, as the condition involves factors beyond dietary sugar.
Economic & Ethical	- The economic implications are linked to ethical concerns over product accessibility. Sugary products will become more expensive. General food prices may rise, disproportionately affecting low-income populations. Eating sugary products may evolve into a status symbol. The sugar beet industry may face decline. Sugar cane production in developing countries could be adversely impacted. Emergence of illegal markets for sugar is likely.
Technological	- Increased use of artificial sweeteners as substitutes for sugar could lead to additional health implications. - Reformulation of industrial food products will drive innovation in recipes and ingredients.
Environmental	- Sugar cane production in developing countries will experience both economic and environmental impacts. Reduced production may lead to environmental benefits, such as decreased land use and less intensive farming practices. However, economic challenges could arise due to diminished production.

Source: Authors' elaboration.

The emerging vision for the group is: *The future vision emphasizes a **shift toward increased use of artificial sweeteners**, accompanied by the **reformulation** of industrial production processes (e.g. for the sugar cane industry, which will be highly impacted). **Education** will play a central role in raising awareness about reducing sugar consumption and adopting healthier alternatives. It will also help **understand processes** and artificial sweeteners. Efforts will also focus on ensuring food safety, promoting **balanced diets and alternatives** and the replacement of sugars. Additionally, marketing and communication strategies, such as improved labelling and public campaigns, will be pivotal in encouraging healthy eating habits and reducing sugars*

Seed 5: Alternative food networks. *Local food systems have replaced global supply chains. People buy fresh, seasonal food directly from nearby farms or community co-ops, supporting local economies and reducing transport emissions.*

i. First-order effects. The discussion focused on the possible first-order effects of the thematic seed (Table **5**).

ii. Everyday life effects. The group explored how the development of alternative food networks could transform everyday life by fostering a **renewed connection between communities and their food sources**.

Access to fresh, healthy, and **locally produced food would increase**, reducing the need for preserved or heavily processed alternatives and encouraging people to **prioritize food preparation** with an emphasis on sustainability and waste reduction. A recurring theme was the importance of enhanced food literacy, where communities place greater emphasis on education around purchasing, cooking—including the use of leftovers—and making informed food choices. Food literacy was seen as fundamental to empowering individuals within local food systems, supporting more sustainable practices and minimizing food waste. Opportunities for consumers to **provide feedback** to producers were also discussed as a means of strengthening engagement.

Community bonds would be reinforced through frequent food-related events that integrate culture and cuisine, fostering a deeper awareness of food origins, **seasonality**, and **traditional practices**. As people invest more time and care into their food choices, they build a closer relationship with the land, leading to **increased climate awareness** and a broader recognition of the value of biodiversity, carbon sinks, and local natural resources.

Economically, the strengthening of local food networks was seen as a catalyst for **rural revitalization**. Greater demand for local produce could promote job creation and educational opportunities in rural areas, reducing the push toward urban migration and encouraging people to return to or remain within their communities. Smallholder farmers, benefiting from expanded local markets, would see improved incomes and contribute to the development of **eco-districts** that prioritize sustainability and community resilience. However, concerns were raised about potential **competitiveness between eco-districts**, particularly in more remote areas, which could exacerbate inequalities in food sovereignty and access. This highlights the importance of **national policy interventions** to support balanced development and ensure that less advantaged communities are not left behind in the transition.

From a **political and socio-ecological** perspective, the rise of local food networks would foster more regular **engagement and participated decision-making** among community members. Participants envisioned the establishment of forums or **"food councils"** where stakeholders could gather, deliberate, and vote on food-related matters, promoting participatory governance in the local food economy. The broader vision emphasized community resilience, food literacy, and environmental stewardship, with citizens empowered to actively shape the systems they rely on.

Nonetheless, participants acknowledged that these localized systems could be **vulnerable to environmental disruptions**, such as droughts or natural catastrophes, increasing the risk of temporary food shortages. Over the longer term, however, greater sustainability within local food systems was expected to contribute positively to carbon sequestration, biodiversity conservation, and overall climate resilience.

iii. Value-chain effects. In a future dominated by local food networks, **supermarkets** and other retail outlets will need to establish closer partnerships with farmers and growers to ensure **fair pricing and equitable distribution** practices. Making local distribution economically viable would require substantial **political support and investment**, alongside the rise of smaller supermarkets, farm shops, and innovative vending solutions such as machines offering products like

Table 5. First-order effects - Alternative food networks.

Dimension	Effects
Social & Economic	- The transformation calls for significant investments in skills and education, especially for young people who would require training to manage the complexities of small-scale, sustainable food systems. This may slow rural-to-urban migration, as decentralized, economically resilient rural communities rise, driven by a stronger local economy and the growth of small- to medium-sized enterprises (SMEs). - The benefits do not come without trade-offs. Farmers who previously depended on export markets may now face financial strain as they adjust to a more localized demand, and with the reduced reliance on imported goods, the diversity of available products – if only produced locally – could decline also due to increased climate catastrophes, leading to narrower dietary choices for local consumers.
Political	- The transition toward local food systems, replacing global supply chains with community-driven food networks, underscores a renewed focus on the roles of local governments, having more rooms for manoeuvres and matter competences, with grassroots organizations in steering food production and distribution playing a key role in connecting the actors. This shift brings with it a more participatory, democratic process, as communities become more engaged, active and vibrant (as it is happening in many "food councils"), along with NGOs, work to ensure land-use policies that promote balances and manage trade-offs between agricultural space, urban development, and eventual housing needs. There would be effective social innovation more fitting to the local context. Such changes foster a heightened sense of responsibility and loyalty toward local territories, though they come with challenges: local policies must remain flexible enough to support these shifts without causing territorial fragmentation or stoking competitiveness that could deepen disparities in regional development.
Technological	- Digital tools, such as mobile apps connecting citizens with nearby farms to buy unsold produce, would become instrumental, enabling consumers to purchase surplus local produce easily. This requires innovations in sustainable farming techniques and infrastructure, particularly developing large storage facilities capable of supporting locally focused food networks. - Investments would be needed in infrastructures and connections to leave no territory behind. Technologies should be open source, and small-scale technologies are widely available, and more physical places would be needed for food production and management (e.g., the transformation of food, small abattoirs, and market-places).
Legal	- Necessity of a legal framework providing elasticity and adaptation to local contexts.
Environmental	- Local food systems promote biodiversity and reduce pollution, aligning with the Farm-to-Fork and other initiatives and encouraging more sustainable practices, including personal food production. There would be more effective environmental innovation fitting to the local context. - Environmental benefits are counterbalanced by risks. Depending on local resources, communities face heightened vulnerability to natural catastrophes like droughts, which could result in food shortages and create instability in the supply chain. Food systems may also become less diverse since they only rely on local production.
Ethical	- This shift empowers people to become more active and informed, aware of environmental and societal costs of food production as they could be more in contact with it (Conscious investors (CSR, EIMIC)). This transformation encourages higher standards in animal welfare, a consciousness of sustainability as central to the food economy, and fair working conditions. - Some ethical concerns linger over potential inequalities in food accessibility due to regional discrepancies (fragmentation of territorial development). - Increased sense of responsibility towards the local territory and community.

Source: Authors' elaboration.

milk and eggs directly from local sources. Legal frameworks would need to evolve to promote and facilitate **adequate cooling and storage** for perishable goods.

Collective purchasing initiatives among citizens could also become more widespread, fostering greater awareness of food quality and production methods.

In parallel, the evolution of **work habits** by 2050 could reshape lifestyles, reduce commuter dependence, and allow individuals more frequent access to local products and more time for food preparation.

Universal standards for animal welfare and stricter quality control measures would be necessary to ensure the consistency and safety of locally sourced food products.

Participants also stressed the importance of effective production **monitoring and forecasting tools** to better balance supply with demand and avoid mismatches in local markets.

On the consumption side, **community networks** facilitating the sharing of surplus cooked food were proposed as a way to create circular models of food use and reduce waste.

Education was seen as a cornerstone of this transition, with the integration of cooking skills and food literacy into school curricula regarded as critical for equipping future generations with the knowledge needed to make sustainable food choices.

Resource management would increasingly require collaboration across communities to achieve sufficient scale and efficiency. Participants envisioned inter-local systems where municipalities or regions could share composting sites, waste management facilities, and recycling infrastructure to collectively reduce waste. Such cooperation would also support a more **diverse local food production base**, helping new-generation farmers cultivate regional plant and animal varieties and thereby enhance biodiversity and resilience.

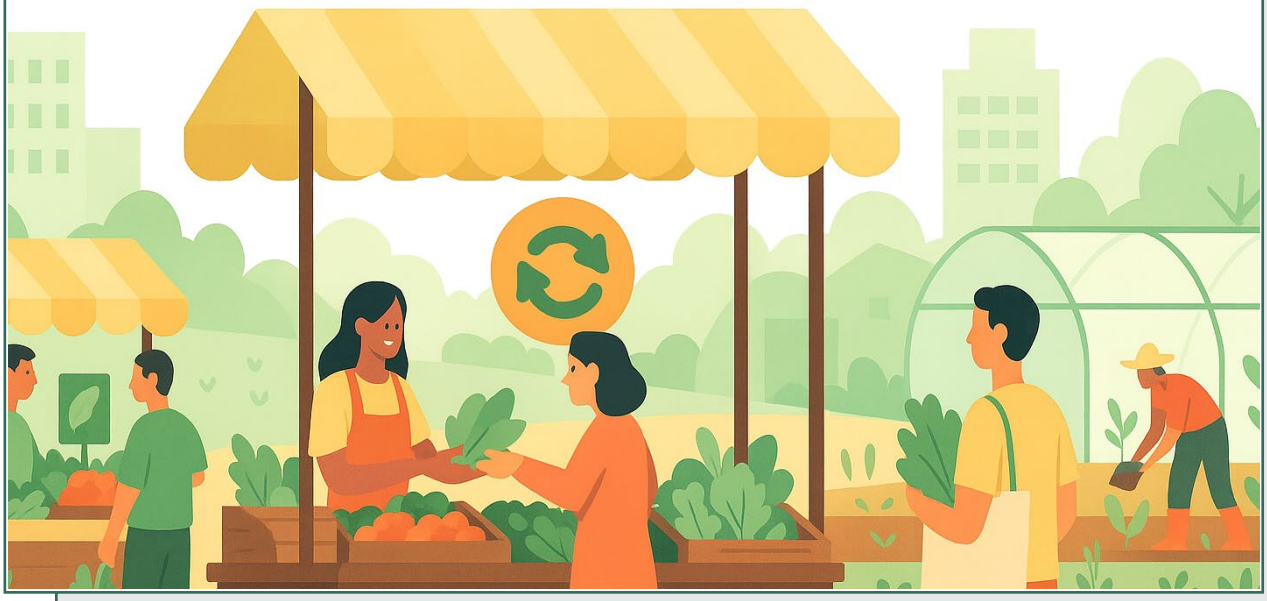
Strengthened local production was seen not only as a response to sustainability concerns but also as a foundation for vibrant, self-sufficient communities. Participants also emphasized the broader political, social, and communicative dimensions of building local food networks. **Decentralized governance models** were seen as pivotal, with local communities setting food policies tailored to their environmental and social contexts. **Community-driven initiatives**, such as sustainable canteen programs and workplace food access policies, could reinforce the role of citizens in shaping their local food economies.

Transparent communication across the supply chain was highlighted as an essential enabling factor, with cooperative strategies needed to foster trust among consumers, producers, and distributors.

Structures like **organic districts and food hubs** could act as key enablers, provided they receive coordinated policy support. At the same time, fragmentation of supply chains could drive up costs, pointing to the need for subsidies or price stabilization mechanisms. Addressing the obesogenic tendencies of mainstream food systems and encouraging healthier food environments were seen as important behavioural shifts.

Finally, introducing stronger **accountability mechanisms** for external economic impacts and reliable certification systems for local goods could strengthen trust in short supply chains and support the long-term success of localized food networks.

The emerging vision for the group is: *The local food system model emphasizes **decentralization and re-localization**, placing **communities** at the heart of food production and distribution decisions. As technical decisions become more localized, community members gain greater influence over the food system, fostering **food literacy** across all levels.*
***Local processing facilities**, such as small-scale abattoirs, play a vital role in supporting these networks by enabling the sustainable processing of locally produced foods, which could be community-led. **Bio-districts**, or **self-sustaining agricultural zones**, are crucial in this model, though they introduce complex dynamics. On one hand, they encourage **healthy competition** as regions strive to adopt greener and more sustainable practices. On the other hand, concerns arise about potential food sovereignty challenges, particularly in municipalities with extreme political leanings that may impose restrictions on food policy autonomy. Despite these challenges, **local economies are revitalized** (reduced outflow from rural areas), and communities become more vibrant, benefiting from **collaborative approaches** within supply chains and a stronger focus on sustainability and circularity – e.g., in waste management.*



Seed 6: Universal Basic Nutrient Income.
Everyone receives a guaranteed basic entitlement to essential nutrients through publicly funded programmes. This Universal Basic Nutrient Income is defined in nutritional terms rather than cash and is delivered through a mix of in-kind provision and credits redeemable for certified nutrient-dense foods. Food insecurity has been eliminated, and nutrient-dense foods are widely available and produced within environmental limits.

i. First-order effects. The discussion focused on the possible first-order effects of the thematic seed. Discussant highlighted the need of having a definition of a UBNI and its components, like nutrients (Table **6**).

ii. Everyday life effects. **Emerging innovations** linked to universal basic nutrition initiatives could significantly reshape consumer behavior and experience.
The development of high-end products from alternative food sources could redefine the very **notion of luxury** in the food sector. New recipes inspired by **novel ingredients** would broaden culinary possibilities, offering consumers exposure to a wider range of flavors and experiences. **Increased accessibility to alternative foods** would not only diversify diets but also empower consumers to make healthier choices, provided that strong efforts are made to improve food literacy and nutritional education.
Nevertheless, **behavioral challenges** could arise as consumers balance the need for sustainable practices

Table 6. First-order effects - Universal Basic Nutrient Income (UNBI).

Dimension	Effects
Social	- Reduced NCDs linked to diets since basic nutrients are guaranteed. - Improve health and decrease inequalities. - Questions of which food is bought and how people spend money on food. - Questions on motivation for people to work since they have access to UBNI.
Economic	- Jobs loss due to AI. - Questions of geographical shifts in imports and exports.
Technological	- A decisive role for education and skill development will rise. - More speculation about precision nutrition and AI versus same food for everyone.
Legal & Political	- Funding of the UBNI: will it be by new taxes, private sector, or other means - Improved health and decreased inequalities.
Environmental	- Citizens have their basic nutritional needs satisfied and can dedicate time and resources to look at the environmental impact of the food they buy. - Possible land-use change linked to production - Possible geographical shifts in imports and exports. - Worldwide distribution of nutrients might have impacts on the value chain.
Ethical	- Reduced nutrient gap within and across regions. - Benefits of equal and sufficient distribution of food.

Source: Authors' elaboration.

with a continued preference for convenience. In many cases, easier food management and **improved food preparation** technologies would help households streamline their diets.
However, there is a risk that increased food availability could exacerbate **food waste**, highlighting the need for strategies that promote efficient food use, healthier preparation methods, and a cultural revaluation of food's economic and social significance.
Technological advances would also have profound effects on food safety and nutrition. Improved food **storage** and handling protocols could significantly reduce spoilage and contamination risks, enhancing the reliability and safety of global food systems.
At the same time, efforts to extend the benefits of universal nutrition innovations to malnourished populations would confront substantial **logistical and public health challenges**, particularly in developing regions. Issues such as spoilage during distribution, health concerns associated with new products, and infrastructural weaknesses could complicate these efforts.
Questions around **balancing food quality and quantity** were also raised, underlining the importance of not merely increasing caloric intake but ensuring that the nutritional needs of populations are adequately met.

For **business and industry**, the impacts of universal basic nutrition initiatives would be equally transformative. Enhanced technologies would streamline food preparation and delivery systems, offering new opportunities for innovation throughout the food sector.
Participants stressed that **fostering innovation** would be critical not only for creating new products but also for scaling up production to meet emerging demands. As the industry adapts, questions regarding **environmental impacts**, resource allocation, and infrastructure development will need to be addressed to ensure that growth in production does not come at the expense of sustainability or social equity.

iii. Value-chain effects. A transition toward universal basic nutrition could have notable effects on **food preparation and consumption patterns**. Education around food preparation, storage, and sustainable consumption choices would likely become more prominent, helping households manage food more efficiently and reduce waste.
Food literacy initiatives may increasingly emphasize the cultural and historical significance of food, encouraging consumers to better understand the origins, value, and applications of what they eat, supporting more informed decision-making.

Changes in land use could also emerge as agricultural systems adapt to new consumption patterns prioritizing nutrient-dense crops over conventional production.

On the **production side**, a shift toward **nutrient-dense foods** and crops could transform agricultural landscapes and value chains. Precision nutrition systems, such as pre-ordered nutrient plans tailored to individual or group needs, may be developed and supported through government frameworks.

These developments could raise new questions about the **organization of food production and distribution**, including who will be responsible for producing food in this new system and how different production models will evolve.

Food waste management could face new challenges, as greater availability of food under universal nutrition frameworks might lead to increased waste alongside declining consumer awareness about the value of food. Policies and infrastructures could be adapted to address these issues at both household and industrial levels.

In food retail, a shift towards promoting **nutrient-dense and sustainable options** could reshape market dynamics, while marketing and communication strategies might give rise to new categories of "luxury foods" centered on nutritional and sustainability attributes.

Wider **systemic effects** could also unfold. Expanded access to nutritional education might become a feature of **public health initiatives**, fostering deeper understanding of food's cultural, environmental, and economic roles. Policies addressing not only nutrient density, but broader aspects of **sustainability** may gain prominence, affecting how food systems align with Green Transition goals. Questions around **infrastructure capacity** and resilience would become increasingly important, as robust systems would be needed to support production, distribution, and waste management in a more nutrition-focused food economy.

The emerging vision for the group is: ***Public programs*** *guarantee all citizens reliable access to essential nutrients, effectively* ***eliminating food insecurity and fostering societal health and equity****. Citizens gain consistent access to nutrient-dense foods, significantly reducing rates of non-communicable diseases (e.g., cardiovascular conditions) and promotes health. The ethical and social impacts are significant; by ensuring equal access to essential nutrients, a UBNI creates a* ***more equitable social structure****. However, there is a perceived* ***trade-off in personal autonomy****, as individuals experience a reduction in their ability to shape their own dietary patterns. New shopping habits and* ***dietary choices*** *emerge, exposing citizens to new ingredients, tastes, and recipes, though reliance on nutrient-specific foods may reduce personal autonomy in shaping individual dietary preferences. With an* ***improved health and food literacy****, citizens become more active and participative, yet possible misunderstanding of the value of food can lead to increased food waste. A centralized,* ***government-led production system*** *supports UBNI, requiring robust infrastructure to ensure access to new diets.* ***Food education*** *is essential to teach citizens about the production, consumption, and value of food.*

3.2 Scenario building: future visions for sustainable food systems

Building on the insights from the Futures Wheel exercises, this step aimed to **integrate the findings** from the different thematic groups into two **broader future scenarios** - one for each macro-group.
The seeds were combined into macro-groups to bring together thematically related levers and avoid developing multiple, largely overlapping scenarios in parallel. Macro-group A (Non-conventional Farming, Protein Transition, and Environmental Taxation) links changes in production practices, shifts in protein sources and price-based regulatory instruments, while Macro-group B (Sugar Tax, Alternative Food Networks, and Universal Basic Nutrient Income) combines demand-side regulation, territorial reconfiguration of food systems and welfare-oriented instruments. This structure was intended to surface interconnections, complementarities and tensions between different types of interventions rather than treating them in isolation.
By merging the thematic perspectives within **macro-group A** (*Non-conventional Farming*, *Protein Transition*, and *Environmental Taxation*) and **macro-group B** (*Sugar Tax*, *Alternative Food Networks*, and *Universal Basic Nutrient Income*), participants co-developed holistic narratives that captured the **interconnections**, **trade-offs**, and **synergies** between different aspects of food system transformation.
These scenarios served as a starting point for further analysis on how to operationalize these visions, guiding the subsequent **identification of barriers** and **enablers**, **stakeholder** roles, and the development of concrete **transition strategies**.

3.2.1 An EU with less animal produce and more alternative proteins supported by environmental taxes (**Macro-group A**)

In this scenario, the European Union transitions towards food systems characterized by a **significant reduction in animal produce** and an increased emphasis on **sustainable alternative proteins**. **Non-conventional farming practices**, environmental taxes, and technological innovations foster more equitable, sustainable, and innovative food systems. These elements cooperate to drive economic, social, and environmental transformations while aligning consumer behavior, regulatory frameworks, and technological progress across diverse contexts.

Investment in **emerging technologies** fosters innovation, stimulates economic growth, and creates new employment opportunities in both rural and urban areas. Consumers benefit from a broader range of **dietary options**, improved health outcomes, and a reduction in greenhouse gas emissions linked to traditional livestock production.
The adoption of non-conventional farming practices further supports this transition by **minimizing land and resource use**, reducing input needs, and promoting greater ecological balance within local and regional food systems. **Environmental taxes** stimulate demand for sustainable products, incentivise responsible production methods, and generate financial resources that are redistributed to support innovation, **education initiatives**, and infrastructure development necessary for scaling sustainable practices across diverse food systems.
Regulatory frameworks play a crucial role in **maintaining market stability** and ensuring **fair competition**. Clear and consistent regulations, together with sustainability certifications, provide the foundation for trustworthy market environments, even amid the introduction of subsidies and incentives. **Policies prioritize affordability** across the supply chain to ensure that alternative proteins are accessible to all stakeholders, from producers to consumers. **International trade agreements** align with global sustainability goals, safeguarding Europe's competitiveness while respecting the diversity of regional food systems.
Public awareness and consumer education efforts reinforce the transition. Campaigns highlight the environmental and health benefits of sustainable choices, helping consumers adjust to new dietary patterns while ensuring that **evolving food systems** remain **responsive** to societal needs and values. Educational initiatives place greater emphasis on nutrient literacy and the cultural significance of sustainable consumption practices, fostering behavioral change over time. **Transparency** is strengthened through certifications and standards, building consumer trust in sustainable products across value chains.
The changes also have significant **economic and social impacts**. Power is redistributed within food systems, ensuring fair wages and equitable value sharing among farmers, producers, and consumers. Long-term investments in education, infrastructure, and innovation promote both environmental and economic sustainability, creating new opportunities

within the food sector. A **bottom-up approach**, starting with local initiatives, enables the development of **context-specific solutions** that are adaptable to the diversity of food systems across European regions.
At the same time, **challenges** arise. Ensuring equitable access to alternative proteins requires strategic deployment of **subsidies**, careful **market regulation**, and ongoing investment in production and processing technologies. Political and market stability must be maintained through clear, consistent regulations and trade frameworks that guide the evolution of interconnected food systems effectively.

3.2.2 Going glocal - A universal income for nutrient-dense healthy and local food (**Macro-group B**)

This scenario envisions a European Union where food systems evolve towards a **"glocal" model**, combining strong local food networks with centralized frameworks to achieve sustainability, accessibility, and equity.
UBNI mechanisms play a **central role**, ensuring access to healthy, nutrient-dense, and local food by incentivizing sustainable consumption patterns. **Taxes on unhealthy food**, such as a sugar tax, are part of this broader approach, serving both as a **funding** mechanism and as a tool to **steer dietary choices**. Different countries and regions may adopt a variety of instruments - such as direct incentives, targeted subsidies, or taxation measures - to align with their specific contexts. While the first scenario focuses more strongly on environmental and economic dimensions, this second scenario places **greater emphasis on social and health outcomes**, strengthening community resilience and fostering systemic and cultural shifts towards healthier, more sustainable ways of living.
Universal access to nutrient-dense and local food becomes a defining feature of this future. Citizens receive vouchers or universal basic nutrition support to guarantee their access to healthy, local foods. **Food is increasingly regarded as a public good**, with its health, social, and cultural dimensions acknowledged in public discourse and policy. Evidence-based guidelines, such as those developed by the WHO, help define what is considered **"healthy" and "local"** ensuring clarity for producers, consumers, and regulators alike. This shift strengthens local economies, improves public health, and builds stronger social cohesion through the emergence of **food communities** and alternative food networks. **Cultural and social shifts** unfold alongside these structural changes. Consumers demonstrate greater **awareness** of food origins and make more sustainable choices, establishing stronger relationships with local producers based on trust, transparency, and mutual support. Broader lifestyle changes emerge, with new dietary practices and community-driven food initiatives becoming integral parts of daily life. Although **protests and resistance** from industries and certain social groups arise, transparent communication and inclusive policymaking help navigate tensions and foster legitimacy for the transition.
Education and food literacy play crucial roles in empowering consumers. Comprehensive campaigns improve public understanding of nutrition, production methods, and sustainable consumption. **Re-education of taste preferences** is supported through engaging and accessible content, designed to resonate with people leading busy lives. Funding for these initiatives is generated through levies on unhealthy products, such as sugar taxes, creating **robust public awareness campaigns** that normalize healthier dietary choices and responsible food habits.
Infrastructure development supports the feasibility of this transformation. Investments in local food systems, supply chains, and logistics ensure that healthy and nutrient-dense foods are accessible to all communities. **Sustainable production practices** expand, aided by financial mechanisms linked to the sugar tax, while food waste is addressed through redistribution initiatives, improved waste management, and greater efficiency in localized systems.
Effective communication strategies become central to public engagement. Clear labelling practices, advertising regulations, and practical communication tools help guide consumer behavior without feeling overly prescriptive. Narratives countering industry resistance focus on evidence-based dialogue, aiming to prevent polarization and foster a sense of shared purpose in reshaping food systems for collective wellbeing.
Policy integration supports systemic change. New policies balance the interests of large-scale food sector actors and local stakeholders, minimizing conflict and encouraging collaboration. Fiscal measures derived from the sugar tax fund public education campaigns, infrastructure projects, and sustainable innovation initiatives. Alternative uses for **agricultural by-products**, such as employing sugars for biobased packaging materials, further diversify rural economies. Clarifying **public definitions of "healthy" and "local" food** is increasingly important to maintain societal consensus and avoid polarization.

Several **challenges** emerge along the transition pathway. Resistance and polarization from industries and political groups pose barriers to change, requiring transparent, **inclusive stakeholder engagement** to sustain momentum. The feasibility of the scenario rests on adequate resource allocation for infrastructure development, waste management, and education. Policymakers must balance **promoting healthier choices with respecting personal freedoms**, ensuring that consumers feel supported rather than restricted in their dietary decisions.

3.3 Barriers and enablers for systemic transformation

This step marked a shift in the workshop reflections from visioning to operationalization of the scenarios developed in the previous stage. Participants identified **key barriers that could hinder the realization of these future visions and enablers that could support systemic change**. For each macro-group, economic, social, political, technological, and institutional factors were examined to understand the conditions shaping food system transformation.

While results are organized by macro-groups, this assessment was conducted within each thematic group. Findings are therefore presented separately before concluding with **common points** identified across thematic areas.

3.3.1 **Macro-group A**: challenges and opportunities

The barriers and enablers discussed in this section were identified by each group for the overarching scenarios, reflecting the interplay of factors influencing the feasibility and sustainability of transitions.

Seed 1. Non conventional farming practices. The transition to non-conventional farming is hampered by **legal and regulatory inconsistencies**, making coordination difficult. Farmers and consumers **resistance to change**, attachment to traditional habits and food, and unwillingness to **pay more** for new products also pose a barrier. The need for large, long-term investments and the **high costs** of developing, testing and scaling new technologies can be challenging to system transition. Additionally, the lack of **specialized knowledge and skills** makes it harder to design practical solutions for this transition.

Table 7. Barriers and enablers for advancing non-conventional farming practices.

Dimension	Enablers	Barriers
Policy	A clear regulatory framework with well-defined rules to guide the transition. *Stakeholders: Policymakers*	Prevailing ideologies and lack of pragmatism in policy development. *Stakeholders: Processors, particularly those adapting quickly to global trends.*
Culture and food habits	Openness to innovation, internationalization, and cultural adaptability. *Stakeholders: Consumers*	Cultural attachment to traditional food practices (e.g., resistance to synthetic meat). *Stakeholders: Consumers, farmers (particularly those who mistrust changes that may threaten their livelihoods) adapting quickly to global trends.*
Behaviors	Leveraging existing consumer habits and increasing awareness of sustainability to drive change. *Stakeholders: Consumers*	Resistance to change, attachment to traditional habits, and reluctance to pay more for new products. *Stakeholders: Consumers, farmers*
Legal	Certifications and consistent supra-national legislation to harmonize practices across regions.	
Competences	Up-to-date, cross-disciplinary knowledge and specialized expertise to navigate complex transitions. *Stakeholders: Universities, academic researchers*	Lack of specialized knowledge among decision-makers. *Stakeholders: Consumers, farmers*
Tech & Innovation	Access to new, disruptive technologies (e.g., AI), to boost innovation. *Stakeholders: AI providers, universities*	High direct and indirect costs of investing in new technologies.
	Support from public financial institutions, and the adoption of a more holistic, global investment approach. *Stakeholders: Banks, venture capitalist*	The need for large, long-term investments, which can be challenging to secure.
Other	Specific education and training programs focused on sustainability to equip stakeholders with the necessary skills.	

Source: Authors' elaboration.

Harmonizing regulations at the supranational level, providing **certifications** and **clear regulatory frameworks** could streamline practices and guide the transition. Leveraging existing sustainable consumption habits and **increasing awareness** of sustainability can drive change. **Financial support** from public institutions and private investors is critical to reducing the burden of upfront costs. **Education programs** focusing on sustainability an up-to-date, cross-disciplinary expertise can empower stakeholders to navigate complex transitions. **Advanced technologies**, particularly AI, can aid innovation (Table **7**).

Seed 2. Protein transition. Policy constraints, such as **bureaucracy**, **political cycles**, and **short-term thinking**, create structural challenges. Cultural and economic barriers, including **poverty**, inaccessible food options, and time constraints in fast-paced societies exacerbate these issues. **Behavioral resistance**, rooted in misinformation, food myths, and emotional or cultural adversity to change, further complicates the transition. **Legal inconsistencies** across nations, **market instability**, and slow approval processes for novel food products obstruct progress. Additionally, **third-party pressures** and the spread of **misinformation** contribute to a challenging environment for advancing sustainable food systems. At the same time, key enablers include initiatives that foster **education**, **awareness**, and **skill development**. School campaigns, multicultural environments, and the influence of chefs and food personalities help drive cultural and behavioral shifts. Financial incentives, such as support for **consumer-oriented innovations**, and skills training, particularly in managing new food, play a crucial role in facilitating change. These factors combined with **targeted support** for small and medium enterprises, create pathways for meaningful transformation in food systems (Table **8**).

Seed 3. Environmental tax. Politicians and policymakers often lack a **long-term vision in policy design**, hindering structural transitions. Cultural attachment to traditional food practices and **resistance to innovation**, fueled by fear, idealized past practices, and distorted narratives, further impede progress. Financial and human **resource limitations** constrain technological advancements, while societal resistance and a lack of understanding of priorities delay adoption. **Divergent priorities** among European Member States and the economic inaccessibility of clean energy present additional obstacles to a unified, sustainable transition.

Table 8. Barriers and enablers for fostering a protein transition.

Dimension	Enablers	Barriers
Policy		Constraining policies, Political cycles, short-term thinking, bureaucracy.
Culture and food habits	Multicultural environments, school campaigns, Chefs, Food Influencers.	Poverty, inaccessible food products and services, lack of time and on-the-go Western culture.
Behaviors	School education and awareness programs.	Bad communication promotes insecurity, food tradition myth, traditional farmer opposition, risk adverse, emotions and cultural adversity to change.
Legal	Certifications and consistent supra-national legislation to harmonize practices across regions.	Differences in regulatory frameworks between nations, creating legal inconsistencies.
Competences	Skills development, Cooking skills for new types of food.	Difficulties in proper food products management, need of support by SMEs.
Tech & Innovation		Slow approval of novel foods and products, with very diversified products there is a need for a very diversified legal framework which can slow down the process of approval.
Finance & markets	Financial incentives to meet consumer's needs and wants.	Lack of finances to start up and business risks, insurance sector must be on board, market instability, lobbyism.
Other		Pressure from third parties (extra EU), misinformation (wrong messages, fake news).

Source: Authors' elaboration.

Table 9. Barriers and enablers for implementing environmental taxes on food products.

Dimension	Enablers	Barriers
Policy	Smart and clear policies allow the transition to unfold. *Stakeholders: Policymakers*	Politicians lacking long term vision in the proposal and design process of policies. *Stakeholders: Policymakers, politicians*
Culture and food habits	Openness to innovation, internationalization, and cultural adaptability. *Stakeholders: Consumers*	Cultural attachment to traditional food practices and more generically resistance to change, fear, idealization of past practices, distortion of narratives (e.g., resistance to synthetic meat, GMOs, or insect food products). Political resistance to innovation and change. *Stakeholders: Consumers, farmers, politicians (who might benefit from propagating certain narratives more than others).*
Tech & Innovation	Creation of new technologies to foster change. *Stakeholders: Universities, research centers, companies, startups, and other actors for change all united in a shared effort to codesign change.*	Financial and human resources able to sustain such change. Resistance from the population, possibly not ready to embrace change and possibly not understanding at first the importance and priority of such initiatives.
Other	A shared common view among European Member States would enable the transition to happen swiftly. *Stakeholders: European citizens and their representatives at all levels.* Hybrid technologies can help foster a sustainable transition through providing an energy source that is clean and accessible. *Stakeholders: Innovators and producers.*	Different level of priority given to such issues. Economic difficulty to access energy due to costs.

Source: Authors' elaboration.

Smart, **clear policies** that facilitate change, driven by policymakers with a long-term vision, can allow the transition to unfold. Cultural adaptability and openness to innovation play a role, supported by consumers who embrace change and internationalization. **Technological advancements**, powered by universities, research centers, startups, and other stakeholders collaborating on innovation, are essential to foster progress. Additionally, a **unified approach** among European Member States and the adoption of hybrid energy technologies can provide clean, accessible energy to support sustainability (Table **9**).

Common points. *A major barrier across all groups is **cultural attachment to traditional practices**, whether in farming or dietary habits. Resistance to change is often rooted in long-standing habits and transitions, misleading narratives, and mistrust of innovations.*
***Legal and regulatory divergences** in policies across nations and regions slow transitions, as mismatched frameworks create confusion and inefficiencies.*
***Harmonized regulations and certifications** are necessary to unify efforts and create long-term plans. Financial hurdles, such as high upfront costs for new technologies and limited funding options, remain significant obstacles. **The need for investment in technologies, research, and market restructuring** is clear, but financial support remains uncertain. **Education** plays a pivotal role in overcoming these challenges. Public education and awareness campaigns can address skepticism and equip stakeholders - farmers, consumers, and policymakers - with the knowledge needed to support sustainable transitions. Educational institutions can foster long-term cultural and systemic change. **Technology is also crucial for driving transformation**, though its high cost and the need for supportive infrastructure remain consistent challenges. Successful transitions rely on coordinated efforts across these areas, ensuring immediate and long-term solutions.*

3.3.2 **Macro-group B**: challenges and opportunities

The barriers and enablers discussed in this section were identified by each group for the overarching scenarios, reflecting the interplay of factors influencing the feasibility and sustainability of transitions.

Seed 4. Sugar Tax. The implementation of a sugar tax faces challenges such as **ideological polarization** and instrumentalisation of the policy to divide public opinion. **Cultural attachment** to sugary products and the fear of new food products can create resistance to healthier substitutes. **Lower-income groups** may struggle with reduced access to

Table 10. Barriers and enablers for implementing a sugar tax.

Dimension	Enablers	Barriers
Policy	Local policies and consultation (policy council), Definitions, Evidence-based data (scientific)	Political parties manipulation, Not acceptable to free mind people's parties, Value-based policy, Lobbies
Culture and food habits	Social media might lead to a cultural shift and sensibilization of consumers Education by NGOs, companies, and the government to leverage acceptance of the change by consumers.	For some people, food is not the most important thing in their life. Many people do not want to shift to healthier options. Social media can also be a barrier depending on how their use. Food security issues raised by local production. Big consumption usually relies on imported product e.g., wheat coming from Canada. Shift to local production might not encounter the needs of big masses, if we consider that industry nowadays produces 80% of the food.
Behaviors	Education in schools and canteens: younger generations need to be exposed to food production and new tastes as well.	Neophobia: people are afraid of new food and products such as novel food, cultured meat, new additives, and vegetal proteins.
Legal	Trade policy rules CODEX	Trade policy rules can also represent a barrier.
Tech & Innovation	AI use, digital data Innovation in industry	Patents for new technologies (like genomes).
Other		Ethical: How far to go with restricting people freedom of choices and dietary habits. What to eat is a personal choice.

Source: Authors' elaboration.

affordable food options if sugary items become more expensive. The **globalized** nature of the food industry raises concerns about how local production can meet widespread demand. Finally, **ethical concerns** exist around people freedom of dietary choice.
Education led by NGOs and schools can help consumers acceptance and expose younger generations to new food and tastes. **Social media** can drive cultural shifts. **Evidence-based policy** frameworks that include local consultations can lower resistance. Innovation in the food industry, trade policy adjustments and international agreements can facilitate the global transition toward reduced sugar consumption (Table **10**).

Seed 5. Alternative food networks. **Cultural traditions** and preferences for unhealthy, sugar-rich, or fatty foods pose challenges to fostering local food systems. **Peer pressure**, **psychological barriers**, and **socioeconomic disparities** further hinder adoption, as some groups may lack access to or awareness of healthier options or may be reluctant to adopt them. **Market structures** favoring short-term profits create resistance to long-term sustainable shifts in corporate food production and distribution. Political polarization and limited investment can delay the implementation of policies supporting alternative food networks.
Flexible and inclusive policies that prioritize collaboration among stakeholders can facilitate transitions to local food networks and healthier diets, underpinned by fiscal and social incentives to ease the transitio. Education initiatives focused on **food literacy, sustainability and learning new skills** can encourage healthier dietary practices while addressing cultural barriers.
Public procurement practices, corporate reputation and green investments can create the environment to kick-off the shift. **Social media influencers** and community-driven movements can promote innovation and build awareness of local food's benefits. Investment in infrastructure, holistic innovation and sustainable technologies is also essential for **enabling decentralized food production** and distribution (Table **11**).

Seed 6. Universal Basic Nutrient Income. The lack of a **universally accepted definition of "healthy" and "local" food** complicates policy development. **Financial constraints** remain a significant barrier, as finding resources to **fund the UBNI is a complex task**.
Cultural diversity across regions poses challenges in creating universally accepted dietary solutions. **Risk assessment tools** for new food products are not yet adequately tailored to address novel foods or production methods. **Technological innovations** may face challenges.
Government and **private sector collaboration** can ensure the financial feasibility of the UBNI, while

Table 11. Barriers and enablers for fostering alternative food networks.

Dimension	Enablers	Barriers
Policy	Food culture and eating habits are closely tied to education and income levels, meaning that broad public health initiatives must address socio-economic disparities. Improving local food culture would involve embracing traditional cuisines while reducing unhealthy elements that are high in fats and sugars. Ability to connect, learn new skills and help others. Can try new foods.	Deeply rooted (unhealthy) traditions (such as cured meat) and peer pressure, along with a general cultural preference for sugar and fat, represent significant barriers to change. In fact, the current physical addiction to sugars makes it also difficult for consumers to choose low-sugar foods. Socio-economic disparities
Culture and food habits	Knowledge (health, food science, agrifood) innovation and holistic approach Better value system Projects Innovation-linked skills Green managers	
Behaviors	Re-educating consumers and producers about healthier choices will be critical in shifting food habits without alienating those who feel a strong cultural connection to traditional foods. People who are motivated to share and innovate in their diets, as well as influencers on social media promoting plant-based lifestyles, have the potential to drive meaningful shifts toward sustainability. Promoting a positive, supportive atmosphere that frames these dietary changes as progressive and environmentally beneficial could help overcome resistance, particularly when paired with education/awareness on the health and environmental impacts of various food choices.	Resistance to unfamiliar foods – such as insect-based products – and a general reluctance to adopt new dietary habits create a psychological barrier. Will the new food be accessible?
Legal	Increased interest in promoting contracts. Green public procurement and good regulation.	
Competences	Knowledge (health, food science, agrifood) innovation and holistic approach Better value system Projects Innovation-linked skills Green managers	Difficulties in proper food products management, need of support by SMEs.
Tech & Innovation	AI, startups, sustainability oriented	Slow approval of novel foods and products, with very diversified products there is a need for a very diversified legal framework which can slow down the process of approval.
Finance & markets	European environmental policies have encouraged a growing emphasis on corporate reputation and green investments, creating the environment to kick-off the shift.	Market structures present one of the toughest obstacles, as they underpin the current economic model. The stock market's focus on short-term profitability overlooks the long-term value of health and sustainability, impeding necessary changes in corporate food production and distribution. Some participants believe substantial change is unlikely without a shift in priorities within ministries of finance.
Other	May help to reduce health inequalities and reduce prevalence of NDCs.	

Source: Authors' elaboration.

sugar taxes and other fiscal measures can provide additional funding sources.
Education campaigns that **emphasize food literacy** can drive acceptance, as well as building on existing cooking skills envelopes on local food. Technological advancements, such as **precision nutrition and AI-driven evaluation tools**, can enhance the design and implementation of UBNI. Policies encouraging **green public procurement** and sustainable agricultural practices can provide structural support. Legal knowledge linked to already **existing vouchers and subsidies** for local nutrient-dense foods can support the scaling of UBNI (Table **12**).

Common points. *What emerges as mutual understanding across the three groups is that* ***economic inequalities pose a barrier to transition****, be that through increased costs of healthier food or uneven access to local food networks and benefits. Financial divides risk excluding vulnerable populations from the benefits of these transitions.* ***Cultural resistance, traditional food preferences****,* ***addiction*** *to sugar, and reluctance to adopt novel foods create barriers to acceptance, amplified lack of information and political polarization and instrumentalization. Policies must balance local specificity with broader systemic goals.* ***Education is a foundation to transition****. Enhanced food literacy, including education on nutrition,* ***environmental impacts of food production*** *and consumption, an exposure to new food is critical across all groups. Empowering individuals with knowledge and skills fosters cultural shifts and improves long-term adoption of sustainable practices. In this regard, successful transitions rely on* ***partnerships*** *between governments, NGOs, businesses, and communities.*

Table 12. Barriers and enablers for implementing a Universal Basic Nutrient Income.

Dimension	Enablers	Barriers
Policy	Land use policy like agri-environmental schemes *Stakeholders: National governments, European Institutions, (agri-food) businesses/lobbying, Consumer groups/associations*	Common definition and regulation on healthy and local food. *Stakeholders: Farmers, (agri-food) businesses/lobbying, Governments*
Culture and food habits	Food education, literacy, awareness. *Stakeholders: Civil society, Academia, Schools and education institutions*	Diversity of cultures around the EU *Stakeholders: Civil society.*
Behaviors	Social norms *Stakeholders: NGOs, Academia*	How is this going to affect consumption behavior? Will less money be spent on food?
Legal	Other vouchers and schemes already exist in EU countries, which may facilitate scaling the measure. *Stakeholders: Certification bodies, Governments, Businesses* Incentives; nudging policies; taxes. *Stakeholders: EU institutions, Governments*	Risk assessment tools are not ready (would need tailoring) to check the risk associated with novel foods. *Stakeholders: EFSA to remove barriers, differences in national regulation, governments*
Competences	Cooking skills already developed on local food *Stakeholders: Civil society, Education institutions*	
Tech & Innovation	Precision nutrition *Stakeholders: Academia, medical sciences, public health* AI to speed up evaluation, data sharing *Stakeholders: Tech industries* Knowledge to produce "new" food *Stakeholders: farmers*	Jeopardization of innovation *Stakeholders: Certification bodies, Governments (programs, credits, loans), Financial institutions, Tech industries and companies*

Source: Authors' elaboration.

3.4 Stakeholders and their role in the transition

The transition toward sustainable food systems involves a wide range of stakeholders, each playing distinct roles and holding varying degrees of influence. Stakeholders can adopt **multiple positions** depending on their actions: they may **oppose emergent sustainable systems** while supporting dominant ones, **pioneer new practices**, **stabilize emergent structures**, **build bridges toward transformation**, or emerge stronger within **redefined food systems**. Recognizing the dynamic and sometimes contradictory roles of stakeholders is essential to understanding the complexity of systemic change.

Several key **stakeholder groups** emerged as critical across both overarching scenarios. **Policymakers and politicians occupy central positions**, shaping and implementing regulatory frameworks that direct the transition toward food system sustainability, accessibility, and appeal. Their influence extends to market dynamics, consumer behavior, and public investment priorities. Depending on their engagement, they can pioneer, stabilize, or oppose the transition. For example, the **European Union** plays a vital role by **harmonizing policies** and strategies across Member States, while **local governments** operationalize **sustainability goals** by normalizing dietary changes and managing public procurement systems.

Consumers' preferences and purchasing behaviors are equally pivotal. Shaped by cultural norms and everyday habits, consumer behavior ultimately determines the market viability of sustainable food practices. Consumers can act as pioneers of new systems or resist changes by clinging to dominant consumption patterns. **Consumer groups and youth movements** are particularly influential in shaping demand for sustainable and equitable food choices.

Farmers, positioned at the heart of food systems, also exert significant influence. Their **openness to innovation and sustainable practices** determines whether they become enablers of change or maintain existing systems. **Local producer associations**, agroecological and organic farmers often drive innovation, while more conservative farmers' unions may resist shifts perceived as threatening to traditional farming models.

Research and academic institutions function as critical drivers of transformation, generating knowledge, developing sustainable innovations, and bridging traditional and emerging systems. **Universities** promoting agroecological research and **economists advocating for degrowth** paradigms exemplify how academic actors contribute to systemic change. Similarly, **formal education institutions**, including schools and vocational training programs, play key roles by updating curricula, fostering food literacy, and equipping future generations with cross-disciplinary knowledge necessary for navigating food system transitions. **Public canteens** that prioritize green procurement policies demonstrate how educational settings can serve as living laboratories for change.

Social media platforms and influencers have emerged as powerful cultural intermediaries, capable of either promoting sustainable food habits or reinforcing dominant, unsustainable consumption patterns. Their ability to **amplify narratives** makes them important actors in shaping public understanding and cultural shifts around food.

Food industry and business operators also hold substantial influence over how sustainable options are introduced and normalized. As gatekeepers within supply chains, they have the capacity to either pioneer, stabilize, or oppose sustainable practices. The actions of sustainable importers, SMEs, the HORECA sector, large food companies, and technology lobbies will significantly shape the availability, desirability, and accessibility of future food options.

NGOs and activist groups serve as both visionaries and watchdogs, advocating for systemic change and ensuring marginalized voices and environmental concerns are addressed. Organizations like IFOAM, IPPC, IPES-Food, Fridays for Future, and Agroecology movements consistently push for deeper structural transformation toward equitable and sustainable food systems.

Financial institutions also play a strategic role by enabling or constraining the flow of investments. National funds, private foundations, and banks that prioritize long-term sustainability objectives can stabilize and amplify the transition, while investments that favor conventional practices may slow down systemic change.

Finally, **start-ups and enterprises** working with artificial intelligence and other technological innovations act as dynamic engines of change. By developing disruptive technologies and new business models, they help define the emerging landscape of food systems, enhancing production processes, advancing innovative food technologies, and addressing critical challenges associated with the sustainable transition.

Understanding the diverse roles stakeholders play is crucial for designing effective transition strategies. Systemic transformation toward sustainable food systems depends not only on technological and policy innovation but also on **fostering collaboration, managing tensions, and recognizing the different capacities for action across stakeholder groups**. Tailoring interventions to engage pioneers, empower bridge-builders, and address sources of resistance can help ensure that the shift toward more sustainable, equitable, and resilient food systems is both inclusive and durable.
The stakeholder landscape revealed through the workshop aligns closely with the dynamics described in the Berkana Institute's Two Loops model. **Pioneers** - such as start-ups, agroecological farmers, academic institutions, and activist networks - operate at the **margins of the dominant system**, experimenting with new practices and visions for sustainable food futures. **Bridge-builders**, including NGOs, educators, and progressive policymakers, connect these pioneering efforts to more established structures, helping **scale up innovations** and create legitimacy for change. **Institutional stewards** - such as local governments, public procurement bodies, and parts of the food industry - work from within existing systems to integrate sustainability goals, often incrementally. At the same time, certain actors, including **conservative industry** representatives, conventional farmers' unions, or financial institutions with vested interests, may function as protectors of the dominant system, resisting change due to uncertainty or perceived threats to stability.

Understanding stakeholder positions along this continuum is essential for tailoring transition strategies - **mobilizing support from pioneers and bridge-builders, empowering stewards, and designing inclusive processes to address sources of resistance**. This systems-level perspective reinforces the need for targeted, context-sensitive interventions that can accelerate the shift toward more equitable, sustainable, and resilient food systems.

In this sense, the **stakeholder analysis** should be read as a **role-based mapping across the two macro-group scenarios** rather than a detailed inventory of levers for each specific intervention. It highlights where momentum, resistance and bridging capacity tend to sit in the system, while pointing to the need for more targeted, follow-up work to define concrete responsibilities and instruments for particular policy mixes and territorial settings.

3.5 Overarching transition strategies

After defining the overarching scenarios, identifying their barriers and enablers, and analyzing the roles of active stakeholders, the two macro-groups propose **overarching transition strategies**. These strategies consider all these factors and aim to drive the sustainable food system transition comprehensively and inclusively.

3.5.1 Pioneering Change and Securing Public Support: A Strategy for Food System Transition

This strategy emphasizes the role of **pioneers** (such as first vegan groups in the 1990s) – who are at the forefront of developing solutions and enabling the transition to a sustainable food system. Their **innovations**, ranging from technological advancements to societal shifts, are critical to defining the future of the food system and underscores the importance of **securing broad public support** - particularly consumers' acceptance of sustainable practices - to ensure a successful system transition. The importance of securing **broad public support**, particularly consumers' acceptance of sustainable practices, is also emphasized. **Cultural factors** are central to this process, with influencers, social media, and journalism playing crucial roles in creating positive narratives and fostering acceptance of sustainable choices. **Social media and communication channels** are particularly vital in shaping public opinion and increasing awareness of sustainability.

Policymakers and authorities are identified as **stabilizers**, responsible for creating, harmonizing, and enforcing the regulatory frameworks necessary to secure the new system. A bold leadership role for the European Union is envisioned, focusing on **harmonizing regulations** across nations and sectors. Banks and venture capitalists, also stabilizers, will accompany the transition by ensuring long-term investments and financial stability. Particular attention must also be given to **protecting more vulnerable stakeholders**, such as small farmers, to ensure they can adapt and thrive during the transition – such as small farmers.

3.5.2 Empowering Local Actors and Building Trust: A Community-Driven Strategy for Food System Transition

This strategy focuses on **empowering local stakeholders** and **fostering collaboration among diverse actors** to drive the transition to a sustainable food system by **prioritizing participatory processes** like public consultations, inclusive decision-making, and shared visions. The transition should be grounded in context-specific and **community-driven efforts** and aligned with broader sustainability goals. Best practices, such as organic districts, can inspire other regions. Similarly, leveraging **pioneers, catalysts, and leaders** within alternative food systems to build a small but impactful network acts as a guiding force, steering efforts toward sustainable practices. **Political skepticism** should be addressed and academics, journalists, civil society organizations, and politicians should build trust in the transition process. For example, influencers can be local leaders, and social media can spread knowledge and mobilize resources. Support from **financial institutions**, the **public sector**, and **local politics** would enable the transition since it is critical to sustaining momentum and ensuring equitable outcomes.

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04. Discussions

> A **sustainable food system** will be essential to achieve the climate and environmental objectives of the Green Deal, while (...) **reinforcing EU's competitiveness**.

European Commission (2021). "**A Farm to Fork Strategy**".

This study aimed to **explore actionable pathways for food system transformation** in Europe by fostering interdisciplinary collaboration and co-creation among policymakers, scientists, industry representatives, and civil society. To achieve this objective, the research developed **future visions**, examined **associated challenges** and **opportunities**, identified **barriers and enablers** to their implementation, and mapped the role of **key stakeholders** in advancing these pathways. The findings were integrated into a systemic framework to provide a comprehensive approach to food system transformation. We now discuss the perspectives that emerged during the workshop and **interpret them in light of existing scientific and policy literature**; where references are included, they serve to situate participants' insights with broader evidence.

Adopting **systemic and futures thinking** enabled the identification of key drivers shaping potential trajectories toward sustainable food systems. This approach facilitated **navigation through the inherent complexities** of food systems by offering structured insights into alternative futures and highlighting the necessity of targeted policy interventions (Störmer et al., 2020). Moreover, this research activity contributed to **bridging the gap** between scientific evidence and policy discussions (OECD, 2019), embedding future-oriented thinking within current efforts to promote sustainability. Crucially, the **participatory approach** also allowed for the identification of interdependencies within food systems, revealing critical areas requiring further attention to ensure resilient and coherent transformations.

A **comparative analysis** of the future visions developed by Macro-group A and Macro-group B reveals important commonalities and contrasts in envisaged pathways. Both visions recognize the **socio-economic dimension** of food system transformation as a recurrent theme, emphasizing that **shifting consumer behavior remains a central challenge**. Cultural and social barriers, including attachment to **traditional habits**, resistance to **regulatory changes**, and skepticism toward unfamiliar products, emerged consistently across thematic groups (Higgs, 2015; Muñoz-Martínez et al., 2024). This mirrors a wide body of research showing that **social norms, identity and perceived intrusiveness** of policy instruments strongly shape the acceptability of dietary and fiscal interventions. These barriers were particularly **salient in discussions on sugar taxation and the protein transition**, where acceptance of new dietary practices was perceived as uncertain, in line with studies highlighting both the **effectiveness** and the **political sensitivity of such measures** (Cawley & Frisvold, 2023; Mazzocchi & Biondi, 2023). These concerns resonate with the wider literature on sugar-sweetened beverage and sugar taxes, which finds that such instruments can reduce purchases and consumption, while also raising questions about **regressivity**, **reformulation** and **substitution effects**, and the distributional fairness of the tax burden (Teng et al., 2019).

Economic impacts and potential inequalities were widely recognized as critical concerns. Across scenarios, participants noted the risk of exacerbating **socio-economic disparities**, especially for low-income populations (Penne & Goedemé, 2021). **Job losses** in the livestock sector and disruptions in agricultural export markets for developing countries (Thom et al., 2024) were frequently cited risks. Consequently, the implementation of **financial incentives, subsidies, and targeted support** measures was viewed as essential to mitigate adverse effects and promote equitable outcomes (Piñeiro et al., 2020).

Environmental benefits provided a compelling rationale across all scenarios, with projected advantages **including reduced resource consumption**, **lower greenhouse gas emissions**, and enhanced **biodiversity**. These expectations are broadly consistent with modelling studies and scenario analyses that quantify the **mitigation and resource-saving potential of dietary shifts** towards more plant-based patterns, especially when combined with changes in production practices (Willett et al., 2019).

Across the different seeds and macro-group visions, several **recurring trade-offs** emerged. Environmental gains from measures such as protein transition, regenerative farming or sugar taxation were often linked to concerns about socio-economic impacts, including **employment losses** in exposed sectors, **distributional effects** on low-income households and risks of **rural decline**. This combination of environmental improvements and concerns about yields, labour requirements and income security reflects findings from empirical **studies on agroecological and regenerative practices**, which report clear benefits for soil health and input reduction but more mixed outcomes for productivity and farm profitability (Mouratiadou et al., 2024).

Participants also pointed to **international trade-offs**, such as possible repercussions for livestock-dependent export markets, sugar cane producers in developing countries or third countries supplying feed and other inputs to European food systems. Similarly, the push towards more **localised food systems** was associated with greater community resilience and participation, but also with potential **vulnerabilities to local climate shocks** and a possible reduction in dietary diversity if not complemented by broader safety nets or wider trade relations. This tension between the resilience and participation benefits of more localised food systems and concerns about vulnerability to local shocks, equity and potential reductions in dietary diversity also appears in the food systems literature, which cautions against **overly romanticised views of re-localisation** and stresses the need for complementary trade and safety-net arrangements (IPES-Food, 2024; Wood et al., 2023).

In the health domain, instruments such as sugar or environmental taxes were seen as **promising levers to reduce non-communicable diseases**, yet participants highlighted tensions between public-health objectives, perceptions of individual freedom and the **regressivity of some pricing instruments**. These trade-offs were explored qualitatively through the futures and stakeholder exercises and point to areas where more targeted, **evidence-based assessment** would be needed to inform concrete policy design, including with regard to impacts beyond EU borders. The discussions on **sugar taxation** illustrate this **interplay between perceptions and evidence** particularly clearly. Participants highlighted concerns about **regressivity**, **substitution** effects and **perceived restrictions** on individual freedom, while also recognising the potential of sugar taxes to reduce consumption of sugary products over time. This reflects the international evidence base, which generally finds that **taxes on sugar-sweetened beverages are effective** in lowering purchases and can contribute to improvements in diet- and weight-related outcomes, but also shows that distributional impacts and **public acceptability** depend strongly on design features (for example the use of revenues and accompanying measures) and communication strategies (Cawley & Frisvold, 2023; Penne & Goedemé, 2021). In this light, the workshop findings underscore the importance of pairing fiscal instruments with **broader policy packages** that address equity and legitimacy concerns, rather than treating them as stand-alone solutions.

Although shared systemic challenges were identified, the two macro-groups align with **different configurations of governance modes**, **market mechanisms** and **technological dependence** described in the literature. Macro-group A, which combines non-conventional farming, protein transition and environmental taxation, points towards a predominantly **multi-level and hierarchical governance setting** that is strongly complemented by **market-based governance**. Environmental and health objectives are defined through **binding rules** and **standards** across EU, national and regional levels, while regulatory and economic instruments such as environmental taxes, subsidies and other price-based measures are used to steer behaviour and private investment along extended value chains. This vision also assumes a relatively **high reliance on technological innovation** and data intensive infrastructures, for example for monitoring footprints, tracing products and scaling new production technologies.

By contrast, Macro-group B, centred on sugar taxes, alternative food networks and Universal Basic Nutrient Income, is closer to **polycentric and community-based forms of governance**, where local authorities, food councils, civil-society organisations and other actors jointly shape territorial food systems. Here, collaborative and deliberative mechanisms, community level rules and welfare type instruments are more prominent, while market-based tools such as sugar taxes play a more targeted role and **technological change** is framed more in terms of **enabling social and institutional innovation** than as the primary driver of transformation. These differences reflect both the way the seeds were combined into macro-groups, which deliberately brought together particular families of levers, and the perspectives that emerged in the discussions.

Taken together, they illustrate how different **combinations of interventions imply distinct mixes of governance modes**, market mechanisms and technological requirements, and underline that strategies for food system transformation need to be calibrated to specific institutional capacities, infrastructures and coordination needs.

Despite the different orientations, both pathways reflect **key enablers and barriers broadly aligned with scientific literature**. Critical impediments include socio-cultural inertia, inadequate investment, and fragmented or misaligned policy frameworks (Conti et al., 2021; Guerrieri et al., 2025). Institutional inertia, entrenched power dynamics, and inconsistent narratives around sustainability further complicate progress. At the same time, education, technological innovation, and coherent governance emerge as common levers for advancing transformation.

Policy support and governance coherence are consistently identified as fundamental enablers. However, successful policy implementation faces obstacles in the form of **political fragmentation, cultural resistance, and economic constraints**. Achieving a shared vision across governance levels remains a key challenge, requiring the alignment of regulatory instruments, market incentives, and **public engagement strategies** (De Schutter et al., 2020; Gautam et al., 2019). **Education** emerges as an equally critical driver. Embedding food literacy, cooking skills, and sustainability principles into education systems is necessary to facilitate lasting behavioral change and foster societal commitment to sustainable food practices (Ehgartner et al., 2025).

Technological progress is recognized as **vital for overcoming operational and technical barriers**. Innovations in sustainable food production, food processing, and precision nutrition technologies offer pathways for large-scale transitions toward sustainability, particularly in the face of systemic inertia and infrastructure limitations.

The application of the Two Loops Model provided concrete insights into stakeholder dynamics. **Educational institutions, research centers, start-ups, and NGOs emerged as critical facilitators of transition**, acting as pioneers or stabilizers of emerging systems. Meanwhile, **decision-makers, farmers, the food industry, consumers, social media actors, and financial institutions** appear as stakeholders whose roles could either accelerate or hinder transformation depending on their positioning and strategies. Regardless of the specific pathways explored, the success of food system transformations ultimately hinges on how these stakeholder roles are shaped and governed, **turning potential blockers into enablers through inclusive and strategic engagement**. This underscores the importance of actively engaging stakeholders across the spectrum to foster a collective vision for sustainable food systems and minimize resistance (Conti et al., 2025).

Beyond the substantive insights, the workshop also illustrates the **strengths and constraints of combining futures**, **systems and participatory design methods** in a single process. The adapted **Futures Wheel** and scenario-building steps proved useful to quickly surface perceived system-wide effects, trade-offs and alternative configurations, while the barrier–enabler mapping and stakeholder role analysis helped participants connect these visions to **concrete leverage points and actor constellations**. At the same time, the resulting pathways and stakeholder roles remain relatively high-level: they indicate directions of change and typical positions in the transition rather than **detailed, seed-specific implementation plans**. Further development of this approach could involve **iterative rounds of workshops**, more fine-grained actor mapping and follow-up co-design sessions focused on specific policy mixes or territorial contexts, as well as a more explicit integration of concise scientific evidence syntheses into the workshop design, potentially combined with **quantitative or modelling exercises** to test the robustness and distributional implications of selected pathways.

While the study provides valuable insights, several **methodological limitations** must be acknowledged. Scenario-building inherently involves a degree of **uncertainty**, and the reliance on **qualitative insights** introduces challenges related to robustness and representativeness. The workshop brought together stakeholders who are, for the most part, actively engaged in debates on sustainable food systems, which may have **biased discussions** towards more transformative positions and under-represented perspectives from incumbent actors in mainstream food industry and large agribusiness. Although a diverse set of organisations participated, representation from **certain groups** (like farmers' organisations and some segments of the food industry) remained **limited**. In addition, the workshop was conducted as a single, full-day in-person event in Bologna, which, despite relatively strong geographical diversity, resulted in a higher proportion of Italian

participants and may have influenced which examples and priorities were foregrounded. The allocation of participants to thematic seeds aimed to **balance expertise** but was not based on a formal sampling strategy, and the use of structured templates and facilitation may have subtly steered attention towards specific types of enablers and solutions.
A further limitation relates to how some participants **engaged cognitively with the seeds:** despite guidance to imagine a mature 2050 state, discussions (e.g. on non-conventional farming) often moved between envisaged future characteristics and current transition dynamics. This means that some "effects" recorded in the Futures Wheel, such as resistance to regenerative practices, should be interpreted as **anticipated barriers along the transition** rather than consequences of the fully established practice. While this offers useful insight into perceived transition challenges, it complicates a strict reading of the tables as **linear impact chains**.
In some discussions (e.g. protein transition and taxing food on environmental or health grounds) perceived socio-economic and political risks such as **employment losses or local contestation** were elaborated in more detail than environmental and health benefits, even where scientific evidence for the latter is comparatively robust. This illustrates both a **strength and a constraint of futures-oriented participatory methods**: they are highly sensitive to what feels salient to participants in terms of lived experience, values and emotions, which is crucial for understanding social acceptance and political feasibility, but they do not automatically mirror the emphasis found in scientific syntheses. For policy-support purposes, this suggests value in coupling such exercises with concise evidence briefings or mixed-method designs that help participants situate their reflections in relation to existing knowledge, while still leaving room for exploratory thinking about possible futures.
Synthesising large volumes of qualitative material entails a risk of **oversimplification or selective interpretation when constructing coherent narratives**. Future applications of this approach could address these limitations by involving a broader range of stakeholders, including **more incumbent actors**, **extending the process** across multiple workshops and locations, and combining qualitative scenario work with complementary quantitative or modelling exercises.
Finally, it is important to recognize that the scenarios developed represent **plausible yet simplified depictions of future pathways**. Their primary value lies not in predicting outcomes but in highlighting trade-offs, exploring potential synergies, and identifying systemic leverage points for action.

Within these methodological boundaries, the workshop points to **several concrete priorities for policy and practice**.
First, **increasing investments in sustainable technologies and practices is critical to enhancing economic profitability and competitiveness**, while enabling the large-scale deployment of low-impact production, processing and distribution models.
Second, **designing policy mixes that combine regulatory and economic instruments with explicit "just transition" measures appears critical**. Across seeds and macro-groups, participants emphasised that instruments such as environmental or sugar taxes, support for regenerative farming and **incentives for protein transition need to be accompanied by targeted support for vulnerable groups**, affected workers and rural communities if they are to be both effective and socially acceptable.
Third, **investing in food literacy, nutrition education and wider sustainability competences emerges as a cross-cutting enabler**: many of the envisaged pathways depend on consumers and citizens being able to navigate new products, labels and norms, and on professionals in education, health and food services acting as multipliers of change.
Fourth, **strengthening governance coherence across levels and sectors remains a core challenge**. The contrasting macro-group visions underline that different combinations of instruments place different demands on institutions, and that governance arrangements need to be adaptive and reflexive, evolving as particular levers are prioritised or combined. Dedicated coordination mechanisms and clearer long-term orientations can help align agricultural, health, social and trade policies behind shared food system objectives.
Finally, the workshop suggests **value in embedding futures-oriented, participatory methods more systematically into food policy processes**.
Iterative use of tools such as scenario building, barrier-enabler mapping and stakeholder role analysis can help surface trade-offs early, reveal overlooked leverage points and build shared ownership of transition strategies among diverse actors. Coupled with more quantitative and evidence-driven assessments, such approaches can support the development of more robust, context-sensitive pathways toward resilient, equitable and sustainable food systems.

CONCLUSIONS

The workshop "Exploring Future Pathways for a Sustainable Food System Transformation" brought together policymakers, scientists, industry representatives and civil society actors to jointly explore how sustainable food systems in Europe might evolve. Utilizing tools and methods from futures design and systems thinking, participants developed diverse future visions addressing key challenges and opportunities for advancing sustainable development in European food systems. The workshop aimed to identify illustrative pathways and building blocks for change by surfacing key barriers and enablers and mapping stakeholder roles. The resulting insights outline promising directions and considerations for future-oriented strategies aligned with Europe's green transition goals, while pointing to areas where more detailed, context-specific planning will be needed.

The methods applied within the workshop proved particularly useful for addressing complex sustainability challenges, providing a structured yet adaptable framework to assess how different stakeholders' actions and various policy tools may influence outcomes. The main strength of this approach was its participatory and interdisciplinary nature, which ensured strong stakeholder engagement by incorporating a diversity of viewpoints. This diversity enhanced both the inclusivity and credibility of the outputs. By identifying synergies, trade-offs, and alternative courses of action, the scenario-building process offered important support for both strategic planning and policy development, particularly in terms of anticipating the impacts on and roles of different stakeholders.
By accurately reflecting real-world complexities in undertaking sustainable food system transformation, the scenarios gained legitimacy and relevance, increasing the chances of acceptance and practical implementation. Scenario analysis also helped participants to anticipate emerging risks associated with inaction while exploring alternative strategies for achieving more resilient and sustainable futures. Through this approach, a variety of plausible futures were assessed, shaped by key trends and drivers, ultimately enabling more informed decision-making grounded in systemic understanding.

From a methodological perspective, the workshop yielded four main lessons regarding format, sequencing, integration of scientific evidence and the use of conceptual models. While the full-day structure allowed comprehensive exploration of future pathways, it also proved challenging for participants, especially toward the later stages. Although the scenario-building exercises based on thematic seeds were highly effective in stimulating discussion and creativity, the subsequent merging of seeds into broader scenarios was more difficult. Participants encountered challenges in transitioning from specific thematic reflections to more integrated systemic visions. Additionally, the final stakeholder mapping exercise using the Two Loops Model, although conceptually rich, required more time and explanation than could be easily accommodated in a single session. Fourth, despite the availability of background material, participants would likely have benefited from a more systematic integration of scientific evidence into the exercises, with clearer prompts to connect emerging visions to the existing knowledge base. Future workshops might therefore consider a multi-session format, clearer transitions between thematic and systemic levels, stronger integration of scientific evidence, and additional scaffolding when introducing complex conceptual models, in order to optimise learning and engagement.

The exploratory nature of this workshop is reflected in its integrative approach, combining design methodologies, systems thinking, and futures thinking to create an experimental space for interdisciplinary dialogue. By blending these perspectives, the workshop enabled participants to engage with uncertainty, anticipate emerging dynamics, and critically reflect on the interdependencies within food systems. This approach facilitated a deeper understanding of the possible pathways, barriers, and enablers shaping sustainable food system transformations, offering valuable insights for both strategic planning and policy development. By fostering systemic, futures-oriented, and interdisciplinary dialogue, the workshop contributed valuable insights into how more sustainable, resilient, and inclusive food systems can be developed, supporting Europe's broader ambitions for a just and sustainable food system transformation.

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List of figures

List of Tables

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