FEASTS
Fostering European Cellular Agriculture for Sustainable Transition Solutions

Title: FEAST Food systems interactive visualisation tool - concept

Deliverable 2.1

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Table of Contents

Executive Summary

This deliverable presents the initial conceptual framework for an interactive visualisation tool designed to advance the understanding of the potential impacts of the CM/CSF sector within European and global food systems. Developed through preliminary literature reviews, this first version outlines the core components of the tool, which will be further refined through upcoming workshops and online consultations with project partners and external stakeholders. The framework will map major environmental and socioeconomic issues across the food supply chain, relevant EU and intergovernmental policy priorities, the potential benefits and impacts of CM/CSF in addressing these issues and aligning with policies, and existing challenges alongside key leverage points for action. Initial design concepts and mock-ups developed in KUMU platform illustrate the intended interactive nature of the tool. This conceptual framework serves as a crucial foundation for the subsequent development of the full demonstrator, with the final version of the "FEASTS Food systems interactive visualisation tool" scheduled for delivery in Month 36.

1. Introduction

1.1 Background

The global food system faces major environmental and socioeconomic challenges, ranging from resource depletion and pollution to climate change and food insecurity.
Addressing these complex issues requires innovative approaches that foster a deeper understanding of the food systems dynamics and identify effective pathways for sustainable transformation. Novel food production from alternative sources of protein, such as cultivated meat and cultivated seafood (CM/CSF) can reduce reliance on conventional animal agriculture, presents significant opportunities to mitigate negative impacts and contribute to more resilient and sustainable food systems.

Within this context, Horizon Europe funded FEASTS project aims to provide an **unprecedented**, **independent**, **solid knowledge base** on the sustainability (environmental, economic, social and ethical) aspects of cultivated meat and cultivated sea food (CM/CSF) sector by:

- performing multi-dimensional, as well as integrated impact assessments; and
- identifying potential challenges of and opportunities offered by the CM/CSF technologies;

in order to secure ethically-responsible development of the sector in the EU, while meeting sustainability, food safety and food security goals within a framework of just transition for all food system actors.

To achieve the project objective, the Work Package 2 (WP2) "**Stewardship model for cultured meat and cultured seafood: towards a mission-driven roadmap"** adopts and implements food systems thinking approach, as well as multi-stakeholder engagement and it sets the ground, prioritisation strategies and criteria for the work to be carried out in project's other work packages. Specifically, within WP2, the **"Task 2.1 – Food Systems Thinking Approach & Mission definition"** aims to design a conceptual framework for advancing the full understanding of CM/CSF sector in the European and global food systems by adopting a food systems thinking approach. Food systems thinking is a holistic approach to understand complex food systems by examining the interconnections and feedback loops among all components, rather than isolating individual parts. We adopt this approach to analyze key dynamics and conditions in the complex food systems from many different aspects (i.e. economic, environmental, social, technological, legal, health etc.) and to identify key leverage points for sustainable food systems transformations.

As an outcome of Task 2.1, this deliverable (Deliverable 2.1) presents the initial **conceptual framework for FEASTS Food systems interactive visualisation tool**. It details the conceptual underpinnings of the visualisation tool, providing a foundation for its subsequent development and refinement in collaboration with project partners and external stakeholders. The visualisation tool will further be developed during the project lifespan and the final version will be delivered as a separate deliverable by the end of the project on Month 36 as Deliverable 2.4.

1.2 Objectives of the Deliverable

Entitled "FEASTS Food systems interactive visualisation tool - concept", this deliverable outlines the core elements and intended functionalities of the visualisation tool. The primary objective of this deliverable is to articulate the foundational structure and intended functionalities of the tool. This includes:

- Identifying the key environmental and socioeconomic challenges inherent in current food systems;
- Outlining the relevant European Union and intergovernmental policy priorities and strategies aimed at addressing these challenges;
- Exploring the potential benefits and impacts of CM/CSF as a means of contributing to solutions; and
- Pinpointing the existing barriers hindering the CM/CSF sector's growth alongside crucial leverage points for effective intervention.

2. Conceptual Framework for the Visualisation Tool

This section outlines the conceptual framework for "FEASTS Food systems interactive visualisation tool" which aims to advance the understanding of the potential impacts of the CM/CSF sector within European and global food systems. This framework seeks to unify perspectives among project partners and external stakeholders. The very first version of the visualisation tool, as a concept, is built by using KUMU online data visualisation platform (https://kumu.io) and it will map out the following key interconnected elements:

2.1 Overview of the Intended Visualisation:

The FEASTS Food systems interactive visualisation tool will provide a dynamic and interconnected representation of the complexities within the European and global food systems and the potential role of CM/CSF. Users will be able to navigate through different layers of information, explore the relationships between various parts of food system, and gain insights into how CM/CSF can act as leverage points for addressing existing environmental and socio-economic challenges and aligning with policy priorities. Descriptive texts will accompany the visual elements to provide context, definitions, and key findings from credible sources.

2.2 Key Elements and Data Streams:

The visualisation will integrate the following core elements, highlighting their interdependencies:

2.2.1 Major Environmental and Socioeconomic Issues in Existing Food Systems:

This layer will map a comprehensive range of challenges across the entire food supply chain, from farm to fork. While acknowledging the broad scope of food system issues, the visualisation tool will particularly emphasize those areas where the production and scaling of CM/CSF can offer potential solutions or significant improvements. Key issues to be visualized and described include, but are not limited to:

- Natural resource use and scarcity
    - Land Use: The extensive land requirements for conventional livestock farming (pastures and feed production) contribute to habitat loss and land degradation. Traditional aquaculture can also impact coastal ecosystems.

    - Water Depletion: Conventional animal agriculture, particularly beef production, is a significant consumer of freshwater resources. Certain aquaculture practices can also strain local water supplies.
    - Mineral Resource Limitations: The production of feed for livestock relies on mineral fertilizers, the extraction of which can have environmental consequences.
- Water and soil pollution
    - Agricultural Runoff: Excess nutrients (nitrogen and phosphorus) from animal manure and fertilizer use in feed production pollute water bodies, leading to eutrophication and dead zones.
    - Animal Waste: The large volumes of animal waste generated by concentrated animal feeding operations (CAFOs) pose significant pollution risks.
    - Aquaculture Effluents: Discharge from aquaculture facilities can contain excess nutrients, antibiotics, and organic matter, harming marine environments.
- Land-use change, pressure on marine ecosystems and biodiversity loss
    - Deforestation: Conversion of forests and natural habitats to pasture and cropland for animal feed production is a major driver of deforestation and biodiversity loss globally.
    - Habitat Destruction (Aquaculture): Certain aquaculture practices, such as mangrove destruction for shrimp farms, directly lead to habitat loss.
    - Impacts of Fishing: Overfishing and destructive fishing practices contribute to biodiversity loss and ecosystem damage in marine environments.
- Greenhouse gas (GHG) emissions
    - Livestock Emissions: Enteric fermentation in ruminant animals (e.g., cattle) is a significant source of methane, a potent GHG. Manure management and land-use change related to livestock also contribute to emissions.
    - Energy Use in Agriculture and Aquaculture: Energy consumption in feed production, farm operations, transportation, and some energy-intensive aquaculture methods contributes to GHG emissions.
- Primary production on land and at sea
    - Environmental Impacts of Intensive Farming: Practices in intensive animal agriculture can lead to soil degradation, water pollution, and biodiversity loss.
    - Unsustainable Fishing Practices: Overfishing, bycatch, and destructive fishing methods threaten marine ecosystems and fish populations.
- Animal welfare
    - The conditions under which animals are raised and slaughtered in conventional agriculture raise significant ethical concerns.
- Food security, nutrition and public health

- Resource Competition: The high resource demands of animal agriculture can exacerbate food insecurity by diverting resources from direct human consumption.
- Zoonotic Diseases: Close contact between humans and livestock can increase the risk of zoonotic disease transmission. Certain aquaculture practices can also pose health risks.
- Antibiotic Resistance: The widespread use of antibiotics in animal agriculture contributes to the growing problem of antibiotic resistance.
- Contaminants in Seafood: Wild-caught seafood can contain increasing levels of microplastics and heavy metals.
- Inequitable access to nutritious and affordable food

- Food waste and loss at various stages of the supply chain (processing and packaging, distribution and retail, consumption)

The visualisation tool will represent these interconnected issues, highlighting the environmental and socioeconomic burdens associated with current food production systems, particularly those related to conventional meat and seafood production. This will provide the necessary context for understanding the potential of CM/CSF to offer more sustainable pathways.

2.2.2 Major EU and Intergovernmental Policy Priorities and Strategies:

This layer will overlay relevant policy frameworks and strategic objectives at both the EU and intergovernmental levels that aim to address the major identified environmental and socioeconomic issues within the food system (as outlined in Section 2.2.1). The visualisation tool will highlight how the development and adoption of CM/CSF can contribute to achieving the targets and objectives of these policies and strategies. Key examples may include:

- The European Green Deal. This ambitious set of policy initiatives aims to make Europe climate neutral by 2050 and includes several strategies directly relevant to food systems and alternative proteins including CM/CSF:
  - Farm to Fork Strategy aims for a fair, healthy, and environmentally friendly food system. CM/CSF can contribute by:
    - Reducing environmental footprint: Lowering GHG emissions, minimizing land and water use, and reducing pollution compared to many conventional methods.
    - Promoting sustainable food production: Offering a novel production method with potentially lower environmental impact.

        - Ensuring food security: Diversifying protein sources and potentially creating more resilient supply chains.
    - Biodiversity Strategy 2030 aims to protect and restore biodiversity. CM/CSF can contribute by:
        - Reducing land-use change and deforestation: Lessening the demand for agricultural land.
        - Alleviating pressure on wild fish stocks and marine ecosystems: Offering an alternative to overfishing and destructive aquaculture practices.
        - Reducing pollution from agriculture and aquaculture: Minimizing nutrient runoff and other contaminants.
    - Climate Adaptation Strategy aims to make Europe more resilient to the impacts of climate change. CM/CSF could offer more stable and less climate-dependent protein production systems compared to traditional agriculture and fisheries, which are vulnerable to climate extremes.
    - Circular Economy Action Plan: CM/CSF production could potentially contribute to a more circular economy through the development of sustainable feedstocks for cell growth and the management of by-products.
    - EU Protein Strategy aims to boost the sustainable production and consumption of plant-based and other alternative proteins in the EU. CM/CSF directly align with this goal by offering innovative protein sources with the potential to reduce environmental footprint of EU's agri-food sector, as well as to contribute to the EU's protein self-sufficiency as the EU livestock sector is critically dependent on imports of plant-based proteins for animal feed.
    - Food 2030
    - EU biotech and biomanufacturing initiative

- The United Nations Sustainable Development Goals (SDGs). Several SDGs are particularly relevant to CM/CSF:
    - SDG 2: Zero Hunger. By diversifying protein sources and potentially increasing food production efficiency, CM/CSF could contribute to ending hunger.
    - SDG 3: Good Health and Well-being. The potential for controlled nutritional profiles and reduced risk of zoonotic diseases and contaminants in CM/CSF products aligns with promoting healthy diets.
    - SDG 12: Responsible Consumption and Production: CM/CSF offers the potential for more resource-efficient and less environmentally damaging production methods.

- SDG 13: Climate Action. The potential for lower GHG emissions of CM/CSF production as compared to conventional animal agriculture and some fisheries contributes to mitigating climate change.
- SDG 14: Life Below Water. CSF can reduce pressure on wild fish stocks and the negative impacts of aquaculture.
- SDG 15: Life on Land: CM can reduce land-use change and the associated impacts on terrestrial ecosystems.

- Net Zero emission targets. Both EU and other international agreements aim for net-zero GHG emissions by mid-century. The potential for CM/CSF to significantly reduce emissions from the protein production sector makes them relevant pathways towards achieving these ambitious targets.

This layer of the visualisation tool will visually connect the development and scaling of CM/CSF with the specific targets and objectives outlined in these key policy frameworks. It will illustrate how these innovative food production methods can act as tools to achieve broader sustainability goals and contribute to a more resilient and environmentally sound food system in line with European and global priorities. The visualisation will highlight the potential for CM/CSF to contribute to multiple policy objectives simultaneously, underscoring their strategic importance.

2.2.3 Potential Benefits and Impacts of CM/CSF:

This central layer of the visualisation tool will explore the potential of CM/CSF to influence the food systems. It will visualise and describe the complex linkages between the adoption and scaling of CM/CSF, and the major environmental and socioeconomic issues identified in section 2.2.1, as well as the relevant policy priorities and strategies outlined in section 2.2.2.

CM/CSF, produced by directly growing animal cells in a controlled environment, offer the potential to decouple protein production from traditional animal agriculture and aquaculture. This layer of the visualisation tool will delve into CM/CSF's potential positive impacts across various dimensions, while also acknowledging potential negative consequences or trade-offs that require careful consideration.

Potential Positive Impacts of CM/CSF:

- Reduced Land Use and Reduced Pressure on Marine Ecosystems: CM production has the potential to drastically reduce the vast land areas currently required for livestock farming, including pastures and feed production. This could free up land for reforestation, biodiversity restoration, which could contribute to mitigating land-use change, a key driver of deforestation and habitat loss. CSF has the potential to alleviate pressure on wild

fish stocks, many of which are overexploited, and reduce the environmental impacts of traditional aquaculture, such as habitat destruction and pollution

- Reduced Greenhouse Gas (GHG) Emissions: While the exact carbon footprint of CM/CSF at scale is still under investigation, many studies suggest the potential for significantly lower GHG emissions compared to conventional livestock and some seafood (e.g. those with high fuel consumption) production. This reduction could contribute to mitigating climate change, a major policy priority under the European Green Deal and international agreements i.e. the Paris Agreement.
- Improved Resource Efficiency (Water and Nutrients): CM production is anticipated to require significantly less water compared to conventional livestock farming, particularly beef. Furthermore, nutrient inputs can be more precisely controlled in bioreactors, potentially leading to more efficient resource utilization and reduced nutrient runoff that leads to water pollution.
- Reduced Water and Soil Pollution: By eliminating the need for large-scale animal agriculture, CM could substantially decrease pollution from animal waste, including nitrogen and phosphorus runoff that contaminates water sources and degrades soil health. This aligns with the environmental objectives of the Green Deal and the Biodiversity Strategy. CSF can potentially minimize pollution associated with traditional aquaculture i.e. excess nutrients, antibiotics, and organic waste, which can harm marine ecosystems.
- Enhanced Biodiversity: The reduced land and ocean footprint and decreased pollution associated with CM/CSF could contribute to the preservation and restoration of biodiversity by lessening habitat destruction and the impacts of pollution. This directly supports the goals of the EU Biodiversity Strategy, and the UN SDGs related to life on land and below water.
- Improved Animal Welfare: CM/CSF production inherently avoids the ethical concerns associated with the rearing and slaughter of animals for food. This aligns with a growing societal concern for animal welfare, although it's not always explicitly a primary driver of current EU policy targets.
- Enhanced Food Security and Reduced Zoonotic Disease Risk: CM/CSF production offers a more controlled environment, potentially reducing the risk of zoonotic disease outbreaks associated with livestock farming and certain aquaculture practices. This could contribute to more stable and geographically diverse protein supply chains, enhancing food security. Additionally, CSF can reduce the risk of contamination with microplastics and heavy metals, which are increasingly present in wild-caught fish.
- Potential for Improved Nutrition and Public Health: The composition of CM/CSF can potentially be controlled and optimized for nutritional content (e.g., fatty acid profiles,

vitamin enrichment), offering opportunities for healthier food products and addressing public health concerns related to diet.

Potential Negative Impacts of CF/CSF:

- High Energy Consumption: Current production methods can be energy intensive. If this energy is not sourced from renewables, the overall environmental benefit could be diminished.
- Waste Generation: While potentially less than conventional production, CM/CSF production will still generate waste streams that need to be managed sustainably.
- Socioeconomic Impacts: The widespread adoption of CM/CSF could have socioeconomic consequences for traditional farmers, fishers, and related industries. This requires careful consideration, innovative future business models and potential policy interventions to ensure a just transition.

The visualisation tool will aim to represent these complex impacts of CM/CSF on the various environmental and socioeconomic dimensions of the food system. By illustrating these linkages, the tool will help stakeholders understand the potential trade-offs and identify areas where research, innovation, and policy interventions can maximize the benefits and mitigate the risks associated with these emerging technologies. The tool will also connect these potential impacts to the specific targets and objectives outlined in the relevant EU and intergovernmental policy priorities. The major environmental and socioeconomic issues in novel food systems, integrating the CM/CSF products and respective production processes and value chains will be updated on the visualisation platform, receiving feedback from FEASTS workflow.

2.2.4 Existing Challenges, Barriers, Gaps, and Leverage Points:

This layer will identify and map the current obstacles hindering the widespread adoption and impact of CM/CSF. It will also highlight key leverage points – strategic areas for intervention and action – that can help overcome these challenges, bridge existing gaps, and accelerate positive change within the food system.

Some of the existing challenges, barriers, and gaps to be shown in the visualisation tool include, but are not limited to:

- Technological Hurdles:
    - Scalability: Achieving industrial-scale production at a cost-competitive level remains a significant challenge. Current bioreactor technology and cell culture media production need substantial advancements for mass production.

    - Media Optimization: Developing cost-effective, animal-free, and food-grade cell culture media in large volumes is crucial. Current media costs are a major barrier to price parity.
    - Scaffold Development (for structure): For certain products (e.g., steaks, fillets), creating complex three-dimensional structures with appropriate texture and mouthfeel is technologically demanding.
    - Cell Line Development: Identifying and optimizing robust, scalable, and stable cell lines for a wide variety of species is an ongoing area of research. Specific challenges include sourcing and adapting marine cell lines and replicating the diverse textures and flavours of different seafood types.
- Economic Barriers:
    - High Production Costs: Current production cost of CM/CSF is significantly higher than conventionally produced alternatives, limiting consumer affordability.
    - Capital Investment: Scaling up CM/CSF production requires substantial investment in research and development, pilot plants, and large-scale manufacturing facilities.
    - Market Access and Pricing Strategies: Determining optimal pricing strategies to balance profitability and consumer adoption will be critical.
- Regulatory Gaps and Uncertainties:
    - Lack of Harmonized Frameworks: Clear and consistent regulatory frameworks for the production, safety assessment, and labelling of CM/CSF are still lacking within the EU and in many other places. This uncertainty hinders investment and market entry.
    - Consumer Information and Labelling: Establishing clear and transparent labelling standards that inform consumers about CM/CSF is essential for building trust and acceptance.
- Consumer Acceptance and Perceptual Barriers:
    - Novelty and "Frankenfood" Concerns: Some consumers may be hesitant to adopt products perceived as “artificial” or “unnatural”. Addressing these concerns through education, awareness and transparent communication is vital.
    - Taste, Texture, and Culinary Applications: Achieving taste, texture, and cooking properties comparable to conventional meat and seafood is crucial for mainstream adoption of CM/CSF.
    - Cultural and Dietary Habits: Overcoming ingrained cultural and dietary habits related to traditional meat and seafood consumption will require time and effective marketing strategies.
- Infrastructure and Supply Chain Gaps:

- Specialized Equipment and Facilities: The production of CM/CSF requires specialized bioreactors and downstream processing facilities, which are currently limited.
- Skilled Workforce: A skilled workforce with expertise in cell biology, bioprocessing, biotechnology and food science is needed to support the growth of the sector.
- Supply Chains for Inputs: Establishing reliable and sustainable supply chains for key inputs like cell culture media components is essential.

There are several potential leverage points in the food system for overcoming above mentioned challenges and barriers. Some of them to be shown in the visualisation tool include, but are not limited to:

- Investing in Research and Development (R&D): Increased public and private funding for R&D focused on reducing production costs, improving scalability, optimizing cell lines and media, and enhancing product quality (taste, texture) is crucial.
- Establishing Clear and Harmonized Regulatory Frameworks: Proactive engagement by governments and regulatory bodies to develop clear, science-based, and harmonized regulations will provide certainty for producers and build consumer trust.
- Promoting Consumer Education and Awareness: Public awareness campaigns and educational initiatives can address consumer concerns, highlight the potential benefits of CM/CSF products, and foster acceptance. Transparent labeling will be key.
- Fostering Public-Private Partnerships: Collaboration between key food system actors i.e. farmers, governments, research institutions, industry can accelerate innovation, facilitate technology transfer, and de-risk investments.
- Incentivizing Infrastructure Development: Government incentives and private investment can support the development of necessary infrastructure, including bioreactor manufacturing, cell culture media production facilities, and skilled workforce training programs.
- Supporting Sustainable Supply Chains: Investing in the development of sustainable and cost-effective supply chains for cell culture media components and other inputs is essential for long-term viability.
- Focusing on Specific Applications and Niche Markets: Initially targeting niche markets or specific applications where the benefits of cultivated products are particularly compelling (e.g., high-value seafood, addressing specific health or environmental concerns) can help build market traction.

- Driving Down Production Costs Through Innovation: Continuous innovation in bioprocessing techniques, media recycling, AI and automation will be critical for achieving cost parity with conventional products.
- International Collaboration and Knowledge Sharing: Facilitating international collaboration and the sharing of knowledge and best practices can accelerate the progress of the CM/CSF sector globally.

By strategically focusing on these leverage points, it will be possible to overcome the existing challenges and barriers, bridge the current gaps, and unlock the significant potential of CM/CSF to contribute to a more sustainable and resilient food system. The visualisation tool will aim to highlight these critical areas for intervention.

2.3 Proposed Interactions and Functionalities

The KUMU platform-based visualisation tool will be designed to allow users to:

- **Explore interconnectedness:** Visually trace the relationships and dependencies between the different elements (issues, policies, CM/CSF impacts, challenges, and leverage points).
- **Filter and focus:** Highlight specific issues, policies, or aspects of the CM/CSF sector to gain a more focused understanding.
- **Compare and contrast:** Examine the potential impacts of CM/CSF on different environmental and socioeconomic challenges.
- **Identify leverage points:** Pinpoint key areas where targeted interventions could have the most significant positive impact.
- **Access descriptive information:** Click on visual elements to access detailed textual descriptions, definitions, and relevant data (where available).

2.4 Underlying Logic and Assumptions

The conceptual framework is based on the understanding that the food system is a complex adaptive system with numerous interconnected elements. The visualisation tool aims to make these connections more explicit. Key assumptions underpinning this framework include:

- CM/CSF have the potential to offer significant environmental and socioeconomic benefits compared to conventional animal agriculture.
- Targeted interventions at key leverage points can accelerate the positive impacts of the CM/CSF sector.
- Alignment between innovation in the CM/CSF sector and existing policy priorities is crucial for achieving sustainable food systems transformations.

2.5 Use of KUMU platform

KUMU (https://kumu.io), a powerful platform for visualising complex systems, has been selected for its ability to represent interconnectedness, create interactive network maps, and embed descriptive content. Its features will allow for a dynamic and user-friendly exploration of the food system and the role of CM/CSF within it, effectively communicating the conceptual framework developed through our research activities.

3. Initial Design and Mock-ups

This section presents the initial design concepts and mock-ups of the interactive visualisation tool as developed in KUMU platform. While the tool is still in its early stages of development, these initial visualisations serve to illustrate the conceptual framework outlined in the previous section and provide a tangible representation of the intended user interface and information architecture.

The screenshot shown in Figure 1 provides the initial representation of key environmental (e.g., GHG emissions, biodiversity loss, water scarcity etc.) and socio-economic (animal welfare, food security etc.) challenges as nodes and the links indicating potential relationships between them.

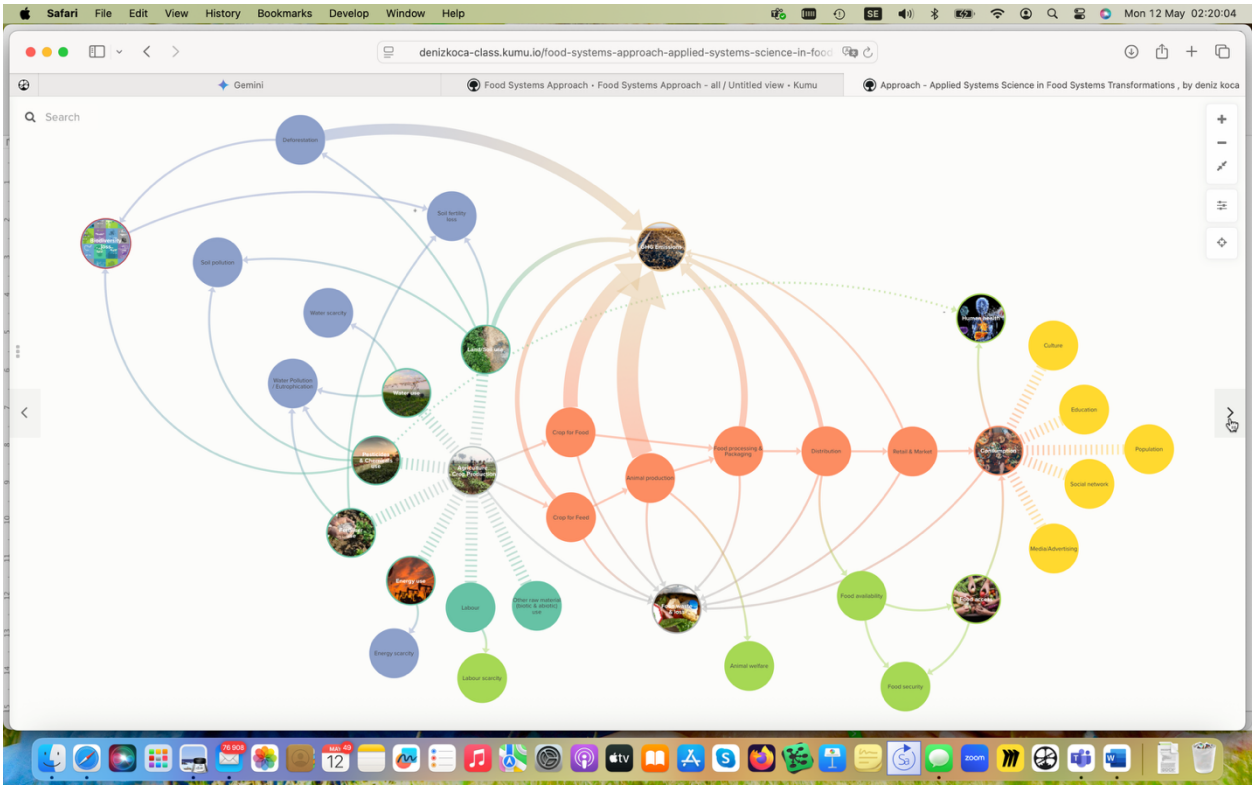

Figure 1: *Initial map illustrating the interconnectedness of major environmental and socioeconomic issues within the food system*.

Figure 2 shows a screenshot of the visualisation tool showing the functionality (e.g “filter and focus” - highlighting where the GHG emissions coming from the food supply chain) of the tool for providing a more focused understanding of the complex food systems.

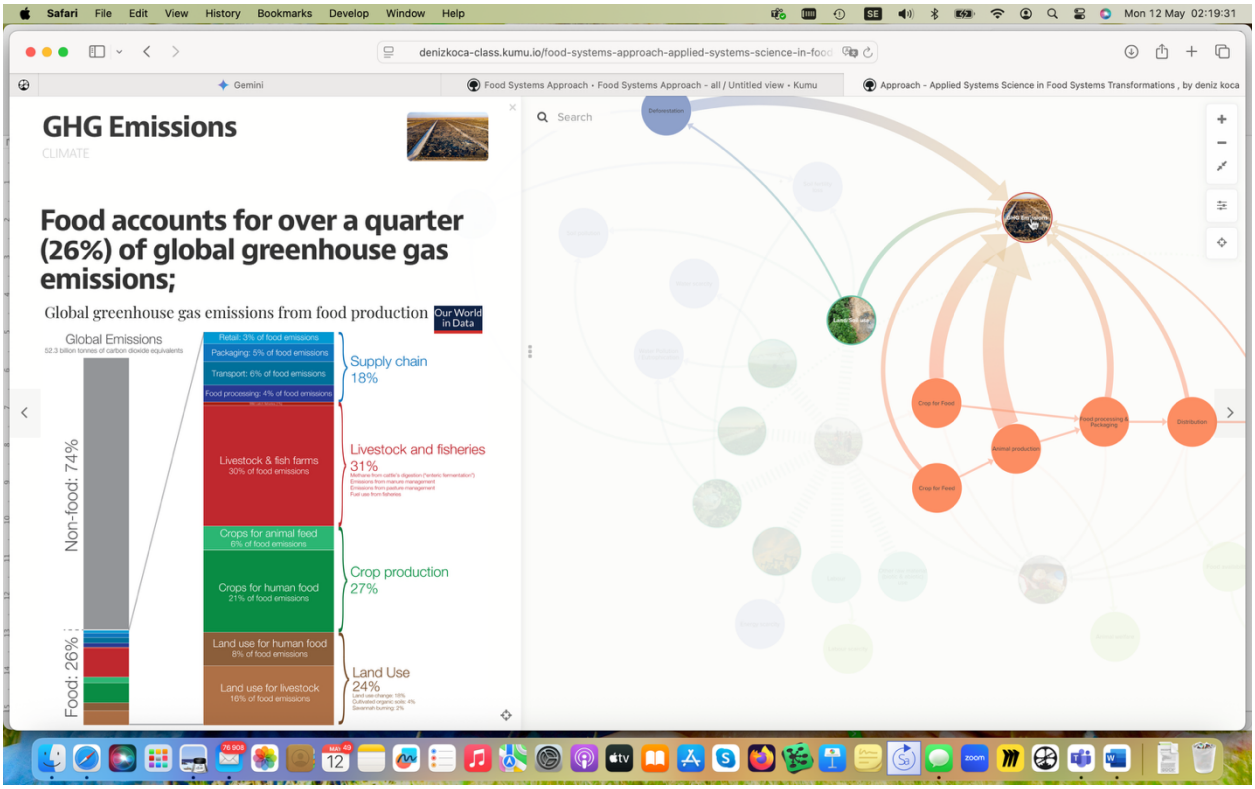

Figure 2: *Early mock-up showing the "filter and focus" functionality of the visualisation tool.*

The screenshot shown in Figure 3 provides an early view of how the concept of CM/CSF is positioned within the food system map as a key leverage to tackle with the major environmental challenges of today's global food system.

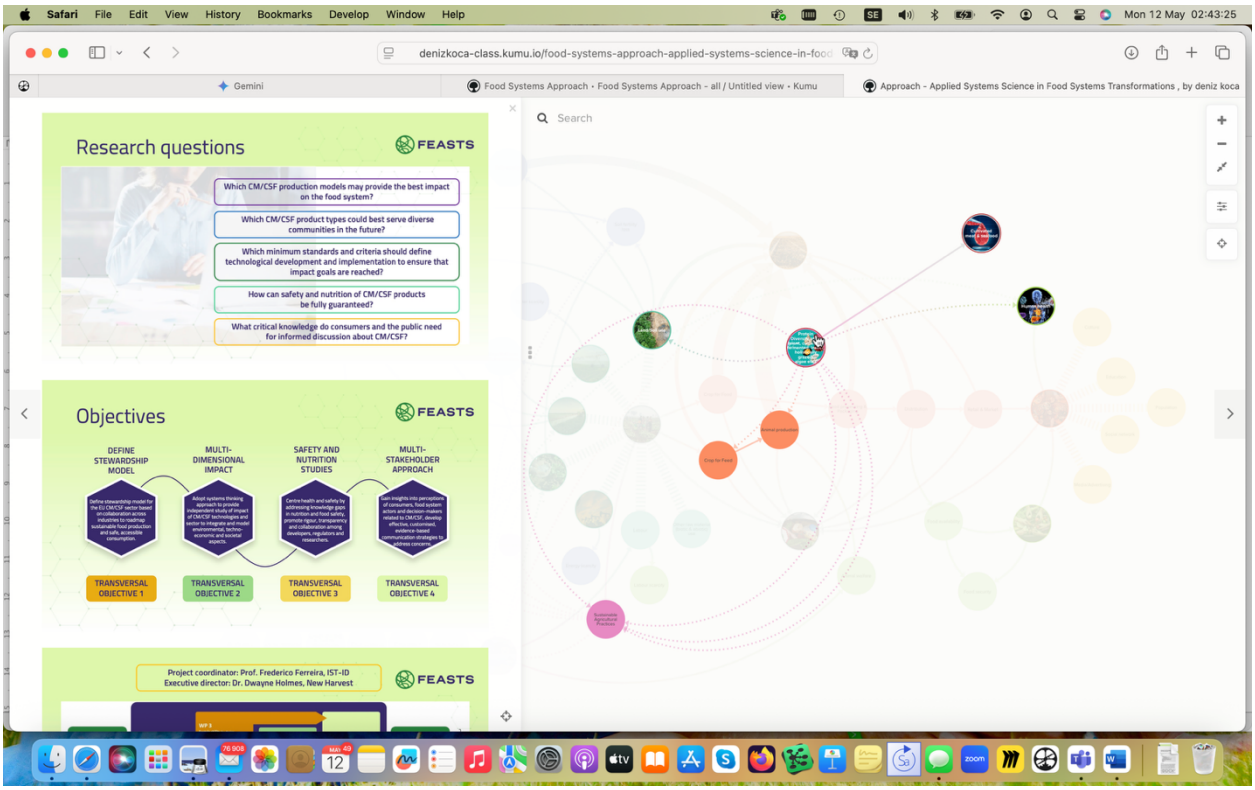

Figure 3: *Initial representation of CM/CSF as a potential leverage point within the food systems.*

The screenshot provided with Figure 4 shows a very first version of how SDG goals, targets and indicator are interconnected with each other. The visualisation tool will show which of these goals and targets will be addressed by CM/CSF sector. A similar mapping of key relevant strategies under European Green Deal will be done and the visualisation tool will highlight how the development and adoption of CM/CSF can contribute to achieving the targets and objectives of such strategies.

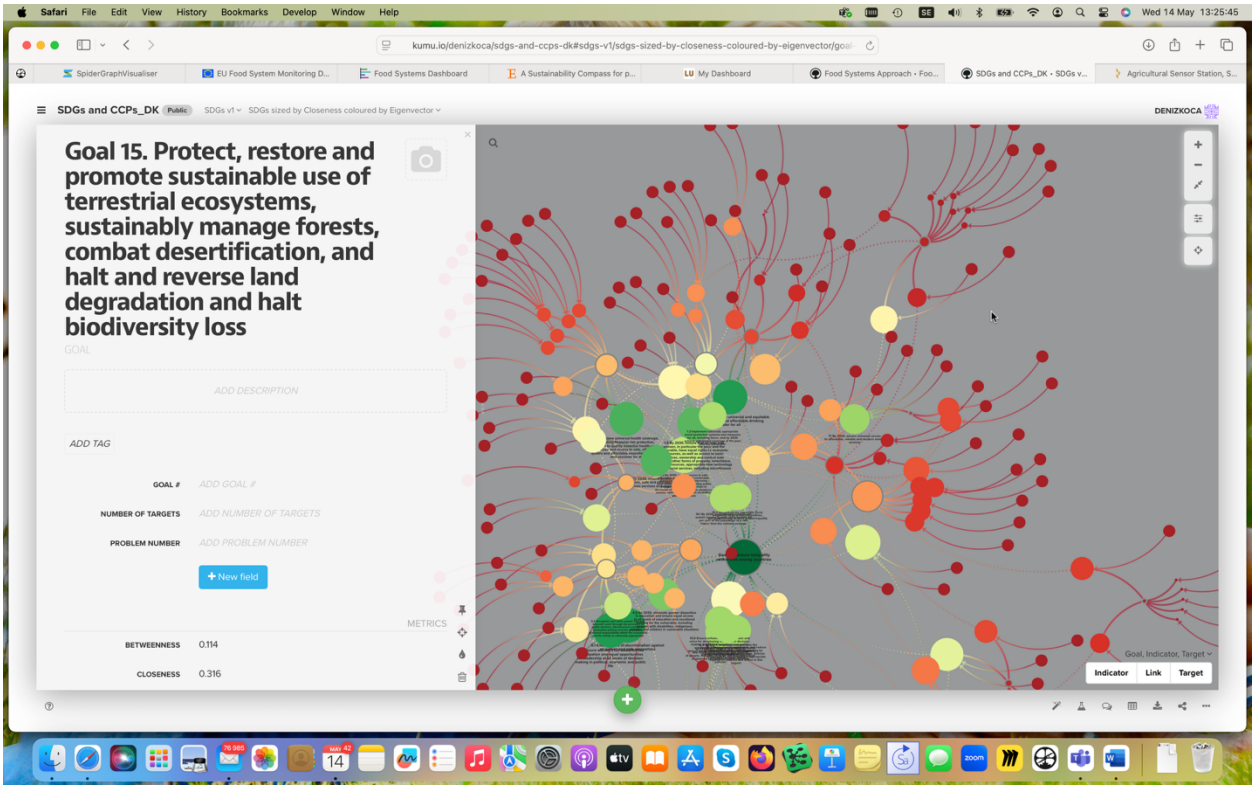

Figure 4: *Initial map showing interconnectedness of Sustainable Development Goals (SDGs), targets and indicators.*

These initial mock-ups in KUMU platform provide a visual foundation for the development of the interactive tool. They allow for early feedback and facilitate discussions among project partners regarding the clarity, usability, and effectiveness of the proposed visualisation approach. Further iterations and refinements will be made based on ongoing research, stakeholder consultations, and technical development. The final version of the visualisation tool, to be delivered in Month 36, will build upon these initial designs to provide a comprehensive and user-friendly interface for exploring the complex dynamics of the food system and the role of CM/CSF. Once the final version is ready, a "presentation" link will be generated and by clicking the link all users will have access to dynamic visualization tool under KUMU online platform.

4. Discussion and Next steps

This deliverable presents the initial conceptual framework for the "FEASTS Food systems interactive visualisation tool" designed to enhance understanding of the CM/CSF sector's potential within European and global food systems. The outlined framework, informed by preliminary literature reviews and intended to be further refined through upcoming workshops and online consultations, provides a structured approach for mapping the complex interplay between environmental and socioeconomic challenges, relevant policy priorities, the potential impacts of CM/CSF, and key areas for intervention. The initial design concepts and mock-ups in KUMU platform, as presented in Section 3, offer a tangible starting point for the development of the interactive tool.

The development of this conceptual framework represents a crucial first step towards achieving a unified understanding among project partners and external stakeholders. The visualisation tool, even in this conceptual stage, highlights the intricate connections within the food system and the multifaceted role that CM/CSF could play in addressing existing challenges and aligning with strategic policy objectives.

Moving forward, the next critical steps involve:

- **Stakeholder Engagement**: Conducting planned workshops and online consultations to gather feedback on this initial conceptual framework and the preliminary KUMU designs. This feedback will be invaluable in refining the structure, content, and user interface of the visualisation tool
- **Data Integration**: Identifying and integrating relevant data to populate the visualisation with meaningful information, ensuring accuracy and relevance to the project's objectives
- **Tool Development**: Progressing with the technical development of the interactive visualisation tool on KUMU platform, building upon the initial mock-ups and incorporating the feedback received
- **Refinement of Leverage Points**: Further investigating and detailing the identified leverage points for action within the CM/CSF sector, ensuring their practicality and potential impact are clearly represented in the tool.

Conclusions

In conclusion, this deliverable establishes the foundational conceptual framework for the "FEASTS Food systems interactive visualisation tool." It provides a clear roadmap for the subsequent development stages and underscores the project's commitment to creating an accessible and insightful tool for understanding the complex dynamics of food systems and the transformative potential of CM/CSF. The next phase of stakeholder engagement and technical development will be instrumental in shaping the final version of the tool, which will be delivered in Month 36.

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