



Ministry of Foreign Affairs

# ***Market report on Needs Assessment Protected Crop in Ukraine***

International opportunities for Dutch SMEs

*Commissioned by the Netherlands Enterprise Agency (RVO)*

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# Summary

## Summary of the needs of the Ukrainian protected cultivation sector

Ukraine's protected cultivation sector is operating in a high-risk, rapidly evolving environment shaped by wartime disruption, energy volatility, and constrained investment capacity. At the same time, the sector remains critical for domestic supply of fresh produce, income generation in rural areas, and recovery-oriented value chains. This study combines desk research, stakeholder mapping, interviews with Dutch and Ukrainian stakeholders, and two structured surveys (small greenhouse producers and industrial greenhouse complexes) to identify the market baseline, needs, barriers, and practical entry pathways for Dutch companies and programmes.

A central finding is that protected cultivation in Ukraine functions as a two-speed market. Industrial greenhouse complexes are predominantly high-technology operations, often using soilless/hydroponic systems, with higher energy dependence and stronger requirements for integrated solutions, commissioning, and service guarantees. Small producers operate mainly low- and mid-technology greenhouses, are more dispersed and seasonal, and are highly sensitive to affordability and access to practical support. A significant share of the smallholder segment consists of new greenhouses established with grant support, forming a "future-facing" group likely to upgrade automation over time if credible pathways, training, and service ecosystems are in place.

Survey evidence points to an acute need for bundled support rather than stand-alone equipment delivery.

Across both segments, priority needs cluster around:

- energy efficiency and resilience (particularly for high-tech complexes),
- water reliability and fertigation discipline,
- post-harvest handling and cold chain improvements to reduce losses and improve quality consistency,
- skills, advisory services, and commissioning to convert investments into measurable performance. Labour and skills constraints are a growing operational issue, and survey feedback indicates a predominantly female workforce in greenhouse operations in the surveyed cases; this underscores the value of accessible training formats and human-centred mechanisation/automation that improves ergonomics, safety, and usability.

Market entry barriers are significant but manageable with the right delivery model. Key constraints include security and logistics risk, financing gaps, energy price uncertainty, limited local service and spare parts capacity, and the complexity of implementing advanced systems without structured follow-up. These factors make local partnering, commissioning, and after-sales support decisive competitive elements. For smallholders, the most scalable approach is a dealer/distributor model with standardised starter packages delivered alongside short-cycle training and SOPs. For industrial complexes, effective entry is based on direct B2B engagement supported by local service partners, defined SLAs, and performance-oriented optimisation.

The sector currently operates in a largely self-sustaining mode. Although several associations include greenhouse producers among their members, there is no active, dedicated greenhouse association that supports market development and coordinates collective action. Likewise, there is no effective lobbying body representing protected cultivation producers in dialogue with the Ukrainian government or in cooperation with international partners

International donor support remains an important enabler for recovery and adoption. Donor-funded initiatives can reduce affordability barriers and de-risk first deployments when solutions are offered as integrated bundles (technology + installation/commissioning + training/advisory + monitoring). Organic production should be framed realistically: EU-aligned organic rules typically require soil-based production and therefore represent a selective niche for protected cultivation, more feasible for smaller operators. For wider impact across the greenhouse sector, the most scalable pathway is low-input, IPM-first upgrading (biocontrol, monitoring

routines, compliance-ready documentation) that improves resilience and market readiness without requiring full organic conversion, especially for hydroponic high-tech operations.

Based on these findings, Dutch engagement has a clear opportunity to contribute through performance-led upgrading and ecosystem building. Priority pathways include:

1. scalable packages for low-/mid-tech producers (water-smart production modules, basic climate upgrades, post-harvest starter sets) delivered through local channels;
2. efficiency and integration upgrades for high-tech complexes (energy optimisation, climate–fertilisation coordination, post-harvest workflow improvements) delivered with commissioning and service contracts;
3. demonstration and training hubs that validate solutions under Ukrainian conditions and build local technician and advisory capacity. Taken together, these approaches can deliver near-term recovery gains while laying the foundation for sustained modernisation of Ukraine’s greenhouse industry and a stronger platform for Dutch–Ukrainian cooperation in the sector.
4. sharing Dutch knowledge and experience in organising greenhouse producers and stakeholders into cooperatives or structured networks, strengthening collective action, market representation, and dialogue with government and international partners.

Ukraine’s vision for protected cultivation is driven by food security, post-war recovery, and long-term EU integration. While a dedicated greenhouse strategy is still emerging, government policy consistently supports protected cultivation as a way to ensure year-round vegetable supply, reduce import dependence, and increase resilience to climate and external shocks. Current support focuses on rapid deployment of low- and entry-level mid-tech greenhouses, prioritising affordability, speed, and broad participation under current economic and energy constraints.

The longer-term vision is one of incremental modernisation rather than rapid transformation. Government and sector stakeholders recognise the need to gradually upgrade greenhouse systems in areas such as energy efficiency, climate control, input management, and professional operations, increasingly influenced by EU standards and sustainability principles. Producers and local suppliers view current grant-funded projects as stepping stones toward more advanced, efficient, and market-oriented production models.

To support this transition, the report proposes establishing an innovation-driven protected cultivation cluster. This cluster would bridge the gap between baseline expansion and performance-led upgrading by providing demonstration and training hubs, applied advisory and commissioning services, an innovation pipeline for validated solutions, and finance-ready investment packages. The model would serve both smallholders and larger greenhouse complexes through differentiated services, implemented in phased stages from pilots to national scaling.

The Netherlands is well positioned to contribute by focusing on upgrading, system integration, and knowledge transfer rather than basic construction. In the short term, Dutch technologies and expertise can improve performance in existing greenhouses through modular upgrades, energy and water efficiency, monitoring, and training. In the medium term, Dutch engagement becomes increasingly relevant in supporting compliance with evolving EU standards related to sustainability, chemical use, traceability, and resource efficiency. Demonstration-based delivery models and local capacity building are key to maximising impact.

Organic production should be positioned realistically within a broader agenda of climate resilience and resource efficiency. The future vision should distinguish between organic, soil-based protected cultivation—more suitable for smallholders and niche markets—and high-tech, hydroponic greenhouse systems for industrial producers. Demonstration and advisory services can play a central role in validating viable organic protocols as well as efficiency and IPM improvements in high-tech systems, ensuring both tracks contribute to a resilient and modern protected cultivation sector.

**To work effectively under current Ukrainian conditions, capacity-building efforts should rely on practical, repeatable, and scalable delivery methods:**

- Train-the-trainer approaches: develop a strong local base of consultants and technicians who can roll out training widely. This should include upgrading the skills of university lecturers and vocational instructors in modern greenhouse systems and production practices.
- Strengthening universities: help higher education institutions embed contemporary greenhouse technologies into their curricula, expand hands-on training infrastructure (such as laboratories, demonstration greenhouses, and digital learning tools), and produce industry-relevant programmes and teaching materials.
- Producer association development: support the creation or reinforcement of national or regional greenhouse producers' associations that can function as hubs for knowledge sharing, coordinated training, best-practice dissemination, sector representation, and collaboration among growers, academia, technology suppliers, and public authorities.
- Investment-linked advisory support: provide targeted commissioning assistance followed by short, structured advisory periods (typically 3–6 months), particularly for systems involving automation, climate management, and fertigation.
- Field-oriented SOP toolkits: develop practical operating packages—such as checklists, seasonal production plans, and problem-solving guides—adapted to both low-tech and mid/high-tech greenhouse operations.
- Blended support models: combine remote monitoring and online consulting with scheduled on-site visits to allow efficient, cost-effective scaling of advisory services.

**Why demonstration greenhouses are critical for sector progress**

Well-conceived demonstration greenhouses can play a catalytic role in advancing the protected cultivation sector by:

- Lowering adoption risk: growers and investors can directly observe how technologies and practices perform under real Ukrainian conditions, including energy limitations, input availability, and labour constraints.
- Accelerating learning: hands-on trials, combined with clear operating procedures, allow producers to replace costly experimentation with validated production routines.
- Strengthening service networks: demonstration sites can function as practical training hubs for installers, technicians, and advisors, which is essential for scaling solutions beyond isolated pilot projects.
- Providing reliable benchmarks: systematically collected data on yields, energy consumption, water use, and product quality creates credible evidence for financial institutions, donors, and policymakers.

**Priority focus areas for demonstration initiatives**

To remain effective and relevant, demonstration projects should concentrate on a limited set of high-impact themes aligned with the sector's most pressing needs:

**A) Small-scale and low-tech greenhouse producers**

- Season extension and basic resilience solutions: simple heating options, energy back-up measures, and improved water security.
- Efficient water use: robust irrigation systems, basic fertigation practices, and labour-efficient operating routines.
- Foundational post-harvest handling: cost-effective cold storage, packing, and handling practices that minimise losses.
- Low-input transition practices: introductory IPM and biocontrol approaches that reduce chemical use while maintaining acceptable yields.

**B) Industrial and mid-high tech greenhouse operations**

- Energy optimisation and efficiency: retrofitting, performance monitoring, system fine-tuning, and targeted operational coaching.

- Integrated system management: coordination of climate, irrigation, and lighting systems supported by structured commissioning protocols.
- Post-harvest performance improvements: workflow optimisation, stepwise mechanisation, and improved consistency of product quality.
- Nursery and biosecurity management: protocols for crop uniformity, hygiene, traceability, and diversification through applied trials.

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# 1 Introduction

Protected cultivation plays a **strategic role in rebuilding** Ukraine's agricultural sector, which has suffered severe disruptions due to the war, because it underpins domestic fresh produce supply, supports rural economic stability, and accelerates the restoration of agri-food value chains. Large areas of open-field vegetable production have been damaged or become inaccessible, supply chains have been broken, and storage and processing facilities have been destroyed. The situation is further aggravated by growing water challenges: pollution from military activity, disruption of irrigation systems, and the catastrophic consequences of the Kakhovka dam destruction, which caused long-term water shortages and contamination in several regions. In some areas, open-field cultivation may no longer be viable due to depleted water resources and soil degradation.

In this context, greenhouses provide a reliable way to restore production quickly, regardless of season, climate fluctuations, or regional security conditions. They also allow for controlled and efficient use of water—an increasingly **critical factor for Ukraine's food system under current pressure**.

Modern protected cultivation optimizes land, water, and energy use, helping ensure stable supplies of fresh vegetables for local markets, strengthening food security, and reducing dependence on imports at a time when logistics remain unpredictable.

Dutch greenhouse technology will play crucial role in Ukrainian sector rebuilding as the sector requires more than simply replacing damaged facilities. Growers need updated technologies, automation, skilled personnel, starting materials such as seeds and young plants, and accessible financial instruments to restart production.

It enables the country to rebuild in a more resilient, resource-efficient way and to align its agricultural development with European standards and future market demands.

## 1.1 Purpose and objectives of the study

Ukraine and the Netherlands have a long-standing cooperation in the agri-food sector, with a particular focus on horticulture, innovation, and knowledge transfer. The Netherlands is globally recognised as a leader in protected cultivation technologies, seed development, greenhouse construction, and integrated value chain solutions. Ukrainian–Dutch cooperation has historically included trade in agricultural inputs, technical assistance projects, capacity-building programmes, and public–private partnerships supported by the Dutch government, RVO, and the Embassy of the Kingdom of the Netherlands in Ukraine.

In recent years, this cooperation has increasingly shifted from pure trade relations towards development-oriented and resilience-focused engagement, including support for modernisation, sustainability, and institutional strengthening. Against the backdrop of Ukraine's EU integration trajectory and post-war recovery agenda, protected cultivation has emerged as a natural area for deepening cooperation, combining Dutch technological expertise with Ukraine's agricultural potential and market demand.

This study focuses on identifying where Ukrainian demand aligns with Dutch capabilities, ensuring that future cooperation delivers practical value for Ukraine while creating mutually beneficial opportunities for the Netherlands.

The study seeks to pinpoint where cooperation between the Netherlands and Ukraine can be most effective in the field of protected cultivation. To do this, it carries out a broad market exploration focused on Ukraine's horticultural recovery and future development. It identifies business opportunities that match Dutch

strengths—from greenhouse technologies across all tech levels to supply chain improvements, starting materials, and training or knowledge-transfer initiatives.

The research also reviews the regulatory environment governing greenhouse development in Ukraine, including construction permits, operational requirements, customs rules, import procedures, and incentives or constraints that may influence foreign participation.

Additionally, the study will assess the impact of the ongoing war on the sector and identify areas where Dutch expertise and technology can contribute to rebuilding. The goal is to support the development of a resilient greenhouse sector based on the principles of “Build Back Better.”

A detailed needs assessment is conducted among Ukrainian stakeholders to understand their priorities in technology, education, storage infrastructure, and access to seeds and planting materials. Alongside this, the study maps relevant public and private actors—government bodies, research institutions, associations, companies, and NGOs—to identify where partnerships, joint ventures, or pilot projects could be developed.

Potential challenges are examined as well, including war-related risks, financing obstacles, supply chain vulnerabilities, and logistical limitations. The study proposes strategies to reduce these risks and support informed decision-making.

Finally, the **research aims to encourage dialogue with Ukrainian authorities to shape a shared vision for the sector and formulates concrete recommendations for Dutch organizations.** These include guidance on market entry, collaboration models, and steps for building a coordinated ecosystem to support the sustainable growth of protected cultivation in Ukraine.

## 1.2 Methodology

Our research combined multiple methods to provide a comprehensive picture of Ukraine’s protected cultivation sector. We conducted extensive desk research and carried out interviews with greenhouse producers across all technology levels—high-, mid-, and low-tech—and of varying sizes, from small farms to large commercial operations. These interviews covered different regions of Ukraine, each experiencing distinct levels of impact from the war. The study also included producers growing a wide range of crops, including vegetables, flowers, leafy greens, and berries.

In addition, the analysis draws on data from two structured survey samples conducted in 2025: small greenhouse producers (n=50) and industrial greenhouse complexes (n=11).

Overall, the methodology consisted of:

- desk research including permits, custom procedure, laws, grants and subsidy programs etc.
- price analysis of cultivated crops
- stakeholder mapping
- stakeholder interviews:
  - greenhouse owners and greenhouse employees (agronomist, engineers)
  - suppliers of greenhouse equipment (greenhouse builders, seeds companies, young plant suppliers etc.)
  - associations related to greenhouse industry
  - educational institutions and training centres
  - others.

## 1.3 Research limitation

The findings of this study should be viewed in light of several limitations.

First, the ongoing war created constraints on data availability and access. In some regions, up-to-date statistics, production figures, and infrastructure assessments are incomplete, inconsistent, or not publicly reported. This reduces the ability to compare regions with high accuracy.

Second, field visits were not possible in all areas due to security risks. As a result, some insights rely on interviews rather than on-site observation, which may introduce subjective perspectives from respondents.

Third, the greenhouse sector in Ukraine is highly diverse—technologically, geographically, and by crop specialization. While the study includes interviews with a broad range of producers (low-, mid-, and high-tech; small and large; different crops and regions), it cannot capture the full variation within the sector.

Fourth, economic conditions in Ukraine are rapidly changing due to the war, fluctuations in energy prices, and shifting logistics. This means that cost estimates, market opportunities, and investment conditions may evolve quickly, potentially making some findings time-sensitive.

Fifth, access to financial data from private companies was limited. Some respondents were reluctant to share information on profitability, production volumes, or losses, which restricts the depth of quantitative analysis.

Lastly, although stakeholder mapping is comprehensive, it may not include newly created organizations, emerging initiatives, or informal market actors who play a role in sector recovery.

# 2 Background & Context

## 2.1 Agricultural context of Ukraine

Agriculture remains a strategic pillar of the Ukrainian economy, contributing significantly to GDP, employment, and export revenues. Despite severe disruptions caused by Russia's full-scale invasion, the sector has demonstrated a high degree of resilience and adaptability. However, this resilience has been uneven across subsectors.

While large-scale grain and oilseed production has partially recovered due to scale, logistics adaptation, and export corridors, horticulture and greenhouse production have proven more vulnerable. These segments are characterised by higher capital intensity, energy dependence, labour intensity, and sensitivity to supply chain disruptions. As a result, the protected cultivation sector has experienced a sharper contraction compared to many other agricultural segments.

At the same time, domestic demand for fresh vegetables has remained relatively stable, driven by population needs, internal displacement, and limited substitution options. This mismatch between demand stability and declining domestic supply has increased reliance on imports and exposed structural weaknesses in the sector. Russia's full-scale aggression against Ukraine has severely disrupted and damaged the country's irrigation systems, water supply infrastructure, sanitation networks, and aquatic ecosystems.

### General climate information

To understand the needs of greenhouse businesses in Ukraine, it is essential to examine the country's climate conditions, including solar potential, water availability, and irrigation infrastructure. While it may seem that water and irrigation issues are less relevant—since many greenhouses rely on private drilling systems—it is important to recognize that these challenges are increasingly significant. The potential of greenhouse businesses has grown, particularly as access to clean water is affected by pollution and damage to public irrigation systems.

Most of the territory of Ukraine lies in the moderate continental climate zone, with four clearly distinguishable seasons. This applies to the western (except the Carpathian mountain range), central and northern parts of the country. The southern and eastern regions have a continental climate with hot summers and less precipitation (especially in the south). From the northwest to the southeast, the climate gradually takes on a continental character, the temperature difference between winter and summer increases and the amount of precipitation decreases. Only a narrow strip of the southern coast of Crimea occupied by Russians lies in the subtropical Mediterranean zone.

The climatic conditions of Ukraine determine its division into vegetation zones. In the area with a moderate continental climate there are zones of mixed forests and wooded steppe. The continental zone is dominated by the steppe. In the south-western region of the country and in the southern part of Crimea there are mountain areas.<sup>1</sup>

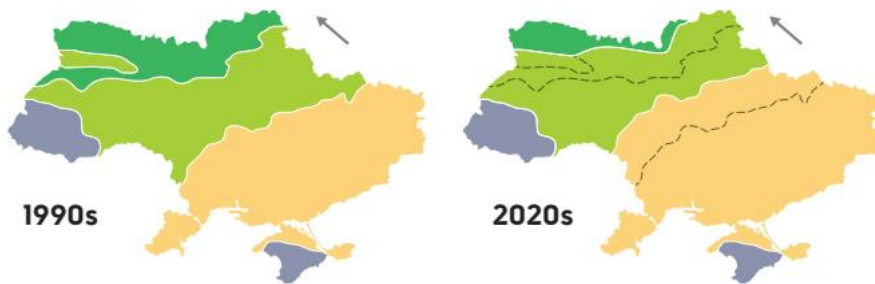
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<sup>1</sup> The breadbasket of the world? | OSW Centre for Eastern Studies 2021.

**Figure 1** Shift of natural zones in Ukraine

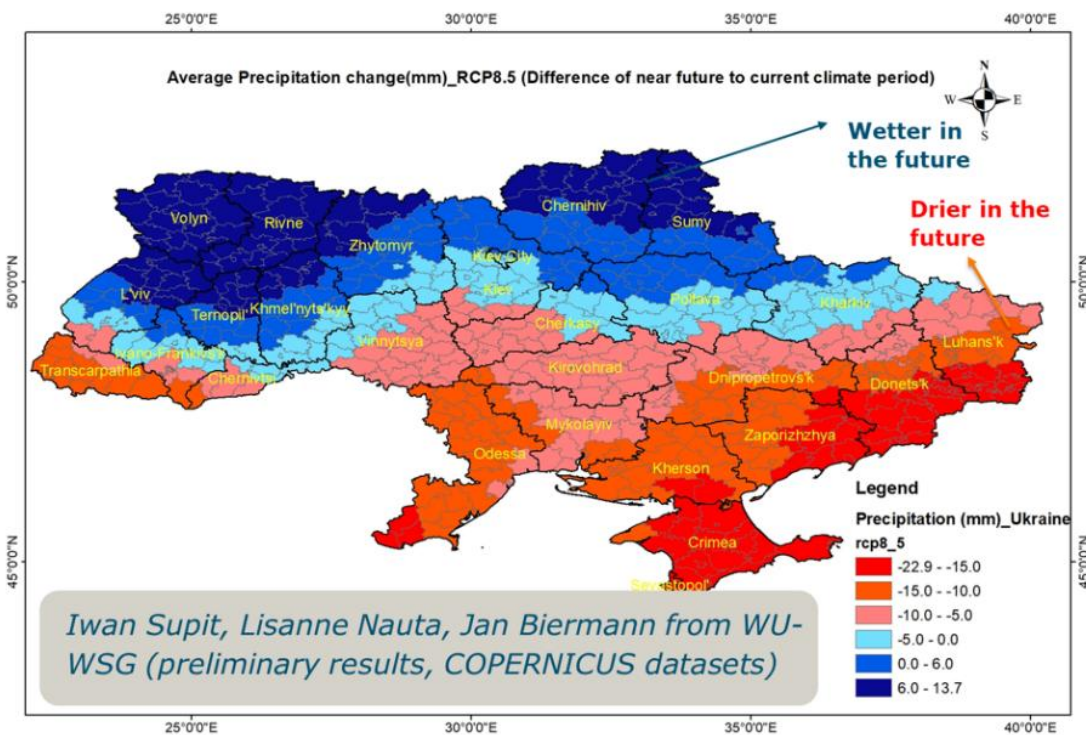
### Shift of natural zones

● Mountains ● Mixed forests ● Forest steppe ● Steppe



Source: Infographic report, *Agribusiness of Ukraine* (Latifundist, 2025)

**Figure** Climate change map of Ukraine



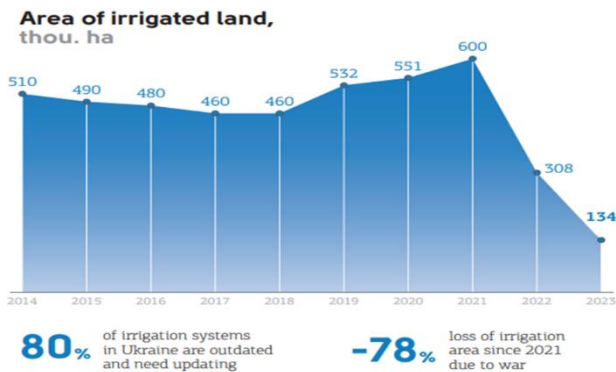
Source: WUR research

### Irrigation

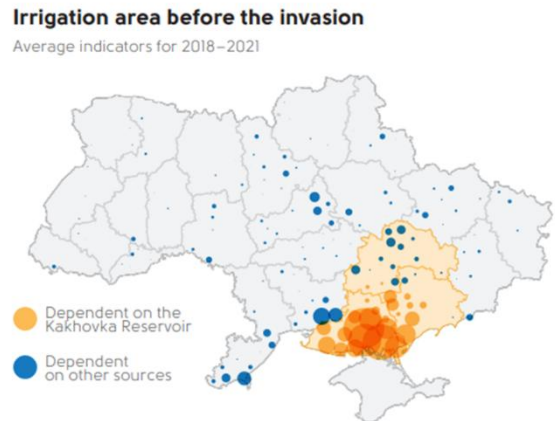
“Before the war, agriculture accounted for a significant share of Ukraine's GDP (10%) and exports (41%). Although irrigation is used on only 1% of all agricultural land, it is vital for crops such as potatoes, tomatoes and rice. Drainage systems, which provide usable pasture and forage land, covered 10% of agricultural land and significantly increase the country's production capacity for cereals and beef.”<sup>2</sup>

<sup>2</sup> [The toll of two years of war on water: Damage and needs assessment in Ukraine's water sector,2024](#)

**Figure** Area of irrigated land



**Figure** Pre-war irrigation area

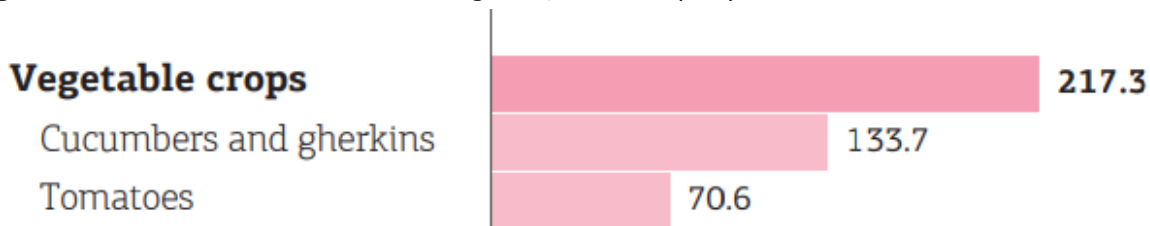


Source: Infographic report *Agribusiness in Ukraine 2023/2024*

A 2023 report prepared jointly by the World Bank, the Government of Ukraine, the European Commission, and the United Nations—with support from additional partners—concluded that restoring Ukraine’s irrigation systems after just two years of war will require approximately ten years of reconstruction work. The continuing escalation of Russia’s aggression is expected to extend this timeline significantly. The full report is available for download at the link below.

[Ukraine - Third Rapid Damage and Needs Assessment \(RDNA3\) : February 2022 - December 2023 \(English\)](#)

**Figure** Losses due to the cessation of irrigation, USD mln per year



Source: Infographic report *Agribusiness in Ukraine 2023/2024*

The table above shows annual losses due to the cessation of irrigation for vegetable crops, measured in USD million per year. Overall losses for vegetable crops amount to **USD 217.3 million annually**. The largest share of these losses comes from **cucumbers and gherkins**, at **USD 133.7 million per year**, followed by **tomatoes**, which account for **USD 70.6 million per year**. This highlights the particularly high dependence of these crops on irrigation and the significant economic impact of irrigation disruptions.

## 2.2 Ukrainian Land Bank

An overview of the Ukrainian greenhouse sector must take into account the landmark legislation adopted in March 2020 that opens the country’s agricultural land market. The reform, which began its partial implementation in mid-2021 and will become fully operational in 2024, enables the free and lawful sale of agricultural land for the first time in the history of independent Ukraine. This transformation is expected to bring significant and lasting impacts not only on the agricultural sector but also on the wider national economy.

Agri -companies are very fragmented, with the vast majority leasing land of less than 100 ha. The largest players (above 3,000 ha) constitute about 1% of all companies operating in the agri -food sector and produce more than 20% of cereals and oilseeds. The most important position, however, is held by medium - sized companies with an acreage of 200–2000 ha. There are about 6,000 of them and, depending on the

species cultivated, they are responsible for cultivating 50–75% of the land tilled by the companies.

Implemented by the State Property Fund of Ukraine, the Land Bank project seeks to create an open and competitive market for state agricultural land using online auction mechanisms. It creates a transparent market for leasing state agricultural lands through online auctions on Prozorro.Sales

**As of December 2025, about 806,000 ha of state-owned land remain available.**

An overview of the Ukrainian greenhouse sector must consider the landmark legislation adopted in March 2020 that opens the country's agricultural land market.

Ukraine's agricultural land market is highly fragmented, with most farms leasing under 100 ha, while medium-sized farms (200–2,000 ha) manage most cultivated land. Land purchases are concentrated in central regions, with pre-frontline areas limited by security risks.

Additional information on the Ukrainian Land Bank can be found in Appendix 1 (Land Bank).

You can find more information on [Land Bank](#)

### What is the cost of leased land in Ukraine?

The initial (minimum) lease rate is set at no less than 12% of the normative monetary valuation of the land. In practice, this means that starting rental prices typically range between UAH 3,000 and 4,000 (~€61–€82), per hectare per year depending on the region.

The final lease price is established through competitive bidding on the Prozorro.Sale platform, following the principle that the highest bid determines the outcome.

According to data from Prozorro.Sale, lease rates for agricultural land can reach UAH 30,000–40,000 (€ 600–800) per hectare per year. Final prices vary significantly based on factors such as soil quality, geographic location, accessibility, and overall market demand.

### What is the cost of purchasing land in Ukraine?

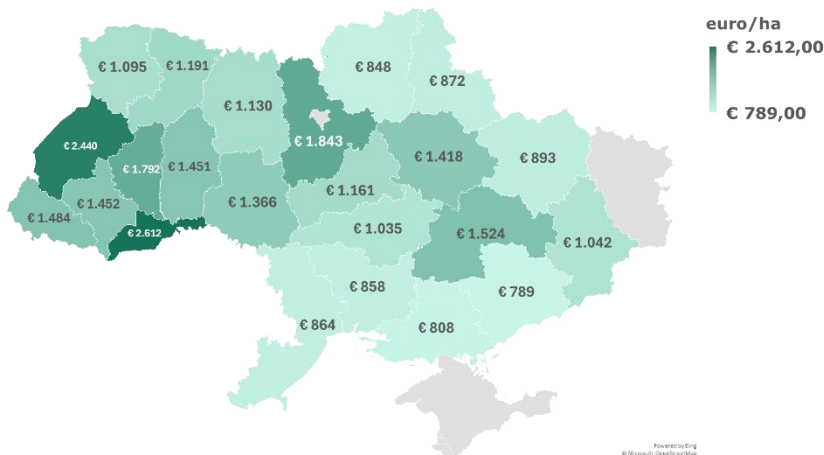
As of 1 July 2025, agricultural land prices in Ukraine vary significantly by region. The highest average price is recorded in the Ivano-Frankivsk region, where farmland costs about €2,612 per hectare. Other high-value regions include Lviv at approximately €2,440/ha, Kyiv at €1,843/ha, and Ternopil at around €1,792/ha.

Among regions closer to the frontline, Dnipropetrovsk oblast stands out with the highest average price, reaching roughly €1,524 per hectare.

In contrast, the most affordable agricultural land is concentrated in other frontline regions. Average prices range from about €790/ha in Zaporizhzhia to €810/ha in Kherson, while Chernihiv (€850/ha), Mykolaiv (€860/ha), and Odesa (€865/ha) also remain at the lower end of the national price spectrum.

This year, agricultural land purchases were most concentrated in a few key regions, with Poltava and Vinnytsia oblasts each recording about 5.4 thousand transactions, followed by the Kyiv region with approximately 4.7 thousand deals.

**Figure** Average cost of agricultural land per 01.07.2025



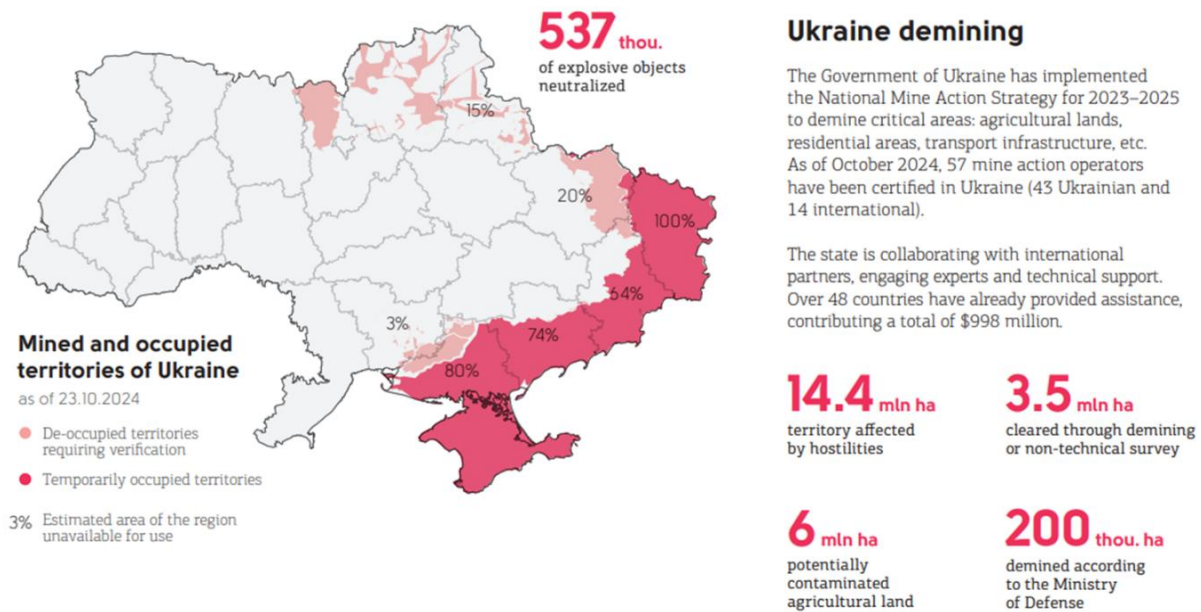
Source: Original map of Ukraine’s regions with average cost in UAH from <https://opendatabot.ua/en/analytcs/land-2025>, adapted for own use in euros.

### 2.3 Demining Ukraine

The image below presents an overview of mined and occupied territories of Ukraine as of October 23, 2024, alongside key figures on national demining efforts. It shows that **14.4 million hectares** of territory have been affected by hostilities, including **6 million hectares of potentially contaminated agricultural land**, while only **3.5 million hectares** have been cleared through demining or non-technical surveys so far. The map highlights heavily affected eastern and southern regions, many of which remain temporarily occupied, and notes that **537,000 explosive objects** have been neutralized, with international partners contributing nearly **USD 1 billion** to Ukraine’s demining efforts.

The widespread mining and explosive contamination of agricultural land in Ukraine will eventually stimulate the development of greenhouse production. As large areas of open-field farmland become unsafe or unavailable for use, producers will increasingly seek alternatives that allow cultivation on smaller, verified, and secure plots of land. Greenhouses offer a practical solution by enabling intensive, high-yield production independent of large land areas and lengthy demining processes. In addition, protected cultivation allows for efficient use of water and inputs, which is particularly important in regions where irrigation systems have been damaged. Under these conditions, land scarcity caused by mining is likely to accelerate the shift toward greenhouse technologies as a key component of a more resilient and modern agricultural system in Ukraine.

**Figure** Demining land in Ukraine as of 23.10.2024



Source: Infographic report *Agribusiness in Ukraine 2023/2024*

## 2.4 Sun and solar energy possibilities

Ukraine’s Energy Strategy up to 2050 aims to support sustainable national economic development by ensuring access to reliable, resilient, and modern energy sources. By 2050, the sector seeks to achieve near climate neutrality, with clean energy availability, reduced energy poverty, an innovative and decentralized system, fully functioning national energy markets, and integration into international markets.

The strategy is guided by principles of economic viability, environmental sustainability, accessibility, social equity, and market orientation, aligning with Ukraine’s National Economic Strategy (2030) and international commitments, including the EU-Ukraine Association Agreement and the Paris Climate Agreement.

Key goals of Ukraine’s Energy Strategy up to 2050 include:

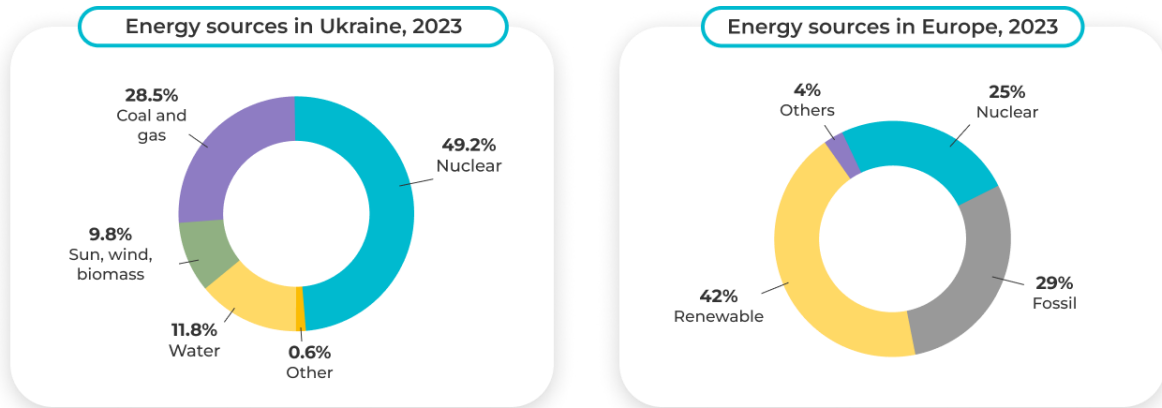
- Achieving maximum climate neutrality and reducing coal use
- Modernizing energy infrastructure and improving resource efficiency
- Integrating with EU markets while ensuring effective internal operations
- Promoting domestic energy resources, alternative energy, and innovative solutions

### Ukraine’s annual solar energy volume is higher than that of Germany

Solar energy in Ukraine is still in its early stages but has significant potential. Ukraine’s annual solar energy volume is higher than that of Germany, one of the industry leaders. From 2018 to 2020, solar energy capacity increased nearly fivefold. As of 2024, solar power plants account for about 75% of “green” energy production in Ukraine (excluding large hydropower plants). There are currently around 1,400 solar generation facilities of various capacities in the country, owned by 931 licensees, according to the NERC registry as of April 24, 2024.

**Solar insolation in Ukraine ranges from 1100 to 1500 kWh/m<sup>2</sup>, making the entire country suitable for solar power plant deployment.** The southern regions of the country are optimal for operation. Approximately half of all solar power plants are concentrated in six regions: Ivano-Frankivsk, Dnipropetrovsk, Vinnytsia, Khmelnytskyi, Kyiv, and Mykolaiv. The least number of plants are in Luhansk, Donetsk, Sumy, and Poltava regions. Over two years of war, about 13% of industrial solar power plants were destroyed or damaged, and these capacities need to be restored as soon as possible.”<sup>3</sup>

**Figure 2** Energy sources in UA and EU 2023



Source: <https://ukraineinvest.gov.ua/en/industries/energy/renewable-energy/>

You can find more information about all others renewable energy in Ukraine via link : <https://ukraineinvest.gov.ua/en/industries/energy/renewable-energy/>

The State Agency on Energy Efficiency and Energy Saving of Ukraine is the central executive authority tasked with developing and implementing a coherent national policy on energy efficiency, energy conservation, and the use of alternative fuels. Its mission is to advance Ukraine’s energy transformation by promoting decarbonization and a green transition in line with European policy principles and standards.

**Renewable Energy**

The Institute of Renewable Energy of the National Academy of Sciences of Ukraine estimates that the combined capacity potential of all renewable energy sources in the country is approximately 874 GW.

**According to the Energy Strategy of Ukraine, the plan is to build 94 GW of solar power stations by 2050.**

<sup>3</sup> <https://ukraineinvest.gov.ua/en/industries/energy/renewable-energy/>

**Figure 3** Solar Energy



Source: <https://www.aseu.solar/en/about-6>

The Solar Energy Association of Ukraine (SEAU) was established on November 30, 2017. It is the country's largest non-profit, non-governmental organization bringing together key stakeholders and participants of Ukraine's solar energy market.

More information is available on the website of the Solar Energy Association of Ukraine (SEAU): <https://www.aseu.solar/en>

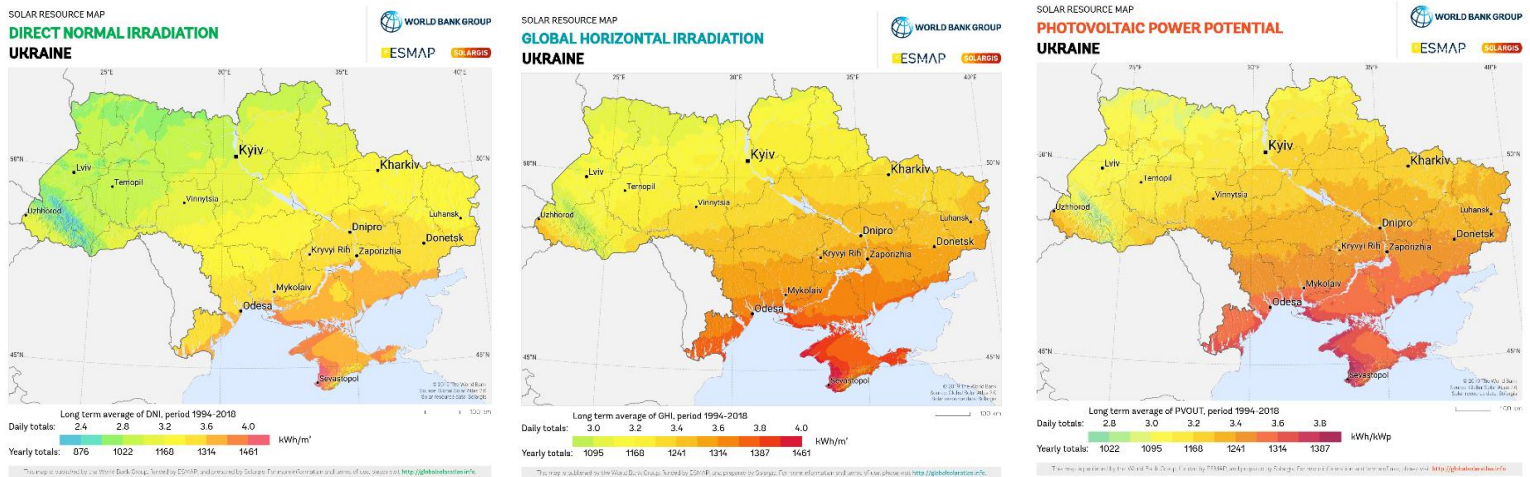
"Overall, about 50% of Ukraine's energy infrastructure has been damaged. The Kyiv School of Economics Research Center estimated the direct damage to Ukraine's energy infrastructure at \$8.8 billion as of June 2023. The situation needs to be considered in a holistic manner, as solar energy is part of the United Energy System of Ukraine.

The war is having a significant negative impact on Ukrainian solar energy. Specifically, 14% of industrial solar power plants (SPPs) have been damaged. Additionally, over 500 MW of installed capacity of SPPs is located in the occupied territories.

These are 62 industrial solar power plants, not counting home solar power plants. Some of these SPPs are forced to operate in parallel with the Russian power grid, i.e. not for Ukraine."<sup>4</sup>

<sup>4</sup> <https://www.aseu.solar/>

**Figure 4** Solar maps of Ukraine



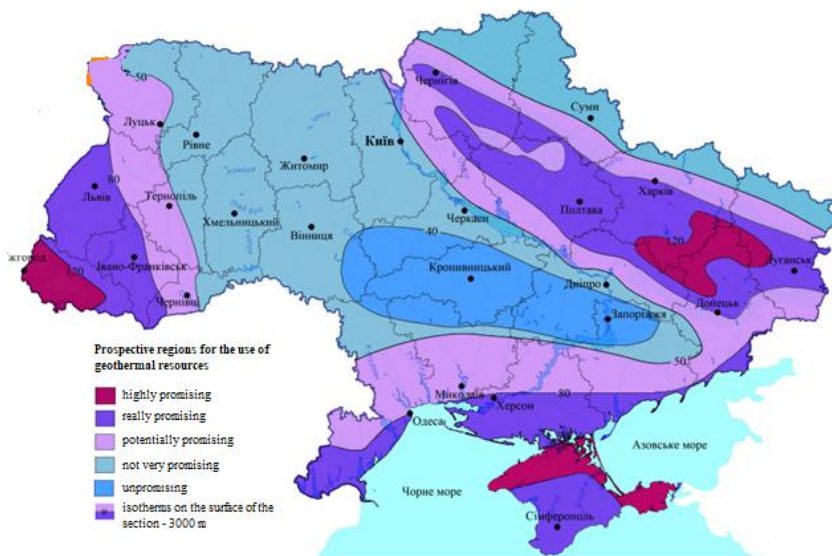
Source: <https://globalsolaratlas.info/download/ukraine>

## 2.5 Geothermal energy possibilities

There is study made in Lviv region by DTESS, TNO, GeoTtermal Ukraine and FoodVentures. (Study on geothermal energy for greenhouse development in Busk, Lviv, Ukraine). It can be requested at RVO.

“Analysis of the distribution of deep heat flux values on the territory of Ukraine, which varies from 40 to over 120 mW/m<sup>2</sup>, allows to identify three main prospective zones, confined to the main oil and gas-bearing regions such as Transcarpathian (west), Steppe Crimea (south) and Dnipro-Donetsk basin (east). The total geothermal potential of Ukraine is estimated at 438\*10<sup>6</sup> kWh p/ year. Annual technically achievable energy potential of geothermal energy in Ukraine is equivalent to 8,4 Mtoe, and its use can save around 10 bcm of natural gas.”<sup>5</sup>

**Figure 6** Prospective regions for the use of geothermal resources in Ukraine



Source: Institute of Renewable Energy at NAS, «Atlas of energy potential of renewable energy in Ukraine»

<sup>5</sup> GEOTHERMAL OVERVIEW OF UKRAINE, Y. V. Demchuk, H. A. Liventseva 2023

More information is available at <https://www.geothermalukraine.org/en/home>. In addition, a relevant publication titled "*Studies Show Large, Untapped Geothermal Potential in Ukraine*" can be found at <https://www.world-energy.org/article/32237.html>.

## 2.5 EU Policy Context: CAP and the European Green Deal

Although Ukraine is not yet a member of the European Union and therefore not a beneficiary of the Common Agricultural Policy (CAP), EU agricultural and environmental policies increasingly shape the external policy context within which Ukraine's agri-food sector, including protected cultivation, is developing. In the context of Ukraine's EU accession path and the EU-Ukraine Association Agreement, these policies function as forward-looking reference frameworks, influencing regulatory alignment, market access conditions, and investment expectations.

The European Green Deal represents the EU's overarching strategy for achieving climate neutrality, sustainable resource use, and environmental protection. In agriculture, it is operationalised through initiatives such as the Farm to Fork Strategy and biodiversity objectives, which aim to reduce pesticide use, improve nutrient management, lower greenhouse gas emissions, and strengthen traceability across food systems. While these policies do not apply directly to Ukraine, they increasingly define the standards and expectations of the EU market, which remains Ukraine's most important trading partner.

Greenhouse production is often perceived as both a risk and an opportunity within sustainability debates: energy use and emissions are scrutinised, while efficient water use, controlled input application, and reduced land pressure are seen as advantages. As Ukraine aligns parts of its sanitary, phytosanitary, and chemical safety legislation with EU standards, the Green Deal serves as an external anchor guiding the direction of regulatory reform, even where implementation remains gradual and selective.

The Common Agricultural Policy (CAP), meanwhile, provides insight into the production models, compliance logic, and support mechanisms that dominate EU agriculture. Although CAP subsidies do not extend to Ukraine, CAP principles—such as environmental conditionality, cross-compliance, and performance-based support—are increasingly relevant as reference points. For Ukrainian producers aiming to access or maintain EU markets, alignment with CAP-related standards in areas such as pesticide use, environmental performance, and documentation is becoming a de facto requirement.

Taken together, the Green Deal and CAP do not function as immediate constraints on Ukraine's protected cultivation sector. Rather, they shape the future competitive environment by signalling which production models are likely to remain viable and attractive for the EU market in the medium to long term. For Ukraine, this implies a gradual shift toward more resource-efficient, compliant, and traceable production systems. For foreign partners, including Dutch companies, it reinforces the relevance of technologies and services that support sustainability, compliance, and performance optimisation in protected cultivation.

## 2.6 "Build Back Better" Principles and Relevance for Protected Cultivation

Ukraine's recovery strategy increasingly emphasises the "Build Back Better" principle, aiming not only to restore pre-war capacities but to modernise and structurally transform key economic sectors. In this context, protected cultivation represents a strategic opportunity to rebuild the horticultural sector on a more resilient, energy-efficient, and climate-adaptive foundation.

Rather than replicating outdated or energy-intensive greenhouse models, reconstruction efforts provide a

window of opportunity to introduce modern technologies, modular designs, improved climate control, water-saving systems, and digital solutions. Protected cultivation aligns closely with broader recovery priorities, including food security, import substitution, regional economic revitalisation, and alignment with EU environmental and safety standards.

For international partners, and particularly for the Netherlands, this creates a clear entry point to support Ukraine's recovery through technology transfer, demonstration projects, capacity building, and public-private cooperation, rather than short-term commercial engagement alone.

## 2.7 Role of Organic Production In Ukraine's Agricultural Recovery

Organic production can play a meaningful role in Ukraine's agricultural recovery as part of a broader transition toward sustainability, environmental resilience and EU-oriented market practices. In the recovery context, organic should not be viewed only as a niche premium label, but also as a framework that strengthens resource stewardship, food safety routines and credibility in export-facing value chains. At the same time, the practical relevance of organic differs across producer types and production systems, which is particularly important for protected cultivation.

Organic production aligns with several recovery priorities:

- Sustainability and environmental resilience: organic systems promote soil health, biodiversity and improved nutrient cycling, which can increase resilience to climate variability and reduce long-term degradation risks.
- EU market access and regulatory convergence: organic certification and compliance-ready documentation can support credibility in EU-oriented supply chains and reinforce gradual alignment with EU requirements for traceability and food safety.
- Value chain rebuilding: for certain regions and producer groups, organic can support market differentiation and stabilise incomes through access to premium domestic channels and specialised buyers.

### Relevance for small and medium growers

For small and medium producers, organic and low-input models can be relevant in two complementary ways:

1. Organic as a selective, soil-based niche (more feasible for smaller operators)

In protected cultivation, organic production is typically linked to soil-based systems (rather than hydroponic growing). This makes organic more applicable to smaller greenhouse operators who can manage soil-based production and target premium local/regional channels. Key needs include advisory support, input selection guidance, hygiene and biosecurity routines, and documentation tools for audit readiness.

2. Low-input / IPM-first upgrading as a scalable pathway (relevant across most greenhouse operations)

Even when full organic certification is not feasible—especially for industrial greenhouse complexes that often use hydroponic/soilless systems—producers can still move toward recovery-aligned outcomes through low-input, low-residue and IPM-based practices.

In this sense, organic and low-input models can contribute to Ukraine's recovery both by enabling niche EU-oriented market differentiation and by supporting a wider shift toward resilient, resource-efficient production practices across the agricultural sector.

## 3 Greenhouse Sector in Ukraine

The full-scale war has had a profound and multidimensional impact on Ukraine's greenhouse sectors. Direct physical damage to greenhouse infrastructure, occupation of key production regions, destruction of energy and water systems have significantly reduced production capacity.

The current state of the covered cultivation sector is shaped by high and volatile energy costs, disrupted logistics and input supply, shortages of skilled labour due to mobilization and migration, persistent geopolitical uncertainty, and strong import competition, particularly from Turkey. In response, the sector is undergoing a process of adaptation marked by declining production volumes, geographic shifts, and structural changes among producers and market participants. While overall vegetable demand has remained relatively stable, it is increasingly satisfied by imports because of reduced domestic supply, higher prices, and lower market predictability. Future recovery and development will depend on improvements in security, energy availability, logistics, access to quality inputs, and the restoration of confidence among producers as well as domestic and foreign investors.

Prior to 2014, traditional cultivation centres were concentrated in east and south of Ukraine (Zaporizhzhia, Kherson, and Kharkiv regions), largely due to their export orientation toward Russia. Following occupation, heightened security risks, and logistical disruptions, many greenhouse enterprises in these areas were forced to suspend operations or relocate to central and western regions. Although some producers resumed activity within one or two seasons, relocation typically resulted in reduced capacity, smaller-scale and lower-technology solutions, and lower overall output. Consequently, production gradually shifted to central and western regions, including Kyiv, Cherkasy, Ternopil, and Zakarpattia, where new conditions emerged for relocated enterprises and household farms.

The covered cultivation vegetable segment has undergone significant quantitative transformation. According to APK Inform, between 2020 and 2023 production declined from 526 thousand tons to 258 thousand tons (approximately 50%), while production areas decreased from 7.07 thousand hectares to 4.4 thousand hectares (a reduction of about 37%). This decline was gradual but accelerated sharply after 2022 due to intensified military actions and the energy crisis.

Beyond physical losses, the war has acted as a systemic shock, amplifying long-standing structural challenges such as rising energy costs, outdated infrastructure, and limited access to finance. Energy price volatility and supply instability have become among the most critical constraints for greenhouse production. Combined with labour shortages and persistent logistical disruptions affecting both inputs and distribution, these factors have significantly undermined profitability and investment attractiveness.

Until 2022, the sector relied on a combination of large industrial greenhouse complexes and numerous small producers and household farms. While output has declined across both segments, the role of household farms has become less visible in the overall production structure.

Cucumbers and tomatoes continue to dominate production volumes, with their shares remaining relatively stable. In contrast, the cultivation of other crops—including early vegetables, leafy greens, and berries—has declined sharply, falling from 38.58 thousand tons in 2020 to just 9.06 thousand tons in 2023.

Since 2022, the war and the partial occupation of Zaporizhzhia and Kherson regions have led to a decline in both production volumes and cultivated areas of greenhouse vegetables and fruits. However, the market is not currently experiencing acute shortages of greenhouse products, as demand has declined in parallel with production due to a reduction in the number of consumers.

Industrial greenhouse complexes typically operate in two production cycles—spring and autumn—while winter production has become increasingly unprofitable. This is primarily due to rising energy costs and strong competition from cheaper imported products, mainly from Turkey, which are difficult to match on price. As a result, many domestic greenhouse operators limit market participation to the spring season. You can find trade analytics in Appendixes below.

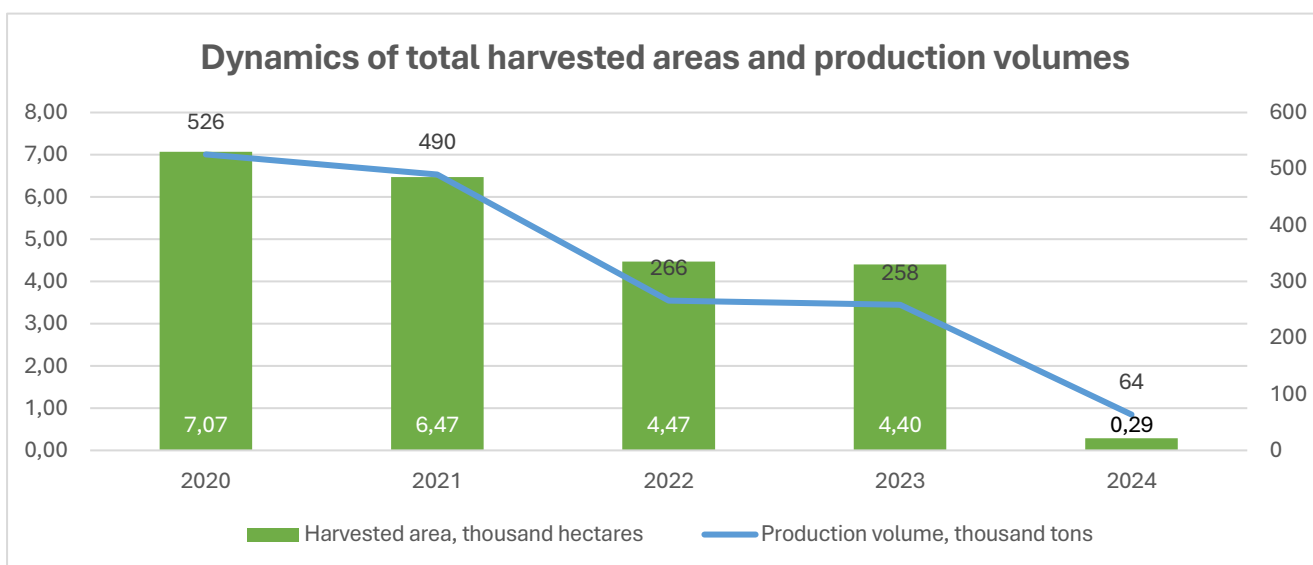
At the same time, large supermarket chains continue to prioritize cooperation with stationary greenhouse complexes, as they are able to provide certified products and stable supply conditions.

### 3.1 Production areas and volumes

#### 3.1.1 Dynamics of production areas and volumes

According to APK Inform between 2020 and 2024, Ukraine’s protected cultivation sector experienced a sharp decline in both cultivated area and production volumes. According to the data, the total harvested area fell from 7.07 thousand hectares in 2020 to 4.40 thousand hectares in 2023, while production volumes dropped from 526 thousand tons to 258 thousand tons.

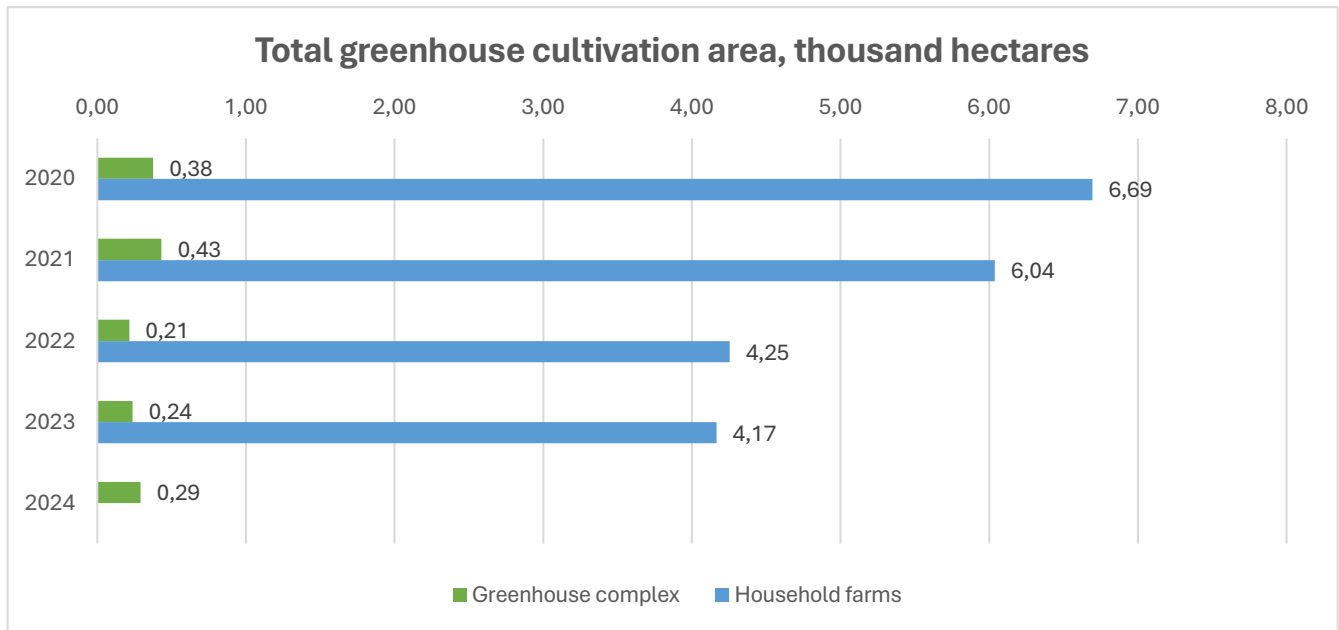
**Figure** Dynamics of total harvested areas and production volumes



Source: APK-Inform

An analysis of cultivated area and production structure shows that output from household farms continues to dominate over that of agricultural enterprises. In 2024, households accounted for approximately 4.17 thousand hectares out of a total 4.46 thousand hectares of protected cultivation. Without household data included in the 2024 statistics, total gross production would have declined by nearly 75%. Overall, throughout the analysed period, the share of industrial-scale cultivation in the market structure remained limited.

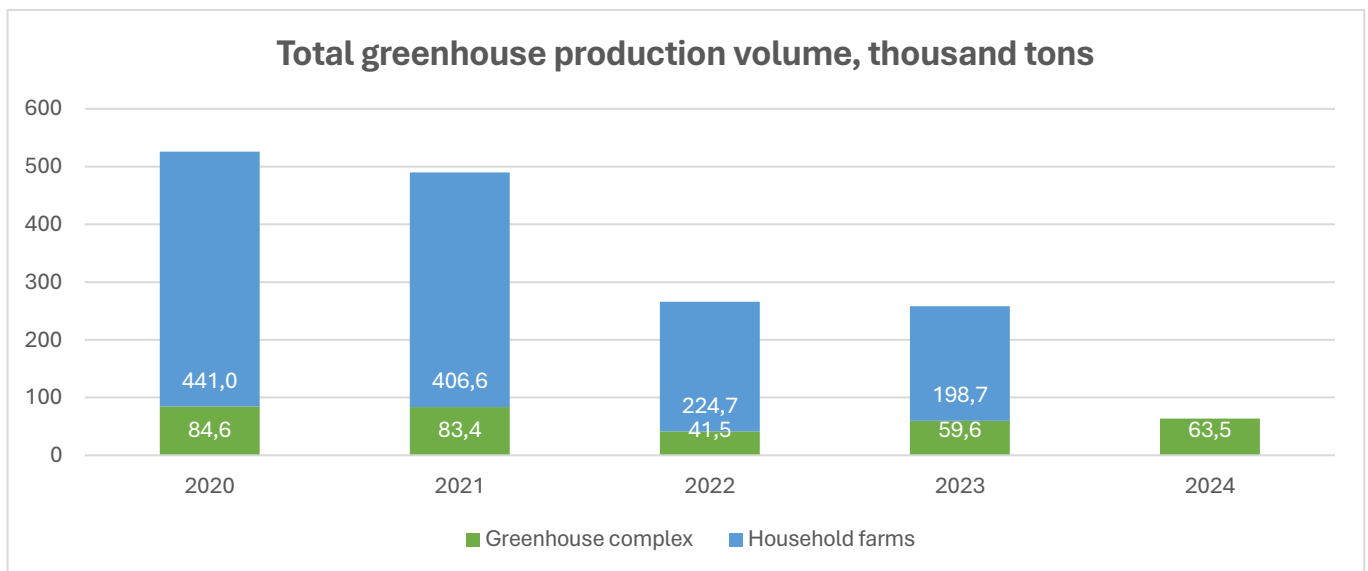
**Figure** Total greenhouse cultivation area, thousand hectares



Source: APK-Inform

It is worth emphasizing that the decline in production is systemic in nature and is caused not only by military actions but also by long-term trends: rising energy prices, in some cases outdated equipment, low profitability of certain crops, and changing climatic conditions. The factor of war became a turning point by acting as a catalyst and accelerating the crisis phenomena.

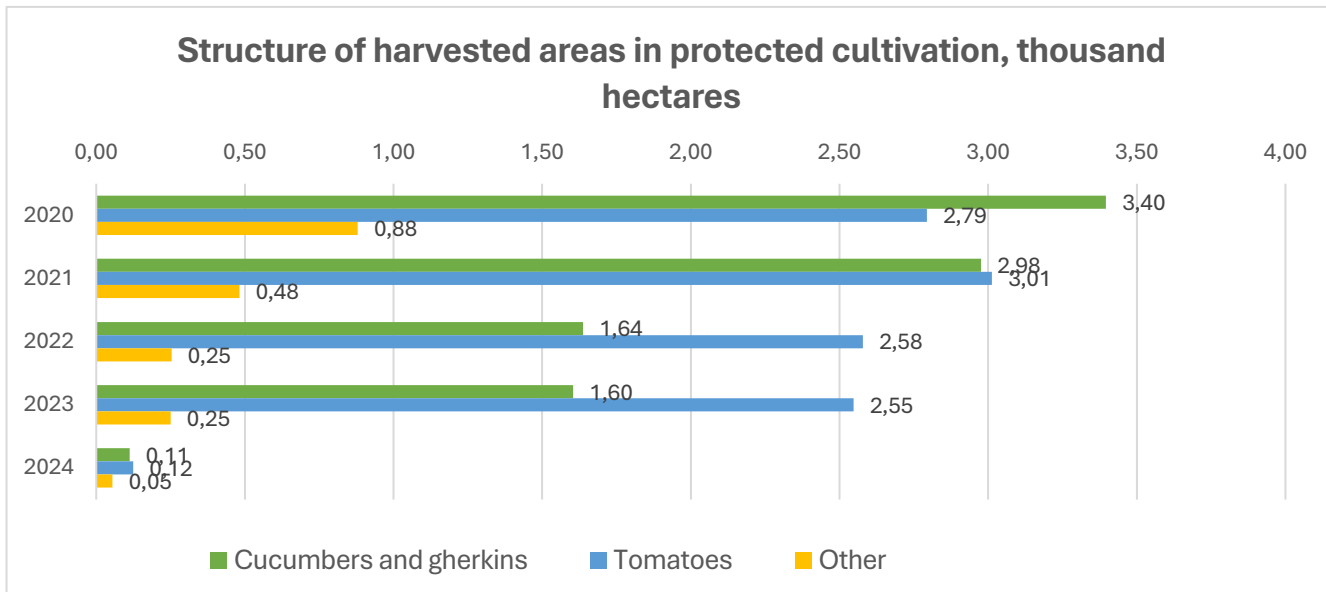
**Figure** Total greenhouse production volume, thousand tons



Source: APK-Inform

In the structure of production in covered cultivation in Ukraine, cucumbers and gherkins dominate, consistently accounting for the largest share both in cultivated area and in harvest volumes. During 2020–2024, their cultivated areas gradually declined, following the general market trend; however, even against the backdrop of decreasing gross indicators, the cucumber segment remained the most active. In 2020, cucumbers and gherkins occupied approximately 3.4 thousand hectares, compared with about 2.79 thousand hectares devoted to tomatoes, while all other crops each accounted for less than 1 thousand hectares. Production structure by greenhouse crop types

**Figure** The structure of production in covered cultivation in Ukraine



Source: APK-Inform

### 3.2 Regional structure of greenhouse production by area and volume

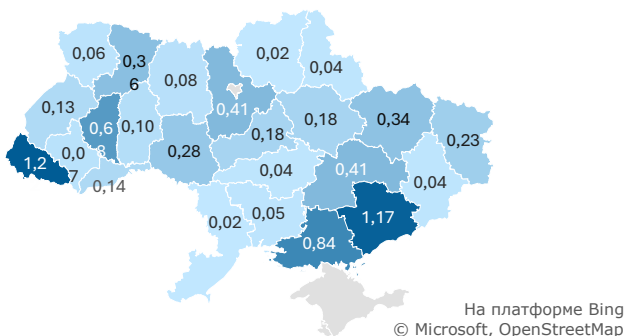
Since the beginning of the hostilities in 2022, the regional structure of covered-soil production has changed significantly. Many producers had been concentrated in the southern and eastern regions, from where they were forced to evacuate urgently. Supported by state and donor assistance programs, a significant portion of production facilities was able to resume operations in new locations within just one to two seasons.

As a result, in 2022, Zakarpattia and Ternopil regions emerged as leaders in harvested area, while the highest yields were recorded in Dnipropetrovsk region. In 2023–2024, the geographic shift continued northward, with Kyiv and Cherkasy regions joining the group with the largest protected cultivation areas. Throughout this period, Kharkiv, Vinnytsia, and Rivne regions also maintained substantial production volumes.

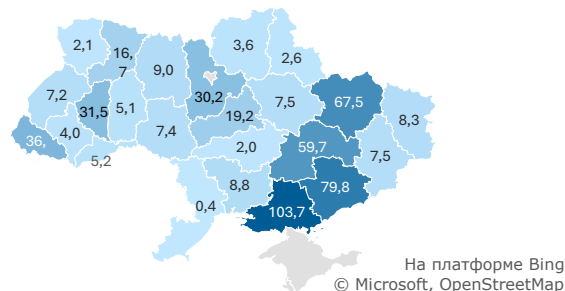
The dynamics of harvested area and production volumes from 2020 to 2024 (2025 data not yet available) are shown below.

**Figure 2020**

Structure of **harvested areas** in greenhouses by region, **thousand hectares** (as of 2020)



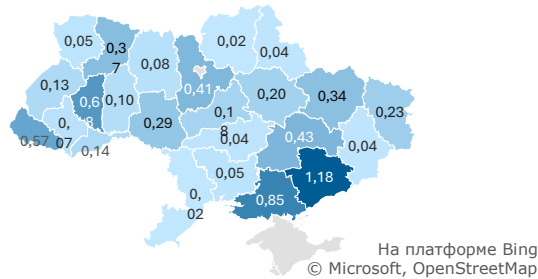
Structure of **production volume** in greenhouses by region, **thousand tons** (as of 2020)



Source: APK-Inform

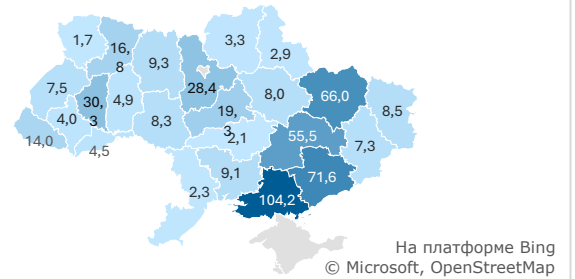
**Figure 2021**

Structure of **harvested areas** in greenhouses by region, **thousand hectares** (as of 2021)



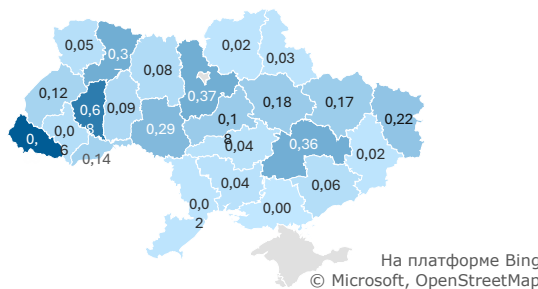
Source: APK-Inform

Structure of **production volume** in greenhouses by region, **thousand tons** (as of 2021)



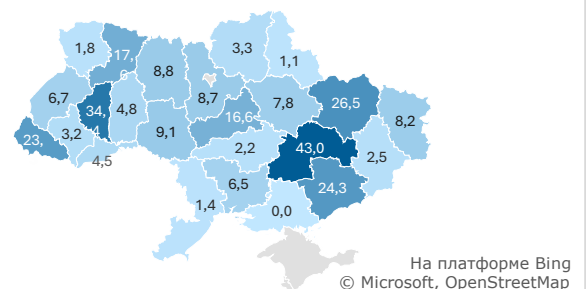
**Figure 2022**

Structure of **harvested areas** in greenhouses by region, **thousand hectares** (as of 2022)



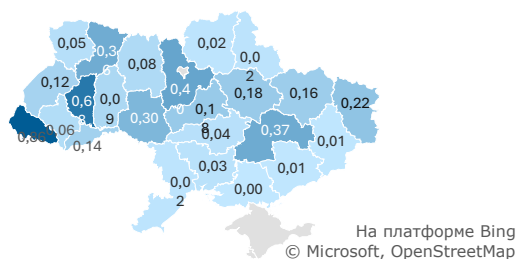
Source: APK-Inform

Structure of **production volume** in greenhouses by region, **thousand tons** (as of 2022)



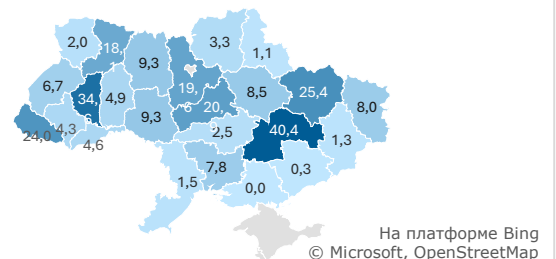
**Figure 2023**

Structure of **harvested areas** in greenhouses by region, **thousand hectares** (as of 2023)



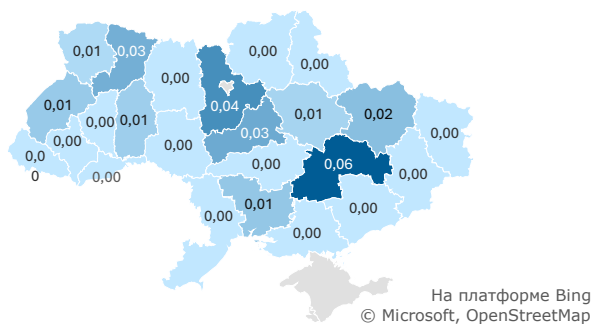
Source: APK-Inform

Structure of **production volume** in greenhouses by region, **thousand tons** (as of 2023)



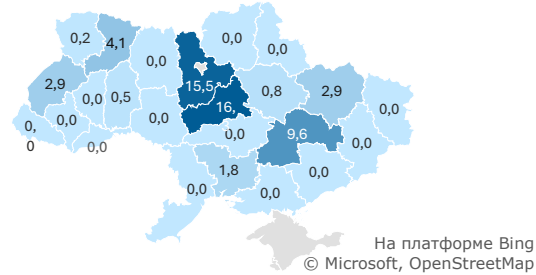
**Figure 2024**

Structure of **harvested areas** in greenhouses by region, **thousand hectares** (as of 2024)\*



Source: APK-Inform

Structure of **production volume** in greenhouses by region, **thousand tons** (as of 2024)\*



### **Additional analytics**

You can find Cucumber and Tomato price analysis in the Appendix 2 (Cucumber and tomato price analytics).

For a detailed overview of which regions of Ukraine produce greenhouse cucumbers, see Appendix 3 (Regional structure of greenhouse cucumber production by area and volume, 2020–2024).

The same information for greenhouse tomatoes is provided in Appendix 4 (Regional structure of greenhouse tomato production by area and volume, 2020–2024)

## **3.3 Greenhouse sector development key risks assessment**

- **Security and military context**

The risks facing the greenhouse sector that are directly linked to military activity extend beyond the physical destruction of infrastructure. Equally significant is the pervasive uncertainty that undermines investment, development, and long-term planning. In areas experiencing active hostilities or elevated security risks, many greenhouse operators are forced to suspend operations or limit them to a minimum level. This risk is most acute near the front line and remains a critical constraint in border regions, where producers are unable to ensure the safety of their assets.

The consequences include the loss of production capacity, an outflow of skilled labor, disruptions in supply chains for plant protection products, construction materials, and seeds, as well as interruptions in distribution channels for finished products. Sudden operational shutdowns further contribute to market disorientation and reduced sector resilience.

- **Energy dependence and energy costs**

Covered cultivation is the most energy-intensive segment of agriculture, as greenhouse operations require a stable and continuous supply of electricity, gas, water, and heat to maintain optimal microclimatic conditions. Following the onset of the full-scale invasion, the resulting energy crisis led to a sharp increase in prices across all energy sources, a trend that continues to persist. At the same time, the risk of further damage to energy infrastructure remains high, increasing the likelihood of supply disruptions and additional tariff hikes.

For the vast majority of greenhouse producers, this high level of energy dependence has translated into a substantial rise in production costs, directly undermining profitability. Under conditions of elevated or further increasing electricity tariffs, many enterprises may be unable to secure reliable access to energy resources or remain competitive with imported products. As a result, producers are increasingly forced to scale back operations or exit the market altogether.

- **Shortage of quality resources and materials**

Greenhouse production depends on a continuous supply of specialized inputs, including seeds of selected varieties, fertilizers, plant protection products, other material and technical resources, as well as construction materials. Sanctions, disruptions to maritime supply routes, shifts away from traditional suppliers due to the potential closure of Ukrainian manufacturing facilities, and supply interruptions or elevated import costs all contribute to the risk of a critical shortage.

As a result, producers may be forced to procure inputs at significantly higher prices or rely on lower-quality substitutes. Over time, a sustained shortage of high-quality resources would undermine the competitiveness of Ukrainian greenhouse products and limit the range of crops and varieties available for cultivation, negatively affecting both market positioning and sector resilience.

- **Labor resources**

Mobilization and population migration—both within the country and abroad—have significantly weakened the labour base of the covered-soil sector. Skilled industry professionals, including mechanics, agronomists, and other technical specialists, have become an increasingly scarce resource, particularly in regions where greenhouse production has been relocated.

Labor shortages result in a range of direct negative effects, including declining product quality, reduced productivity, higher incidence of technical errors, and increased workload and exhaustion among remaining staff. This risk is assessed as having a medium to high probability and a long-term nature. Its consequences may include disruptions to production cycles, lower yields, and rising labour costs, which may be unsustainable for small and medium-sized producers.

- **Financial risks and access to credit**

The greenhouse sector is widely perceived by the banking system as high-risk due to the ongoing war, uncertainty surrounding cash flows, and price volatility. As a result, lending interest rates remain prohibitively high for agricultural producers. While state support programs—such as grants and subsidized loans—provide some relief, they reach only a limited share of potential investors, leaving the majority of producers without access to long-term financing.

This restricted access to capital significantly constrains the sector's ability to modernize facilities, expand cultivation areas, and adopt new technologies. Consequently, the likelihood of a substantial decline in investment across the greenhouse sector is high and is already having a negative impact on the competitiveness of Ukrainian producers in both domestic and international markets.

- **Logistical and trade restrictions**

Logistics for covered-soil products is challenging: the products are highly perishable, require temperature

control, and have a limited shelf life. Active hostilities, frequent air attacks, port blockades, border-crossing difficulties, and unpredictable transport routes make exports extremely expensive and risky. Domestic logistics are also severely affected by fuel shortages, elevated transportation costs, and safety risks on key road corridors.

As a result, the competitiveness of Ukrainian cucumbers in European markets has declined not only because of reduced export volumes, but also due to high logistics costs and the increased risk of product losses during transit, which significantly erodes potential profit margins. The probability of further logistical disruptions remains high and, in many cases, has already led to a loss of international market presence and a growing dependence on domestic sales channels.

- **Climate change and extreme weather events**

Although greenhouses provide partial protection from external climatic conditions, their operation remains highly dependent on reliable water supply, temperature stability, lighting systems, and air quality. Current climate trends—characterized by sharp temperature fluctuations, extreme heat and cold events, intense and sudden precipitation, droughts, and flooding—increasingly affect the stability of municipal and private infrastructure on which greenhouse operations depend.

Local water shortages, power outages during extreme weather events, and structural damage caused by storms represent tangible and growing risks. As observed globally, the likelihood and severity of negative impacts from climate change are increasing each year and are already manifesting in unpredictable production disruptions in several countries. Potential consequences include heightened yield volatility, rising insurance costs, and the need for additional capital investment in adaptive technologies and infrastructure.

- **Legislative and regulatory risks**

Ukraine's agricultural sector continues to operate under a frequently changing regulatory environment. Tax policy remains unstable, land relations are complex, and administrative permitting procedures often fail to enhance investment attractiveness. Instead, they divert managerial resources away from operational and strategic priorities, consuming time, effort, and attention. For greenhouse enterprises in particular, unresolved issues related to land status, lease arrangements, and a rising tax burden remain especially acute.

The persistent expectation of new or amended regulations encourages owners and investors to delay or abandon investment decisions. While the probability of further regulatory tightening is assessed as medium, its impact on investor confidence is critical. Potential consequences include a significant outflow of capital to alternative agricultural or non-agricultural sectors, stagnation in greenhouse development, and increased opportunities for foreign competitors to capture the domestic market through imported products.

While Section 3.5 outlines sector-level risks, Section 9 translates these risks into practical market entry barriers for suppliers and investors and summarises mitigation measures relevant for Dutch engagement.

### **Implications of the sector baseline for Dutch engagement**

- The market functions as a two-speed sector: dispersed low-/mid-tech smallholders require scalable dealer-led
- Energy volatility makes energy efficiency, optimisation and resilience measures central to investment decisions, especially for heated production and high-tech complexes.
- Water reliability and fertigation discipline remain high-impact leverage points across both segments, but solutions must be adapted to different infrastructure levels.
- Post-harvest losses and quality consistency create demand for affordable cold chain and packing/grading upgrades, often best delivered through bundled support.
- Limited local service and spare parts capacity increases perceived risk; offers that include commissioning, follow-up and local partner set-up have a clear advantage.
- Sector risks and market dynamics reinforce the value of demonstration, training and advisory as adoption accelerators and as a foundation for scalable market entry.

# 4 Survey results: current state and needs of high-tech greenhouses

High-tech greenhouse complexes in Ukraine's are highly specialized, primarily producing cucumbers and tomatoes. Almost all complexes have been affected by the war, with 85% of surveyed facilities reporting losses. Production has declined—only 80% of total greenhouse areas are operational, and on 22% of the area, current output is below 70% of pre-war levels.

Glass-covered greenhouses remain the dominant structure, with cultivation carried out using hydroponics or substrate-grown seedlings, most of which are derived from imported seeds.

Gas and fuel pellets are the primary energy sources for heating, although a combined approach using multiple energy types is common. In complexes managing nearly 60% of the surveyed area, energy costs increased by 20% or more during the war, while some complexes successfully reduced costs by transitioning to alternative energy sources.

Heating and ventilation processes are the most automated, whereas lighting and irrigation systems are less frequently automated. More than half of the surveyed complexes (54% by number, covering 24% of the area) rate their technical equipment at 2 or 3 out of 5, indicating a relatively low level of modernization that limits further development.

Key challenges and risks constraining growth include energy supply issues, military risks, and workforce shortages.

## **Labor and Workforce**

The weighted average labour requirement is 12 workers per hectare. Approximately 56% of the surveyed area is cultivated by employees with secondary technical or higher education, and women make up nearly 70% of the workforce. In complexes managing 15% of the area, the average employee age exceeds 50, while across the sample, most workers are aged 45 and above.

## **Development Plans and Investment Priorities**

Despite the numerous challenges, nearly all surveyed complexes plan to continue developing and investing in their operations. The main concern among respondents is that planning and forecasting remain extremely difficult during wartime.

The war has underscored the critical importance of energy independence, making it a top priority for investment and development, as reported by two-thirds of complexes. To implement their plans, most complexes rely on grant funding or a combination of grants, loans, and their own resources.

While 45% of complexes (managing 25% of the area) do not yet see significant opportunities to improve business efficiency, others identify potential in expansion and technological development. Almost all respondents plan to explore new market niches, primarily through cultivation of additional crops.

## **Government and International Support**

Ten out of eleven surveyed complexes have not received comprehensive state support for operations or development. Government policy in the greenhouse sector is generally rated no higher than 3 out of 5, and where state support is desired, respondents prefer direct financial assistance.

Half of the surveyed complexes have experience participating in international projects, and two-thirds have used or are currently using the Agrifood Platform. Almost all plan to continue participating in international initiatives in the future.

Direct financing is seen as the most valuable form of international support, intended primarily for constructing new greenhouses and upgrading existing facilities.

## International Collaboration

Surveyed complexes actively use Dutch seeds and other material and plan to continue collaborating with Dutch companies, mostly through dealer networks.

### 4.1 General information about respondents

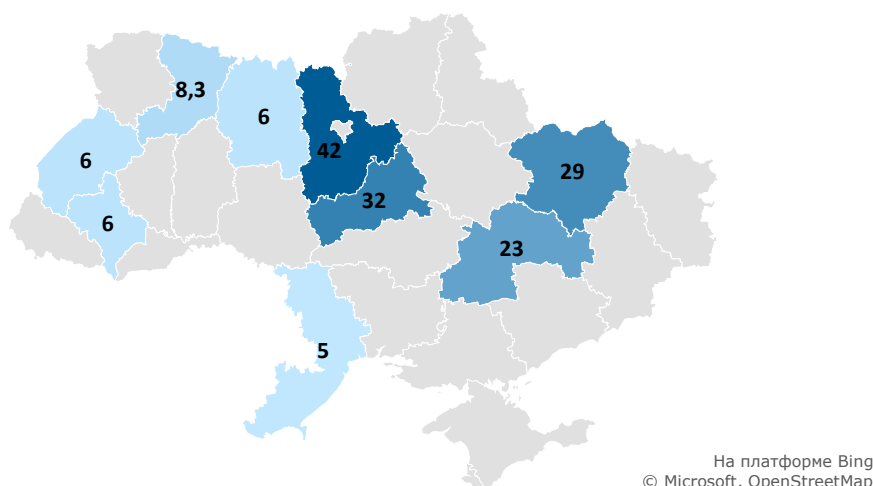
As part of the survey, 11 in-depth interviews were conducted with representatives of greenhouse complexes in 9 regions of Ukraine engaged in the cultivation of vegetable crops.

Greenhouse area of respondents:

- Total – 157.3 ha
- Operational – 125.3 ha
- Share of greenhouses in operation – 79.7%

Five of the 11 surveyed greenhouse complexes are members of the Ukrainian Greenhouse Association. The operational greenhouse area at these complexes accounts for 44.7% of the total sample.

**Figure** Regional distribution of respondents' greenhouses, ha



All respondents' main crops are cucumbers and tomatoes.

Share of main vegetables grown, based on operational greenhouse area:

- **Cucumbers** – 38%
- **Tomatoes** – 62%

Primarily, the surveyed greenhouse complexes focus on retail for selling their products. Nine out of 11 respondents (representing 73% of the total operational greenhouse area) indicated this sales channel. Six complexes reported selling to wholesale markets, which accounts for only 35% of the operational greenhouse area. Only three complexes engage in export sales (covering 45% of the area), and just one complex reported having its own retail outlet.

Further analysis of the survey results was carried out in two ways: as a **share of the total number** of respondents, and as a **weighted average**, taking into account the operational greenhouse area of each respondent.

### Labour

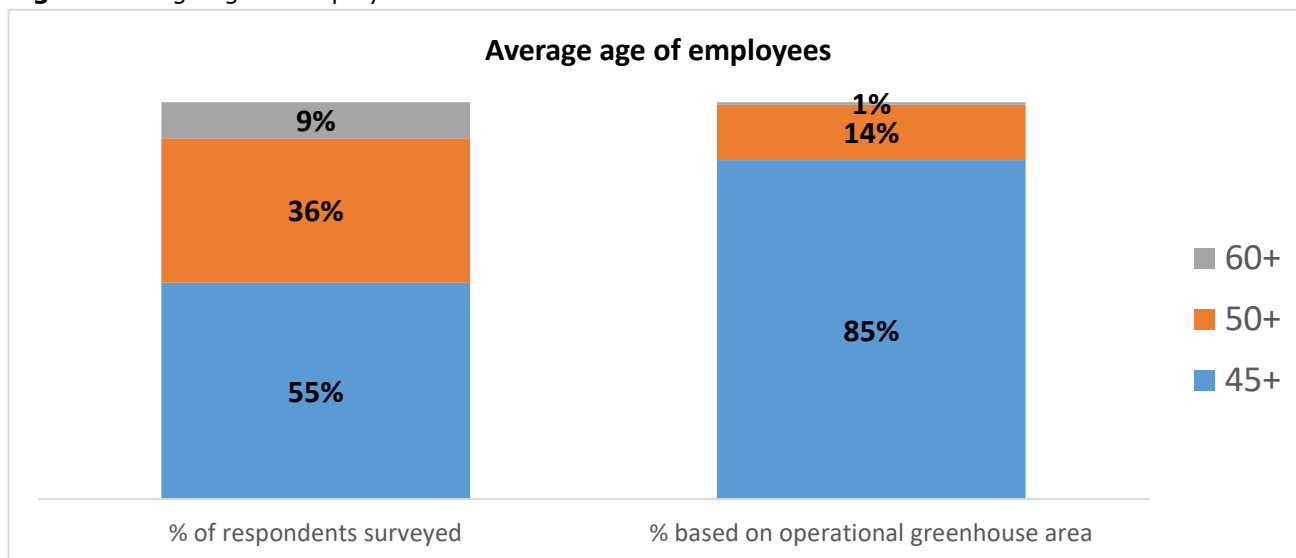
The number of employees at the surveyed complexes ranged from 12 to 756 people. The weighted average labour intensity is 12 employees per 1 hectare of operational greenhouse area.

The share of women at the surveyed complexes ranges from 44% to 96%, with a weighted average of 69%.

The workforce at the surveyed complexes is predominantly composed of employees aged 45 and older (in 55% of complexes and in 85% of cases when weighted by the number of employees at each complex).

At the same time, the core of the workforce consists of employees with secondary technical or higher education. Although only two complexes (18% of respondents) indicated this level of education among their staff, when weighted by the number of employees at these complexes, this share reaches 50%.

**Figure** Average age of employees



**Direct losses caused by the war**

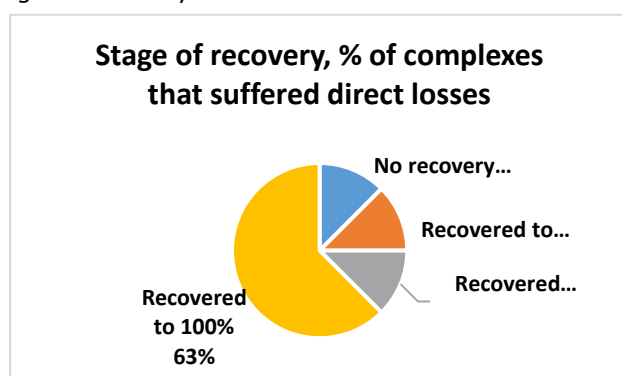
Most of the respondents surveyed have suffered direct losses as a result of the war: such responses were reported by 72.7% of respondents, covering 85.4% of the total greenhouse area.

At the same time, almost all affected complexes have already managed to recover from the losses:

- 63% have fully offset the damage;
- 25% have partially recovered, reaching 70–80% of pre-damage capacity.

Only one of the affected complexes has decided not to undertake recovery measures at this time

**Figure** Stage of recovery



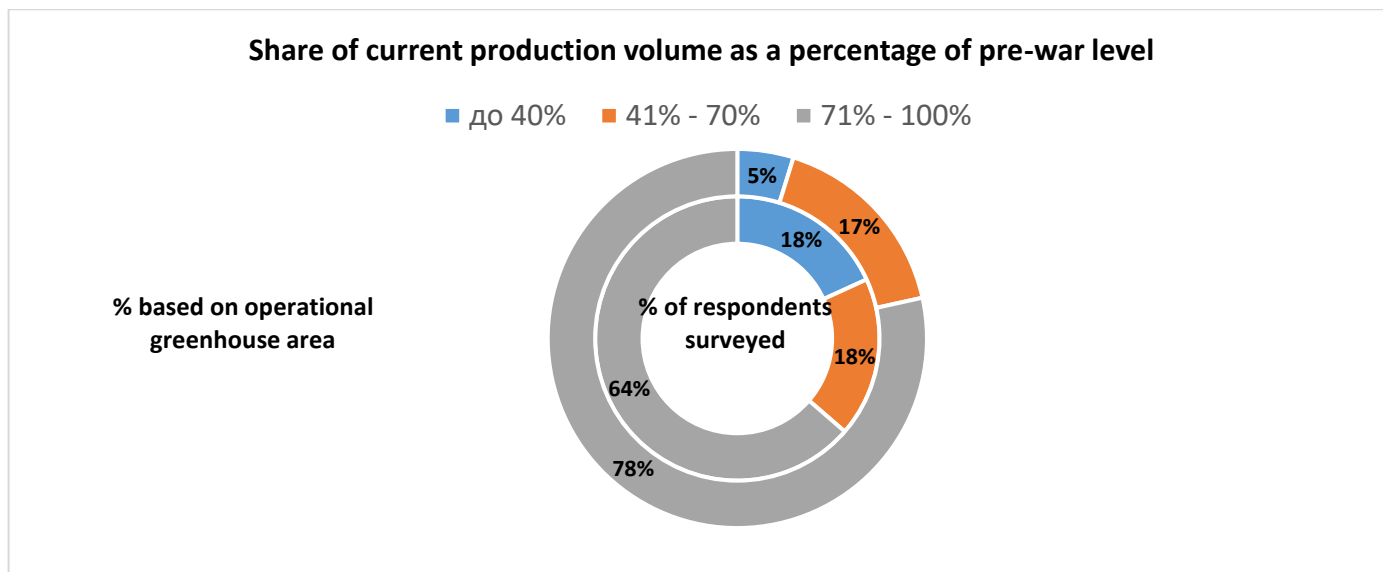
**Ratio of current production volume to pre-war level**

Despite the losses incurred as a result of the war, most greenhouse complexes have managed to restore production to levels identical or close to pre-war levels. Specifically, 64% of surveyed complexes, covering 78% of protected cultivation area, are currently producing between 71% and 100% of their pre-war output.

Approximately one-fifth of the surveyed complexes (18% of respondents, covering 17% of the area) are currently operating at only 41% to 70% of their pre-war production volumes.

The smallest group, accounting for 18% of respondents but representing only 5% of the total area, was forced to reduce production volumes to less than 40% of their output prior to the full-scale invasion.

**Figure** Share of current production volume as a percentage of pre-war level



## 4.2 Key changes in production processes during the war

### Key changes in production processes during the war

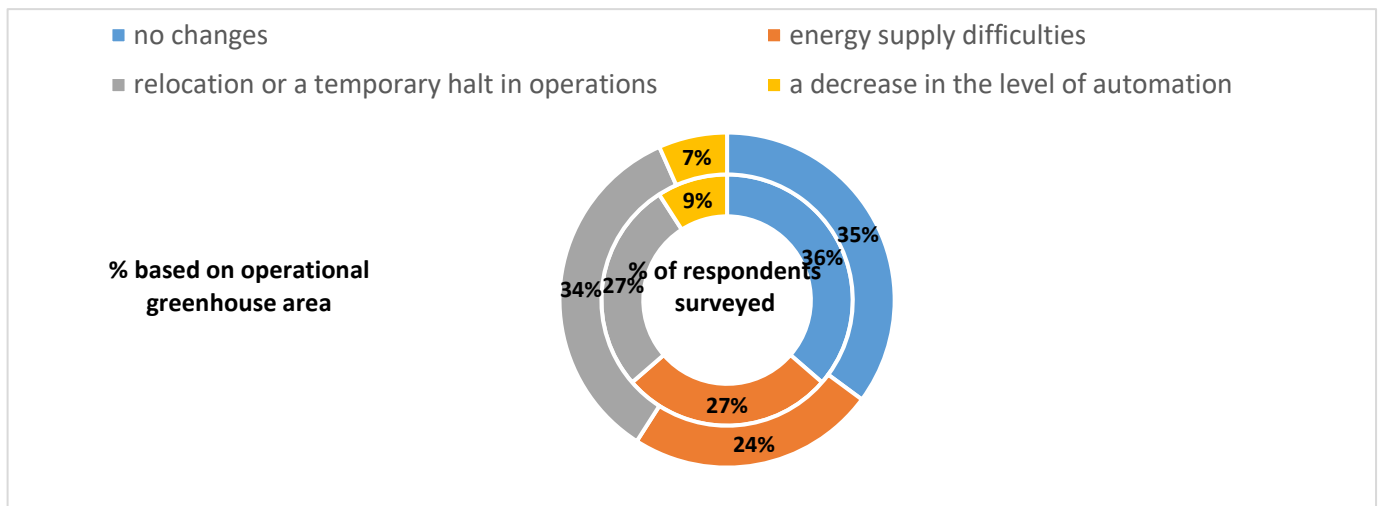
The key changes in greenhouse production processes were, as expected, the relocation of facilities or temporary suspension of operations, disruptions in energy supply, and challenges related to automation.

Greenhouse operations were equally affected by forced interruptions in production cycles and by instability in energy supply, with each issue reported by 27% of respondents. At the same time, the relocation of greenhouse facilities or temporary shutdowns proved to be a challenge primarily for respondents operating larger greenhouse areas: those reporting this issue account for 34% of the total surveyed growing area.

In addition, 9% of respondents said that the level of automation in their greenhouses decreased because of the war or because they had to reduce it themselves due to energy problems.

At the same time, about one third of respondents did not face major changes in their greenhouse production during the war. This was reported by 36% of those surveyed, who together account for 36% of the total greenhouse area.

Figure **Key changes in production processes during the war**

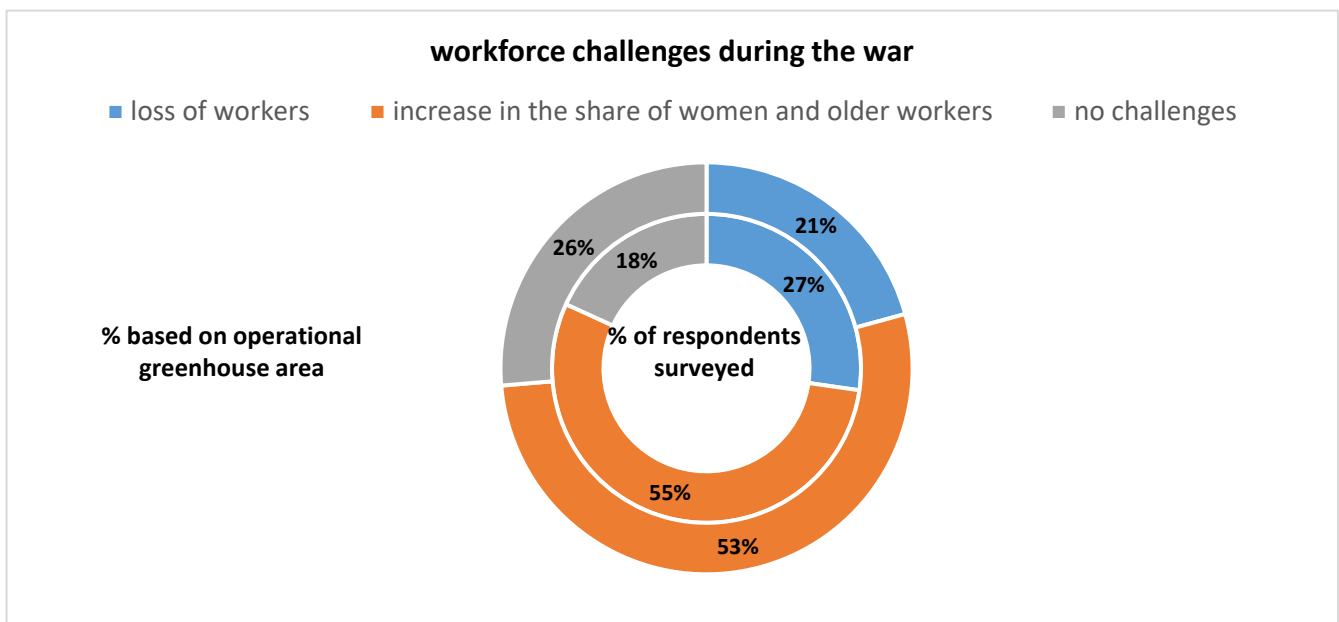


**Key changes in staffing policy, input procurement, and sales processes during the war**

Staffing became a major challenge for greenhouse operations during the war. More than half of respondents (55%) increased the share of women and older employees.

In addition, nearly one third of respondents (27% of greenhouse operations, representing 21% of the total area) reported a loss of workers due to internal displacement, people leaving the country, or joining the military.

At the same time, many respondents (18% of operations, covering 26% of the total greenhouse area) did not report serious staffing problems during the war.



At the same time, other aspects of operations were changed much less often. Only 9% of respondents, covering 5% of the total area, were forced to change their input procurement processes.

A slightly larger share—27% of respondents, representing 22% of the total area—made changes to their sales processes, mainly due to the loss of export channels or shifts in delivery regions.

## 4.3 Technology: Energy and packaging

### Type of greenhouse covering and growing technology

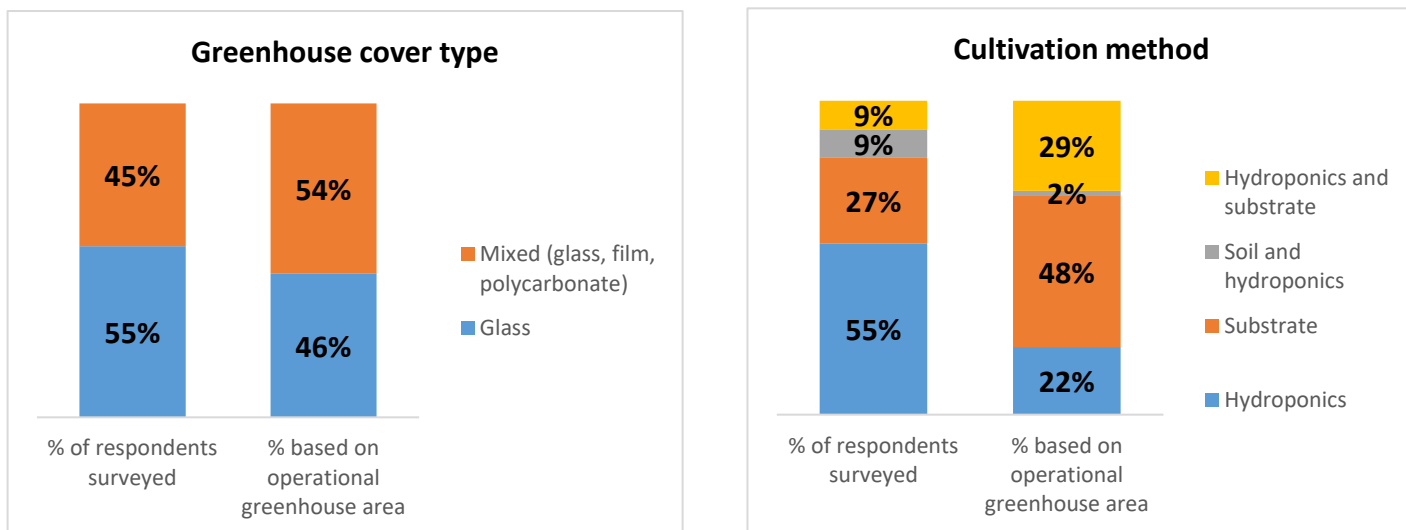
Slightly more than half of the surveyed greenhouse operations have fully glass-covered greenhouses: 55% of respondents fall into this category, collectively representing 46% of the total greenhouse area.

The remaining operations have mixed coverings, including glass, polycarbonate, and film.

Among growing technologies, hydroponics is the most common, reported by 55% of respondents. Slightly fewer use substrate-based cultivation (27%), while some combine hydroponics with substrate or soil (9% each).

In terms of area, however, the largest share is occupied by substrate-only cultivation (44%), followed by combinations of substrate and hydroponics (29%), and hydroponics-only cultivation (22%).

All surveyed greenhouse operations grow their own seedlings using imported seeds.



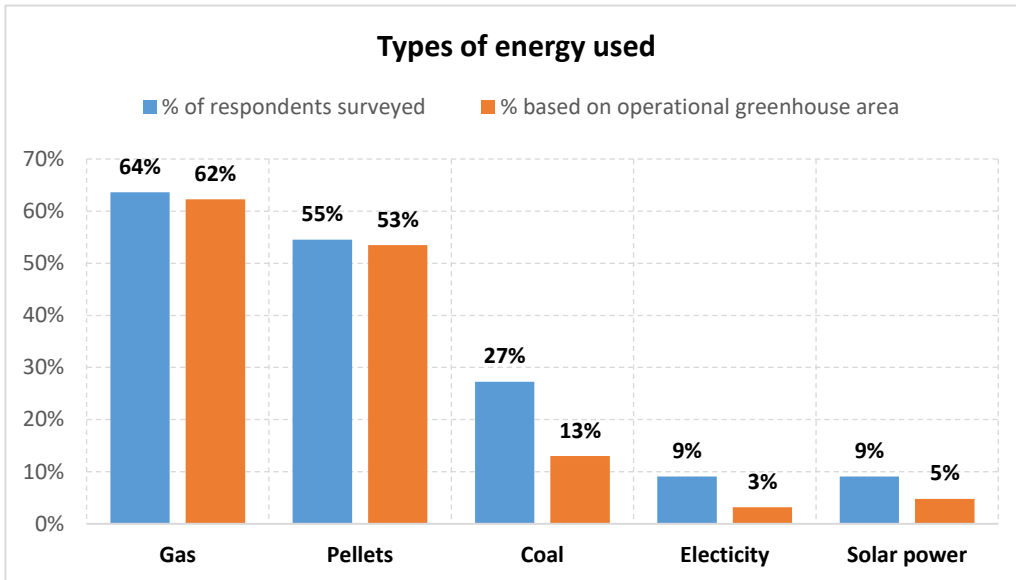
## Energy

More than half of greenhouse operations use more than one type of energy and combine them depending on circumstances and needs.

The most common energy source is natural gas, used by 64% of the surveyed greenhouses. Slightly more than half of respondents (55%) use solid fuel in the form of pellets. It is worth noting that the share of respondents and the share of total greenhouse area are almost identical for these cases.

Among those currently combining gas and pellets (18%), there are plans to shift the focus toward pellets and make them the primary energy source.

Almost one third of greenhouse operations (27%) use coal, 9% use electricity, and another 9% use solar energy. However, in these cases, the share of total greenhouse area is much smaller than the share of operations: 13% for coal, 3% for electricity, and 5% for solar energy.



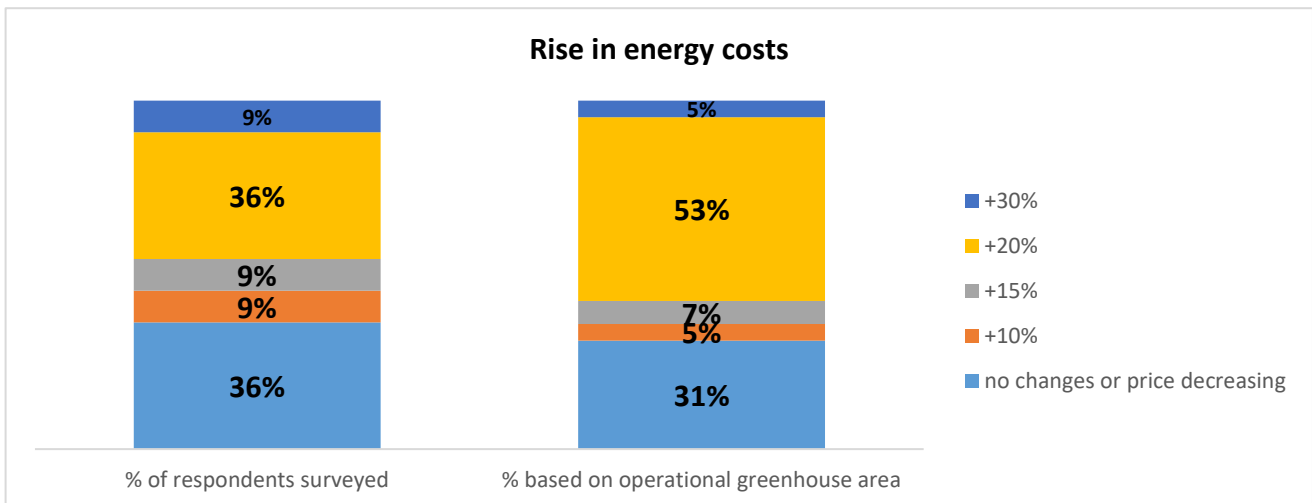
### Increase in energy costs

The vast majority of greenhouse operations were, as expected, forced to review their energy expenses due to resource shortages, rising prices, and other factors.

One third of operations, representing more than half of the total greenhouse area (36% of respondents covering 53% of the area), increased their energy costs by 20% during the war.

A similar share of operations, occupying a smaller area (36% of respondents covering 31% of the area), were able to keep their energy expenses at the same level as before the war—or even slightly lower.

Meanwhile, 9% of respondents, representing a relatively small portion of the total area (5–7%), had to increase their energy costs by 10%, 15%, and 30%, respectively.



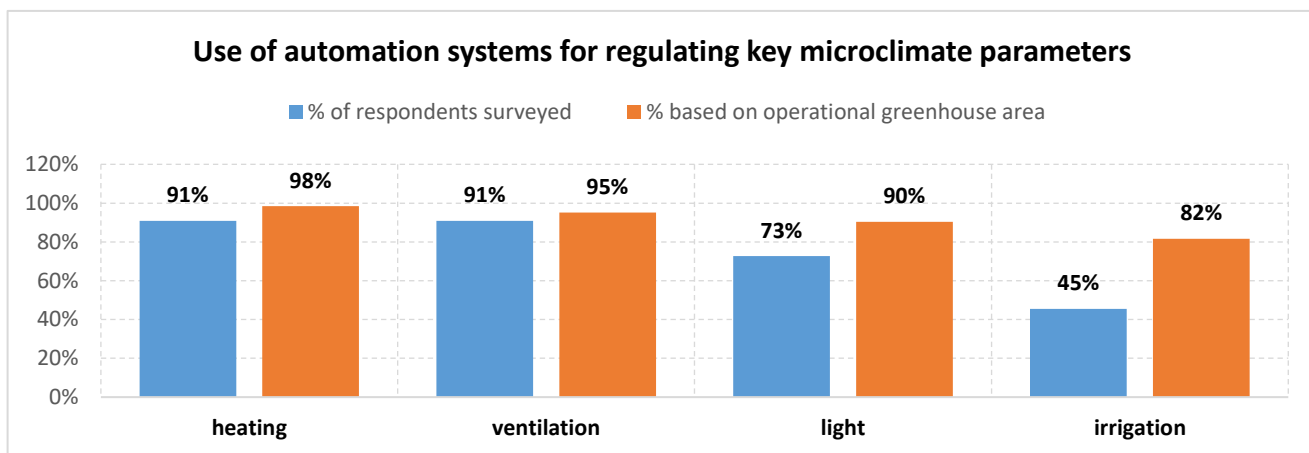
### Use of automation systems for regulating key microclimate parameters

Almost all surveyed greenhouse operations use automation to control the main aspects of the microclimate.

Specifically, 91% of respondents have automated heating control and 91% have automated ventilation control, covering 98% and 95% of the total greenhouse area, respectively.

Most greenhouse operations—73% of respondents, representing 90% of the total area—have automated lighting control.

At the same time, only 45% of respondents reported having automated irrigation systems; however, these systems still cover 82% of the total greenhouse area surveyed.



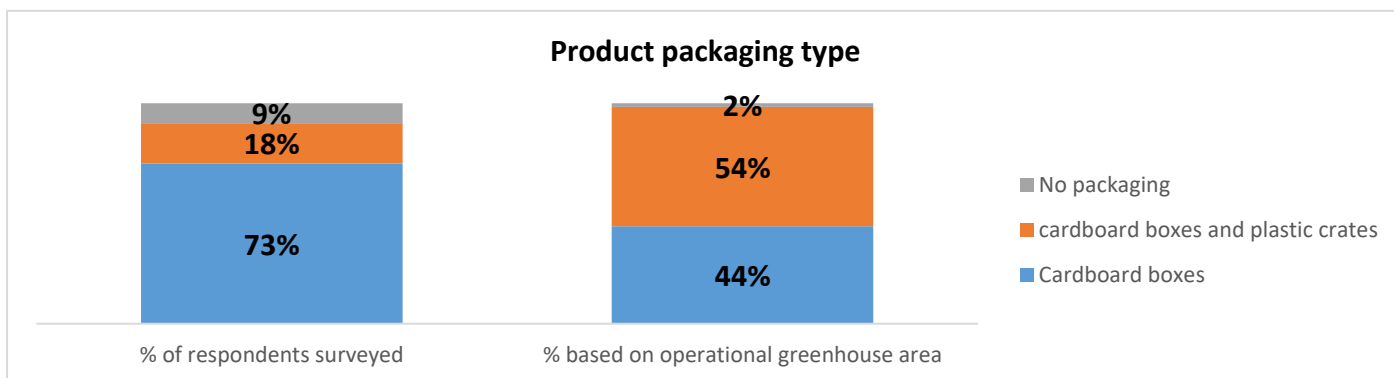
### Product packaging type

Cardboard boxes are the most common type of packaging used by the surveyed greenhouse operations. They are the primary packaging option for 73% of respondents, representing 44% of the total greenhouse area surveyed.

Another significant group of respondents—18% of operations, accounting for 54% of the total area—prefer a combination of cardboard boxes and plastic crates as their optimal packaging solution.

Only a small number of greenhouses (9%), covering just 2% of the total area, ship their products without their own packaging.

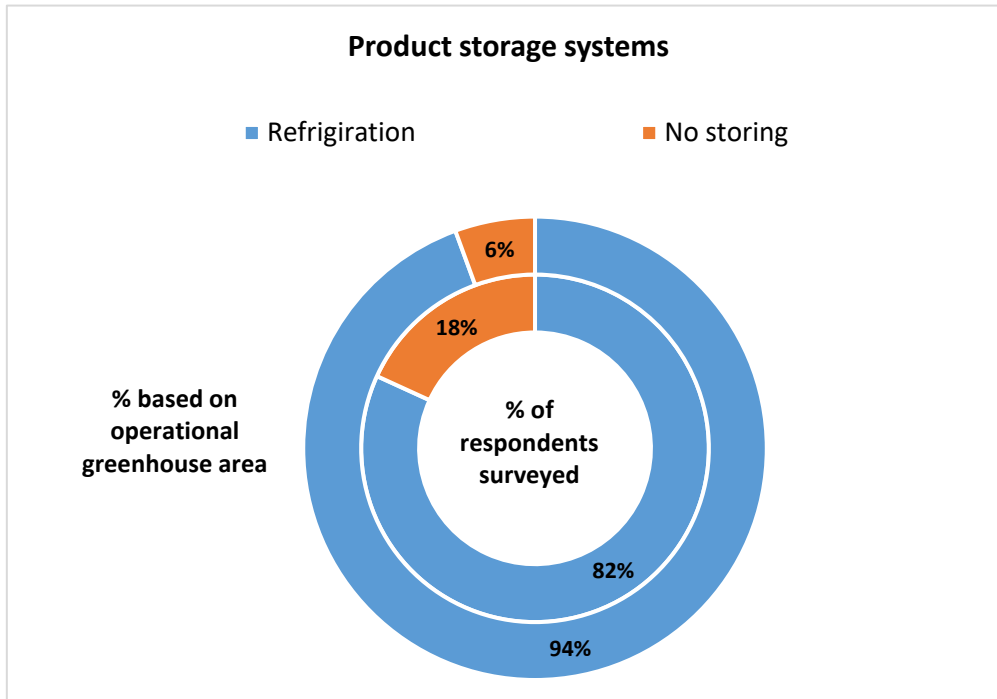
All respondents use only manual sorting when preparing products for sale.



### Product storage systems

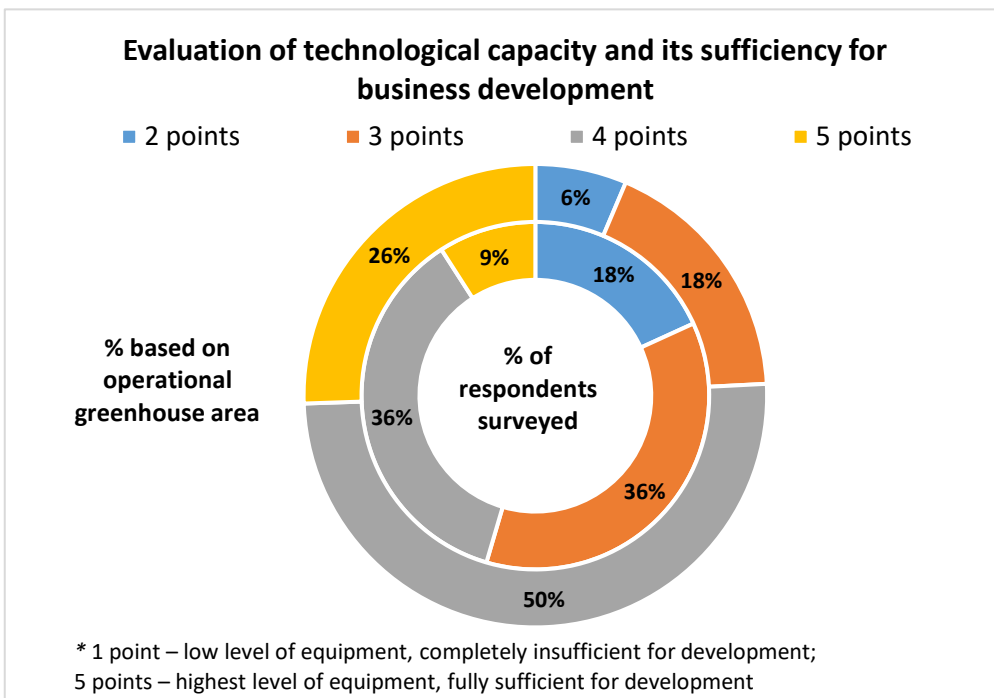
Almost all surveyed greenhouse operations use refrigeration to store their products before shipment. Such respondents make up 82% of the total, representing 94% of the combined greenhouse area surveyed.

Accordingly, 18% of respondents, covering only 6% of the total area, store their products without specialized cooling or do not store them on their own premises at all.



### Evaluation of technological capacity and its sufficiency for business development\*

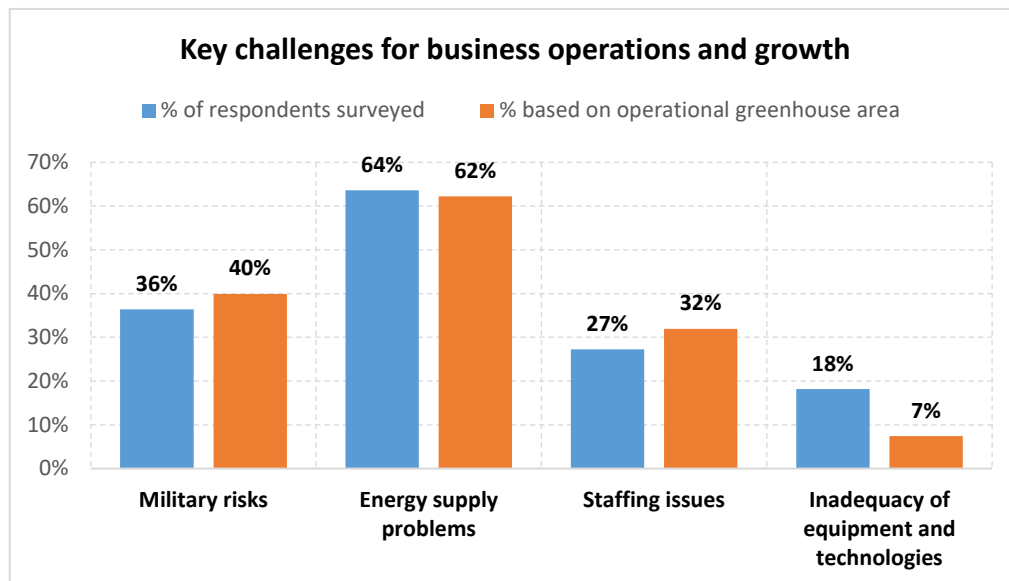
The subjective assessment of their own technological equipment varies significantly, dividing greenhouse operations into the following groups:



- 18% of respondents, covering 6% of the total area, believe they do not have sufficient technological equipment, rating it 2 out of a maximum of 5 points.
- 36% of respondents, representing 18% of the area, see their level of equipment as average, giving it 3 out of 5 points.
- Another 36% of respondents, covering exactly half of the total surveyed area and forming the largest group, rate their technological equipment as good but with room for improvement, giving it 4 out of 5 points.
- The smallest group, 9% of respondents, yet occupying a significant 26% of the area, consider their technological equipment excellent, rating it 5 out of 5 points.

## Key challenges for business operations and growth

The biggest challenge for maintaining greenhouse operations during the war is, as expected, energy supply issues, reported by 64% of respondents, representing roughly the same share of the total greenhouse area. In addition, military-related risks (36% of respondents) and staffing problems (27%) are also major concerns, primarily among larger operations.



A significant, though less frequently mentioned, issue is the inadequacy of technological equipment, cultivation technologies, and installed facilities. This factor is a concern for 18% of respondents, who operate on just 7% of the total surveyed greenhouse area.

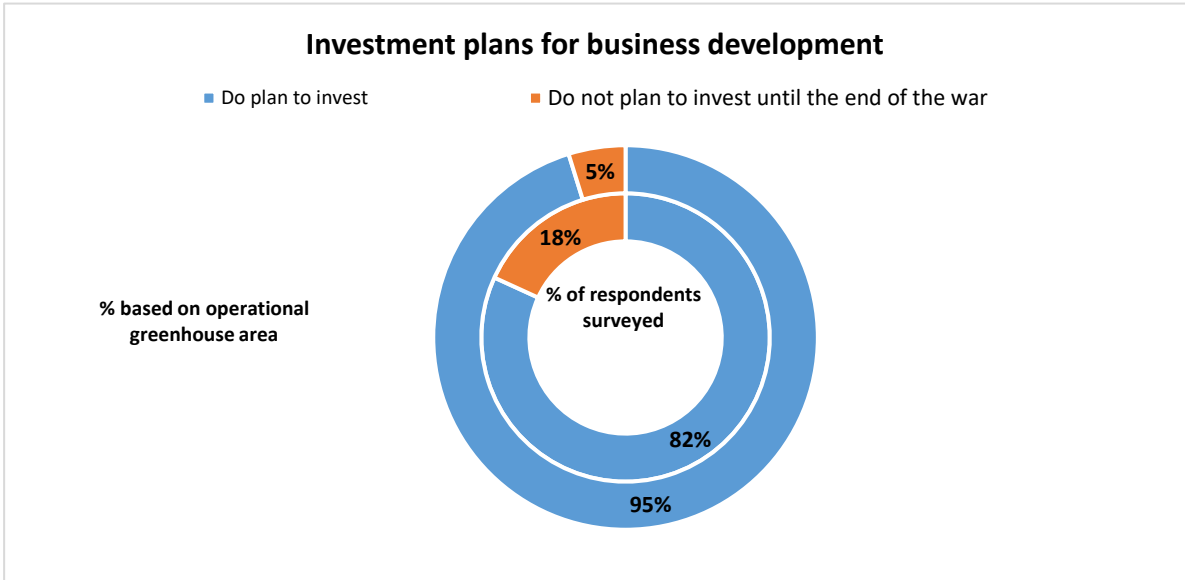
### 4.4 Investment plans for business development

Despite the ongoing full-scale invasion, most surveyed greenhouse operations still plan to continue developing and investing.

Only 18% of respondents, representing 5% of the total greenhouse area, currently have no development or investment plans.

Among those intending to invest, the most common priority is energy independence, in response to ongoing energy challenges caused by the war. This option was chosen by 67% of respondents, covering 65% of the total surveyed area.

About 11% of respondents plan to invest in greenhouse upgrades or their own processing facilities. Additionally, 11% of respondents, representing nearly one third of the total area (27%), plan to invest specifically in energy-efficient lighting.

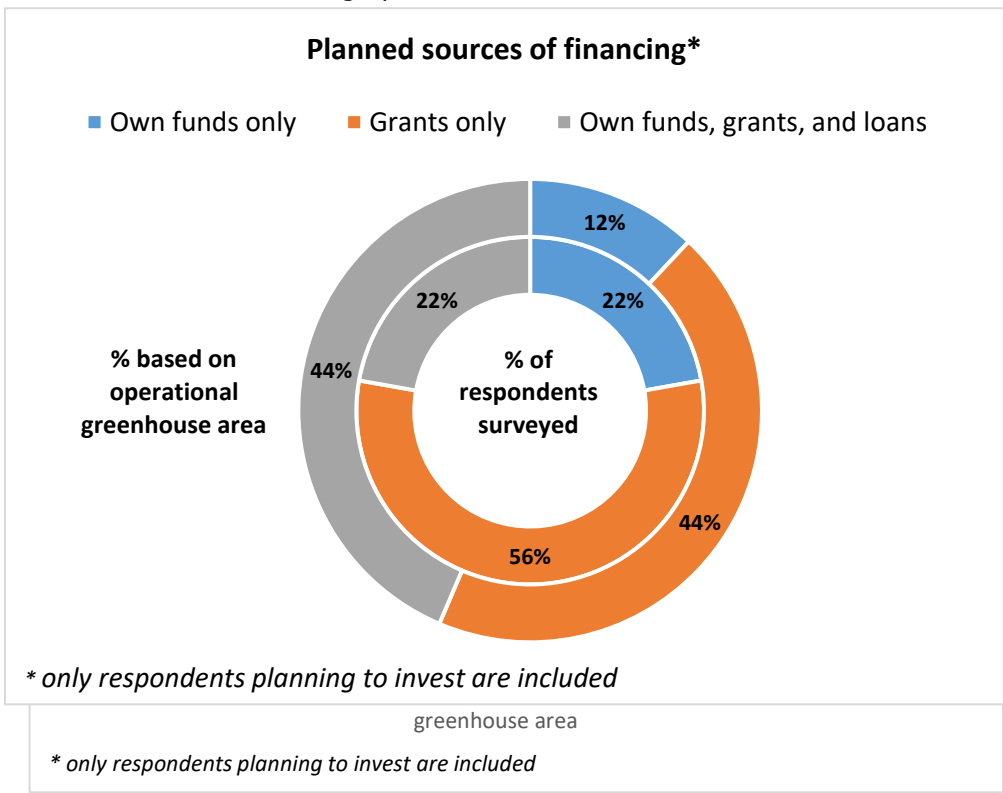


#### 4.5 Planned sources of financing\*

More than half of the surveyed greenhouse operations plan to rely on grant funding to implement their investment plans. This was reported by 56% of respondents, whose operations account for 44% of the total greenhouse area.

Another 22% of respondents, representing only 12% of the total area, do not expect external support and are prepared to invest exclusively their own funds in further business development.

The remaining 22% of respondents, however representing almost half of the total area (44%), plan to combine own and external financing by in

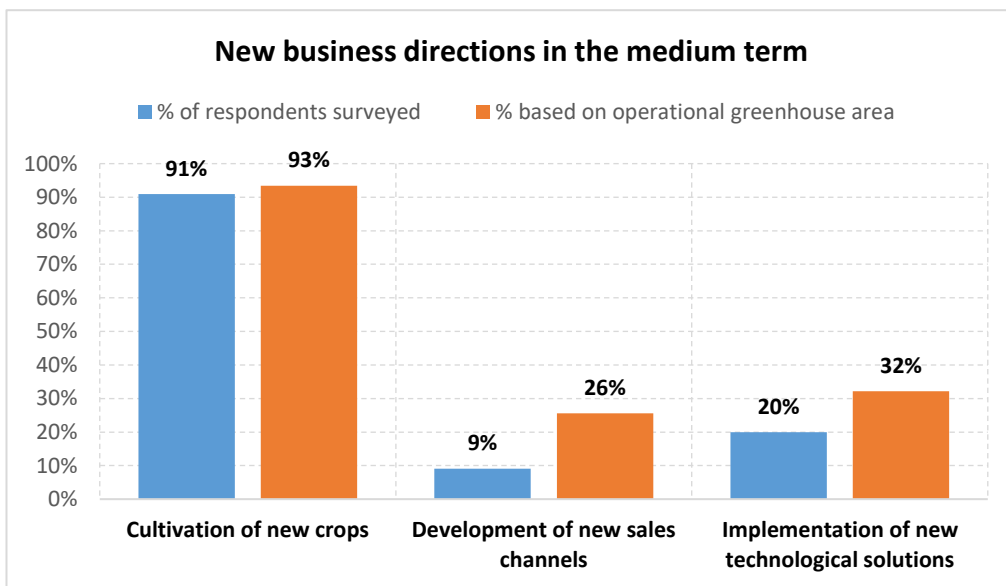


### New business directions in the medium term

Among new business directions that could support further development, most surveyed greenhouse operations mentioned growing additional crops using their existing facilities. This option is being considered by 91% of respondents, representing 93% of the total greenhouse area covered by the survey.

The second most popular option is the introduction of new technological solutions, which 20% of respondents plan to implement, accounting for 32% of the total area.

In addition, 9% of respondents, representing a substantial 26% of the total area, are interested in establishing new, alternative sales channels for their products.



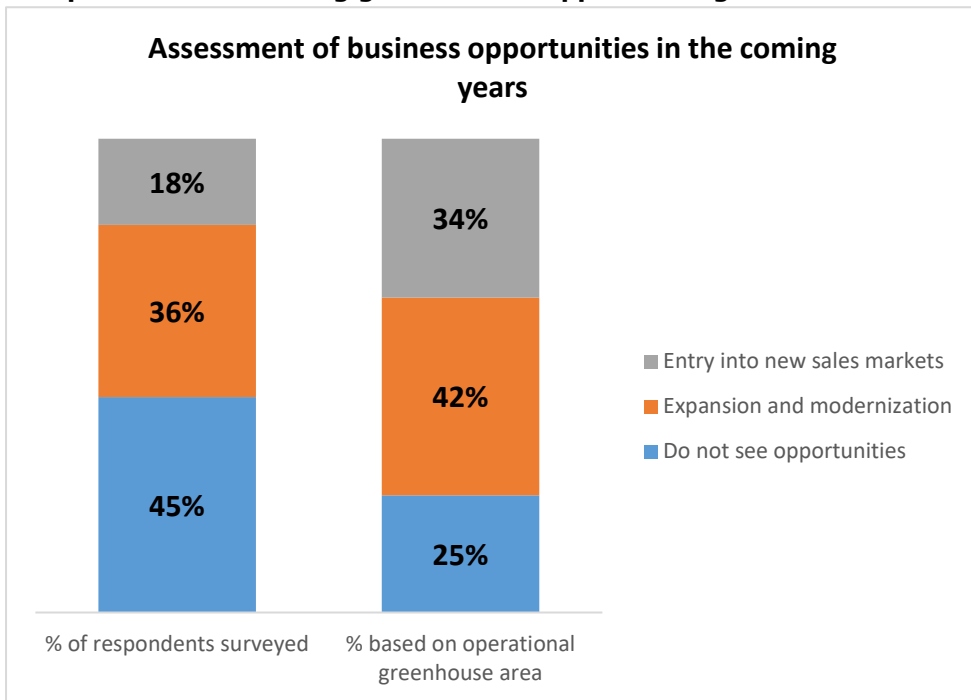
### Assessment of business opportunities in the coming years

Slightly more than one third of surveyed large producers in protected cultivation see business opportunities in the coming years through expansion and modernization. This was reported by 36% of respondents, representing 42% of the total greenhouse area.

Another 18% of greenhouse operations, covering 34% of the total area, view entering new sales markets as their main business opportunity in the near term.

At the same time, nearly half of respondents (45%), representing 25% of the area, are pessimistic and do not see any market opportunities for their operations.

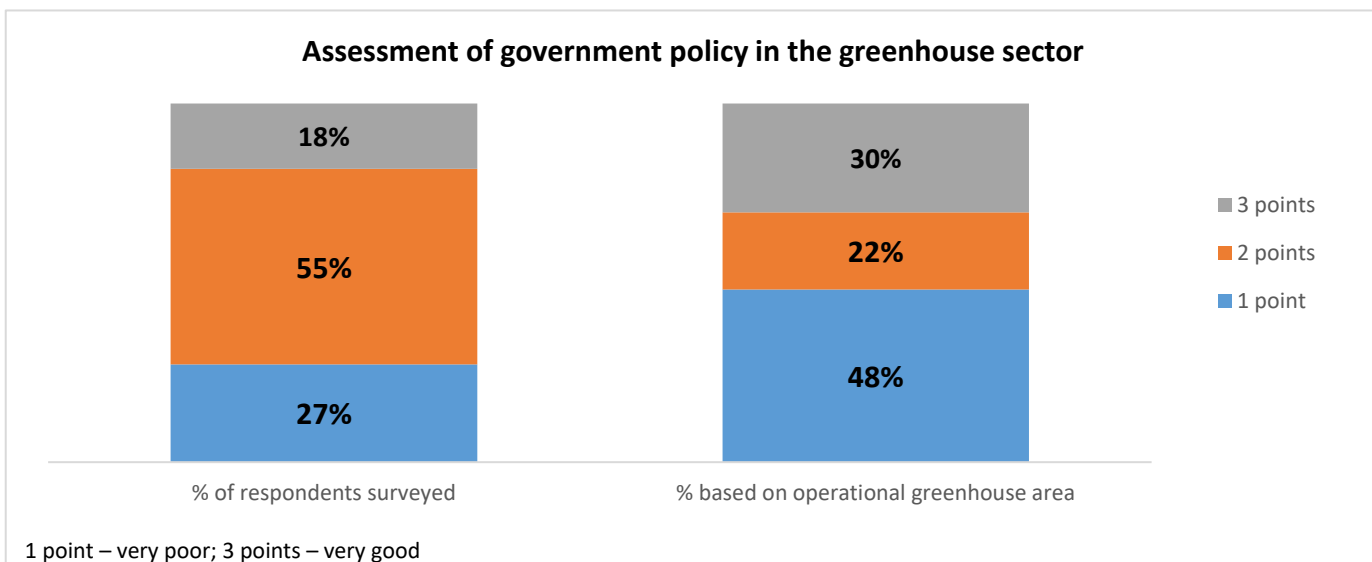
**Experience of receiving government support during the war**



The vast majority of surveyed greenhouse operations have no experience of successfully receiving government support during the full-scale invasion. This was reported by 91% of respondents, representing 74% of the total greenhouse area.

Only 9% of respondents, however, representing as much as 26% of the total area surveyed, received government assistance during the war.

**Assessment of government policy in the greenhouse sector**



Opinions on government policy in the protected cultivation sector are somewhat divided, but all focus on low or medium ratings, with no good or excellent evaluations.

The majority—55% of surveyed greenhouse operations, representing 22% of the total area—rated government policy in this sector 2 out of 5 points.

Another 18% of respondents, covering 30% of the area, consider government policy generally satisfactory, giving it 3 out of 5 points.

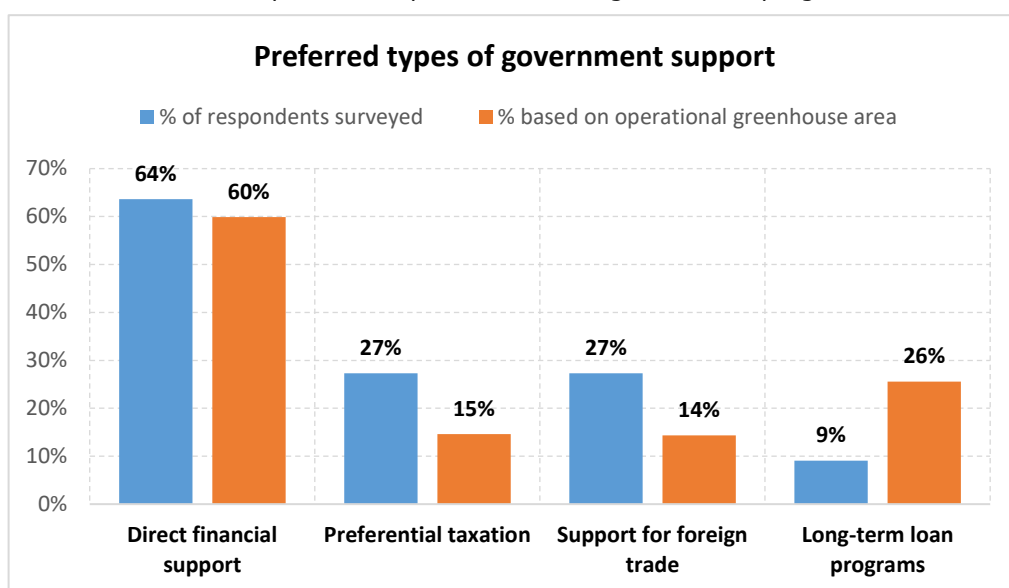
At the same time, 27% of respondents, representing nearly half of the total area (48%), view government policy in this sector as extremely poor, assigning only 1 out of a maximum of 5 points.

### Preferred types of government support

The most desired form of government support, according to the majority of surveyed greenhouse operations, is direct financial assistance. This was indicated by 64% of respondents, representing 60% of the total surveyed area.

Second in popularity are preferential taxation and support for foreign trade, each selected by 27% of respondents.

Among other desired forms of government involvement, 9% of respondents, covering 26% of the total area, mentioned the development and promotion of long-term loan programs.



### Experience in participating in international or donor-funded projects

Almost equal groups of survey participants were formed depending on their experience in international or donor projects.

Slightly less than half of the respondents (45%) confirmed that they had participated in international cooperation programs. With their support, representatives of greenhouse complexes, for example, were able to purchase generators, recover after a missile strike, receive consultations, and undergo professional training. Some reported successfully receiving a grant for the development of processing, which, however, cannot currently be implemented due to the proximity of the front line.

At the same time, 55% of respondents have not yet participated in international or donor-funded projects. However, the vast majority of all surveyed operations (91% of respondents, covering 98% of the total area) have similar projects planned and would like to take part in such initiatives.

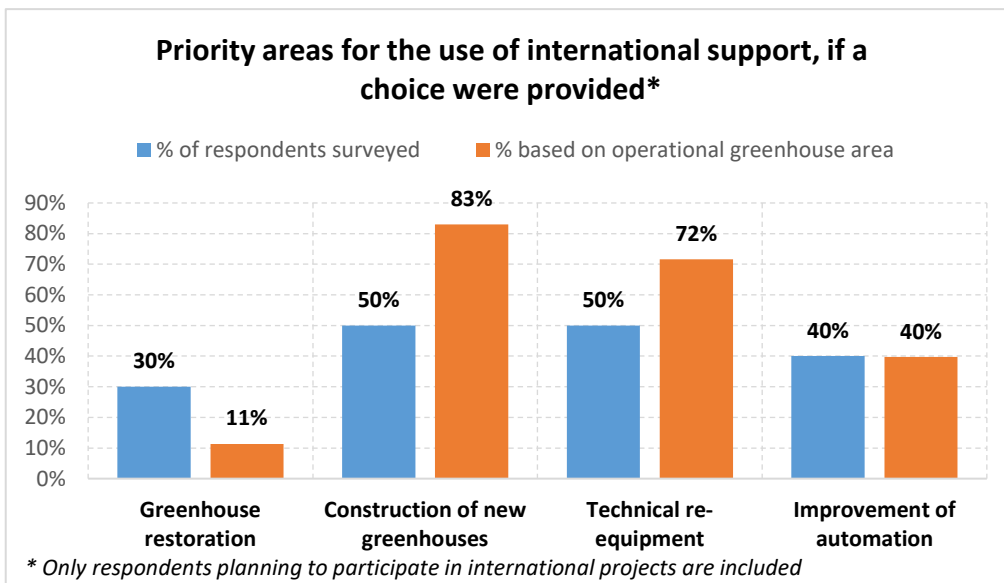
Surveyed greenhouse operations show some initiative in seeking partners and support. About 36% of respondents, covering 38% of the total area, reported that they are familiar with and use the Agrifood Platform. It is worth noting that within the surveyed sample, two out of three greenhouses located in Kharkiv Oblast—the region most affected by the war—use this platform.

At the same time, 64% of greenhouse operations (covering 62% of the area) are not familiar with the platform.

### Priority areas for the use of international support

Among the areas where greenhouse operations would like to use international support, four options were most frequently mentioned, often together in the same response:

- **Construction of new greenhouses**, desired by 50% of respondents, representing 83% of the total surveyed area;
- **Technical re-equipment**, also requested by 50% of respondents, though covering slightly less area (72% of the total);
- **Improvement of automation**, mentioned by 40% of respondents, representing 40% of the area;
- **Restoration of greenhouses**, desired by 30% of respondents, mainly smaller operations, together covering 11% of the total surveyed area.



Among the surveyed greenhouse operations, about one third have already collaborated with research institutions and maintain periodic cooperation with these sector representatives. This was reported by 27% of respondents, collectively covering nearly half of the total area (43%).

Examples of such collaboration included consultations with Dutch companies on seed material, microclimate control systems, and general professional training.

At the same time, the majority of respondents—73%, representing just over half of the total area (57%)—have no experience collaborating with research institutions.

### Use of Dutch consumables or services

The vast majority of surveyed greenhouse operations are well acquainted with Dutch suppliers of material and technical resources and actively use consumables from the Netherlands. This was reported by 82% of respondents, whose operations together account for 92% of the total area of all participants.

Most commonly, this involves planting material, though some respondents also mentioned technologies or masterclasses provided by Dutch companies.

Only 18% of respondents, covering just 8% of the total area, reported not using any supplementary materials or services imported from the Netherlands.

At the same time, 100% of respondents expressed interest in cooperating with representatives of the Dutch greenhouse sector.

### **The most convenient form of cooperation with Dutch companies**

The vast majority of surveyed operations consider working through a dealer or local representative the most convenient channel for cooperation with Dutch companies. This was indicated by 82% of respondents, covering 70% of the total surveyed area.

A much smaller share, 9% of respondents representing 5% of the area, prefer direct cooperation with Dutch companies or organizations.

Another 9% of operations, covering 26% of the total area, have no preference regarding the communication channel and are willing to cooperate either directly or through intermediaries.

# 5 Market Opportunity Analysis

## 5.1 Market needs and gaps: a two-speed market (macro picture for protected cultivation)

The needs assessment shows a two-speed protected cultivation market in Ukraine: (i) smallholders/low-tech greenhouses with strong seasonality and limited infrastructure, and (ii) industrial greenhouse complexes where the priority is efficiency, resilience and performance optimisation. This segmentation matters because it drives very different purchasing logic, price sensitivity, and delivery models.

This opportunity analysis builds on the sector baseline (Section 4) and the segmented needs assessment (Section 7). Detailed survey outputs for industrial greenhouse complexes are provided in Appendix B.

### Smallholders / low-tech greenhouses (survey n=50)

A large share of low-tech production is structurally seasonal: 32% of respondents report no heating, which corresponds to ~62% of active greenhouse area in this segment. Post-harvest capacity is limited: 80% report no storage/refrigeration (~83% by area), and sorting is overwhelmingly manual (90% manual sorting).

This segment therefore prioritises:

- “Minimum viable” continuity upgrades (basic heating/energy resilience; water and irrigation reliability).
- Low-cost yield stabilisation (simple climate improvements, robust irrigation and hygiene routines).
- Basic post-harvest improvements (affordable cold storage options, packing discipline).
- Advisory support as a multiplier (short-cycle coaching, practical SOPs).

### Industrial / mid-high tech greenhouse complexes (survey n=11)

Complexes operate with more automation and larger scale, but are exposed to energy and operational efficiency constraints. Energy profiles show reliance on gas (64%) and pellets (55%). Cold storage is more common: 82% have refrigeration/cold storage (~94% by area), yet pre-sale handling remains labour intensive (manual sorting is still typical).

This segment prioritises:

- Energy efficiency and resilience (retrofits, monitoring, optimisation, fuel flexibility).
- Automation and integration upgrades (especially where irrigation/lighting automation lags behind heating/ventilation control).
- Service ecosystems (maintenance, spare parts, uptime management).
- Post-harvest efficiency (grading/packing workflow improvements to reduce labour bottlenecks).

What this means for Dutch SMEs: one “generic greenhouse offer” will underperform. The market needs segment-specific packages: affordable, serviceable solutions + training for smallholders, and optimisation + service + integration for complexes.

## 5.2 Opportunity areas for Dutch solutions: where demand and Dutch strengths align

Based on the segmented needs, Dutch opportunities cluster into six solution spaces that can be tailored by technology level.

### Energy resilience and efficiency

- Smallholders: basic continuity solutions (critical backup for irrigation/cooling; pragmatic heating upgrades where relevant).

- Complexes: efficiency retrofits, monitoring and operational optimisation, hybrid strategies and commissioning support.

#### **Water, irrigation and fertigation reliability**

- Smallholders: durable irrigation kits and water-saving practices that reduce manual workload.
- Complexes: precision fertigation, sensors and integration with climate strategy.

#### **Climate control, automation and mid-tech upgrading**

- Smallholders: simple, serviceable improvements to key functions (ventilation/heating control where feasible).
- Complexes: system integration and tuning (climate–irrigation–lighting), upgrading weaker links (often irrigation/lighting control).

#### **Post-harvest handling (cold storage, packing, grading)**

- Smallholders: affordable cold storage access + basic packing/handling routines (loss reduction, better buyer access).
- Complexes: workflow and equipment upgrades to reduce labour dependence and improve consistency.

#### **Starting material and nursery quality (seeds, seedlings, young plants)**

- Smallholders: reliable access to quality seed and practical nursery hygiene protocols.
- Complexes: predictable access to high-performing genetics, nursery QA, biosecurity and traceability.

#### **Low-input and organic-transition solutions**

Across both segments, a realistic near-term pathway is often IPM / biocontrol and “low-residue” practices first, with certification readiness as a longer-term option where commercially viable.

- Dutch fit: IPM protocols, biocontrol packages, advisory and documentation routines that improve compliance and quality consistency.

## **5.3 Opportunities in training, demonstration projects and knowledge transfer**

The needs assessment indicates that technology gaps are closely linked to operational capacity gaps. In practice, this means that “hardware-only” interventions often underperform, particularly under wartime constraints (energy volatility, disrupted logistics, limited service capacity). For Dutch companies and programmes, this creates a clear opportunity to position training, demonstration and advisory support not as add-ons, but as core enablers of adoption and performance.

### **Why demonstration greenhouses matter for sector development**

A well-designed demonstration greenhouse can accelerate sector development by:

- Reducing adoption risk: farmers and investors can see performance in Ukrainian conditions (energy constraints, input availability, labour realities).
- Shortening learning cycles: practical trials and SOPs help operators move from “trial-and-error” to proven routines.
- Building service ecosystems: a demo site can become a training centre for technicians, installers, and advisors—critical for scaling solutions beyond one-off projects.
- Creating credible benchmarks: data on yields, energy use, water efficiency, and quality provides evidence for banks, donors and policy makers.

## Priority themes for demonstration projects (linked to needs)

To maximise relevance, demonstration projects should focus on a limited number of high-impact themes:

### A) Smallholders / low-tech greenhouses

- Season extension and minimum resilience packages (simple heating/energy backup options; water reliability).
- Water-smart production (robust irrigation, fertigation basics, labour-saving routines).
- Post-harvest basics (affordable cold storage options; packing and handling routines that reduce losses).
- Low-input transition practices (IPM/biocontrol starter approaches to reduce chemical load without jeopardising yield).

### B) Industrial / mid-high tech greenhouse complexes

- Energy efficiency and optimisation (retrofits, monitoring, tuning; performance coaching).
- System integration (climate-irrigation-lighting coordination; commissioning protocols).
- Post-harvest efficiency upgrades (workflow redesign; staged mechanisation; quality consistency).
- Nursery and biosecurity protocols (uniformity, hygiene, traceability; diversification trials).

## Recommended formats for training and knowledge transfer

To be effective in Ukraine's current context, capacity building should be delivered through applied and scalable formats:

- **Training-of-trainers (ToT):** build a local pool of advisors and technicians who can replicate training at scale, including training of university lecturers and vocational teachers on modern greenhouse technologies and practices.
- **University capacity building:** support universities in integrating new technologies into curricula, strengthening their practical training base (labs, demo greenhouses, digital tools), and developing high-quality study programmes and teaching materials aligned with industry needs.
- **Greenhouse producers' association:** support the establishment or strengthening of a national (or regional) greenhouse association to serve as a platform for knowledge exchange, joint trainings, dissemination of best practices, representation of sector interests, and cooperation between producers, universities, technology providers, and policymakers.
- **Short advisory cycles linked to investments:** e.g. commissioning support plus 3–6 months of follow-up, especially for automation, climate control, and fertigation systems.
- **Field-based "SOP packages":** checklists, seasonal calendars, and troubleshooting guides tailored to low-tech and mid/high-tech greenhouse segments.
- **Hybrid support models:** remote monitoring and consulting combined with periodic field visits to enable cost-effective scaling.

## How this supports market entry and donor-funded delivery

Demonstration and training components also align well with how support is often implemented:

- Donors and public programmes increasingly favour bundled approaches (equipment + training + measurable results).
- Demonstration sites provide an anchor for transparent monitoring (energy use, yields, water efficiency), improving accountability and replicability.
- For Dutch SMEs, demo-based engagement can serve as a low-risk entry route: it builds references, partner networks, and a service footprint (often via dealers/installers), while directly addressing the "price barrier" through co-financed pilots.

## Practical recommendation: a "hub-and-spoke" model

A scalable approach is to establish one or a few demonstration hubs (potentially linked to a university/research

institution or a leading enterprise) and then roll out a “spoke” network of:

- pilot farmers/enterprises,
- trained local advisors/technicians,
- distributor/installer partners,
- and programme-backed adoption packages.

This model is particularly relevant for protected cultivation, where the sector’s growth depends not only on access to equipment, but on the ability to operate systems efficiently and consistently under local constraints.

**Figure** Opportunity packages by segment (matrix)

Package	Smallholders / low-tech	Industrial / mid-high tech	Delivery model (typical)
Package 1: Resilient greenhouse basics	Primary fit: minimum continuity (energy/water) + SOPs	Secondary fit: backup + operational energy routines	Dealers + donor bundles; short coaching cycle
Package 2: Water-smart production	Strong fit: robust irrigation, fertigation basics	Strong fit: precision fertigation + integration	Distributors/installers; demos where useful
Package 3: Mid-tech climate upgrade & optimisation	Selective fit: simple controls where feasible	Primary fit: integration, tuning, commissioning + coaching	Direct B2B + service contracts; local technical partners
Package 4: Post-harvest starter/upgrade	Strong fit: affordable cold storage + packing routines	Strong fit: grading/packing efficiency + cold chain reliability	Bundles through programmes + dealers; pilots for SMEs/complexes
Package 5: Nursery & starting material quality	Good fit: seed access + nursery hygiene protocols	Strong fit: QA, biosecurity, traceability, diversification trials	Partnerships with local nurseries; training hub / joint trials
Package 6: Low-input transition toolkit (IPM + biocontrol)	Good fit: IPM basics, monitoring, advisory follow-up	Strong fit: biocontrol programmes + compliance-ready routines	Demo sites + advisory network; possible co-financing

Source: Authors’ elaboration based on surveys of smallholders (n=50) and greenhouse complexes (n=11), 2025.

## 5.4 Alignment with Ukraine’s reconstruction and development priorities

The opportunity areas identified above align with Ukraine’s near-term recovery needs and longer-term modernisation goals in horticulture. In practice, protected cultivation contributes to food security and regional supply stability, while also creating pathways for energy-efficient production and more resilient value chains.

### Where the alignment is strongest

- Energy resilience and efficiency: upgrades and retrofits reduce exposure to price volatility and disruptions, and support continuity of fresh vegetable supply.
- Water reliability and resource efficiency: irrigation and fertigation improvements address operational bottlenecks and enable more predictable yields, including in low-tech settings.
- Post-harvest infrastructure: cold storage and packing improvements reduce losses, expand market choice, and improve quality consistency—particularly relevant for smallholders with limited storage and for complexes supplying retail.
- Skills, advisory and service ecosystems: commissioning, training and advisory support help ensure that investments translate into measurable productivity gains rather than underused assets.

- Low-input and organic-transition pathways: IPM/biocontrol and safer input routines support gradual convergence with stricter buyer requirements and sustainability trends without requiring immediate full organic certification for all producers.

## Implications for programme design (including international support)

- Market development interventions should prioritise bundled delivery (equipment + installation + advisory + follow-up) rather than one-off procurement.
- Demonstration and training hubs can serve as anchors for replication, partner screening and local service capacity building.
- A segmented approach (smallholders vs complexes) increases effectiveness: smallholders benefit most from affordable packages and advisory, while complexes benefit from optimisation, integration and service contracts. See Section 8.5 for an indicative overview of relevant donor tracks and application routes.

## 5.5 Short-, medium-, and long-term market outlook

Ukraine's protected cultivation market will likely develop along two parallel tracks, reflecting different investment capacities and risk profiles.

### Short term (0–2 years): stabilisation and “minimum viable” upgrading

The focus is on keeping production running and reducing losses, especially under energy and logistics constraints.

- Smallholders / low-tech: demand concentrates on affordable continuity improvements (water/irrigation reliability, simple resilience measures) and basic post-harvest solutions (cold storage access, packing routines).
- Complexes: priorities include energy optimisation and reliability, staged upgrades to automation where gaps remain, and post-harvest efficiency improvements to manage labour constraints.

### What this means for Dutch SMEs

- Highest traction comes from practical, serviceable packages with training/advisory attached.
- Dealer/representative channels are especially relevant for smallholders; direct B2B and service contracts are more relevant for complexes.

### Medium term (2–5 years): modernisation and scaling of service ecosystems

As recovery finance stabilises and learning accumulates, demand shifts from “survival” to productivity and efficiency gains.

- Increased appetite for mid-tech upgrades (integrated climate/irrigation control, sensors, better fertigation routines).
- Expansion of post-harvest capacity and standardisation (quality consistency, packaging formats).
- Stronger demand for skills pipelines, including technicians and applied grower training, supported by demonstration hubs and advisory networks.

### Opportunities likely to expand

- “Performance optimisation” services (commissioning + follow-up).
- Partnerships for nursery quality and starting material systems.
- Wider adoption of IPM/biocontrol and low-input approaches.

## Long term (5+ years): selective high-tech investment and differentiation

Over the longer term, parts of the sector may move toward more advanced systems—particularly where energy efficiency, market positioning and finance support it.

- Selective investments in higher-tech protected cultivation (often through larger players or clusters).
- Greater focus on standards, traceability, and compliance for premium buyers.
- Potential expansion of certified segments (including organic) in niches where economics and market demand justify it.

## Strategic note

Across all horizons, the market will reward solutions that combine technology + knowledge + service. For Dutch companies, competitive advantage is strongest where offers are packaged as end-to-end solutions (from design and installation to operational optimisation) and adapted to the two key segments.

## 5.6 Opportunities in organic and low-input segments

Organic production and certification is likely to remain a niche segment in Ukraine's protected cultivation in the short term, due to cost pressure, input constraints and the operational complexity of meeting organic requirements in intensive greenhouse environments. However, the needs assessment indicates a broader and commercially relevant pathway: low-input, low-residue and IPM-based upgrading, which can be adopted by a wider group of producers and can function as a stepping-stone toward certification where market economics justify it.

## Why this segment matters (beyond "organic" as a label)

- Buyer requirements are tightening for quality, food safety and consistency, especially for retail and organised buyers. Low-residue routines and better documentation often become de facto expectations even without formal certification.
- Risk management: biological crop protection and integrated pest management can reduce reliance on constrained or higher-risk chemical inputs, supporting continuity and reputational risk reduction.
- Market differentiation: low-input positioning can help producers access premium domestic channels and, in selected cases, export-oriented value chains.

## Where the demand sits by segment

Smallholders / low-tech greenhouses

- Most relevant entry point is practical low-input upgrading (IPM basics, monitoring routines, safer input use), not immediate certification.
- Adoption is most feasible when combined with advisory support, demonstration and affordable starter packages.

Industrial / mid-high tech greenhouse complexes

- Stronger potential for structured IPM/biocontrol programmes integrated into climate and crop management routines.
- Interest may be driven by quality consistency, reduced residue risk, and—where commercially viable—steps toward certification readiness.

## Opportunity areas for Dutch companies (what can be offered)

- IPM and biocontrol packages: starter kits, monitoring tools, beneficial organisms supply models, and integrated protocols adapted to Ukrainian conditions.
- Operational protocols and training: crop scouting routines, decision trees, resistance management, hygiene/biosecurity SOPs, and safe input handling.

- Transition support (“low-input pathway”): stepwise plans that prioritise the highest-impact shifts first (e.g., biocontrol in key crops), while maintaining yield stability.
- Certification readiness where relevant: guidance on documentation, traceability and audit-ready routines for operators that intend to pursue organic certification.

## Role of demonstration and advisory (critical enabler)

Low-input and organic-transition solutions perform best when delivered as bundles, not products:

- Demonstration greenhouse modules can validate IPM/biocontrol performance under local constraints (energy volatility, input availability, labour realities).
- Advisory follow-up (e.g., a full season or 3–6 months) is often required to stabilise outcomes and build confidence.

## Practical recommendation for positioning

For market entry, Dutch engagement is best framed as “low-input performance and compliance upgrading” rather than “organic-only”. This approach:

- expands the addressable market,
- aligns with both smallholders and complexes,
- and creates a credible pathway toward certification in niches where premiums and demand justify it.

### Key takeaways

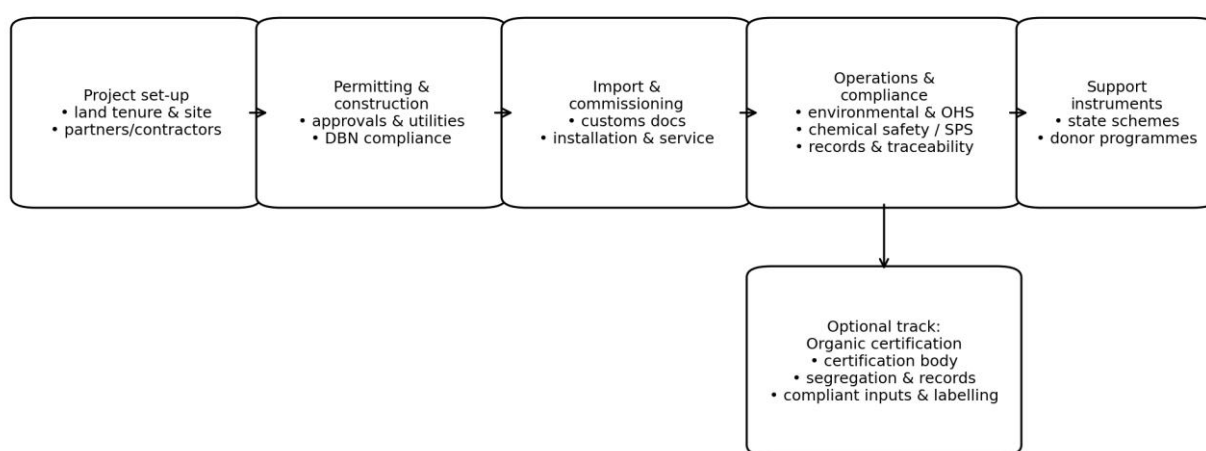
- Ukraine’s protected cultivation market is a two-speed market: smallholders/low-tech prioritise affordable continuity (energy/water, basic post-harvest), while industrial complexes prioritise efficiency, resilience and performance optimisation.
- The highest-impact opportunities for Dutch SMEs sit in six solution spaces: energy efficiency/resilience, water/irrigation/fertigation, climate control & automation upgrades, post-harvest (cold chain, packing, grading), starting material & nursery quality, and low-input/IPM & biocontrol transition.
- For smallholders, adoption is enabled by durable, serviceable “minimum viable” packages combined with training/advisory; for complexes, value is unlocked through integration, commissioning and optimisation, backed by service capacity and spare parts.
- Demonstration greenhouses and applied training are not add-ons: they reduce adoption risk, build service ecosystems, and provide credible performance benchmarks for financiers and programmes.
- International support modalities work best when delivered as bundles (equipment + installation/commissioning + advisory + follow-up) rather than hardware-only procurement.
- A practical entry route for Dutch companies is to align with dealer/representative channels for the smallholder segment and direct B2B + service contracts for complexes, using pilots/demos to overcome price and risk barriers.

# 6 Policy & Regulatory Framework.

## Government support

This section summarises the core regulatory and policy factors that shape protected cultivation investments in Ukraine. In practice, the main constraints tend to be administrative capacity and procedural variability under wartime conditions, alongside gradual EU-approximation reforms (notably in SPS and chemical safety) and the growing role of public support programmes in the entry-level segment.

**Figure** Regulatory and support pathway for protected cultivation projects in Ukraine (simplified)



Simplified pathway (indicative sequencing; project-specific requirements may differ).

Figure 6.1 provides a simplified end-to-end pathway for setting up and operating protected cultivation facilities in Ukraine. It links regulatory steps (permits and construction norms, import and commissioning, operational compliance) with support instruments (state grant schemes and donor programmes). An optional track shows additional requirements for operators aiming at organic certification.

Ukraine’s policy and regulatory framework for protected cultivation presents a manageable but evolving environment, shaped by wartime conditions, EU integration commitments, and targeted government support instruments. While formal legal barriers for foreign participation remain limited, administrative complexity and transitional regulation require careful navigation.

Trade policy developments with the European Union have created a more dynamic external environment. Temporary trade liberalisation measures introduced during the war have been partially rolled back, reinforcing the importance of regulatory compliance, quality differentiation, and strategic market positioning for export-oriented greenhouse production.

At the operational level, greenhouse development is governed by general construction, land-use, environmental, and SPS regulations rather than a dedicated legal framework for protected cultivation. Permitting and customs procedures are feasible but can be time-consuming, particularly for larger or more complex projects, highlighting the importance of local partnerships and phased implementation strategies.

A key regulatory trend is the gradual alignment of sanitary, phytosanitary, and chemical safety regulations

with EU standards, including ongoing reform of plant protection product legislation and the introduction of a national chemical safety framework aligned with EU REACH principles. While this process remains incomplete and transitional, it signals a clear long-term direction toward stricter compliance requirements, traceability, and environmental oversight.

Government support programmes, particularly grant schemes for greenhouse and tunnel construction, play a central role in shaping the protected cultivation market. These schemes primarily support low- and entry-level mid-tech greenhouses and are implemented predominantly through local Ukrainian manufacturers of greenhouse structures. As a result, public funding contributes both to farm-level recovery and to the development of a domestic greenhouse construction sector. At the same time, the widespread deployment of basic solutions creates visible performance gaps, generating follow-up demand for upgrades, optimisation, training, and compliance-oriented technologies.

For Dutch companies, the Ukrainian protected cultivation sector offers opportunities best approached through long-term, partnership-based engagement rather than direct competition in basic construction. Public support mechanisms, regulatory transition, and local industry development together create a pathway in which Dutch technology, services, and expertise can complement domestic capabilities, supporting gradual upgrading, resilience, and alignment with European standards.

## 6.1 Permitting procedures for greenhouse construction and operation

Protected cultivation facilities fall under general construction and land-use permitting rules. In practice, administrative complexity and procedural uncertainty—rather than formal legal restrictions—tend to be the main bottlenecks, especially for larger or higher-tech projects requiring multiple approvals, utility connections, and coordination with local authorities. Regional practices and capacity can differ, making local engagement critical for realistic timelines.

A relevant recent development is the introduction of dedicated State Building Standards for greenhouse complexes, **DBN V.2.2-2:2024 “Buildings and structures. Greenhouses”**, which provides a clearer technical reference framework for design and construction of new or reconstructed greenhouse facilities.

“The updated [State Building Standards](#) (DBN) for natural and artificial lighting came into force on February 28, 2019. According to them, the territory of Ukraine is divided according to the light climate into 4 zones (previously there were 2).”<sup>6</sup>

So, the new light-climatic zones now look like this:

- Zone I - regions: Ternopil, Khmelnytsky, Rivne, Lviv, Ivano-Frankivsk, Volyn, Zhytomyr;
- Zone II - oblasts: Kyiv, Cherkasy, Chernivtsi, Zakarpattia, Vinnytsia, Chernihiv, Sumy, Kharkiv, Poltava;
- Zone III - regions: Luhansk, Donetsk, Dnipropetrovsk, Kirovohrad;
- Zone IV - the Autonomous Republic of Crimea, regions: Kherson, Odessa, Mykolaiv, Zaporizhia.

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<sup>6</sup> <https://vatra.in.ua/en/info/statti/karta-svitloklimatychnoho-rajonuvannia-terytorii-ukrainy/>

**Figure 5** New light-climatic zoning of Ukraine



Source: <https://vatra.in.ua/en/info/statti/karta-svitloklimatychnoho-rajonuvannia-terytorii-ukrainy/>

### Implications for Dutch companies

- Permitting is feasible but benefits from a phased approach (pilot → scale-up), strong local project management, and early engagement on utilities and local approvals.

## 6.2 Trade policy and international market access

Ukraine's agricultural trade relations with the European Union have undergone significant changes since 2022. During the initial phase of the war, the EU introduced Autonomous Trade Measures (ATMs), allowing Ukrainian agricultural products to enter the EU without duties or quotas. These measures provided critical short-term support to Ukrainian exporters.

As of mid-2025, the EU has partially reintroduced tariff and quota regimes closer to pre-war conditions, while negotiations continue on a modernised trade framework under the Deep and Comprehensive Free Trade Area (DCFTA). These developments reflect political pressures within the EU and concerns among EU producers, resulting in a more dynamic and less predictable trade environment.

Although trade measures primarily affect field-grown commodities, they also influence the protected cultivation sector by shaping overall export prospects, compliance incentives, and alignment with EU standards. For high-value greenhouse products, future export opportunities will increasingly depend on regulatory compliance and quality differentiation rather than volume-based competitiveness.

### 6.2.1 GLOBAL G.A.P. certification and EU export readiness for greenhouse vegetables

For Ukrainian greenhouse producers, GLOBALG.A.P. certification is often a practical prerequisite for exporting fresh greenhouse vegetables to the EU, because it is widely used by European importers and retail supply chains as a supplier qualification standard. In other words, while EU market entry is governed by mandatory regulatory requirements (including traceability obligations), many commercial buyers expect GLOBALG.A.P. (or an equivalent assurance scheme) as evidence of good agricultural practice, documented control of inputs, and consistent production management.

Open-source evidence suggests that GLOBALG.A.P. exists in the Ukrainian greenhouse segment but is concentrated among a limited number of larger, professional producers, rather than being widespread across the sector. For example, “TK Dniprovskiy” (GREEN AGRO) publicly states that its production is certified under GLOBALG.A.P. In addition, corporate communications related to DF Agro (Synkiv) refer to international certification (including GlobalG.A.P.) in the context of export-oriented positioning. At the same time, for several greenhouse businesses, no direct public confirmation could be identified through open sources (e.g., certificate copy, GGN/certificate number, or explicit statement on official channels), which limits the ability to validate certification status without producer-provided identifiers.

From a compliance perspective, GLOBALG.A.P. aligns well with core EU expectations on traceability and controlled production, as EU food law sets traceability requirements for food business operators, and buyers often seek additional, audit-based assurance through private standards. Practically, certification readiness typically requires: (i) batch-level record keeping and traceability, (ii) documented pesticide/fertiliser management, (iii) hygiene and worker safety procedures, (iv) internal controls and corrective actions, and (v) audit preparedness. Support focused on these elements can therefore directly strengthen export-readiness for greenhouse vegetables and improve access to EU-linked supply chains.

Optional verification note (for footnote): Independent verification of GLOBALG.A.P. status is normally done via the GLOBALG.A.P. portal using a GGN/certificate number provided by the producer.

#### **Implications:**

Trade policy developments reinforce the importance of compliance readiness and strategic positioning for protected cultivation, particularly for companies targeting EU markets with high-value or off-season products.

### **6.3 Permitting and compliance requirements**

Protected cultivation facilities in Ukraine operate under general agricultural, construction, and environmental legislation, as there is no dedicated legal framework for greenhouses. Regulatory requirements typically include construction permits, land-use compliance, connection to utilities, environmental standards, and occupational safety regulations.

In practice, administrative complexity and procedural uncertainty—rather than formal legal restrictions—represent the main challenges, especially for larger or high-tech greenhouse projects.

Coordination with local authorities and variability in regional practices can lead to delays and increased transaction costs.

Sanitary and phytosanitary (SPS) requirements apply to both domestic and export-oriented producers. While alignment with EU standards is progressing, certification systems, traceability, and enforcement capacity remain uneven, particularly among small and medium producers.

### **6.4 Customs procedures and import of equipment**

Most advanced greenhouse technologies, climate control systems, automation equipment, and specialised inputs are imported. Ukraine’s import regime for such products is governed by the Customs Code of Ukraine and standard tariff classifications.

While no sector-specific import restrictions apply to greenhouse equipment, customs clearance can be time-

consuming due to complex classification, documentation requirements, and valuation procedures. Temporary wartime facilitation measures have eased imports of critical goods, but these measures are evolving and may be phased out.

**Implications:**

Successful import strategies typically rely on experienced local partners, advance classification planning, and, where relevant, the use of bonded warehouses or phased deliveries to reduce regulatory and logistical risk.

## 6.5 Environmental, Sanitary and Phytosanitary (SPS) Requirements and Alignment with EU Regulations

The regulatory framework for plant protection products (PPPs) and chemical safety in Ukraine is undergoing a gradual but significant transformation driven by commitments under the EU–Ukraine Association Agreement. Currently, the sector is governed by legacy legislation adopted in the mid-1990s, which only partially reflects EU regulatory approaches.

In response to obligations under Article 64 of the Association Agreement, Ukraine has initiated legislative reforms aimed at harmonising SPS rules with EU standards, particularly Regulation (EU) No 1107/2009 on plant protection products and Regulation (EU) No 2019/1009 on fertilising products. Draft legislation on plant protection products and fertilisers is under consideration and signals a clear direction toward EU approximation.

A key proposed change is the introduction of registration of active ingredients as a prerequisite for registering formulated PPPs. This represents a structural shift from the current system and brings Ukrainian regulation closer to EU practice, albeit with simplified procedures and partial alignment reflecting Ukraine’s non-EU status. The draft framework also предусматривает the introduction of lists of banned active ingredients and co-formulants, broadly aligned with EU restrictions.

An additional milestone is the Law “On Chemical Safety and Chemical Product Management”, which entered into force in 2024 and establishes a national chemical safety system aligned with EU REACH and CLP principles. While implementation will be gradual, this reform strengthens traceability, oversight, and environmental compliance across agricultural inputs, including those used in protected cultivation.

Overall, Ukraine is moving toward closer alignment with EU SPS and chemical safety standards, but the process remains transitional. Draft laws have not yet been fully adopted, secondary legislation is pending, and enforcement capacity is still developing. During this transition period, the current regulatory regime remains in force.

**Implications for Protected Cultivation and Dutch Companies**

- Regulatory window of opportunity: Ongoing harmonisation creates a time-limited window for introducing products and technologies under existing rules, with lower registration costs and shorter timelines than in the EU.
- Rising importance of compliance-oriented solutions: Progressive tightening of SPS and chemical safety rules will increase demand for greenhouse technologies that support traceability, residue management, and safe input use.
- Need for forward-looking strategies: Market entry should anticipate future regulatory requirements to ensure smooth transition toward EU-level compliance.
- Opportunities beyond inputs: Regulatory reform creates demand for advisory services, digital monitoring, training, and compliance support—areas where Dutch expertise is particularly strong.
- These reforms also reflect broader EU policy orientations under the Green Deal, reinforcing the long-term importance of reduced chemical use, traceability, and environmental compliance.

## 6.6 Government Support Programmes

Government support for protected cultivation focuses primarily on grant schemes and concessional financing aimed at small and medium producers, particularly for low- and mid-tech greenhouses and post-war relocation projects. These instruments help reduce initial capital barriers and stimulate adoption of protected cultivation systems. <https://diia.gov.ua/services/grant-na-teplicyu>

In parallel, capacity-building initiatives supported by public institutions and international partners, including EBRD and FAO, are strengthening skills and knowledge in modern greenhouse management, energy efficiency, and climate-adapted production through platforms such as AgriAcademy.

### **Implications:**

Public support and training programmes lower entry barriers for domestic producers and create complementary opportunities for foreign technology providers, trainers, and service companies.

### **Overview of Greenhouse Grant Schemes**

Since 2022, government support programmes have become an important instrument for sustaining and partially rebuilding protected cultivation in Ukraine. These programmes are primarily aimed at supporting food security, small and medium agricultural producers, and the relocation or restart of production capacities affected by the war.

Within this framework, greenhouse and tunnel construction has emerged as a priority area of support, as protected cultivation allows for relatively fast deployment, year-round vegetable production, and reduced dependence on imports. Grant schemes are therefore increasingly shaping the structure and pace of recovery in the protected cultivation segment. State support program was mainly aimed on self-employment / creating jobs and rural development. For greenhouses it was more difficult than for f.e. berries, since greenhouse production require less labour.

### **Scope, Eligibility and Funding Logic**

Greenhouse grant schemes operate predominantly on a co-financing basis, whereby public funding covers part of the initial investment costs, while beneficiaries contribute own capital. According to publicly available programme documentation and stakeholder interviews, grant-supported greenhouse projects are typically small to medium in scale and focus on standardised, modular solutions. F.e. FAO operate with vouchers.

Pure state grants under national programmes generally support projects with investment volumes in the order of several hundred thousand euros, most commonly associated with basic or entry-level mid-tech greenhouses. In selected cases, larger project budgets have been observed where state support is combined with donor or development partner funding, although such cases are not representative of the programme as a whole.

Eligible costs usually include:

- greenhouse structures and basic construction works,
- irrigation and fertigation systems,
- simple climate control and monitoring equipment,
- installation and commissioning.

Highly automated, energy-intensive high-tech greenhouses typically fall outside the scope of direct grant support and depend primarily on private investment or donor-backed financial instruments.

### **Implementation Model and Role of Local Suppliers**

In practice, the implementation of grant-supported greenhouse projects is carried out predominantly by local Ukrainian manufacturers and contractors, particularly in the construction of greenhouse structures. Local suppliers provide most of the plastic tunnels, metal frames, basic glazing systems, and standard irrigation components used in grant-funded projects.

This implementation model is driven by several factors:

- grant budget ceilings that favour cost-efficient solutions,
- short implementation timelines,
- logistical constraints under wartime conditions,
- beneficiaries' preference for readily available and familiar technologies.

As a result, government support programmes have contributed not only to farm-level recovery, but also to the development and consolidation of a domestic greenhouse construction sector. Local manufacturers have expanded production capacity, standardised designs, and improved installation capabilities in response to grant-driven demand.

### **Impact on the Protected Cultivation Market**

Rather than driving rapid quantitative growth, government grant schemes have had a structuring effect on the protected cultivation market. They have shaped:

- the predominance of low- and entry-level mid-tech greenhouses,
- the geographic spread of new projects in safer regions,
- the dominance of local suppliers in basic construction and equipment.

At the same time, the reliance on locally produced low-tech solutions has revealed performance limitations, particularly in energy efficiency, climate optimisation, yield stability, and operational management. These limitations are increasingly recognised by producers once greenhouses are operational, creating demand for incremental upgrades, optimisation, and professional support.

In this sense, grant-supported projects often represent a first step in greenhouse development, establishing basic infrastructure that may later be upgraded as producers gain experience, capital, and access to markets.

### **Implications for Dutch Companies**

For Dutch companies, government support programmes do not currently represent a primary channel for direct participation in basic greenhouse construction, as this segment is largely served by local suppliers. However, the programmes play a critical role in preparing the market for more advanced solutions.

Key implications include:

- short-term opportunities are strongest in complementary technologies and services, rather than core construction;
- grant-funded greenhouses generate follow-up demand for improved climate control, water efficiency, monitoring, and production optimisation;
- visible performance gaps in locally supplied systems increase openness to mid-tech upgrades and hybrid solutions;
- training, advisory services, and demonstration projects offer practical entry points to showcase added value beyond the local baseline.
- 

Overall, government grant schemes should be understood as a market development mechanism: by accelerating the deployment of basic greenhouse infrastructure through local suppliers, public funding contributes to sector growth while simultaneously creating a pipeline of future demand for higher-value technologies and expertise, including those offered by Dutch companies.

## **6.7 Policy Alignment with European Standards and Future Reforms**

Ukraine's EU integration trajectory will continue to drive regulatory alignment across agriculture, food safety, and environmental protection. While alignment enhances long-term predictability and market access, it also poses challenges related to implementation capacity, compliance costs, and economic feasibility for producers.

Stakeholders have expressed concerns about the pace and sequencing of reforms, particularly in the area of plant protection and chemical regulation. The effectiveness of future reforms will depend not only on legislative adoption but also on enforcement capacity, institutional coordination, and support for producers during the transition.

### **Implications for Dutch Companies**

Taken together, Ukraine's policy, regulatory, and support environment creates a market that is accessible but highly structured by public policy instruments and transitional regulation. For Dutch companies, success in the protected cultivation sector depends less on short-term export transactions and more on strategic positioning within this evolving framework.

Government grant schemes currently play a central role in shaping market demand, particularly in the low- and entry-level mid-tech segments. As these programmes are largely implemented through local greenhouse construction suppliers, direct competition in basic structures is limited. Instead, Dutch companies are best positioned to engage upstream and downstream of grant-funded projects, providing technologies and services that address performance gaps, efficiency challenges, and future compliance requirements.

At the same time, ongoing alignment with EU SPS and chemical safety standards creates both uncertainty and opportunity. While regulatory reform remains incomplete, companies that anticipate future compliance needs and integrate traceability, monitoring, and sustainability into their offerings are likely to gain a competitive advantage as standards tighten.

Trade policy volatility and administrative complexity further reinforce the importance of phased market entry models, local partnerships, and a focus on value-added solutions rather than price-based competition. In this context, Dutch expertise in modular greenhouse design, energy efficiency, climate optimisation, training, and system integration aligns well with the emerging needs of the Ukrainian market.

While current grant schemes prioritise rapid deployment of basic greenhouse infrastructure, future upgrading needs are likely to be influenced by sustainability and efficiency requirements aligned with EU Green Deal principles.

Overall, the Ukrainian protected cultivation sector offers meaningful opportunities for Dutch companies willing to engage as long-term partners in sector development, rather than short-term suppliers. Public support mechanisms, regulatory transition, and local industry development together create a pathway in which Dutch technology and know-how can complement, rather than replace, domestic capabilities.

## **6.8 Policy reforms affecting the sector**

Policy reforms relevant to protected cultivation include both external trade conditions and domestic support instruments.

On the trade side, EU Autonomous Trade Measures introduced during the war supported Ukrainian exports, but by mid-2025 the EU partially reintroduced elements closer to pre-war tariff/quota regimes, increasing the importance of compliance, quality differentiation and strategic positioning for any EU-facing greenhouse value chains.

Domestically, government functions related to agriculture have been integrated into the Ministry of Economy, which plays a central role in SME support and the design of greenhouse grant schemes.

### **Implications**

- Policy is pragmatic and phased: rapid deployment of basic infrastructure now, with gradual upgrading (energy efficiency, climate control, input management, professionalism) expected in the medium term—often implicitly influenced by EU market expectations and Green Deal/CAP reference frameworks.

## 6.9 Potential incentives for foreign investors

Direct government grants primarily target domestic SMEs and focus on low- and entry-level mid-tech greenhouses, usually implemented through local greenhouse structure suppliers. These programmes lower entry barriers for domestic producers and shape market structure—creating a large installed base of basic facilities and, consequently, demand for upgrades, optimisation, services, and training.

For foreign companies, incentives are therefore less about subsidised “export sales” into grant-funded construction and more about positioning within a market that is being structured by public programmes and donor-linked instruments: complementary technologies, hybrid mid-tech upgrades, compliance solutions, training, and demonstration projects.

## 6.10 Regulation of organic production and certification

Ukraine has an established legal framework for organic production. The core act is the Law of Ukraine No. 2496-VIII “On Basic Principles and Requirements for Organic Production, Circulation and Labelling of Organic Products” (adopted 10 July 2018; entered into force in August 2019). It provides the legal basis for organic rules, certification, state control and labelling, complemented by secondary acts (including detailed production rules and the state organic logo).

For EU market linkage and benchmarking, the applicable reference is Regulation (EU) 2018/848, which entered into application on 1 January 2022.

**Relevance for protected cultivation.** Organic greenhouse production is feasible, but it typically faces practical constraints: reliable access to compliant inputs (including fertilisers and plant protection solutions), availability and cost of biological crop protection, and higher documentation workload linked to traceability and segregation.

For many greenhouse enterprises, a realistic near-term pathway may be “low-input” or biologically oriented production (e.g., integrated pest management and reduced chemical load) even where full organic certification is not immediately achievable; this can still prepare producers for stricter buyer requirements over time.

### **Implications for Dutch engagement (practical).**

- **Compliance-enabling packages** (traceability tools, record-keeping systems, audit-ready workflows) can reduce transaction costs for certified organic operators and for producers transitioning toward lower-input production models.
- **Biological crop protection, safer input handling, and advisory support** are critical complements to technology supply in the organic/low-input segment, where operational know-how determines whether standards can be met consistently.
- **Partner verification** can use the public state registers (operators and certification bodies) to reduce reputational and compliance risks when working with “organic” claims.

## 6.11 Recommended Actions (Summary)

Based on the current policy, regulatory, and support environment, Dutch engagement in Ukraine’s protected cultivation sector is most effective when aligned with phased, partnership-oriented approaches.

### **Recommended actions include:**

- Prioritise engagement around grant-supported projects, focusing on post-construction upgrades,

optimisation, and performance improvement rather than basic greenhouse structures, which are predominantly supplied by local manufacturers.

- Position Dutch offerings as complementary to local solutions, emphasising energy efficiency, climate optimisation, water management, digital monitoring, and compliance-oriented technologies that address limitations of low- and entry-level mid-tech greenhouses.
- Support capacity building and demonstration activities, including training programmes, pilot projects, and knowledge partnerships that showcase Dutch expertise and build trust among producers transitioning from basic to more advanced production models.
- Adopt phased market entry strategies, starting with advisory services, system components, or modular add-ons that can be integrated into existing greenhouses, and scaling up as regulatory alignment and market maturity progress.
- Monitor regulatory and support programme developments closely, particularly in relation to SPS reform, chemical safety regulation, and the evolution of government grant schemes, to ensure timely adaptation of products and services.

Taken together, these actions allow Dutch companies and public instruments to engage constructively with Ukraine's protected cultivation sector, supporting gradual upgrading, resilience, and long-term competitiveness in line with national recovery priorities.

# 7 Ukrainian Demand & Needs Assessment

This chapter is based on the analysis of primary survey data collected for this study from two groups of respondents: industrial greenhouse complexes and small greenhouse producers. The segmentation is essential for interpreting needs and demand patterns, as the production systems differ substantially. Industrial greenhouse complexes in the sample are predominantly high-technology greenhouses, characterised by larger scale and higher levels of automation and energy dependence. In contrast, small producers operate mainly low- and mid-technology greenhouses, where seasonality, limited infrastructure and affordability constraints shape investment priorities. Importantly, within the smallholder group there is a significant share of new or recently established greenhouses supported through grant programmes, which influences demand for equipment packages, training, and advisory support.

Within the smallholder segment, newly established low- and mid-tech greenhouses supported through grant programmes can be considered a “future-facing” target group for engagement: while they currently operate at lower technology levels, a share of these producers is expected to upgrade automation over time and/or transition toward more professional greenhouse models.

Survey results also point to gendered labour dynamics in greenhouse operations; see Box 1.

## **Box 1. Gender and workforce note (survey insight)**

Survey feedback indicates a predominantly female workforce in greenhouse operations (reported up to ~90% in the surveyed cases). This can be interpreted as part of the wider war-related labour reallocation, where women increasingly take on a broader set of operational tasks. For programme design and market delivery, this implies that training, advisory services and demonstration formats should be accessible to women working in greenhouses, and that mechanisation and automation should prioritise human-centred solutions that reduce manual handling and improve ergonomics and safety (e.g., labour-saving handling aids, adjustable workstations, simplified packing and grading tools, and intuitive control interfaces supported by SOP-based training).

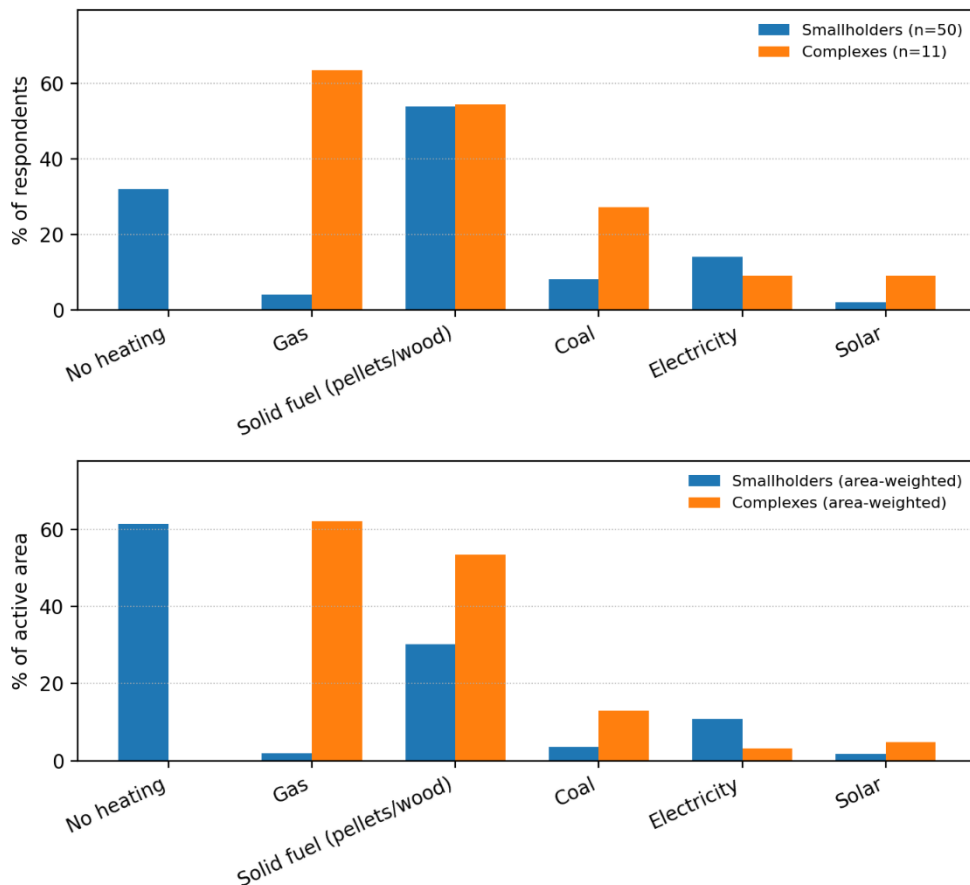
## **7.1 Technological needs (climate control, automation, energy) – segmented by greenhouse type**

### **Smallholders / low-tech greenhouses (n=50)**

For small producers, the dominant constraint is production continuity with limited or absent heating capacity, which structurally limits winter output. Heating profiles show:

- No heating / seasonal production: 32% of respondents (~62% of active area).
- Solid fuel (pellets/wood): 54% (~30% of area).
- Electric heating: 14% (~11% of area).
- Coal: 8% (~4% of area).
- Gas: 4% (~2% of area).
- Solar: 2% (~2% of area).

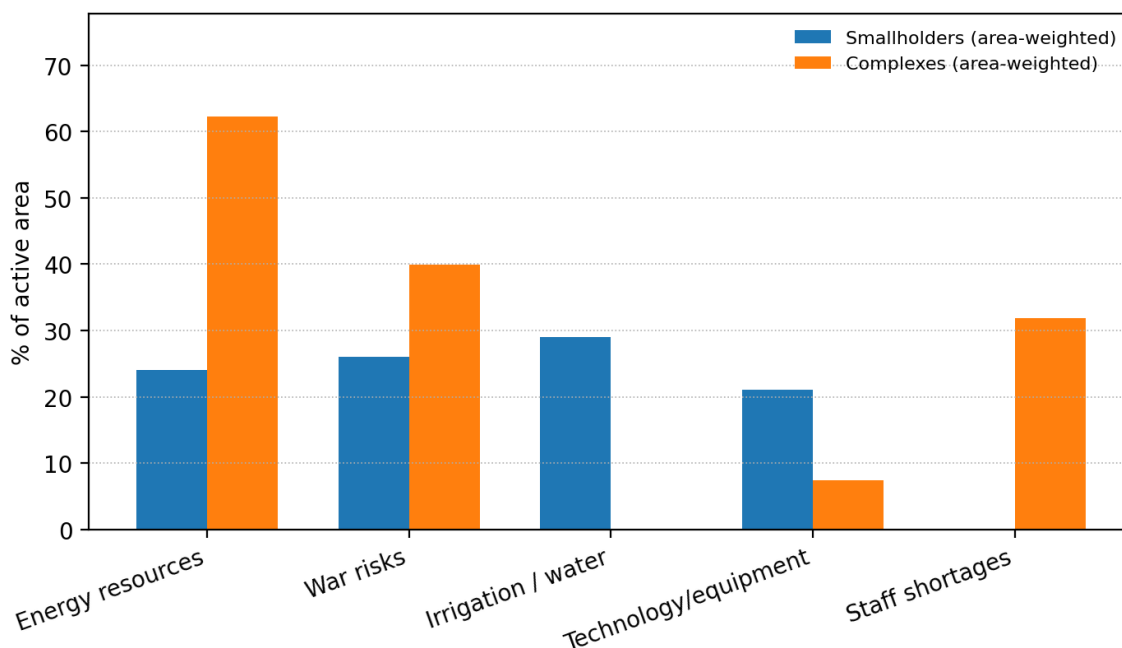
**Figure** Energy carriers used for greenhouse heating, by segment (share of respondents and area-weighted).



Source: survey of smallholders (n=50) and greenhouse complexes (n=11), 2025.

Cost pressure has increased markedly: energy expenditure as a share of production costs rose from around 31% pre-war to around 46% during the war (area-weighted). When weighted by area, the most significant constraints for smallholders are irrigation (29%), war-related risks (26%) and energy resources (24%).

**Figure** Most significant constraints for further development (area-weighted, where quantified).



Source: survey of smallholders (n=50) and greenhouse complexes (n=11), 2025.

Priority needs for this segment are therefore best framed as minimum viable packages:

- Minimum energy resilience: backup power for critical operations (irrigation, basic cooling/packing) and pragmatic heating improvements where relevant.
- Water and irrigation reliability: durable, easy-to-maintain irrigation solutions and reduction of manual workload.
- Affordable 'durable tech': equipment that can be serviced locally and performs under unstable conditions.

## Industrial / mid-high tech greenhouse complexes (n=11)

For greenhouse complexes, the priority shifts from "basic heating presence" to energy cost exposure, resilience and efficiency upgrades. The most common energy carriers are gas (63.6% of respondents; ≈62% of area) and pellets (54.5%; ≈53% of area), with coal (27.3%; ≈13% of area) used by a minority.

Automation is present but uneven. By respondent share, automated control is most common for heating (91%) and ventilation (91%), while lighting (73%) and especially irrigation (45%) are less consistent. When weighted by greenhouse area, larger sites show higher automation coverage (heating 98%, ventilation 95%, lighting 90%, irrigation 82%).

Priority needs for complexes are therefore upgrade and optimisation packages:

- Energy efficiency retrofits and operational optimisation (monitoring, tuning, heat management).
- System integration and reliability (climate-irrigation-lighting coordination; maintenance routines; spare parts/service capacity).
- Commissioning and performance support, since operational tuning determines realised returns in higher-tech environments.

## 7.2 Knowledge and skills needs: training, internships, education – segmented

### Smallholders / low-tech

Skills needs for smallholders are practical and field-based, aimed at reducing losses and stabilising yields: SOPs for irrigation routines, hygiene and seasonal planning; basic pest and disease prevention; and simple post-harvest routines (packing discipline and temperature handling where refrigeration exists).

The smallholder profile indicates the need to design training that is accessible and scalable: women account for around 72% of the workforce, and area-weighted data show a significant share of workers aged 40–50 and above (with about one-third of area managed by workers older than 50).

- Hands-on coaching and train-the-trainer formats (extension-style delivery).
- Business skills: pricing, channel selection, simple planning, and cooperation models.
- Low-input / IPM basics, as an entry point toward safer production and potential organic transition.

### Industrial / mid-high tech greenhouse complexes

Complexes require technical and data-driven competencies to extract value from existing systems: climate strategy, sensor/controller calibration, fertigation routines, troubleshooting, and maintenance engineering. Structured training pipelines (technicians/growers; internships) reduce dependency on a few key specialists.

- Commissioning and optimisation support linked to equipment upgrades.
- Energy management skills tied to retrofit packages.
- Maintenance workflows and service planning to protect uptime.

While several donor- and industry-supported training initiatives exist (e.g., short courses and online formats linked to AgriAcademy and recent sector plans), these activities do not substitute for a structured education pipeline. Stakeholders noted that Ukraine currently has limited dedicated curricula on protected cultivation within agrarian universities and vocational colleges, and that practical training is constrained by the lack of

functioning training greenhouses and demonstration sites. As a result, the sector faces a persistent shortage of professionally trained greenhouse agronomists and farm managers—skills that are essential for moving from “built greenhouse capacity” to stable, efficient production.

## 7.3 Needs related to starting material (seeds, seedlings, young plants) — segmented

### Smallholders / low-tech

The smallholder segment is dominated by own propagation:

- Purchased seedlings: 6%.
- Own seedlings from domestic seed: 16%.
- Own seedlings from imported seed: 58%.
- Own seedlings from mixed domestic + imported seed: 20%.

Key needs include stable access to quality seeds and basic nursery hygiene/health protocols to reduce cycle failures. For many smallholders, “organic/low-input” is best approached as a practical transition pathway (reduced chemical load and better routines first), supported by advisory services.

### Industrial / mid-high tech greenhouse complexes

Complexes report a more standardised model based on own seedlings and predominantly imported seed, which implies demand for reliable access to high-performing genetics and predictable import logistics, plus nursery QA systems (uniformity, biosecurity, traceability of inputs). Diversification ambitions increase demand for validated crop protocols and variety trials.

Organic and low-input practices are a cross-cutting niche: adoption of biological crop protection and compliance-ready routines creates demand for biocontrol know-how, compliant input choices and advisory support to maintain yield stability during transition.

## 7.4 Storage and logistics needs — segmented

### Smallholders / low-tech

Post-harvest is a major bottleneck for smallholders:

- Storage: 80% report no refrigeration/storage, while 20% have basic refrigeration (area-weighted ≈83% vs 17%).
- Sorting: 90% manual, 2% mechanised, 8% mixed.
- Packaging (multi-response): 62% cardboard boxes; 54% plastic crates; 12% nets; 8% containers; 6% cassettes; and 12% no packaging.

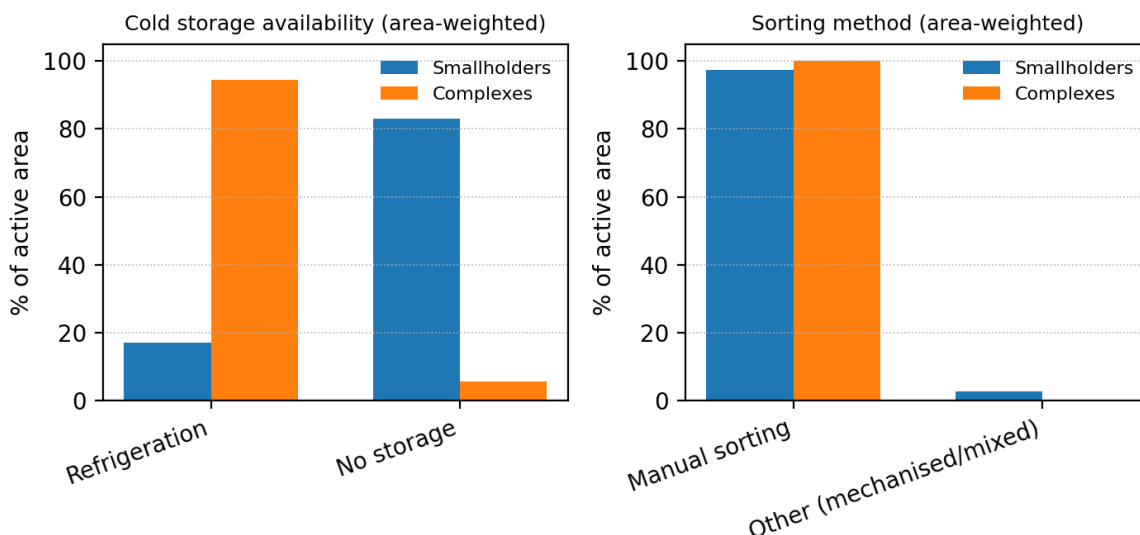
This lack of storage forces quick sales and limits market choice, reinforcing demand for low-cost cold storage solutions, standardised packaging/handling routines, and simple labour-saving grading workflows.

### Industrial / mid-high tech greenhouse complexes

Complexes are more likely to have basic cold storage (82% of respondents; ≈94% of area), but still face efficiency constraints: sorting remains 100% manual and packaging is dominated by cardboard (73%) and mixed packaging (18%), with a small share reporting no packaging (9%).

Priority needs therefore include upgrading grading/packing efficiency to reduce labour bottlenecks, improving cold storage reliability and contingency planning (incl. energy backup), and packaging standardisation aligned with demanding buyers.

**Figure** Post-harvest bottlenecks by segment: cold storage availability and sorting method (area-weighted).



Source: survey of smallholders (n=50) and greenhouse complexes (n=11), 2025.

## 7.5 Needs of government, business, and research institutions

Industrial complexes report very limited success in accessing wartime state support (91% indicate no successful experience; ~74% of area). This points to three public-sector needs: (i) clearer delivery design of support programmes (eligibility, timelines, transparency, monitoring), (ii) segmented instruments for smallholders/low-tech versus commercial/industrial greenhouses, and (iii) embedding commissioning/training/advisory into support as a standard component to avoid under-use of delivered equipment.

For business, smallholders primarily need affordable packages (cash/equipment/training), practical technologies and accessible dealer/service channels. Complexes need efficiency upgrades, spare parts and service ecosystems, performance optimisation, and blended finance routes (own funds plus grants/credit where feasible).

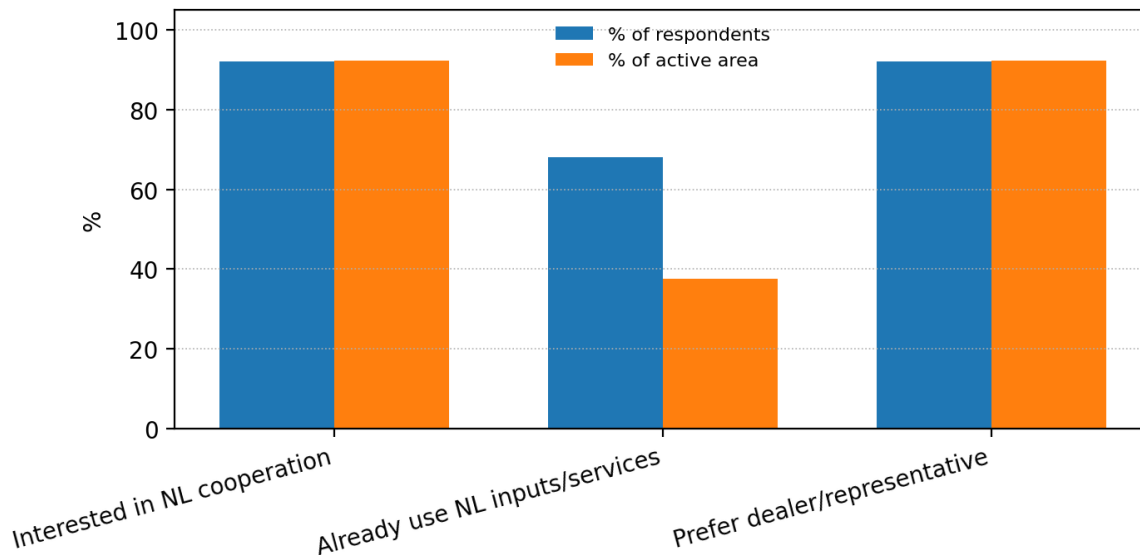
Linkages to R&D are weak among smallholders: 86% report no cooperation with research institutions (8% cooperate sometimes; 6% regularly). This reinforces the case for applied extension and demonstration capacity that translates knowledge into adoption.

## 7.6 Synergies between Ukrainian needs and Dutch expertise (by segment)

### Smallholders / low-tech (scale + fast impact)

Interest in cooperation is high: 92% of smallholders express interest in working with Dutch companies, and 68% already use Dutch-origin seeds or other resources. Most prefer mediated engagement: about 65% indicate cooperation via a dealer/representative (versus ~35% direct). Price sensitivity is a key barrier—high-quality inputs and technologies do not always pay back at current domestic price levels—so bundled solutions and co-financing instruments are particularly relevant.

**Figure** Smallholder engagement with Dutch companies: interest, current use of Dutch inputs, and preferred cooperation format



Source: survey of smallholders (n=50), 2025.

- Robust 'mid-tech adapted down' packages (irrigation, simple climate improvements, low-cost post-harvest solutions) paired with training/advisory.
- Local distribution, service and spare parts capacity through dealers and trusted partners.
- Demonstration and train-the-trainer formats to accelerate adoption.

## Industrial / mid-high tech greenhouse complexes (performance, efficiency, compliance)

Dutch fit is strongest in climate and energy efficiency optimisation, automation/monitoring, commissioning plus performance optimisation services, and post-harvest workflow improvements—delivered with maintenance/service, spares, and operational training.

## Organic / low-input as a cross-cutting niche

Dutch strengths in IPM and biological crop protection, compliance-ready production systems and knowledge transfer align with both smallholder low-input upgrading and complex-level differentiation (quality consistency, residue management and certification pathways where commercially relevant).

## 7.7 Demand for advisory services and farmer support

Both segments show that outcomes depend on implementation capacity. Smallholders need practical routines and business support to reduce losses and stabilise output, while complexes need optimisation and technical troubleshooting to realise returns on equipment and efficiency upgrades.

### Advisory content by segment

- Smallholders: short-cycle coaching (SOPs, irrigation, hygiene, basic IPM), post-harvest routines and packaging discipline, and business support (pricing, channels, cooperation).
- Complexes: commissioning and optimisation (climate strategy, fertigation, calibration, troubleshooting), energy management advisory tied to retrofit packages, and maintenance workflows/service planning.

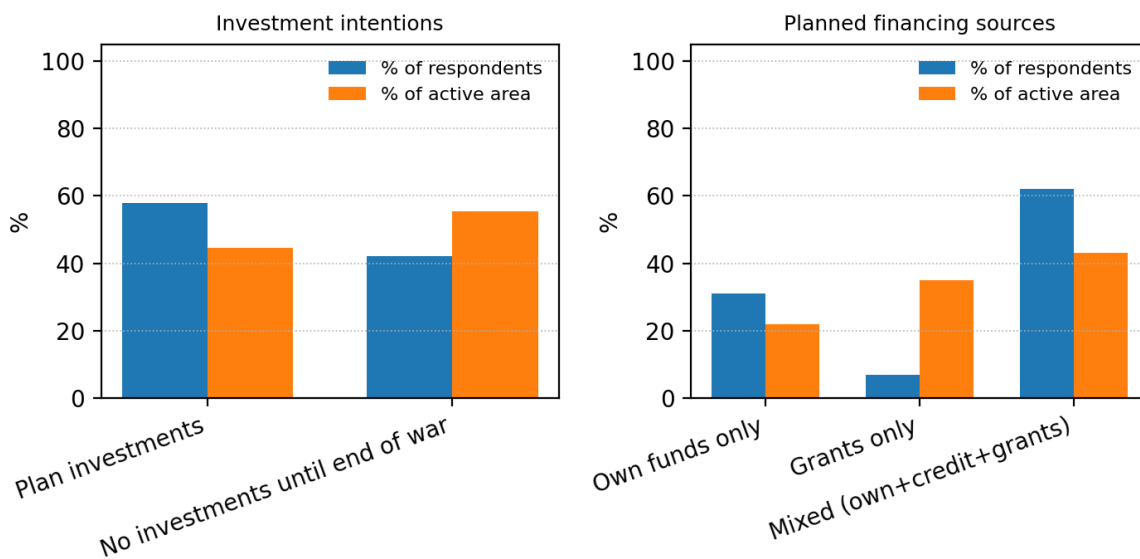
## Implications for international programmes

Smallholders report low prior participation in international/donor projects (14%), but intentions are high: 76% indicate plans to participate in international programmes in the future. Use of sector platforms remains limited

(e.g., 16% report using the Agrifood Platform). Preferences for support are pragmatic and multi-component (multi-response): money (86.8%), equipment (60.5%) and training/consulting (42.1%). Priority uses include building new greenhouses (52.6%), automation improvements (47.4%) and broader technical upgrades (44.7%), while direct recovery is selected less frequently (7.9%). See Section 8.5 for an indicative overview of current programme types and access channels (incl. SAR/DAR).

Investment intent is also visible: 58% of smallholders (45% of area) plan investments, most commonly for new greenhouse construction (66%). Financing is typically mixed (62% combine own funds, credit and/or grants), while 31% rely only on own funds and 7% only on grants (the latter representing a larger share of area).

**Figure** Smallholders’ investment intentions and planned financing sources (respondent vs area-weighted).



Source: survey of smallholders (n=50), 2025

# 8 Stakeholder Mapping

This chapter maps the key public, private and knowledge stakeholders shaping Ukraine's protected cultivation sector. It highlights practical entry points for Dutch engagement, including policy and regulatory counterparts, implementation partners, industry platforms and education/research institutions. International donor programmes relevant to protected cultivation are summarised separately in Section 7.5.

## 8.1 Government Bodies and Public Institutions

This subsection outlines the key government bodies and public institutions shaping the policy, regulatory, and operational environment for protected cultivation in Ukraine. The focus is on institutions with direct relevance for greenhouse development, public support mechanisms, regulatory compliance, and market entry, rather than on an exhaustive institutional overview.

Following recent government restructuring, agricultural policy functions have been integrated into the Ministry of Economy of Ukraine, which now serves as the central authority for both economic development and agricultural sector governance.

### **Ministry of Economy, Environment and Agriculture of Ukraine** <https://me.gov.ua/?lang=en-GB>

The Ministry of Economy is the central authority responsible for economic policy and agricultural policy functions, including food security, SME support and investment promotion. It plays a leading role in defining national priorities for agricultural development, including protected cultivation.

The Ministry is directly involved in the design and administration of government grant schemes for greenhouse and tunnel construction, as well as broader SME and recovery instruments that affect agricultural producers.

**Relevance for Dutch engagement:** Key implications and entry points include:

- Primary policy and programme counterpart for aligning Dutch solutions with public support instruments (e.g., grants, recovery programmes).
- Relevant for structuring pilots and demonstration projects that link technology, training and measurable performance outcomes.
- Counterpart for sustainability-oriented solutions and environmental compliance, including safer chemical use, waste and water management, and monitoring systems.
- Relevant for longer-term alignment with EU environmental expectations affecting inputs and production systems.

The Ministry of Economy is the primary policy and programme counterpart for Dutch engagement in the protected cultivation sector, including policy dialogue, alignment of Dutch solutions with public support instruments, and the development of pilot or demonstration projects.

### **State Service of Ukraine on Food Safety and Consumer Protection**

The State Service is the main authority responsible for sanitary and phytosanitary (SPS) control, food safety, plant health, and enforcement related to plant protection products.

In protected cultivation, it oversees compliance with pesticide use, residue limits, plant health requirements and certification procedures, and supports gradual alignment with EU standards.

**Relevance for Dutch engagement:** Key implications and entry points include:

- Key counterpart for compliance-oriented technologies, monitoring and traceability systems, and advisory

services linked to EU-aligned food safety standards.

- Relevant for guidance on residue management, plant health and certification workflows for greenhouse operators.

### **State Agency for Restoration and Infrastructure Development of Ukraine**

<https://restoration.gov.ua/en/>

The Agency coordinates recovery and reconstruction efforts in war-affected regions and influences the geographic prioritisation and sequencing of recovery projects.

For protected cultivation, its relevance lies in linking greenhouse development with regional recovery, relocation of production and infrastructure rehabilitation.

**Relevance for Dutch engagement:** Key implications and entry points include:

- Potential partner for regionally targeted pilots and integrated recovery initiatives involving protected cultivation and related infrastructure.
- Useful counterpart when projects require coordination across utilities, logistics or site rehabilitation.

The Agency represents a potential partner for regionally targeted pilot projects and integrated recovery initiatives involving protected cultivation.

### **Regional and Local Authorities**

Regional and local authorities are responsible for land allocation, construction permits, utility connections and local implementation of national programmes. In practice, they are operational gatekeepers for greenhouse projects.

Administrative capacity and procedures vary significantly across regions, making local engagement critical for feasibility, timing and compliance.

**Relevance for Dutch engagement:** Key implications and entry points include:

- Important for practical project implementation (permits, utilities, siting) and for regionally anchored demonstration or training initiatives.
- Engagement is typically most effective via local producer partners and implementation contractors.

Overall, effective engagement requires a multi-level approach: strategic dialogue at the national level on policy and support instruments, combined with operational coordination at regional and local levels for implementation.

Successful project implementation requires cooperation with regional and local authorities, often in partnership with local producers and contractors.

### **Overall Assessment**

Government bodies and public institutions in Ukraine exert a strong structuring influence on the protected cultivation sector. With agricultural policy now consolidated within the Ministry of Economy, decision-making related to regulation, funding, and recovery instruments is more centralised, while implementation remains decentralised at the regional and local levels.

For Dutch companies and public support instruments, effective engagement requires a multi-level approach: strategic dialogue at the national level combined with operational cooperation at the regional and local levels.

*While government bodies define the regulatory framework and administer support instruments for protected cultivation, the practical implementation of greenhouse programmes depends on private sector actors, producer organisations, and knowledge institutions operating at the market level.*

## 8.2 Industry Associations

Industry associations play an important intermediary role in Ukraine's protected cultivation sector, acting as connectors between producers, suppliers, government bodies, and international partners. While the sector does not yet have a single, strong umbrella organisation dedicated exclusively to greenhouse production, several industry associations influence market development through advocacy, information exchange, training, and coordination of donor- and grant-supported activities.

Industry associations act as intermediaries between producers, businesses and public institutions. They provide platforms for outreach, policy dialogue and coordination of pilot activities, although their technical service functions remain limited.

- **Ukrainian Agribusiness Club (UCAB):** a cross-sector agribusiness association representing leading agri-food companies and acting as a visible platform for policy dialogue, advocacy, and market intelligence. UCAB is relevant primarily as an entry point for engaging larger agribusiness stakeholders and for tracking broader policy and investment discussions that may affect greenhouse value chains (inputs, trade, finance, labour).
- **Association "Greenhouses of Ukraine":** relevant contact point for greenhouse operators and sector messaging.
- **Ukrainian Horticultural Association (UPOA / UHA):** an association positioning itself as a knowledge and coordination platform for export-oriented fruit-and-vegetable producers, with emphasis on quality, competitiveness and market access. For protected cultivation, UPOA/UHA is relevant as a route to producers active in structured value chains and standards-driven production (e.g., certification-oriented growers) and as a stakeholder in discussions on support programmes affecting horticulture investment.
- **Ukrainian Berries Association:** a specialised branch association uniting professional players in the berry (and related fruit) market, including growers, processors, planting material suppliers and other sector actors. It is particularly relevant for tunnel-based berry production and donor-/grant-linked support programmes, and can serve as a dissemination channel for practical guidance and mobilisation of participants for pilots and trainings.
- **UKRSADPROM Association (USPA):** an association consolidating fruit and berry producers and related businesses (including suppliers and service providers). In the protected cultivation context, UKRSADPROM is relevant for outreach to horticulture producers (including those using tunnels/covered systems), policy dialogue on sector needs, and market access topics (quality requirements, supply chain constraints, export readiness).
- **National Association of Agricultural Advisory Services of Ukraine (NAAASU):** a cross-sector platform that promotes rural development through strengthening advisory (extension) services and practical knowledge transfer to farmers. In the protected cultivation context, NAAASU is particularly relevant as an intermediary for outreach to small and emerging greenhouse growers, dissemination of practical guidance, and mobilisation of participants for training activities (including online formats) linked to donor- and grant-supported roll-out of low-tech and entry-level greenhouse projects.
- **UAMC – Ukrainian Association of Medical Cannabis:** emerging niche stakeholder working on the legal and regulatory enabling environment for medical cannabis in Ukraine and acting as a sector platform for information exchange and stakeholder coordination. For protected cultivation, UAMC is relevant as a contact point on compliance and licensing developments and as an interface to potential future demand for controlled-environment production solutions (traceability, quality management, biosecurity, and climate control requirements).

Other niche associations may exist, but this report focuses on stakeholders linked to food supply chains and mainstream protected cultivation.

**Relevance for Dutch engagement:** Associations are practical entry points for:

- targeted outreach and needs validation across producer groups;
- identifying hosts for pilot and demonstration activities;
- communicating training offers and recruiting participants for ToT formats.

## Overall Assessment

Industry associations in Ukraine's protected cultivation sector currently function more as facilitators and coordinators than as strong sector-wide advocates. Their influence is particularly visible in the implementation of grant- and donor-supported greenhouse programmes, where they support information dissemination, coordination, and training.

For Dutch stakeholders, industry associations represent practical entry points for outreach, pilot activities, and partnership building, especially when engagement is aligned with existing support programmes and focuses on upgrading, optimisation, and capacity development rather than basic infrastructure provision.

## 8.3 Universities and research institutions

Ukraine's higher and vocational education offers a broad pipeline of agronomy and horticulture graduates, and several institutions explicitly reference protected cultivation (closed soil / greenhouse farming) in their programmes. In practice, however, **greenhouse-related training is largely delivered within agronomy and horticulture tracks, while engineering disciplines (automation, climate control, energy systems, digitalisation/robotics)** are only marginally integrated into greenhouse education. As a result, graduates are typically prepared for crop production tasks, but less for operating and maintaining modern, technology-intensive greenhouse systems.

Across the reviewed institutions, **hands-on training capacity is constrained by the material base.** Where greenhouses exist, they are often **small-scale, outdated or low-tech**, and mainly used for basic practical exercises (seedlings, simple cultivation trials) rather than modern controlled-environment production. This limits exposure to key competencies required in contemporary greenhouses: climate and irrigation management, sensor-based monitoring, integrated pest management, and production planning for quality and market requirements. Several universities indicate intentions to upgrade infrastructure (including plans for demonstration greenhouses), but such initiatives remain fragmented and depend on external support.

Horticulture education itself is typically framed around **berry and vegetable production**, combining open-field and protected-ground elements. This provides a relevant agronomic foundation, but the overall system lacks **dedicated, practice-based greenhouse training centres** that could serve as national reference hubs (with modern demo facilities, applied R&D and industry partnerships).

Strengthening greenhouse education would therefore require:

1. targeted investments in modern training greenhouses (incl. demo units),
2. structured integration of engineering competencies into agronomy/horticulture curricula, supported by cooperation with commercial greenhouse operators and technology suppliers.

- **National University of Life and Environmental Sciences of Ukraine (NUBiP/NULES), Kyiv**  
<https://nubip.edu.ua/en>

Ukraine's largest and the most influential agrarian university, offering comprehensive programs in agronomy, horticulture, agroengineering, environmental sciences, and sustainable agriculture, including research and training in greenhouse and protected cultivation systems.

NUBiP is a major national agrarian university. It maintains an extensive network of practical training facilities (university-managed farms, stations and laboratories) located across different agro-climatic zones in Ukraine. According to the university, the total land area managed by these structures exceeds 34,000 ha and includes research fields and other assets, including greenhouses (as part of the practical training base).

### Greenhouse-related teaching and training capacity

NUBiP hosts specialised academic units that explicitly cover protected cultivation. The university's Department of Vegetable Production and Protected Ground is a dedicated unit within the agronomy/horticulture domain.

Course materials published by NUBiP confirm curriculum content directly relevant to greenhouse agronomy and protected cultivation, including greenhouse structures and covering materials, and applications of automation/robotics and computer technologies in intensive protected-ground production. It is not still a specialization or profession study, but a subject for agronomy specialization.

The department also runs student applied/scientific activities (e.g., the student research club "Ovochivnyk"), which is oriented to modern technologies in open-field and protected-ground vegetable production.

### **Planned demo/modern greenhouse (demonstration–practice–research use)**

A formal planning document of the Agrobiological Faculty indicates an intention to begin the design of a greenhouse of 0.06 ha at the teaching laboratory "Fruit and Vegetable Garden" ("Plodoovochevyi sad"), involving the rectorate, relevant departments and employers.

- [Nemishaiv Vocational College of NUBIP of Ukraine](#)

Nemishaiv Vocational College of the National University of Life and Environmental Sciences of Ukraine (NUBIP) is one of the leading institutions of vocational agricultural education in the country. Its key areas of training include greenhouse technologies, open-field production, agroengineering, and energy systems. The college enrolls approximately 1,500 students, around 300 of whom specialize in agronomy and plant production technologies. The institution is equipped with training and production greenhouses as well as specialized laboratories, actively implements innovative cultivation technologies, and maintains close cooperation with local communities.

The college has a practical training base that includes five greenhouses used for hands-on learning in crop production technologies; greenhouse use has been monitored by partners supporting the facilities as part of humanitarian assistance.

- **Uman National University** (formerly — Uman National University of Horticulture )

<https://www.udau.edu.ua/>

The university provides education at the bachelor's, master's, and Doctor of Philosophy (PhD) levels. It has a total student population of approximately 6,000, including about 2,800 students enrolled in agricultural disciplines.

Its research activities are supported by 23 educational and research laboratories. With a strong agricultural focus, the university specializes in agricultural sciences and is dedicated to training qualified professionals for the agricultural sector.

The university explicitly references training for "closed soil technologies" (protected/under-cover production) within its horticulture-related programmes.

- **National University of Water and Environmental Engineering, Rivne**

<https://nuwm.edu.ua/>

The university trains specialists for the agro-industrial sector and related fields, including agroengineering, agronomy, energy, environmental management, and construction. More than 400 students are currently enrolled in agricultural programs, primarily in agroengineering and agronomy.

The university plans to introduce a new educational trajectory, "**Energy-Efficient Technologies of Protected Cultivation**," within the Agroengineering and Agronomy programs. This initiative will include a series of short, practice-oriented courses covering greenhouse vegetable production, automation and digitalisation, robotics, biological plant protection, and hydroponic nutrition management.

University is would like to be supported by the establishment of a modern hydroponic greenhouse powered by

renewable energy sources, including solar panels for electricity and lighting and a heat pump for heating. The greenhouse (0.05 ha) will function as an educational and practical center for training, testing, and research of energy-efficient and energy-independent technologies in greenhouse vegetable production. It will be accessible to students, farmers, and veterans and will enable hands-on research in controlled-environment crop production, microclimate management, and the application of advanced digital and robotic solutions.

- **Zhytomyr Ivan Franko State University**

<https://enter.zu.edu.ua/specialty/546/info/#presentation>

Zhytomyr Ivan Franko State University is a leading public university in Zhytomyr, Ukraine, founded in 1919. Within its Natural Sciences Faculty, the university offers academic programs related to agriculture and plant production, including a bachelor's degree in Agronomy with a specialization in Greenhouse Farming. This program provides students with training in modern protected cultivation technologies, covering greenhouse systems, controlled-environment plant production, crop management, and essential agronomic practices.

The university offers a Bachelor-level Agronomy programme with an educational track titled "Greenhouse Farming."

- **Zhytomyr Agrotechnical Vocational College**

<https://zhatk.zt.ua/en/>

Zhytomyr Agrotechnical Vocational College offers agricultural education, including agronomy and plant production training, which provides a foundation relevant to greenhouse and protected cultivation practices

- **Lutsk National Technical University**

<https://lntu.edu.ua/uk>

Lutsk National Technical University is a comprehensive technical university in western Ukraine with a dedicated faculty training agronomy specialists. Through its agronomy program and associated departments, students gain skills relevant to modern plant production, which can be applied to protected cultivation and greenhouse technologies as part of broader agricultural education.

The total number of students: approximately 12,000 persons. The Faculty of Agrarian Technologies and Ecology trains specialists in agrarian fields: Agronomy, Agroengineering. The number of students in agronomy exceeds 200 people, in agroengineering – over 300 people.

- **Sumy National Agrarian University (SNAU), Sumy**

<https://snau.edu.ua/en/>

Sumy National Agrarian University (SNAU) is a leading multidisciplinary higher education institution in Ukraine specializing in the agricultural sector. Its core areas include agriculture, veterinary medicine, food technologies, engineering, economics, and law. The university actively внедs innovative approaches and places strong emphasis on organic production and sustainable development.

SNAU has a well-developed practical and research infrastructure, including its own training and research farms, experimental fields, and heated greenhouses, some of which are organically certified.

Practical training infrastructure includes laboratory facilities equipped with a greenhouse for raising seedlings (used in the educational process).

The total student population exceeds 8,500, with approximately 1,500 students enrolled in relevant fields such as agronomy, horticulture, food technologies, and organic production.

SNAU plans to establish an "Innovative Center of Organic Niche Crops" based on its existing certified greenhouse facilities. This initiative will provide students with unique hands-on experience in high-tech organic greenhouse production, supporting advanced training, applied research, and the development of sustainable protected cultivation practices.

- **Kharkiv Petro Vasylenko National Technical University of Agriculture, Kharkiv**  
<https://khntusg.com.ua/en/>

A leading technical university specializing in agricultural engineering, agro-technologies, energy efficiency, and mechanization of agricultural production, with strong expertise relevant to protected cultivation technologies.

- **Vinnitsia National Agrarian University, Vinnitsia**  
<https://vsau.org/en/>

A major regional agrarian university focused on agronomy, horticulture, plant protection, agricultural engineering, and agri-food technologies, with practical training facilities supporting modern crop production and greenhouse practices.

The university is referenced in academic literature as operating a greenhouse complex used as part of student training.

- **Poltava State Agrarian Academ, Poltava**  
<https://www.pdau.edu.ua/>

A well-established agrarian higher education institution providing education and research in agronomy, agroengineering, plant production, and sustainable farming systems, with relevance to protected ground cultivation.

- **Odesa State Agrarian University / Agrarian and Economic University, Odesa**  
<https://osau.edu.ua/en/>

A multidisciplinary agrarian institution combining agricultural sciences and economics, preparing specialists in agronomy, horticulture, agricultural management, and agri-food systems, including elements of controlled-environment crop production.

Programme descriptions indicate graduate profiles that include specialists in greenhouse plants, suggesting coverage of protected-cultivation-related competencies within relevant horticulture curricula.

Despite the presence of agrarian universities and some emerging initiatives, stakeholders highlighted that formal education on protected cultivation remains fragmented and often lacks hands-on components. Where specialised greenhouse modules exist, they are typically limited in scale and not yet supported by sufficient practical infrastructure (training greenhouses, modern hydroponics units, climate-control labs). This practical gap reduces the ability of universities/colleges to deliver job-ready greenhouse agronomists and operational managers at the pace required by the sector.

## 8.4 International Donors and Their Programmes

International donors continue to play a significant role in shaping the operating environment of Ukraine's protected cultivation sector, particularly through policy support, recovery funding, technical assistance, and capacity building. Donor engagement influences production models, technology choices, and the pace of sector recovery, while also defining the boundaries within which private sector engagement takes place.

Overall, donor programmes relevant to protected cultivation are strongly oriented towards resilience, food security, SME support, and regulatory alignment, with a predominant focus on low- and entry-level mid-tech solutions. Direct donor support for high-tech greenhouse development remains limited.

In addition to national institutions and market actors, international donors play a key role in shaping the scale, design, and technological level of greenhouse development programmes in Ukraine.

## **European Union (EU)**

The European Union is the largest international donor supporting Ukraine's recovery, reform agenda, and alignment with EU standards. In agriculture, EU support focuses on SPS reform, institutional capacity building, environmental compliance, and rural development.

While EU programmes do not typically finance greenhouse construction directly, they significantly shape the regulatory framework within which protected cultivation operates, particularly through food safety, SPS, and environmental legislation.

Implications for Dutch engagement:

EU-funded reforms define the long-term regulatory trajectory of the sector. Dutch engagement is most effective when aligned with EU priorities in compliance, sustainability, traceability, and quality standards.

## **Food and Agriculture Organization of the United Nations (FAO)**

FAO plays a central role in supporting food security and agricultural resilience under wartime and post-war conditions. Its interventions include support to small and medium producers through input distribution, small-scale greenhouse and tunnel solutions, and extensive training and technical assistance.

FAO-supported greenhouse interventions prioritise rapid deployment and basic production capacity rather than productivity optimisation or technological upgrading.

Implications for Dutch engagement:

FAO programmes create entry points for demonstration activities, training, and gradual upgrading of basic greenhouse systems, but are generally not suited for direct deployment of advanced technologies.

## **European Bank for Reconstruction and Development (EBRD)**

EBRD supports private sector development through financing instruments, advisory services, and capacity building. In agriculture, its activities include SME financing, blended finance instruments, and advisory support, as well as training initiatives such as AgriAcademy.

EBRD interventions are particularly relevant for producers seeking to scale operations, improve efficiency, and transition from basic to more advanced production models.

Implications for Dutch engagement:

EBRD represents a key partner for co-financed pilots, mid-tech solutions, advisory services, and scaling strategies where private investment plays a central role.

## **World Bank Group**

The World Bank Group supports Ukraine primarily through large-scale recovery programmes, institutional reform, and infrastructure investment. Its engagement in agriculture focuses on systemic recovery, governance, and policy frameworks rather than sector-specific technology deployment.

Direct involvement in protected cultivation is limited, but World Bank programmes influence the broader recovery context and investment climate affecting agricultural production.

Implications for Dutch engagement:

The World Bank provides strategic coordination and macro-level recovery frameworks, but offers limited direct entry points for greenhouse-specific interventions.

## **United States Government Support (Post-USAID Context)**

Historically, USAID was a major donor supporting Ukraine's agricultural sector through programmes focused on agribusiness development, SME support, and value chain strengthening. However, following institutional changes in 2025, USAID no longer operates as an independent donor agency, and most programmes have

been terminated, completed, or transferred to other U.S. government structures.

As a result, the United States’ direct role as an active donor in protected cultivation has diminished, and any ongoing or future engagement is expected to take place through restructured U.S. government instruments or successor arrangements, rather than through traditional USAID-branded programmes.

Implications for Dutch engagement:

USAID should be considered a legacy donor in the sector. Coordination with U.S. stakeholders may remain relevant in specific cases, but USAID is no longer a primary active programme partner for new initiatives in protected cultivation.

**Other Bilateral Donors**

Several bilateral donors, including Germany, Switzerland, and Nordic countries, support agricultural recovery, sustainability, and rural development through targeted, project-based interventions. These programmes are often regionally focused and implemented in partnership with international organisations or local NGOs.

While their scale is limited compared to major multilateral donors, such initiatives can have meaningful impact at the regional level.

Implications for Dutch engagement:

Bilateral donor programmes offer opportunities for coordination on niche pilots, sustainability initiatives, and regionally focused projects, rather than large-scale sector interventions.

**Overall Assessment**

International donors play a structuring and stabilising role in Ukraine’s protected cultivation sector by supporting basic production capacity, regulatory alignment, and farmer resilience. Donor funding is largely concentrated on low- and entry-level mid-tech solutions and is typically implemented through local suppliers and service providers.

This donor landscape leaves a clear space for Dutch engagement focused on technological upgrading, system integration, training, and performance optimisation, complementing donor-supported baseline infrastructure rather than duplicating it.

In practice, donor-funded greenhouse initiatives often overlap with national grant schemes, reinforcing the dominance of locally supplied low-tech and entry-level mid-tech greenhouse models.

Donor programmes supporting baseline greenhouse development indirectly contribute to alignment with future EU policy expectations, even where immediate compliance with Green Deal objectives is not required.

**Table** International Donors: Focus and Implications for Dutch Engagement

Donor	Main Focus in Ukraine	Relevance for Protected Cultivation	Type of Support	Implications for Dutch Engagement
European Union	EU alignment, SPS, environment	Indirect but systemic	Policy reform, capacity building	Align with compliance, sustainability, traceability

FAO	Food security, resilience	High (small-scale greenhouses)	Inputs, in-kind support, training	Demonstrations, training, gradual upgrading
EBRD	Private sector development	High (SMEs, scaling)	Loans, advisory, training	Mid-tech solutions, co-financed pilots
World Bank Group	Recovery, institutions	Low (indirect)	Budget support, investment projects	Strategic coordination, limited direct entry
U.S. Government (post-USAID)	Legacy support	Declining	Transitioned / concluded programmes	Not a primary partner for new initiatives
Other bilateral donors	Sustainability, regional recovery	Low–medium		

### Where the Netherlands Fits among International Donors

Within the current donor landscape, the Netherlands occupies a distinctly complementary position. While most international donors active in Ukraine focus on food security, resilience, regulatory alignment, and the deployment of basic production capacity—primarily through low- and entry-level mid-tech solutions implemented by local suppliers—the Netherlands is well positioned to support the next stage of sector development.

Dutch engagement can build on donor-supported baseline infrastructure by introducing technological upgrading, system integration, energy efficiency, and compliance-oriented solutions, as well as training and advisory services that address performance gaps observed in grant- and donor-supported greenhouses. In contrast to donors whose interventions are largely stabilising and humanitarian in nature, Dutch programmes and companies can act as bridges between recovery and modernisation, supporting the transition towards more competitive, market-oriented, and EU-aligned protected cultivation systems.

### Financing and access to credit

In 2024, Ukraine allocated UAH 157 million (approximately EUR 3.2 million) to support greenhouse farming, benefiting 34 enterprises. The “Your Greenhouse” grant program covers up to 70% of project costs (max. UAH 10 million / EUR 205,000), with applicants providing at least 30% from their own funds or loans. A key requirement is job creation, with a minimum of four permanent and ten seasonal positions per hectare. While significant, this funding is sufficient mainly for mid- to low-tech greenhouse projects rather than large-scale, high-tech operations.

# 10 Market Entry Barriers & Risk Analysis

## 10.1 Overview: why entry barriers differ by segment

Market entry barriers in Ukraine's protected cultivation are shaped by two realities outlined in Sections 4 and 6: (i) a smallholder/low-tech segment with high price sensitivity and limited infrastructure, and (ii) industrial greenhouse complexes where the main constraints relate to energy exposure, service ecosystems and operational efficiency.

Key sector risks are outlined in Section 3.5; Section 8 focuses on market entry barriers and practical mitigations for Dutch companies and programmes.

For Dutch companies, this means that barriers are not only "macro" (security and logistics), but also go-to-market (channel choice, financing model, after-sales service, and advisory capacity).

Key cross-cutting entry barriers include: (a) security and disruption risk; (b) energy volatility; (c) logistics and lead times; (d) financing and affordability; (e) service and spare parts; and (f) compliance and documentation requirements.

## 10.2 Security, disruption, and operational continuity risks

Even when demand exists, uncertainty about operational continuity affects purchasing decisions, investment horizons and contract structures.

### What this means in practice

- Smallholders tend to delay higher-value purchases and prefer low-risk, low-cost solutions that improve continuity quickly.
- Complexes may proceed with staged investments (retrofitting and optimisation rather than greenfield projects), often requiring risk-sharing through grants, warranties, and service guarantees.

### Implications for Dutch entrants

- Demand often shifts to resilience-oriented solutions (backup planning, efficiency retrofits, robustness) and shorter payback offers.
- Buyers value suppliers with local service capacity and realistic contingency planning.

### Mitigation approaches

- Stage projects into modules (pilot → scale-up).
- Use contracts that clarify force majeure and delivery contingencies.
- Offer "minimum viable" packages first, then upgrade pathways.

## 10.3 Energy volatility and infrastructure constraints

Energy cost exposure is a structural barrier for protected cultivation, influencing both operating economics and technology selection.

### Segment differences

- Smallholders: many are seasonal or rely on solid fuel; winter production is structurally constrained, which limits willingness to invest in advanced systems.
- Complexes: reliance on gas/pellets and high energy intensity makes efficiency retrofits and optimisation critical, but also raises the threshold for investment decisions under volatile prices.

## Implications

- “High-tech” solutions without a strong energy case may be rejected.
- Projects may require hybrid designs and strong emphasis on energy efficiency, monitoring and operational routines.

## Mitigation approaches

- Position solutions around energy performance (measurable savings, monitoring, optimisation).
- Provide options for fuel flexibility and staged retrofits (not only full system replacement).
- Integrate energy planning into commissioning and training.

## 10.4 Financing, affordability, and procurement realities

Affordability is a major market entry barrier, especially for smallholders, and even for complexes when projects require large upfront CAPEX.

Typical constraints

- Smallholders often cannot finance full system upgrades without support and prefer co-financed bundles.
- Complexes may combine own resources with grants, but still require bankable ROI cases and predictable service costs.

## Procurement dynamics

- Many purchases occur through donor-supported programmes or blended finance structures; procurement processes can be time-bound and documentation-heavy.
- Buyers often compare offers based on upfront cost, which can disadvantage higher-quality solutions unless value is demonstrated.

## Mitigation approaches

- Package offers for co-financing (hardware + commissioning + advisory), aligned with programme logic.
- Use demonstration projects and performance benchmarks to support ROI arguments.
- Provide clear total-cost-of-ownership messaging (energy savings, reduced losses, labour reduction).

## 10.5 Go-to-market barriers: channels, service capacity, and after-sales support

For Dutch companies, some of the most decisive barriers are practical: reaching customers through the right channel, ensuring after-sales support, and building trust.

## Channel barriers

- Smallholders: often prefer purchasing through dealers/representatives, expecting local availability, service, and smaller package sizes.
- Complexes: more likely to engage directly on larger projects, but still require local installation partners and rapid response service.

## Service and spare parts

- Limited local service capacity for specialised systems increases perceived risk and can block decisions even when technology is attractive.

## Knowledge transfer gap

- Without training and follow-up, systems may underperform, leading to reputational risk for suppliers and reduced repeat demand.

## **Mitigation approaches**

- Build or partner with local distributors/installers and define service SLAs.
- Offer commissioning plus follow-up performance coaching (especially for fertigation and climate control).
- Use a hub-and-spoke model via demonstration sites to train technicians and advisors and create credible references.

These market entry barriers are not uniform across the sector: they play out differently for smallholders/low-tech greenhouses (where affordability, channel access and basic service support are decisive) and for industrial greenhouse complexes (where energy economics, uptime, integration and performance guarantees become critical). As a result, successful market entry depends on segment-specific delivery models and on bundling technology with commissioning, training and after-sales service. The next section translates these constraints into practical market entry strategies for Dutch companies and programmes (Section 9).

# 11 Market Entry Strategies for Dutch Companies

Section 9 translates the opportunity analysis and needs assessment (Sections 4 and 6) and the identified entry barriers (Section 8) into practical market entry pathways for Dutch companies and programmes. Because Ukraine's protected cultivation market is effectively a two-speed market—with distinct demand profiles for smallholders/low-tech greenhouses and industrial greenhouse complexes—successful entry depends on segment-specific delivery models, partner choices and service capacity. The following SWOT summarises the strategic starting position for Dutch engagement and frames the recommended entry routes and implementation steps presented in the subsections below. Additional survey evidence for industrial greenhouse complexes is provided in Appendix B.

## SWOT

### Strengths

- Strong Dutch reputation and proven track record in protected cultivation technologies (climate control, irrigation/fertigation, energy efficiency, post-harvest).
- Scalable solutions across technology levels: ability to offer both robust mid-tech (suited for smallholders) and advanced optimisation/integration (suited for complexes).
- Complementary strengths in knowledge transfer (training, commissioning, performance coaching) and applied innovation (demo models).
- Strong fit with emerging demand for low-input/IPM & biocontrol and compliance-ready production routines.

### Weaknesses

- Higher perceived cost of Dutch solutions versus local/low-cost alternatives; ROI can be hard to justify without co-financing or demonstrated performance.
- Limited local service footprint for some specialised systems (risk of downtime, spare parts delays, underperformance).
- Fragmented customer base in the smallholder segment increases sales and service cost per client; requires dealer networks and standardised packages.
- Dependence on reliable local partners (installers, service providers) to ensure quality of implementation.

### Opportunities

- A two-speed market creates clear entry pathways:
- Smallholders/low-tech: high demand for affordable resilience, irrigation reliability, basic post-harvest and training bundles (often donor-compatible).
- Complexes/mid-high tech: strong need for energy optimisation, integration, and post-harvest efficiency upgrades with service contracts.
- High interest in cooperation with Dutch companies and willingness to engage via dealers/representatives supports a scalable go-to-market model.
- Donor and recovery programmes can enable co-financing and “bundled delivery” (equipment + training/advisory), lowering adoption barriers.
- Demonstration greenhouses can accelerate adoption, create performance benchmarks and build technician/advisory capacity (hub-and-spoke scaling).

## Threats

- Ongoing security risks and disruptions can reduce investment horizons, delay projects and increase contract risk.
- Energy volatility and infrastructure constraints can undermine project economics, especially for heated winter production.
- Procurement uncertainty (timelines, documentation, programme changes) and competition for funding can slow pipeline conversion.
- Competition from lower-cost suppliers and grey imports, especially for standard equipment categories.
- Skills gaps and limited service ecosystems may lead to underperformance if solutions are delivered without commissioning and follow-up support.

### 11.1 Export of equipment and technologies

Direct export is a viable entry route for Dutch suppliers, particularly for standardised greenhouse inputs and modular equipment. In Ukraine's protected cultivation market, export success depends on ensuring installation quality, basic commissioning and reliable after-sales support.

- Best-fit products: irrigation components, sensors/controllers, greenhouse coverings, small post-harvest equipment, packaging-related items, and IPM/biocontrol inputs
- Key constraints: lead times and logistics planning, import documentation and compliance, and expectations for troubleshooting and spare parts.
- Minimum set-up: local representative/distributor, a defined critical spares list, and commissioning checklists supported by remote assistance.

### 11.2 Distributor-based market entry models

Distributor and dealer models are typically the most scalable route for reaching the dispersed smallholder segment and for standardised solution packages. Successful models combine product availability with local installation and first-line service.

- Dealer/representative-led approach (smallholders/low-tech): standardised starter packages (water-smart production, basic climate upgrades, post-harvest starter sets) delivered with short-cycle training and SOPs.
- Hybrid model (mid-tech SMEs and regional clusters): dealer sales combined with a certified installer partner for commissioning and periodic follow-up.
- Human-centred mechanisation/automation: prioritise labour-intensive tasks (handling, internal transport, packing/grading) with ergonomic, easy-to-use solutions aligned with the predominant workforce profile, supported by SOP-based training.
- Direct B2B remains suitable for larger complexes, but even there a local service partner and spares availability are decisive.

Newly established low- and mid-tech smallholders—many of whom entered protected cultivation through grant programmes—can be treated as a “future-facing” engagement group. While they currently operate at low-to-middle technology levels, a share of these growers is expected to upgrade automation over time and/or transition toward more professional greenhouse models. Early engagement through dealer-led packages, training and demonstration can therefore shape technology choices and build a pipeline for future upgrades.

### 11.3 Joint ventures and localisation of production

Joint ventures and localisation are not required for initial entry, but can become attractive once demand is proven and a service ecosystem is established. Localisation should be approached stepwise, starting with service and assembly rather than full manufacturing.

- When it makes sense: high logistics costs, frequent need for spare parts/service, or a stable pipeline via

programmes and key clients that justifies scale.

- What to localise first: assembly/configuration, installation and maintenance services, and selected recurring items with manageable quality control.
- Risk management: strict QA, partner certification and transparency requirements; scale only after performance references are secured.

## 11.4 Demonstration greenhouses and training hubs

Demonstration and applied training are high-leverage tools for accelerating adoption and reducing performance risk. A hub-and-spoke model can validate solutions in Ukrainian conditions, train technicians and advisors, and provide credible performance benchmarks.

- Smallholders: water-smart production modules, affordable post-harvest basics (cold storage and packing routines), and low-input/IPM starter practices.

Cross-cutting: validate human-centred labour-saving modules (ergonomic workstations, handling aids and intuitive controls) and embed them in short-cycle training to improve safety and productivity for the actual greenhouse workforce.

- Complexes: energy optimisation and system integration (climate–irrigation–lighting), post-harvest efficiency upgrades, and nursery QA/biosecurity routines.
- Best practice: link pilots to training-of-trainers (ToT) and follow-up advisory cycles so that results translate into replication at scale.

Beyond short-term trainings, demonstration greenhouses can function as permanent practice bases for universities/colleges and professional upskilling, addressing the structural shortage of greenhouse agronomists and farm managers caused by limited training infrastructure.

## 11.5 Public–private partnership (PPP) models

PPP formats can support market entry and sector development when they focus on capacity building and shared infrastructure, rather than one-off procurement. For protected cultivation, PPPs are most effective when anchored in demonstration and training hubs.

- Relevant formats: demo and training hubs hosted by public institutions or leading enterprises; municipal/regional pilots for cold chain and market infrastructure; applied research partnerships validating practical SOPs and low-input solutions.
- Why it matters for Dutch entry: PPPs reduce adoption risk, create credible references and performance benchmarks, and help build local service capacity.
- Implementation note: define clear roles (equipment, training, monitoring) and measurable indicators to support transparency and replication.

Newly established low- and mid-tech smallholders—many of whom entered protected cultivation through grant programmes—can be treated as a “future-facing” engagement group. Early interaction through dealer-led packages, training and demonstration can shape technology choices and increase the likelihood of later upgrades toward automation and professional greenhouse investment.

## 11.6 Comparison of advantages and disadvantages for different company profiles

**Table** Summarises recommended entry routes by company profile, highlighting the trade-offs between speed of entry, required local capacity and performance risk.

<b>Company profile</b>	<b>Best-fit segment</b>	<b>Recommended entry route</b>	<b>Advantages</b>	<b>Disadvantages / constraints</b>	<b>Minimum local capacity needed</b>
Equipment exporter	Smallhold	Export +	Fast entry;	Service gap	Distributor/impo

(standard products)	ers + complexes	distributor/dealer	scalable; low fixed costs	risk; price competition	ter; basic spares; remote support
Systems integrator (automation/climate/fertigation)	Complexes (primary)	Direct B2B + local installer partner	High value add; optimisation ROI; long-term relationships	High implementation risk; needs strong commissioning	Certified installer; commissioning SOPs; spare parts; SLAs
Energy efficiency / retrofit specialist	Complexes	Direct B2B + performance coaching	Measurable outcomes; strong demand driver	Requires data access and operational discipline	Audit capability; monitoring; follow-up coaching
Irrigation/fertigation supplier (mid-tech scalable)	Both	Dealer model (smallholders) + integrator partnerships (complexes)	High benefit-to-cost; broad demand	Quality depends on installation and training	Installer network; training materials; service
Post-harvest / cold chain solutions	Both (different scale)	Programme pilots + dealer (smallholders); direct projects (complexes)	Clear loss-reduction story; market access link	CAPEX sensitivity; energy reliability needed	Local installers; maintenance plan; user training
Seeds/starting material & nursery know-how	Both	Partnerships with local nurseries + training hubs	Leverage on yield/quality; supports diversification	Biosecurity and QA discipline required	Nursery partners; QA protocols; training
IPM/biocontrol + advisory providers	Both	Demo sites + advisory network + co-financing	Cross-cutting; supports compliance/quality	Requires behaviour change and follow-up	Scout/advisory capacity; monitoring routines; demos

## 11.7 Market entry via organic and donor-funded programmes

Donor-funded initiatives can reduce affordability barriers and de-risk early pilots, making them a practical entry route for Dutch companies. For protected cultivation, the most effective modality is bundled delivery: technology combined with commissioning, training/advisory and follow-up, supported by clear performance indicators. Relevant donor tracks and channels are summarised in Section 8.5.

- Smallholders/low-tech: affordable resilience and water-smart packages, basic post-harvest improvements, and short-cycle training.
- Workforce and inclusion: where surveys indicate a predominantly female workforce, ensure training and advisory components are accessible to women working in greenhouses, and prioritise safety and ergonomics in supported equipment packages.
- Complexes: energy efficiency and optimisation projects (integration, post-harvest workflows) delivered with service contracts.
- Organic positioning: frame engagement as low-input/IPM-first upgrading (biocontrol, monitoring routines, compliance-ready documentation), with a stepwise pathway to certification readiness where viable.

Taken together, these strategies highlight that sustainable market entry depends on segment-specific delivery models and on embedding local implementation capacity, after-sales support and knowledge transfer. This

reduces performance risk, accelerates adoption and builds the service ecosystem needed for longer-term market development.

# 12 Concept Vision for the Future of Protected Cultivation in Ukraine

## 12.1. Vision of the Government and the Sector

The vision of both the Ukrainian government and key sector stakeholders for protected cultivation is shaped by a combination of food security priorities, post-war recovery objectives, and long-term European integration goals. While formal long-term strategies specific to the greenhouse sector remain under development, a consistent direction of travel can be observed across policy documents, support programmes, and stakeholder initiatives.

From a government perspective, protected cultivation is increasingly viewed as a strategic production model that can contribute to year-round domestic supply of vegetables, reduce import dependence, and strengthen resilience against climate variability and external shocks. This vision is reflected in the prioritisation of greenhouse and tunnel construction within national grant programmes and recovery initiatives, particularly for small and medium producers and relocated businesses.

At the same time, the government's approach is largely pragmatic and phased. In the short term, policy focuses on the rapid deployment of basic and entry-level mid-tech greenhouse infrastructure using cost-efficient, locally available solutions. This approach supports quick recovery and broad participation, while avoiding high capital intensity under current economic and energy constraints.

Looking ahead, both government institutions and sector representatives recognise the need for gradual upgrading of protected cultivation systems. This includes improvements in energy efficiency, climate control, input management, and operational professionalism. Although not always explicitly framed as such, this longer-term vision is increasingly influenced by Ukraine's alignment with EU policies and market expectations, including principles associated with the European Green Deal and the Common Agricultural Policy.

For sector stakeholders, including producers, associations, and local manufacturers, the vision combines growth with learning. Many greenhouse operators see current grant-supported projects as a first step toward more advanced production models once financial capacity, skills, and market access improve. Local suppliers similarly aim to expand capabilities beyond basic construction, responding to emerging demand for higher-quality, more efficient solutions.

Overall, the shared vision for the protected cultivation sector can be characterised as incremental modernisation rather than rapid transformation. The emphasis is on building a broad production base now, while creating conditions for future technological upgrading, sustainability, and closer integration with European markets. This vision provides a clear framework for international partners: immediate opportunities lie in supporting recovery and baseline capacity, while medium- and long-term engagement will increasingly focus on upgrading, innovation, and alignment with EU standards.

## 12.2 Proposals for the development of an innovation-driven cluster

An innovation-driven cluster for protected cultivation can accelerate Ukraine's transition from baseline greenhouse expansion to performance-led upgrading. Given the "two-speed" market structure identified in this study (smallholders/low-tech vs industrial complexes), the cluster model should serve both segments through differentiated services, while creating a shared platform for technology validation, skills development and replication.

## Core building blocks of a protected cultivation cluster

- Demonstration and training hub(s): a small number of anchor sites that test solutions under Ukrainian conditions (energy constraints, input availability, labour realities) and provide credible benchmarks (yield, energy use, water efficiency, quality outcomes).
- Applied advisory and commissioning services: a structured support layer that turns investments into performance (SOPs, calibration, troubleshooting, seasonal planning).
- Partner ecosystem: local installers, service providers, distributors/importers and input suppliers linked to Dutch technology providers and knowledge partners.
- Innovation pipeline: applied trials (varieties, IPM/biocontrol, fertigation recipes, climate strategies), with simplified documentation for replication and procurement readiness.
- Finance and programme interface: “fundable” packages that combine equipment + installation/commissioning + advisory + monitoring, aligned with donor and recovery programme logic.

## How the cluster should serve different producer segments

- Smallholders / low-tech: practical modules (water-smart production, basic post-harvest, minimum resilience) delivered through dealers and trained local advisors, with short coaching cycles.
- Complexes / mid-high tech: optimisation and integration services (energy, climate-irrigation-lighting coordination, post-harvest efficiency), delivered as direct projects with service contracts and performance follow-up.

## Implementation approach (phased)

Phase 1: establish one anchor hub and run a limited set of pilot modules with monitoring.

Phase 2: train local technicians/advisors (ToT) and replicate pilots via a “spoke” network in priority regions.

Phase 3: scale through programme co-financing and commercial channels, building a sustained service ecosystem and reference portfolio.

## 12.3 Role for the Netherlands

The Netherlands is well positioned to play a **strategic, complementary role** in the development of Ukraine’s protected cultivation sector. Given the current structure of the market—characterised by public and donor-supported deployment of basic greenhouse infrastructure, strong involvement of local manufacturers, and gradual regulatory alignment with the European Union—Dutch engagement is most effective when focused on **upgrading, system integration, and knowledge-driven modernisation**, rather than on basic construction.

In the short term, Dutch value lies in supporting the transition from grant- and donor-funded baseline greenhouses towards more efficient and professionally managed systems. This includes modular technologies and services that can be integrated into existing structures, such as improved climate control, energy efficiency solutions, water and nutrient management, monitoring systems, and operational training. These interventions address clear performance gaps observed in low- and entry-level mid-tech greenhouses without requiring large upfront investments.

In the medium term, as regulatory alignment with EU SPS, chemical safety, and environmental standards progresses, Dutch expertise becomes increasingly relevant in enabling compliance and sustainability. Technologies and services aligned with the European Green Deal and CAP-related standards—such as reduced chemical use, traceability, resource efficiency, and digital monitoring—can support Ukrainian producers in meeting future market requirements, particularly for EU-oriented value chains.

To maximise impact, Dutch engagement should prioritise delivery models that match Ukraine’s market structure and constraints. In practice, this means combining technology with local implementation capacity and knowledge transfer, and using demonstration projects to reduce adoption risk and support replication at scale.

### **Priority roles for the Netherlands**

- Provide upgrade pathways for baseline greenhouses (mid-tech modules, energy and water efficiency, post-harvest improvements).
- Build commissioning, training and advisory capacity through hubs and train-the-trainer models.
- Support service ecosystems (installer training, spare parts availability, defined service standards).
- Enable low-input/IPM and compliance-ready routines that support quality, buyer requirements and stepwise convergence with EU-oriented standards.

## **12.3 Organic and climate-resilient protected cultivation as part of the future vision**

In Ukraine’s protected cultivation, “organic” should be positioned as part of a broader agenda of climate resilience, resource efficiency and risk reduction—but it must be framed realistically in relation to prevailing production systems. In particular, organic production rules (as typically applied in the EU context) do not allow crops to be grown in hydroponic systems. This is important because industrial greenhouse complexes commonly rely on hydroponic or soilless cultivation for yield stability and high productivity. As a result, the future vision should differentiate between (i) organic, soil-based protected cultivation (more relevant for smallholders and selected niche models), and (ii) high-tech, hydroponic greenhouse production (more relevant for industrial-scale complexes), with both tracks contributing to resilience and modernisation in different ways.

### **Role of demonstration and advisory**

A demonstration greenhouse (or demonstration modules within a cluster hub) is a practical accelerator for both tracks:

- For organic soil-based models: validation of feasible crop portfolios and soil/IPM protocols under protected conditions.
- For industrial hydroponic models: validation of efficiency gains (energy/water), IPM/biocontrol performance and operational optimisation routines.

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# Appendix 1: Ukrainian Land Bank

The reform, which began its partial implementation in mid-2021 and will become fully operational in 2024, enables the free and lawful sale of agricultural land for the first time in the history of independent Ukraine. This transformation is expected to bring significant and lasting impacts not only on the agricultural sector but also on the wider national economy.

Ukraine’s agricultural land market is highly fragmented, with most farms leasing under 100 ha, while medium-sized farms (200–2,000 ha) manage most of the cultivated land.

As of December 2025, about 806,000 ha of state-owned land remain available. Land purchases are concentrated in central regions, with pre-frontline areas limited by security risks, though Dnipropetrovsk oblast shows higher activity due to its fertile soils and logistical importance.

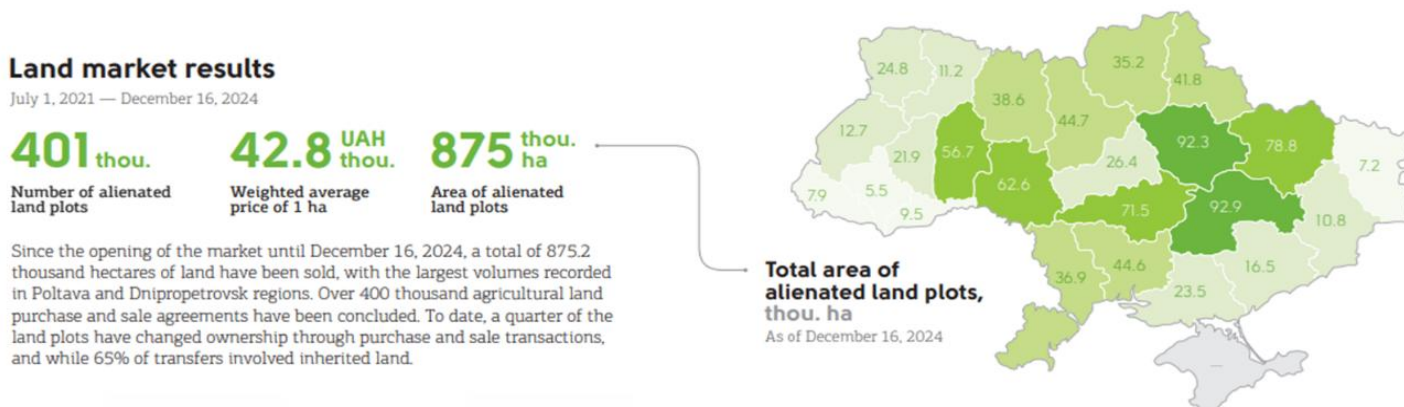
Lease rates typically start at €61–€82 per ha per year, while competitive bidding can push prices up to €612–€816, and land purchase prices vary widely across regions.

In 2025, the highest volume of land transactions occurred in Poltava, Vinnytsia, and Kyiv regions.

Agri -companies in Ukraine are very fragmented, with the vast majority leasing land of less than 100 ha. The largest players (above 3,000 ha) constitute about 1% of all companies operating in the agri -food sector and produce more than 20% of cereals and oilseeds. The most important position, however, is held by medium -sized companies with an acreage of 200–2000 ha. There are about 6,000 of them and, depending on the species cultivated, they are responsible for cultivating 50–75% of the land tilled by the companies. <sup>7</sup>

As of 14 December 2025, the total area of state-owned land is approx. 806,000 hectares.

**Figure** Land market results as December 16, 2024



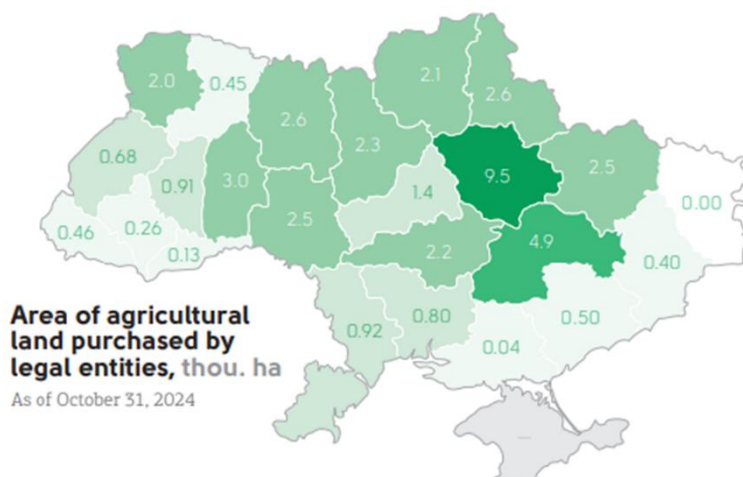
Source: Infographic report *Agribusiness in Ukraine 2023/2024*

The map below shows the area of agricultural land in Ukraine purchased by legal entities as of October 31, 2024, measured in thousand hectares. The largest concentrations are in central regions, with the highest value shown in one region at 9.5 thousand hectares, followed by several others with moderate levels between 2–5 thousand hectares. Western and southern regions generally show lower levels of land purchases, while some

<sup>7</sup> [The breadbasket of the world? | OSW Centre for Eastern Studies](#) 2021

eastern and occupied territories record little to no activity.

**Figure** Agricultural Land purchased by legal entity



Source: Infographic report Agribusiness in Ukraine 2023/2024

In the pre-frontline oblasts, the volume of agricultural land purchased by legal entities remains limited and uneven. Ongoing security risks, proximity to active hostilities, and uncertainty about future land use significantly constrain investment activity. As a result, land transactions in these regions are noticeably lower compared to more stable central areas, reflecting cautious behavior by legal entities and heightened risk perceptions.

#### Why Dnipropetrovsk oblast shows relatively high land purchases:

- It is a pre-frontline but not occupied region, which makes investment risky but still feasible compared to frontline or occupied oblasts.
- The oblast has a large agricultural base, fertile soils, and established agribusinesses that continue operating despite the war.
- It serves as a logistical and economic hub for eastern and central Ukraine, attracting relocated agribusinesses from more dangerous regions.
- Legal entities may be consolidating land in relatively safer parts of the oblast in anticipation of post-war recovery and long-term agricultural demand.

In short, Dnipropetrovsk oblast combines high agricultural potential with manageable (though elevated) risk, which explains why land market activity there remains higher than in other pre-frontline regions.

### What is the cost of leased land in Ukraine?

The initial (minimum) lease rate is set at no less than 12% of the normative monetary valuation of the land. In practice, this means that starting rental prices typically range between UAH 3,000 and 4,000 per hectare per year, depending on the region.

The final lease price is established through competitive bidding on the Prozorro.Sale platform, following the principle that the highest bid determines the outcome.

According to data from Prozorro.Sale, lease rates for agricultural land can reach UAH 30,000–40,000 (€ 600–800) per hectare per year. Final prices vary significantly based on factors such as soil quality, geographic location, accessibility, and overall market demand.



This year, agricultural land purchases were most concentrated in a few key regions, with Poltava and Vinnytsia oblasts each recording about 5.4 thousand transactions, followed by the Kyiv region with approximately 4.7 thousand deals.

# Appendix 2: Cucumber and tomato price analytics

## 1. Cucumber price analytics

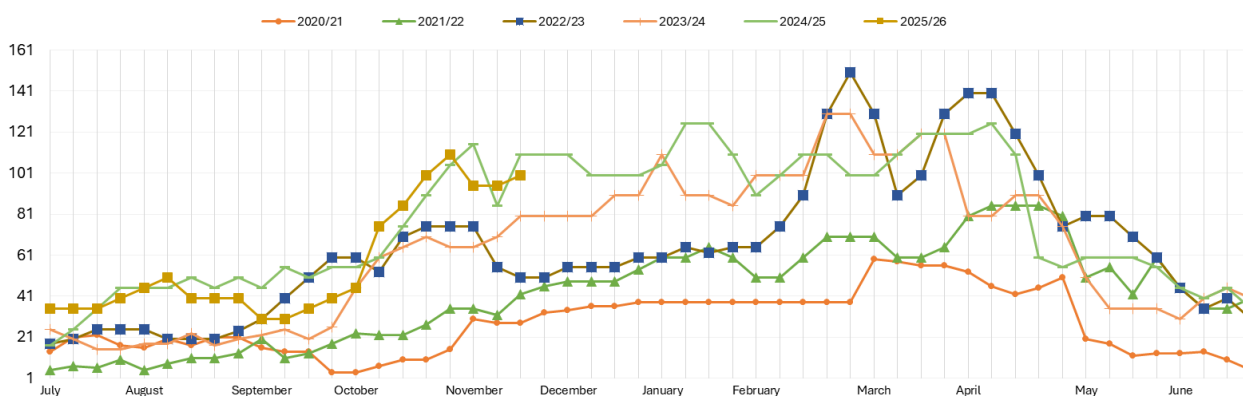
Cucumber price dynamics for Ukrainian producers over the past five seasons (2021–2026) indicate significant structural changes in the market. Previously, prices followed a predictable seasonal cycle: rising in winter when domestic production was low (100–120 UAH/kg) and falling during the spring–summer harvest to 20–40 UAH/kg.

In 2024/25 and 2025/26, this pattern shifted. Winter peaks reached 150 UAH/kg, reflecting a reduction in production areas that prevents Ukrainian greenhouses from fully meeting demand, even during the main growing season.

Summer prices have also changed. Whereas they previously fell sharply, they now remain above 40–50 UAH/kg. This is driven by domestic supply shortages, Turkish imports that set a price floor, and weaker reliability and quality of local production.

Notably, in 2025/26, summer prices start higher than in previous years, highlighting ongoing market tension. For retail chains, this makes local cucumbers less competitive, while imported products benefit from more stable prices and quality.

**Figure** Average cucumber prices as of 21.11.2025



Source: APK-Inform

Price and trade dynamics directly influence investment feasibility and upgrading priorities in protected cultivation, shaping the opportunity areas described in Section 5 and the most viable delivery models discussed in Section 10.

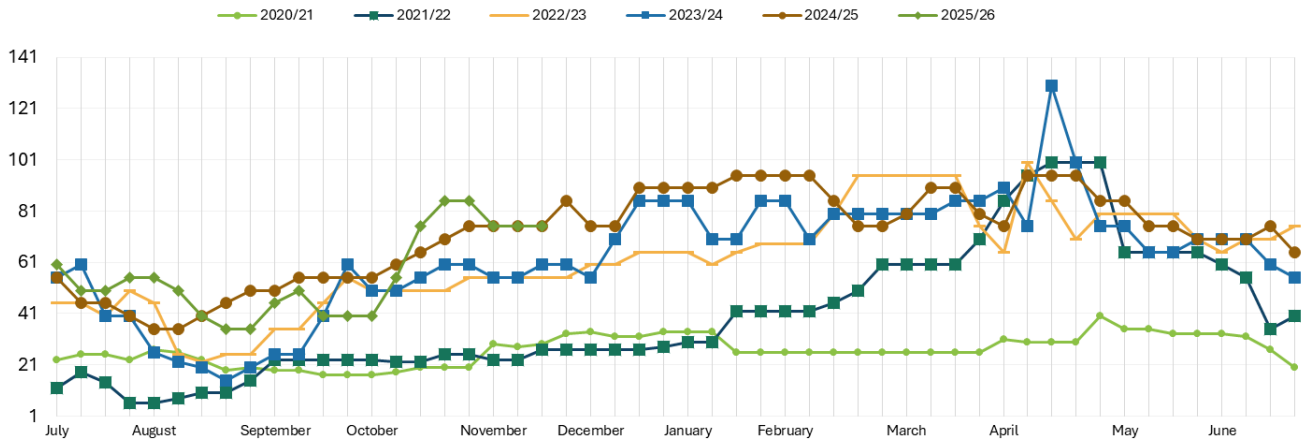
## 2. Tomato price analytics

Tomato prices for producers over the past five seasons (2021–2026) also reflect notable changes in seasonal patterns. Traditionally, prices rose steadily in autumn and winter, when imports dominated the market and domestic supply sharply declined. Over the past two seasons, winter prices have ranged between 80–120 UAH/kg, while spring has occasionally seen short-term peaks of up to 140 UAH/kg, signalling a shortage of

Ukrainian products during the off-season.

Previously, prices fell rapidly at the start of summer to 20–40 UAH/kg, reflecting the influx of fresh domestic produce. In the 2024/25 and 2025/26 seasons, such sharp declines have not occurred; prices remain elevated throughout the peak harvest period, dropping only to 40–60 UAH/kg. This shift is driven by a reduced number of producers, rising production costs, and competition from imported tomatoes.

**Figure** Average tomato prices as of 21.11.2025

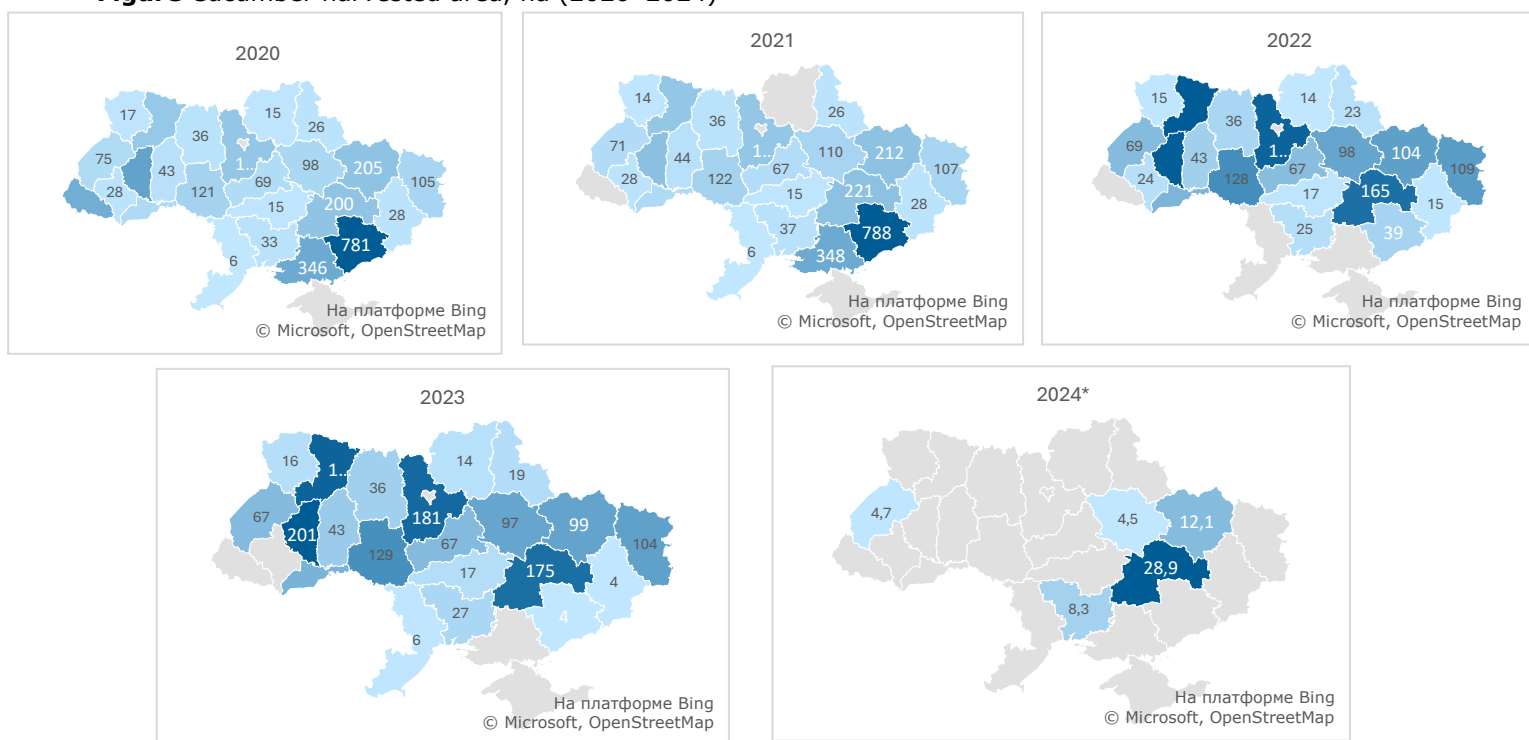


Source: APK-Inform

# Appendix 3: Regional structure of greenhouse cucumber production by area and volume, 2020–2024

During 2020–2021, leadership in greenhouse cucumber production remained concentrated in the eastern and southern regions, particularly Zaporizhzhia, Dnipropetrovsk, Kherson, and Kharkiv. Since 2022—and especially in 2023–2024—the production centre has shifted rapidly toward central regions, primarily Vinnytsia, Kyiv, Ternopil, and Rivne. This shift reflects the forced relocation of businesses and structural changes in farming, as the southern and eastern parts of the country were increasingly affected by military actions and occupation.

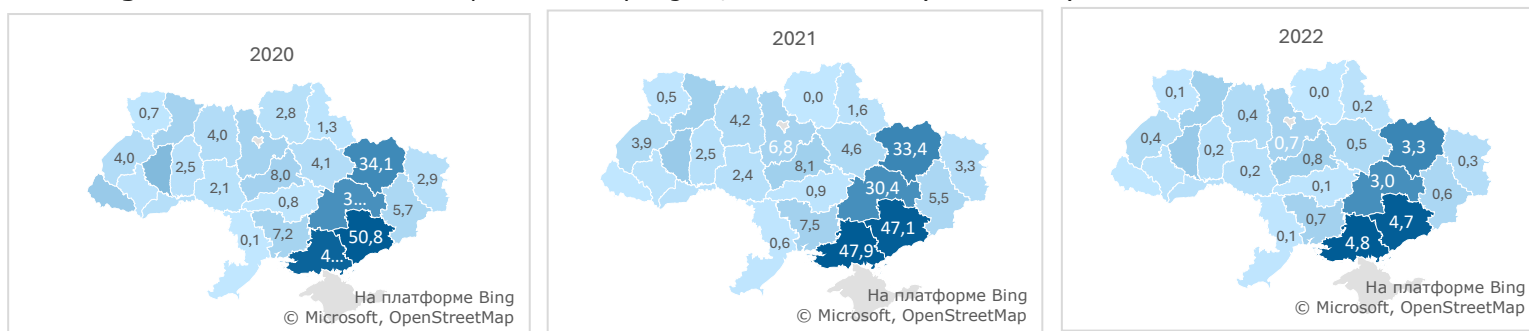
**Figure** Cucumber harvested area, ha (2020–2024)

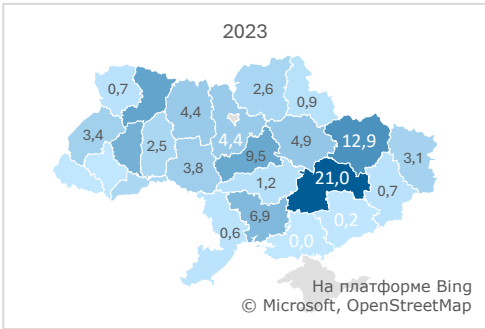


Source: APK-Inform

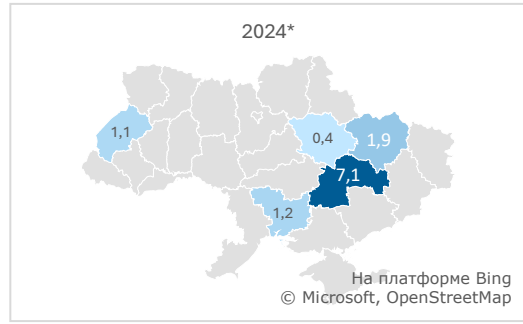
Despite the overall decline in gross production, some relocated producers were able to partially restore cucumber harvesting in new locations within a single season. This recovery was facilitated by cucumbers being one of the fastest-recovering greenhouse crops, owing to their short growing cycle and consistently strong domestic demand.

**Figure** Greenhouse cucumber production by region, thousand tons (2020–2024)





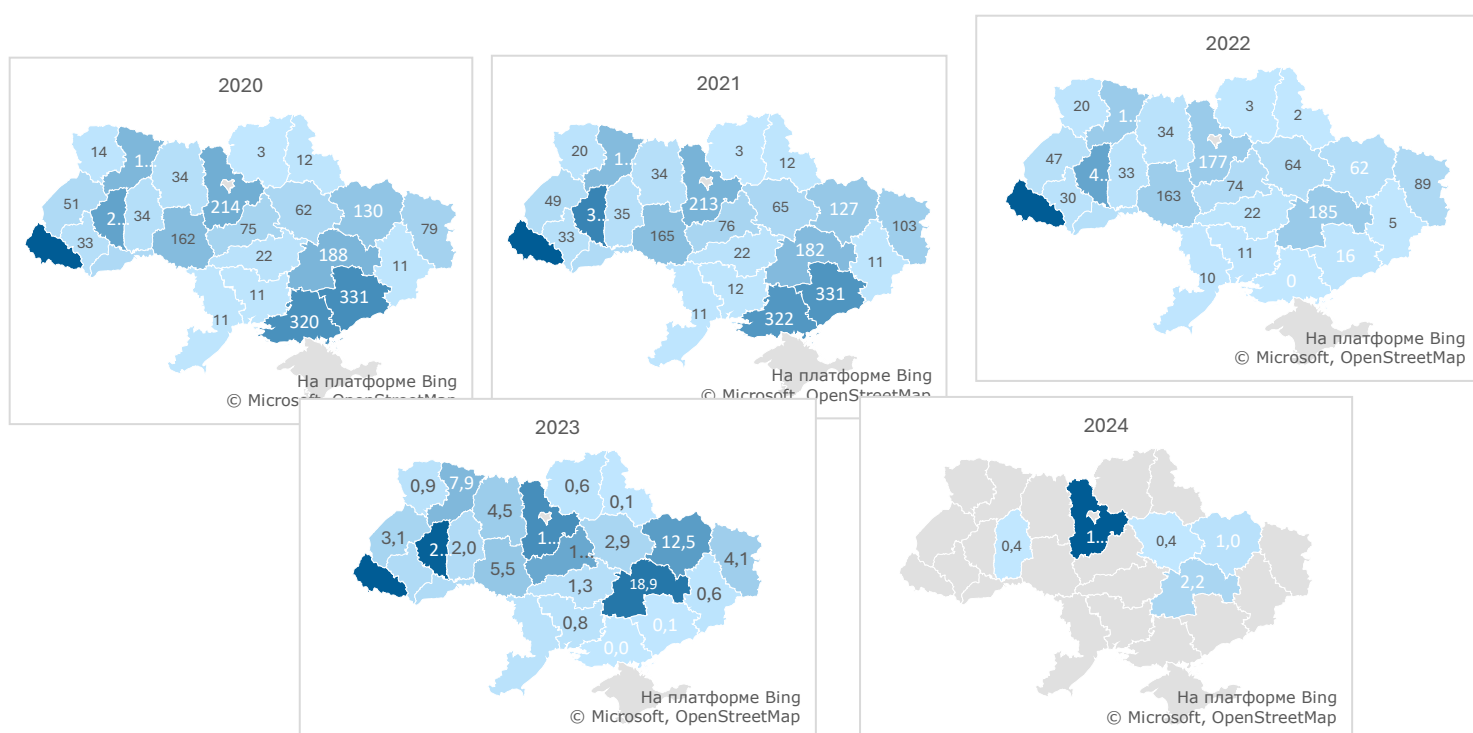
Source: APK-Inform



# Appendix 4: Regional structure of greenhouse cucumber production by area and volume, 2020–2024

In 2020–2021, greenhouse tomato production was primarily concentrated in the southern and eastern regions, as well as in Kyiv and Zakarpattia. Since 2022, the production center has shifted rapidly northwestward: alongside Zakarpattia, Dnipropetrovsk and Ternopil regions emerged as leading producers, while other regions also increased their share of total output. This shift was a direct result of the relocation of production facilities and the loss of cultivated areas in the south and east due to heightened military risks.

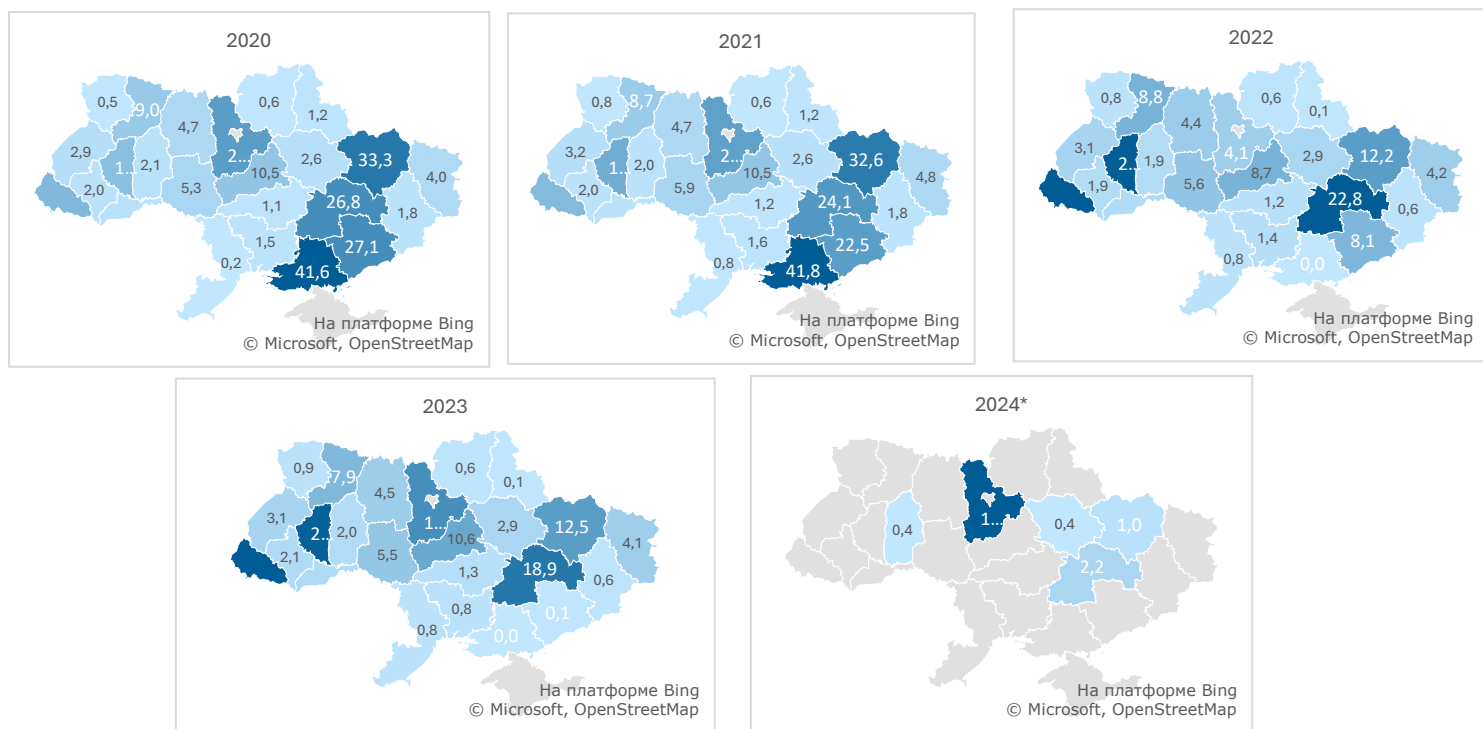
**Figure** Tomato harvested area, ha (2020-2024)



Source: APK-Inform

Relocated Ukrainian greenhouse enterprises are actively expanding production. New projects are supported by grant programs and strong local demand, with investments focused primarily on modern, energy-efficient greenhouses. Relocated enterprises from the south and east have been able to partially maintain production volumes thanks to their rapid integration into the infrastructure of host regions, where demand for tomatoes has increased due to internal population migration along similar routes.

**Figure** Greenhouse tomato production by region, thousand tons (2020–2024)



Source: APK-Inform

# Appendix 5: Cucumber and tomato import export analytics

## 1. Cucumber trade analytics

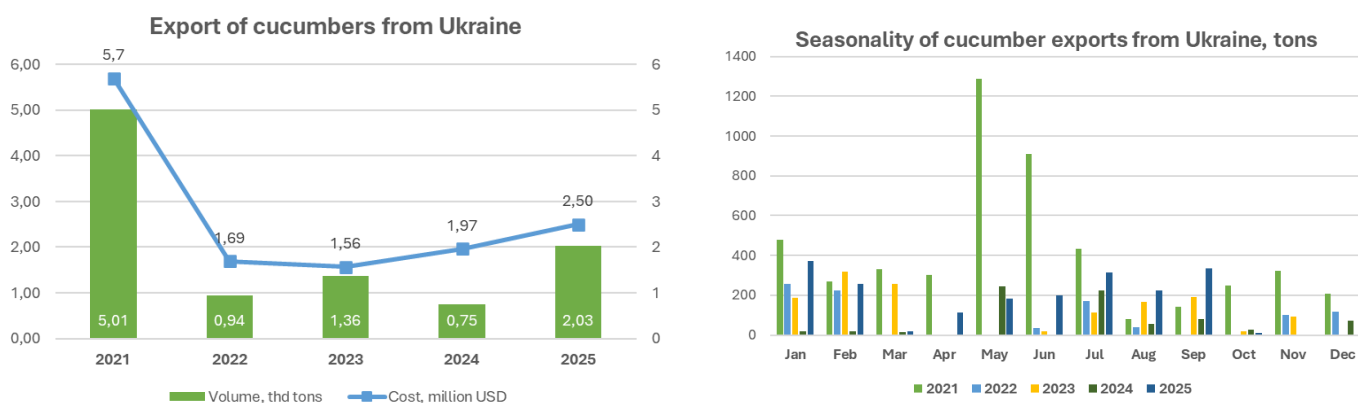
### Export of cucumber

The dynamics of Ukrainian cucumber exports show a sharp decline in both volume and value after 2021. Export volumes fell from 5 thousand tons in 2021 to around 1 thousand tons annually during 2022–2024, before recovering to 2 thousand tons in 2025 (over 10 months). Similarly, export revenue dropped from approximately €4.87 million in 2021 to €1.28–1.71 million in 2022–2024, rising to €2.14 million in 2025.

This decline reflects a combination of factors: an overall reduction in greenhouse production, logistical and energy challenges, and the time required for relocated farmers or new greenhouse enterprises to reorganize and establish operations.

Before the war, the peak period for Ukrainian cucumber exports was May and June, when the largest volumes were shipped abroad. After this period, exports typically declined sharply due to the end of the first growing cycle and increased competition from local products in foreign markets. Over the past three years, this pattern has shifted: export peaks have become less pronounced and now more frequently occur in January–February and July–September.

**Figure** Dynamics of cucumber exports in terms of volume and value



Source: APK-Inform

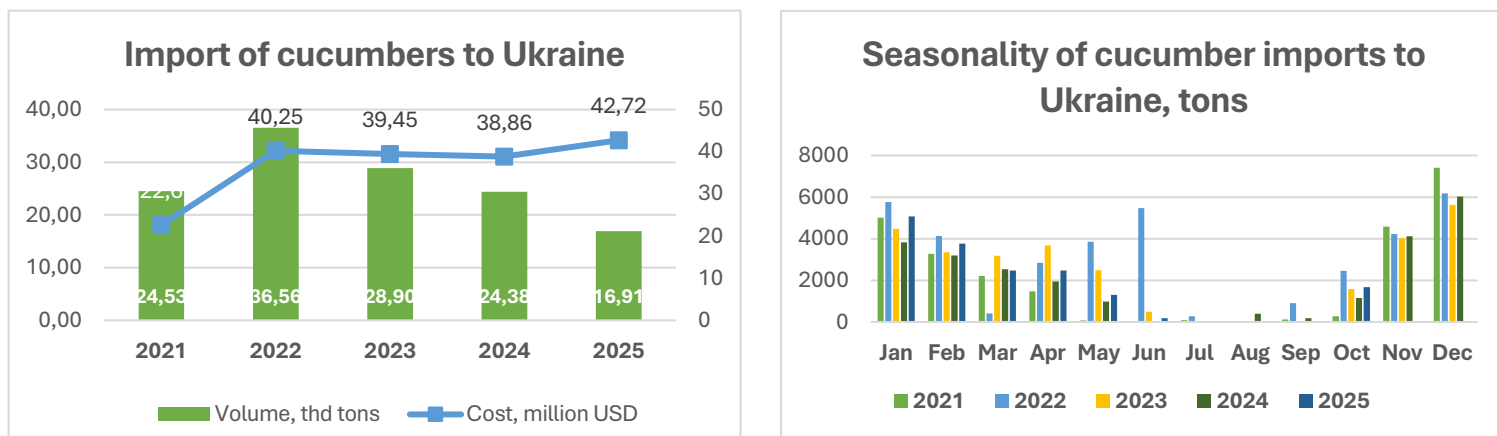
### Import of cucumber

Cucumber imports in physical terms during 2021–2025 fluctuated between 24–37 thousand tons per year. Due to disruptions in supplies from local enterprises in the first year of the full-scale invasion, cucumber imports in 2022 increased significantly, rising by 49%. However, over the following seasons, as more producers adapted, the need for imports gradually decreased to pre-war levels. Additionally, the depreciation of the hryvnia and the corresponding rise in domestic prices also contributed to the decline, somewhat limiting purchasing power and affecting the geography of supplies. Even in 2022, for roughly the same total import value of just over \$40 million, Ukraine was able to purchase more than twice the volume of cucumbers compared to the first 10 months of 2025.

Import supplies exhibit clear seasonality, peaking between October and January, when shipments reach 4–7 thousand tons per month. From February to March, as domestic greenhouse production in Ukraine increases, the need for imports falls to 1–4 thousand tons. During summer, when open-field produce enters the market, imported cucumber volumes naturally drop to a minimum.

Notably, in 2022, imports extended beyond the usual season, reaching near-record levels in May–June and resuming with significant shipments in September. In 2023, this anomaly was less pronounced, and over the following two years, it nearly disappeared, effectively restoring the Ukrainian market to its pre-war seasonal rhythm.

**Figure** Dynamics of cucumber imports\_in physical and value terms



Source: APK-Inform

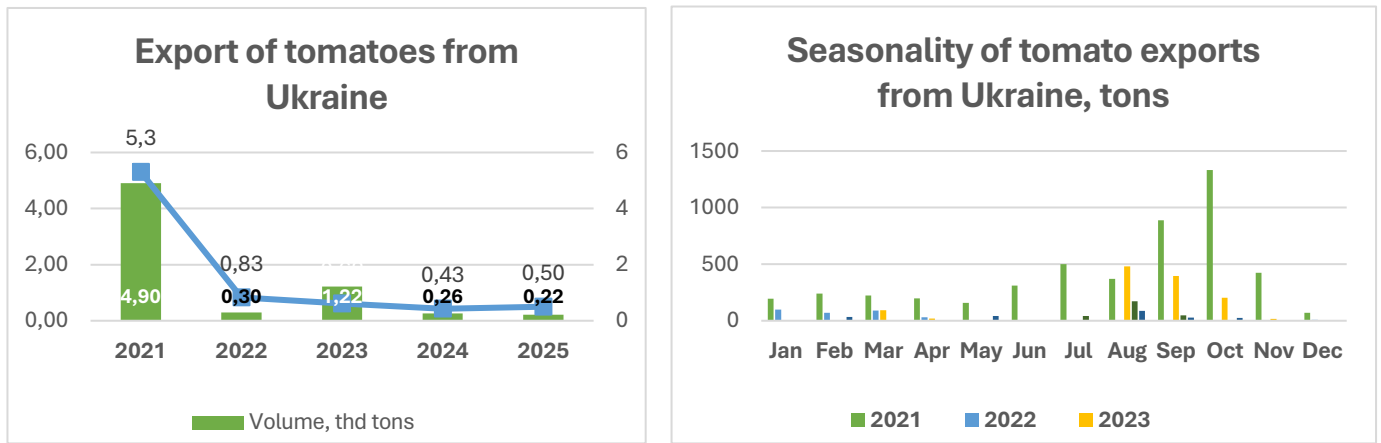
## 2. Tomato trade analytics

### Export of tomato

Annual export volumes of Ukrainian tomatoes have declined sharply since the start of the full-scale invasion, falling from 4.9 thousand tons in 2021 to around 0.5 thousand tons in 2025. Alongside this drop in volume, export revenue also fell—from approximately €4.53 million to €0.17 million—reflecting Ukraine’s loss of market positions abroad due to reduced production, logistical difficulties, and energy and labor constraints under wartime conditions.

Seasonal tomato exports are unevenly distributed, with the main foreign shipments occurring in September–October and largely dependent on open-field harvest conditions. Greenhouse tomatoes are now reserved almost entirely for the domestic Ukrainian market. Since 2021, Ukrainian producers have been unable to supply tomatoes for export consistently throughout the year due to the challenges faced by greenhouse enterprises and the significant overall decline in production.

**Figure** Dynamics of tomato imports\_in physical and value terms



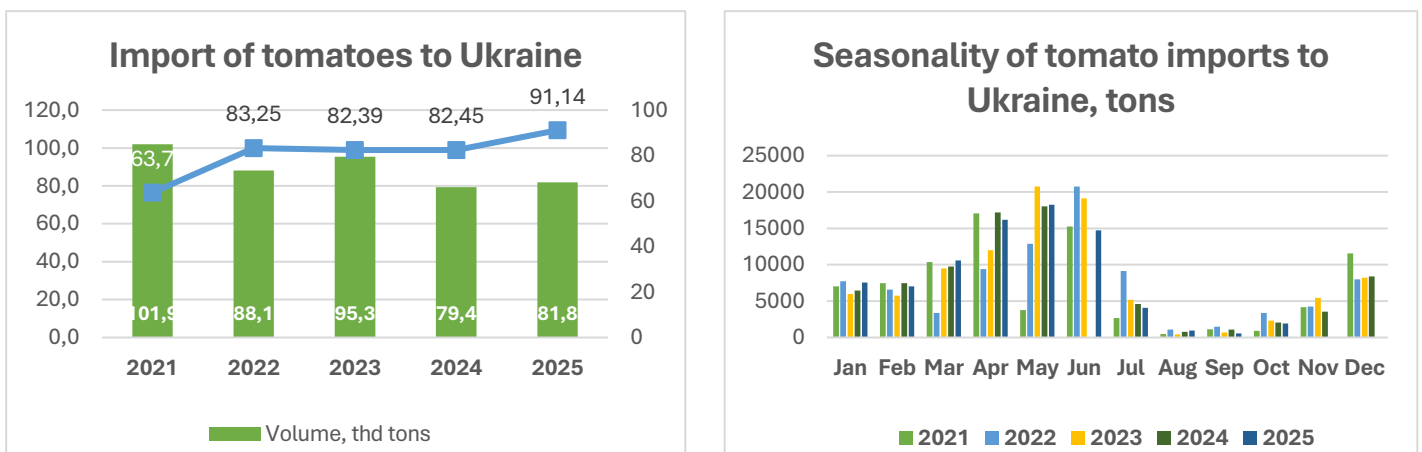
Source: APK-Inform

### Import of tomato

Between 2021 and 2025, Ukraine maintained consistently high tomato import volumes, ranging from 80–100 thousand tons per year. At the same time, the value of imports rose from approximately €54.7 million in 2021 to over €77.8 million in 2025, reflecting both higher international prices for imported products, the depreciation of the hryvnia, and changes in the geography of suppliers. This increase in import costs is particularly pronounced amid the decline in domestic greenhouse tomato production, making Ukrainian consumers increasingly dependent on external sources.

The seasonal dynamics of tomato imports are pronounced. Peak volumes occur in April–June (up to 18–22 thousand tons per month), when consumption rises, open-field products are not yet available, and Ukrainian greenhouse enterprises cannot fully meet demand. Additionally, higher production costs during the war have eroded many producers’ price advantage over imports, forcing them to compete more aggressively, while some have lost previous production volumes or exited the market entirely. In the summer–autumn period (July–November), import volumes decline significantly as domestic products become sufficiently available on the market.

**Figure** Dynamics of tomato imports\_in physical and value terms



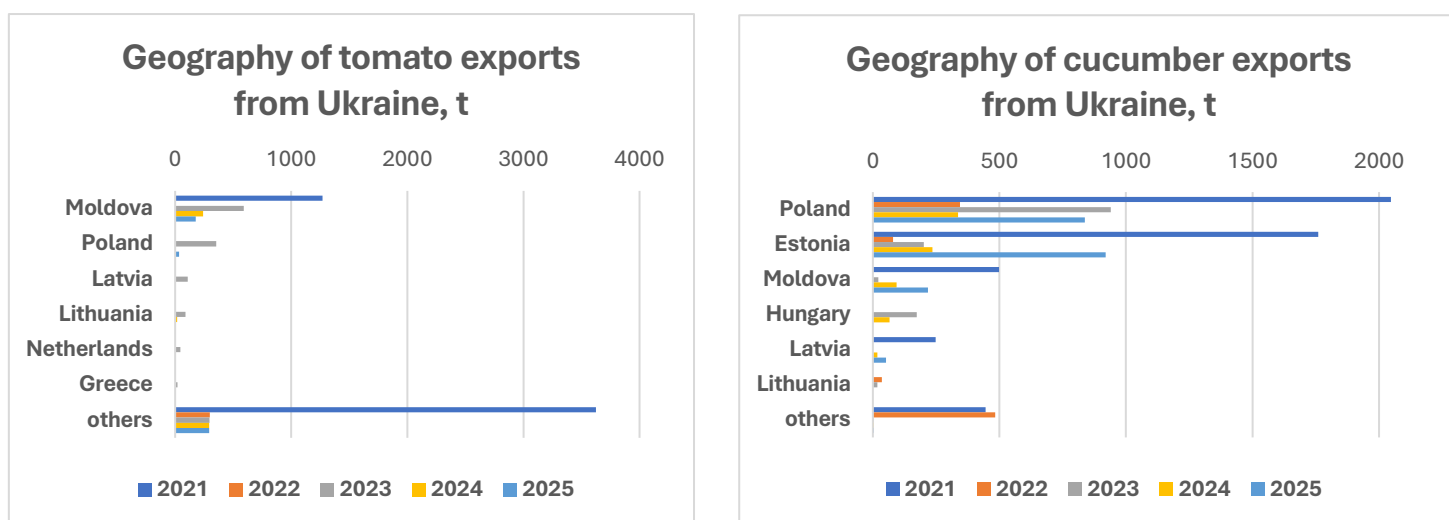
Source: APK-Inform

### Geography of exports of main crops

In recent years, Ukrainian tomato exports have been concentrated primarily in neighbouring countries, with Moldova as the dominant destination, far surpassing all others. Shipments to Poland, the Baltic states (Latvia, Lithuania), the Netherlands, and Greece occur occasionally but contribute minimally to overall export volumes. Moldova’s prominence is driven by logistical convenience, while exports to other countries are limited by transit difficulties, heightened competition in European markets, and import restrictions.

Cucumber exports, in contrast, are more diversified. Poland and Estonia are the main destinations, with significant volumes also sent to Moldova, Hungary, and Latvia. Growth in exports to Estonia is supported by distribution networks that carry Ukrainian products throughout the Baltic region, while Poland remains a key hub for processing, re-export, and domestic consumption. Proximity to the EU, strong demand, and relatively reliable logistics—even under wartime conditions—are the primary factors shaping these export flows.

**Figure** Geography of exports



Source: APK-Inform

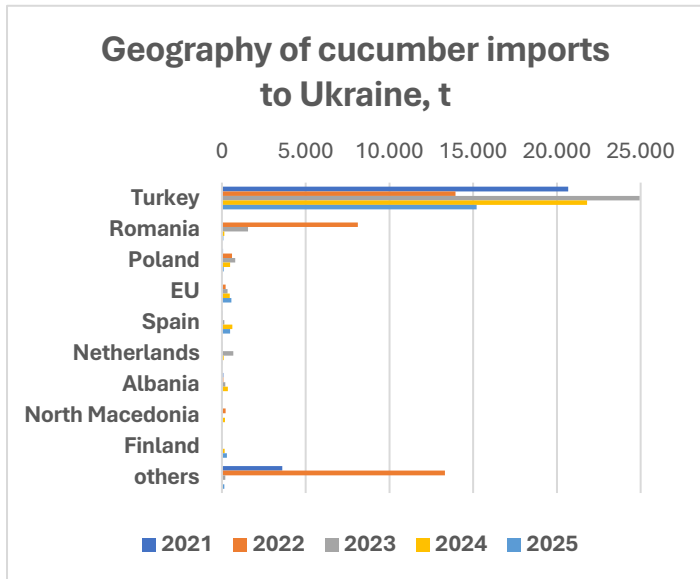
### Geography of imports of main crops

In the structure of tomato imports to Ukraine, Turkey predominantly dominates — accounting for approximately 40% of all annual arrivals, and in 2025 this figure already exceeds 60 thousand tons. Smaller suppliers — Poland, Spain, the Netherlands, Morocco, and other EU countries — participate episodically and do not significantly affect the market situation. The main factors behind this dominance are competitive pricing, established supply chains, and the adaptability of Turkish businesses.

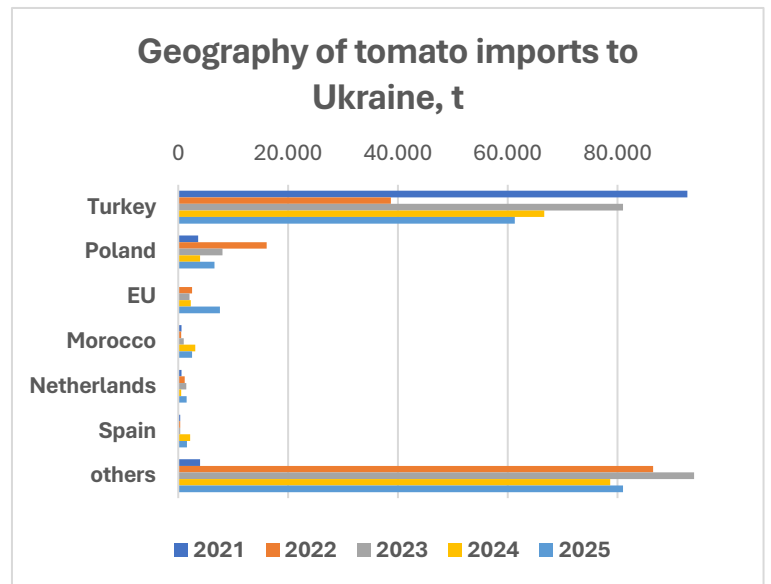
A similar trend is observed for cucumber imports: Turkey also leads, with the most active growth over the past two years, providing the bulk of supplies — nearly 15 thousand tons in the partial 2025 year. Alternative suppliers include Romania, Poland, other EU countries, Spain, and a number of less significant exporters (Albania, the Netherlands, North Macedonia). The high share of imports from Turkey is explained by the alignment of Ukraine’s seasonal shortages with the peak of Turkish supply, competitive logistics, and the significant flexibility of suppliers.

It is worth noting that in recent years the geography of imports has become even more concentrated on Turkey, meaning that in the event of sharp price or political fluctuations in the Turkish market, Ukraine faces increased import risk.

**Figure** Geography of imports



Source: APK-Inform



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