

СЕРІЯ «Соціальні та поведінкові науки»

UDC 615.1:338.45:339.92(477)

[https://doi.org/10.52058/3041-1254-2026-1\(23\)-1377-1392](https://doi.org/10.52058/3041-1254-2026-1(23)-1377-1392)

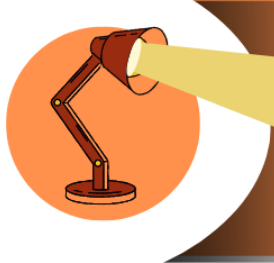
Petrenko Liudmyla Doctor of Economic Sciences, Professor, Kyiv National Economic University named after Vadym Hetman, Kyiv, <https://orcid.org/0000-0001-7851-9644>

STRATEGIC DESIGN OF BUSINESS RESILIENCE UNDER WARTIME CONDITIONS: RELOCATION AND GEOGRAPHICAL REORGANIZATION OF UKRAINIAN PHARMACEUTICAL COMPANIES

Abstract. Abstract. This article examines the condition and geographical transformations of the tangible assets of Ukraine’s pharmaceutical sector under wartime conditions, and systematizes the survival and adaptation strategies adopted by firms whose production and logistics resources have been damaged or destroyed. The study aims to assess the nature and scale of these transformations and to develop a typology of managerial responses to war-related risks. Methods: the analysis draws on in-depth interviews with representatives of the pharmaceutical industry, as well as the examination of empirical data, corporate reports, and sectoral analytics.

Results: a conceptual “resilience matrix” is proposed and visualized, structured around two critical variables - spatial vulnerability and capital mobility - serving as a tool for strategic planning. Prepared as of January 2026, the paper captures the ongoing structural shifts within the industry. Six core archetypes of pharmaceutical firms’ strategic responses to wartime threats are identified, differentiated by the degree of physical asset relocation and the depth of business model transformation: (1) “Fortress” (Immobile Defense) - refusal to relocate due to high asset specificity, coupled with investments in on-site autonomy and physical protection (Pharmaceutical Company “Zdorovya”, “Chervona Zirka” Chemical-Pharmaceutical Plant, “Stoma”, Viola Pharmaceutical Factory); (2) full relocation (The Phoenix Strategy) - dismantling and moving equipment, personnel, and technologies from combat/occupied areas to safer regions with the restoration of a full production cycle (Microkhim: Rubizhne → Kyiv);





(3) partial/hybrid relocation (Split Operations) - relocating critical lines or establishing a distributed structure in which, for example, R&D and production operate in different locations (Biolik: Kharkiv → Zhytomyr/Kharkiv); (4) virtual relocation (CMO Model) - loss of physical assets while retaining intellectual property, brand equity, and managerial capabilities, followed by a shift to contract manufacturing at external sites (Fitofarm: Bakhmut → CMO network within Ukraine); (5) expansion–duplication (Shadow Site) - building new capacities in safer regions of Ukraine or abroad, integrated into the existing value chain to hedge the core asset (Biopharma: Bila Tserkva + Uzhhorod; Lekhim Group: Kharkiv + Tashkent); and (6) logistics migration (Decentralization) - reconfiguring warehouse network topology by abandoning centralized hubs in favor of a network of regional warehouses in Western Ukraine (BaDM, Optima-Pharm: Kyiv/Dnipro → Lviv/Ivano-Frankivsk/Ternopil).

Conclusions. Despite unprecedented physical losses, Ukraine's pharmaceutical industry has demonstrated not only resilience but also features of antifragility: many firms have not merely restored operations, but have evolved into more viable organizational forms. The proposed typology of strategies and the resilience matrix offer a deeper understanding of the determinants of business survival under extreme conditions and can inform the design of crisis-management strategies.

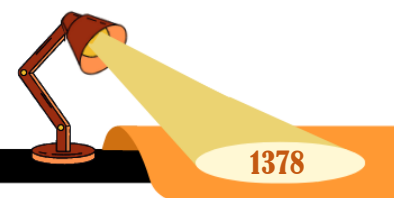
Keywords: economic security, uncertainty, strategy, cybersecurity, business resilience, economic efficiency, adaptation, investment decisions, competitiveness.

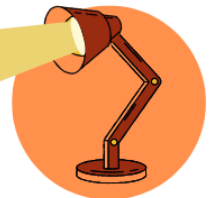
Петренко Людмила доктор економічних наук, професор, Київський національний економічний університет імені Вадима Гетьмана, м. Київ, <https://orcid.org/0000-0001-7851-9644>

СТРАТЕГІЧНА АРХІТЕКТОНІКА РЕЗИСТЕНТНОСТІ БІЗНЕСУ В УМОВАХ ВОЄННОГО КОНФЛІКТУ: РЕЛОКАЦІЯ ТА ПРОСТОРОВА РЕОРГАНІЗАЦІЯ ФАРМАЦЕВТИЧНИХ ПІДПРИЄМСТВ УКРАЇНИ

Анотація. Ця стаття присвячена аналізу стану та географічних трансформацій матеріальних активів української фармацевтичної галузі в умовах війни, а також систематизації стратегій виживання й адаптації підприємств, чії виробничі та логістичні ресурси зазнали руйнувань. Мета дослідження - оцінити характер і масштаби цих трансформацій та сформувані типологію управлінських рішень у відповідь на воєнні ризики. Методи: використано глибинні інтерв'ю з представниками фармацевтичного бізнесу, аналіз емпіричних даних, корпоративних звітів і галузевої аналітики.

Результати: візуалізовано концептуальну «матрицю стійкості» бізнесу за двома критичними змінними - просторовою вразливістю та мобільністю капіталу -



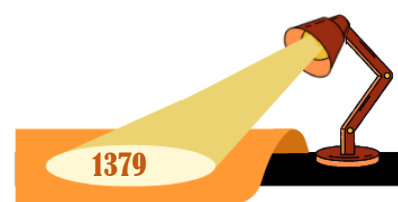


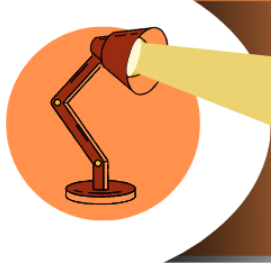
що може слугувати інструментом стратегічного планування. Статтю підготовлено станом на січень 2026 року; вона відображає актуальний перебіг структурних змін у галузі. Деконструйовано шість базових архетипів стратегічної реакції фармацевтичних компаній на воєнні загрози, що відрізняються рівнем фізичного переміщення активів і глибиною трансформації бізнес-моделі: (1) “Фортеця” (*Immobile Defense*) - відмова від релокації через високу специфічність активів і інвестиції в автономність та фізичний захист на місці (ТОВ «ФК “Здоров’я”», ПАТ «Хімфармзавод “Червона Зірка”», АТ «Стома», фармфабрика «Віола»); (2) повна релокація (*The Phoenix Strategy*) - демонтаж і переміщення обладнання, персоналу та технологій із зони бойових дій/окупації в безпечніший регіон із відновленням повного виробничого циклу (компанія «Мікрохім»: Рубіжне → Київ); (3) часткова/гібридна релокація (*Split Operations*) - переміщення критичних ліній або формування розподіленої структури, коли, наприклад, R&D та виробництво функціонують у різних локаціях (АТ «Біолік»: Харків → Житомир/Харків); (4) віртуальна релокація (*СМО Model*) - втрата фізичних активів за одночасного збереження інтелектуальної власності, бренду та управлінської компетенції з переходом до контрактного виробництва на зовнішніх майданчиках (ПрАТ «Фітофарм»: Бахмут → СМО-мережа в Україні); (5) розширення–дублювання (*Shadow Site*) - будівництво нових потужностей у безпечних регіонах України або за кордоном, які інтегруються в наявний ланцюг створення вартості й страхують основний актив (компанія «Біофарма»: Біла Церква + Ужгород; група «Лекхім»: Харків + Ташкент); (6) логістична міграція (*Decentralization*) - зміна топології складської мережі та відмова від централізованих хабів на користь мережі регіональних складів на Заході України (БадМ, «Оптіма-Фарм»: Київ/Дніпро → Львів/Івано-Франківськ/Тернопіль).

Висновки. Попри безпрецедентні фізичні втрати, українська фармацевтична галузь продемонструвала не лише стійкість, але й риси антикрихкості - багато компаній не просто відновили діяльність, а еволюціонували у більш життєздатні форми. Представлена типологія стратегій та матриця стійкості дозволяють глибше зрозуміти чинники виживання бізнесу в екстремальних умовах та можуть бути використані для розробки антикризових стратегій.

Ключові слова: економічна безпека, невизначеність, стратегія, кібербезпека, стійкість бізнесу, економічна ефективність, адаптація, інвестиційні рішення, конкурентоспроможність.

Problem Statement. As of January 2026, Ukraine’s economy is entering its fifth year of operating under a full-scale military conflict of the highest intensity since World War II. This period has become an unprecedented historical testing ground for validating classical approaches and developing new theories of crisis management. Traditional economic models designed for cyclical financial crises or pandemic shocks





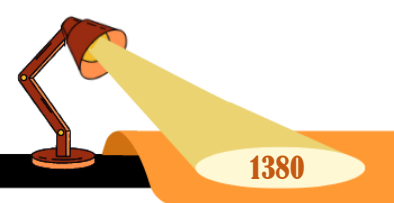
have proven insufficient to capture a reality in which the primary driver of volatility is not market dynamics, but a direct physical (“kinetic”) impact on the means of production.

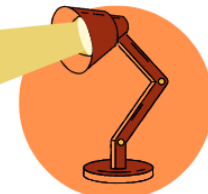
Russia’s full-scale invasion, launched on February 24, 2022, undermined the fundamental assumptions on which Ukrainian businesses had relied: the inviolability of borders, the security of logistics routes, and the physical integrity of assets. According to estimates by analytical centers, corporate-sector losses amount to hundreds of billions of US dollars. Yet rather than the anticipated collapse, a complex structural transformation has unfolded. Ukrainian businesses have demonstrated a phenomenon that goes beyond “resilience” - the ability to return to a previous state. Instead, the evidence points to a broad manifestation of “antifragility,” whereby systems improve their structure under stressors and evolve into new, more viable forms [1, 2, 3].

Prior to February 24, 2022, the architecture of Ukraine’s pharmaceutical industry was characterized by a high concentration of production capacity in the industrial hubs of the East (Kharkiv) and the Center (Kyiv), alongside centralized logistics organized around the Kyiv transport node. The full-scale war exposed the fundamental vulnerability of this model. The destruction of the central warehouses of leading distributors and the blockade of seaports dealt a severe blow to the sector’s logistics [1]. Over 2022–2025, a process of spatial reorganization has emerged, with the industry’s “center of gravity” shifting westward (Lviv, Uzhhorod, Ivano-Frankivsk), thereby forming a new axis of operational security.

Review of Recent Research and Publications. To systematize the empirical evidence, we draw on an expanded version of Dynamic Capabilities Theory. Originating from the resource-based view of the firm, this framework explains how enterprises survive and adapt in rapidly changing, turbulent environments. In the classic definition proposed by Teece and co-authors, dynamic capabilities are “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” [4]. In other words, dynamic capabilities capture organizational flexibility and adaptive capacity: firms that possess them can timely realign resources, processes, and competencies in response to external shocks or emerging opportunities.

Since Teece and colleagues’ seminal contributions in the 1990s, the theory has been further extended and specified. Eisenhardt & Martin (2000) emphasized that dynamic capabilities manifest as specific organizational and strategic “routines”-recurrent processes through which firms generate new resource configurations [5]. Such processes include new product development, the formation of strategic alliances, organizational restructuring, and related activities. Their analysis suggests that in moderately predictable markets, dynamic capabilities tend to take the form of established procedures and best practices, whereas in highly turbulent contexts they are



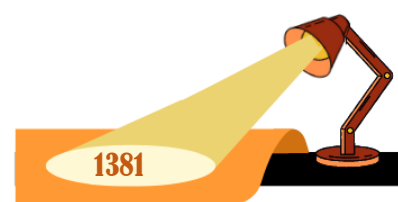


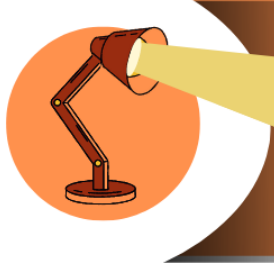
expressed through flexible, improvisational rules and rapid experimentation - i.e., an ability to “learn by doing.” Importantly, dynamic capabilities per se do not automatically ensure sustained competitive advantage; outcomes depend on how effectively a firm uses these capabilities to reconfigure its resource base in line with evolving market requirements - a point also underscored in Eisenhardt & Martin observations [5].

Further developments in the dynamic capabilities literature have refined the key components of this construct. According to Teece (2007), dynamic capabilities comprise three core managerial clusters: sensing (identifying and anticipating change), seizing (capturing opportunities), and transforming (reconfiguring the business) in response to external threats and opportunities [6]. Put differently, well-developed dynamic capabilities endow a firm with “strategic flexibility,” enabling it to first recognize emerging conditions, then rapidly decide and implement appropriate responses, and finally reconfigure its structure to sustain performance over the longer term [6]. Contemporary literature reviews (e.g., the content-analytic review by Schilke et al., 2018) confirm that the concept has become central to strategic management, while research increasingly focuses on how dynamic capabilities relate to environmental contingencies and where their boundary conditions lie [7]. In particular, substantial knowledge has accumulated regarding the antecedents of dynamic capabilities, their internal dimensions, and their performance implications across contexts ranging from relatively stable markets to crisis situations [7].

The application of dynamic capabilities theory in contexts of war and extreme crises is of particular interest, as such environments are characterized by radical uncertainty and the disruption of established structures. Under these conditions, a firm’s ability to rapidly “reinvent” business processes, reorient supply chains, and mobilize new resources becomes a critical determinant of survival [8, 9]. A growing body of empirical research indicates that, in crisis settings, firms with more developed dynamic capabilities tend to demonstrate stronger resilience. For example, Makkonen et al. (2014), analyzing the aftermath of the 2008 global financial crisis, found that North American firms that succeeded in developing innovative and flexible capabilities not only navigated the crisis more effectively but also strengthened their competitive positions [8]. In a different context, Mansour et al. (2019), focusing on tourism organizations in Libya during a protracted armed conflict, showed that firms that cultivated dynamic capabilities were better able to adapt to sustained wartime turbulence and remain operational - most notably by combining crisis management with innovation and by enhancing organizational resilience [9]. In other words, dynamic capabilities constitute a foundation for resilience: they enable enterprises to simultaneously withstand destructive shocks and reconfigure themselves in ways that allow crisis conditions to become a catalyst for business model renewal [8, 11].

The relevance of the dynamic capabilities approach has increased markedly following the onset of Russia’s full-scale war against Ukraine in 2022. The war has





caused large-scale disruptions in supply chains, the loss of production assets in active combat zones, and mass relocation of enterprises - conditions that require unprecedented levels of organizational flexibility. Recent research has begun to document and theorize this experience. In particular, Obrenovic et al. (2024), drawing on a systematic review, proposed a conceptual model explaining how firms can sustain performance during wartime by deploying internal dynamic capabilities in the sourcing domain [10]. They emphasize that when established supply arrangements collapse, “resilient” enterprises rapidly leverage human capital, infrastructure, and technological resources to secure alternative inputs and materials, thereby maintaining production continuity. Consequently, even under wartime conditions, companies can survive and avert business shutdowns if they possess well-developed dynamic capabilities - namely, the ability to sense changes, swiftly reconfigure operations, and effectively realign organizational structures to new wartime realities [8, 10].

The objective of the study is to investigate how the war has reshaped the spatial organization of tangible assets in Ukraine’s pharmaceutical sector and to classify the survival and adaptive responses of firms affected by the destruction of production and logistics infrastructure.

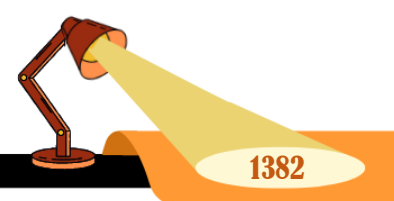
Main body of the paper. Bridging established theoretical lenses with wartime managerial practice, we argue that the explanatory power of dynamic capabilities becomes fully visible only when it is “refracted” through the material constraints and spatial realities faced by firms under kinetic risk. In peacetime, the reconfiguration of resources is often analyzed primarily as a strategic choice shaped by markets and competition. Under war conditions, however, strategic choice is bounded by physical exposure, infrastructure fragility, and the technological (im)possibility of moving production systems. Consequently, the firm’s capacity to sense, seize, and transform must be interpreted not only as an organizational attribute, but also as a function of where assets are located and how mobile they are.

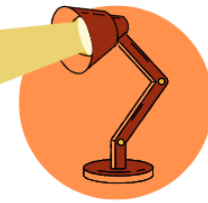
Against this backdrop, we propose to conceptualize business transformation through two critical variables:

- Spatial Vulnerability:** the degree of physical threat to assets as a function of their geographic location (conventionally, the “red,” “orange,” and “green” wartime risk zones).

- Capital Mobility:** the technological feasibility of relocating means of production and business processes (on a continuum from highly mobile sectors such as IT to largely immobile chemical and biotechnology plants).

At the intersection of these dimensions lies a decision space, which we visualize as a “resilience matrix.” This model is intended to provide an analytical foundation for assessing firms’ strategic actions depending on the level of threat and the mobility of their assets.





Zone / Risk level	Low capital mobility	Medium capital mobility	High capital mobility
High risk	“Fortress” (Immobile Defense) / “Virtual Relocation”	Partial / “Hybrid relocation”	“Phoenix” (Full relocation)
Moderate risk	“Shadow Site” (Expansion / Duplication)		“Decentralization” (Logistics migration)
Safe zone	<i>Standard operations</i>	<i>Standard operations</i>	<i>Standard operations</i>

Fig. 1. Business Resilience Matrix - typology of business transformations during wartime based on indicators of spatial vulnerability

Based on an analysis of the operating practices of relocated and war-affected pharmaceutical enterprises, we identify six baseline behavioral archetypes (Fig. 1). To enable a systematic interpretation of these processes, we classify firm strategies by (i) the extent of physical asset relocation and (ii) the depth of business-model transformation.

1. Fortress (Immobile Defense). This is a “hold-the-ground” strategy typical of enterprises with critically low asset mobility located in high-risk areas (the “red” zone). The firm effectively converts its production site into an autonomous, highly protected node - an operational “island of safety.” The strategic emphasis shifts from efficiency optimization to security and self-sufficiency: firms invest in energy independence (on-site generators and alternative power sources), physical fortification of facilities, and close coordination with local military and civil administrations.

A representative case is provided by the Kharkiv-based manufacturers Zdorovya and Chervona Zirka, two of the region’s largest producers, which have adopted - or were compelled to adopt, given asset specificity - the Fortress strategy. Their production of solid and sterile dosage forms cannot be rapidly relocated without substantial loss of functionality: complex water-treatment systems, HVAC infrastructure, and sterile cleanroom environments are embedded in the buildings’ fixed capital, such that dismantling is functionally equivalent to destroying the production system. Establishing a new GMP-compliant plant for a large-scale producer such as Zdorovya (with more than 300 product items) is estimated to require several hundred million US dollars and typically entails a 2–3-year validation period at the new site. As of early 2026, Zdorovya continues to operate in Kharkiv, supplying analgesic and psychotropic medicines for frontline and hospital needs. The company has invested in autonomy (generators, wells) and enhanced physical security of its facilities; there is no evidence of production lines being relocated outside the region.



The Chervona Zirka plant (specializing in herbal medicines and solid dosage forms) likewise remains in the region. Its adaptation has been primarily logistical: finished goods are no longer stored at the production site; instead, inventories have been geographically diversified across distributors' warehouses in central Ukraine, thereby minimizing stock exposure within the strike zone.

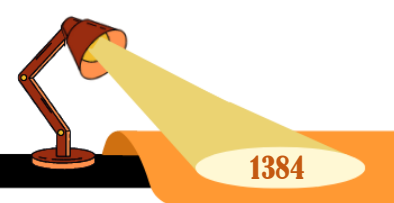
JSC "Stoma" — a Ukrainian manufacturer of artificial teeth, dental materials, and medicinal products, founded in 1929 as the Kharkiv Plant of Medical Plastics and Dental Materials. Today, it is one of the largest medical enterprises in Ukraine. The company demonstrates relative resilience thanks to its niche focus and the specifics of its products: dental materials (including artificial teeth and acrylic materials), as well as medicinal products in ointment/gel forms, do not require the same stringent aseptic manufacturing conditions as vaccines or infusion solutions. This enables "Stoma" to manage production and inventory more flexibly. The company's core assets remain in Kharkiv and operate under heightened security; production has not been relocated, but the logistics hub has been decentralized to ensure export continuity [13, 14].

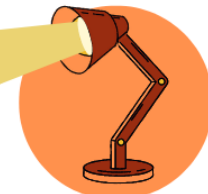
Another Fortress example is the Viola pharmaceutical factory in Zaporizhzhia, which continues operating in a frontline city. Despite proximity to the active combat line and repeated missile attacks, the enterprise has not relocated; rather, it has made substantial investments in operational autonomy. Following the destruction of the Kakhovka Hydroelectric Power Plant and ensuing water-supply disruptions, Viola established strategic water reserves and upgraded purification systems - critical for the production of liquid dosage forms (syrups, tinctures) [17]. These measures have enabled the factory to function as a key supply node for frontline hospitals, particularly for wound-care materials and antiseptics.

2. Full Relocation (The Phoenix Strategy). This strategy entails the complete transfer of physical assets and personnel, followed by the restoration of the full production cycle at a new site. It is typically adopted by firms operating in the "red" zone that possess sufficient capital mobility - i.e., the technical and organizational capacity to dismantle, transport, and reinstall equipment, technologies, and key staff.

A representative case is Microkhim (Rubizhne, Luhansk region). This flagship manufacturer, whose assets remained in occupied Rubizhne, implemented the Phoenix strategy after its production facilities were seized and destroyed. Microkhim evacuated its R&D team, documentation, and – critically - stocks of active pharmaceutical ingredients to Kyiv. Supported by grant funding and the preservation of its R&D core, the company restored production on leased sites and established a new operational base in the capital. This case illustrates a context in which intellectual capital proved more decisive than the physical "walls" of the plant.

3. Partial / Hybrid Relocation (Split Operations). This intermediate strategy involves relocating selected critical lines and/or establishing a distributed organizational architecture (e.g., geographically separating R&D and manufacturing).





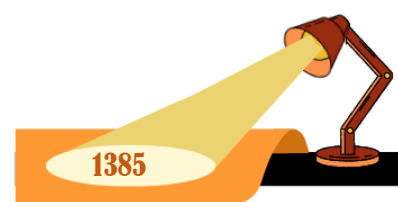
The firm retains its primary production site within the risk zone but evacuates, duplicates, or decentralizes the most vulnerable and strategically significant segments of production.

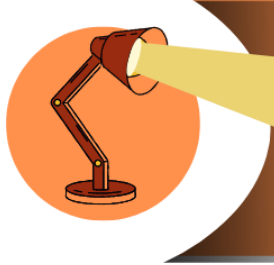
A representative case is Biolik (Kharkiv → Zhytomyr). The Kharkiv-based company Biolik Pharma, specializing in immunobiological products and vaccines, pursued a hybrid relocation of critical technologies. Given the proximity of its facilities to the Russian border (north of Kharkiv, along the Belgorod axis), the enterprise was repeatedly exposed to shelling. According to management estimates, up to 50% of capacity was damaged or lost, including the key production line for DTP vaccines (against pertussis and diphtheria) [12]. Rather than relocating to Western Ukraine - where building a new plant from scratch would require years - the company opted to move part of its operations to Zhytomyr. In 2023, Biolik acquired a suitable facility in Zhytomyr and transferred surviving equipment to re-establish vaccine production. The new site was rapidly adapted to GMP requirements, reducing time-to-launch relative to greenfield construction. The company plans to employ approximately 200 staff in Zhytomyr (compared to about 450 employees in Kharkiv before the war). Thus, while the Kharkiv legal entity and some operations remain, the firm physically relocated its most vulnerable, high-technology segment to a safer region, creating a distributed production structure.

4. Virtual Relocation (Virtual Relocation / CMO Model). This strategy involves the complete loss of physical assets and a shift to an asset-light operating model: the enterprise retains intellectual property, brands, and its marketing/development team, while outsourcing manufacturing to partners' contract facilities (i.e., through a Contract Manufacturing Organization (CMO) arrangement). In effect, the firm transforms from an integrated manufacturer into a “virtual” pharmaceutical company.

A representative case is Fitofarm (Bakhmut). The company's plant in Bakhmut was completely destroyed as a result of hostilities. During the war, the firm did not attempt to rebuild production capacity; instead, it implemented a Virtual Pharma model. By preserving its portfolio of established brands, patents, and market-facing competencies, Fitofarm placed production orders with other Ukrainian manufacturers under contract. This enabled the company to maintain market presence without large-scale capital expenditures in “concrete and steel,” while shifting production risks to outsourcing partners. In practical terms, Fitofarm became a marketing and distribution-oriented firm that manages product portfolios without owning its own manufacturing base.

5. Expansion–Duplication (Strategic Shadowing). This strategy entails building new capacities in safer locations (Western Ukraine and/or abroad) that are integrated into the existing value chain as a reserve - effectively a “shadow” duplicate of the core asset. It is typically adopted by firms operating near the boundary of the



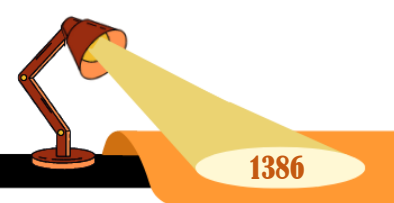


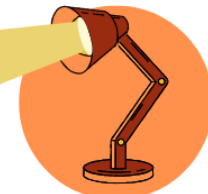
“orange” zone (relatively safer regions that remain exposed to strike risk) whose assets are largely immobile. Rather than relocating existing facilities, these firms invest in parallel production capacity in safer territories to hedge risk and enable subsequent scaling.

Illustrative cases include Biopharma (Bila Tserkva + Uzhhorod), Farmak (Kyiv + Barcelona), and the Lekhim Group (Kharkiv + Tashkent). One of the largest wartime investments is Biopharma’s new blood plasma fractionation plant in Uzhhorod (approximately €80 million) [16]. This “shadow site” in Zakarpattia complements the company’s main facility in Bila Tserkva (Kyiv region) and functions as a geographic hedge: Zakarpattia is widely regarded as one of Ukraine’s safest regions and borders four EU countries, so relocating a critical stage of processing high-value inputs (blood plasma) to Uzhhorod reduces exposure to wartime risks. If the Bila Tserkva plant were damaged, the Uzhhorod site could be expanded toward a full-cycle configuration (as envisaged in the project’s second phase). In addition, the location strengthens export optionality: Biopharma plans to process plasma not only from Ukraine but potentially from the EU, which would have been logistically more constrained from the country’s center under wartime conditions. Importantly, the Uzhhorod plant is not conceived as an autonomous replacement but as a duplicate integrated into the existing chain: in the first phase (launch expected in 2026), it will produce intermediate plasma fractions that are then transported back to Bila Tserkva for final purification and filling. In other words, Bila Tserkva remains the core node, while Uzhhorod provides redundancy and capacity expansion.

The Lekhim Group offers another example of diversification as risk protection. Its production complex at Lekhim-Kharkiv remained largely intact throughout 2022–2025, and the company even modernized the site (relocating and protecting refrigeration units and upgrading ventilation systems) to strengthen operational autonomy. At the same time, the group’s primary “risk-escape” vector is international: it is building a manufacturing facility within **Tashkent Pharma Park** (Uzbekistan) valued at more than US\$40 million [15]. This constitutes the creation of a full-fledged duplicate asset in an alternative jurisdiction, hedging the group against the risk of a complete loss of its production base in Ukraine.

6. Logistics Migration / Distribution Decentralization (Logistical Redundancy). A distinct set of wartime transformations has occurred in the logistics infrastructure of Ukraine’s pharmaceutical sector. The largest medicine distributors, which previously concentrated warehousing capacity in Kyiv and Dnipro, shifted - following the destruction of key facilities - toward a distributed warehouse network across western and central regions. This strategy entails the creation of a redundant and geographically diversified inventory-storage system designed to withstand targeted strikes on logistics nodes. Firms are moving away from large centralized hubs toward networks of smaller regional warehouses, some of which are located in underground





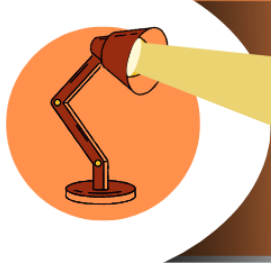
or otherwise protected premises (“inventory bunkerization”). Operationally, this has driven a transition from Just-in-Time to Just-in-Case logistics, with firms accepting higher operating costs in exchange for improved supply reliability and continuity.

At the start of the full-scale war, pharmaceutical distribution in Ukraine was concentrated in three national companies, each operating one or two mega-hubs in the East and/or Center of the country. While this centralized model delivered economies of scale, it proved structurally vulnerable under kinetic risk. During 2022–2025, warehouse infrastructure was repeatedly targeted. In particular, Optima-Pharm lost its central warehouse in Kyiv due to missile strikes in August and October 2025 (losses estimated at approximately US\$100 million and the destruction of up to 20% of the country’s monthly medicine stock), and also lost a facility in Dnipro [18]. In December 2025, BaDM completely lost its newly built logistics center in Dnipro (43,000 m²), with damages exceeding UAH 5 billion; earlier, hubs in Irpin and Poltava had also been destroyed [19]. Venta.LTD faced an additional legal constraint: 24% of the company’s assets were frozen due to the Russian origin of capital, temporarily limiting its ability to maneuver operationally [20]. Nevertheless, Venta has relied on its modern automated warehouse in Ternopil (opened in 2016) as the principal operational stronghold in western Ukraine [21].

The new geography of warehousing: in response to these shocks, all major distributors have moved toward logistics decentralization. In 2025, BaDM launched an investment program of approximately US\$100 million to build five new warehouse complexes; key locations include Ivano-Frankivsk (as the new primary hub), as well as Vinnytsia and Odesa [22]. The stated objective is to double total warehouse capacity to roughly 120,000 m² by 2027 by dispersing inventories nationwide. Optima-Pharm has likewise expanded western capacity by installing mezzanine, multi-level racking systems at existing warehouses in Lviv and the village of Uhryniv (Ivano-Frankivsk region), increasing storage density in safer areas [23]. As a result, the logistics “backbone” of Ukraine’s pharmaceutical market has effectively shifted toward the Lviv–Uzhhorod–Ivano-Frankivsk axis. This reconfiguration has not only strengthened supply resilience during the war but also creates enabling conditions for the integration of Ukrainian pharmaceuticals into the European supply-security architecture as a manufacturing partner.

Logistics decentralization almost inevitably increases the importance of digital coordination processes: the lower the concentration of warehousing and the greater the number of regional nodes, the more complex the “handoffs” between ordering, picking, and routing become, and thus the higher the requirements for rapid communications, reliable connectivity, and the resilience of WMS/ERP/EDI layers. In the Ukrainian context, this dependency is especially visible: even when transport remains physically operational, cyber incidents can sharply reduce the throughput of digital services (for example, in March 2025 a cyberattack on Ukrzaliznytsia disrupted online services,



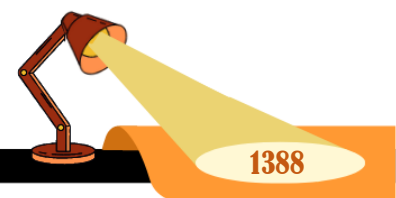


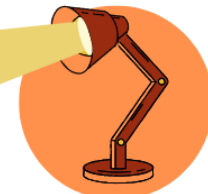
including online freight services, forcing a temporary shift to paper-based documentation/workarounds), while the December 2023 attack on the telecom operator Kyivstar demonstrated how a connectivity outage can cascade into dispatching and “warehouse–transport–pharmacy” coordination. Against this backdrop, it is critical to understand the vulnerability of the European model: “cyber incidents can instantly disable ordering, picking, and dispatch through the failure of WMS/ERP/EDI layers—turning ‘distributed warehouses’ into ‘distributed downtime.’” This is well illustrated by the German case: on 28 October 2024, the pharmaceutical wholesaler AEP (supplying more than 6,000 pharmacies) [24] was hit by a targeted ransomware attack that partially encrypted its IT systems; the company shut down external connections, was largely unreachable by phone/email, and restoring ordering and deliveries took more than a week, with customers reporting delays and restrictions—meaning that a digital disruption immediately translated into a last-mile supply risk without any physical strikes on warehouses. At the same time, in wartime Ukraine there have been no cases where a cyberattack specifically on a Ukrainian national pharmaceutical distributor resulted in a similarly prolonged paralysis of WMS/ERP/EDI and mass supply disruptions; however, Germany’s AEP experience should be considered a practical risk scenario as logistics decentralization deepens and dependence on digital layers increases.

Conclusions. The analysis confirms that Ukraine’s pharmaceutical sector demonstrates a distinctive form of resilience. Firms with high technological mobility of assets - particularly knowledge-intensive producers such as Microkhim - have been able to relocate successfully and restore operations in safer regions. By contrast, large-scale manufacturers with “heavy,” largely immobile asset bases (e.g., Zdorovya, Biopharma) have predominantly pursued on-site fortification strategies or invested in duplicative “shadow” facilities in western locations. In this way, the sector has not only withstood the shock but has also undergone adaptive reconfiguration.

A defining trend over 2023–2025 has been the decisive westward reorientation of pharmaceutical logistics infrastructure. Supply chains have been redesigned to account for wartime risks: instead of concentration in Kyiv and Dnipro, the system now relies on a network of logistics nodes in western Ukraine (including Lviv, Uzhhorod, Ivano-Frankivsk, among others). This shift has strengthened the resilience of domestic supply during the war and has simultaneously brought Ukrainian pharmaceuticals closer to the European supply-chain security architecture.

The proposed resilience matrix and strategy typology enable the wartime survival experience of firms to be synthesized in a structured manner. They demonstrate that organizational transformation capacity is a critical determinant of competitiveness under conditions of extreme turbulence. Companies that were able to rapidly reconfigure operations - through relocation, diversification, or other adaptive mechanisms - not only avoided collapse but also gained opportunities to strengthen





their market positions in the new environment. These conclusions have practical relevance for crisis-management strategies grounded in the principles of antifragility and long-term business resilience.

References:

1. Derevianko, O. H. (2017). Study of stability and antifragility of reputation in view of multi-vector character of reputation management of enterprises. *EUREKA: Social and Humanities* (5), 48–56. <https://media.neliti.com/media/publications/297274-study-of-stability-and-antifragility-of-8bcaead.pdf>.
2. Taleb, N. N. (2012). *Antifragile: Things That Gain from Disorder*. Random House.
3. Paliiev, V. I. (2025). Factors influencing the antifragility of business organizations under conditions of global instability. *Scientific Notes of KNEU*, (3(40)), 102–108. https://doi.org/10.33111/vz_kneu.40.25.03.15.102.108.
4. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z).
5. Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, 21(10–11), 1105–1121. [https://doi.org/10.1002/1097-0266\(200010/11\)21:10/11<1105::AID-SMJ133>3.0.CO;2-E](https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E).
6. Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of sustainable enterprise performance. *Strategic Management Journal*, 28(13), 1319–1350. <https://doi.org/10.1002/smj.640>.
7. Schilke, O., Hu, S., & Helfat, C. E. (2018). Quo vadis, dynamic capabilities? A content-analytic review of the current state of knowledge and recommendations for future research. *Academy of Management Annals*, 12(1), 390–439. <https://doi.org/10.5465/annals.2016.0014>.
8. Makkonen, H., Pohjola, M., Olkkonen, R., & Koponen, A. (2014). Dynamic capabilities and firm performance in a financial crisis. *Journal of Business Research*, 67(1), 2707–2719. <https://doi.org/10.1016/j.jbusres.2013.03.020>.
9. Mansour, H. E. L., Holmes, K., Butler, B., & Ananthram, S. (2019). Developing dynamic capabilities to survive a crisis: Tourism organizations' responses to continued turbulence in Libya. *International Journal of Tourism Research*, 21(4), 493–503. <https://doi.org/10.1002/jtr.2277>.
10. Obrenovic, B., Godinic, D., & Njavro, M. (2024). Sustaining company performance during the war-induced crisis using sourcing capability and substitute input. *Environment, Development and Sustainability*, 26, 30001–30026. <https://doi.org/10.1007/s10668-023-03892-9>.
11. Venkatesh, V. C., & Prashar, A. (2021). Dynamic capabilities in crises: A state of the art review. *Academy of Strategic Management Journal*, 20(3), 1–18. <https://www.abacademies.org/articles/Dynamic-capabilities-in-crises-a-state-of-the-art-review-1939-6104-20-3-775.pdf>.
12. Zhytomyr.info. (2024, June 27). *Na okolytsi Zhytomyra relokovane farmpidpriemstvo z Kharkova planuie vidkryty tsekh po vyrobnytstvu vaktsyn* [On the outskirts of Zhytomyr, a relocated pharmaceutical enterprise from Kharkiv plans to open a workshop for vaccine production]. Retrieved January 8, 2026, from https://www.zhitomir.info/news_221997.html [in Ukrainian].
13. STOMA JSC. (n.d.). Official website. Retrieved January 8, 2026, from <https://www.stoma.kharkov.ua/>.
14. Kharkiv Regional Military Administration. (2023). *Analiz potentsiinykh klasteriv Kharkivskoi oblasti* [Analysis of potential clusters of Kharkiv region]. Retrieved January 8, 2026, from <https://kharkivoda.gov.ua/content/documents/431/43045/files/Аналіз%20Харківська.pdf> [in Ukrainian].
15. Slobodnichenko, M., Pytel, L., Isaieva, O., Lukyanchuk, Y., Pilkiewicz, M., & Hrabova, I. (2025). *Stronger Together: Ukraine's Pharmaceutical Sector and EU Partnerships*. Kyiv: Morion. 208 p.





16. Ukraine Business News (UBN). (2025, September 24). A Ukrainian pharmaceutical company is building an €80M pharmaceutical production plant in Uzhhorod. Retrieved January 8, 2026, from <https://ubn.news/a-ukrainian-pharmaceutical-company-is-building-an-e80m-pharmaceutical-production-plant-in-uzhhorod/>.

17. Zaporizka miska rada. (2025, April 11). *Yak pratsiuie fabryka «Viola»* [How the “Viola” factory operates]. Retrieved January 8, 2026, from <https://zp.gov.ua/news/212076-iak-praciuje-fabrika-viola> [in Ukrainian].

18. Kohanets, R. (2025, November 15). *Russian Drone Attack Wipes Out Another Ukrainian Medicine Warehouse*. UNITED24 Media. Retrieved January 8, 2026, from <https://united24media.com/latest-news/russian-drone-attack-wipes-out-another-ukrainian-medicine-warehouse-13463>.

19. Dzheripa, A. (2025, December 7). *Russian strike on Dnipro destroyed UAH 5 billion worth of medicines at one of the largest suppliers*. LIGA.net. Retrieved January 8, 2026, from <https://news.liga.net/en/politics/news/russian-strike-on-dnipro-destroyed-uah-5-billion-worth-of-medicines-at-one-of-the-largest-suppliers>.

20. Institute of Legislative Ideas (IZI Institute). (2025, September 24). *What is happening with the frozen assets of “Venta.LTD” - one of the largest pharmaceutical distributors in Ukraine?* Retrieved January 8, 2026, from https://izi.institute/en/news/What_is_happening_with_the_frozen_assets_of_Venta_LTD/.

21. Venta.LTD. (n.d.). *About company*. Retrieved January 8, 2026, from <https://www.ventald.com.ua/en/about>.

22. InVenture. (2025, October 29). *Ukrainian Pharma Distributor BaDM to Invest \$100 Million in Building Five New Warehouses*. Retrieved January 8, 2026, from <https://inventure.com.ua/en/news/world/ukrainian-pharma-distributor-badm-to-invest-dollar100-million-in-building-five-new-warehouses>.

23. VITANT GROUP. (2025, March 12). *Design, manufacture and installation of a mezzanine to increase warehouse space and the number of cargo handling operations*. Retrieved January 8, 2026, from <https://www.vitangroup.com/en/2025/03/12/design-manufacture-and-installation-of-a-mezzanine-to-increase-warehouse-space-and-the-number-of-cargo-handling-operations/>.

24. Koch, M.-C. (2024, November 1). *Cyber-attack on pharmaceutical distributor AEP*. heise online. Retrieved January 8, 2026, from <https://www.heise.de/en/news/Cyber-attack-on-pharmaceutical-distributor-AEP-10001220.html>

Література:

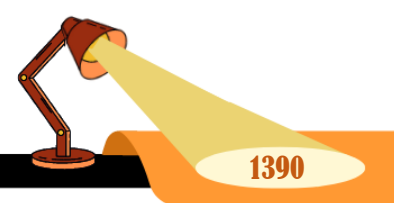
1. Derevianko O. H. *Study of stability and antifragility of reputation in view of multi-vector character of reputation management of enterprises*. EUREKA: Social and Humanities. 2017. No. 5. P. 48–56. <https://media.neliti.com/media/publications/297274-study-of-stability-and-antifragility-of-8bcaeaad.pdf>

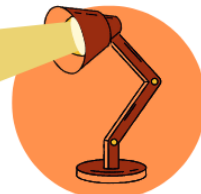
2. Taleb N. N. *Antifragile: Things That Gain from Disorder*. Random House, 2012.

3. Paliiev V. I. *Factors influencing the antifragility of business organizations under conditions of global instability*. Scientific Notes of KNEU. 2025. No. 3(40). P. 102–108. https://doi.org/10.33111/vz_kneu.40.25.03.15.102.108

4. Teece D. J., Pisano G., Shuen A. *Dynamic capabilities and strategic management*. Strategic Management Journal. 1997. Vol. 18, No. 7. P. 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z)

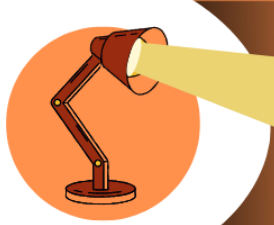
5. Eisenhardt K. M., Martin J. A. *Dynamic capabilities: what are they?* Strategic Management Journal. 2000. Vol. 21, No. 10–11. P. 1105–1121. [https://doi.org/10.1002/1097-0266\(200010/11\)21:10/11<1105::AID-SMJ133>3.0.CO;2-E](https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E)





6. Teece D. J. *Explicating dynamic capabilities: the nature and microfoundations of sustainable enterprise performance*. Strategic Management Journal. 2007. Vol. 28, No. 13. P. 1319–1350. <https://doi.org/10.1002/smj.640>
7. Schilke O., Hu S., Helfat C. E. *Quo vadis, dynamic capabilities? A content-analytic review of the current state of knowledge and recommendations for future research*. Academy of Management Annals. 2018. Vol. 12, No. 1. P. 390–439. <https://doi.org/10.5465/annals.2016.0014>
8. Makkonen H., Pohjola M., Olkkonen R., Koponen A. *Dynamic capabilities and firm performance in a financial crisis*. Journal of Business Research. 2014. Vol. 67, No. 1. P. 2707–2719. <https://doi.org/10.1016/j.jbusres.2013.03.020>
9. Mansour H. E. L., Holmes K., Butler B., Ananthram S. *Developing dynamic capabilities to survive a crisis: Tourism organizations' responses to continued turbulence in Libya*. International Journal of Tourism Research. 2019. Vol. 21, No. 4. P. 493–503. <https://doi.org/10.1002/jtr.2277>
10. Obrenovic B., Godinic D., Njavro M. *Sustaining company performance during the war-induced crisis using sourcing capability and substitute input*. Environment, Development and Sustainability. 2024. Vol. 26. P. 30001–30026. <https://doi.org/10.1007/s10668-023-03892-9>
11. Venkatesh V. C., Prashar A. *Dynamic capabilities in crises: a state of the art review*. Academy of Strategic Management Journal. 2021. Vol. 20, No. 3. P. 1–18. <https://www.abacademies.org/articles/Dynamic-capabilities-in-crises-a-state-of-the-art-review-1939-6104-20-3-775.pdf>
12. На околиці Житомира релоковане фармпідприємство з Харкова планує відкрити цех по виробництву вакцин – Житомир.інфо, - Режим доступу: https://www.zhitomir.info/news_221997.html (дата звернення: 08.01.2026).
13. STOMA JSC. Official website. Available at: <https://www.stoma.kharkov.ua/> (accessed January 8, 2026).
14. Аналіз потенційних кластерів Харківської області [Електронний ресурс]. – Харківська обласна військова адміністрація. -Харків: ХОВА, 2023. – Режим доступу: <https://kharkivoda.gov.ua/content/documents/431/43045/files/Аналіз%20Харківська.pdf> (дата звернення: 08.01.2026).
15. Slobodnichenko M., Pytel L., Isaieva O., Lukuanchuk Y., Pilkievich M., Hrabova I. *Stronger Together: Ukraine's Pharmaceutical Sector and EU Partnerships*. - Kyiv: Morion, 2025. - 208 p.
16. A Ukrainian pharmaceutical company is building an €80M pharmaceutical production plant in Uzhhorod. – UBN (Ukraine Business News), Available at: <https://ubn.news/a-ukrainian-pharmaceutical-company-is-building-an-e80m-pharmaceutical-production-plant-in-uzhhorod/> (accessed January 8, 2026).
17. Як працює фабрика «Віола» – Запорізька міська рада, - Режим доступу: <https://zr.gov.ua/news/212076-iaak-praciuje-fabrika-viola> (дата звернення: 08.01.2026).
18. Russian Drone Attack Wipes Out Another Ukrainian Medicine Warehouse – UNITED24 Media, Available at: <https://united24media.com/latest-news/russian-drone-attack-wipes-out-another-ukrainian-medicine-warehouse-13463> (accessed January 8, 2026).
19. Russian strike on Dnipro destroyed UAH 5 billion worth of medicines at one of the largest suppliers – LIGA.net, Available at: <https://news.liga.net/en/politics/news/russian-strike-on-dnipro-destroyed-uah-5-billion-worth-of-medicines-at-one-of-the-largest-suppliers> (accessed January 8, 2026).
20. What is happening with the frozen assets of “Venta.LTD” — one of the largest pharmaceutical distributors in Ukraine? – IZI Institute, Available at: https://izi.institute/en/news/What_is_happening_with_the_frozen_assets_of_Venta_LTD/ (accessed January 8, 2026).
21. About company – Venta.LTD, Available at: <https://www.ventaltd.com.ua/en/about> (accessed January 8, 2026).





22. Ukrainian Pharma Distributor BaDM to Invest \$100 Million in Building Five New Warehouses – InVenture, Available at: <https://inventure.com.ua/en/news/world/ukrainian-pharma-distributor-badm-to-invest-dollar100-million-in-building-five-new-warehouses> (accessed January 8, 2026).

23. Design, manufacture and installation of a mezzanine to increase warehouse space and the number of cargo handling operations – Vitant Group, Available at: <https://www.vitantgroup.com/en/2025/03/12/design-manufacture-and-installation-of-a-mezzanine-to-increase-warehouse-space-and-the-number-of-cargo-handling-operations/> (accessed January 8, 2026).

24. Koch, M.-C. Cyber attack on pharmaceutical distributor AEP [Електронний ресурс]. heise online. 01.11.2024. Режим доступу: <https://www.heise.de/en/news/Cyber-attack-on-pharmaceutical-distributor-AEP-10001220.html> (accessed January 8, 2026).