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Hand in hand for urban food security: Feed4Food's living labs and knowledge hubs in European cities

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1 Introduction

Food insecurity has resurged as a policy concern within European cities, where affordability pressures and climate-related extremes intersect with social vulnerability. EU risk assessments in 2024–2025 flagged food affordability as a persistent concern for low-income groups despite easing inflation, while climate services and public-health briefings documented record summer heat and widening heat-health risks that disproportionately affect disadvantaged urban residents (van Daalen et al., 2024; European Commission, 2024; European Environment Agency, 2024). These dynamics sharpen the case for urban agriculture (UA) as part of city-region food strategies; not as a substitute for regional production, but as a complementary, place-based lever that can expand access to fresh, nutritious foods, cool neighborhoods, and build local capabilities where needs are greatest. World Food Day (WFD) 2025 (Food Agriculture Organization, 2025)—coinciding with FAO's 80th anniversary—calls for actors to work "hand in hand" toward "better foods and a better future," emphasizing practical, cooperative solutions that advance a sustainable, inclusive, and resilient food future. Positioning UA within this frame highlights its dual contribution to food security (access, availability, utilization) and to equitable, climate-resilient urban development. In this opinion paper, we align our argument with WFD 2025′s cooperation ethos and propose UA as a social infrastructure that tangibly connects municipal services, civil society, SMEs, and residents around nutrition, circularity, and inclusivity. UA can be a clear vehicle to achieve food justice, going beyond ensuring access for all in creating community-based spaces where all people are respected and valued, irrespective of ethnicity, gender, disability or past (Asma Ben-Othmen et al., 2023). Our perspective draws on the Feed4Food project's approach and early implementations across Eastern and Mediterranean contexts. Feed4Food develops Living Labs (LL) that co-design and test UA in real settings—public plots and peri-urban interfaces—linking agroecological practices (soil improvement, biodiversity, bio-waste composting) with appropriate technologies (low-cost sensing for irrigation/microclimate, water-saving protocols, simple decision support), social-service logistics for distributing fresh produce and explicit inclusion of vulnerable groups as co-workers. These LL are integrated in the ecosystem of the cities and are tracked using clear indicators for inclusion, ecological

sustainability and nutrition. Conceptually, this operationalises a "two-axis" logic—meeting immediate needs while building longer-term system resilience and robustness—adapted from food-systems work in fragile settings to urban European contexts. Accordingly, this opinion paper aims to advocate greater emphasis on urban agriculture in European food policy and practice. We articulate how UA LL can be organized and managed across socioeconomic settings and climatic conditions, capitalizing on technological advancements and open knowledge. We also indicate how UA LL are breeding grounds for innovative ways of learning that are now generally considered to be essential to achieve system changes. The paper proceeds as follows: Section 2 ("Living labs and urban agriculture") specifies governance-light, co-created, and climate-fit agronomic design; Section 3 ("Knowledge and learning hubs") details training, open data, simple KPIs and peer-to-peer mechanisms for rapid learning; and the different ways UA LL facilitate social, experiential and territorial learning. Section 4 ("Transition") outlines city-scale pathways (land use, circularity, procurement) to embed UA as an equitable, evidence-based component of urban food security consistent with the spirit of World Food Day 2025.

2 Living labs (LL) and urban agriculture (UA)

Given the diverse challenges in sustainable food production, innovative approaches are needed to ensure that food security can be maintained in a sustainable way for all population groups in urban settings. According to the (European Network of Living Labs, 2025), LL are "real-life test and experimentation environments that foster co-creation and open innovation among the main actors of the Quadruple Helix Model, namely: Citizens, Government, Industry, and Academia." LL are therefore particularly suited to exploring options for inclusive ways of developing urban agriculture. Therefore, we conceptualize urban agriculture LL as place-based, co-produced interventions in real settings (municipal plots, schoolyards, peri-urban interfaces) that test and scale inclusive agroecological practices and governance tools. This conception aligns with city-region agroecology, which emphasizes contextuality, resilience, multifunctionality, equity, and two-way knowledge flows across rural-urban gradients (Vaarst et al., 2018). LL braid land use, waste, water, social services, and food policies under networked governance—consistent with urban innovation literature, highlighting multi-actor coordination and the value (and risks) of data-enabled city services (Diaconu et al., 2025; Mincu et al., 2025; UN-Habitat, 2020a). Mainstreaming urban agriculture (UA) requires explicit integration into statutory urban and territorial planning—moving beyond pilots to zoning, land-banking, and public procurement that safeguard space for food production and circular bioeconomy functions (Gunapala et al., 2025). International frameworks already call for this: FAO's Urban Food Agenda emphasizes "integrated food system planning" and inclusive food governance (UN FAO, 2019), providing tools cities can embed in land-use and infrastructure plans and in MUFPP (Milan Urban Food Policy Pact)-aligned strategies (Cook, 2025), while highlighting current knowledge gaps on food flows that planning must close. In parallel, UN-Habitat's New Urban Agenda (UN-Habitat, 2020a) positions sustainable, climate-resilient urbanization as a multi-sector mandate in which food security is a legitimate planning concern with local (city-level) implementation responsibilities. Evidence from city-region/agroecology scholarship further shows that governance innovations at the rural–urban interface (e.g., coordinated land-use, ecosystem-service zoning, and short supply chains) are central to resilient food systems. Practically, living labs and knowledge hubs—ideally anchored by municipalities with universities as boundary organizations—can operationalize this integration by co-producing site-allocation tools, standard metrics, and capacity building for planners, thus lowering barriers to dedicating land and scaling inclusive models. Finally, comparative policy analyses (e.g., Spanish MUFPP cities) show that where food strategies are embedded in territorial planning cultures, political sustainability and land access improve (Pascual and Guerra, 2024)—underscoring why UA must be treated as core urban infrastructure for equitable, climate-resilient cities. Feed4Food operationalizes this logic across Eastern and Mediterranean contexts (Cyprus, Greece, Romania) through co-designed LL that: (i) establish low-input production (indigenous cultivars, mulching, municipal bio-waste composting, habitat diversification), (ii) deploy appropriate technologies (soil-moisture and microclimate sensing, simple irrigation decision rules, controlled deficit irrigation, soil amendments), (iii) employ vulnerable populations including people with disabilities, elderly, refugees and people from very poor households, and (iv) connect harvest logistics to proximate beneficiaries (food-aid channels, schools, elderly and migrant centers). These LL are embedded in routine municipal operations (land access, circular waste management, and procurement) and monitored with concise financial-economic, inclusion, nutrition, and microclimate indicators. Scientifically, the LL design follows agroecological city-region principles that are: diversified crops to buffer seasonality; minimized external inputs via recycling and incorporating indigenous cultivars; and explicit social aims (inclusion, skill enhancement and confidence building, cohesion) alongside nutrition and cooling co-benefits (Vaarst et al., 2018). Because European cities are heterogeneous and administratively bounded, LL also require territorial governance that recognizes food spaces, mobilizes territorial capital (natural and social), and strengthens proximity markets and short chains—gaps and opportunities documented in Spanish municipal food strategies (Pascual and Guerra, 2024). Finally, LL are positioned to embody a "two-axis" logic adapted from fragile-context food-systems practice. That refers to meeting immediate food and nutrition needs of vulnerable groups (e.g., short-cycle crops, targeted distribution) while advancing structural transformation (skills, circularity, climate adaptation). Although European urban settings differ in several aspects, this dual approach is salient for equity-focused, climate-exposed neighborhoods and aligns with World Food Day's emphasis on better nutrition, environment, and livelihoods (Hänke et al., 2023; UN-Habitat, 2020b). By identifying the challenges for adoption and impact, the LL aims to provide inspiration and tangible proof of concepts for policymakers, communities, innovators, and entrepreneurs across the LL cities and beyond.

3 Knowledge and learning hub (KLH)

To enhance the function of LL, a central Knowledge and Learning Hub (KLH) has been created, where data and information are gathered in one central database, and analyzed as one integrated system. Specifically, it provides immediate information on the performance of the LL by analyzing the causes of success or failure and providing feedback to the stakeholders, including the results of the risk assessment. In this way, the gathered quantitative measures can be challenged and continuously revised, for instance, for their representativeness of the LL sustainability goals, and the effectiveness of the LL themselves. The KLH consolidates site data (financial-economic, agronomy, inclusion and nutrition indicators, microclimate, dissemination and communication, training, and circularity metrics) into shared dashboards and suitability models, enabling cross-case comparison and rapid iteration. Specifically, Feed4Food developed Key Performance Indicators (KPIs) (Parmenter, 2015) based on the project's targets for each of the three LLs. The KPIs determine what the KLH will contain, both on data upload functionalities and also visualizations (Fatima et al., 2025). The aim is to ensure that all the measures needed for the KPIs can be collected by the LL. The selected KPIs are: (1) Economic viability (sustainability dimension economic), (2) Effective training (sustainability dimension social), (3) Pesticide use (sustainability dimension environmental), (4) Nutritious food production (sustainability dimension social), (5) Native varieties cultivation (sustainability dimension environmental), and (6) Water reuse (sustainability dimension environmental).

Also, KLH explicitly offers a layered dashboard structure, catering to the needs of different stakeholders in terms of (visual or other) displays as well as the type of information provided, contributing to further inclusion of all stakeholders in the process. KLH specifies a minimal, comparable metric set (financial-economic, inclusion and nutrition access indicators; water and energy intensity; microclimate co-benefits; contributions to circularity) and a protocol for sharing anonymized data among cities—linking local experimentation to transparent, monitorable learning that municipalities can steward (UN-Habitat, 2020b). By structuring evidence that flows from pilots to municipal decision points, the KLH helps turn scattered experiments into an adaptive, accountable public service for food security in urban neighborhoods—particularly in heat- and water-stressed Eastern and Mediterranean cities. While the KLH brings together data to facilitate learning across UA LL, each UA LL serves as fertile ground for three interlinked learning modes: experiential, territorial, and social learning. Experiential Learning involves learning through direct experience and reflection. In urban agriculture, it includes hands-on activities such as planting, harvesting, and composting. Kolb's experiential learning theory (Kolb, 2015) emphasizes a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Territorial Learning refers to the process of understanding and engaging with the specific socio-ecological context of a place. The LL connects learners to local landscapes, food systems, and urban planning, and through this fosters place-based knowledge and civic empowerment (Simon, 2021). Finally, Social Learning occurs through interaction, observation, and shared experiences within a group, and is widely seen as being crucial for a shift toward sustainability in farming in general (Noguera-Méndez et al., 2016) and for urban agriculture in particular (Opitz et al., 2016). By blending these learning modes, UA LL not only teach sustainable agriculture but also act as platforms for civic empowerment and urban transformation.

Further, a Site Allocation Tool is created that can be used by private and public stakeholders to localize the best places to start new initiatives. The tool is based on a qualitative response model that predicts expert assessments on site suitability from a set of georeferenced biophysical (soil, land use, water availability) and socio-economic (vicinity to markets and social safety, accessibility for people with disabilities) site characteristics (Constantin et al., 2024). Scaled up across all cadastral units and informal sites, the tool generates a detailed baseline map of site suitability. Here, we again build on examples from non-European contexts, as this tool has been successfully applied in Benin (Sonneveld et al., 2021). For environmental impact, a Life Cycle Analysis is part of the toolbox and included in the KLH (Litskas et al., 2025). The tool reports on changing site suitability under prospective interventions like improving soil fertility, water availability, and enhancing safe entrances. Dedicated simulation models are developed in the Hub to simulate the performance of business models under alternative assumptions on climate change, institutional development, and population growth/urbanization in the medium (2022–2027) and long run (2022–2035). In this way, the longer-term financial viability of the LL is guaranteed through appropriate design and inclusion of relevant partners (public and private). Conceptually, these models are a small-scale application of an agent-based, spatially explicit optimization, multi-commodity model (Keyzer and van Wesenbeeck, 2012; Wesenbeeck, 2014). Finally, the KLH models the impact of scaling the LL, employing landscape modeling, where the landscape is seen as the socio-economic environment (see van Wesenbeeck et al., 2019). These model exercises are done to ensure that, even if the LL by themselves are sustainable, sustainability is also maintained under scaling, when they will have a substantial system-wide impact. Economically, this includes impacts on prices for inputs and outputs; socio-politically, this includes push-back from powerful agents with a vested interest in the status quo. In these models, alternative city policies are also allowed. Additionally, the KLH operationalizes reflexive monitoring: recurring cycles of co-reflection, reframing, testing and redesign that enable collective learning "in action" under complexity (Van Mierlo et al., 2010). In Feed4Food, LL data are pooled and analyzed by the KLH; lessons are returned through facilitated sessions; and short learning loops adjust agronomic regimes, distribution, and governance routines (Klaassen et al., 2020).

Beyond analytics, the KLH acts as a capacity-building and knowledge-brokerage node. It supports flexible training sessions (like water-saving gardening, composting city waste, safe ways to handle harvests, and basics of small businesses) and provides useful resources that show circular-economy programs how municipal knowledge hubs connect academia, SMEs, and communities to define practical KPIs, and incubate communities of practice. The KLH also anchors a city-region perspective. Linking LL evidence to a City Region Food Systems (CRFS)

frame—short chains, public procurement, territorial diet quality—helps cities situate neighborhood production within broader resilience strategies across the four food-security pillars (supply, access, utilization, stability), consistent with post-COVID lessons on shock-ready governance (Blay-Palmer et al., 2021; Cook, 2025). In parallel, agroecological city-region scholarship underlines two-way knowledge flows between local/traditional know-how and "modern ecological knowledge"; the KLH formalizes this exchange with open resources and peer-to-peer learning across climates and socioeconomic settings (Vaarst et al., 2018).

4 Transition and scaling

World Food Day 2025 calls on us to act "Hand in Hand for Better Foods and a Better Future," emphasizing cross-sector collaboration and practical, near-term change. Feed4Food's city-based living labs and knowledge hubs provide the scaffolding for such coordinated action, particularly in Eastern and Mediterranean contexts where social vulnerability and climate pressures intersect (Food and Agriculture Organization 2025). The Feed4Food transition strategy incorporates (1) aligning policy and governance levers, (2) access to land, markets and basic infrastructure, (3) circular innovation, (4) inclusion and agro-food heritage, (5) institutionalizing monitoring and learning. (6) Developing financially sound business models that respect and support the core values of inclusivity, circularity and ecological sustainability. Accordingly, cities are supported to embed urban and peri-urban agriculture within food, health and spatial planning using recognized frameworks. This means adopting multi-actor food councils; integrating UA into land-use and green-infrastructure plans; and using public-food procurement (schools, care facilities) to create stable markets for socially inclusive farms (Cook, 2025). Such multilevel coordination is consistent with UN-Habitat guidance on devolved powers, vertical–horizontal cooperation and participatory planning that localizes the SDGs. Transition pathways need predictable financing for land access (temporary plots, micro-leases, public land banks), simple processing spaces, water harvesting and cold chain "commons." FAO's Urban Food Agenda stresses building territorial markets and inclusive procurement to link small producers with consumers, while strengthening municipal data and governance capacity to steer investments where they can most reduce food insecurity. UN-Habitat likewise highlights fiscal decentralization and adequate flows for urban investments as preconditions for sustainable urbanization (UN-Habitat, 2020a). Resource loops could be closed with circular innovation. Nutrient cycling (separate bio-waste collection, composting, digestate use), water reuse and low-energy protected cultivation that fit local climates could be prioritized. Inclusion and protection of cultural and biological heritage should be kept at the core of scaling. City-region agroecology provides the normative compass—contextual, equitable, resilient, and multifunctional—against which to judge transition choices. Inclusive, participatory governance and the "cities for all/right to the city" lens are necessary to translate investments into reduced poverty and improved wellbeing. FAO explicitly proposes learning "hubs" and decision support to empower local actors, while warning that indicator sets must be paired with the capacity to use and debate data. UN-Habitat documents persistent data and monitoring gaps at the city level and recommends standardized, participatory monitoring, so local priorities steer implementation. Feed4Food's deliverables contribute here via LL governance templates and equity-impact indicators that can be rapidly adopted by municipalities.

Taken together, the governance templates and KPIs are capable of connecting municipal policy, circular infrastructure and community agency—the combination that World Food Day 2025 asks us to deliver—so that LL become durable engines of food security, equity and climate resilience in European cities.

5 Conclusions

Urban agriculture will not replace regional farming, but it can reliably complement it when treated as social infrastructure. Co-designed Living Labs embedded in municipal routines shorten the last mile to nutritious food, create cooler, safer microclimates, and build skills and social ties—benefits that matter most in Eastern and Mediterranean cities under heat and water stress and pressures for land use change (loss of agricultural land for residential, commercial purposes). Knowledge and learning hubs translate site results into accountable policy by curating open indicators and facilitating rapid iteration across sites, while innovative learning takes place within LL. Taken together, these components support a pragmatic, equity-centered transition that cities can deploy now while building structural resilience for the longer term.

Author contributions

VL: Writing – original draft, Writing – review & editing, Conceptualization, Methodology. VI: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. VC: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. DCD: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. LvW: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

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