



Lessons for the West from Ukraine on Operations and Supply Chains

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Abstract

The war in Ukraine has become one of the most closely studied conflicts by Western militaries because it has highlighted how modern operations and military supply chains perform under sustained, high-intensity combat. The war in Ukraine has highlighted that military success depends not only on combat power but also on the ability to sustain operations under constant attack. Western militaries and policymakers have drawn several important lessons about operations and supply chains. The paper examines the major lessons learned from Ukraine war and provides recommendations for governments and industries seeking to build more resilient supply chains. This paper argues that operational success depends as much on resilient supply chains as on combat power. Also, the Russia–Ukraine war has demonstrated that critical infrastructure and supply chains are central elements of modern warfare, not just supporting functions. In the first part, this paper explains the critical infrastructure-supply chain nexus. In the second part, explains the importance of having resilient supply chains and logistics during the war, whereas in the last part summarizes the lesson learnt for the West from Ukraine on operation and supply chains.

Keywords: *Supply Chains Resilience; Ukraine War; Logistics; EU; NATO; U.S; Defense Industry; Risk Management*

I. The importance of resilient critical infrastructure

The critical infrastructure–supply chains nexus refers to the interdependent relationship between essential infrastructure systems and the supply chains that enable them to operate. Critical infrastructure includes assets, systems, and networks that are essential for the functioning of society and the economy, such as energy, transportation, water, telecommunications, healthcare and financial infrastructure. Critical infrastructure depends on secure, resilient supply chains for the materials, equipment, technology, services, and workforce needed to operate. At the same time, supply chains themselves rely on functioning critical infrastructure—such as transportation, energy, communications, and water systems—to move goods and maintain operations.

Disruptions in one can quickly cascade into the other, creating economic, security, and public safety risks. For example, a cyberattack disrupts an electricity grid, manufacturing plants stop production, transportation systems experience delays, hospitals face shortages of medical supplies and consumers experience shortages and rising prices. Similarly, a shortage of semiconductor chips can delay maintenance of power grids, telecommunications networks, vehicles, and defense systems.

The Russia–Ukraine war has demonstrated that critical infrastructure and supply chains are central elements of modern warfare, not just supporting functions. Both sides have targeted infrastructure to weaken military capability, economic resilience, and civilian morale.

II. Supply chains and logistics during the war

- ***Supply chains are now part of the battlefield.***

What we have witnessed, Ukraine has consistently targeted Russian logistics rather than only frontline forces. Recent Ukrainian drone operations have extended this approach deep behind Russian lines, targeting large logistics hub, fuel storages, bridges and road and railway infrastructure forcing Russia to use longer, more expensive, and less efficient supply routes.¹ The objectives were reducing fuel available for Russia's military, lowering export revenues that help finance the war, and increasing the economic cost of continuing the conflict. Recent reporting indicates that these attacks have disrupted refinery operations and contributed to fuel shortages in parts of Russia. Traditionally, rear-area logistics operated with relative safety, but the war in Ukraine has shown that supply trucks, maintenance units, repair facilities, fuel convoys may all be targeted by drones, missiles, electronic warfare, and cyber-attacks, which requires logistics personnel to train for camouflage, deception, dispersion, rapid movement and air defense integration.² Therefore, ***digital logistics are essential*** because it was shown that modern operations depend heavily on real-time inventory tracking, battlefield communications, satellite connectivity, predictive maintenance, data sharing across units, while at the same time these systems must remain functional under cyber-attack and electronic warfare.

- ***Cheap systems can have strategic effects.***

The war has challenged assumptions that only expensive platforms provide decisive capability. Drones have transformed the battlefield, especially low-cost drones costing hundreds or thousands of dollars have destroyed tanks, artillery, ships, and air-defense systems worth of hundreds of millions of dollars. This suggests future supply chains must support high-volume production and continuous adaptation rather than relying solely on a small number of exquisite platforms.³

- ***Resilience matters more than efficiency.***

Many Western logistics systems have been optimized for cost and efficiency using on-time principles, whereas the war in Ukraine has demonstrated that in high-intensity conflict, resilience is often

¹ S. Kullab & D. Zhyhinas, (2026), Ukrainian midrange drones reshape the battlefield by targeting Russian supply lines, Publisher: Associated Press. <https://apnews.com/article/russia-ukraine-midrange-drones-war-c0909dbcc38d597142d1c662979c8406>

² M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

³ S. Kullab & D. Zhyhinas, (2026), Ukrainian midrange drones reshape the battlefield by targeting Russian supply lines, Publisher: Associated Press. <https://apnews.com/article/russia-ukraine-midrange-drones-war-c0909dbcc38d597142d1c662979c8406>

Y. Trofimov (2026), There's a New Way of War, but Is It Evolution or Revolution?, The Wall Street Journal <https://www.wsj.com/world/war-tech-change-c22ec6d6>

more valuable than efficiency. Among the other implications, as most important include the need for larger stockpiles of ammunition, fuel, and spare parts, especially in war time; having multiple supply routes rather than reliance on a few major hubs in order to ensure fast and on-time delivery of supplies; and change the mind-set of the political-military leadership to accept redundancy as a military necessity rather than waste.⁴ Subsequently, **large logistics hubs are vulnerable**. The conflict has shown that certain infrastructure such as fixed depots, large fuel storage sites, rail junctions, bridges and common posts are “easy targets” because they can all be struck by long-range missiles and drones. Therefore, in order to adapt to the current situation and to strengthen the resilience and defense capabilities it is important to make the logistics distributed, mobile, concealed, and rapidly relocatable, or in other words **"disaggregate to survive, reaggregate when needed."**⁵

- **Industrial capacity is a strategic weapon.**

The conflict has demonstrated that sustained warfare consumes enormous quantities of artillery shells, drones, missiles, vehicles and replacement parts, which made many Western countries to realize that decades of reduced production left them with limited surge capacity. Therefore, the Western countries need to maintain its production lines, to invest in their domestic manufacturing, to secure critical suppliers and to coordinate allied critical suppliers and allied production.⁶ Therefore, **allied interoperability is critical**. Ukraine's experience illustrates both the benefits and challenges of receiving equipment from multiple partners. Western forces can improve effectiveness by standardizing ammunition where possible, using interoperable communications, harmonizing maintenance procedures, simplifying spare-parts management across allies.

- **The speed of procurement is decisive during conflicts.**

Ukraine has dramatically shortened the cycle from battlefield feedback to fielding improved equipment. Rather than years-long acquisition programs, Ukrainian companies frequently receive frontline feedback to redesign systems, test prototypes, and deploy improvements within days or weeks.⁷ This rapid innovation cycle contrasts with many Western procurement systems that can take years to deliver new capabilities.

- **Adaptability is the overarching lesson.**

Perhaps the most significant lesson is organizational rather than technological. Ukraine has repeatedly demonstrated advantages through rapid decision-making, decentralized innovation and close collaboration between soldiers and industry, whereas for Western militaries, the challenge is fostering institutions that can adapt at the pace of modern warfare rather than relying on procurement and planning cycles measured in years.⁸ Enhancing supply chain resilience requires a balanced approach that combines technology, diversified sourcing, effective risk management, strong supplier collaboration, and flexible operations. While building resilience often requires additional investment, it helps organizations reduce risks, adapt to changing conditions, and maintain reliable operations in an increasingly uncertain global environment.

⁴ M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

⁵ Ibid.

⁶ Ibid.

⁷ S.Baker, (2026), Ukraine's defense industry edge is that it can test in days, not months or years, Business Insider, <https://www.businessinsider.com/ukraines-defense-industry-edge-tests-days-not-months-or-years-2026-7>

⁸ Ibid.

- **Weaponization of energy**

The **weaponization of energy** in the Russia–Ukraine war refers to the use of energy resources, infrastructure, and energy markets as tools to achieve military, political, and economic objectives rather than purely commercial ones. It has been a defining feature of the conflict since Russia's full-scale invasion in February 2022. Russia has used **energy as a geopolitical weapon** in several ways:⁹

- **by reducing gas supplies to Europe:** Before and during the early stages of the war, Russia sharply reduced natural gas exports to several European countries, particularly through pipelines such as Nord Stream. The aim was widely seen as increasing energy prices, creating economic pressure, and weakening European support for Ukraine;
- **through price manipulation,** Russia has lowered gas supplies contributed to record energy prices in Europe during 2022, increasing inflation and raising concerns over energy shortages; and
- **to gain political leverage:** Countries highly dependent on Russian gas faced difficult choices between maintaining sanctions and ensuring affordable energy for households and industry by choosing Russia as a main energy supplier.

III. EU and NATO support for Ukraine during the war

III-1. EU's support for Ukraine.

As of mid-2026, the **European Union and its 27 member states** report that they have provided **€215.2 billion** in total support to Ukraine since Russia's full-scale invasion began in February 2022.¹⁰ Russia has used energy exports and attacks on infrastructure to exert pressure on Ukraine and Europe, while Ukraine has increasingly targeted Russian energy assets to weaken Moscow's war-financing capacity. Therefore, European Union has continued to target Russia's "shadow fleet" designed to reduce Russia's oil revenues which are considered a major source of funding for its war against Ukraine, while maintaining stability in global energy markets. Russia's shadow fleet consists of hundreds of oil tankers used to transport Russian crude oil and petroleum products outside the reach of Western sanctions. These vessels often operate through complex ownership structures, frequently change names and flags of registration, use insurers and service providers outside Western jurisdictions and sometimes disable automatic identification systems (AIS) or conduct ship-to-ship transfers to obscure cargo origins.

Some of the key measures are **blacklisting vessels** which includes prohibiting access to EU ports and from receiving a broad range of maritime services from EU operators¹¹, **targeting operators and facilitators** that include shipping companies, insurers, traders, and individuals alleged to facilitate sanctions evasion and connected to Russia's military-industrial complex¹², **restricting maritime services**

⁹ Boute A. Weaponizing Energy: Energy, Trade, and Investment Law in the New Geopolitical Reality. American Journal of International Law. 2022;116(4):740-751. doi:10.1017/ajil.2022.53 Weaponizing Energy: Energy, Trade, and Investment Law in the New Geopolitical Reality | American Journal of International Law | Cambridge Core <https://researchonline.lse.ac.uk/id/eprint/120195/>

¹⁰ European Commission, (2026), EU Assistance to Ukraine, https://commission.europa.eu/topics/eu-solidarity-ukraine/eu-assistance-ukraine_en

¹¹ European Council, (2026), Timeline – EU sanctions against Russia, <https://www.consilium.europa.eu/en/policies/sanctions-against-russia/timeline-sanctions-against-russia/> The EU has sanctioned hundreds of tankers believed to be part of the shadow fleet. Sanctioned ships are

¹² European Council, (2026), Russia's war of aggression against Ukraine: new EU sanctions target energy revenues, the military-industrial complex, propaganda and human rights violations,

such as insurance, maintenance, financing, and technical support for vessels involved in transporting Russian oil in violation of sanctions¹³, and **closing circumvention routes** that includes targeting ports, logistics networks, and companies in third countries that are alleged to help the shadow fleet evade sanctions. At the same time, enforcement remains challenging. Therefore, the **European Union (EU)** and the **United States (U.S.)** have coordinated efforts to target Russia's "**shadow fleet**" as part of broader sanctions efforts. The EU and U.S. coordinate closely with other G7 partners through intelligence sharing on sanctions evasion, harmonizing sanctions and vessel designations where possible, promoting compliance with the G7 oil price cap, and strengthening maritime monitoring and enforcement. Nevertheless, while sanctions have increased the operational costs and complexity of Russian oil exports, Russia has continued exporting significant volumes by adapting its shipping and trading networks.¹⁴ As a result, the EU and U.S. have continued to update and expand sanctions to address evolving methods of evasion.

III-2. NATO's role and support for Ukraine

Ukraine's wartime supply chains and NATO's role are closely connected, but they are not the same thing. Ukraine is **not a NATO member**, though it has received extensive support from NATO countries and NATO-coordinated programs.

NATO itself does not directly fight in Ukraine. Instead, it coordinates and supports assistance provided by member states through initiatives such as ¹⁵ training Ukrainian forces, coordinating military aid deliveries, supporting logistics planning, helping Ukraine improve interoperability with NATO equipment, providing non-lethal assistance such as communications equipment, medical supplies, and logistics support through programs like the Comprehensive Assistance Package with over **€1.4 billion** in contributions for non-lethal assistance as of June 2026.¹⁶ A major coordination effort is NATO Security Assistance and Training for Ukraine (NSATU), which helps organize the delivery of equipment and training from Allied countries.¹⁷ Since Russia's full-scale invasion in February 2022, NATO Allies have collectively provided **well over €200 billion** in military, financial, and humanitarian assistance to Ukraine, with military support accounting for a substantial share. The exact total continues to rise as new packages are announced.¹⁸

As discussed, Ukraine faces several persistent logistical supply chain challenges. Russian strikes on transportation infrastructure, high consumption rates of artillery ammunition, maintaining both older Soviet-designed equipment and newer Western systems simultaneously, rapid repair and replacement of damaged equipment, protecting supply routes from drones and long-range missiles. The introduction of Western weapons also required new maintenance systems, new spare parts inventories, and different ammunition standards, making logistics more complex. The war has influenced NATO's own thinking about logistics and industrial capacity, and some of the key lessons include increased production of

<https://www.consilium.europa.eu/en/press/press-releases/2026/06/15/russia-s-war-of-aggression-against-ukraine-new-eu-sanctions-target-energy-revenues-the-military-industrial-complex-propaganda-and-human-rights-violations/>

¹³ Herbert Smith, Freehills Kramer, (2026), Sanctions Tracker: EU's 20th sanctions package targets energy revenues, the shadow fleet and financial circumvention, <https://www.hsfkramer.com/notes/crt/2026-05/sanctions-tracker-eu-sanctions-package-targets-energy-revenues-the-shadow-fleet-and-financial-circumvention>

¹⁴ Ibid.

¹⁵ NATO, NATO's support for Ukraine, <https://www.nato.int/en/what-we-do/partnerships-and-cooperation/natos-support-for-ukraine>

¹⁶ NATO, Comprehensive Assistance Package (CAP) for Ukraine, <https://www.nato.int/en/what-we-do/partnerships-and-cooperation/comprehensive-assistance-package-cap-for-ukraine>

¹⁷ NATO, (2026), NATO's support for Ukraine, <https://www.nato.int/en/what-we-do/partnerships-and-cooperation/natos-support-for-ukraine>

¹⁸ Ibid.

ammunition and missiles, building more resilient defense-industrial supply chains, expanding maintenance and repair facilities closer to Europe¹⁹, adopting faster procurement and innovation cycles, particularly for drones and counter-drone technologies.²⁰

In sum, Ukraine's wartime supply chain has become a highly adaptive network designed to sustain military operations under attack. NATO's contribution has largely been to coordinate, train, and facilitate the flow of military and non-military assistance from Allied countries while drawing lessons to strengthen its own logistics and defense-industrial systems.

Conclusion

The conflict demonstrates that resilient supply chains are not merely an economic asset but critical component of national security and long-term economic stability. Ukraine's experience in the war has highlighted that **operational success depends as much on resilient supply chains as on combat power**. Also, the Ukraine war illustrates that energy is not only an economic commodity but also a strategic instrument of state power. The conflict has accelerated changes in global energy policy and highlighted the importance of resilient, diversified energy systems. Nevertheless, there is growing pessimism among leading scholars about the future security of global supply chains who argue that *“as shocks and economic conflict become more frequent, disruptions to the trade order that once seemed unthinkable have become increasingly common”*.²¹ Therefore, for Western militaries, several lessons stand out:

¹⁹ S.Siebold, (2026), US plans PAC-3 missile maintenance facility in Europe, Reuters, <https://www.reuters.com/business/aerospace-defense/us-talks-europe-missile-co-production-source-says-2026-07-07/>

²⁰ S.Baker, (2026), NATO can't just stockpile millions of drones and hope they'll still matter in the next war, officials warn, Bussiness Insider, <https://www.businessinsider.com/nato-cant-stockpile-lots-drones-maybe-out-date-next-war-2026-7>

²¹ Tufts University, March 27, 2026, workshop Supply Chain Conflict: Lessons from the Russia-Ukraine War and China-U.S. Economic Relations hosted by Russia and Eurasia Program and the Center for International Environment and Resource Policy (CIERP) <https://sites.tufts.edu/fletcherrussia/supply-chain-conflict-lessons-from-the-russia-ukraine-war-and-china-u-s-economic-relations/>

	Challenges	Lesson learned
1.	Logistics is a decisive combat capability:²² Russia's early invasion exposed the consequences of weak logistics: fuel shortages, abandoned vehicles, and stalled offensives. Ukraine, by contrast, repeatedly targeted Russian fuel, ammunition, bridges, rail hubs, and depots, demonstrating that attacking logistics can produce operational effects disproportionate to the resources employed.	Western forces should treat logistics as a primary warfighting function rather than a supporting activity.
2.	On time logistics are too vulnerable:²³ Many Western militaries adopted lean inventories after decades of expeditionary operations. Ukraine has shown that in high-intensity warfare ammunition consumption is enormous, replacement equipment is needed rapidly, and disrupted transport networks can halt operations.	Resilience often matters more than efficiency. Larger stockpiles and redundant supply routes become strategic assets.
3.	Supply chains must be dispersed:²⁴ Large logistics hubs are now highly vulnerable to drones, precision missiles, satellite surveillance, and electronic intelligence.	Ukraine has increasingly dispersed depots into smaller, mobile locations that are harder to detect and destroy. Western implication: • smaller warehouses, • frequent relocation, • camouflage, • deception, • rapid reconstitution after attack.

²² D. Davydenko, M. Khvostova, D. Kryvosheiev, O. Lyman, (2022), Lessons for the West: Russia's military failures in Ukraine, ECFR – European Council on Foreign Relations <https://ecfr.eu/article/lessons-for-the-west-russias-military-failures-in-ukraine/>

M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

²³ Ibid.

²⁴ M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

S. Kullab & D. Zhyhinas, (2026), Ukrainian midrange drones reshape the battlefield by targeting Russian supply lines, Publisher: Associated Press. <https://apnews.com/article/russia-ukraine-midrange-drones-war-c0909dbcc38d597142d1c662979c8406>

4.	Speed of adaptation matters:²⁵ Ukraine has created unusually short feedback loops between soldiers and manufacturers. Equipment is modified within days or weeks rather than years, allowing rapid adaptation to changing battlefield conditions. Western procurement systems are generally much slower.	Lesson: • decentralized procurement, • rapid prototyping, • continuous battlefield feedback, • modular equipment upgrades.
5.	Commercial technology is a force multiplier:²⁶ Ukraine has integrated commercial drones, satellite internet, civilian mapping software, smartphones, additive manufacturing (3D printing), commercial imagery etc. This has lowered costs and accelerated innovation.	Western militaries should better integrate commercial technologies alongside traditional defense systems.
6.	Supply chains are now contested everywhere:²⁷ Historically, logistics areas behind the front line were relatively secure. Ukraine has demonstrated that no rear area is safe. Supply convoys, railways, fuel storage, ports, and repair facilities can all be targeted hundreds of kilometers from the front.	Operational implication: • logistics units require air defense, • electronic warfare protection, • mobility, • deception, • survivability training.
7.	Industrial capacity is a strategic weapon:²⁸ The war has become one of sustained production. Success depends on the ability to manufacture artillery shells, drones, missiles, replacement vehicles, and spare parts.	Ukraine has relied heavily on Western industrial support, while NATO countries have recognized that decades of reduced production capacity left them with insufficient surge capability.
8.	Multi-modal transportation is essential:²⁹ Ukraine has relied on combinations of rail, trucks, civilian vehicles, drones, temporary bridges, and alternative routes.	When one network is disrupted, another must compensate. Western planning increasingly emphasizes redundancy rather than dependence on a single transportation mode.

²⁵ S.Baker, (2026), Ukraine's defense industry edge is that it can test in days, not months or years. Business Insider, <https://www.businessinsider.com/ukraines-defense-industry-edge-tests-days-not-months-or-years-2026-7>

²⁶ M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

²⁷ Ibid.

S. Kullab & D.Zhyhinas, (2026), Ukrainian midrange drones reshape the battlefield by targeting Russian supply lines, Publisher: Associated Press.<https://apnews.com/article/russia-ukraine-midrange-drones-war-c0909dbcc38d597142d1c662979c8406>

²⁸ C.Stelzenmuller et al, (2023), Lessons from Ukraine, Brookings Institute, <https://www.brookings.edu/articles/lessons-from-ukraine/>

²⁹ NATO, (2023), RUSSIAN WAR AGAINST UKRAINE LESSONS LEARNED CURRICULUM GUIDE, nato.int/content/dam/nato/webready/documents/deep/231208-RusWar-Ukraine-Lessons-Curriculum-Guide-en.pdf
M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

9.	Data and visibility drive logistics: ³⁰ Effective operations require near-real-time knowledge of inventory, equipment status, transportation routes, and battlefield demand.	Digital logistics systems improve forecasting and resource allocation, especially in fast-moving operations.
10.	Logistics and operations must be planned together: ³¹ Ukraine has demonstrated that operational plans and sustainment plans cannot be separated. Long-range strikes increasingly focus on fuel, ammunition, maintenance, and transportation infrastructure.	Conversely, operational maneuver often depends on protecting and sustaining these logistics networks.
	Overall takeaway The conflict suggests a shift from logistics systems optimized for peacetime efficiency to	Key takeaway: The central lesson for Western militaries is that resilience has become as
Takeaways:	systems designed for wartime resilience. The key themes are: • resilience over efficiency, • distributed rather than centralized supply networks, • rapid industrial adaptation, • protection of logistics assets, • large-scale production capacity, • continuous innovation informed by frontline experience. These lessons are influencing military planning across NATO and other Western defense organizations as they reassess readiness for potential high-intensity conflict.	important as efficiency. Future operations will require logistics systems that are dispersed rather than centralized, redundant rather than optimized, rapidly adaptable rather than bureaucratic, digitally connected, protected against precision strike, drones, cyber-attacks, and electronic warfare. In high-intensity conflict, like the Ukraine war, the side that can continuously generate combat power through resilient supply chains is likely to maintain the operational advantage, even if it begins with fewer forces.

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³⁰ NATO, (2023), RUSSIAN WAR AGAINST UKRAINE LESSONS LEARNED CURRICULUM GUIDE, nato.int/content/dam/nato/webready/documents/deep/231208-RusWar-Ukraine-Lessons-Curriculum-Guide-en.pdf
M. Slusher, (2025), Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience, Center for Strategic and International Studies, <https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience>

³¹ L.Freedman, (2023), Modern Warfare: Lessons from Ukraine, Lowy Institute, <https://www.lowyinstitute.org/publications/modern-warfare-lessons-ukraine>