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MECHANISMS FOR ATTRACTING FOREIGN INVESTMENT TO INCREASE THE COMPETITIVENESS OF THE UKRAINIAN IT SECTOR IN THE CONTEXT OF INDUSTRY 4.0

This article provides a comprehensive examination of the mechanisms that shape the international competitiveness of the Ukrainian IT sector in the context of Industry 4.0, offering an integrated assessment of how foreign direct investment (FDI), cross-border mergers and acquisitions (M&A) activity, and venture capital (VC) flows influence the sector's ability to generate long-term competitive advantages under conditions of heightened global uncertainty and war-related disruptions. Building on an empirical dataset, the study evaluates the dynamics of inward FDI, distinguishing between genuine new capital inflows and reinvested earnings, analyses the contraction of international M&A transactions and the partial substitution of foreign investment by domestic venture funding and constructs a competitiveness index that captures technological, structural, and cost-based parameters across a group of benchmark countries. The regression analysis confirms a strong relationship between investment activity and the sector's competitive trajectory, revealing that the decline of the Ukrainian innovation capacity, the dominance of outsourcing models, and the instability of institutional and regulatory frameworks have become key constraints on the formation of sustained competitive advantages. The findings demonstrate that, despite the sector's resilience and export potential, the imbalance between rapid IT export growth and insufficient inflows of new foreign capital undermines its ability to transition toward higher-value-added product models and deeper integration into global digital value chains. On this basis, the article substantiates the need for a multi-level system of investment-enhancing mechanisms, including the stabilisation of the «Diia.City» regime, the introduction of targeted R&D incentives, the development of public-private cluster partnerships (PPPs), and the strengthening of corporate governance practices, which together are essential for restoring investment attractiveness and reinforcing Ukrainian international competitiveness in the digital economy.

Keywords: *International competitiveness, IT sector, Foreign direct investment, Industry 4.0, Investment attractiveness, Innovation development.*

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МЕХАНІЗМИ ЗАЛУЧЕННЯ ІНОЗЕМНИХ ІНВЕСТИЦІЙ ДЛЯ ПІДВИЩЕННЯ КОНКУРЕНТОСПРОМОЖНОСТІ ІТ-СЕКТОРУ УКРАЇНИ В КОНТЕКСТІ ІНДУСТРІЇ 4.0

Стаття присвячена комплексному аналізу міжнародної конкурентоспроможності ІТ-сектору України в умовах розвитку Індустрії 4.0 та оцінюванню ролі іноземних інвестицій у формуванні його довгострокових конкурентних переваг. У роботі досліджено динаміку ПІІ, транскордонної M&A-активності та венчурного фінансування, виокремлено структурні диспропорції інвестиційних потоків і розраховано інтегральний індекс конкурентоспроможності у порівнянні України з основними країнами-конкурентами. Отримані результати демонструють наявність тісного зв'язку між інвестиційною активністю та позиціями галузі на світових ринках, тоді як домінування реінвестованих прибутків, зниження інноваційності та переважання аутсорсингових моделей стримують перехід до продуктів з більшою доданою вартістю. На основі аналізу обґрунтовано необхідність удосконалення механізмів залучення іноземного капіталу та розвитку державно-приватних інструментів підтримки ІТ-індустрії.

Ключові слова: *міжнародна конкурентоспроможність, ІТ-сектор, прямі іноземні інвестиції, Індустрія 4.0, інвестиційна привабливість, інноваційний розвиток.*

Problem statement. In the context of the structural transformations of the global economy, the accelerating pace of digitalisation, and the growing importance of Industry 4.0 technologies, the challenge of ensuring effective mechanisms for attracting foreign investment into Ukrainian IT sector becomes particularly relevant, since access to external capital largely determines the sector's ability to integrate into global markets, and despite the stable upward trajectory of IT exports, the investment development of the sector is constrained by a number of systemic limitations ranging from the instability of the regulatory environment and restricted access to long-term

financing to the insufficient structural diversification of business models and the slowdown in innovation activity, and this combination of factors weakens the capacity of IT companies to compete effectively on the international market, while the absence of functional mechanisms for attracting external capital inhibits the formation of long-term competitive advantages, which in turn creates an objective need to design mechanisms capable of ensuring a steady inflow of foreign investment as a key precondition for enhancing the sector's international competitiveness.

Analysis of recent research and publications. A substantial corpus of academic work has examined the competitiveness of the Ukrainian IT sector. In particular, G. Halkos and N. Tzeremes focus on the theoretical foundations of how competitiveness is formed across economic sectors [1], while V. Petrenko and A. Karnaushenko analyse the key factors and methods used to evaluate the competitiveness of the IT industry [2]. V. Puzikova investigates the current state of foreign investment inflows into Ukraine as well as the mechanisms through which such investments influence the development of industries [3]. However, despite the availability of significant academic contributions, a notable shortage of studies remains that comprehensively address the mechanisms for enhancing investment attractiveness and attracting foreign capital specifically to the Ukrainian IT sector, creating a distinct research gap and underscoring the relevance of conducting the present study.

Formulating the purposes of the article. To develop recommendations for improving the mechanisms for attracting foreign investment into the Ukrainian IT sector. Furthermore, the study aims to provide a comprehensive assessment of the Ukrainian IT industry's international competitiveness and to determine the impact of foreign investments on its long-term competitive advantages.

Presentation of the main research material. The initial step is to define the fundamental economic categories that form the theoretical foundation of the analysis. The concept of international competitiveness is fundamentally multilayered and complex, leading to the emergence of numerous academic approaches to its definition. In modern economic literature, the majority of researchers interpret international competitiveness as the capacity of an industry to operate efficiently and innovate under conditions of global competition, while maintaining stable market positions [1–2].

The competitiveness of the IT sector features several specific characteristics due to its operation in a highly dynamic and technologically advanced environment. Unlike traditional economic sectors, the IT sector is characterised by a rapid rate of technological change, intensified global competition, relatively low barriers to market entry, and a strong reliance on the quality of human capital [2, p. 4]. In this context, the further development of the sector is inseparably connected with the processes united by the concept of Industry 4.0, which is based on the integration of digital technologies, automation, artificial intelligence, and big data into production processes [4, p. 5]. It should be noted that for the IT sector, Industry 4.0 has a dual effect: on the one hand, it serves as one of the catalysts for increasing the productivity of the sector itself, and on the other hand, it creates conditions for the spreading of IT solutions across all spheres of the economy, thereby increasing demand.

A vital factor shaping and maintaining the competitiveness of any industry is the inflow of foreign investment. This involves long-term capital commitments made by non-residents in enterprises of another country, aiming to gain a level of managerial control [3]. Competitiveness increases as foreign capital enters, not only by enhancing the financial capacity of firms but also through technology transfer, the adoption of modern management practices, and the dissemination of innovations. These processes, in turn, boost labour productivity and improve the industry's capacity to integrate into global value-creation networks.

This influence is especially significant for the Ukrainian IT sector, as the sector is highly export-oriented, which fosters its strong integration into the global digital landscape and maintains consistently high demand for the services of local companies. At the same time, the IT sector holds a unique position among other branches of the Ukrainian economy. It has demonstrated steady progress in external trade and continues to hold strong prospects for further expansion. Over the last decade, IT exports from Ukraine have increased rapidly (at an average annual rate of approximately 18%), thereby gradually increasing the sector's weight in the national economy. By 2024, the value of exported IT services had surpassed $6,6 billion, roughly five per cent of the country's GDP [5]. Even during wartime, the IT sector has maintained a high level of activity, confirming its resilience and strategic importance for the Ukrainian economy.

Despite the positive dynamics of IT exports, the inflow of foreign investment into the sector remains unstable. This trend is clearly visible in the movements of FDI, as shown in Fig. 1. Although at first glance, these indicators appear to improve after the start of the war, in 2022–2024, FDI volumes fluctuated between $200 million and $500 million, exceeding pre-war average levels. However, a more detailed analysis reveals that most of these inflows are not related to new investments into Ukraine, but rather reflect the internal reinvestment of profits that foreign companies cannot repatriate due to forced restrictions. Before the war, reinvested profits accounted for approximately 60% of FDI in 2022–2024, increasing to around 95% afterwards. On the one hand, this indicates that foreign IT companies continue their operations in Ukraine, but on the other hand, it highlights the problem of the almost complete lack of new long-term investments.

At the same time, the dynamics of net FDI do not always adequately reflect actual investment activity, as a significant portion of the values is skewed by capital outflows or profit repatriation. Therefore, it is advisable to consider gross FDI inflows, which characterise the total volume of new investments without accounting for withdrawn funds. It is evident that a significant proportion of investments in the information technology sector are realised through M&A deals. As demonstrated in Fig. 2, from 2019 to 2021, the number and volume of M&A deals in the Ukrainian IT sector experienced active growth, driven by the global trend of increasing interest in digital technologies during the COVID-19 pandemic. Nevertheless, the share of foreign capital in the structure of such deals exceeded 80%. Starting from 2022, M&A volumes are expected to decrease, reaching a minimum of $10 million by 2024, while the participation of foreign capital is expected to have almost disappeared.

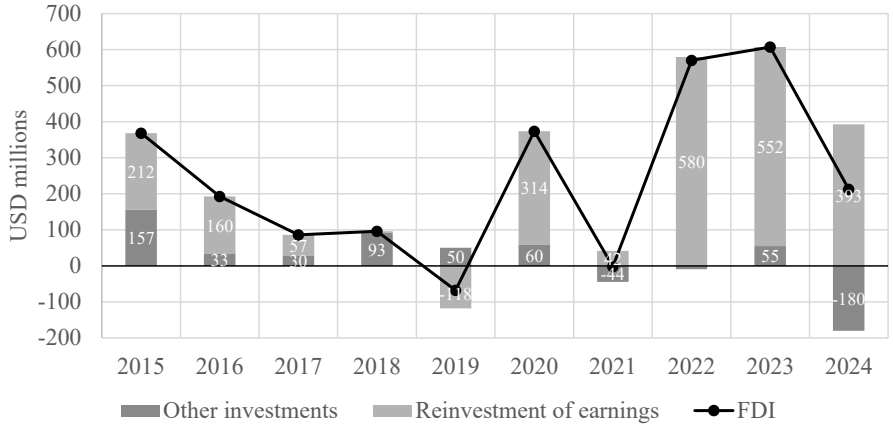

Figure 1. FDI in the IT Sector of Ukraine

Source: built based on data from [6]

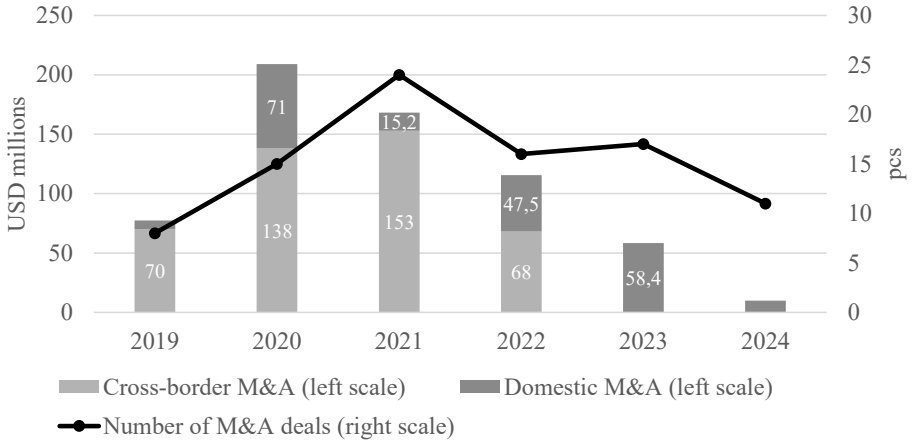

Figure 2. Dynamics of M&A Activity in the IT Sector of Ukraine

Source: built based on data from [6; 7]

However, despite the war, the main issues of investment development in the Ukrainian IT sector are systemic in nature. A significant problem is the structure of the Ukrainian IT market. A considerable portion of companies operate under outsourcing or outstaffing models, collectively accounting for about 50% of the sector, while the share of enterprises developing their own products does not exceed 31% [7, p. 11]. The development of a unique, innovative offering is hindered by such a structure, which in turn reduces investor interest.

In order to better understand the advantages of companies developing their own products, refer to Fig. 3, which illustrates the dynamics of VC, the main source of investment for new innovative product-type companies.

As demonstrated by the data, the dynamics of venture investments generally follow the trend characteristic of M&A deals. Nevertheless, wartime circumstances exhibit specific differences. Thus, VC volumes recovered quickly after 2022, mainly due to domestic investments, a significant share (approximately 35.7%) of which is state investments in the Defence Tech sector [7, p. 17]. At the same time, foreign VC, although reduced, continues to be present in the Ukrainian market, showing gradual growth. Notably, the total volume of VC investments in the IT sector over the past six years has more than doubled the volume of foreign direct investment in the same period.

Following thorough consideration of the trends in investment dynamics, the next step is to quantitatively assess the level of international competitiveness of the Ukrainian IT sector to subsequently determine the relationship between investment activity and the strengthening of the sector's position in global markets. To account for both quantitative and qualitative indicators of competitiveness, an integral index will be used, determined by the formula [8]:

$$I = \sum_{i=n}^{n} w_i \times x_i, \tag{1.1}$$

where: w_i – the weight coefficient of the indicator;

x_i – the normalized (min-max) value of the indicator;

n – the number of indicators.

Evaluating competitiveness requires identifying Ukraine's main competitor countries in the global digital services market. For this purpose, we refer to the "Digital Tigers 2023" report, prepared by the IT Ukraine Association [9], which states that Ukraine's key competitors in the international IT sector include India, Poland, the Czech Republic, and Brazil. The selection of

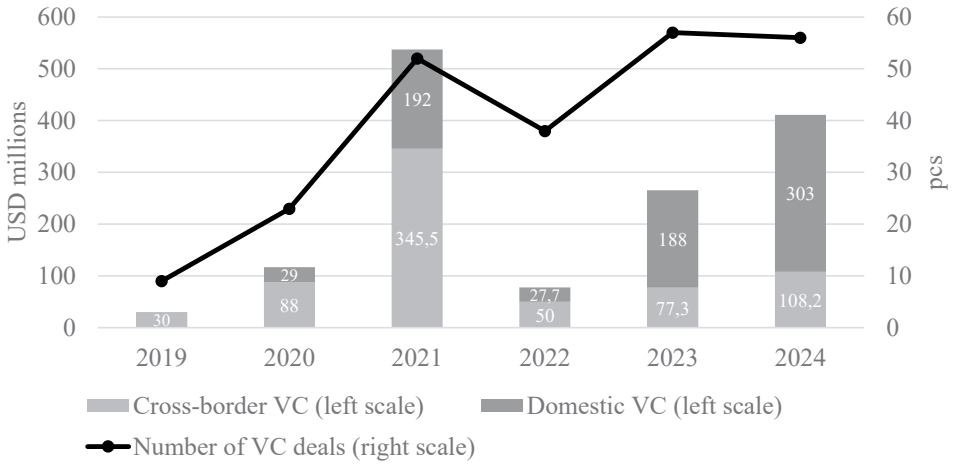

Figure 3. Dynamics of VC Investment in the IT Sector of Ukraine

Source: built based on data from [7]

these countries is determined by the export orientation of their IT industries and similar trading partners.

The next step is to identify a set of key parameters that most accurately reflect the competitive strengths of each country's IT sector. For this analysis, we focus on the following indicators:

– share of IT exports in total services exports, which helps capture the degree of a country's specialisation;

– labour productivity, used to assess production efficiency and the ability to generate high value added;

– cost of IT services, as pricing remains one of the major factors shaping international demand;

– R&D expenditures and the innovation index (developed by the World Intellectual Property Organization), since investment in research determines the sector's ability to maintain long-term competitiveness;

– IT Development Index (developed by the International Telecommunication Union), which serves as a composite measure of the quality of digital infrastructure.

The evaluation was conducted using Formula (1.1) and is based on five-year data (2020–2024) for the selected countries.

As demonstrated by the evaluation results (Fig. 4), Ukraine maintained the second position among the countries studied in terms of the international competitiveness of its IT sector until 2022. With the start of the war, the country's standing deteriorated noticeably – Ukraine fell to fourth place. However, in 2023, there was a partial rebound, as the index value allowed Ukraine to slightly surpass India, followed by another decline in the subsequent period. The data also suggests a shift in the Ukrainian closest competitor: before the war, Poland was the country most similar in terms of development level, whereas after 2022, it became India.

Ukraine's primary strengths persist in the high level of industry specialisation and the advantageous price-to-quality ratio of IT services, both of which strengthen the nation's standing in the international market. At the same time, innovation-related indicators worsened sharply after the outbreak of the war, and their values are now among the lowest within the group of analysed countries.

Considering the obtained results, it is expedient to analyse the relationship between international competitiveness and FDI volumes in order to verify the presence of such an influence. For this purpose, FDI values with a one-year lag are used and expressed in percentage terms to minimise excessive variation. The correlation–regression analysis (Fig. 5) confirms a statistically significant relationship, as all countries exhibit relatively high coefficients of determination, and the strength of this association increases with higher competitiveness levels, which is particularly evident for the Czech Republic

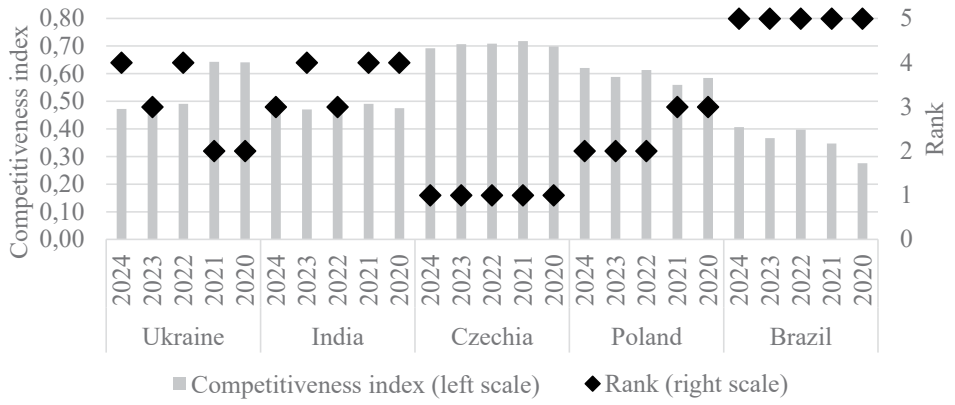

Figure 4. IT sector competitiveness comparison

Source: authors' calculations based on data from [6; 9–11]

and Poland, where R^2 exceeds 0,80. For Ukraine, the relationship also remains substantial, with an R^2 of 0,71, indicating that investment activity has a notable effect on the competitiveness dynamics of the IT sector.

Undoubtedly, the war and the risks surrounding it remain the dominant deterrents. However, no less significant are the structural constraints, overcoming which can substantially increase the investment attractiveness of the IT sector in conditions of hostilities. This, in turn, requires the development of new mechanisms for attracting foreign capital or the modernisation of those already in place. For analytical clarity, three levels of responsibility were distinguished.

At the level of state policy, the primary task is to improve the institutional and legal mechanisms, as a critically important precondition for attracting long-term FDI is ensuring the stability of the provisions in the special legal framework "Diia.City", particularly about taxation and residency requirements, and although its core parameters have been officially declared unchangeable for 25 years, in practice, frequent changes in regulatory requirements are observed, which undermine investor confidence [12]. Furthermore, it is advisable to reorient the legal regime of "Diia.City" not only towards attracting service companies but also towards encouraging product investments and R&D activities. Specifically, it is appropriate to introduce tax credits for significant R&D investments, as well as mechanisms for accelerated depreciation for investments in digital infrastructure, server equipment, etc. Another important step is the liberalisation of foreign-exchange regulation for "Diia.City" residents, especially by guaranteeing unrestricted repatriation of dividends and the return of invested capital.

To enhance investor trust, it is advisable to expedite the digitalisation of regulatory procedures, as fully transitioning all interactions between investment stakeholders and state authorities into a digital format would minimise the human factor and consequently reduce corruption risks. Additionally, it is necessary to intensify the harmonisation of Ukrainian legislation in the field of intellectual property with the relevant EU directives, which would not only facilitate European integration but also reinforce legal guarantees for international technology companies.

An additional aspect of state policy should involve establishing a risk absorption instrument for foreign investors, which anticipates the co-financing of investment projects with government participation in strategically significant sectors, particularly in Deep Tech and Defence Tech. The government's involvement in such joint projects would help mitigate some war-related risks, thereby providing an extra layer of guarantees and asset protection for foreign investors.

In the process of attracting foreign investment, the role of IT companies is no less significant. The majority of foreign capital entering the sector does so through VC and M&A transactions. It is therefore incumbent upon Ukrainian IT firms to focus on establishing a coherent and transparent business architecture. This should include the formation of an appropriate corporate structure. For small and medium-sized enterprises, this implies a gradual move away from the widespread use of individual entrepreneurs towards properly incorporated legal entities. For large companies, it means shifting to a holding-type model with a clearly articulated system of ownership and corporate governance.

Furthermore, it is recommended that IT companies proactively seek external financing by participating in international industry forums, investment summits, and professional networking events, including platforms such as Web Summit, the Consumer Electronics Show, Disrupt SF, etc. During these events, it is crucial to consistently cultivate a positive image of the Ukrainian IT sector by emphasising its technological strengths, the stability of its operational processes, and its capacity to fulfil contractual obligations even in the presence of wartime risks.

An essential precondition for enhancing investment attractiveness is the gradual transition from the dominant outsourcing model to the development of high-value proprietary IT products, as this shift creates the basis for attracting strategic investors willing to accept higher risks in exchange for access to innovative technologies. At the same time, the anticipated profitability of the product segment can partially offset the risks associated with the wartime environment. The principal strategic directions for company development are presented in Table 1.

The use of mixed mechanisms in the form of PPPs is an effective tool for consolidating efforts, distributing risks, and pooling financial resources, and this approach becomes particularly relevant under conditions of limited public funding.

One of the most effective approaches in this regard is the formation of partnerships within regional IT clusters

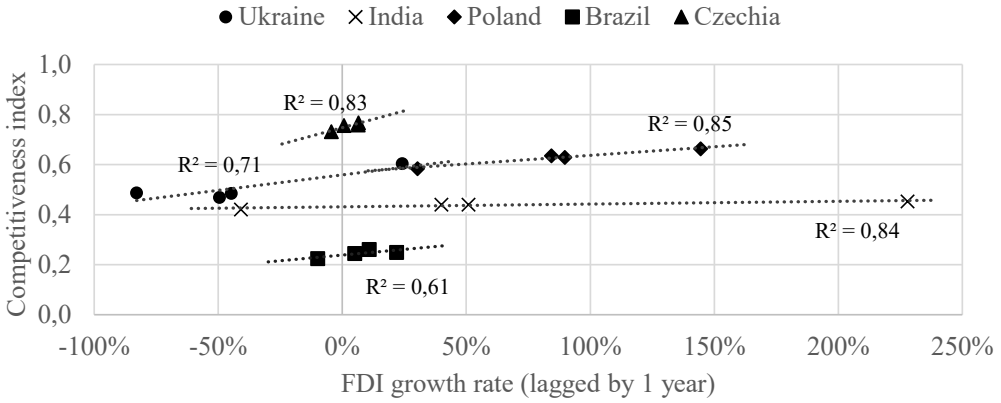

Figure 5. Relationship between FDI growth and IT sector competitiveness index

Source: built by the authors

Table 1

Prospective directions for the development of Ukraine's IT sector

IT Direction	Explanation	Investment attractiveness
Defence Tech	Military and defence-oriented IT solutions, including monitoring systems, autonomous platforms and data processing in combat conditions.	High: strong potential for public-private co-financing, as well as interest from venture and defence-focused funds.
Cybersecurity	Development of cybersecurity products and platforms, taking into account Ukrainian practical experience under conditions of cyber and hybrid warfare.	High: strong demand from international strategic and corporate investors, as well as specialised funds.
AI & ML	Intelligent algorithms for finance, healthcare, and industrial automation.	High: VC is interested in technological scaling and innovation.
e-Governance	Export of solutions based on the "Diia" model, including eID, digital document, and public service platforms, accompanied by IT consulting.	Medium: interest from international donors, developing-country governments, and IFIs (World Bank, GIZ, USAID).
IoT Solutions	Integrated solutions for Industry 4.0, logistics, energy, and infrastructure based on sensor systems and cloud technologies.	Medium: corporate capital shows interest, but this field requires physical production capacity and significant capital investment.

Source: built on the basis of data from [13]

to attract foreign investment and stimulate innovation activity. The essence of this model lies in combining the capital of the private sector and international investors with state support in order to jointly finance projects aimed at developing digital technologies and strengthening export potential, within the framework of PPPs, it is reasonable to establish joint venture funds focused on supporting IT start-ups and research initiatives, the financing of which would be carried out through the issuance of cluster bonds. Such an approach reduces investment risks and financial burdens, while creating a stable foundation for attracting long-term foreign capital.

A significant mechanism for attracting foreign investment into Ukrainian IT sector is the deepening of cooperation between universities and business, as such interaction forms the foundation of a full-fledged innovation ecosystem in which educational and research institutions generate new knowledge and technologies while the entrepreneurial sector ensures their effective commercialisation, and the establishment of joint research laboratories, technology parks, and business incubators at universities promotes the concentration of intellectual capital and signals to foreign investors the existence of a favourable environment for the development of high-tech business. Furthermore, close collaboration between academic institutions and private companies helps reduce investors' transaction risks by preparing a skilled workforce capable of working with advanced technologies and by creating stable channels for the transfer of knowledge and technological solutions. Ultimately, this model of interaction strengthens Ukrainian international reputation as an innovation hub and contributes to deeper integration into global value-creation chains.

Conclusions. The findings of the study provide substantial evidence that investment activity plays a pivotal role in shaping the international competitiveness of the Ukrainian IT sector, with the imbalance between the growth rate of IT exports and the instability of new FDI inflows creating strategic vulnerability in the sector. Despite maintaining operational stability during wartime, the investment structure predominantly relies on reinvested profits, thereby limiting opportunities for technological renewal and the entry of new foreign entity participants.

In this context, implementing an effective state policy is considered a crucial factor in enhancing Ukraine's competitive position. Such a policy must include not only the assurance of the stability of the "Diia.City" framework and the harmonisation of the regulatory environment with European standards, but also the creation of risk-sharing instruments capable of increasing the confidence of strategic investors in high-risk segments. It is equally important to acknowledge the efforts of businesses that are transitioning from an outsourcing model to developing high-technology products, which establish a resilient and innovative portfolio and possess the capacity to generate sustainable long-term value. Another essential component is the advancement of a PPPs ecosystem in which the synergy of resources from the state, the private sector, universities, and international institutions enables the formation of full-scale innovation hubs capable of attracting investment, supporting the start-up environment, and creating competitive technological solutions. It is precisely such a multi-level development model that has the potential to ensure the sustainable recovery and further growth of the Ukrainian IT sector, its deeper integration into global technological value chains, and the strengthening of its international standing in the context of Industry 4.0.

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