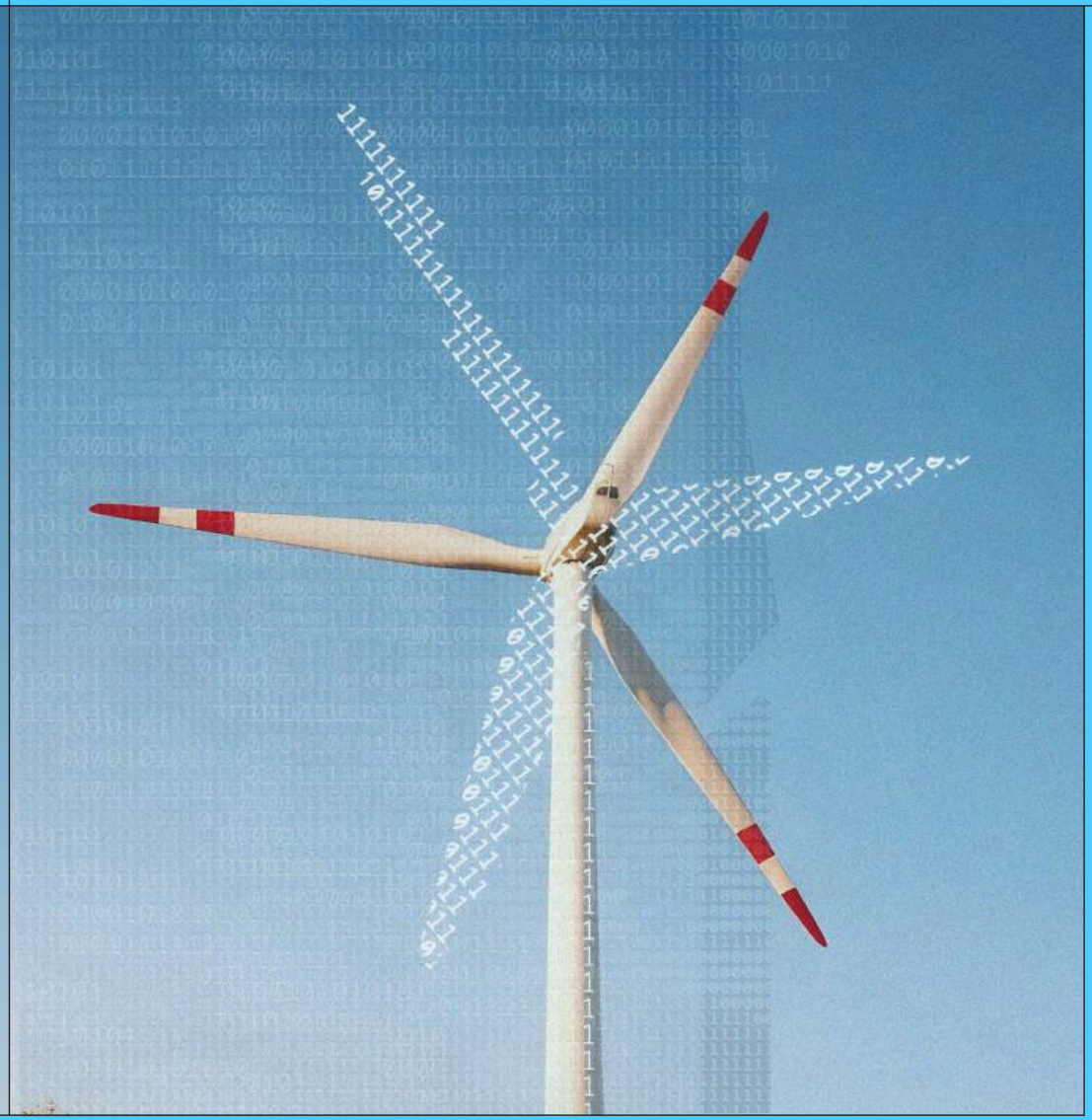
DataDriven | Research & Consulting
IT Ukraine Association
UKRSIBBANK BNP PARIBAS GROUP

# code economy

## how IT shapes Ukraine's economy



# how Ukraine is building a resilient economy through technology

Information technology in Ukraine has already become a systemic foundation of the economy. This is confirmed by the "Code Economy" — the first comprehensive study built on economic modeling and the theory of creative destruction developed by Nobel laureates in economics. This modeling allows the structural impact of the IT industry on the long-term transformation of the country's economy to be assessed. The study was prepared by the analytics company DataDriven, commissioned by the IT Ukraine Association in partnership with UKRSIBBANK BNP Paribas Group, KyivstarTech, and MODUS X, and with the support of the Ministry of Digital Transformation of Ukraine.

The IT industry has a powerful impact on the country's economy: one UAH from the IT sector generates an additional 1.09 UAH in the broader economy, and one specialist supports 2.29 jobs in related industries. In 2025, over 305,000 IT professionals and 2,243 IT companies were operating in Ukraine. Overall, the industry provides more than 800,000 direct and indirect jobs. The total market volume is $7.85 billion USD, of which $1.25 billion is the domestic market.

In 2025, the IT industry accounted for 3.2% of GDP, generated $6.6 billion in exports — equal to 41.6% of services exports — and remains a key contributor to the state budget, having paid 50.5 billion UAH in taxes.

Ukrainian IT exports demonstrate stability and high geographic concentration: approximately 80% of all revenues come from 10 partner countries. The key markets remain Europe (51% of total volume, or $3.39 billion) and the United States (36%, or $2.4 billion).

Under the conditions of full-scale war, the IT sector has confirmed its role as an economic stabilizer. The High-IT segment (industries with high IT intensity, where technology spending exceeds 1.66%) showed growth of +19.9%. By comparison, less digitized industries grew by only +4.7%.

Digitalization is creating new efficiency in core industries that generate the country's main added value. In the agricultural sector, the adoption of digital solutions provides a 10–30% increase in productivity and up to 40% savings in resources such as water and fertilizers.

In trade and retail, e-commerce reached $6.56 billion in 2025 (+7%, year-over-year), and the share of cashless transactions by volume reached a record 95.5%. Digital solutions in retail allow for a 15% acceleration in capital turnover and a 20% reduction in operational losses.

Industry is undergoing transformation through Industry 4.0 approaches. Automation and the use of digital twins is reducing equipment downtime by 30–50% and increasing production volumes by 10–20%.

In the public sector, digitalization has already become basic infrastructure. The Diia ecosystem, for example, covers more than 23 million users and provides over 160 services, scaling government services without additional costs.

EdTech digital solutions reduce training time by 40–60%, lower the cost of training per learner to $180 at scale, improve student outcomes by 25%, and automate routine teacher tasks. MedTech in Ukraine has transformed health into a direct economic factor.

Over three years, the number of electronic medical records grew by 528%, covering 37 million users and over 400,000 healthcare workers, while digital infrastructure provides access to care for 6 million internally displaced persons. Telemedicine and AI diagnostics reduce wait times, and early disease detection saves up to $10 for every dollar invested.

The level of digitalization directly affects the economy's ability to withstand crises. Sectors with high IT intensity not only grow faster (19.9–23% CAGR) but also adapt significantly better to external shocks compared to less digitized industries. Had traditional sectors reached the High-IT level before the full-scale invasion, the economy could have preserved approximately 196 billion UAH. That is, if two sectors were identical in all indicators before the war but one spent 1% more on IT, after the invasion it would have retained 0.48% more of its added value.

Digitalization is a factor of efficiency, and it is the level of technological development that will determine how quickly the economy can recover, scale, and compete in the global market.

The theoretical foundation for understanding this mechanism is Aghion and Howitt's model of endogenous growth through creative destruction.

In 2025 they, together with Joel Mokyr, received the Nobel Prize in Economics for their research on innovation-driven growth. The model explains growth through the sequential replacement of technological generations: use new solutions to displace old ones, increase productivity, and launch the next cycle of transformation. It is through this logic that the IT sector generates a multiplicative effect that spreads across the entire inter-industry chain.

At the same time, the depth of transformation depends on the readiness of the industries themselves; where skilled personnel are lacking or where institutional inertia holds back change, even available technological solutions do not realize their full potential.

The full-scale invasion turned out to be a paradoxical accelerator. Losses in exports, migration of specialists, and reduced investment on one hand;  on the other hand, the war in one blow removed barriers that had slowed the adoption of new solutions for years, and compressed transformation cycles from years to months. Industries that had completed more iterations of digital transformation before 2022 maintained production even when physical infrastructure was lost — digital assets proved more mobile and recovered faster than material ones. In this context, IT is not a separate industry but the infrastructure of resilience and long-term growth for the Ukrainian economy.

Ukraine's experience forms a unique natural experiment. No peacetime economy could observe how digital transformation unfolds under such pressure and at such a pace. This makes Ukrainian data and conclusions valuable not only for understanding its own recovery, but also for the global discussion about the role of technology in the structural resilience of economies.

# methodology

This study defines the IT sector as the totality of companies and individual entrepreneurs operating in the field of software development, IT services, and related technological areas. Telecommunications services are not included within the scope of the analysis.

## The analysis covers types of economic activity corresponding to the IT sector (KVED classification):

- **58.21** Publishing of computer games
- **58.29** Publishing of other software
- **62.01** Computer programming
- **62.02** Information technology consultancy
- **62.03** Computer facilities management
- **62.09** Other information technology and computer system activities
- **63.11** Data processing, web hosting, and related activities

Primary data presented in UAH were converted to USD at the average annual exchange rate of the National Bank of Ukraine for the respective year. Specific features of individual indicators are noted on the corresponding pages of the report.

## Interviews with Companies and Experts

To gain a deeper understanding of industry dynamics, a series of structured interviews was conducted in January–February 2026 with executives of leading Ukrainian companies, independent industry experts, and representatives of relevant associations. The thematic focus covered the impact of IT on adjacent sectors and the industry's adaptation under martial law conditions. The results were used to verify quantitative estimates and identify nuances not reflected in official administrative statistics.

## Primary Data Sources

The primary basis for calculations consists of official data from state authorities:

- State Tax Service of Ukraine
- State Statistics Service of Ukraine
- National Bank of Ukraine
- Ministry of Education and Science of Ukraine
- Ministry of Digital Transformation of Ukraine
- Ukrainian Startup Fund
- Diia.City Register, Other relevant sources

Industry sources were additionally consulted: DOU, Digital State UA, and AIN. In cases of limited access to the full volume of data, a triangulation method was applied. This weighted aggregation of several independent sources minimizes systematic bias. Methodological benchmarks are drawn from the work of the World Bank, OECD, McKinsey Global Institute, and other authoritative international institutions.

## Analytical Methods and Theoretical Framework

The macroeconomic section is based on input-output tables for the years 2015–2024. The following methods were applied: multiplicative analysis based on the Leontief model, a difference-in-differences method with verification through event study and placebo tests, and counterfactual modeling (peer average growth and adjusted CAGR).

The theoretical framework of the study is the "creative destruction" model by Philippe Aghion and Peter Howitt, which allows for an assessment of IT's role as a catalyst for the structural transformation of Ukraine's economy.

This concept explains the mechanism of economic growth through a process by which new technologies displace obsolete ones, radically increasing the productivity of the entire system. The significance of this approach has been confirmed at the highest academic level. In 2025, Philippe Aghion, Peter Howitt, and Joel Mokyr were awarded the Nobel Prize in Economics for their foundational explanation of innovation-driven growth and the role of technological change in national development. It is precisely this logic that allows the Ukrainian IT sector to be analyzed not merely as a separate industry, but as the driving force behind the country's transition to a new economic model.

**For methodology inquiries:** hello@itukraine.org.ua

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Supporting this research is UKRSIBBANK's investment in the development of the Ukrainian market and the country's digital ecosystem. Today, it is innovation and technology that are becoming the foundation of the country's economic resilience, competitiveness, and digital independence.

**Andriy Kashperuk**

Deputy Chairman of the Board,
Director of Retail Business,
UKRSIBBANK BNP Paribas Group

IT in Ukraine is already a systemic component of the economy. The industry accounts for $7.85 billion in market volume, generates $6.6 billion in exports, and brings together over 305,000 professionals. Every hryvnia in IT generates an additional 1.09 UAH in the broader economy, and one specialist supports more than two jobs in adjacent industries. The "Code Economy" study for the first time comprehensively demonstrates this effect and proves that IT is the foundation for sustainable growth across the entire economy.

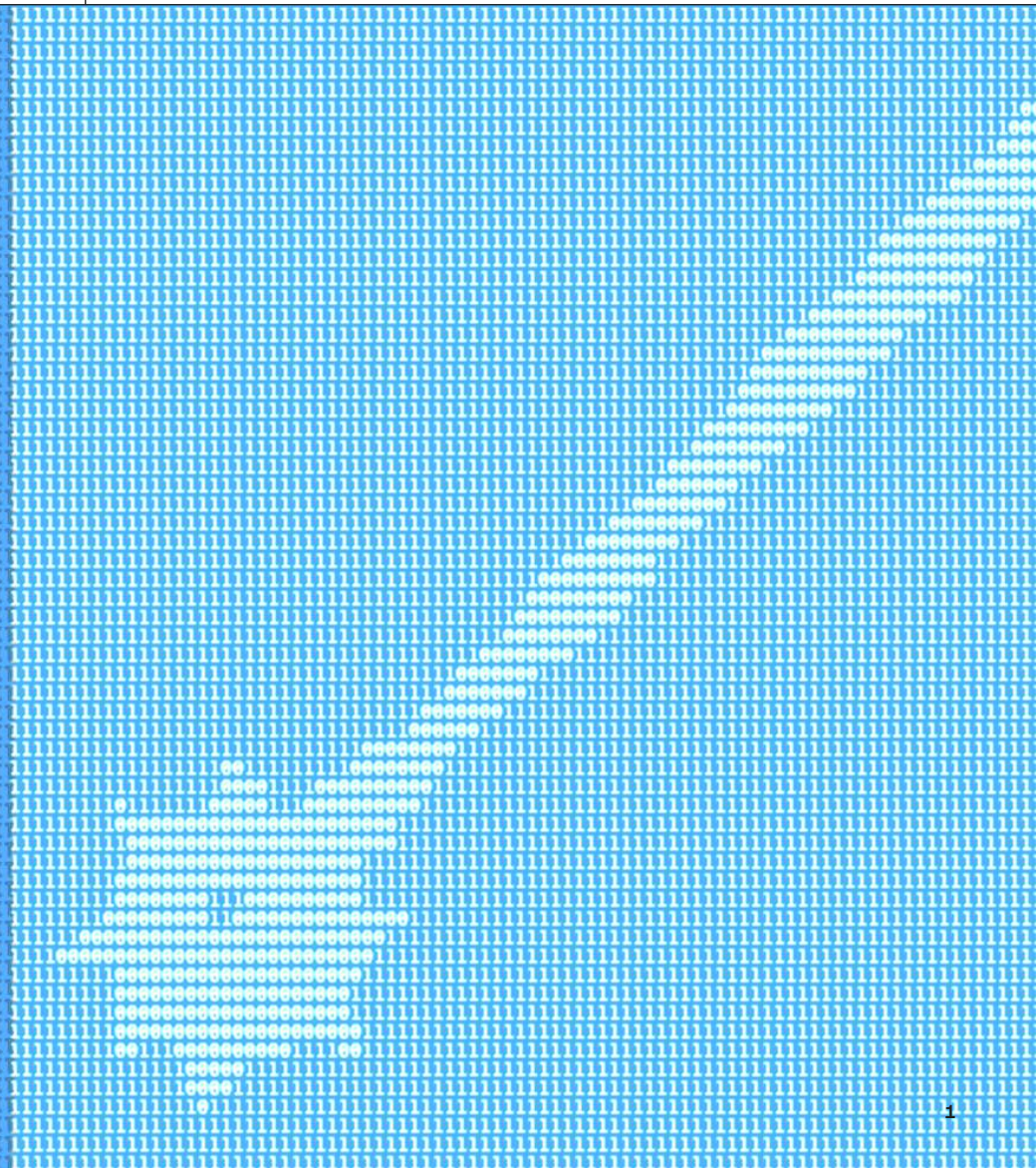
**Maria Shevchuk**

Executive Director, IT Ukraine Association

# general overview of the it



# Ukraine is a digital state



**Oleksandr Borniakov**
Acting Minister of Digital Transformation of Ukraine

Over six years, Ukraine has traveled the path from the vision of a "state in a smartphone" to becoming a global leader in digital transformation. This is evidenced by 24 million Diia users, the world's first digital passports, among TIME's best inventions, and 5th place in the world for Ukraine on the E-Government Development Index. But this is only the foundation.

The next stage is building a digital economy and creating the world's first Agentic State, where services will be proactively delivered by AI agents. This transition is impossible without a developed tech sector. Today, it is the main driver of our economy and the industry with the highest added value.

One specialist here creates 2.29 jobs in adjacent fields. Every engineer or developer effectively drives the development of entire industries. Ukraine is gradually changing its role in the global market.

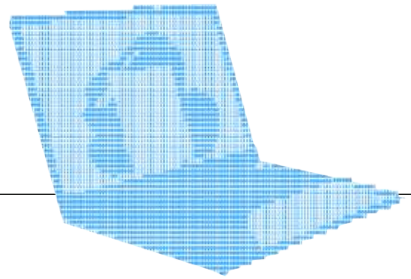
We are creating our own innovations. 39% of companies are already developing their own products — and this is a real transition to a knowledge economy. Yet we still import too much, and we must build up our own productive capacity. Our focus right now is smart technological self-sufficiency. We must develop our own technologies to minimize dependence on external solutions.

The state's role in this process is to be a partner. We are working to ensure the best conditions for tech business development and to systematically build trust. To this end, we are implementing clear legal instruments that global investors, venture funds, and institutional capital are accustomed to.

The Ukrainian IT sector has already proven its maturity. Now is the time to scale this success toward achieving our strategic goal: bringing Ukraine into the TOP 30 economies in the world by GDP.

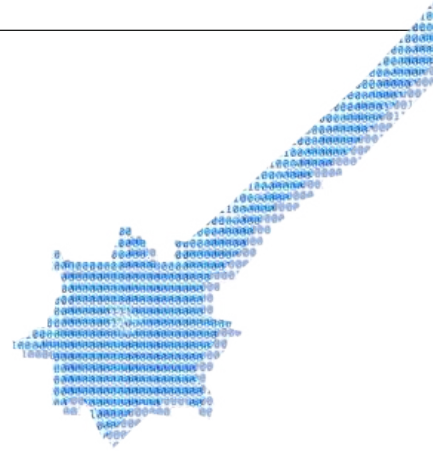
Information technology has become the systemic foundation of public administration, exports, productivity, and macroeconomic resilience.

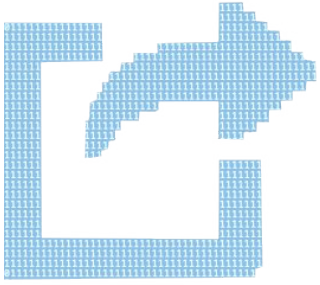
# The "Ukraine as a digital state" model rests on **three interconnected components:**



1 a high level of digital skills among the population

2 institutional readiness of the state

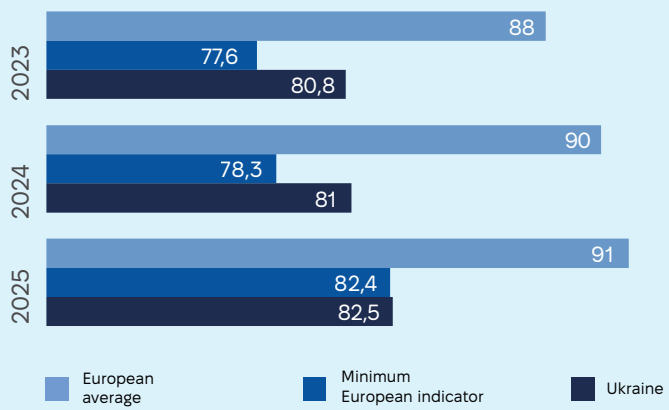




3 the macroeconomic role of IT exports

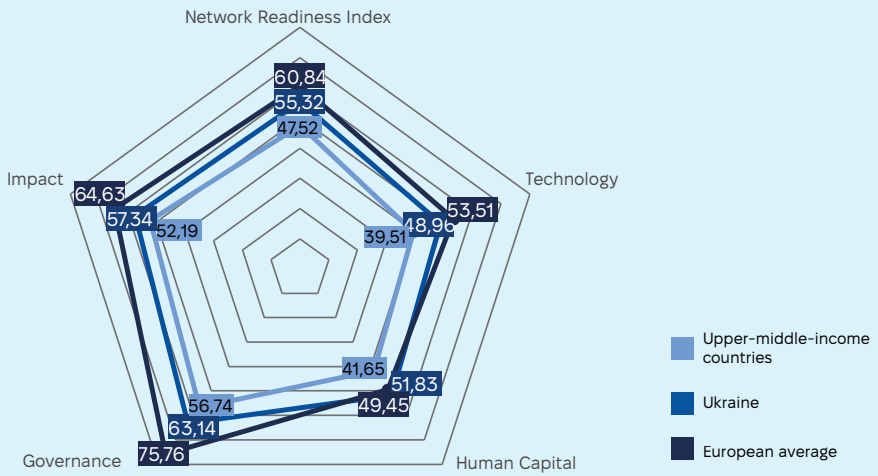
# 82,5 ICT Development Index

Ukraine demonstrates steady growth and remains above the minimum European level, gradually approaching the regional average:




# 54,3 The Network Readiness Index

Ukraine's digital readiness profile is stronger than the average among countries in its income group:

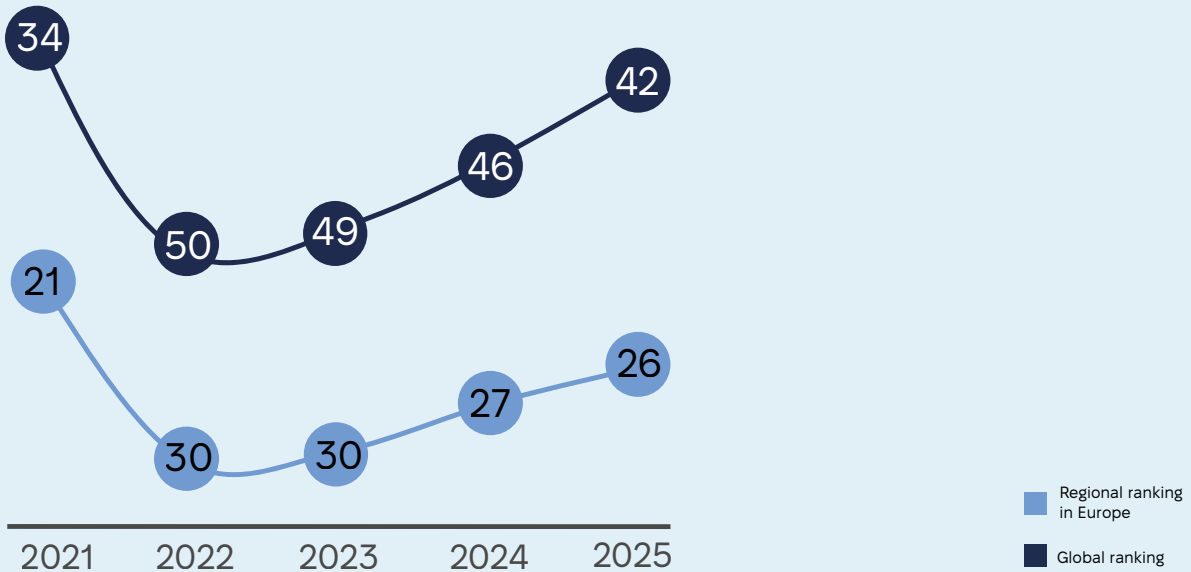



The ICT Development Index measures the level of information and communication technology development through indicators of access to and use of digital infrastructure. According to this Index, Ukraine rated **82.5 points** in 2025 — an increase of **+1.5 points**, representing approximately **+1.85% annual growth**[1]. At the same time, the development of digital infrastructure alone does not provide a complete picture of the depth of digital transformation. What is decisive is the extent to which the economy, society, and state institutions are capable of converting this foundational base into an ability to effectively use digital technologies.

**Network Readiness Index:** In 2025, Ukraine ranked 46th among 127 economies, scoring 54.3 points. Particularly noteworthy is that the country performs above what would be expected for its income level, with its key strengths found in components related to human capital (People — 46.66 points; 43rd place), inclusion (Inclusion — 79.28 points; 26th place), and the economic use of digital technologies (Economy — 51.93 points; 19th place). It is also worth highlighting that within the People block, the Individuals sub-component particularly stands out (68.72 points; 12th place); while among individual indicators, Ukraine ranks 1st in the world for E-Participation — a measure of how effectively the state engages citizens through digital tools (100 points)[2].

# 42nd place Global Startup Ecosystem Index

Ukraine is steadily restoring its global and regional ecosystem positions:




On the Global Startup Ecosystem Index 2025, Ukraine ranked 42nd in the world, with its startup ecosystem growing by 26.2% over the year[3]. This indicates that the country's digital foundation is gradually converting not only into technology usage, but also into the formation of an innovative entrepreneurial ecosystem capable of creating new products and bringing them to global markets.

The existing digital transformation is reflected in the quality of public administration. According to UN data, in 2024 Ukraine ranked 30th in the world on the E-Government Development Index with a score of 0.8841, rising from 46th place in 2022 and becoming the sub-regional leader of Eastern Europe. The structure of the index shows that Ukraine's position is based primarily on a high level of digital public services. Within the EGDI.

[1] ICT Development Index 2025
[2] The Network Readiness Index
[3] Global Startup Ecosystem Index

## Ukraine ranked 5th in the world on the Online Service Index, 47th on the Human Capital Index, and 78th on the Telecommunications Infrastructure Index[4]

Ukraine has developed one of the largest digital ecosystems of public services in Europe, with Diia at its core. As of the end of 2024, the platform provided access to 137 electronic public services, and the mobile application had 21.8 million users. In 2025, the state's digital ecosystem continued to scale through the launch of new services and became increasingly oriented toward a shift in the model of the state — from a Digital State to an Agentic State, where AI is set to deliver proactive, personalized, and more efficient services. In this context, Diia.City has solidified its position as the key legal and tax environment for tech business development, facilitating investment attraction, supporting product companies, and creating institutional conditions for building the digital economy. By year's end, the space united over 3,400 residents and 142,500 specialists, and generated 34.6 billion UAH in tax revenues[5].

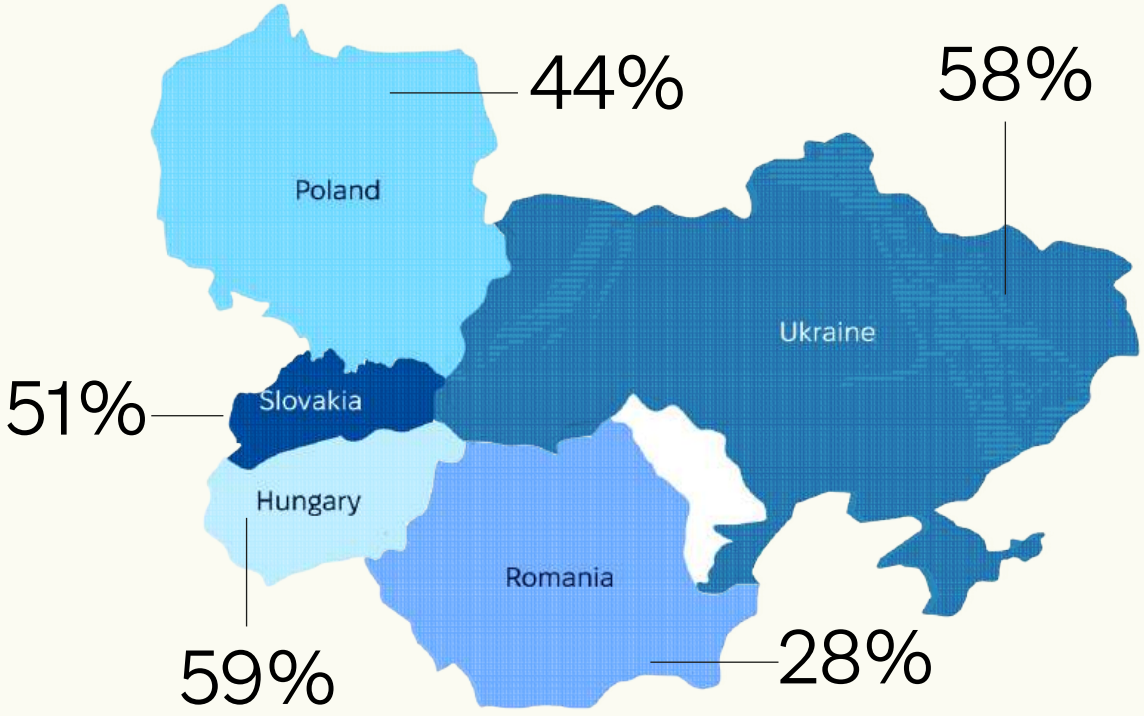
The Diia.Business center network covered 16 locations in 2025, while the portal, according to official data, surpassed 15 million page views, and the number of unique users over the year alone exceeded 650,000[6]. In practical terms, this infrastructure reduces the transaction costs of entering business and facilitates access to knowledge, financing, export support, and digital tools. Support for entrepreneurship is directly linked to Ukraine's development as an IT state; it creates an environment in which digital solutions are commercialized, integrated into the market, and expanded to external markets.

An additional element of this model is uResidency, a special status that gives foreigners the right to register a business in Ukraine's jurisdiction, earn income outside of Ukraine, and automatically pay taxes in Ukraine. In 2024, over 300 applications were received. Currently, uResidency is undergoing an update. Within the framework of Ukraine's development as an IT state, the significance of uResidency lies in expanding the use of Ukrainian digital services beyond the domestic market.

At the same time, the high level of digital competencies among the population reinforces Ukraine's role as an IT state. **58% of Ukrainians have basic or above-basic digital skills**, which is comparable to the EU average **(56%)**, while **96% of the population possess at least basic digital competencies**[7]. Thus, human capital is not a constraint on further digital integration of the economy — on the contrary, it forms an environment for scaling digital products.

[4] UN E-Government Knowledgebase
[5] Ministry of Digital Transformation of Ukraine
[6] Diia.Business
[7] Digital State UA

# ratio of digital skills among the population in countries of the region:




Particularly telling is the Open Data Maturity Index (2025), in which Ukraine ranks **4th in Europe with** a score of **97.1%**, trailing only France (100%), Lithuania (98%), and Poland (97.8%). For comparison, the average score for EU-27 countries is **86%**. This index measures not only the existence of an open data portal, but a state's comprehensive readiness for a data economy:

- the level of standardization
- regulatory compliance
- the ability to reuse data and integrate it into business processes
- real demand for open data from society and business

In this context, a score of 97.1% means that Ukraine already functions as a state where public data is a real resource — accessible, standardized, and suitable for use in commercial and non-commercial products across all sectors of the economy.

The regulatory component demonstrates a high level of institutional maturity: **92.25% of national legislation has been harmonized with international standards**, and the **level of digitalization of public services has reached 99.63%**[8] — one of the highest rates in the world.

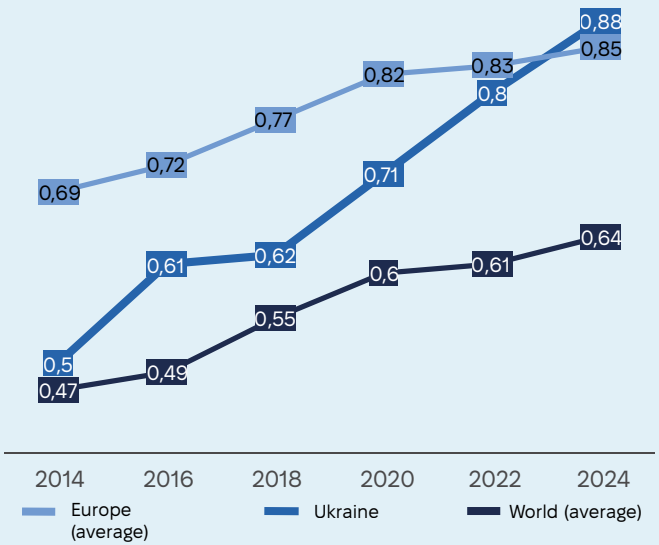
[8] European Union

**0,8841** E- Government Development Index (2024)

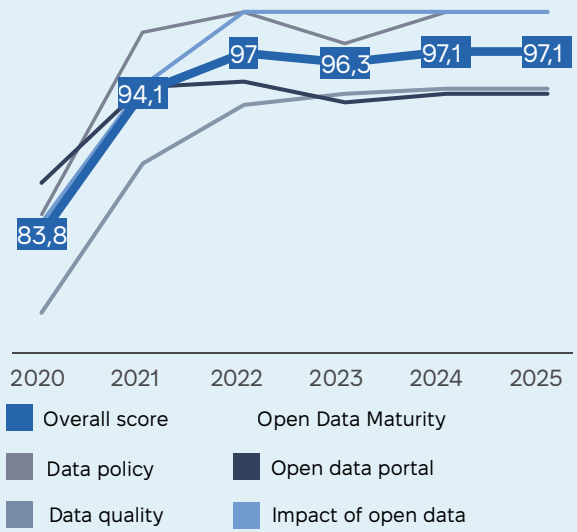
**97,1** Open Data Maturity (%)

**61** Government AI Readiness Index

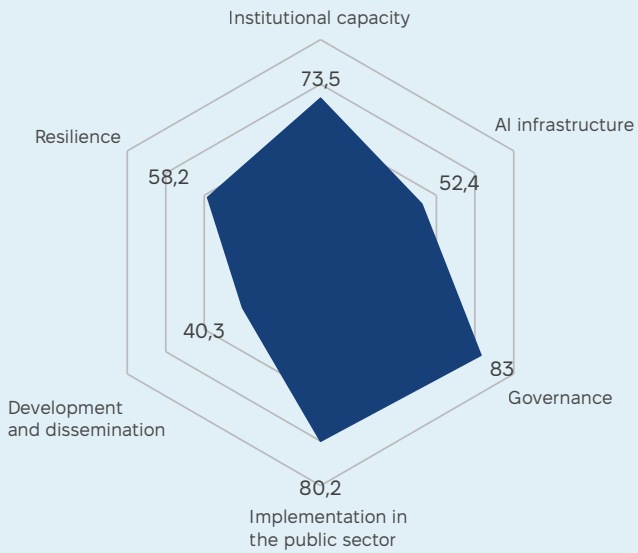
Based on 2024 results, Ukraine surpasses Europe and the world on the EGDI indicator




The state has achieved one of the highest levels of open data ecosystem development.




Readiness has been established for the broad integration of AI solutions into the public sector.




In the Government AI Readiness Index, Ukraine scored 61 points, indicating an established basic infrastructure, human resource potential, and the presence of policies for implementing artificial intelligence technologies in the public sector[9].

Thus, the state is entering a phase of integrating AI solutions into public administration, in particular, by implementing the Ministry of Digital Transformation's national AI strategy and forming an institutional infrastructure for artificial intelligence development — including establishing an AI Center of Excellence, which coordinates the development and implementation of AI solutions in public services and digital governance.

# Number of IT Companies

As of 2025, there are **2,243 active verified IT companies operating in Ukraine**[10] which indicates the preservation of the industry's structural integrity despite four years of full-scale war, the overall decline in global investment in the technology sector, and the slowdown in growth of the global tech market[11].

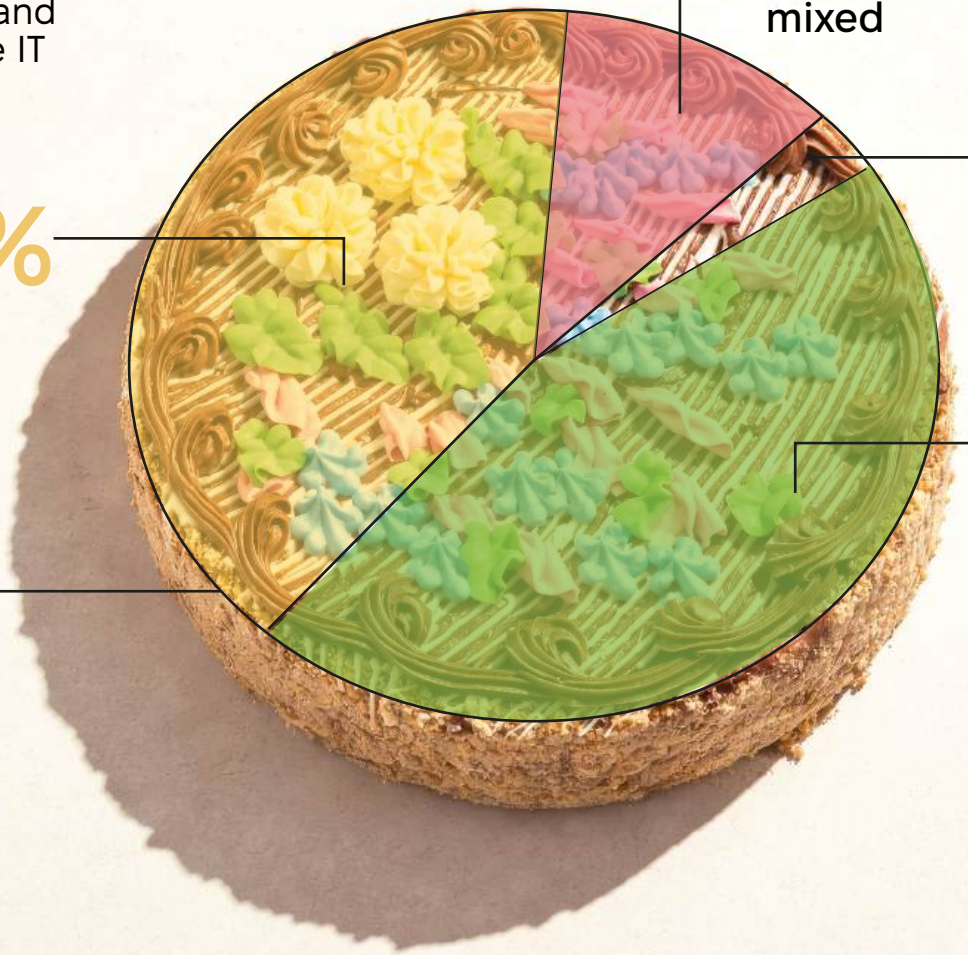
The IT industry's revenue in 2025 amounts to approximately **$6.07 billion**[12], reflecting stabilization following contraction in 2024 and the impact of devaluation processes. Despite the correction in export volumes in previous years, the overall structure of the industry remains substantial and ready for a recovery in growth.

The structure of business models in the IT market[13] remains diversified. The largest share is held by service companies — 46% of the market — confirming the preservation of the industry's service-export specialization. At the same time, 39% of companies operate in the product segment, indicating a gradual strengthening of internal technological capacity and the development of proprietary digital products. A further 12% of the market is formed by companies with a mixed business model that combines service and product approaches, which increases the sector's flexibility under conditions of unstable demand. The share of classical outstaffing stands at 3%, pointing to a gradual move away from the simplest form of integration into global value chains.

[9] Oxford Insights
[10] The sample includes companies operating on a commercial organizational-legal basis, not in the process of dissolution, and registered no later than December 31, 2025. Sector affiliation was determined by activity profile in accordance with the list of IT services (KVED 58.21; 58.29; 62.01; 62.02; 62.03; 62.09; 63.11; 63.12), and the presence of at least 5 employees. Digital tool: YC.Market
[11] McKinsey
[12] The assessment of total IT industry revenue was carried out by aggregating the financial indicators of active companies under the relevant KVEDs (58.21; 58.29; 62.01; 62.02; 62.03; 62.09; 63.11; 63.12), registered as of December 31, 2025 and not in the process of dissolution; the revenue of the largest IT company in Ukraine in 2025 — 10,876,263,000 UAH (4.4% of the sector's total revenue) — was used as the base extrapolation point, yielding an estimated industry volume of 247.2 billion UAH or approximately $6.07 billion at the NBU's average annual exchange rate for 2025 (source: YouControl Market).
[13] Calculated using the data triangulation methodology from sources DOU; Digital State UA; Lviv IT Cluster.

# number of it companies

**Ecosystem:** number of companies and structure of business models in the IT market.



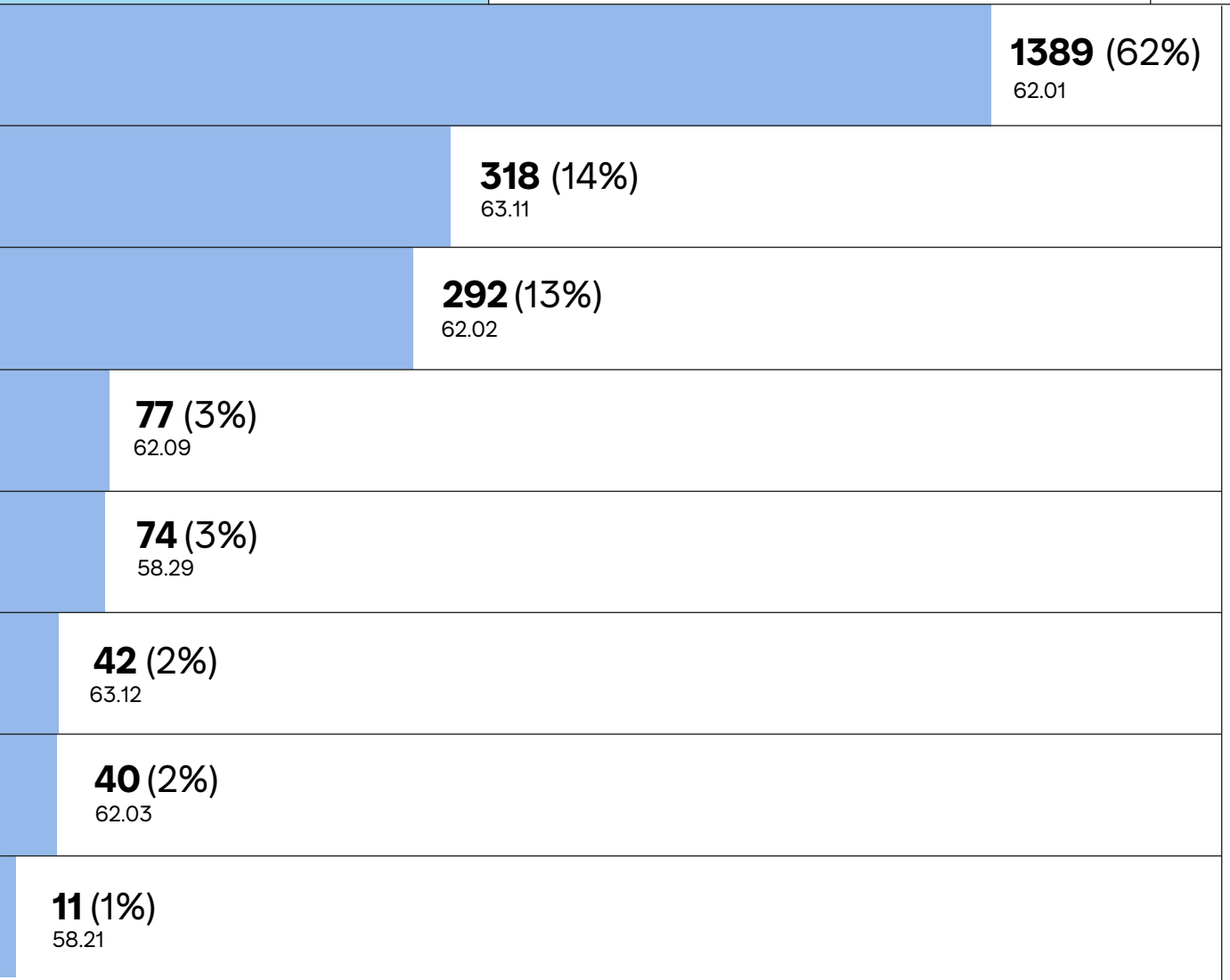
12%
mixed

3%
outstaffing

39%
product

46%
service

**2 243**
**active verified IT companies**




The distribution of activity among active companies indicates the quantitative leadership of companies in the field of computer programming.

- **62.01** Computer programming
- **63.11** Data processing, web hosting, and related activities
- **62.02** Information technology consultancy
- **62.09** Other information technology and computer system activities
- **58.29** Publishing of other software
- **63.12** Web portals
- **62.03** Computer facilities management
- **58.21** Publishing of computer games

# it services export as a factor of macroeconomic stability

At the same time, the IT sector plays the role of a key macroeconomic stabilizer. In 2025, IT services exports amounted to **$6.6 billion**, accounting for **41.6% of Ukraine's services exports.** After a peak of **$7.3 billion in 2022** and a decline in 2023–2024, the sector returned to positive momentum with growth of **+3% in 2025**. Notably, during the period 2019–2021, IT services exports grew from $4.2 billion to **$6.9 billion**, demonstrating rapid expansion prior to the full-scale war.

**IT services exports remain one of Ukraine's key sources of foreign currency revenues** and one of the few sectors that demonstrated resilience under conditions of full-scale war. The dynamics of 2019–2025 reflect different stages of the industry's development: rapid growth in 2019–2021, driven in part by global digitalization and rising demand for IT services during the COVID-19 pandemic; a subsequent contraction following the outbreak of full-scale war in 2022; and, a gradual stabilization against the backdrop of shifting global tech market conditions.

Cumulatively over the period 2019–2022, the sector demonstrated a **76% increase in IT services exports**, indicating a high scaling potential. The correction of 2023–2024 did not have the character of a structural decline, but rather reflected a cyclical realignment following the exceptionally rapid growth of the preceding years.

Particularly telling is the ratio of IT services exports to the overall structure of services exports. In 2025, IT accounted for **41.6%**[14] **of Ukraine's services exports**, which effectively means the sector played a dominant role in the services economy.

Structurally, IT exports also differ by higher added value compared to traditional commodity sectors. The main part of the value chain is created through engineering competencies, software solutions, and intellectual output. IT's dependence on material resources, physical logistics, and capital-intensive production infrastructure is significantly lower compared to other Ukrainian export industries. Against the backdrop of agricultural products (which account for 41.5% of the goods and services export structure), metallurgy (8.7%), mineral resources (5.4%), and machinery (3.8%), IT forms a distinct segment of intangible exports (12% of total goods and services exports), where the key assets are highly skilled talent and technological expertise.

[14] National Bank of Ukraine (data as of March 25, 2026)

# sectoral distribution of exports

(%, 2025)

**41,5%**
agricultural products

**12,3%**
IT services

**8,7%**
metallurgy

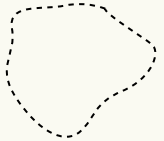
**5,3%**
mineral resources

**3,6%**
timber

**3,9%**
machinery

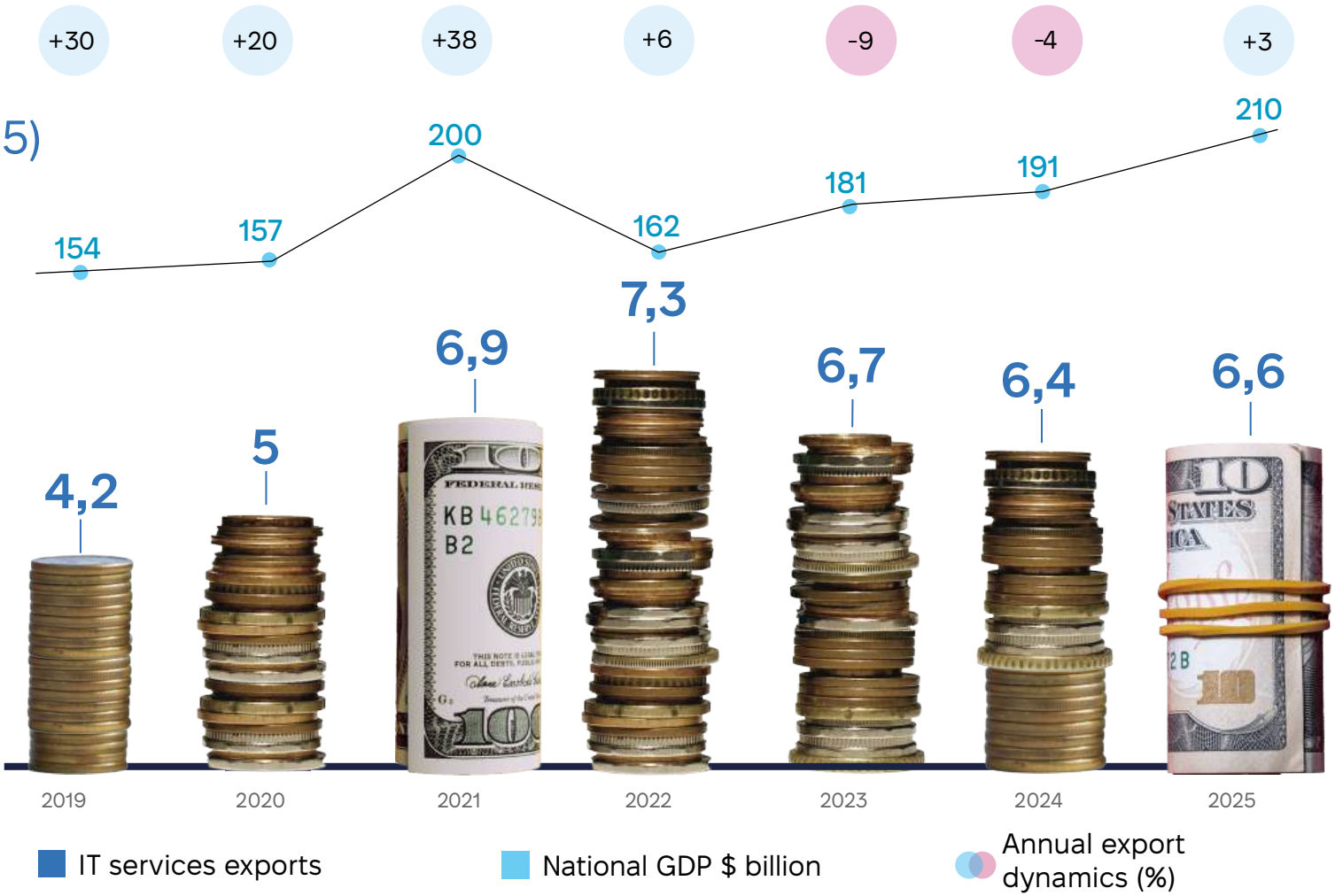
**3%**
chemicals

**21,68%**
other



# Dynamics of Ukraine's IT services exports and ratio to GDP (2019–2025)

From a strategic perspective, what matters is not only the gradual recovery of growth, but also the very maintenance of exports at a $6.5–7 billion level — a range that the industry demonstrated as relatively stable even before the full-scale invasion. Accordingly, stabilization at this level creates a foundation for transitioning to a higher-quality export model with a greater share of complex technological solutions.



# geography of it exports

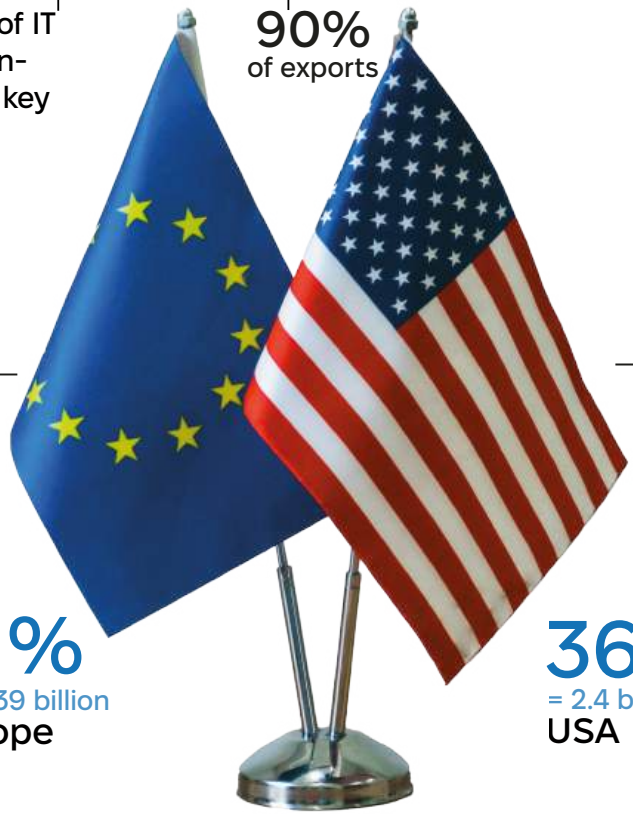
In 2025, the geography of Ukrainian IT exports maintained a high level of concentration. Approximately 80% of revenues are generated by a limited group of 10 countries (the USA, Malta, Cyprus, the United Kingdom of Great Britain and Northern Ireland, Israel, Switzerland, Germany, Estonia, Poland, and the UAE), which creates a clear core of stable external demand while simultaneously highlighting the strategic importance of market diversification.

In export statistics, it is important to distinguish between countries of actual demand and contracting jurisdictions. Countries such as Malta and Cyprus often serve as corporate hubs for contract registration by international technology companies, meaning that the actual consumer markets for Ukrainian IT services are more concentrated in the USA, the United Kingdom, EU countries, and Israel.

## Geographic distribution of Ukraine's IT services exports in 2025 (USD billion)

In 2025, exports of IT services were concentrated in two key regions:

90% of exports



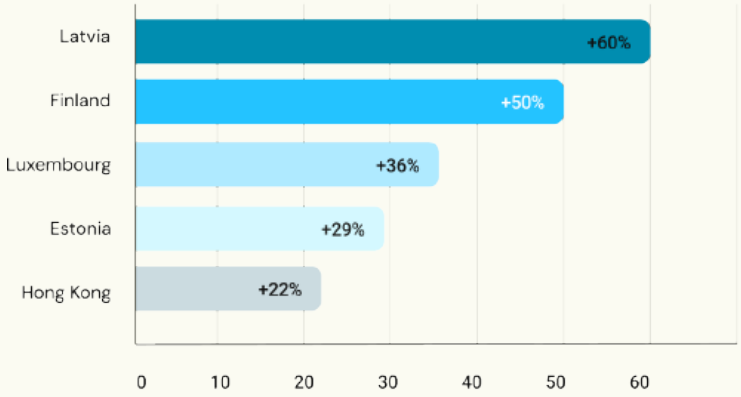
51%
= $3.39 billion
Europe

36%
= 2.4 billion
USA

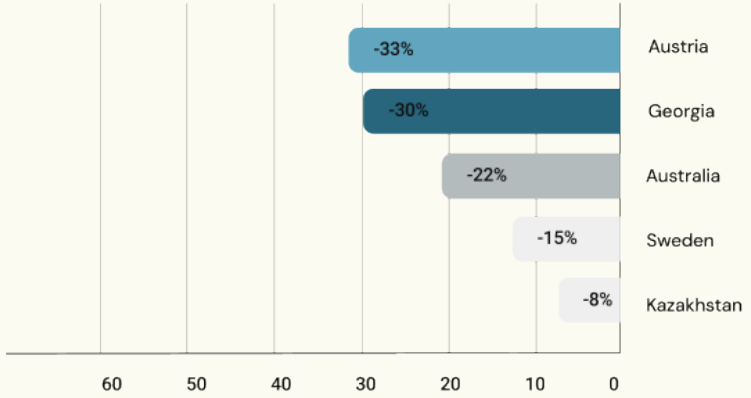
| | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|
| **USA** | 2,973 | 2,677 | 2,397 | **2,392** |
| **Malta** | 0,581 | 0,567 | 0,501 | **0,578** |
| **United Kingdom** | 0,693 | 0,535 | 0,565 | **0,557** |
| **Cyprus** | 0,314 | 0,362 | 0,394 | **0,480** |
| **Israel** | 0,347 | 0,293 | 0,297 | **0,264** |
| **Switzerland** | 0,331 | 0,274 | 0,266 | **0,248** |
| **Germany** | 0,286 | 0,275 | 0,263 | **0,237** |
| **Estonia** | 0,138 | 0,158 | 0,166 | **0,216** |
| **Poland** | 0,122 | 0,162 | 0,166 | **0,190** |
| **United Arab Emirates** | 0,093 | 0,110 | 0,138 | **0,169** |
| **Total export volume** | 7,349 | 6,727 | 6,446 | **6,656** |

**Table 1.**
The 10 Largest Partner Countries by Volume of Ukraine's Computer Services Exports in 2022–2025, USD billion.

## The largest export growth was recorded in cooperation with:




## Declines were observed in the markets of:



The United States remains the absolute leader, accounting for $2,392 million in export revenues, which constitutes nearly one third of the total volume of Ukrainian computer services exports. The American market remains key for service models, R&D, SaaS solutions, and enterprise development. The partial dependence of Ukrainian IT companies on this market is confirmation of high competitiveness, as the USA is the most demanding and supply-saturated market in the world.

At the same time, the United Kingdom remains a fully-fledged end market with high technological intensity and demand for complex engineering solutions.

In aggregate, the European direction accounts for 51% of Ukrainian IT exports from the total volume of IT services, corresponding to $3.39 billion. Thus, Ukraine's export structure relies on two key regions — the USA and Europe — which form the foundation of the sector's stability.

Despite the general stabilization in 2025, the dynamics of individual markets show heterogeneity. The largest export growth was recorded with Latvia (+60%), Finland (+50%), Luxembourg (+36%), Estonia (+30%), and Hong Kong (+29%). Declines were observed in markets with Austria (-33%), Georgia (-30%), Australia (-22%), Sweden (-15%), and Kazakhstan (-8%).

In smaller markets (with export figures up to $50 million), such fluctuations are often driven by individual contracts, while a systemic redistribution of demand can be traced in favor of key technology hubs.

According to industry research, countries in the region — which includes Poland, Ukraine, Romania, the Czech Republic, and Bulgaria — have formed one of the key global centers for software development services, serving primarily companies from the USA, the United Kingdom, and Western Europe. The presence of over 1.5 million developers in the region, combined with high quality and competitive pricing of IT services, forms a model of cost-effective engineering development, which explains the orientation of IT exports toward developed economies and the integration of Eastern European technology companies into global value chains. The stabilization of key markets and the expansion of geographic reach create opportunities for export diversification, with a tendency to shift focus from volume toward higher added value and long-term partnerships[15].

The structure of the top 10 partners in 2025 confirms that the Ukrainian IT sector remains globally integrated and oriented toward developed economies and financial hubs. The partner structure of Ukrainian IT exports corresponds to the broader regional pattern of Central and Eastern Europe.

[15] Sigma Software

# the it sector's tax model

In 2025, the total volume of tax payments made across relevant IT types of economic activity amounted to 50.53 billion[16] UAH, equivalent to approximately $1.21 billion. The primary fiscal contribution came from companies, which accounted for $789 million (32.94 billion UAH), or 65.2% of all tax revenues within the segment. At the same time, individual entrepreneurs paid $422 million (17.59 billion UAH), corresponding to 34.8% of the total volume.

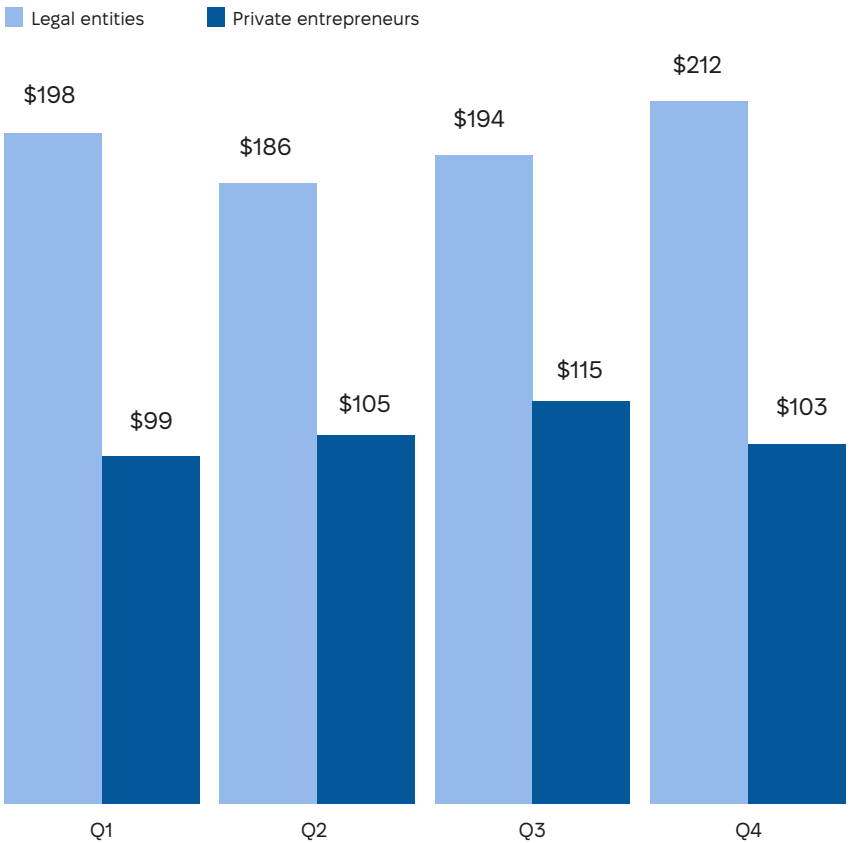
Across the individual taxpayer categories, the dynamics in 2025 varied. Legal entities paid $198 million (8.27 billion UAH) in Q1, $186 million (7.71 billion UAH) in Q2, $194 million (8.05 billion UAH) in Q3, and $212 million (8.91 billion UAH) in Q4. Individual entrepreneurs contributed $99 million (4.15 billion UAH), $105 million (4.37 billion UAH), $115 million (4.76 billion UAH), and $103 million (4.32 billion UAH), respectively. Following a decline in Q2, the corporate segment recovered in the second half of the year and reached its peak in Q4. In the individual entrepreneur segment, revenues grew through Q3, after which a slight decline was observed in Q4.

The largest volume of revenues was generated by "Computer Programming" — $814 million (33.93 billion UAH), or 67.2% of all revenues. Next in terms of revenue volume was "Data Processing, Web Hosting, and Related Activities" — $201 million (8.37 billion UAH), or 16.6%. The share of "Information Technology Consultancy" amounted to $139 million (5.79 billion UAH), or 11.5%, "Other Information Technology and Computer System Activities" — $45 million (1.86 billion UAH), or 3.7%, and "Computer Facilities Management" — $14 million (0.57 billion UAH), or 1.1%. Together, these areas form the core of the tax base of the IT segment under study, indicating the defining role of programming and related service activities in shaping the industry's fiscal output.

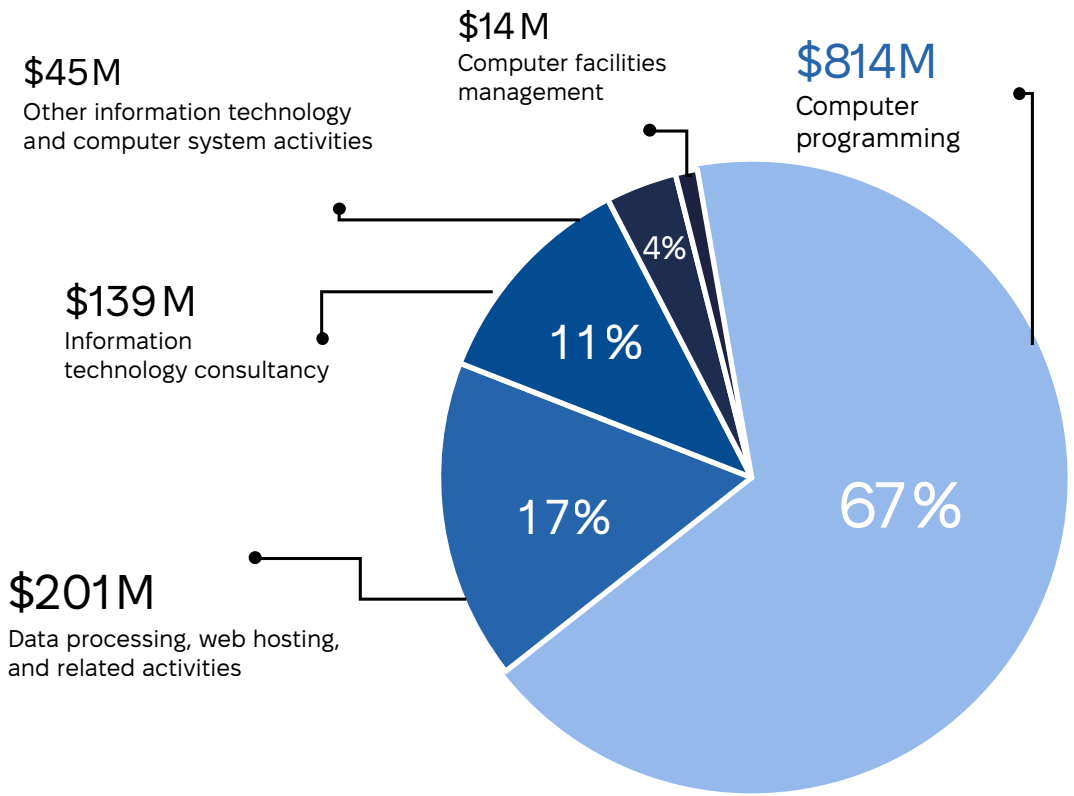
The fiscal architecture of Ukraine's IT sector rests primarily on programming and related services. On one hand, this demonstrates the high productivity of the industry's core and its ability to generate a stable volume of tax revenues. On the other hand, such a concentration creates a structural risk, as any deterioration in conditions specifically within these areas will have a disproportionately strong impact on the sector's overall fiscal profile.

[16] Data from the State Tax Service

# $ 1,21 billion total tax payments made in 2025



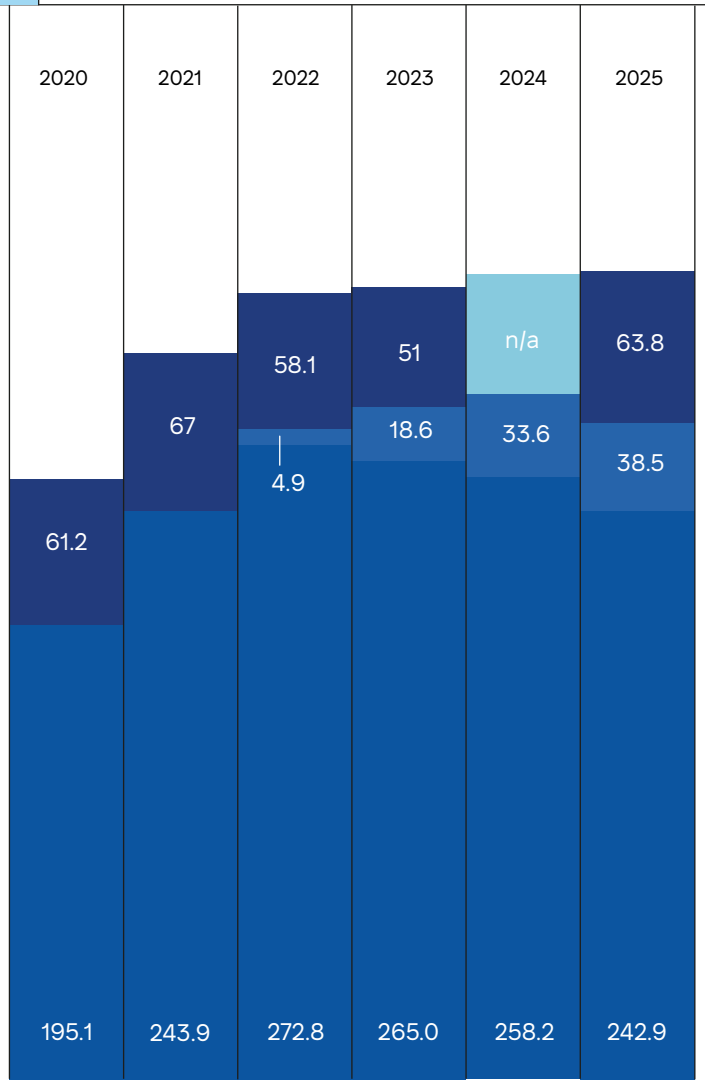

## Distribution of taxes paid by type of activity



Number of specialists (thous.)[17]

in-house IT teams of large companies outside the statistics

14,3k+




# it talent as the foundation of the industry

The structure of the Ukrainian IT market in 2025 reflects a transition to a mature development model. The industry is characterized by a stabilization in the number of specialists, a growing share of experienced personnel, and a transformation in the competencies in demand. These processes are influenced by a combination of factors: a reduction in the influx of new specialists, relocation waves of previous years, a shift in the demand structure, and the active implementation of artificial intelligence, which is gradually reshaping the work of IT teams.

Based on 2025 results, the total number of specialists in the industry is estimated at approximately **305,178 people**[18]. The regulatory conditions, formats of cooperation, and institutional structure of the industry are changing. Enterprises in other sectors (banking, retail, agriculture, industry, etc.) are building up their own IT departments, which are reaching the scale of standalone IT companies.

[17] The distribution of IT specialists by employment formats is formed on the basis of administrative data that reflects the market structure but is not mutually exclusive. The number of individual entrepreneurs is determined by State Tax Service data under IT KVEDs. The number of GIG specialists is based on the Diia.City registry. The assessment of full-time employees is based on State Tax Service data regarding tax and unified social contribution payments by companies under IT KVEDs. A separate segment of IT specialists in non-IT companies is highlighted, assessed as a share of the total market headcount. The indicators reflect the market structure and are not subject to direct summation, as the same specialist may simultaneously fall into several employment formats.

[18] The indicator does not account for the number of private entrepreneurs in the general taxation system.

As of 2025, the number of individual entrepreneurs in the IT sector stands at approximately 242,900,[19] demonstrating a gradual decline from the peak value in 2022 (264,200).

Structurally, the largest share falls on computer programming (161,600), confirming the dominance of the development segment in the Ukrainian IT ecosystem. At the same time, the areas related to data processing and IT consultancy remain significant (approximately 33,000 each), indicating a gradual expansion of these industries' functional profiles. Approximately 14,300 IT specialists form the IT infrastructure inside companies in other sectors. This figure underscores a fundamental shift: the boundary between the "IT industry" and the rest of the economy is increasingly blurring. A modern large company, regardless of sector, inevitably becomes a technology company: it builds internal platforms, automates processes, and maintains a staff of developers and engineers. Some players go even further.  DTEK has spun off its IT division into a standalone company, MODUS X, while Kyivstar has created Kyivstar Tech — effectively transforming in-house teams into full-fledged participants in the IT market.

First, the market has gradually stabilized following the shock caused by the full-scale war. In the early years, companies revised their business models, optimized team structures, and adapted to new working conditions. By 2025, these processes were largely complete, and employment dynamics became more predictable.

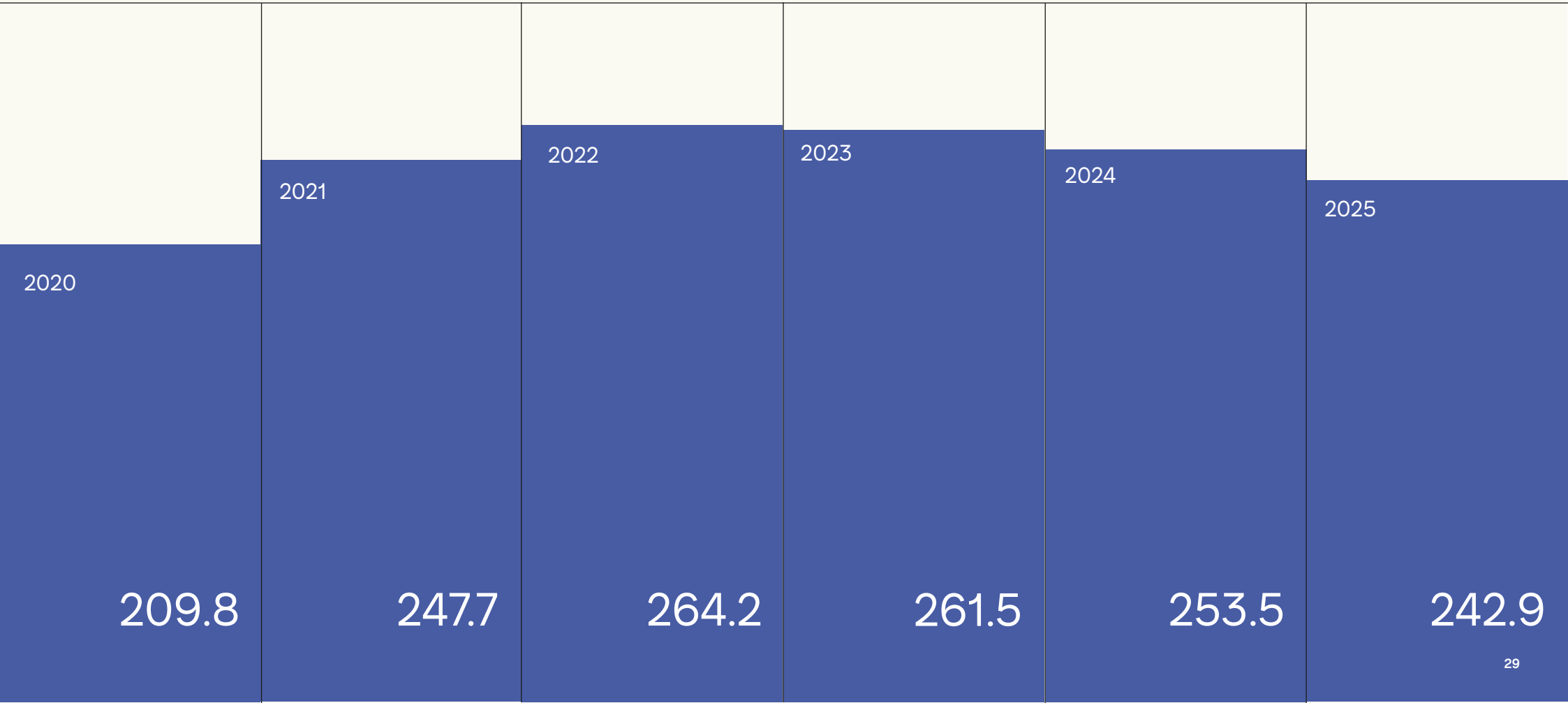
Second, the geography of doing business has changed, but not necessarily the geography of the specialists themselves. Many Ukrainian IT companies have established legal structures abroad — in EU countries, the United Kingdom, or the USA. As a result, some contracts are processed through foreign jurisdictions, while a significant portion of development continues to be carried out by Ukrainian teams.

Third, hiring recovery is occurring selectively. Companies are opening positions for specific competencies, primarily in AI, cybersecurity, and defense technologies. The mass team expansion characteristic of the pre-2022 period has not yet been observed, which explains the stabilization of the overall number of IT specialists.

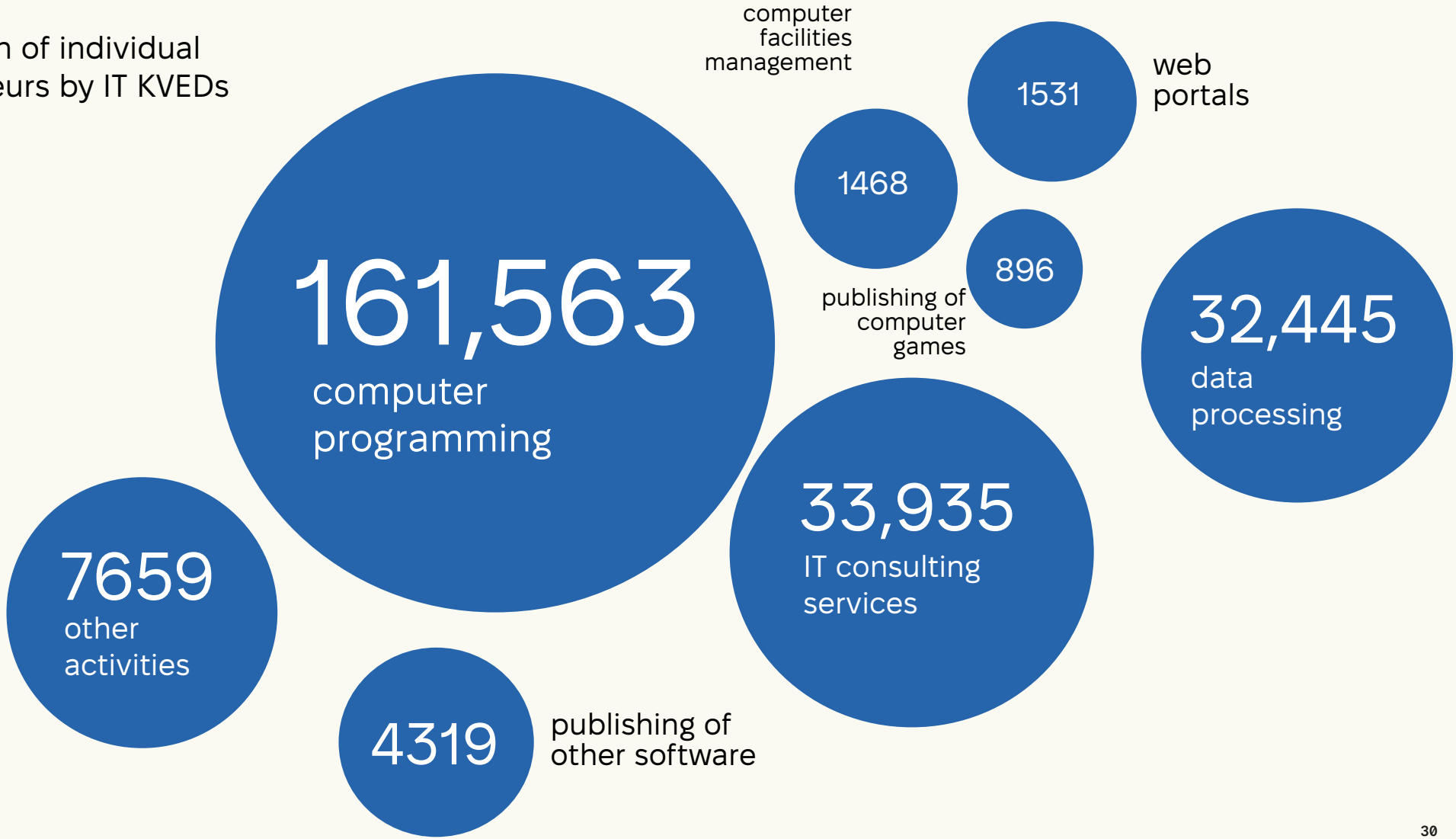
Fourth, the operational efficiency of teams is increasing. Companies are more actively implementing development automation, DevOps platforms, and AI tools, which allows for a greater volume of work to be completed without a proportional increase in headcount. As a result, the productivity of engineering teams is growing faster than the overall number of employees.

[19] The indicator does not account for the number of private entrepreneurs in the general taxation system.
[20] Data from the State Tax Service

## Number of private entrepreneurs among IT specialists (thous.)[20]



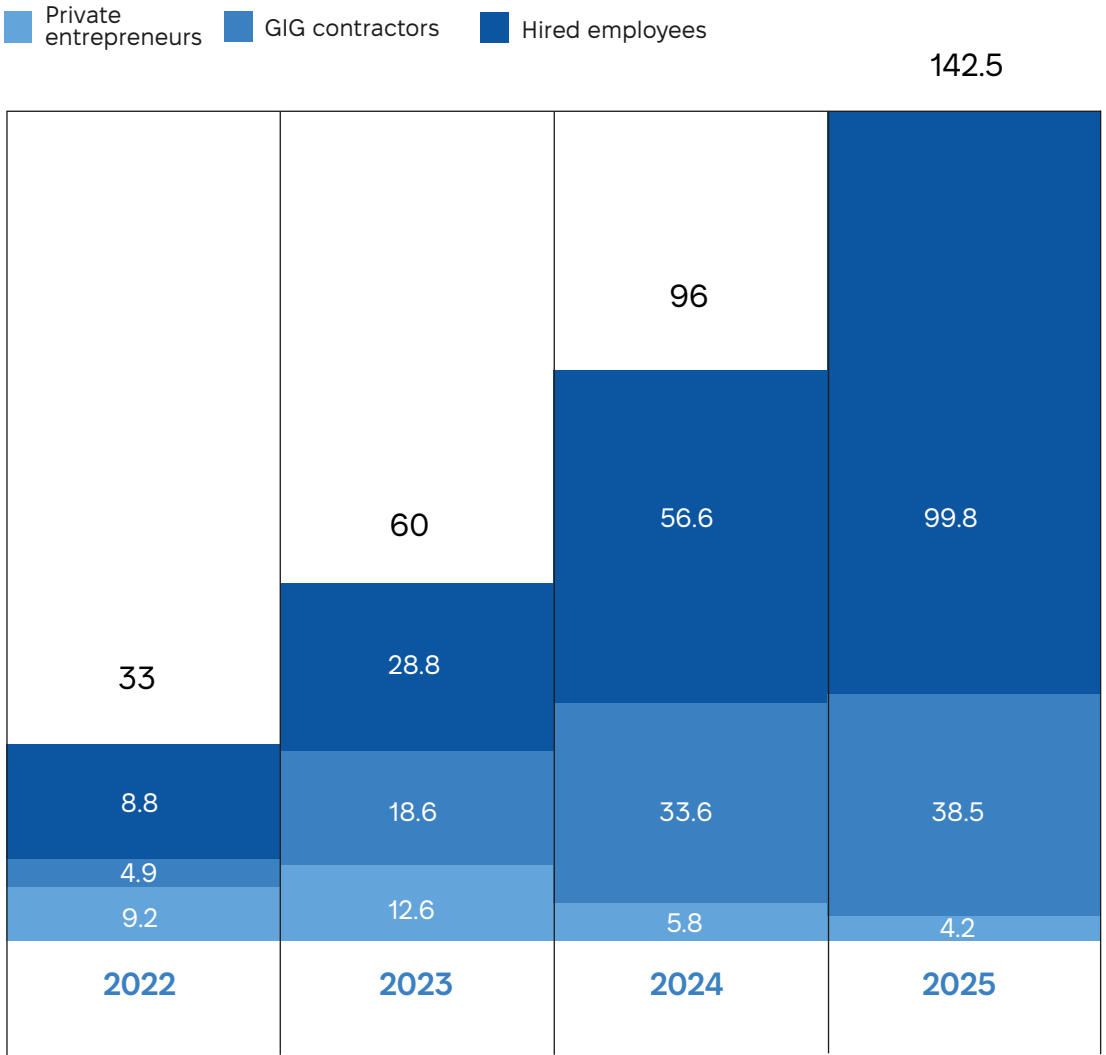
# Distribution of individual entrepreneurs by IT KVEDs (2025)



At the same time, the stabilization in headcount does not mean a decline in industry activity. On the contrary, the Ukrainian IT ecosystem demonstrates a high level of entrepreneurial and innovative dynamism: startups are developing, the defence-tech segment is growing, and technology clusters, industry associations, and R&D centers in international companies are operating. In these conditions, the quantitative stabilization of specialists is accompanied by a qualitative transformation of the industry, where innovation, specialization, and integration into global technology chains play a key role.

In parallel, the legal space that is Diia.City continues to expand. As of the end of 2025, 142,500 workers were recorded in the register. At the same time, the employment structure within the regime has changed significantly. The number of full-time employees grew to 99,800 (70% of the total), while gig contracts account for 38,500 people, and a further 4,300 are registered as individual entrepreneurs. The noticeable slowdown in the growth of GIG contracts against the backdrop of a sharp increase in full-time employment is largely explained by the possibility of reserving full-time employees from military service — a factor that has become decisive in the choice of employment format under wartime conditions.

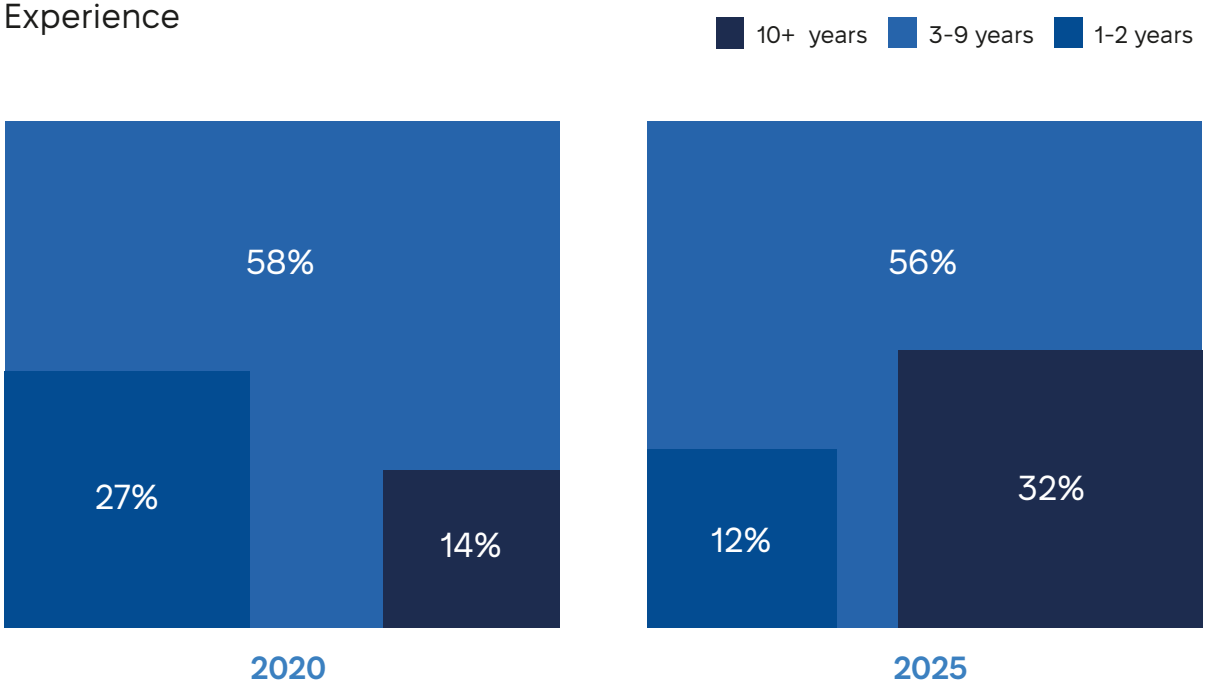
Number of IT specialists in Diia.City resident companies (thous.)



# profile of an it professional

The majority of specialists — 58% — have 3–9 years of experience, a further 27% have been working in the industry for over 10 years, and the share of junior specialists with 1–3 years of experience is only 14%.

Experience




The structure of the Ukrainian IT market in 2025 demonstrates a gradual transition to a more mature industry model. The industry is characterized by a stabilization in the number of specialists, the growing role of experienced personnel, and a shift in the competency structure. These processes are influenced by several factors: a reduction in the entry of new specialists, relocation processes from previous years, a change in the demand for skills, and the spread of artificial intelligence tools, which are gradually changing the work structure of engineering teams.

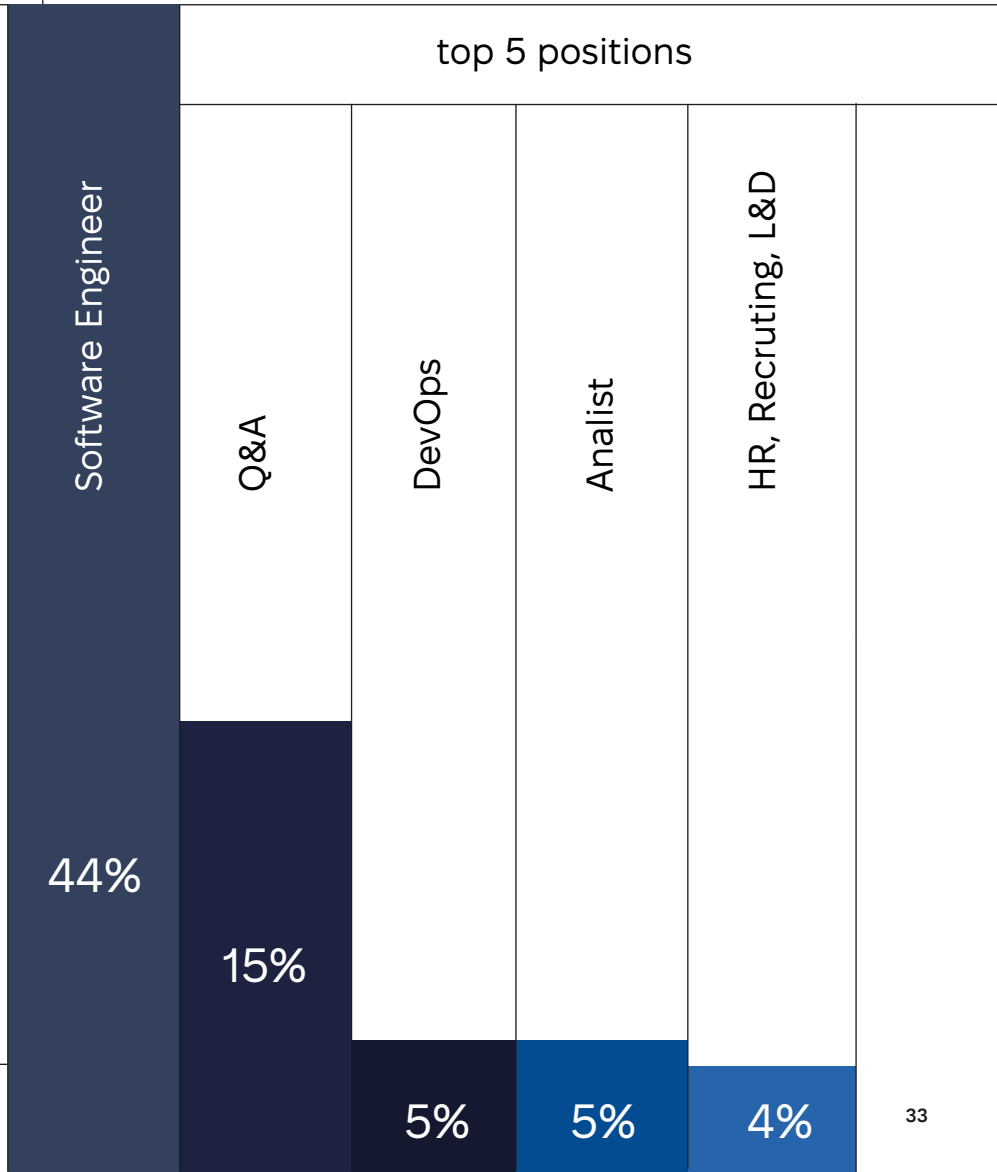
For comparison, in 2022 the share of beginners in Ukrainian IT (with up to three years of experience) was 26.3%, while those with more than 10 years of experience accounted for 13.5%. A similar trend is observed over a longer timeframe. As recently as 2020, the share of specialists with over 10 years of experience was only 12%. This "seniorization" has been the result of a narrowing of entry into the profession, the gradual automation of some basic tasks using AI tools, and the accumulation of experience by those who remained in the industry after the crisis years — which increases the industry's capacity to deliver complex projects, but at the same time creates a potential deficit of junior talent in the future.

The work format[21] also reflects a transition to a mature organizational model. In 2025, 68% of specialists work fully remotely, 21% in a hybrid format (occasionally visiting the office), and 11% more frequently or permanently in the office.

[20] DOU

# The demographic structure of the industry[22] is changing relatively slowly, but demonstrates gradual diversification. In 2019, the share of women in the industry was 24%, in 2024 — 26%, and in 2025 it grew to 29%. Accordingly, the share of men decreased from 76% to 71%.

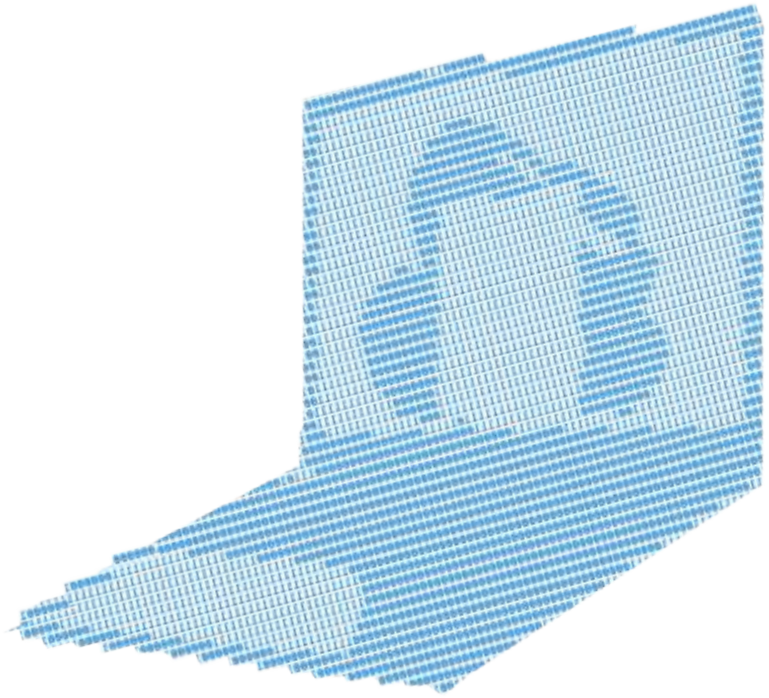
The distribution of roles[21] confirms the dominance of the engineering component. In 2025, Software Engineers account for 44% of all positions, QA — 17%, DevOps — 5%, analysts — 5%, and HR/Recruiting/L&D — 4%. This structure indicates that Ukrainian IT is increasingly functioning as an engineering production system, where the key value lies in creating complex technological products rather than merely executing individual development tasks. The growing share of QA, DevOps, and analytics also signals a transition to more mature processes oriented toward release stability, test automation, infrastructure reliability, and the measurability of solutions.




[21] DOU
[22] Ibid

# In summary, the profile of a Ukrainian IT professional in 2025 is that of an experienced, well-educated engineer with a high level of English proficiency, integrated into international teams and oriented toward long-term professional development.

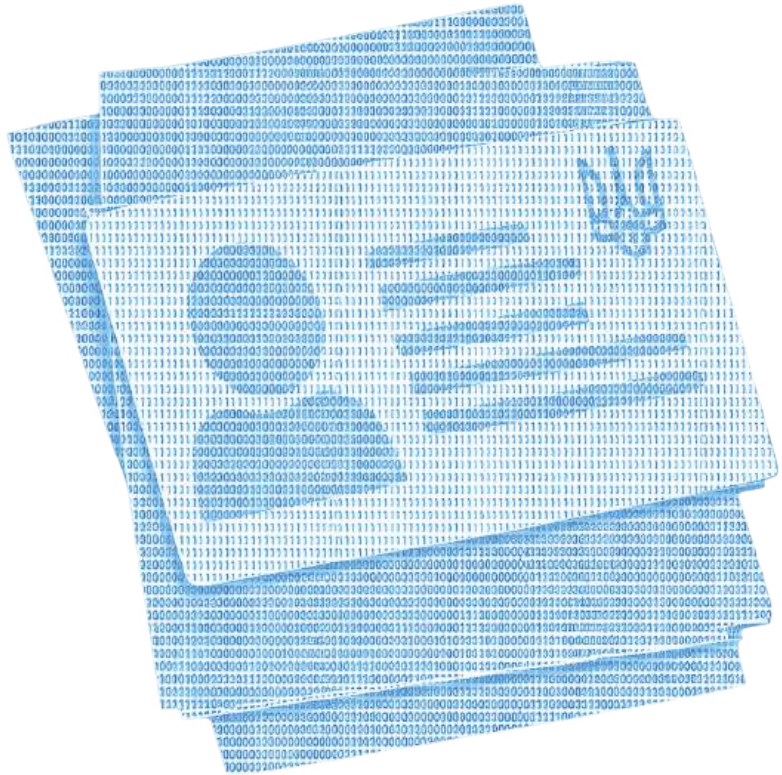
The educational and qualification level[23] of Ukrainian IT specialists remains high. 97% have higher or incomplete higher education, and 63% obtained higher education in computer science, technical, or related fields. In terms of English proficiency, 63% fall into the Advanced/Upper-Intermediate category, 26% — Intermediate, and 11% — Pre-Intermediate. The increase in the share of high-level English language proficiency reflects deeper integration into the global market, where direct contact with international clients is becoming the standard way of working.



[23] Ibid

# Diia.City

As a legal and tax space for technology businesses, Diia.City continues to expand actively. Both Ukrainian technology teams and international companies are joining it. For example, the number of Diia.City residents in 2025 grew by more than double to 3,400 companies; whereas at the end of 2024, there were approximately 1,500 companies in the space. In practical terms, this means that approximately 2,000 companies joined the space over the course of a year.



# architecture of the space

Among Diia.City residents, service companies predominate. They account for 65% and work on custom solutions for clients in both external and domestic markets; a further 28% are product businesses that create and scale their own technological products; 7% operate under a hybrid model, combining the development of proprietary solutions with the execution of contract projects. This distribution demonstrates the dominance of the service model alongside the gradual growth of the product segment's share, forming a more balanced structure for the space's technology ecosystem.

The industry profile of Diia.City residents allows for an assessment of which specific technology niches have become the core of this legal space. The analyzed data demonstrates that the space functions as a structured system with several dominant niches and a number of specialized directions.

The largest number of Diia.City residents work in defense technologies. Around 500 companies operate in the defense tech sphere — from unmanned systems and robotics to communications and electronic warfare solutions.

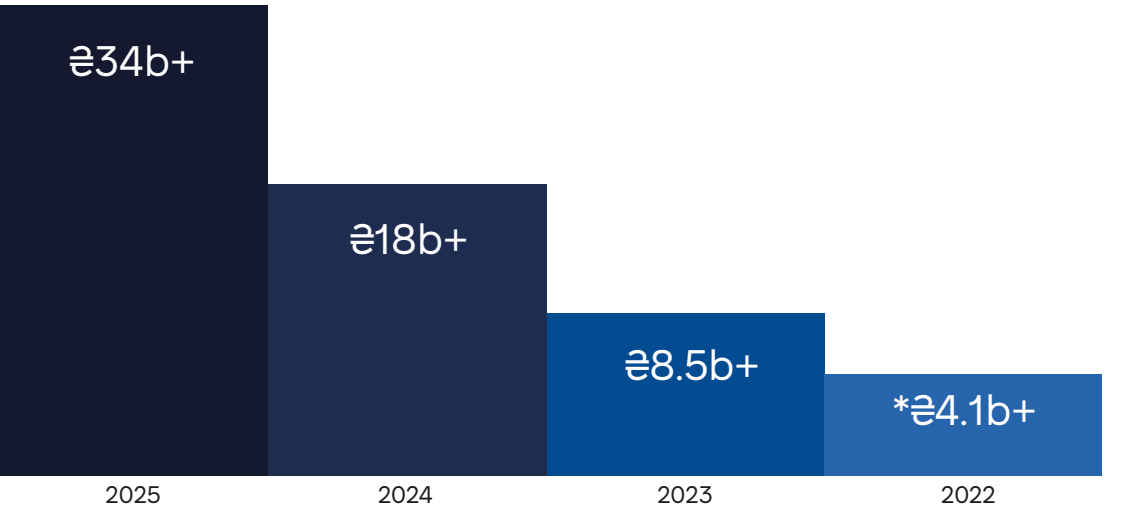
Approximately 200 residents focus on artificial intelligence solutions, creating tools for automation, data analysis, and machine learning applied in education, marketing, media, and the corporate sector. A roughly equal number of companies work in R&D and microelectronics, developing research centers, engineering solutions, and the production of technological components.

Smaller in number but still significant directions include HealthTech and Wellness (around 80 companies), AgroTech (over 30), and BIM technologies and digital modeling (around 20). Notably, companies from the latter two niches were only permitted to join Diia.City in February 2025 — meaning their numbers reflect the relatively recent expansion of the types of activities supported by the Diia.City space.

Also, among the most well-represented categories is software for improving business process efficiency — approximately 350 companies are working on solutions for management, finance, and internal automation.

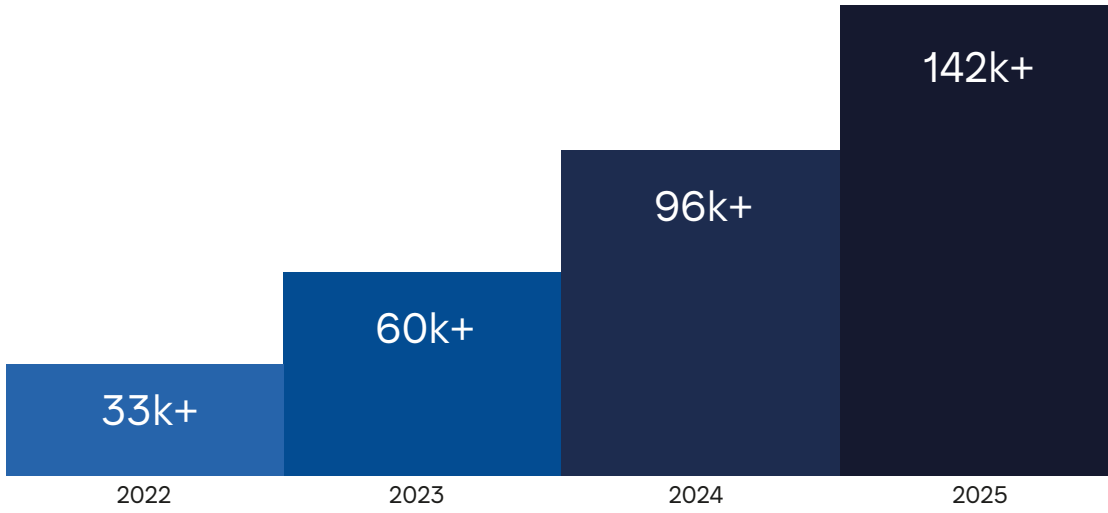
At the same time, the structure of the space also includes companies from niches such as FinTech, GameDev, EdTech, EnergyTech, GovTech, e-commerce, Blockchain/Web3, cloud services, and media technologies. This configuration indicates the formation of a multi-sectoral technology ecosystem, where Diia.City serves as a unified tax and legal framework for different types of innovative business.

Among the companies in the space, the number of so-called "unicorns" — businesses valued at over $1 billion — is growing. There are currently nine: airSlate, DataRobot, Fintech IT-Group, Lyft, PandaDoc, Preply, Quantum Systems, Superhuman, and Talkdesk. This concentration of highly capitalized companies demonstrates the regime's integration into the global technology market and its attractiveness for scalable product and engineering businesses.




**Dynamics of tax payments by Diia.City residents by year**

*22.5% more than in 2021, prior to residency




**Dynamics of growth in the number of IT specialists in Diia.City resident companies, by year**

# growth dynamics

In 2025, the number of IT specialists in resident companies exceeded 142,000 people. Over the four years of the space's existence, the total number of employed has grown more than fourfold, indicating the scaling of residents and the gradual formation of a stable technology employment market within the space.

In the context of the expansion dynamics of Diia.City, it is also worth examining the gradation of tax revenues. It demonstrates steady and accelerating growth throughout the entire period of the space's operation.

In 2022, the volume of taxes paid amounted to ₴4.1 billion. By 2023, this figure exceeded ₴8.5 billion, effectively doubling in a single year. In 2024, revenues grew by more than double compared to the previous year — to over ₴18 billion. By the end of 2025, the volume of payments exceeded ₴34 billion.

Thus, over four years, tax revenues have grown by more than eightfold. And importantly, the growth dynamics of tax revenues from Diia.City residents outpaces the growth dynamics of their numbers.

# the industry's educational pipeline

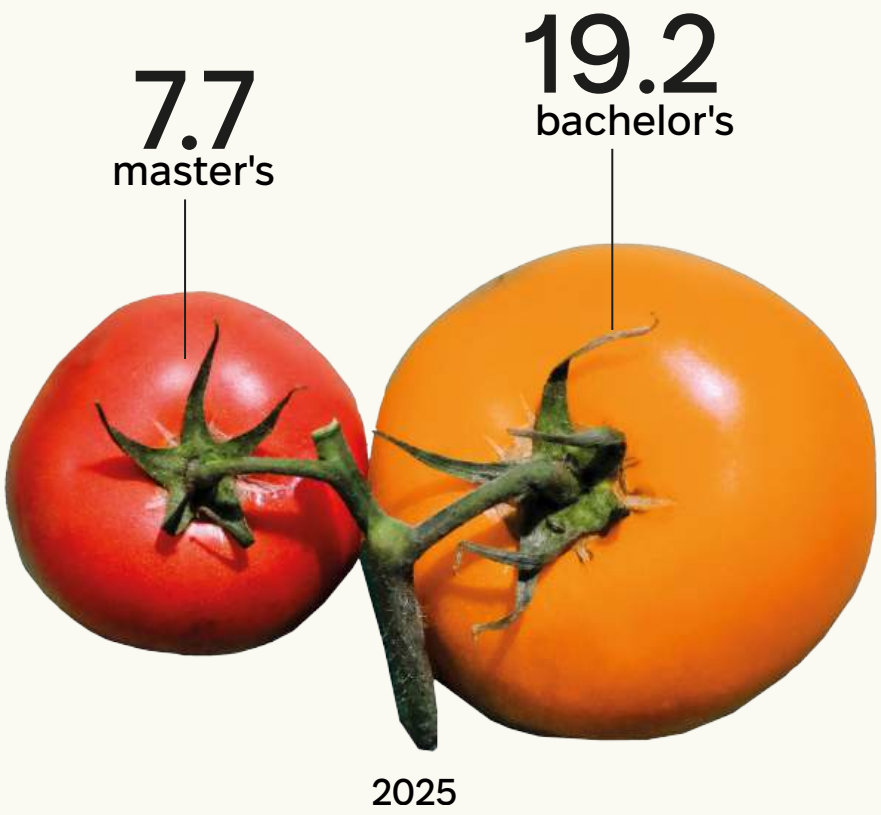
In 2025, the Ukrainian IT market faced for the first time not so much a deficit in demand for personnel, but rather the risk of long-term changes in supply. Following the peak growth of interest in IT education in 2020–2022, the number of applicants to relevant programs began to decline. This creates a potential gap in developing new talent that may manifest in the labor market in the second half of the decade.

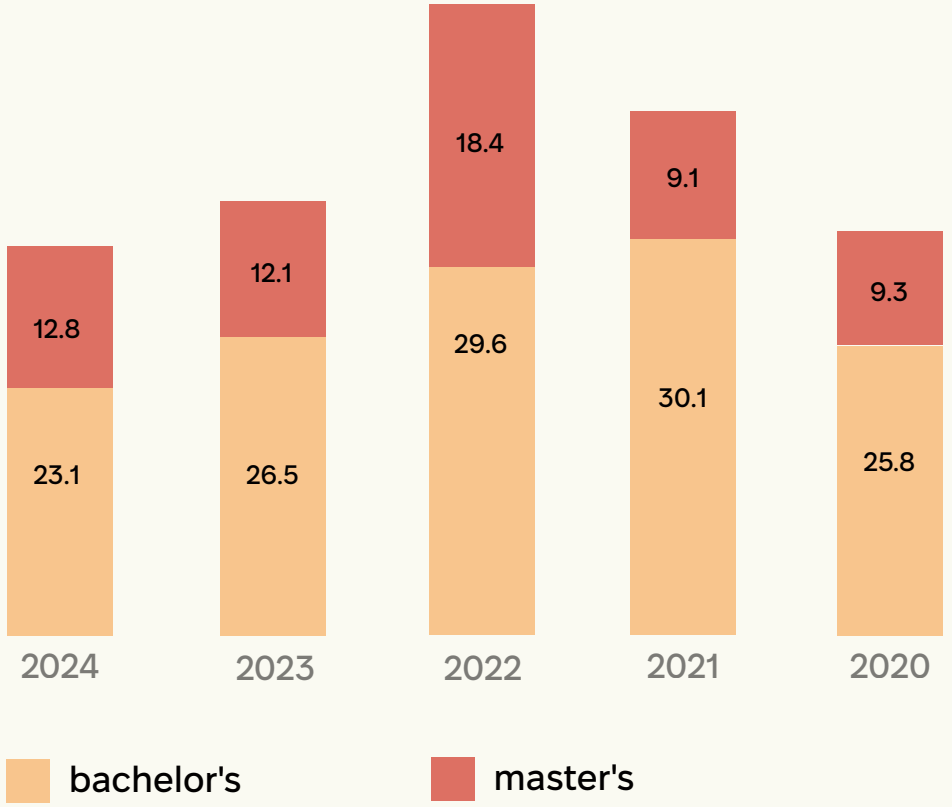
The reduction in enrollment is explained by a complex of factors. First, the full-scale war led to significant youth migration and a partial shift of applicants toward foreign universities. Second, the demographic decline in the number of school graduates reduces the overall pool of applicants. Third, the logic of entering the profession is changing. The development of online courses, corporate training, and AI tools is lowering the barrier to entry in certain IT specializations and partially reducing the industry's dependence on classical four-year university education. As a result, the decline in enrollment is not only an educational but also a demographic phenomenon, linked to the changing structure of the country's young population.

At the same time, the number of IT graduates remains relatively stable due to the inertia of the educational cycle. Students who enrolled during the period of peak demand have not yet completed their studies. Thus, in the short term, the market receives a stable flow of graduates, while new enrollment is gradually declining.

The number of applicants to IT programs declined from a peak of approximately 48,000 in 2022 to approximately 27,000 in 2025 — a drop of nearly 45% over three years. This is one of the lowest figures in recent years and represents an effective break from the trend of the previous decade, when IT consistently ranked among the most popular educational fields.

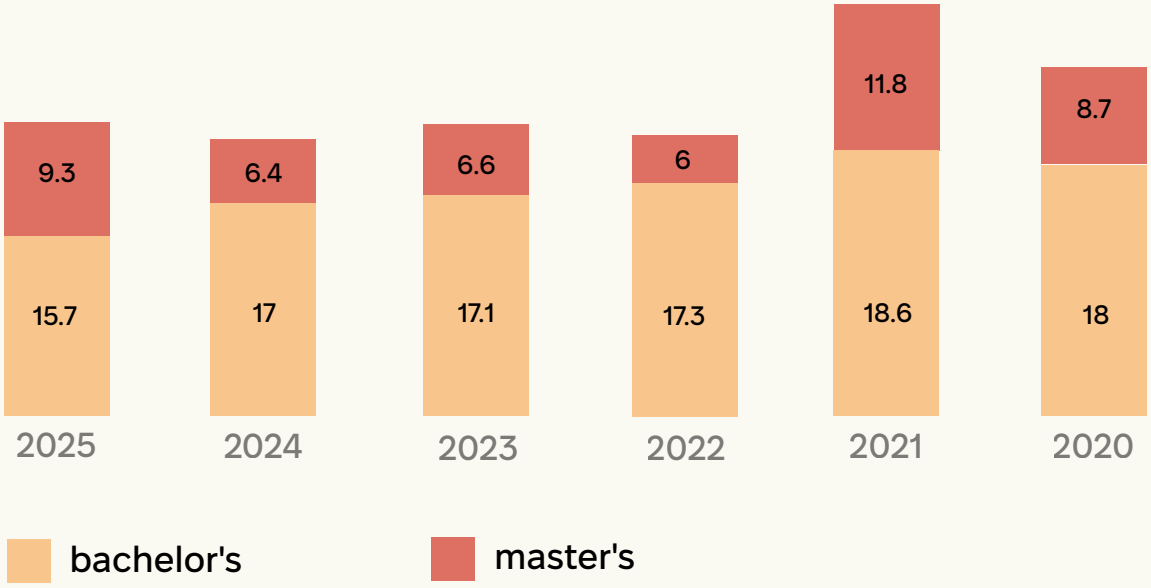
# number of applicants to IT-related programs[24] (thous. of people)




[24] Ministry of Education and Science of Ukraine. The chart accounts for applicants to IT programs. For the bachelor's level: F2, F3, F4, F5, F6, F7; for the master's level: 121, F2, F3, F4, F5, F6, F7. The respective codes cover software engineering, computer science, systems analysis and data science, cybersecurity, information systems and technologies, and computer engineering.

# number of graduates in IT-related programs[25] (thous. of people)

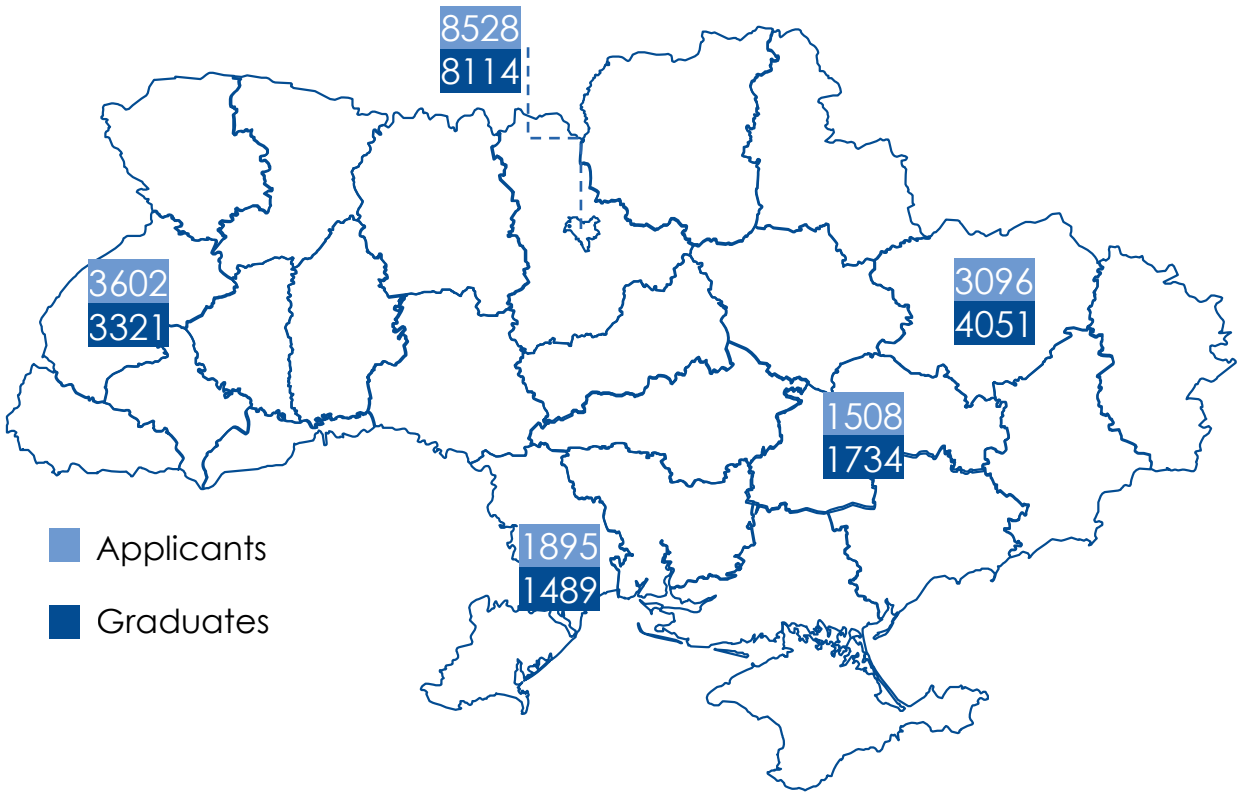



At the same time, the number of graduates demonstrates different dynamics. After gradual growth in 2020–2024 to approximately 30,400 people, in 2025 it declined only to approximately 27,000. Thus, the education system continues for now to supply personnel educated prior to the enrollment decline, which partially smooths out the short-term supply deficit in the labor market.

Perceptions of IT as a guaranteed social elevator have also changed. If in 2020–2022 the industry was perceived as the fastest path to a stable career, then in 2023–2025 expectations were influenced by the slowdown of the global technology market, mass layoffs at international companies, the difficulty of employment for junior specialists, and rising requirements for candidates.

[25] Ministry of Education and Science of Ukraine

## Applicants and graduates of IT programs in 2025, top-5 regions[26]




[26] Ministry of Education and Science of Ukraine

Regionally, IT education remains concentrated in several major centers — Kyiv, Lviv, Kharkiv, Dnipro, and Odesa. These cities are home to the leading universities, technology companies, and startup ecosystems, confirming the dependence of the educational geography on the structure of the country's IT hubs. This concentration reinforces the uneven access to quality training and ties the development of the industry to large urban agglomerations.

The decline in enrollment may change the structure of entry into the profession in the second half of the decade. If the trend continues, in 2027–2029, the market may face not so much a talent shortage as a reformatting of the junior pipeline. The share of experienced specialists will grow, while new professionals will more frequently enter through alternative educational pathways and career transitions from other industries. At the same time, the spread of AI tools is already reducing the need for a large number of entry-level positions by automating some typical tasks. As a result, companies will increasingly rely on internal training programs, the development of mid-level specialists, and the retraining of professionals from adjacent fields.

In the 2010s, industry growth was largely determined by the scaling of international projects and high external demand for engineering services, which stimulated team expansion. Under the new conditions, development increasingly depends on project complexity, specialist specialization, and team efficiency. The spread of AI tools further transforms this model by automating some typical tasks and increasing the importance of experience, architectural competencies, and the ability to work with complex technological systems.

# startup ecosystem

In 2025, the Ukrainian startup ecosystem comprised of approximately 2,700 active civilian and dual-use startups, forming one of the most dynamic segments of the country's technology economy.

The structure of the ecosystem demonstrates a distinct industry specialization. The most well-represented areas are DefenseTech, EdTech, MedTech, GreenTech, AgroTech, and GovTech, reflecting both the country's domestic needs and global technology trends. Dual-use technologies, capable of being applied simultaneously in civilian and defense spheres, play an important role.

The full-scale war has significantly changed the country's innovation landscape. Ukrainian startups are actively developing technologies for unmanned systems, robotics, intelligence analytics, and software for military command systems. Some of these solutions have high export potential and are gradually being integrated into global technology chains.

The defense technology segment is growing particularly rapidly, effectively forming a new type of innovation economy — defence-driven innovation. Investments in defense solutions have ceased to be niche and have transformed into one of the key segments of the venture market.

The most dynamic companies in this area in 2025 — Swarmer, Tencore, Dropla, Teletactica, M-Fly, and Norda Dynamics — are increasingly playing the role of private R&D centers for the defense sector, complementing the traditional system of military-industrial research and accelerating the innovation implementation cycle.

Among the most promising[27] Ukrainian startups are **Ability.ai, Beholder, Buntar Aerospace, Deus Robotics, Haiqu, HIMERA, LetsData, Mantis Analytics, Norda Dynamics**, and Osavul. The composition of this list demonstrates a shift in the technological profile of the ecosystem. A significant portion of new companies operate in the fields of **AI, defence-tech, robotics, aerospace, and data analytics**, which aligns with the global trend of deep-tech solution development while simultaneously reflecting the specifics of the Ukrainian market, where demand for dual-use technologies has grown substantially as a result of the war.

The largest classical venture rounds[28] in 2025 remained relatively modest by global standards and were concentrated in a limited number of companies. Among the largest such rounds in 2025, **Reface ($18M), Swarmer ($15M), Tonik ($12M), Limitless ($10M), Liki24 ($9M), PeopleForce ($5.4M), and Trypillian ($5M) stand out.**

Compared to global technology markets[29], these volumes remain relatively small, reflecting the structure of the Ukrainian startup ecosystem, where the majority of companies are at the early stages of development, while the number of mature scale-up companies remains limited.

The financial structure of the ecosystem is characterized by high polarization and dependence on institutional support. **The Ukrainian Startup Fund** (USF)[30] has become the key driver of early-stage development. Over 380 companies have been funded, over $8.7 million in direct investments has been provided, and supported projects have attracted more than $50 million in private capital. This demonstrates the multiplier effect of state support, where small grants stimulate significantly larger private investments, particularly at the pre-seed and seed stages, which are traditionally the riskiest for investors.

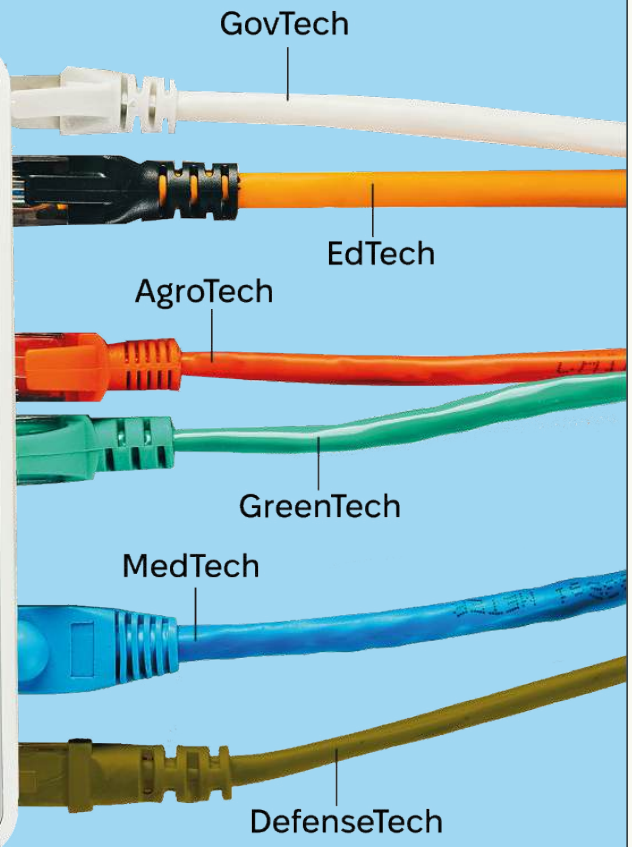
Throughout 2025, the Ukrainian Startup Fund received 229 applications from pre-seed and seed startups for funding under the USF grant program supported by UMAEF (Ukraine-Moldova American Enterprise Fund).

[27] Top 100 Rising Ukrainian Startups 2026
[28] By classical venture rounds" means investment by funds into startup equity at standard development stages (Seed, Series A, Series B, etc.), which involve the acquisition of a stake in the company and subsequent business scaling.
[29] In Q4 2025, the average deal size in the global market reached approximately $24.7 million, according to BVK data.
[30] Ukrainian Startup Fund

# startup ecosystem

**2700**
**active startups**
(civilian and dual-use)

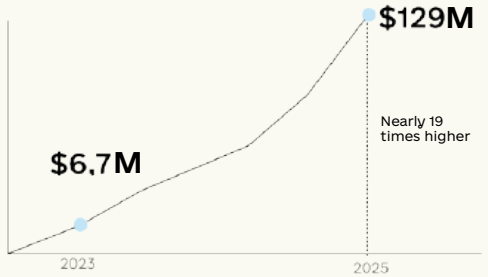
**Most represented sectors** →




Data: Ukrainian Startup Fund

## volume of investments in defense startups

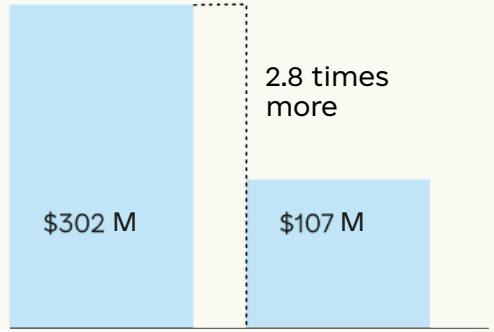
according to AVentures estimates ($, million)




this made defense technologies one of the largest segments of Ukraine's venture market

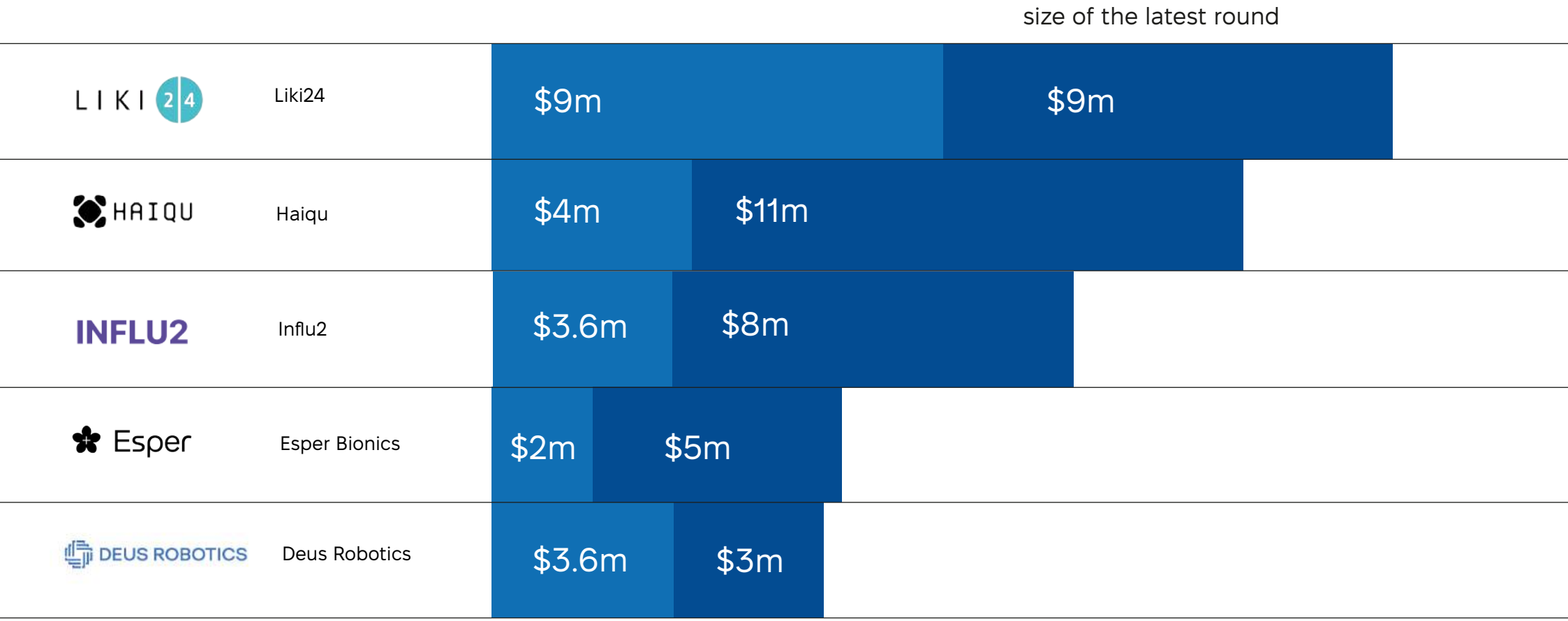
## investments in startups

2025 ($, million)




# top-5 best USF startups[31]

by total amount of funds raised




[31] The mentioned startups are recipients of support from the Fund in financial and non-financial forms and belong exclusively to the civilian sector.

# investments

A significant portion of IT companies in Ukraine are profitable service businesses that do not require external capital for operational activities. They are financed from contract revenues. The absence of a need for venture financing in such companies is a sign of a sustainable business model.

According to AVentures[32] estimates, the investment structure of the Ukrainian startup ecosystem demonstrates a significant concentration of capital at early stages of development. In 2025, startups attracted approximately **$498 million in investments and grant financing**, which is 8% more than in 2024. The largest share of financing was formed by late stages (Series D and Growth) — approximately $150 million, or 30% of the market. This indicates the preservation of investor interest in the Ukrainian technology sector even under conditions of elevated risk.

At the same time, early-stage investments play a significant role. Startups at the Seed and Series A stages attracted $191 million, which is the second highest figure in the entire history of the Ukrainian startup ecosystem.

The investment structure of the Ukrainian startup ecosystem in 2025 demonstrated a substantial reorientation toward defense and dual-use technologies. According to AVentures  estimates, the volume of investments in defense startups grew from **$6.7 million in 2023 to $129 million in 2025** — nearly 19 times over two years — making defense technologies one of the largest segments of the country's venture market[33].

The growing interest in defense technologies is explained by several factors. First, the Ukrainian front has effectively become a global testing ground for military innovations, attracting the attention of international investors, governments, and defense corporations. Second, a significant portion of defense developments has dual-use potential, meaning they can be applied in both military and civilian infrastructure.

As a result, some global funds are gradually reorienting their investment strategies toward defense tech, AI solutions, and other dual-use technologies. This leads to a relative decline in investment activity in certain traditional sectors — in particular consumer apps, marketplaces, and classical SaaS products.

Startups with an AI component attracted **$302 million in investments in 2025**[34], which is almost **2.8 times** more than companies without AI solutions.

[32, 33, 34] AVentures

Raising $3.74 million became an important market signal. This is the first public case in which international investors directly financed the Ukrainian legal entity of a defense startup. Diia.City's instruments made it possible to structure the deal according to rules familiar to international investors and demonstrated that defense tech companies can scale while remaining within the Ukrainian jurisdiction.

**Roman Tkachenko**
Co-founder and CBDO of TENCORE

The Diia.City space forms an infrastructure that makes investing in Ukrainian startups clear and familiar for international venture investors. Through the ability to use elements of English law — including convertible loans, options, liquidation preferences, liquidated damages, and warranties and indemnities — investors can structure deals according to rules they are familiar with and invest directly in Ukrainian legal entities. There are numerous public and non-public cases of such investments, including in defense tech startups. One of the most well-known examples is the company Tencore, which raised $3.74 million to scale its R&D and production.

Growth is expected in the number of investment deals in defense startups within the Ukrainian jurisdiction, structured through Diia.City. Additionally, there is potential for the first Series B rounds, the volumes of which may exceed $50 million.

Among the largest deals of 2025, **Superhuman[35] (approximately $1 billion), Carmoola ($405 million), and Fintech Farm (~$40 million), as well as deals involving Reface ($18 million) and Swarmer ($15 million)**, stand out.

This asymmetry between the scale of alternative financing and classical VC rounds indicates that the ecosystem is in a transitional phase. On one hand, a new layer of global-level technology companies is forming; while, on the other hand, the majority of startups remain dependent on early-stage capital and grant programs.

A separate role in shaping the defense ecosystem is played by the Brave1 cluster. This state platform supports military technologies that bring together startups, investors, military personnel, and manufacturers. Over its two years of existence, Brave1 has become the key institutional mechanism for the rapid testing and scaling of dual-use innovations, providing startups with access to financing, testing grounds, and state procurement. In practical terms, this model creates an innovation cycle unique to Europe, where technologies travel from prototype to combat application in the shortest possible timeframes. The initiative has already issued over **570 grants totaling more than $50 million[36]**.

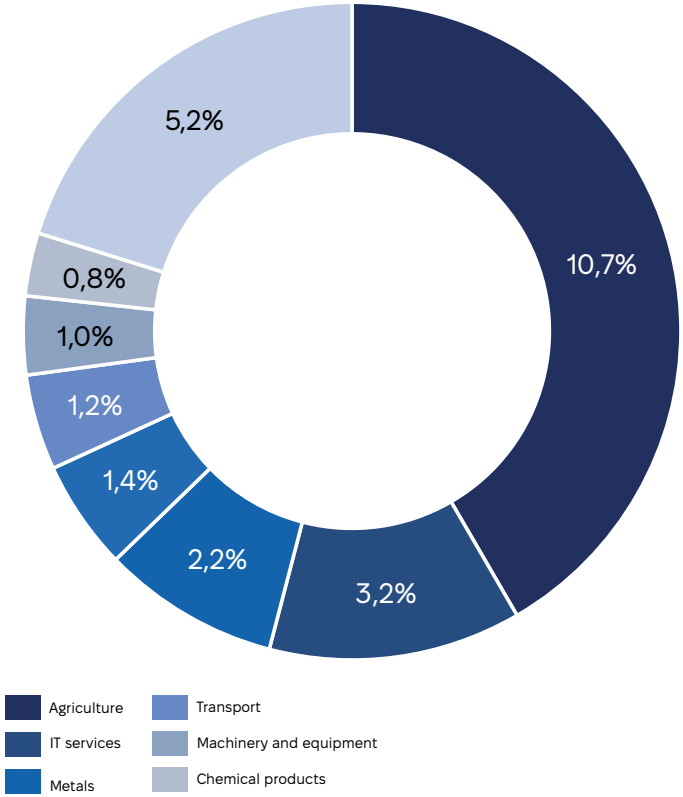
At the same time, the defense-tech ecosystem is forming not only around state instruments. Specialized venture funds and accelerators that invest in military technologies at early stages of development play an important role. Among them are MITS Capital, D3.vc, Defense Builder, Green Flag Ventures, Double Tap Investments, Angel One, and Radius Capital[37], as well as international investors working with Ukrainian teams through European and American hubs.At the same time, the defense-tech ecosystem is forming not only around state instruments.

[35] Superhuman is an AI email startup acquired by Grammarly in 2025 as part of the development of its AI platform.
[36] Ministry of Digital Transformation of Ukraine
[37] BRDO

# the systemic effect of it on the economy

# IT in Ukraine's economy

## Share of sector exports in GDP




In 2025, the IT sector accounts for 3.2% of GDP, which in absolute terms amounts to approximately $6.6 billion. The industry's nominal contribution has been growing steadily for the third consecutive year, while its relative share is gradually declining.

The reason is the faster growth of other sectors. The defense-industrial complex, construction, and energy received a powerful impulse from recovery programs and military contracts, which significantly changed the structure of the Ukrainian economy. This explains the paradox: the industry grows in absolute numbers but shrinks as a share of the overall pie. This dynamic reflects the broader structural transformation of the economy under wartime conditions.

The volume of the Ukrainian IT market in 2025 amounted to $7.85 billion. Compared to $6.66 billion in computer services exports, this figure indicates the growing role of domestic demand for IT products and services.

In 2025, Ukraine's nominal GDP amounted to $210 billion, which allows IT to be considered a structural component of economic resilience, not merely an export industry. However, far less is known about how exactly the IT industry impacts the rest of the economy.

If before 2022 IT was one of the main growth engines of the entire economy, then by the end of 2025 it remained its stabilizer and multiplier. It is a sector that does not decline where others do, continues to grow its absolute contribution, and generates economic activity well beyond the boundaries of its own industry.

Every IT company, beyond creating its own added value, generates demand across dozens of adjacent industries through procurement and employee salaries. This indirect and induced impact typically goes unnoticed in industry reports, although it is precisely this that defines the systemic significance of the sector for the national economy. Furthermore, the question of whether the level of digitalization in other sectors affects their ability to adapt to crisis shocks remains open — a question that gained particular relevance after February 24, 2022.

# indirect and induced effects

The impact of the IT sector on the economy is not limited to its own added value. Every IT company generates demand in adjacent industries through data center rental, cloud infrastructure procurement, and the engagement of legal, accounting, and recruiting support. Employees of IT companies return their incomes to the economy through consumer spending (retail, real estate, transport, education, healthcare). These two channels — inter-industry procurement and consumer spending — create a multiplier effect that can be precisely measured using input-output analysis.

Based on calculations using the State Statistics Service's input-output tables, every UAH of IT sector output generates on average 2.09 UAH of total economic output through the inter-industry procurement channel. In other words, 1.09 UAH of additional value is created outside the IT sector itself — in telecommunications, financial services, real estate operations, professional services, and other industries that supply IT companies with the necessary resources.

When the induced effect is added — that is, the impact of salaries that IT sector and adjacent industry employees spend on goods and services within the country, creating additional demand — the total multiplier rises to 3.75. This means that every UAH of IT output ultimately generates 3.75 UAH of economic activity — one of the highest figures among all 42 sectors of the Ukrainian economy. A significant portion of this effect is formed through consumer and fiscal channels. The incomes of IT industry workers and entrepreneurs return to the economy through spending on housing, services, transport, and retail, while tax revenues finance public expenditure.

According to the assessment model, one job in IT in 2025 supported approximately 2.29 additional jobs in adjacent sectors. Under the base scenario, this yields approximately 806,000 direct and indirect jobs, indicating a substantial indirect contribution from the IT industry to domestic employment and consumer demand.

It is important to note that the IT industry's multiplier effect is not stable — it changes depending on the macroeconomic context. Prior to the full-scale invasion, it was growing. The multiplier through inter-industry procurement rose from 1.84 in 2019 to 2.07 in 2021, reflecting the deepening integration of the IT industry with other sectors of the economy. From 2022 to 2025, the induced multiplier declined from 3.7 to 2.2, reflecting structural changes in household consumer behavior during the war — growing savings motives, mass migration, declining real incomes in immobile sectors — rather than a weakening of IT's role.

"Code Economy" quantitatively assesses the full macroeconomic impact of the IT sector through three analytical frameworks.

## 1 multiplier analysis

how much each UAH of IT output increases the total economic output through inter-industry chains and consumer spending.

## 2 sectoral resilience analysis

whether pre-war digitalization helped sectors better withstand the shock of the full-scale invasion.

## 3 counterfactual modeling

how much additional value the IT boom created for the economy, and how much the IT sector itself lost due to the war.

# the role of digitalization during the war

The full-scale invasion was a powerful shock to the Ukrainian economy. However, different sectors responded to it differently. The analysis revealed that sectors that made greater use of IT services proved more resilient despite the scale of destruction of production capacities, loss of logistics, and loss of personnel.

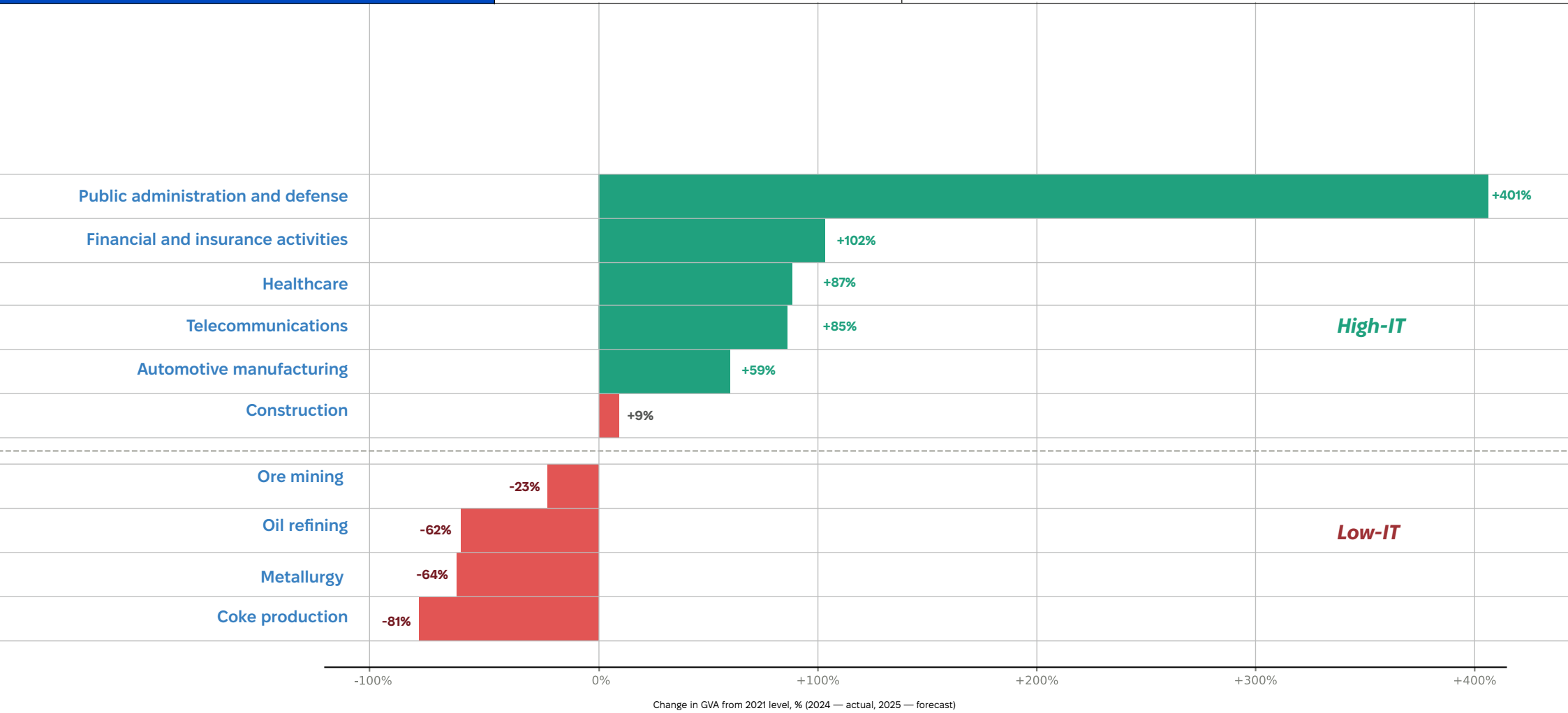
To test the hypothesis, 40 sectors of the economy (excluding IT itself) were divided into two groups based on the share of IT product expenditures in the sector's total intermediate consumption in 2019–2021. A threshold value of 1.66% was chosen — this is the median IT intensity among all 40 sectors, ensuring an equal division into two groups of 20 sectors each. High-IT sectors (above the median) include financial services, telecommunications, automotive manufacturing, public administration, and healthcare. Low-IT sectors include agriculture, metallurgy, extractive industry, construction, and oil refining. A broader period from 2015 was used for analyzing gross value added dynamics. This allowed verification of whether both groups truly developed similarly prior to the shock, and not only in the last three years before the full-scale war.

Over six years (2015–2021), both groups developed almost synchronously. Their average annual GVA growth rates were 18.3% for High-IT and 18% for Low-IT sectors.

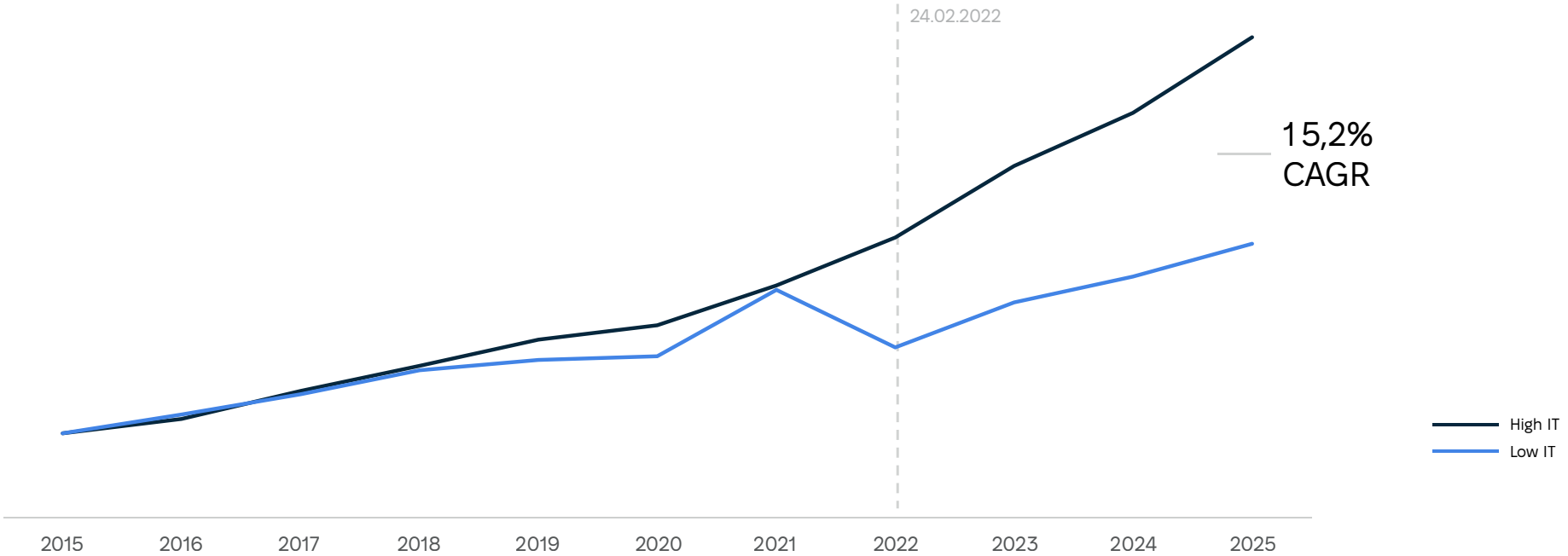
Following the full-scale invasion, High-IT sectors not only maintained growth, but they accelerated, showing a CAGR[38] of +19.9% for 2021–2025. Low-IT sectors lagged significantly with a CAGR of +4.7%. By 2025, the indices stood at 567 (High-IT) and 324 (Low-IT) — a gap of 244 index points that did not exist even a year before the invasion.

At the sectoral level, the best results for 2021–2025 were shown by High-IT sectors: public administration and defense (+401%), financial and insurance activities (+102%), healthcare (+87%), telecommunications (+85%), and automotive manufacturing (+59%). Among Low-IT sectors: coke production (–81%), metallurgy (–64%), oil refining (–62%), and ore mining (–23%). Construction partially recovered (+9%), but still lags significantly behind High-IT sectors.

[38] CAGR (Compound Annual Growth Rate) is the average annual growth rate that shows uniform annual increase over a specific period.




Change in GVA from 2021 level, % (2024 — actual, 2025 — forecast)




Statistical analysis confirms that this relationship is not coincidental. If two sectors were identical in all indicators before the full-scale war, but one of them spent 1 percentage point more on IT products, then after the invasion that sector retained 0.48% more of its added value. For a sector with a GVA of 100 billion UAH, this means 480 million UH of preserved added value solely due to a higher level of digitalization. At first glance this may seem modest, but the effect accumulates. Between the High-IT and Low-IT groups, the difference in IT intensity is 5 percentage points, which translates into a 2.4% difference in GVA — or 2.4 billion UAH for the same sector.

Admittedly, part of this effect is explained not only by digitalization. Low-IT sectors are predominantly industries tied to physical assets (mines, factories, fields), which are objectively more vulnerable to destruction. However, the fact that both groups developed at identical rates during 2015–2021 and diverged precisely after the shock indicates that digitalization is at least a significant factor of adaptability.

The results of the analysis raise a practical question: what would have happened if Low-IT sectors had been more digitalized before the full-scale war?

Over 2022–2025, sectors with low IT intensity cumulatively lost 1,237 billion UAH of added value compared to 2021. The largest losses were sustained by ore and other mineral extraction (–302 billion UAH), agriculture (–271 billion UAH), metallurgy (–221 billion UAH), and construction (–147 billion UAH).

Had these sectors integrated IT solutions at the level of High-IT sectors before the full-scale war (5.68% instead of 0.67% of intermediate consumption), the economy would have preserved an additional approximately 196 billion UAH (approximately $4.6 billion) — representing 15.9% of all wartime losses in these sectors.

The degree of compensation varies significantly depending on the nature of the losses. For sectors where losses were relatively small (pharmaceuticals, metal products manufacturing, woodworking), digitalization could have compensated for between 46% and 195% of the shock. For large sectors with extensive physical destruction (extractive industry, metallurgy), the compensation share is smaller (2–3%). When losses are driven primarily by physical destruction or inaccessibility of production assets, digital tools can mitigate the consequences but cannot replace the infrastructure itself.

At the same time, even partial compensation in absolute figures remains significant, e.g., for agriculture this amounts to +55 billion UAH (20.4% of losses), for transport +29 billion (40.5% of losses).

Even under more moderate scenarios — raising IT intensity only to the median level or by 1 percentage point — additional GVA amounts to 37–39 billion UAH (approximately $900 million), compensating for approximately 3% of cumulative losses. These figures should be viewed as indicative estimates. They do not account for the cost of digital transformation itself or possible non-linear effects. However, they provide a quantitative basis for prioritizing digitalization as an element of economic resilience strategy — with clear sectoral targeting.

# what it would have looked like without the full-scale invasion

Before the full-scale war, the Ukrainian IT sector demonstrated one of the fastest growth dynamics in the region. Computer services exports grew from $4.2 billion in 2019 to $6.9 billion in 2021, corresponding to an average annual rate of approximately 29%.

After 2022, the trajectory changed sharply. Despite the retention of contracts and the rapid adaptation of companies, the sector effectively entered a stagnation mode. In 2022, exports amounted to $7.3 billion (+5.8%), primarily due to contracts concluded before the invasion. In 2023, the volume declined to $6.7 billion (–8.5%), in 2024 to $6.4 billion (–4.2%). Only in 2025 did the first recovery signal appear — $6.66 billion (+3.3%).

To understand the scale of missed opportunities, one can ask a simple question: where would this curve be today if there had been no full-scale war?

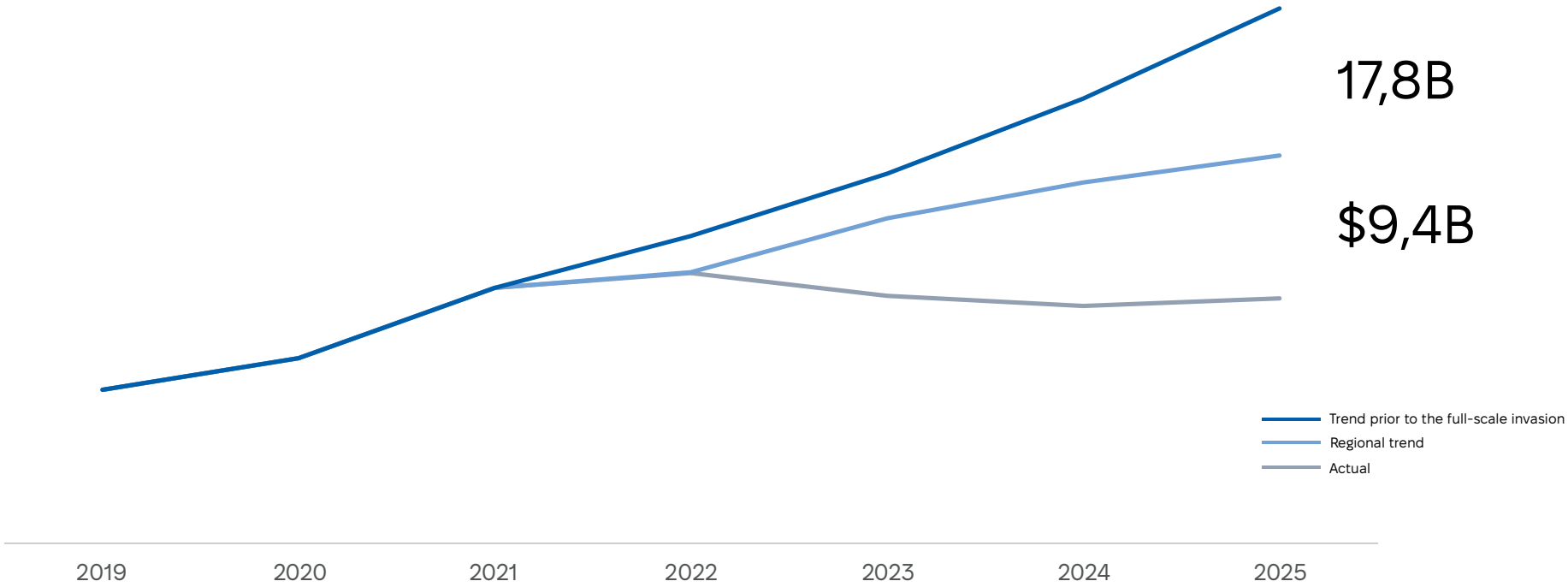
## The first scenario

is based on the dynamics of IT markets in Eastern European countries with a similar industry structure — Poland, Romania, the Czech Republic, Hungary, Bulgaria, Lithuania, Estonia, Latvia, Serbia, and Croatia. On average, their IT exports grew by 51.8% from the 2021 level to 2025. Applying this dynamic to Ukraine's baseline figure of $6.9 billion, Ukraine's IT exports in 2025 could have amounted to approximately $10.5 billion. Cumulative losses for 2022–2025 in this scenario are estimated at approximately $9.4 billion.

## The second scenario

continues the pre-war growth trend, but at a more conservative rate — 20% per year instead of 29% in 2019–2021. Under this scenario, IT exports in 2025 would have amounted to $14.5 billion, with cumulative losses of $17.8 billion. Thus, the range of cumulative IT export losses over four years of full-scale war would amount to between $9.4 and $17.8 billion.

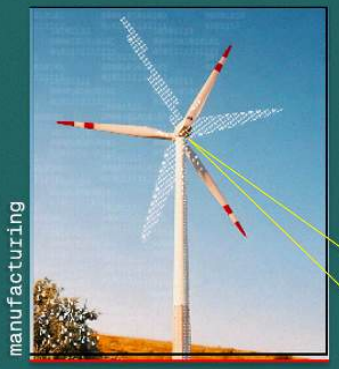
These figures become even more telling in the context of the multiplier effects described earlier. If every UAH of IT services generates 3.75 UAH of total economic activity, then $9.4–17.8 billion in direct IT export losses implies significantly greater losses for adjacent industries.




The chart of IT export dynamics makes this picture particularly vivid. The actual line after 2021 is nearly horizontal within the $6–7 billion range, while both alternative trajectories continue to grow. In 2025, actual exports amounted to only approximately 63% of the level that could have been expected based on the dynamics of peer countries.

At the same time, the very fact that IT exports have held at the $6.4–7.3 billion level each year during the full-scale war is an indicator of the sector's high resilience. In 2025, the industry again demonstrated growth of 3.3%, and December – with a figure of $685 million – became one of the strongest months in the entire history of the industry, creating a cautious signal of the beginning of a recovery phase.

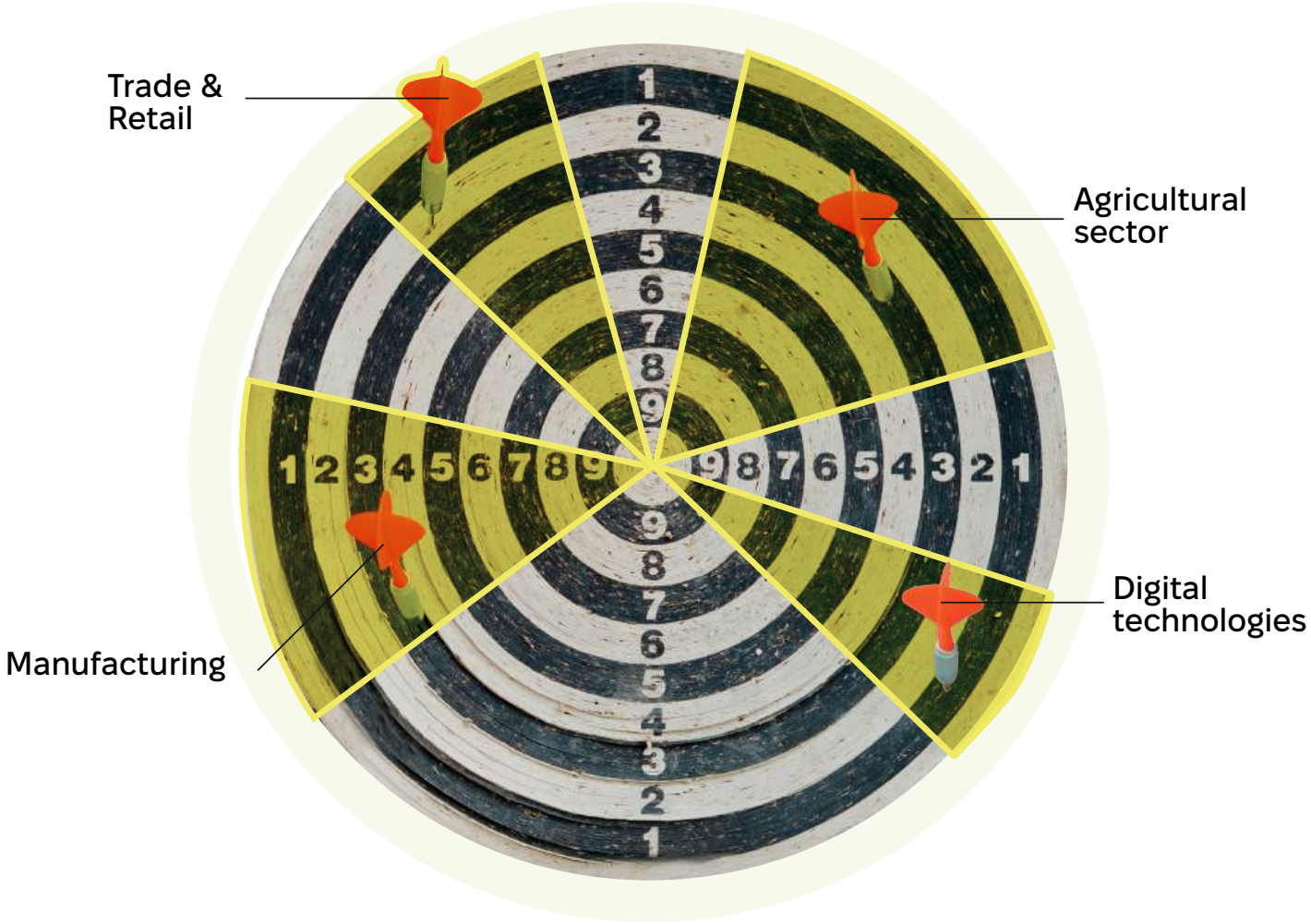
# sectoral analysis



# sectoral analysis

**IT impacts 40 industries.**
For the analysis, agriculture, manufacturing, trade, and retail were selected, as these sectors cover the full value chain — from production and processing to sales and end-user interaction. It is precisely in these areas that digitalization delivers a systemic effect for the entire economy.



# sectoral analysis

The agricultural sector, trade and retail, and industry belong to the sectors of defining importance for the functioning of the Ukrainian economy. Together they encompass the full value creation chain — from production and processing to sales and final consumer interaction — which is why digitalization has a systemic effect on these industries. It influences key macroeconomic parameters: productivity, export capacity, capital turnover speed, employment resilience, and the economy's ability to adapt to crises.

During the wartime period, the significance of these sectors only intensifies, as they are the most sensitive to personnel shortages, unstable logistics, growing operational risks, and the need for rapid management decisions. Under such conditions, digital tools cease to be a means of targeted optimization and become a prerequisite for manageability, scalability, and economic resilience. This is precisely why focusing on these sectors allows digital transformation to be viewed not as a collection of individual technological solutions, but as a process that changes the very architecture of the economy — from production cycles and supply chains to consumer behavior, the labor market, and investment attractiveness.

# agriculture

# the agricultural sector accounts

**59%**
of goods exports

**10-12%**
of Ukraine's GDP

**+10%**
At such a scale, a productivity increase of even 10% delivers a tangible macroeconomic effect — a GDP growth of approximately 0.9% (approximately $2 billion).

The agricultural sector accounts for **10–12% of Ukraine's GDP**[39] and provides **41.5% of the country's total exports** and **59% of goods exports**[40]. This is additionally confirmed by investment dynamics: Ukraine's agricultural sector traditionally ranks among the three most investment-attractive industries in the economy and remains one of the key drivers of the M&A market[41]. By the end of 2025, 18 M&A[42] deals totaling approximately **$167 million**[43] were recorded in the agricultural sector, indicating further consolidation and the sector's approach to new levels of managerial complexity in view of agribusiness scaling.

Even a partial increase in efficiency in agricultural production has macroeconomic significance. It affects foreign currency revenues, the resilience of regional employment, the tax base, and the economy's ability to maintain production under wartime conditions. At such a scale, a productivity increase of even 10% yields a measurable macroeconomic effect in the form of GDP growth of approximately 0.9% ($2 billion)[44].

Digital solutions in agriculture — from basic accounting systems and GPS navigation to precision farming, satellite monitoring, telematics, analytics, and Farm Management Systems — are becoming a prerequisite for the manageability of the production cycle.

**Today, the key challenge of digital transformation in the agricultural sector is not so much access to technologies as their fragmented use and the absence of an integrated management system.**

The level of actual digital maturity remains uneven. Large agricultural holdings already integrate ERP[45], telematics, precision farming systems, and analytical platforms into unified management frameworks. Medium and small businesses more often use only individual digital tools without fully connecting them to one another. This asymmetry is precisely what makes the topic of agricultural digitalization strategically important.

[39] Ministry of Economy of Ukraine
[40] National Bank of Ukraine
[41] Mergers and acquisitions
[42] БExcluding the agricultural processing sector
[43] InVenture

[44] The volume of agricultural revenue is estimated as 6%, amounting to 816 billion UAH, of the total revenue of 13.6 trillion UAH from the largest 16,000 companies (according to AgroReview data, 2025). A hypothetical 10% productivity growth is interpreted as a proportional revenue increase of 81.6 billion UAH. To assess the macroeconomic effect, the resulting growth is correlated with Ukraine's nominal GDP (8.93 trillion UAH; State Statistics Service), yielding approximately 0.91% of potential GDP growth.
[45] Enterprise Resource Planning – enterprise resource planning system

## trends and indicators of agricultural sector digitalization

**~25-35%**[46]

the level of digital maturity in the agricultural sector is approximately

**~up to 15%**

the integration of digital solutions can provide productivity growth

**According to companies surveyed during the preparation of the study, planning mistakes are the most costly for the sector:** untimely procurement, mismatched fertilizer volumes, and imbalance between financing and field needs.
At the scale of large land banks, even a minor mistake can escalate into multimillion losses.

**+10-15%**

digitalization of the planning stage increases crop yields. reduces the risk of strategic miscalculations.

[46] GTInvest

Integration — meaning a unified platform that brings together various solutions such as GPS navigation, planning systems, analytics, and others within a single company or industry — is poorly developed in the agricultural sector. Fragmented solutions are not integrated with one another and rarely transform into systemic management decisions.

Even in developed economies, including the USA, the level of fully integrated digitalization in the agricultural sector does not exceed 70%[47]. Ukraine can achieve such indicators; however, this requires time. The USA needed approximately two decades for the mass adoption of agricultural technologies. Ukraine needs a medium-term transformation that will require several years of consistent integration of digital solutions into production processes.

**The integration of digital solutions can provide up to 15% productivity growth[48], reduce structural risks, and increase the share of added value that remains in the country. Fragmented digitalization preserves information asymmetry: agronomic, operational, and financial data exist in different systems. As a result, management decisions lag behind the production cycle. Resources are purchased at peak demand, crop protection product[49] and fertilizer costs are standardized imprecisely, and deviations are recorded only after they have become losses. Such effects are cumulative in nature and create volatility in financial results regardless of market conditions.**

### International research proves that the systemic barriers to an integrated digital model are:

- high cost of solutions
- limited practical applicability for certain types of farms
- deficit of digital skills
- poor compatibility between platforms
- operator qualification requirements
- distrust of algorithmic solutions

As a result, even those digital tools that are already in use often do not add up to a unified management system[50].

The integration of digital solutions into a unified management framework eliminates this asymmetry by synchronizing data across the functional levels of a farm. Decisions regarding sowing, resource provision, and logistics, formed on the basis of a single array of current data, allow deviations to be identified at the stage of their emergence rather than their recording. This reduces the cost of management error: the number of forced decisions under time pressure decreases, the gap between planned and actual production indicators narrows, and the predictability of operational results improves.

According to estimates from companies surveyed in the preparation of this study, planning errors are the most costly for the sector: untimely procurement, misaligned fertilizer volumes, and imbalances between financing and field requirements. At the scale of large land banks, even a minor error scales into million-dollar losses. Therefore, digitalization of the planning stage does not merely increase yields by approximately 10–15%, but reduces the likelihood of strategic miscalculation[51].

Large agricultural holdings (e.g., MHP, Astarta, Kernel, etc.) have the highest level of digitalization. They use comprehensive IT systems to manage all processes: for example, implementing a global system based on SAP, as well as developing their own AI products (Smart TA) that optimize poultry and grain cultivation.

[47] Worldmetrics
[48, 49] OECD
[50] Crop protection products
[51] ScienceDirect

Due to the war, rural households in Ukraine suffered approximately $2.25 billion in losses; 25% of agricultural households stopped or reduced production volumes due to military actions, while in frontline regions this figure reached 38%[54].

These farms are typically oriented toward domestic sales and therefore **make virtually no investments in IT technologies.**

As a result of this situation, the digital infrastructure of such agricultural companies is nearly absent, and no comprehensive platform operates at the level of all small farmers.

Large-scale farms implement telematics systems, autonomous vehicle driving, analytical solutions, and more. For example, the majority of large farms employ autopilot systems (GPS navigation) in the fields and telemetric monitoring systems (telematics) for machinery. Medium-sized agricultural enterprises also use digital tools, but on a smaller scale. They may implement individual solutions — such as farm management systems (FMS/ERP), GPS navigation, or biometric stations — but these systems typically operate autonomously, without a unified management center. Among all innovation-oriented agricultural companies, such farms have a significant level of precision technology adoption: approximately 80% of those surveyed use autopilots, while approximately 70% use telematics.

At the same time, more complex technologies — such as the use of artificial intelligence for yield forecasting — have not yet become widespread: only approximately 22% of innovative companies use AI models for these purposes. Furthermore, research confirms that only large agricultural enterprises in Ukraine tend toward the separate development of their own technological solutions (such as FMS[52]), striving for full automation of their own business processes. A study by Aggeek, which surveyed representatives of 54 Ukrainian agricultural companies with varying land banks, showed that small enterprises (up to 999 hectares) demonstrate the lowest levels of digital tool usage across the majority of the processes studied.

In particular, in the area of plant development monitoring, they lag significantly behind medium-sized farms (1–9 thousand hectares): satellite analysis usage stands at 50% versus 92%. A similar trend is observed in automated solutions: inspection planning systems (FMS) are practically unused by small farmers (8% versus 15% among larger farms). In the area of crop sales, small farms remain predominantly in the traditional model: the usage rate of electronic exchanges equals zero, while among medium-sized farms it reaches 15%, and electronic contracts are used 2.5 times less frequently (50% versus 67%). Similarly, ERP system usage stands at 17% versus 21% among other companies within the 1–500 thousand hectare range[53].

[52] Farming Management System
[53] Aggeek
[54] FAO

# the value creation chain

Supply chain management remains a systemic area of development across all market segments regardless of farm size. This is confirmed by market participant assessments: representatives of AgroTech companies characterize the sales and product realization stage as the most complex and simultaneously the least digitized segment. Verification of product origin, compliance with organic certification requirements, and fulfillment of contractual obligations to buyers — particularly international ones — are the most sensitive to operational disruptions and the human factor.

IT systems for technical condition management, telematics, and predictive analytics improve the quality of land, machinery, and personnel utilization. Satellite monitoring and IoT sensors enable real-time tracking of crop conditions and rapid adjustment of decisions.

GIS systems[55] integrated with agronomic platforms and weather models enable decisions regarding crop structure to be formed on the basis of spatial analysis of soil quality, microclimatic zones, and yield forecasts, rather than on the empirical experience of an agronomist. This shifts planning from reactive to proactive logic. Farm Management Systems provide approximately 15% yield growth through the optimization of sowing schedules, fertilizer application rates, and the alignment of field operations with the agroclimatic calendar.

At the resource management level, ERP systems and digital procurement platforms synchronize field requirements with available inventory and financial limits in real time. This eliminates one of **the most costly structural failures in the sector — the imbalance between the volume of purchased resources and the actual needs of the production cycle.**

A separate dimension is access to financing. Digital accounting and transparent reporting increase the credit attractiveness of a farm, which expands access to advance financing by approximately 25%. Financial systems such as SAP (Systems, Applications and Products), as well as specialized financial platforms, link agronomic decisions with the farm's financial capabilities within a unified management framework.

**Farm Management Systems increase yields by approximately 15%** through the optimization of sowing schedules, fertilizer application rates, and work planning. Smart irrigation and IoT systems provide **approximately 40% resource savings** (primarily water and crop protection products) while simultaneously increasing yields.

The implementation of machinery management systems and robotization allows the need for manual labor to be reduced by up to **approximately 97%**[56], minimizing downtime and the human factor. The use of digital crop monitoring provides up to **approximately 40%** savings on pesticides through the early detection of pests and diseases.

At the same time, precision farming technologies contribute to a reduction in labor costs of **approximately 30%** through automation and the application of robotic solutions.

Navigation systems, autopilots, and PA[57] systems ensure that field operations are carried out in accordance with specified agronomic parameters, minimizing deviations from the processing technology.

The final link in the agricultural sector's value creation chain manifests at the sales stage. The production efficiency achieved at previous stages is converted into a financial result only when the product reaches the buyer with preserved quality, verified origin, and fulfilled contractual deadlines. In this context, technological solutions, such as PHMS systems (Post-Harvest Management), ensure storage control and reduce product losses by approximately 15% through sensor monitoring of humidity and temperature. TMS solutions and GPS routing increase logistics transparency and reduce operational disruptions, providing approximately 4% more added value to products through logistics optimization and the avoidance of quality loss during transportation. The greatest strategic effect today might be provided by the Digital Product Passport (DPP) and blockchain verification of product origin. This is the key to premium EU markets, increasing the accessibility of integration into foreign markets by approximately 10–20%.

[55] Geographic Information Systems – geolocation systems
[56] ScienceDirect
[57] Precision Agriculture is precision farming

Collectively, these processes create **a spillover effect for adjacent sectors of the economy in the range of 5–15%**[58]**.** Growth in the agricultural sector generates additional demand for IT services, financial products, and logistics and processing infrastructure, increasing their utilization and technological level.

Since agriculture is one of the foundational sectors of the Ukrainian economy with a significant share in GDP, exports, and employment, changes in its productivity have a broader macroeconomic dimension of implementation. The technological transformation of production processes gradually affects the financial stability of companies, the employment structure, and the quality of the sector's integration into domestic and external markets. Digital solutions are ceasing to be a tool of local optimization and are transforming into a basic prerequisite for the manageability of the production cycle, cost control, and adaptation to shocks. In international assessments, this is confirmed by the fact that the speed of agricultural sector digitalization depends primarily on the integration of technologies into daily management, access to capital, digital skills, and the practical applicability of solutions for a specific farm[59].

Ukrainian examples confirm that the impact of digitalization in agriculture is measurable in practice. The implementation of AgriLab's digital solutions made it possible to reduce agrochemical support costs per hectare by 14%, as well as to provide approximately 15% yield growth following agro-diagnostics.

At the same time, in the "Agrocultura Mostyska" project in Lviv Oblast, field zoning enabled a reduction in fertilizer costs by 14 euros per hectare and an increase in yields on suitable plots by 3%[60]. Digitalization is changing the architecture of market behavior in the agricultural sector. When a producer gains tools for quality control, origin verification, and predictable logistics, they transition from the position of a raw material supplier at spot price to the position of a contract partner with fixed specifications and predictable delivery volumes.

The agricultural sector employs 2.3–2.5 million people in Ukraine, accounting for approximately 15% of total employment. However, against the backdrop of a 22% decline in the rural population between 2001 and 2021, and the acceleration of this trend due to the war, access to labor resources is becoming a structural constraint on production. In this context, digitalization is transforming the human capital development model of the industry. It creates demand for new technically competent professions — such as agricultural drone operators, digital platform administrators, and analytical agronomists — which are characterized by higher wages and greater attractiveness for young people. Agriculture is transforming into a sector with higher added value, which stimulates the retention of skilled personnel in the regions, slows the outflow of population from small towns, and strengthens the economic resilience of rural territories.

[58] Frontiers
[59] OECD
[60] Ukrainian Black Sea Region Agrarian Science
[61] APD

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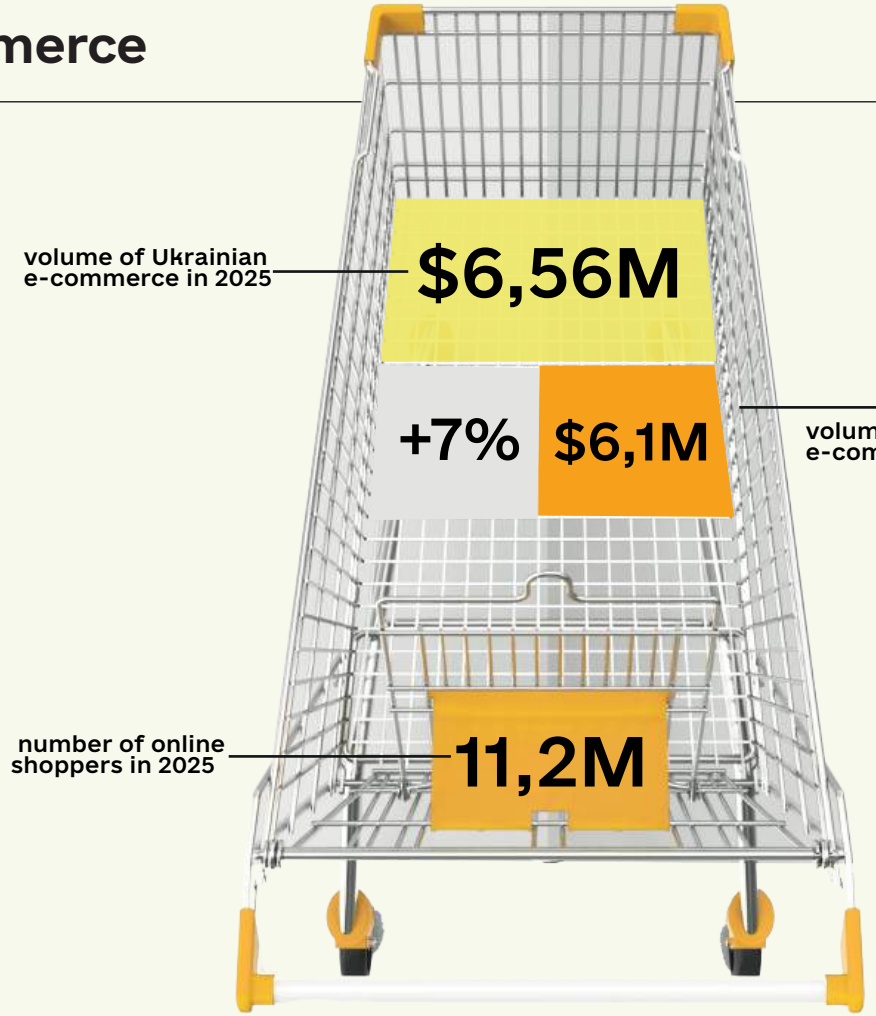
# trade & retail

# trade & retail

## digitalization is ceasing to be an optimization tool in retail and is becoming the basic Infrastructure of the market.

## e-commerce



A new stable pattern of consumer behavior has formed in Ukraine. In 2025, it increasingly functioned as one of the basic digital infrastructures of the economy, where consumer behavior, payment services, logistics, telecommunications, and data analytics converged. By the end of 2025, the volume of Ukrainian e-commerce had reached $6.56 billion (256 billion UAH), which is 7% more than in 2024, while the number of online shoppers grew to 11.2 million people[62]. This means that the digital channel is already functioning not as an auxiliary tool, but as a full-fledged environment for demand formation, customer retention, and the redistribution of turnover among market participants.

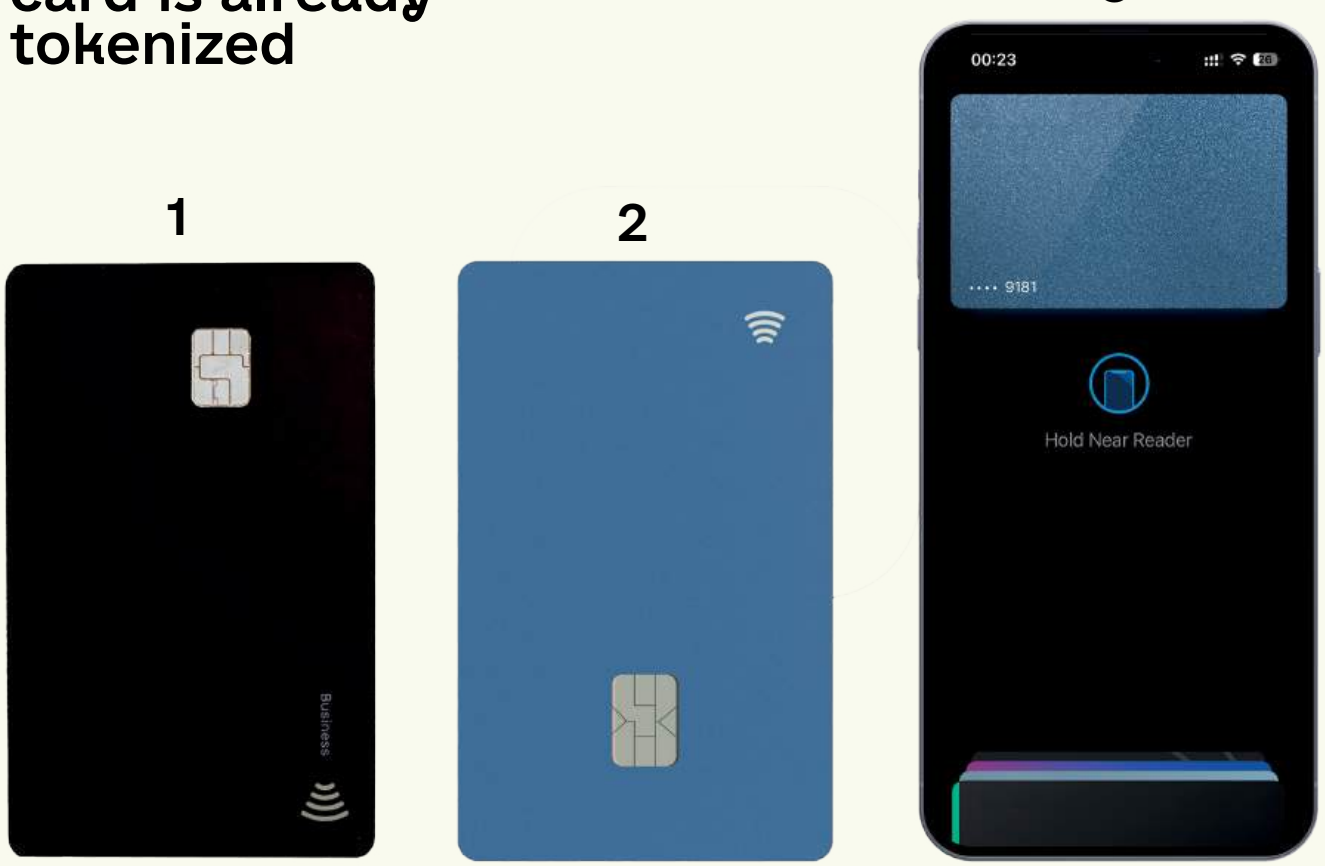
This transformation is further reinforced by the role of FinTech. During 2025, the number of tokenized payment cards in Ukraine grew by a quarter (25.9%) — to 20.7 million. Every third active card is already tokenized. At the same time, by the end of 2025, Ukrainians conducted 9.5 billion payment card transactions totaling 7.16 trillion UAH, with the share of cashless transactions standing at 95.5% by number and 65.4% by value[63]. This indicates that digital payments in Ukraine have already become a widespread norm, and the convenience of payment has become part of the competitive model of retail itself.

Marketplaces, proprietary online stores, mobile applications, CRM systems, loyalty programs, and payment solutions are merging into a unified service architecture, where the physical point of sale is merely one of the channels. This is precisely why retail digitalization today affects not only the convenience of purchasing, but also the speed of capital turnover, the accuracy of inventory management, the efficiency of logistics, and the level of transaction transparency. In this sense, retail is becoming not merely a consumer of technologies, but an environment in which mass models of digital interaction are tested for the entire economy.

A quarter of all orders from leading retailers today are placed through mobile applications[64]. Mobile applications do perform a sales function, but they also serve as a platform for loyalty programs, personalized offers, and behavioral data collection, as well as a separate information channel. A competitive advantage in customer interaction is realized only when the retailer's internal operational processes are capable of supporting it — and this is precisely where digitalization of the value chain plays a defining role.

[62] Forbes
[63] National Bank of Ukraine
[64] Promodo

# every third active card is already tokenized




based on 2025 results:

**the number of tokenized payment cards**
in Ukraine grew
**+25,9%**
and amounts to
**20,7M**

Ukrainians conducted
**9,5 billion**
**payment card transactions**

totaling
**7,16 trillion UAH**

**share of cashless transactions**

**95,5%**
by number

**65,4%**
by value

# the measurable effect of digitalization in retail

Digitalization in retail encompasses three interconnected blocks: procurement, management of own assets, and sales. Unlike the agricultural sector, where the digital effect manifests primarily through increased productivity of the production cycle, in retail it is realized through the acceleration of capital turnover, reduction of operational losses, and transformation of the customer interaction model. Although the effects of each individual solution mentioned below measure, on average, in the range of 15–30%, their systemic result emerges precisely from their integration into a unified management framework.

## procurement: managing the risk of deficit

Procurement is the first point where the absence of digital integration generates hidden costs: supplier duplication, inflated contract prices, approval delays, reactive responses to shortages instead of anticipating them, and inventory surpluses instead of forecasting them in advance. IT centralizes all supplier data — orders, invoices, contracts, schedules, interaction history — in a single system, which fundamentally changes the nature of procurement decisions from reactive to proactive.

Automated cost analysis through platforms such as SAP Ariba, Coupa, JAGGAER, or Tacto — which integrate procurement spend analytics, supplier management, and contract management in a unified digital framework — identifies supplier duplication and inflated prices. This provides savings of approximately 15%[65] on total procurement costs.

The digitalization of procurement increases the manageability and speed of supply, as it transfers supplier selection, contract approval, and document flow into a unified analytical framework. Supplier management platforms allow partners to be ranked by price, quality, and reliability, enabling the early identification of delay or shortage risks and the ability to respond to them before a contract is signed. At the same time, electronic tenders, digital contracts, and automated document flow reduce transaction approval time by approximately 85%[66], decreasing administrative burden and accelerating deal closure. As a result, the procurement function transitions from established practices and manual decisions to a model in which contract structure and selection move to analytics-driven decisions.

# own assets as managed capital

Warehouses, inventory, and retail outlets are the most capital-intensive assets of a retailer. Their inefficient use directly affects capital turnover: excess inventory freezes funds, shortages generate lost sales, and accounting errors create a gap between the actual and documented state of assets. Digital solutions such as WMS[67], ERP, and related systems increase the productivity of warehouse and logistics operations, reduce the number of sorting errors and shortages, and improve inventory turnover. In particular, WMS can increase warehouse operation productivity by 15%, while practical cases demonstrate that warehouse voice automation can reduce picking errors by 35% and increase picking speed by 25%[68].

ERP systems, in turn, provide more precise inventory control and can improve inventory turnover by approximately 15%, directly reducing the volume of frozen working capital. At the level of large retail networks, the integration of ERP, WMS, and TMS together with automation in logistics centers reduces loading and unloading time, increases vehicle turnover, and reduces the burden on personnel. At the point-of-sale level, POS[69] and back-office systems ensure more accurate stock-taking, write-offs, and internal transfers; the automation of such operations can reduce product losses from theft, write-offs, and accounting errors by 20%. The system directs personnel, automates document flow, and replaces subjective reports with precise analytics for management decision-making.

## sales: from transaction to customer relationship

At the sales stage, digitalization provides revenue growth through a deeper understanding of buyer behavior and the expansion of customer interaction channels.

Modern POS solutions accelerate service, reduce receipt errors, support various payment instruments, and synchronize with online channels, reducing front-office personnel costs by up to 20%. CRM systems[70] accumulate purchase history, segment customers, and form personalized offers, reducing time spent on routine operations by up to 30% while increasing audience retention rates.

Omnichannel platforms integrate the online store, marketplaces, and offline network into a unified management framework, equalizing product availability across channels and improving sales manageability, thereby providing a 25% increase in online revenue. As a result, the retailer also gains a more precise understanding of demand, faster response to changes in buyer behavior, and higher predictability of merchandise turnover. It is precisely at the sales stage that digitalization ultimately transitions retail from a sales accounting model to a model for managing the complete customer lifecycle.

[65] Tacto
[66] Innora
[67] Warehouse Management System
[68] RAU
[69] Point of Sale
[70] Customer Relationship Management

# spillover effect: retail as an infrastructural catalyst for adjacent sectors

The digitalization of retail has a pronounced spillover effect. Approximately 11 million online shoppers[71] generate arrays of transactional data that are used to develoop fintech solutions — acquiring, credit scoring, insurance products, and personalized financial services. The high frequency of transactions, large volume of recurring operations, and rapid feedback make retail an environment in which financial solutions undergo practical testing faster than in most other sectors.

The growth of online cash register operations, cloud POS systems, and traffic analytics creates stable demand for telecommunications infrastructure — 3G/4G/5G channels, data centers, edge solutions, and 24/7 redundancy. The high demands of retail on service continuity stimulate the development of resilient telecommunications networks that are beneficial for the entire economy.

The growth of e-commerce activates investment in courier platforms, sorting centers, and 3PL operators. This infrastructure serves not only trade, but also pharmaceuticals, financial services, healthcare, and public services. At the same time, the processing of millions of online transactions intensifies the need for fraud prevention systems, payment gateway protection, SOC centers, and cyber threat monitoring.

## digital retail forms an infrastructural framework for the financial, logistical, and cybersecurity resilience of the country.

In the macroeconomic dimension, the digitalization of trade reduces the share of shadow operations through transaction automation and transparency, expands the tax base, and increases labor productivity. It accelerates capital turnover, reduces losses, and stimulates the development of adjacent sectors. This is confirmed by the dynamics of fiscalized payments: in 2025, declared revenues through POS/software POS systems[72] grew to 5.6 trillion UAH (approximately $142.3 billion), which is more than 1.2 trillion UAH ($30.5 billion), or 27.6%, more than in 2024. At the same time, the number of payment documents increased from 9.5 billion to 10.4 billion — that is, by 921.07 million receipts, or 10%[73].

The dynamics of Ukrainian retail in 2024–2025 become apparent in comparison with previous periods. If in the first half of 2023 the e-commerce market was still feeling the consequences of the full-scale invasion (dollar revenue was 43% below 2021 figures and 13% below 2022[74]), then 2024 became a year of confident recovery. The volume of online purchases grew by 25%, indicating the industry's transition to a stage of stable recovery.

Today the industry integrates financial, logistical, and information flows, acquiring a system-forming role in the digital economy. In the first half of 2025, the growth of online sales was increasingly less explained by marketing pressure and increasingly more by a structural shift of demand into the digital channel: business advertising budgets grew on average by only 6% in dollar terms, while traffic increased by 11%, and in certain categories the number of purchases grew significantly faster[75].

In the second half of 2025, the structural transformation of the market became firmly established. Development took place under conditions of extreme uncertainty: an energy crisis, personnel shortages, and declining purchasing power. Against this backdrop, the business activity index dropped from 43.7 to 36.8 points. A telling change in consumer behavior emerged: the December transaction peak in 2025 amounted to only **12%** (compared to **35%** in 2024)[76]. This indicates the exhaustion of the short-term surge effect and a transition to a mature, uniform model of digital consumption.

Wartime challenges became defining for this stage. According to RAU data, in 2025 retail actively invested in autonomous energy supply, service resilience, and energy-efficient solutions. Digitalization began to be associated not only with commercial efficiency, but also with operational continuity. This transition was accelerated by three factors: the growth of a critical mass of mobile-first consumers, the convergence of fintech with telecommunications infrastructure, and institutional shocks that forced businesses toward radical technological modernization.

[71] Forbes
[72] Cash register; Software cash register
[73] State Tax Service of Ukraine
[74, 75] Promodo
[76] RAU

UKRSIBBANK
BNP PARIBAS GROUP

# UKRSIBBANK BNP Paribas Group

## is one of the largest banks in Ukraine.

**60% of shares belong to the international BNP Paribas Group — a leader in sustainable finance in Europe — and 40% of shares belong to the EBRD. For over 35 years, UKRSIBBANK has been a stable partner offering modern and reliable banking backed by a leading European group, caring for clients and employees, contributing to the strengthening of the Ukrainian economy, and positively influencing the development of society.**

## Ratings: 2025

- **#1 in the "Bank Viability Rating, 2025"** by Mind.ua
- **TOP-3** in the reliability rating of Ukrainian retail banks, 2025 by Focus media

## areas of specialization:

Digital banking UKRSIB online 2.0 and UKRSIB business

SME lending

Acquiring, POS terminals, and payment solutions

Open Banking and API

Export financing

Embedded finance

Customer Service Quality Center

**UKRSIBBANK is one of the key financial partners of the IT industry.**

**~2млн** million active clients in 2025.

**30%** of the IT market is served by UKRSIBBANK

**35+** years in the Ukrainian market.

**2k+** IT companies

**100k+** IT professionals

use financial services.

контакти

**UKRSIBBANK BNP Paribas Group**
www.ukrsibbank.com
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Kyiv

# impact case:

## UKRSIB online 2.0

a modern mobile banking application for individuals, created for convenient daily financial management.

## challenge

**What problem did the client or sector face?**

Customer engagement online, the need to update the user experience, low productivity of the system in response to modern trends. Increased satisfaction with using the application.

**What effect was expected from the changes?**

The bank optimized online onboarding according to modern trends and customer needs.

**What barrier had to be overcome?**

Customers expected a modern and user-friendly application that would allow them to manage updates efficiently. The bank lost customers in online onboarding due to the previous application's low productivity and outdated design and optimized onboarding. After the release of the new application, customers began actively using it successfully.

## solution:

**What exactly was implemented?**

**A new UKRSIB online 2.0 application.**

**How does it work?**

**Faster and more efficient.** The UKRSIB online 2.0 application includes all major banking services: from issuing credit and debit cards, accounts, loans, deposits, currency exchange operations, etc. Thanks to analytics and the use of the latest technology, push notifications, and AI support, the app enables instant payments within other banks. UKRSIBBANK became one of the first banks in Ukraine to implement such technologies. The bank's team created a stylish dark design for the UKRSIB application with an intuitive interface. Opening a new account, card, or deposit became faster and more efficient.

**In 2025, online was opened:**

**94%** deposits

**90%** card accounts for existing clients

**58%** card accounts for new clients

# impact case:

## UKRSIB online 2.0 online banking

Digital solution of the bank and its economic impact

### Was automation, AI, or integration used?

The new mobile application UKRSIB online 2.0 fully automates customer operations, quickly adapts to modern UI/UX requirements and includes notifications. The solution works thanks to integrations with Diia, Mastercard, Google Firebase, Portmone, Java Dreams, ensuring high speed and reliability.



### result

measurement period: 2024–2025

**+20%**
increase in customer productivity

**+10%**
increase in client turnover in 2025 compared to 2024

**100%**
migration of users from the old application to the new one in 2025

**+5%**
increase in transactions through the digital channel in 2025 compared to 2024

**10 M UAH**
reduction in operational costs in 2025 compared to 2024

# manufacturing

# manufacturing –
## a critically important sector of the Ukrainian economy

**~19%**
of Ukraine's GDP

**95 billion**
volume of realized industrial output in 2025

# overview of IT impact

Industry currently remains a critically important part of the Ukrainian economy and accounts for approximately 19% of GDP. After a decline of 36.7% in 2022, industrial production volumes began to recover. Growth amounted to 6.8% in 2023 and 3.6% in 2024; however, in 2025, industry experienced a decline of -1.7%[77]. In 2025, the volume of realized industrial output amounted to $95 billion[78].

The processing industry remains the key source of budget revenues[79]. In 2025, enterprises in this sector paid $8.3 billion to the Consolidated Budget, accounting for 18% of all tax revenues in the country. The main portion of these payments was made by industries with high added value — those producing machinery and equipment, vehicles, aerospace technology, and food products. The economic significance of these industries extends beyond production itself: they generate demand for logistics, energy supply, engineering maintenance, and other adjacent sector services, creating a multiplier effect for the economy.

Alongside agricultural products, industrial goods remain a key element of Ukrainian exports. In 2025[80], the main volume of foreign deliveries was formed by metals and metal products, as well as machinery and transport vehicles. Together with the food sector, these categories constitute the foundation of the country's export basket.

Digital transformation has become one of the key instruments for maintaining industrial competitiveness. It began before the full-scale war, but after 2022 significantly accelerated due to infrastructure damage, personnel shortages, and supply chain instability. Under these conditions, enterprises are increasingly transitioning from traditional production models to data-driven management, automation, and digital platforms, which allows operational activity to be maintained even in an environment of high uncertainty.

Global Industry 4.0 experience confirms that digitalization can increase productivity by 30–50%[81] and significantly optimize operational costs. For Ukraine, this effect may be even more substantial due to the low starting base for automation at a significant portion of enterprises. According to international industry research estimates, the modernization of production processes can reduce equipment downtime by 30–50%[82] and increase throughput capacity by 10–30%.

The use of digital twins[83] reduces the product development cycle and decreases the need for physical prototypes, while ERP systems with demand forecasting functions reduce inventory volumes and the need for working capital. Automation accelerates production cycles, and predictive maintenance improves equipment operational stability, leading to increased labor productivity, reduced material losses, and improved product quality. Logistics digitalization reduces delivery times and transportation costs, while the automation of commercial processes accelerates contract conclusion and reduces errors, allowing enterprises to receive revenue more quickly.

[77, 78] State Statistics Service of Ukraine
[79] Ministry of Economy of Ukraine
[80] State Customs Service of Ukraine
[81] Bain & Company
[82] McKinsey & Company
[83] Digital Twin is a digital copy of a physical object or process that helps optimize business efficiency.

# the processing industry

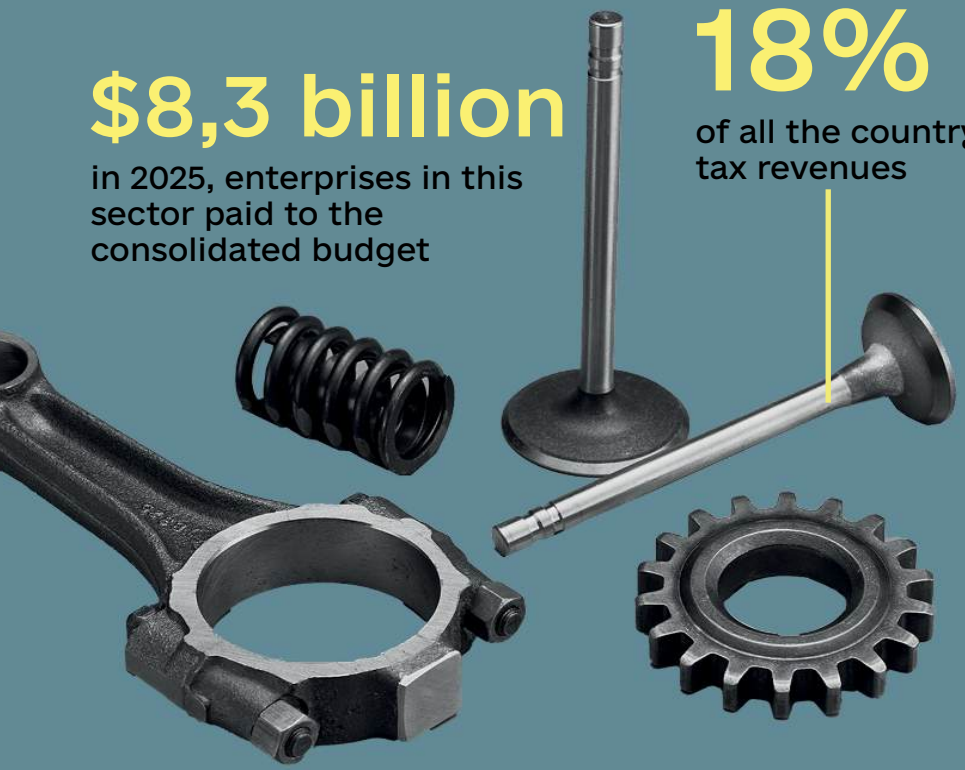
is the key source of budget revenues:

**$8,3 billion**

in 2025, enterprises in this sector paid to the consolidated budget

**18%**

of all the country's tax revenues



## the use of AI and automation in supply chain management provides:

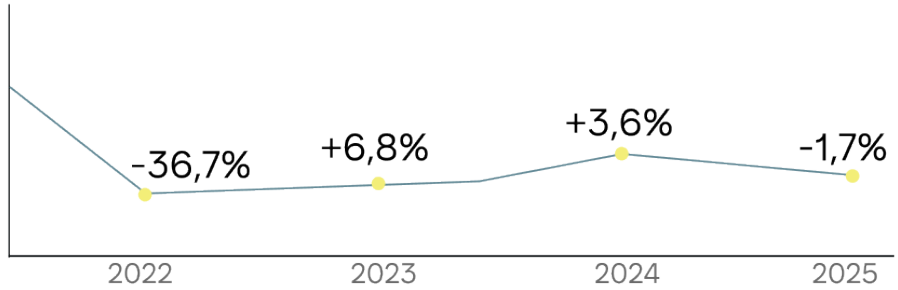
**+10-20%**

productivity growth

**-15-30%**

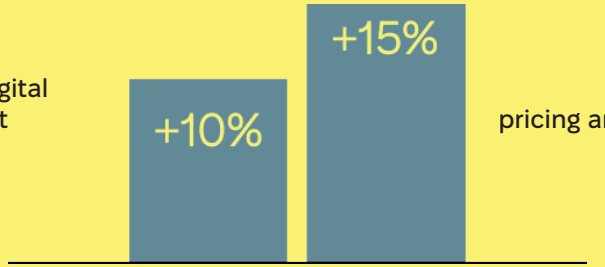
inventory reduction

## production volumes




## impact on on-time delivery indicators:

implementation of digital logistics management systems




automation of pricing and contracting

# impact structure

## digitalization across the production cycle

The economic effect of digitalization in industry is created at all stages of the production cycle — from resource planning to after-sales service. Unlike other sectors where digital technologies often affect only individual processes, in industry they change the entire logic of value creation. This allows productivity to be increased without a proportional increase in material resource costs, which is critically important for an economy functioning under conditions of limited investment and physical infrastructure losses.

The greatest effect of digitalization manifests in three key areas: planning and resource provision, production itself, and market interaction. It is precisely the synergy of these levels that creates a systemic efficiency gain, while point solutions provide only limited results.

## planning and production

According to implementation estimates[84], the use of AI and automation in supply chain management provides productivity growth of 10–20%, inventory reduction of 15–30%, and improvement in on-time and complete order fulfillment indicators. This allows capital locked in inventory to be freed up and increases the operational resilience of enterprises, which is critically important under conditions of limited resources and high uncertainty.

The most tangible effect of industrial digital transformation manifests directly in production processes. Automation and the implementation of Smart Manufacturing solutions provide substantial efficiency gains. According to Deloitte[85] estimates, enterprises record increases in output and productivity at the level of 10–20%, and also gain 10–15% additional production capacity.

IoT sensors, computer vision, and digital twins allow equipment utilization to be optimized, process parameters to be stabilized, and production cycle duration to be reduced. For Ukrainian enterprises operating under conditions of energy constraints, damaged infrastructure, and personnel shortages, digitalization becomes a tool that minimizes emergency shutdowns and allows production volumes to be maintained despite external shocks.

[84] Supply & Demand Chain Executive
[85] Deloitte

# delivery, sales, and service

The implementation of digital logistics management systems significantly increases operational efficiency: such solutions provide supply chain efficiency growth of 15–30%, inventory reduction of 10–20%, and transportation cost reduction of 8–15%[86].

A separate effect manifests when improving on-time delivery indicators through increased transparency and forecasting capabilities, while digital sales management and contracting tools additionally increase operational speed and order fulfillment accuracy.

Particularly important is developing the service component. The digitalization of product servicing improves efficiency indicators and creates long-term revenue sources. Remote diagnostics, planned maintenance, and digital customer support platforms allow manufacturers to transition from one-time equipment sales to service accompaniment models, which increases their competitiveness in international markets. In such a model, the manufacturer receives not only revenue from equipment sales, but also a stable revenue stream from its maintenance, analytics, and operational optimization.

A telling example is the Ukrainian company a-gnostics, which develops AI solutions for industrial diagnostics. Its Di-agnostics system analyzes machine operating sounds and allows potential failures to be predicted before they occur, helping enterprises avoid downtime and optimize maintenance schedules. According to the company's data, the use of such systems can reduce maintenance costs by approximately 40%, increase equipment productivity by up to 60%, and provide diagnostic accuracy of over 95%[87].

In addition, the company has created the Pro-gnostics platform, which forecasts electricity consumption for enterprises with an accuracy of over 97%, allowing energy consumption and costs to be optimized.

Such solutions demonstrate a fundamental change in the business model. Industrial companies are gradually transitioning from the role of equipment supplier to the role of provider of comprehensive asset management services. Digital services are becoming an integral part of value creation.

[86] ASC Software
[87] a-gnostics

# the macroeconomic and systemic effect of industrial digitalization

In 2025[88], Ukraine's economy employed **5.35 million workers**, of whom **1.21 million were in industry (22.7%)**, making it the largest employment sector. The majority of workers are concentrated in the processing industry — **823,000 people**, including 214,000 in food production. The economic role of the sector is defining. Industry accounts for approximately one fifth of the country's gross added value, while the processing industry provides a significant share of tax revenues. This means that even a moderate increase in productivity through digitalization will have a powerful multiplier effect for the entire economy.

An important indicator of the sector's condition is the industrial production index[89], a measure that reflects changes in the physical volume of production without the influence of prices. In 2025, it stood at 93.3%, indicating stabilization following the beginning of the recovery process in 2023 (123.8%). However, in the longer-term dynamics, production volumes still fall significantly short of pre-war indicators: in September 2025, the overall index stood at only 52.7% relative to the 2016 level (93.4%)[90]. The fastest growth in employment and production is observed in the machinery, electronics, and equipment manufacturing industries — precisely those where the share of software, automation, and engineering competencies is highest.

The key macroeconomic effect of digitalization lies in the possibility of transitioning from the export of low-tech products to the production of complex machinery and equipment with high added value.

Industries related to electronics, machinery, and defense technologies demonstrate significantly higher profitability than industry as a whole. For example, in 2025 the operating profitability of computer and peripheral equipment manufacturing reached 133.8%, while the overall activity profitability of enterprises in this industry was 88.9%. For comparison, the average operating profitability in industry is approximately 6.7%, and the average figure across all large and medium-sized enterprises in the economy is approximately 8.5%.

The digitalization of production stimulates the development of industrial IT, system integration, CyberTech, and engineering services, forming a domestic technology market. At the same time, it transforms the employment structure, increasing demand for highly qualified technical personnel and creating a need for reform of specialized education and corporate training systems.

[88] State Statistics Service of Ukraine
[89] Minfin
[90] He base year for comparison is 2016, in which one of the highest industrial production index values was recorded (101.4%). The use of a ten-year interval allows the current state of the sector to be assessed relative to this peak level and reflects the scale of deviation from full production potential.

MODUS X

# impact case:

## MODUS X — Deep

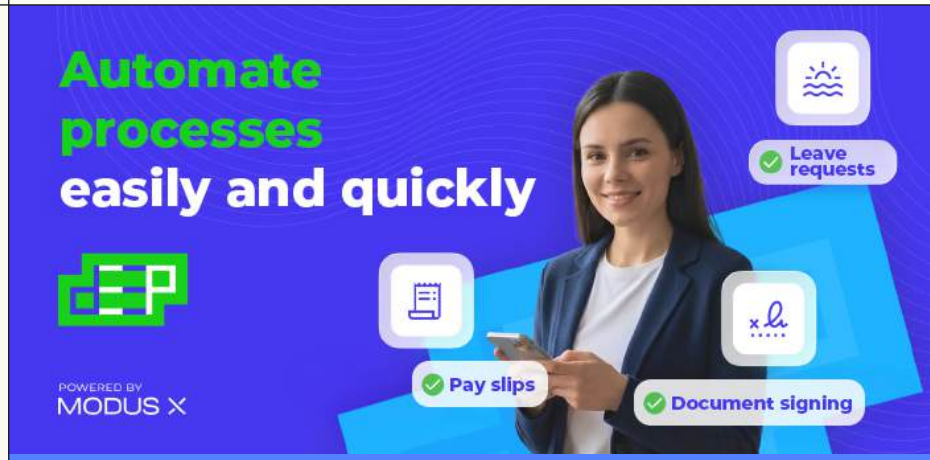

**At industrial enterprises, a significant portion of workers do not have access to IT infrastructure, meaning HR processes remain paper-based and require physical presence.**

The absence of a unified digital environment complicates communication, while standard ERP and HCM systems do not meet these needs, as they are oriented toward office workers and are complex to replace.



**DEEP**

DEEP HR is a product of the Ukrainian IT company MODUS X, developed as a mobile platform for the digitalization of HR document flow and internal communications at enterprises with distributed or production structures.




**Unlike classical HR systems, DEEP HR does not replace the company's existing accounting solutions, but integrates with them through a universal data exchange layer.** This allows an enterprise to obtain a fully functional digital HR front without changing internal processes and without data migration.

## the key components

for employee and company

the user mobile application

the HR manager work environment

- **HR document flow:** complete administration of leave applications and other personnel documents, receipt of pay slips and certificates, document signing with a digital signature including Diia.Sign.
- **Internal communications:** company news and announcements, conducting surveys, targeted message distribution to specific departments or personnel groups.

MODUS X

# Effect: case DTEK

# impact case:

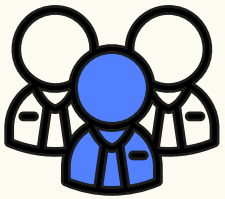
## MODUS X — Deep

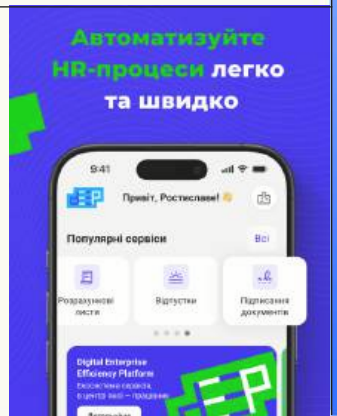
DTEK
НАША ЕНЕРГІЯ ЖИВИТЬ ЖИТТЯ

**DEEP HR grew out of the practical experience of implementation within the DTEK group. Since 2023, MODUS X has been implementing the DTEK One Click program at DTEK**

a large-scale digital transformation of document flow and HR processes covering over 70,000 employees across the country, from office workers to mine and energy facility personnel.

Before the program began, only every third employee in the group had access to corporate digital services.






## These are some of the key operational indicators after two years of implementation:

**25k**
active users monthly
in the mobile application

**44k+**
vacation requests quarterly
processed entirely in digital format without paper documents

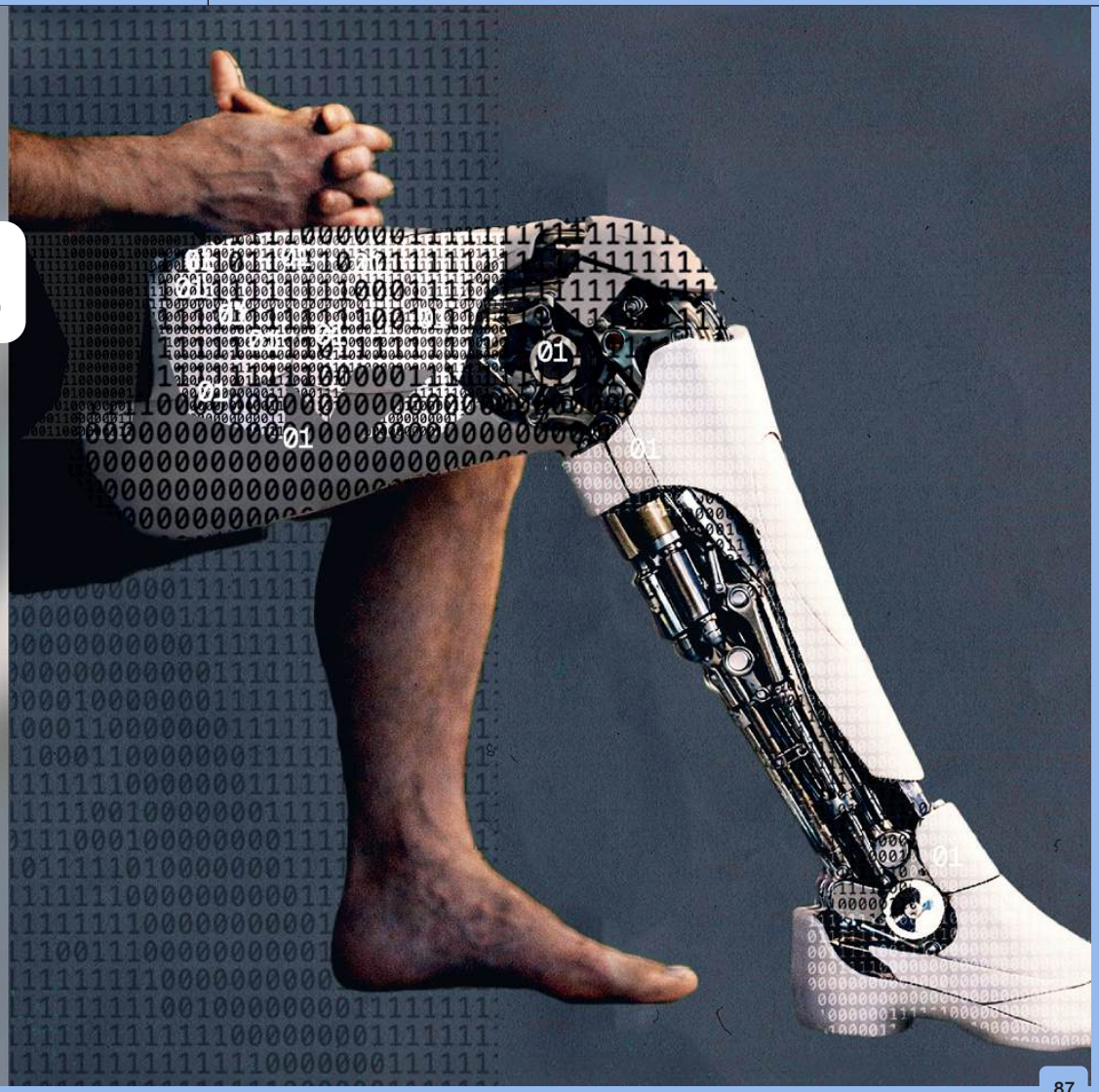
**100%**
охоплення персоналу групи,
включно з виробничим

**2.5k+**
digital certificates monthly,
without physical visits to the HR department. complete digitalization of resignation applications and clearance sheets

**reduction of the workload on HR departments**
through the elimination of manual processing of paper documents and administration of in-person appointments.

# digital technologies

## GovTech, EdTech, MedTech



Digital technologies are increasingly taking on the role of critical infrastructure, fundamentally changing the logic of Ukraine's economic functioning. If previously digitalization was viewed primarily as a tool for optimizing individual processes, in 2025 its significance became strategic. It determines the state's ability to manage complex systems, businesses' ability to scale their activities, and citizens' ability to learn, work, and receive services regardless of physical limitations. Thus, digital solutions have ceased to be merely a technological "superstructure" and have become the operational foundation of the economy.

Under conditions of full-scale war, digitalization has become the guarantor of the viability of state institutions, the continuity of education, and the accessibility of healthcare. The deficit of resources and personnel, damage to physical infrastructure, and the need for instant responses have significantly shortened the cycle of implementing changes. At the same time, the very criterion of effectiveness has changed. It is now not merely speed or convenience, but above all resilience and the system's ability to function under extreme conditions.

This section examines three key directions of digital transformation: GovTech, EdTech, and MedTech — interconnected systems, each of which creates its own economic effect while simultaneously supporting the others.

The significance of these directions lies in the transformation of the basic conditions of economic functioning, and not merely individual services. Digitalization creates both a direct effect in the form of the acceleration and cost reduction of services, and an indirect macroeconomic impact at the level of productivity, employment, investment attractiveness, and systemic resilience.

The common logic of these reforms lies in the fundamental transformation of process structures: digital solutions reduce the cost of scaling, transform data into a strategic management resource, and eliminate geographical limitations. As a result, the synergy of these technologies ensures a qualitative leap in the productivity and stability of the economy as a whole.

## GovTech

forms a transparent institutional environment with low transaction costs, accelerated procedures, and predictable rules of interaction between the state, business, and citizens.

## EdTech

ensures the preparation and adaptation of human capital to the requirements of the digital economy, creating a flexible and qualified workforce.

## MedTech

supports the active participation of the population in the economy, minimizing working time losses due to illness and increasing the overall efficiency of the healthcare system.

Tech

# impact case:

## Kyivstar.Tech

## challenge

**As the number of digital services grows, the burden on internal processes increases sharply.**

Clients move online, but contact centers, operational systems, and core solutions cannot keep pace with this rate. As a result, scaling begins to work against the business — costs increase, service speed declines, and quality becomes more difficult to control. Such a challenge is characteristic not only of telecommunications, but of other industries as well.

**Kyivstar.Tech** — a Ukrainian IT company that creates high-quality technological products and solutions for businesses.

## solution

**Kyivstar Tech develops products for Kyivstar that cover the complete customer interaction cycle and internal operations.**

Разом ці та інші продукти формують єдину систему обслуговування клієнтів — від запиту до результату.

## Kyivstar product ecosystem


**My Kyivstar**

**the primary digital interaction channel with B2C clients.** The application covers the complete customer cycle: from SIM card purchases to the management of various services and subscriptions in the areas of mobile and fixed communications, streaming, radio, gaming, taxi, and telemedicine.


**JET Contact Center**

**a web interface for contact center operators,** that unites all customer interaction processes in a single window: data access, request processing, result recording, and sales.

Tech

# impact case: Kyivstar.Tech

## effect

as of the end of 2025:

**6.2млн+**
active users monthly in My Kyivstar

**1млн+**
requests processed monthly through JET Contact Center

**This made it possible to:**

- transfer a significant portion of customer interactions to digital channels
- reduce the load on contact centers
- increase the speed and quality of service
- scale the service without a proportional increase in operational costs

## solutions for business and industries

**A separate direction of Kyivstar Tech is creating and implementing IT solutions for business.**

The company works with the key processes of large organizations: BSS system automation, service management, and business logic restructuring.

provisioning gateway

In particular, solutions such as the Provisioning gateway allow business logic to be changed rapidly, costs to be reduced, and dependence on complex core systems and external vendors to be decreased.

solutions in partnership with Creatio

In parallel, the company implements low-code solutions in partnership with Creatio and provides consulting on BSS solution implementation, helping businesses optimize processes and increase efficiency.

## result

**The expertise of Kyivstar Tech demonstrates that the combination of digital products and internal systems allows businesses to scale services without losing efficiency — from customer experience to operational processes.**

# GovTech
## overview of IT impact

GovTech is the foundation of digital infrastructure for managing state processes and interaction between the state, business, and citizens. In a broader sense, it also encompasses coordination systems in the security and defense sector. A striking example is the implementation of digital tools in the Armed Forces of Ukraine for resource management, logistics, and improving situational awareness.

The economic effect of GovTech is primarily evident in the areas of licensing, registration, procurement, reporting, and administrative procedures. When interaction with the state becomes faster, cheaper, and more predictable, business gains the ability to launch operations more quickly, minimize compliance costs, and scale without unnecessary bureaucratic barriers.

In 2025, the digitalization of the state reached a level where its development directly determines macroeconomic dynamics. According to estimates by the Forum for Research on Eastern Europe and Emerging Economies, every percentage point of growth in the digitalization level can increase Ukraine's GDP by **0.42%**[91]. Similar conclusions are confirmed by regression analysis of Ukrainian data for 2012–2022: a 1% increase in the E-Government Development Index (EGDI) correlated with GDP growth of approximately **0.2%**[92].

A separate powerful driver is integration processes. Ukraine's accession to the EU's Digital Single Market has the potential to additionally increase the country's GDP by 12.1%. This indicates the enormous macroeconomic potential of digital integration and its role in post-war recovery.

Ukraine belongs to a group of states with a high level of digital governance. According to the UN **E-Government Development Index (EGDI)**[93], Ukraine's score grew from 0.616 in 2018 to 0.802 in 2022 and reached 0.884 in 2024. This dynamic reflects the rapid scaling of digital public services. In the global ranking of 2024, Ukraine ranked 30th among 193 countries, rising by 16 positions compared to 2022. Ukraine is currently the de facto leader in the level of digital governance development in the Eastern European sub-region.

Particularly impressive is the dynamics of the **E-Participation Index**, which measures citizen engagement with the state through digital tools. While in **2022 Ukraine ranked 57th**, by **2024 it topped the global ranking (1st place)**. This demonstrates the mass implementation and active use of electronic consultations, digital petitions, online feedback systems, and other mechanisms of direct citizen participation in public administration.

For comparison, leading digital governance countries demonstrate EGDI values as close to the maximum as possible. **Denmark, for example, has a score of approximately 0.985**. At the same time, Ukraine's rapid dynamics indicate that digital channels of interaction between the state, business, and citizens have already become part of the basic institutional infrastructure. A significant portion of citizen and business interactions with public services **already takes place in digital format**. According to expert estimates gathered during the preparation of this study, the share of such interactions **may exceed half** of all administrative contacts, indicating the gradual transformation of digital services into the primary channel of interaction with the state.

An important institutional signal showing the international recognition of the Ukrainian GovTech ecosystem was the establishment of the **Global Government Technology Centre Kyiv**[94] **(GGTC Kyiv)** — a global GovTech center in partnership with the World Economic Forum. The Centre became the world's second GovTech center after Berlin and the **21st center in the network of Fourth Industrial Revolution Centers (C4IR)**.

[91] FREE Network
[92] Ivanova, V. «The Impact of Digitalization and E-Governance on Economic Growth in Ukraine»
[93] UN E-Government Knowledgebase
[94] Digital State

GGTC Kyiv serves as a platform for cooperation between governments, technology companies, researchers, and startups with the goal of developing innovative solutions in digital governance, sharing practices, and scaling successful GovTech models. The center integrates the Ukrainian GovTech ecosystem into a global network of experts and partners, which allows Ukrainian experience in state digital transformation to be disseminated at the international level and new technological solutions to be attracted to modernize the public sector.

The economic effect of GovTech is formed in the front office — through services for citizens and business — and in the internal processes of public administration.

**GovTech** scales according to the logic of the platform economy. It requires significant initial investments in basic components (identification, electronic signature, registry interaction, UX standards), but has extremely low marginal costs for each subsequent digital procedure if it is created on the basis of already prepared building blocks. The state implements the **Once-Only** principle: data is requested from the user only once, and thereafter authorities exchange it within established security rules.

The high impact of GovTech in Ukraine is largely driven by the network effect: each additional digital procedure reduces the time and cost of interaction with the state for citizens, businesses, and the state apparatus itself. A key role in this is played by the institutional establishment of standards under which online procedures become not an additional but the primary channel of communication with the state.

Effective scaling of services is impossible if each government body creates registries and information systems in isolation. Therefore, **Diia.Engine** — a low-code platform for the rapid deployment of state registries and services — has become a strategic element of infrastructure. It is currently used by **25 state bodies** to maintain **82 registries**. According to estimates by the Ministry of Digital Transformation, development on this platform **costs half as much** and occurs **2–3 times faster** than the traditional creation of systems from scratch.

**"Trembita"** isthe national electronic interaction system that ensures connectivity between state information resources and registries. It minimizes data duplication and guarantees high system interoperability. In practice, this creates the necessary mechanism for implementing the **Once-Only** principle (single data request) and optimizes the launch of complex public services.

For the defense sector, a telling new GovTech direction has been the Army+ application. Access is granted to active military personnel, authorization occurs through BankID or Diia, and future scaling to a wider range of defense forces is planned. The key innovation of the application was electronic reports, which replaced paper document flow — traditionally one of the most bureaucratized areas of military service. Through the application, military personnel can submit reports for leave, change of duty station, recovery after treatment, and other administrative procedures without paper documents and multi-level approvals. In the first year of operation, **over 1 million electronic reports** were submitted through the system, and the application itself was integrated into more than **1,500 military units**, demonstrating the systematic transition of the army to digital document flow[95]. In the first six months of the application's operation, over 680,000 military personnel authorized through it.

In addition, the application is gradually integrating services that directly address the needs of military personnel. For example, through the digital infrastructure, Ukrzaliznytsia ticket reservation for military personnel was implemented, simplifying the logistics of travel during leave or rotations.

[95] Ministry of Defense of Ukraine

Ukrainian GovTech is also a powerful market for technology component developers. The company Kitsoft implemented the "eMalyatko" service case as a comprehensive online service on the Diia portal, bringing together 9 services from various agencies (birth registration, benefit assignment, tax identification number registration, place of residence registration, etc.). The key feature of the project lies in the one-stop shop principle: instead of visiting numerous institutions, parents submit a single online application, after which the system automatically launches all administrative procedures. Kitsoft is developing its own low-code platform Liquio, which has become the foundation for over 200 projects, including the Diia portal and Kyiv Digital, and is now available as open source (Community Edition).

State Enterprise "INFOTECH" is responsible for the digital infrastructure of the Ministry of Internal Affairs services, consistently digitalizing procedures that historically required the physical presence of citizens. Through the Electronic Driver's Cabinet, users can remotely check vehicle data, order the exchange or restoration of a driving license, and receive other services without visiting service centers. In practice, "INFOTECH" acts as the digital transformation operator for one of the most regulated areas — transport and security — transferring the paper-based interaction model to the digital sphere.

It is also worth noting the market of products built on the basis of open government data and integrations. Among the most in-demand services are YouControl and Opendatabot, which aggregate information from state registries and provide tools for the rapid verification of companies, beneficiaries, court decisions, tax debts, and sanctions lists.

Through automatic monitoring and instant notification systems, such platforms allow businesses to quickly assess counterparty risks and track any changes in their status. The economic significance of this sector is confirmed by the scale of coverage: the total audience of online services using open data is estimated in the range of 11.6–16.2 million people monthly[96]. This demonstrates how the openness of government data stimulates the creation of added value by the private sector and increases the overall transparency of the economy.

[96] BRDO

# the measurable effect of GovTech

## transaction effect

In the traditional model of interaction with the state, costs arise not only through direct payment for services, but also through time losses, complex document logistics, repeated visits, and errors that trigger new approval cycles.

For large businesses, digital solutions reduce the contract approval cycle by approximately 90% (from weeks to days). In the area of work completion act operations, digitalization frees up 80–85% of the human resources previously engaged in routine paper document flow[97]. Digitalization significantly accelerates capital turnover: funds arrive faster, while compliance and transaction processing costs steadily decrease.

## resource effect

State digital sales and procurement systems convert "state resources" into transparent market transactions. Through electronic auctions, small privatization objects, rental of state and municipal property, licenses, and other assets are realized. This creates an institutional shift: from non-transparent administrative access to open market procedures. The state receives an effect not only in the form of direct revenues, but also through a radical reduction in asset maintenance costs (cost of ownership).

At the level of measurable results, in 2025 the **Prozorro.Sale** system provided over **16.2 billion UAH**[98] **in revenues to budgets** at various levels. According to Prozorro.Sale data, the average level of competition stands at **2.4 participants** per lot, which even at moderate market activity guarantees the formation of a fair market price.

An important component of this mechanism is analytical transparency. Open data and BI tools create for the market the opportunity to analyze transaction history and make decisions based on public statistics, which was previously impossible due to the closed nature of information.

## capability effect

Conceptually, the digital governance system can be divided into two levels: front-end (digital services for citizens and business) and back-end (internal public administration systems — registries, document flow, verifications, analytical systems, and inter-agency interaction). The digitalization of these processes allows the state to process significantly larger volumes of requests without a proportional expansion of personnel, while simultaneously eliminating the human factor and corruption risks.

In practice, this manifests in the formation of data-driven governance — a management model where state decisions are based on integrated registries, analytical systems, and digital platforms. Ukraine already demonstrates results in this direction. According to the World Bank's GovTech Maturity Index[99] assessment, the country belongs to Group A — the highest level of digital maturity of state systems among 198 countries of the world.

[97] Interviews with industry representative
[98] Ministry of Economy of Ukraine
[99] GovTech Maturity Index 2025

# ~23M

users, making it one of the largest state digital platforms in Europe.

# ~160

цифрових послуг

## GovTech Awards 2025[100]

In 2025, the Diia.AI assistant received a prestigious award as the best AI solution for government services. The assistant helps users find the services they need, analyze life situations (from business registration to social benefits), and automatically generate the required documents.

The central element of this model is the Diia ecosystem, which объединates digital documents, online services, integration of state registries, and platforms for interaction between the government and businesses. A new stage of development has become the implementation of artificial intelligence. In just the first months of operation, more than 120 thousand users utilized the service, confirming the strong demand for intelligent automation of public services.

[100] Digital State

# spillover-ефект:

## GovTech as infrastructure for economic productivity

At the macro level, the development of GovTech generates four key spillover effects that stimulate the development of the entire economic system.

The reduction of transaction costs frees up the economy's time resource. Fewer resources are spent on bureaucratic barriers, and more on production, service, and innovation. The cumulative effect of service digitalization since 2020 has been estimated at 184 billion UAH in savings[101]. Taking the difference between the average offline and online cost of a single service, the direct cost reduction amounts to 1,341 UAH per transaction (the average cost of an online service is only 242 UAH compared to its offline equivalent). At the scale of the state, this means the ability to increase service throughput capacity without a proportional expansion of physical infrastructure. The Ministry of Digital Transformation notes that basic services alone (electronic passports, student cards, vehicle registration certificates) generate approximately 49 billion UAH in savings annually. The full transition of public services to online has the potential to raise this figure to 85.9 billion UAH.

## de-shadowing and fiscal effect

Digital processes create an immutable "digital footprint" that increases transaction transparency and tax administrability, and expands the tax base. In 2025, Diia.City residents paid 34.6 billion UAH in taxes[102]. In total, the IT sector paid 43.4 billion UAH in 2025, meaning Diia.City's share constituted 79.7% of all tax revenues from the IT sector.

## investment effect through predictability

For an investor, critically important factors are speed of market entry, standardization of procedures, the ability to act remotely, data accessibility, and uniform rules for all participants. For both external and domestic investors, what matters is the transition of a significant portion of state-market interaction into a regulated, transparent, and predictable environment. GovTech reduces the operational and regulatory risk of interaction with the state, which directly influences decisions regarding market entry, tender participation, and business scaling.

## forming a market around the state platform

GovTech in Ukraine functions as basic infrastructure. The state sets standards and opens data, while private business offers innovative technological solutions on this basis. As a result, a new segment of the digital economy emerges, which transfers GovTech standards to other industries, strengthening the country's overall institutional capacity.

[101] Civitta
[102] Ministry of Digital Transformation of Ukraine

# EdTech

## digitalization of education and EdTech

The structure of Ukrainian EdTech development has a pronounced global orientation. A significant portion of technological educational products created by Ukrainian teams are designed from the outset with international markets and scaling beyond Ukraine in mind. As a result, the most mature segment of the industry is formed precisely by globally scaled products that work with users in various countries and integrate into the global educational ecosystem. This model allows technologies to be scaled faster, investments to be attracted, and competitive educational products of world-class quality to be created.

Under conditions where physical infrastructure is destroyed, mass population is displaced, and citizens are mobilized, digital learning formats ensure the continuity of education for millions of pupils and students. The World Bank, citing RDNA4 (Rapid Damage and Needs Assessment), reported data on 3,373 damaged and 385 destroyed educational institutions (over 10% of infrastructure) with an estimated recovery needs assessment of $13.4 billion. Digitalization became the basic prerequisite for educational continuity, while EdTech served as the answer to the question of how to make distance and blended learning effective, not merely possible.

In the field of education, it is important to distinguish between several closely related but not identical concepts. The broadest of these is the digitalization of education — the process of transferring educational services, administrative procedures, and interactions between process participants into digital format. This refers to electronic journals, online schedules, student registries, digital classrooms, materials access platforms, and communication tools.

EdTech is a narrower and qualitatively different segment. These are technological products and solutions that do not merely digitize existing processes, but change the very logic of learning: personalizing educational trajectories, automating assessment, and using data analytics and artificial intelligence to adapt content – increasing engagement and overall learning effectiveness.

EdTech encompasses technological solutions for education: tools created or adapted to enhance the processes of learning, teaching, and education management. This understanding is also captured in international definitions (specifically as "technologies developed or adapted for educational purposes").

Ukrainian EdTech is represented by an extensive ecosystem of products — from language platforms and mobile applications to corporate LMS systems and professional training services. It is important to distinguish between format and content. Distance or online learning is merely a format for organizing the process, while EdTech is the toolkit that makes online, blended, or in-person formats more effective: higher quality, measurable, personalized, data-driven, and less routine for the teacher.

For Ukraine, starting from 2022, this distinction is critical. At the level of state digital infrastructure, by 2025 several mass-coverage platforms had formed that create the basic architecture for implementing EdTech solutions. In particular, the free platform "All-Ukrainian Online School," created in 2020, reached the mark of 1 million registered users in September 2025. In parallel, the state educational ecosystem "Mriia" as of late autumn 2025 covered over 2,600 connected schools and approximately 400,000 daily users (pupils, teachers, and parents).

The second strategic vector of Ukrainian EdTech development is the export of technological educational products. The most striking example is Preply, which in January 2026 attracted an investment round of $150 million at a company valuation of $1.2 billion, granting it unicorn status[103].

It is important to note that Preply represents only one EdTech segment, — online marketplaces for language learning. In parallel, other types of products created by Ukrainian teams are developing: microlearning platforms (Headway) and tools for skills development and lifelong learning (Mate Academy); as well as solutions at the intersection of EdTech and other technology industries, such as AI learning assistants (Grammarly) and corporate knowledge management systems (Academy Ocean).

According to the World Economic Forum's estimate, 59 out of 100 workers in the global economy will require upskilling or reskilling by 2030[104], while 63% of employers cite a deficit of necessary skills as the main obstacle to business transformation. Professional training and retraining systems are becoming a key instrument for adapting the economy to technological changes. In this context, EdTech serves as the infrastructure for rapid competency renewal, allowing the market to flexibly respond to structural changes in labor demand.

Due to personnel shortages, enterprise relocation, and high staff turnover, companies are increasingly implementing their own training programs. Internal platforms, knowledge libraries, and competency management systems allow the time for employee preparation to be significantly reduced and corporate standards to be rapidly scaled. It is worth noting that corporate training in itself is not EdTech, in which educational technologies emerge where the process is incorporated into technological systems (LMS/LXP, etc.).

Learning is becoming an integral part of the operational business model. Such a model is particularly effective for large organizations with distributed teams, manufacturing enterprises, retail, and logistics, where the quality of personnel preparation directly affects financial results.

According to UNICEF data as of September 1, 2025, **4.6 million children** face educational barriers[105]. More than a third of pupils were not studying fully in classrooms, and 11% relied exclusively on the online format (based on the results of the 2024/25 academic year)[106].

The global education market is estimated at approximately $7.6 trillion[107], while EdTech accounts for only a small share of this figure — approximately $200 billion as of 2025.

[103, 104] Ministry of Education and Science of Ukraine
[105] Forbes
[106] World Economic Forum
[107] UNICEF

# where EdTech generates a measurable effect

EdTech minimizes time and geographical barriers in access to educational resources. In crisis conditions — particularly during the COVID-19 pandemic and the full-scale war — educational technologies became critical infrastructure for supporting the learning process. Research on digital learning indicates that the use of online courses and specialized platforms can reduce the time for mastering material by 40–60%[108]. In particular, the "All-Ukrainian Online School" platform functions as a centralized repository of educational content and a key instrument for supporting the educational process at the national scale.

The time effect is directly linked to the reduction of the administrative burden on teachers. This is achieved through the automation of routine tasks: maintaining journals, preparing test materials, analyzing educational progress, and so on. In the state educational ecosystem "Mriia," for example, tools for automating teacher work are provided, including an announced function for test generation using artificial intelligence[109].

EdTech provides substantial economies of scale thanks to the digital nature of platforms. Unlike traditional formats, where costs grow almost proportionally to the number of students (the need for new teachers, classrooms, and materials), in digital solutions the main portion of capital investment falls at the initial stage — platform development and content creation.

After this, the marginal cost of attracting each subsequent user drops sharply. The same course or training module can be used by millions of people without a proportional increase in expenditures. This effect is particularly noticeable in the corporate segment, where digital platforms allow programs to be standardized, knowledge to be updated instantly, and costs for offline events and personnel adaptation to be radically reduced.

A PwC study[110] recorded that the cost of training per learner decreased from approximately $2,600 (for 100 participants) to approximately $180 when scaling to 3,000 people — that is, by more than 14 times. At the same time, the scalability of educational platforms has its limitations. One of the most critical challenges of massive open online courses (MOOCs) remains the low completion rate. Only a small fraction of registered users complete a course to the end — often these are single-digit figures (percentages of the total number)[111], although specific indicators largely depend on the course format and user motivation. This is precisely why the development of EdTech products today is focused not only on content, but also on retention mechanics: personalization, interactivity, mentorship support, and the combination of technology with human interaction in blended learning formats.

EdTech serves as an instrument for the accelerated development of skills. Adaptive learning systems that use data analytics to personalize content demonstrate on average 25%[112] improvement in learning outcomes compared to traditional formats. The practical manifestation of this effect is most noticeable in the segment of professional training and digital skills. Technology platforms allow programs to be rapidly scaled in areas with the highest demand for new competencies: in IT, digital marketing, data analysis, and product management.

[108] World Bank
[109] Holoniq
[110] eLearning Industry
[111] Ministry of Education and Science of Ukraine
[112] PwC

Since a significant portion of the learning process in Ukraine in 2022–2025 takes place in online or blended format, the quality of education becomes a key question. The mere fact there is access to an online lesson or platform does not guarantee material comprehension or stable progress. A survey by Rakuten Viber and EdEra[113] indicates that 95% of Ukrainian teachers note a deterioration in students' knowledge levels. Respondents primarily attribute this to the consequences of the war: psychological stress, unstable conditions, and interruptions in the educational process. Among other significant factors, prolonged distance learning (57.6%), accumulated educational losses from the COVID-19 pandemic period, and a general decline in motivation are highlighted.

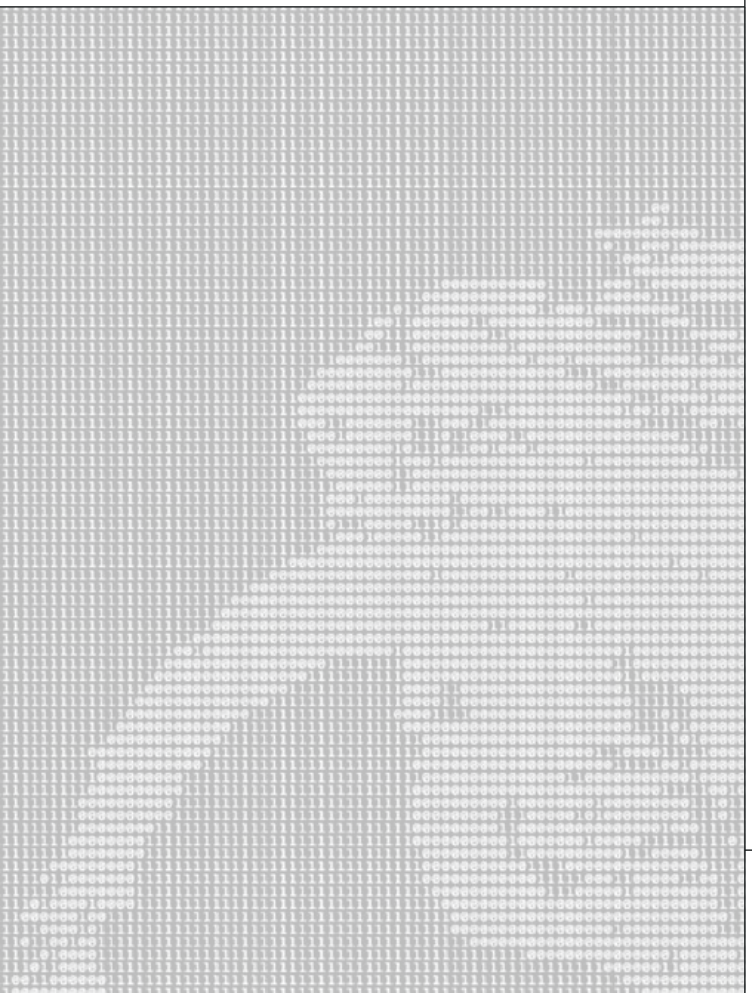
The quality of online education critically depends on access to equipment and stable internet. According to research by the **Kyiv School of Economics (KSE)[114], 22%** of Ukrainian children face a shortage of necessary devices or technical means for learning. Another defining element of quality is the readiness of teachers themselves to work with educational technologies. In 2023, UNESCO and the Ministry of Education and Science of Ukraine launched a large-scale digital pedagogy program that covered tens of thousands of teachers. This direction remains a priority today, as the effectiveness of **EdTech** depends not only on the sophistication of the tools, but also on the capacity of teachers to integrate them into the learning process.

In the higher education system, implementing online and blended formats is also accompanied by challenges: low student engagement, limited communication between teachers and learners, and the difficulty of maintaining motivation in a distance learning environment.

In the adult learning segment (Lifelong Learning), the key challenge is not so much access to content as the low course completion rate and actual skill acquisition. Modern EdTech platforms are increasingly implementing personalization tools, adaptive learning trajectories, and in-depth progress analytics. This allows user engagement to be effectively maintained and learning outcomes to be substantially improved.

[113] Open Praxis
[114] Myungjae Kwak. The Effectiveness of AI-Driven Tools in Improving Student Learning Outcomes Compared to Traditional Methods

# spillover effect



EdTech generates powerful spillover effects that influence the labor market, the pace of technological modernization of the economy, and the volumes of digital product exports. In 2026, these effects manifest in Ukraine across several interconnected directions.

Simplifying access to learning and retraining significantly reduces the risks of long-term unemployment under conditions of global technological and domestic economic transformations. According to business surveys[115], approximately 60% of companies identify a deficit of qualified labor as one of the key obstacles to development, underscoring the critical demand for tools for rapid employee training and reskilling. A telling example is the Preply platform, founded by Ukrainian entrepreneurs. The company develops a global online tutoring marketplace that integrates individual teaching with advanced digital tools. The uniqueness of the Preply model lies in the synergy of a scalable technology platform and a personalized approach. The human-led strategy utilizing artificial intelligence keeps the teacher as the central figure in the educational process, while AI tools help adapt content to the learner's needs and effectively scale the market.

In parallel, a segment of B2C learning products oriented toward independent adult learning is forming. A striking example is the Headway application, created by the Ukrainian company Genesis, which is based on the microlearning model — short educational formats in the form of condensed book summaries and learning materials. According to Forbes, the Headway Inc. product ecosystem today covers over 160 million users worldwide, and the company's annual revenue is estimated at approximately $160 million. The company develops a portfolio of several applications (Headway, Impulse, Nibble, AddMile, Skillsta), which together form one of the largest global platforms for adult learning in short digital course format.

The educational process in Ukraine had to be maintained under conditions of war, mass relocation, power supply interruptions, and security risks. This unique experience is gradually being institutionalized by creating new coordination platforms and innovation hubs. One such example is the WINWIN EdTech Center of Excellence, created in 2025 as a national center for developing educational innovations with participating state bodies, academic institutions, and international partners. Its goal is the strategic coordination of EdTech solutions, support for startups, and the integration of Ukrainian technologies into international collaboration networks.

[115] Detector Media

# MedTech

## digital healthcare as an instrument of macroeconomic stabilization

In the field of digitalization, it is important to distinguish between several closely related but not identical concepts pertaining to the healthcare sector. The broadest of these is HealthTech — a term for digital and technological solutions operating in this field in general: from telemedicine, medical data platforms, and insurance services to mental health support products. MedTech is a narrower segment and relates primarily to those technologies that directly change medical practice: medical devices, diagnostic systems, remote monitoring solutions, clinical software, rehabilitation, prosthetics, VR/AR tools, and clinical decision support systems. BioTech, in turn, has a different logic: it encompasses biopharmaceuticals, bioinformatics, genetic developments, regenerative medicine, and generally those directions where the key resource is working with biological processes and materials.

It is equally important to distinguish between the digitalization of medicine and MedTech itself. The digitalization of medicine is primarily the transfer of medical processes, services, and document flow into digital format: electronic records, prescriptions, referrals, registries, patient pathways, and data exchange between institutions and the state. MedTech is the next level: not merely a digital environment, but technological solutions that change the way a patient is diagnosed, treated, rehabilitated, or monitored. eHealth (digital healthcare infrastructure) provides electronic record-keeping, medical data exchange, and the operation of key services, serving as the core of the ecosystem.

Today, MedTech in Ukraine has a significantly broader scale. It is an instrument of macroeconomic stabilization through the preservation of human capital. In a country simultaneously experiencing demographic decline, wartime losses, and the migration outflow of the working-age population, health becomes a direct factor of GDP. When the healthcare system is unable to effectively prevent chronic diseases, it does not merely generate medical costs — it removes productive resources from the economy. Chronic diseases function not as a medical problem, but as a structural factor of economic underutilization of labor resources. Each complication represents months or years of removing a person from productive activity. A telling example is diabetes: Ukraine loses up to 2% of GDP annually through its complications — approximately $4.2 billion; this sum is comparable to the country's annual IT exports. Diabetes complications reduce an average of 5 years of healthy working life, while timely detection can add 5–10 years of active economic participation. Multiplied by 3 million patients, this is a scale of effect that no sectoral reform can replicate.

# eHealth as national infrastructure

A key factor in the rapid scaling of digitalization is regulatory integration. Financing within the Medical Guarantees Program is provided exclusively upon the existence of an electronic record. This fundamentally distinguishes the trajectory of healthcare digitalization in Ukraine from most countries, where digital solutions are implemented in parallel with traditional ones rather than replacing them. The eHealth infrastructure became the operational core of the system, not merely its supplement.

Over 2022–2024, the number of electronic medical records grew from 0.7 billion to 3.7 billion (an increase of +528% over three years). The eHealth system covers over 37 million registered users, over 400,000 registered healthcare workers (approximately 360,000 active), 15,000 pharmacies, 7,000 primary care facilities, and 2,000 specialized care facilities. The central database processes 1,000–1,500 requests per second[116], and the system has generated 62.7 million electronic prescriptions and 342[117] million referrals.

Under wartime conditions, the system ensures the extraterritoriality of medical assistance for over 6 million internally displaced persons. The digital medical infrastructure performs a function that the traditional system could not provide physically — it makes medical care territorially independent.

[116] Vox Ukraine
[117] eHealth

# the value chain: where digitalization generates a measurable effect

Digitalization in the healthcare sector encompasses four interconnected economic levers: time reduction, cost optimization, treatment effectiveness, and the formation of a new data and innovation infrastructure.

## 1 time reduction

The first and most significant lever is the freeing up of time resources for patients, doctors, and medical institutions. Online registration eliminates physical queues and chaotic visits to reception desks, which not only saves time for both parties but also allows medical facilities to effectively balance their workload. According to forecasting calculations, if at least 50% of the population transitions to online appointment booking instead of in-person visits, the potential for economic productivity growth amounts to 3.6 billion UAH per year[118]. It is important to understand the fundamental mechanism: time freed from medical bureaucracy does not disappear — it is converted into productive activity. A patient who previously spent 2–3 hours on an in-person appointment or waiting, after transitioning to a digital platform spends only 5 minutes. These 175 minutes returned to the work cycle, learning, or childcare have a clear and measurable macroeconomic value.

At the same time, telemedicine provides the ability to consult online, saving patients time and money while allowing doctors to work more efficiently. Research shows that telemedicine consultations significantly reduce wait times for medical assistance for patients of various profiles — on average by 25 days compared to traditional visits[119]. The cumulative time savings represent a structural change in the system's throughput capacity without increasing the number of doctors. Telemedicine allows existing personnel to serve a larger patient flow within realistic physical workloads, mitigating the personnel deficit and guaranteeing the continuity of service delivery.

Mobile diagnostic devices (portable medical equipment for examining and monitoring a patient outside a hospital) allow diagnostics to be conducted on-site, particularly in remote regions, reducing transport and organizational barriers to medical care access. In addition, digital tools for early online consultation and primary patient condition assessment allow some such cases to be redirected from the expensive emergency care pathway to early and inexpensive diagnostics, which can provide savings of $300 to $1,500[120] per case. The common logic of these solutions lies in the fundamental change of the patient's pathway; they minimize the need for in-person hospital visits by transferring consultation, diagnostics, and triage (primary screening) to a remote or decentralized format.

[118] PMC
[119] eHealth
[120] Dialog Health

## 2 cost optimization

The second strategic lever is the direct financial optimization of healthcare system costs. With total industry expenditures at the level of 7–8% of GDP, even a minimal optimization of 5% (achieved through data-driven management) is capable of generating 30–34 billion UAH in savings per year[121]. The central instrument of this process is Medical Information Systems (MIS). They centralize service and financial accounting, eliminate duplication of diagnostic procedures, and radically reduce administrative expenditures. To date, the system has already generated 19.7 million electronic medical conclusions and 62.7 million e-prescriptions. These figures reflect a large-scale transformation: processes that previously took from several hours to days in paper format are now carried out instantly.

A digital healthcare system operating with aggregated real-time data gains the ability to identify anomalies, excessive prescriptions, or inefficient resource allocation preventively — before they become a systemic problem. Thanks to MIS and electronic registries, financial and service flows become fully transparent for auditing, which today already provides measurable savings in both the state budget and the medical insurance sector.

## 3 treatment effectiveness

The third lever directly strengthens the country's human capital quality through a radical increase in the accuracy and speed of medical interventions. The traditional diagnostic model has a physical throughput "ceiling," limited by the number of doctors and their working hours. For example, approximately 3 million patients with diabetes in Ukraine require regular retinal screening. At a standard procedure duration of one hour, the system would require 3 million physician hours per year — a resource that physically does not exist within the current medical infrastructure.

The Ukrainian MedTech case CheckEye demonstrates a practical solution to this problem. An AI solution reduces the duration of screening from one hour to 5 minutes and allows the procedure to be delegated to a nurse. This accelerates the process by 10–12 times, reduces examination costs by 3–4 times, and transitions from selective monitoring to 100% coverage of risk groups[122].

Voice AI assistants reduce the administrative burden on doctors by 30–40%, which increases the system's throughput capacity without expanding personnel. A practical Ukrainian example of this approach is Tayra.ai, an AI MedTech solution that automates medical documentation during appointments. According to the developers, the system increases doctor productivity by 20%, reduces consultation duration by 40%, and decreases the time for preparing medical conclusions by up to 70%[123].

# 3 treatment effectiveness

MedTech addresses not only the efficiency problem, but also the scale problem. Early diagnostics and remote monitoring prevent critical complications, reduce hospitalization, and improve population health. This allows medication costs to be reduced by 53% through the minimization of medical errors and better patient condition monitoring[124].

MedTech in Ukraine is gradually forming into an ecosystem where different solutions cover different stages of prevention and medical supervision. Devices track health conditions and motivate physical activity, leading to lower morbidity and fewer sick days. For example, Ovul provides personalized monitoring of women's hormonal health and fertility, CheckEye offers AI screening of chronic diseases and their complications through retinal image analysis, Esper Bionics develops bionic prosthetics, and eXtra Vision specializes in VR/AR medicine and surgical visualization, together combining MedTech and wartime rehabilitation solutions. Collectively, such solutions demonstrate that MedTech is developing around a common logic of transferring part of medical supervision from episodic in-person visits to a format of continuous digital monitoring, where risks are identified earlier and medical intervention becomes cheaper and more precise.

Such preventive devices reduce medical costs by 15%[125]. According to CheckEye estimates, $1 invested in earlydetection saves up to $10[126] in the treatment of late-stage conditions — one of the highest return on investment multipliers in any sector. This forms the logic whereby investments in prevention are not social expenditures, but a financially justified decision with predictable positive returns.

[121] The potential savings estimate is based on Ukraine's nominal GDP for 2025 and the generally accepted range of healthcare expenditures: 7–8% of GDP, corresponding to 593–677 billion UAH. Applying a conservative optimization coefficient of 5% by implementing data-driven management systems yields a potential annual savings of 29.6 to 33.9 billion UAH.

[122] Interview with CheckEye
[123] TAYRA
[124] PMC
[125] World Economic Forum
[126] Interview with CheckEye

# 4 data and digital healthcare infrastructure

The fourth lever creates a direct effect in the healthcare system and forms the infrastructural foundation for its further development. Digital data on population health is one of the key analytical assets of the state, and its accumulation, structuring, and use determine the system's ability to transition from reactive treatment to personalized preventive medicine.

Electronic Medical Records (EMR) ensure the secure storage of patient history and doctor access to data from any location, which minimizes errors and duplication of procedures. The system has already generated 342 million referrals, reflecting the scale of digital circulation while simultaneously forming a data array for strategic planning, procurement, and auditing. This database is precisely the technical foundation for clinical analytics and prescription control.

Open registries, medical information systems, and dashboards provide managers with demand and resource analytics, allowing needs to be more accurately forecasted and healthcare to be financed.

On this basis, a space for medical innovations is also forming. Digital twins — virtual models of a patient, individual organs, or treatment processes — allow therapy to be modeled, risks to be forecasted, and solutions to be tested before their application. This forms a new type of interaction between medical science and clinical practice[127]. In Ukraine, this technology is at an early stage, but already sets the development vector toward precision and personalized medicine.

[127] Duke Center for Computational and Digital Health Innovation

# spillover effect: how MedTech creates value beyond the healthcare industry

The development of MedTech creates new market segments — from startups to equipment manufacturing and digital services — opening space for attracting domestic and external investments. Ukraine, with its +528% growth in digital medical records over three years, regulatory clarity, and proven system resilience under extreme conditions is forming a unique investment case with no analogues in most developing markets.

Demand for digital medicine accelerates the formation of new value chains — in IT, analytics, insurance, and pharmaceuticals — and sets the pace of transformation for adjacent industries. If the agricultural sector provides the export currency base, and IT forms the technological infrastructure, then MedTech serves as an internal multiplier of human capital in a country recovering from wartime losses and competing to retain its population.

# peer review and expert interviews

## peer review of methodology

**Viktor Halasyuk,** CEO, Ukraine Global Faculty and KMEF Academy; author, the YouTube channel "Halasyuk про економіку"; Adjunct Professor, Doctor of Economics, kmbs.

## expert interviews

**Andriy Zhukovskyi**, CEO Kyivstar.Tech
**Andriy Kashperuk**, Deputy Chairman of the Board, Director of Retail Business, UKRSIBBANK BNP Paribas Group
**Anton Skokov**, Head of Digital Business Services, "Vchasno"
**Volodymyr Strashko**, CEO Unicorn School
**Hryhoriy Lehenchenko** CTO Prozzoro.Sale
**Inna Maslenchuk**, MedTech/BioTech Lead, WINWIN Ukraine's Global Innovation Strategy 2030, Ministry of Digital Transformation of Ukraine
**Kyrylo Honcharuk** та **Mykhailo Shuranov**, Founder & CEO та Founder & Communications Advisor CheckEye
**Maksym Khimchenko**, Director, State Enterprise "INFOTECH"
**Oleksandr Yefremov**, CEO Kitsoft
**Oleksandr Prokudin**, Senior Product Manager MODUS X
**Oleksiy Nishchuk**, Chief Growth Officer Genesis
**Yuliia Tychynska**, CEO, Co-founder Tayra

## and others experts

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UKRSIBBANK
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