

УДК: 338.2

LOCAL ADAPTATION AS THE FOUNDATION OF UKRAINE'S FOOD SYSTEM RESILIENCE
UNDER WAR CONDITIONS

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<https://doi.org/10.31073/foodresources2025-25-28>

Subject. This study investigates the resilience of Ukraine's agro-food system during the full-scale war, focusing on the disruptive impact of military aggression and the adaptive responses it triggered. Special attention is given to the transformation of local food systems, the restoration of supply chains, and the revitalization of cooperative mechanisms under conditions of institutional fragmentation and crisis. **Purpose.** The primary aim is to examine the potential of local cooperation, institutional adaptation, and innovation as key pillars for strengthening food security in Ukraine under wartime conditions. The research seeks to identify structural barriers and propose policy-oriented solutions that support autonomous, community-based food initiatives. **Methods.** The research is grounded in a multi-method approach combining comparative historical analysis of cooperative movements (notably in Western Ukraine during the 1920s–1930s), statistical review of food system disruptions, and institutional diagnostics. Key factors analyzed include legal fragmentation, low trust in institutions, financial instability, and the limited availability of managerial capacity. **Results.** The study reveals that despite the war-induced collapse of centralized supply systems, local communities have demonstrated a capacity for self-organization, restoring food accessibility and economic functions through ad hoc partnerships. Wartime realities have fostered innovation in food logistics, including digital cooperation tools, short supply chains, and hybrid civil-public alliances. Historical precedents of Ukrainian cooperation movements provide both cultural legitimacy and operational blueprints for contemporary applications. Comparative insights from Central and Eastern Europe underscore the value of embedding such initiatives into a supportive regulatory framework. **Scope of results.** The results can inform national and local strategies for post-war food system recovery, contributing to sustainable food self-sufficiency, institutional resilience, and inclusive economic rebuilding. The proposed policy of «facilitated cooperative entry» can foster long-term stabilization and technological renewal in the agro-food sector.

Key words: food security, local cooperation, institutional adaptation, agro-food system resilience, wartime economy

ЛОКАЛЬНА АДАПТАЦІЯ ЯК ОСНОВА СТІЙКОСТІ ПРОДОВОЛЬЧОЇ СИСТЕМИ
УКРАЇНИ В УМОВАХ ВІЙНИ

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Тема. Це дослідження вивчає стійкість агропродовольчої системи України під час повномасштабної війни, зосереджуючись на руйнівному впливі військової агресії та адаптивних заходах, які вона спричинила. Особлива увага приділяється трансформації місцевих продовольчих систем, відновленню ланцюгів постачання та активізації кооперативних механізмів в умовах інституційної фрагментації та кризи. **Мета.** Основна мета – вивчити потенціал місцевої кооперації, інституційної адаптації та інновацій як ключових стовпів зміцнення продовольчої безпеки в Україні в умовах воєнного часу. Дослідження спрямоване на виявлення структурних бар'єрів та пропонування політично орієнтованих рішень, що підтримують автономні, громадські продовольчі ініціативи. **Методи.** Дослідження ґрунтується на багатометодологічному підході, що поєднує порівняльний історичний аналіз кооперативних рухів (зокрема на Західній Україні у 1920-х–1930-х роках), статистичний огляд порушень продовольчої системи та інституційну діагностику. Аналізовані ключові фактори включають правову фрагментацію, низький рівень довіри до інституцій, фінансову нестабільність та обмежену наявність управлінського потенціалу. **Результати.** Дослідження показує, що попри спричинений війною колапс централізованих систем постачання, місцеві громади продемонстрували здатність до самоорганізації, відновлюючи

доступність продуктів харчування та економічні функції через спеціальні партнерства. Реалії воєнного часу сприяли інноваціям у продовольчій логістиці, включаючи цифрові інструменти співпраці, короткі ланцюги постачання та гібридні цивільно-державні альянси. Історичні прецеденти українських кооперативних рухів забезпечують як культурну легітимність, так і операційні моделі для сучасного застосування. Порівняльний досвід країн Центральної та Східної Європи підкреслює цінність інтеграції таких ініціатив у сприятливу регуляторну базу. **Сфера застосування результатів.** Результати можуть бути використані для розробки національних та місцевих стратегій відновлення продовольчої системи в повоєнний період, сприяючи сталій продовольчій самодостатності, інституційній стійкості та інклюзивній економічній відбудові. Запропонована політика "спрощеного кооперативного вступу" може сприяти довгостроковій стабілізації та технологічному оновленню агропродовольчого сектору.

Ключові слова: продовольча безпека, місцева кооперація, інституційна адаптація, стійкість агропродовольчої системи, воєнна економіка

Introduction. Ensuring national food security under conditions of full-scale war has become one of the most pressing challenges facing Ukraine's agro-food system. As the war disrupted production, logistics, and market infrastructures, the capacity to provide safe, sufficient, and accessible food to the population came under unprecedented threat. These disruptions revealed deep-rooted structural vulnerabilities over-centralization, dependency on export corridors, and a lack of resilience at the local level.

In response, Ukraine's food system began to demonstrate emergent forms of adaptation, particularly through local cooperation, community-based governance, and spontaneous food security networks. These responses, while often improvised, highlighted the capacity of local actors—farmers, civil society organizations, municipalities, and displaced communities – to restore food access, rebuild value chains, and maintain social cohesion amidst systemic breakdowns.

Unlike traditional top-down food supply models, these grassroots efforts relied on flexible coordination, trust-based logistics, and rapid decision-making. They included wartime cooperatives in Zakarpattia, urban gardens in Uzhhorod and Lviv, and informal digital tools like Telegram bots to coordinate deliveries where official systems failed. In many cases, these initiatives not only ensured basic nutrition but also became loci of psychological support, community rebuilding, and civic engagement.

From an analytical perspective, these phenomena require rethinking classical models of food system governance. While traditional food security frameworks emphasize centralized control and national provisioning strategies, Ukraine's wartime experience suggests that resilience often stems from decentralized, adaptive, and locally anchored systems. This has reinvigorated scholarly interest in cooperative movements, informal governance, and bottom-up innovation as pillars of food system renewal.

The purpose of this paper is to explore these emergent patterns of local adaptation and cooperation, with particular attention to institutional, legal, and infrastructural conditions that enabled or constrained them. The study also draws on historical analogies especially the interwar cooperative traditions of Western Ukraine to contextualize contemporary initiatives within a broader lineage of self-organized resilience.

This research aims to contribute to the development of a new conceptual framework for food system recovery, one that is not only reactive but proactive capable of transforming crisis into opportunity, and improvisation into policy. In doing so, the paper positions local cooperation not as a peripheral phenomenon, but as a central mechanism of food sovereignty, civic agency, and national recovery.

Materials and methods. The subject of this study is the analysis of adaptive responses in Ukraine's agro-food system to the disruptions caused by Russia's full-scale invasion, with a particular emphasis on local cooperation mechanisms, institutional adaptation, and grassroots innovation. The research investigates how these factors have contributed to food system resilience under conditions of war-induced fragmentation.

To achieve the objectives of the study, a combination of interdisciplinary research methods was applied: Comparative analysis, this method was used to explore the cooperative traditions of Western Ukraine; Institutional diagnostics, a structured assessment of the systemic barriers limiting the scaling of community-based food initiatives was conducted; Case study analysis, selected field cases such as urban gardens in Lviv and Uzhhorod, wartime cooperatives in Zakarpattia, and Telegram-based logistics solutions in Khmelnytskyi were examined to document practical forms of grassroots resilience. These cases demonstrate how informal coordination and digital tools enabled food access under disrupted formal mechanisms; Policy and institutional comparison, the Ukrainian case was contextualized through international comparisons with cooperative recovery models in Central and Eastern Europe (e.g., Poland's Local Action Groups, Lithuania's Short Food Supply Chains, and rural innovation hubs in Slovakia and Romania). Emphasis was placed on regulatory environments, financing tools, and governance architectures that enabled successful cooperative ecosystems.

This mixed-methods approach allowed the study to capture both structural-level dynamics and community-level practices, bridging the macro-institutional and micro-social dimensions of food system resilience during wartime. It also supports the formulation of evidence-based policy recommendations for scaling, institutionalizing, and sustaining local cooperation beyond the immediate crisis.

Results and Discussion. The Russian full-scale invasion of Ukraine in 2022 has severely impacted the national agro-food system across all verticals production, distribution, processing, and export. Over 20% of arable land has become inaccessible or contaminated by explosives [1], while major grain storage facilities and logistics hubs have been damaged or destroyed. Export corridors through the Black Sea, previously responsible for over 60% of Ukraine's agricultural exports, have become bottlenecks due to military blockades and geopolitical constraints.

Internally, the collapse of centralized procurement systems and delays in humanitarian deliveries have left many communities reliant on spontaneous, locally organized food initiatives. Municipal authorities, overstretched and under-resourced, have often turned to civic volunteers and informal networks to fill operational gaps. These structural shocks have exposed Ukraine's overdependence on external logistics and centralized state actors, while simultaneously catalyzing bottom-up responses built on improvisation, trust, and mutual aid.

Despite systemic breakdowns, numerous Ukrainian communities have mobilized informal networks and revived cooperative principles to ensure food access. Civil society organizations, small-scale producers, and municipalities have formed ad-hoc alliances to restore food processing chains, establish mobile markets, and pool local resources for procurement and distribution [2].

These decentralized responses have included wartime cooperatives in Zakarpattia and Lviv, inclusive urban gardens in Poltava and Uzhgorod, and Telegram-based logistics tools in Khmelnytskyi oblast. Rather than isolated anomalies, these initiatives represent a systemic pattern of adaptive resilience. They highlight how, under conditions of crisis, cooperation and solidarity emerge organically in the absence or delay of formal state mechanisms.

Particularly notable is the rise of urban gardening, driven both by food insecurity and a collective need for psychological stability. Projects such as *Rozsadnyk* in Lviv and IDP-led farms in Dnipro oblast combine food production with social cohesion, mental health support, and civic engagement. These examples reveal that food security is increasingly redefined not only in economic or logistical terms, but also through lenses of care, dignity, and local identity [3].

In parallel, informal coordination tools ranging from Google Sheets to Telegram bots function as improvised logistics systems embedded in trust-based social capital. While lacking formal recognition, they have enabled communities to bypass institutional bottlenecks and deliver essential goods with speed and accountability.

This convergence of digital improvisation, community trust, and cooperative memory suggests a paradigm shift: from state-centric provisioning to locally anchored, horizontally

networked food resilience. Such initiatives underscore that resilience is not just a product of institutional design, but a lived, evolving practice of communities under stress [4].

Examples include wartime cooperatives formed in Zakarpattia and Lviv regions, where producers, bakeries, and local authorities collaborated to secure food for internally displaced persons [5]. In the Chernihiv region, destroyed bridges and roads forced residents to coordinate direct distribution through local farmers and faith-based networks. In some areas, digital tools such as Telegram-based order systems, Google Sheets coordination, and mobile payment apps served as basic but effective infrastructure for decentralized food logistics. While lacking formal status, these systems proved to be responsive, transparent, and embedded in community trust [6].

A notable wartime trend has also been the rise of urban and peri-urban gardening, particularly in cities like Uzhgorod, Lviv, Poltava, Lutsk, and Morshyn. These initiatives often led by volunteer groups, NGOs, or local authorities provided food, psychosocial support, and spaces for inclusive community engagement. For example, in Uzhgorod, an elevated garden was created to enable people with disabilities to participate in food production [7]. In Lviv, over 400 IDPs joined the Rozsadnyk community garden, with some of the vegetables used in free social meals at the "Inshi" bistro.

Other gardens emerged on university campuses, municipal land, or even former flower farms, highlighting the flexibility and social function of urban agriculture. These spaces often doubled as therapeutic environments, offering mental health relief through engagement with soil, plants, and collective care. According to initial surveys, residents of shelters who participated in gardening reported improved emotional states and increased social connection [8].

Digital innovation played a parallel role in enabling access and coordination. For example, a Telegram bot launched in Teofipol helped local farmers reach consumers despite disrupted traditional markets. Although the tool faced scaling challenges, it exemplified the potential of digital platforms to connect decentralized food actors in real time [9].

Finally, the success of these efforts frequently hinged on the presence of local leaders trusted figures who could unite communities, mobilize resources, and maintain long-term engagement. In Ploska village [10], residents quickly co-funded agricultural equipment after a proposal was shared by a well-regarded community prefect. Such examples underscore how trust, leadership, and local initiative can sustain food access and cohesion even in the absence of formal infrastructure.

These practices mirror historical forms of rural solidarity, particularly as seen in interwar Galicia, where cooperatives often replaced the state in delivering essential goods and services. Their re-emergence in wartime conditions underscores the latent capacity for community-led governance in Ukraine's food system provided institutional support mechanisms are in place. Such mechanisms may include access to microfinancing, legal templates for cooperative registration, or integration with municipal development strategies [11].

While wartime conditions foster improvisation and solidarity, formalizing these initiatives faces several challenges:

- Legal fragmentation – Ukraine's cooperative legislation remains outdated, complex, and poorly harmonized with tax and banking systems, creating legal uncertainty for grassroots initiatives attempting to scale or formalize.

- Financial inaccessibility – Most local initiatives lack seed funding, access to credit, or grant-writing capacity. International donors often require technical documentation and reporting capacity beyond the reach of informal groups.

- Low institutional trust – Decades of corruption and bureaucratic opacity have eroded willingness to engage with state-led programs, especially in rural areas where state presence is minimal or distrusted.

- Leadership gap – A shortage of qualified coordinators with both agronomic and managerial expertise limits scalability. Many initiatives rely on single individuals, making them vulnerable to burnout or loss of continuity.

Unless these structural barriers are addressed, the resilience observed during wartime may prove short-lived or remain confined to isolated cases. Yet, these cases offer proof-of-concept

models that could be institutionalized through deliberate public policy and targeted donor support [12].

Several post-socialist states in the CEE region have demonstrated successful pathways for cooperative revival and food resilience, offering valuable lessons for Ukraine's post-war transformation. Poland's Local Action Groups [13], developed under the EU's LEADER program, have empowered rural communities to design and implement local development strategies through inclusive governance. These groups function as intermediary institutions that unite municipalities, civil society, and producers, channeling EU structural funds directly to community-designed projects. Their success is rooted in the combination of grassroots initiative, clear legal frameworks, and sustained technical assistance.

Similarly, Lithuania's Short Food Supply Chains [14] model has fostered direct connections between small farmers and consumers, reducing dependence on intermediaries and enabling greater price transparency. Supported by EU rural development funds, these chains have adopted digital platforms, farmers' markets, and cooperative branding initiatives to enhance visibility and competitiveness [15]. Lithuanian policy has also emphasized producer education and regional coordination as key enablers of resilience.

Slovakia and Romania have implemented rural innovation hubs that combine digital infrastructure with agricultural extension services, fostering collaboration between research institutions, farmers, and local authorities. These hubs often serve as incubators for social entrepreneurship and food tech adaptation, offering tailored support for cooperative formation and product innovation [16].

Across the region, three recurring features underpin success:

- Simplified legal pathways for cooperative registration and operation, aligned with tax incentives and clear governance rules.
- Integrated development strategies that embed food security within broader rural policy, avoiding siloed interventions.
- Multi-level stakeholder engagement, combining top-down support (e.g., funding, training) with bottom-up ownership and contextual flexibility.

For Ukraine, this experience highlights the importance of designing hybrid governance models ones that empower local actors while providing the institutional scaffolding necessary for scale, quality assurance, and cross-regional coordination. In the context of war recovery, such models must also be conflict-sensitive and inclusive, ensuring access for marginalized groups and war-affected communities [17].

By strategically adapting and localizing CEE practices, Ukraine has the opportunity to leapfrog outdated models and construct a resilient, innovative, and community-driven agro-food system capable not only of withstanding future shocks, but also of competing in regional and global markets [18].

These countries invested in:

- simplified cooperative registration processes
- digital platforms for producer-consumer matching
- multi-stakeholder governance councils at regional levels
- integration of food systems planning into rural development strategies

For Ukraine, adapting such tools within its post-war recovery framework may unlock new opportunities for rural development, social cohesion, and export diversification. A hybrid model of smart decentralization, anchored in both local autonomy and national coordination, may offer the most viable path forward for a resilient food system in a time of ongoing conflict and reconstruction [19].

Conclusions. The war in Ukraine has laid bare the deep structural vulnerabilities and over-centralization of the national food system. Disruptions in logistics corridors, contamination of arable land, collapse of procurement chains, and widespread institutional disorientation have not only destabilized agricultural production but also challenged the very foundations of food

governance. Yet amidst this devastation, new architectures of resilience have emerged built not by decree, but through community will, solidarity, and local innovation.

This study reveals that local cooperation rooted in Ukraine's historical legacy of rural self-organization and reignited under conditions of existential threat has become a vital mechanism of adaptive resilience. Across frontline, rural, and urban territories, citizens have formed cooperative alliances, launched grassroots food networks, and turned private plots and city parks into life-sustaining gardens. These decentralized systems, often improvised and operating outside formal institutional frameworks, have filled critical gaps left by the weakened state, offering not only food security but emotional anchoring, psychological rehabilitation, and community renewal.

Notably, initiatives such as inclusive urban gardens in Uzhhorod and Poltava, IDP-led vegetable farms in Lviv, and Telegram-based logistics bots in Khmelnytsky region demonstrate the power of digital tools and social trust to create agile, transparent, and citizen-driven infrastructures. However, these successes remain fragmented and vulnerable to dissipation unless integrated into broader recovery strategies.

The transformational potential of these bottom-up responses is currently constrained by systemic barriers: outdated regulatory frameworks, fragmented institutional mandates, lack of localized funding tools, insufficient legal protection for cooperatives, and a general mistrust toward governmental actors. Without purposeful support, these community-driven solutions risk remaining isolated experiments rather than becoming the foundation for a new food system paradigm.

The post-war recovery period offers Ukraine a rare and generative policy window not just to rebuild, but to redesign. Learning from both internal experience and the trajectories of CEE countries, it becomes clear that community cooperation does not scale spontaneously. It requires enabling ecosystems: simplified legislation, institutional support scaffolding, interoperable digital platforms, financial facilitation, and investment in local leadership and civic capacity.

In this light, local cooperation must be recognized not as an emergency workaround, but as a strategic pillar of Ukraine's long-term food security and regional development. Building a hybrid food governance architecture where state priorities align with community capacities, and analog traditions converge with digital tools will allow Ukraine to leapfrog outdated development models and build a truly resilient, inclusive, and sovereign food system.

Ultimately, the wartime crisis may become the genesis of systemic transformation: from fragmented survival strategies to participatory governance rooted in cooperation, care, and collective agency. What has begun as necessity may endure as vision where food is not just a commodity, but a shared civic responsibility, and cooperation is no longer a memory of the past, but a foundation of the future.

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