Title: "The Role of Local Food Systems in fostering sustainable transition in European rural areas"

Author name and affiliation: Nassim Chahid1,2*, Tristan Berchoux1,3 Paolo Prosperi1,2

*Corresponding author: chahid@iamm.fr

1) CIHEAM-IAMM, Montpellier F-34093, France

2) MoISA, Univ Montpellier, CIHEAM-IAMM, CIRAD, INRAE, Institut Agro, IRD,

Montpellier, France

3) TETIS, Univ Montpellier, AgroParisTech, CIRAD, CNRS, INRAE, Montpellier France

1. Introduction and Objectives

Food systems play a critical role in global sustainability, nutrition, and food security. These complex systems encompass activities and practices that determine how food is produced, processed, distributed, and consumed along food chains. The intricate interactions between various actors, processes, and outcomes within food systems necessitate a transition towards more sustainable practices to ensure sustainable and healthy diets with minimal environmental impact.

EU rural areas present significant diversity in their local food systems. As highlighted in the literature, different farm sizes and supply chains contribute differently to local food systems (Rivera et al., 2020; Darnhofer, 2021; Brunori et al., 2020), and policies have a strong impact on territorial networks, and economic and environmental capacities (Galli et al., 2020; Leeuwis et al., 2021). In line with this view, this study aims to elaborate an analytical framework for food systems sustainability, using a multidisciplinary and systemic approach to assess the dynamics of food systems at a local level, applicable to EU regions. This framework will examine food systems across multiple areas at a local scale, from a food system perspective. It will ensure data analysis including food production, processing, distribution, and consumption. Its goal is to support EU regions in agricultural and food transition to generate data at a local level. This data will serve as a foundation for identifying key levers of action tailored to the specific needs and priorities of local policies. Such an approach will enable the development of more decentralized and effective policy management, ultimately ensuring the empowerment of rural populations through improved food access, awareness about food quality, and better consumer behaviors regarding nutritious food. In addition, the framework will address the importance of managing feedback loops and trade-offs within food systems, as these interactions significantly impact the overall sustainability and effectiveness of policy interventions.

2. Methods and Data

2.1. Framework Building Process

This framework analyzes the transitions of local food systems towards sustainability in European rural areas and addresses the complexity of food systems using a comprehensive approach that integrates various components across different scales. The development of this framework for assessing local food system sustainability was informed by an extensive literature review. The following steps were taken to build this framework, combining quantitative and qualitative approaches. It begins with a literature review to identify key indicators for food system assessment, which are then categorized into four main features: i) agricultural production systems, ii) food supply chains and consumption, iii) food environments, and iv) land-use layouts and spatial organization. A cluster analysis will be conducted to develop food system typologies, and the results will be cross-referenced with existing literature. Additionally, qualitative analysis through stakeholder interviews will validate the choice of indicators, ensuring their practical relevance at the local scale by utilizing EU and French databases for

quantification. Food system types will be validated by experts using a Delphi approach and local stakeholders in the field.

2.2. Scale Definition and Data Collection

Defining the boundaries of local food systems is complex, as they often interact with other systems through trade, labor, environmental, and technological links. Various scholars define local food systems based on different factors, from geography to market arrangements, actor relationships, business size, and production practices. Given these multiple perspectives and methodologies and considering the objective of our study which is to assess food systems in EU regions, we selected a suitable scale for local food system analysis.

3. Results

3.1. Indicator selection and drivers

Drawing upon academic resources, relevant indicators were selected based on their alignment with developed typologies and data availability at European or French scales. The selected indicators enabled the identification of 4 distinct types of food systems. These differ by production characteristics, supply chains, food environments, and land layouts and organization. The dynamics we identified apply to each type in a different manner. A first type of food system (Smallholder's food system) tends to prioritize strengthening local connections through territorial food programs to encourage healthy and diversified diets. As an example, certain food systems tend to increase local and organic procurement in local catering. Other conventional food systems seek to integrate more mainstream markets to commercialize local foods, which puts an emphasis on supply chains and market structures. A third type (Agro-industrial food systems) maintain specialized production systems and provide products from small-scale farmers. This type puts emphasis on longer food supply chains and high exportation rate. The last type (alternative/niche food systems) is mainly focusing on bringing new innovations to the food system weather it's in farming or supply chains or governance. These dynamics illustrate food system transitions at a local scale.

In this study, drivers serve as a critical tool for understanding and explaining food system transitions, as they directly influence them. Some are interrelated, inducing synergies and therefore accelerating their effects. We conceptualize them as a secondary analytical lens for understanding food system typologies, as their influence varies across different types depending on the transition dynamics.

3.2. Trade-off Consideration

Current food system assessments are essential for recognizing trade-offs and comprehending the policies and practices that promote synergies. Nevertheless, these analyses do not encompass the full complexity of food systems, which are composed of networks of interrelated components uniquely shaped by different factors. The interactions among these elements are dynamic, which generates feedback loops that can either enhance positive or negative feedback. It is therefore important to take trade-offs into account when formulating policies and interventions. For example, intensifying local food production may improve food security and economic growth, it may also result in unexpected environmental repercussions or increased cost for consumers. Since food systems are not linear, this indicates that modifications in one sector can have extensive effects across the entire system, influencing various stakeholders and policy domains. Acknowledging these complexities is essential for crafting balanced and sustainable strategies that reconcile competing goals. By employing a systems perspective and encouraging collaboration among multiple stakeholders, policymakers can make more effective and well-informed moves, refine interventions, and establish food systems that are more equitable.

3.3. Policies and Measures

The findings will contribute to EU policies and programs aimed at addressing rural challenges. To achieve this, a set of key levers of action will be identified through interactions with policymakers as well as a comprehensive literature review of local policies. We will examine various types of policy levers based on criteria such as applicability and effectiveness. The goal is to assign each policy type to the most adequate type of food system and transition pathway in order to enhance its relevance and impact.

4. Discussion and Conclusion

In conclusion, this framework offers a novel approach to understanding and addressing the complex challenges of food system sustainability at the local level, with potential implications for broader regional and global food system transitions.

Through this study, our goal is to provide a clearer image of the diversity of local food systems across EU regions, thus enabling the development of more decentralized and effective policy measures. These measures are meant to improve food access, especially for vulnerable populations, while also promoting a better awareness about healthier and diverse consumption habits. By encouraging these practices, this study contributes to broader public health objectives such as some EU rural areas' shared goals about food security. However, we acknowledge that food choices are not only dependent on the structure of the food system but are also strongly influenced by individual preferences, socioeconomic conditions, and cultural factors. This study aligns with food system sustainability perspectives by offering a comprehensive analytical framework combining both theoretical and empirical approaches, enhancing the understanding of local food system dynamics and facilitating informed and evidence-based decision-making. This dual approach ensures the policies suggested are not only grounded in academic literature but also adapted towards implementation.

References

Brunori, G., Galli, F., & Grando, S. (2020). Food systems as assemblages. In *Innovation for sustainability* (Vol. 25, pp. 107-121). Emerald Publishing Limited.

Darnhofer, I. (2021). Resilience or how do we enable agricultural systems to ride the waves of unexpected change?. *Agricultural systems*, *187*, 102997.

Galli, F., Prosperi, P., Favilli, E., D'Amico, S., Bartolini, F., & Brunori, G. (2020). How can policy processes remove barriers to sustainable food systems in Europe? Contributing to a policy framework for agri-food transitions. *Food Policy*, *96*, 101871.

Leeuwis, C., Boogaard, B. K., & Atta-Krah, K. (2021). How food systems change (or not): governance implications for system transformation processes. *Food security*, *13*(4), 761-780.Rivera, M., Guarín, A., Pinto-Correia, T., Almaas, H., Mur, L. A., Burns, V., ... & Zamora, P. S. (2020). Assessing the role of small farms in regional food systems in Europe: Evidence from a comparative study. *Global Food Security*, *26*, 100417.