

Strategic Vulnerabilities in Western Ammunition Production: Insights from the Ukraine War

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The war in Ukraine has placed significant strain on ammunition supplies, exposing critical vulnerabilities in the defence supply chains, as well as the production and distribution capacities of both Ukraine and its allied militaries. Reports indicate that Ukraine is firing approximately 5,000 artillery shells per day, equating to around 2 million per year. This level of consumption far exceeds Western pre-war production capacity (Axe, 2025; Gressel, 2024), Ukraine's domestic production rate and current Western allied capabilities (Gressel, 2024). Many contemporary Western defence systems are designed for efficiency and rely heavily on globalised supply chains, stockpiles, on-demand manufacturing. This has been suitable for stabilised periods and routine operations, but not for heavily sustained conflict (Hellberg and Lundmark, 2025). Whilst this reduces costs and maintains readiness under peaceful conditions, it results in ill-prepared capabilities to support high-intensity prolonged conflict that requires rapid replenishment of critical materials (Hellberg and Lundmark, 2025; UK Government, 2022). The war in Ukraine shows how military vulnerabilities become evident on the front line, from limited re-stock and reliance on external suppliers to insufficient domestic production.

This paper examines how the war in Ukraine exposes weaknesses in ammunition production and supply across NATO and allied forces. It argues that to sustain high-intensity operations it requires a combination of strategic stockpiling, domestic industrial investment, and strengthened public-private collaboration, thus providing actionable insights for policymakers and governments to ensure defence resilience.

Historical Context

Ammunition shortages have long challenged wartime operations, highlighting the critical importance of maintaining robust stockpiles and a high level of operational readiness. In World War 1, Britain experienced the "Shell Crisis" in 1915, where the British Army delayed offensives due to an ammunition shortage, which critically endangered operations (Strachan, 2016). This highlighted inefficiencies in Britain's pre-war stockpiles and munitions production. It ultimately led to the

creation of the Ministry of Munitions to coordinate wartime production and supply (Strachan, 2016). This historical example from over 100 years ago demonstrates that inability to plan and prepare for war can lead to immediate operational impacts when demand for such materials surges.

Similar patterns of defence shortages were evident during the Second World War, although large-scale industrial coordination helped to mitigate many of these pressures. Germany experienced chronic ammunition shortages as a result of sustained allied bombing efforts, which affected production, supply and distribution (United States Strategic Bombing Survey, 1947). In contrast, the United States used industrial abilities to ensure rapid production of defence materials, producing millions of artillery shells, tanks and aircrafts which essentially created a strategic advantage (United States Strategic Bombing Survey, 1947). This demonstrates the importance of reserve capabilities, domestic manufacturing and the capabilities to expand production on demand and during crisis periods.

Ammunition supply continues to be an important concern in modern-day conflict. In the Gulf Wars, even with technological advancement, there remained shortages due to the rapid escalations putting unprecedented demand on stockpiles (U.S. Air Force, 1993). In the Iraq and Afghanistan wars, logistical challenges demonstrated the limits of efficiency-based supply chains, illustrating that such systems do not meet the demand for sustained operations in high-conflict areas (Erbel & Kinsey 2018).

Across these cases, a clear pattern is evident: a reliance on stockpiles is only suitable for stability periods and demand-driven manufacturing creates vulnerabilities and exposes risk when unexpected high-intensity conflict occurs. These lessons are directly applicable to the situation in Ukraine, where ammunition and artillery has exceeded pre-war expectations. Military readiness requires robust stockpiles, production capacity and efficient industrial coordination.

Case Study: Ukraine War

The war in Ukraine is a long-term, high-intensity conflict requiring sustained ammunition use, thus exposing the limitations of Western industrial and logistical systems (Hellberg & Lundmark, 2025). Forces in Ukraine are reported to have used thousands of artillery rounds per day during the height of conflict, far exceeding regular western ammunition production (Associated Press, 2023). Assessments show that both Russian and Ukrainian forces rely heavily on artillery and attrition-focused systems as key battlefield tools (Gady & Kofman, 2023). Similarly, research shows that the exchange of munitions from allied European states to Ukraine often occur at a rate that drastically reduces their own domestic levels (Gressel, 2024). These rates of consumption have challenged the idea that modern technological advancements in militaries means they can rely on quality instead of quantity.

NATO members have experienced significant supply constraints as the war in Ukraine has placed pressure on stockpiles and in some cases diminished them below recommended readiness levels (Hellberg & Lundmark, 2025). European defence ministries have struggled to keep up with the demand for ammunition stock, prompting urgent measures such as emergency procurement and purchasing initiatives (Gressel, 2024; Hellberg & Lundmark, 2025). U.S. production capacity has increased from approximately 14,000 shells per month before the war to a target of around 100,000 per month. However, this still falls short of sustained Ukrainian consumption levels (Axe, 2025; U.S. GAO, 2024). Since 2022, the US has transferred over 3 million artillery shells to Ukraine, alongside additional large-scale contributions from European allies, highlighting the extent to which allied stockpiles have been reduced (Axe, 2025). Instead of smooth cooperation, the conflict has exposed weaknesses and imbalances in production and has strained the ability of NATO members to support prolonged operations. For comparison, Russia is estimated to produce approximately 3 million artillery shells annually, providing a standard against which Western and Ukrainian supply capacity can be assessed (Reuters, 2023).

Industrial complications further these constraints, as expanding munitions production is more complex than it might appear at first glance. Artillery shell production requires carefully managed explosives, propellants, casings and high-quality manufacturing processes (European Parliament

Research Service, 2025). Many of these materials depend on specialised suppliers which are already heavily integrated in the global supply chain. Securing these raw materials and recruiting skilled labour often causes delays, limiting the ability to scale production rapidly. In this way, defence industrial systems designed for cost efficiency and minimal stockpiling reduce adaptability in the event of war. Lean models that may be effective in low conflict or peaceful conditions struggle to accommodate the sudden increase of demand.

These operational impacts are significant, as Ukrainian forces have repeatedly reported rationing artillery fire due to supply constraints, directly affecting combat effectiveness and resulting in adjustments in tactical force employment (Khurshudyan & Hrabchuk, 2023). NATO allies are now opting towards long-term procurement agreements to secure production and support industrial defence growth (NATO, 2025). The situation in Ukraine demonstrates that industrial capability is a key factor in sustaining operational stability and should not be reduced to a secondary economic consideration. It highlights that high-intensity conflict cannot be supported without resilient production systems.

Analysis: Structural and Strategic Vulnerabilities

After the Cold War, many Western militaries adopted “just-in-time” production models. This reduced stockpiles and manufacturing capacity to cut costs (Ekström, 2025). Whilst this approach may be logical under peaceful conditions, it lacks adaptability when necessary to respond to surges in demand due to high conflict (Ekström, 2025). Ukraine’s ammunition-heavy operations demonstrate that rapid consumption on a large-scale level causes stock depletion and puts pressure on supply chains.

A key weakness in the supply chain is the shortage of suppliers and the dependence on global networks for production, as many of the essential materials come from a limited number of international sources. If there is disruption at any stage it can critically affect production, leaving governments and militaries unable to meet demand (Urmston et al., 2024; Hellberg et al., 2025). Regulation and procurement procedures further intensify constraints related to defence contracts, environmental commitments, and workforce planning. Even if emergency measures are put in place to

mitigate impact, these are reactive and cannot guarantee that delays will not occur (Urmston et al., 2024).

These vulnerabilities cause militaries to have strategic weaknesses in readiness, preparedness and deterrence (Hellberg et al., 2025; Andari et al., 2025). Operations that require efficient resources from allied NATO states are being strained due to industrial capacity and coordination, further exposing fractures and dependencies in the supply chain (Kancs, 2026). Advanced munitions such as drones and precision weapons create further complications as they are difficult to produce in large quantities due to the complex nature of their materials (Antai & Hellberg, 2025). In this way, Ukraine demonstrates that even with technological advancements, it does not replace industrial necessity, and that front-line advantage may ultimately depend on a sustainable supply chain.

To summarise, the conflict demonstrates that to have military resilience there must be an effective strategy that takes into consideration industrial production with technologically advanced equipment during periods of peace and conflict (Hellberg et al., 2025; Antai & Hellberg, 2025). To mitigate these vulnerabilities, it requires diverse supply chains, increase in stockpiling, and long-term planning to ensure that militaries can meet operational demand without exhausting their resources (Urmston et al., 2024).

Policy Implications & Recommendations

Lessons from Ukraine indicate that both strategic anticipation and vigorous industrial planning are required for high-intensity operational demand.

Stockpiling: Nations should maintain robust reserves of high-demand munitions that should be able to be used at any given time, balancing efficiency with readiness (Hellberg & Lundmark, 2025; Clark, 2022). Historical examples have repeatedly demonstrated that dependence on real-time production is inefficient during prolonged conflict.

Domestic industrial investment: It is critical to expand and advance national production and manufacturing capacity. Redundant facilities to produce artillery shells and ammunition can reduce

dependence on global suppliers (Hellberg et al., 2025; Urmston et al., 2024). Collaboration with private sector participants such as defence firms can facilitate resilience and strategic demand planning (Ekström, 2025).

Public-Private Collaboration: Long-term contracts with private firms and improved procurement plans allow rapid production in emergencies (Ekström, 2025). Partnerships between governments and defence firms should form agreements on production, workforce planning, sourcing of raw materials, and crisis events (Ekström, 2025).

Allied coordination: NATO and allied states should improve cooperative arrangements for industrial planning (NATO, 2025; European Parliament Research Service, 2025). Through joint alliance, it can be ensured that reduced stock in one nation does not compromise entire operations through combined stockpiles, shared production plans and contingency agreements. Case-by-case scenarios can be planned to prepare increased demand and ways to appropriately allocate resources (NATO, 2025).

Conclusion

The war in Ukraine has revealed critical vulnerabilities in Western modern defence supply chains and industrial production (Hellberg & Lundmark, 2025; Ekström, 2025). The limitations of demand manufacturing have been made clear in environments where high-intensity conflict and prolonged conflict exist, highlighting the consequences associated with low stockpiles and dependence on allied states and international supply chains (Urmston et al., 2024; Clark, 2022). These weaknesses demonstrate that militaries can still be constrained even with contemporary technological advancements if operational demand exceeds capacity (Antai & Hellberg, 2025).

The conflict has highlighted the importance of integrating industrial adaptability into both governmental and military strategies. (Hellberg et al., 2025; Ekström, 2025). To strengthen military resilience, there must be an increase in strategic stockpiling, domestic production investment and enhanced public-private relationships to improve collaboration and ensure readiness to sustain high-conflict periods (Hellberg & Lundmark, 2025; Urmston et al., 2024). Additionally, alliance

coordination can reduce risk of depleted stock and improve overall deterrence and prevention (North Atlantic Treaty Organization, 2025; European Parliament Research Service, 2025).

The situation in Ukraine, combined with historical examples such as World Wars and modern conflicts, demonstrates that operational capacity and industrial planning are equally important as tactics employed on the battlefield (Strachan, 2016; United States Strategic Bombing Survey, 1947; U.S. Air Force, 1993). To adopt an effective long-term strategy, NATO and allied forces must work together and ensure that proactive policies are enforced to prioritise demand and flexible supply chains (European Parliament Research Service, 2025; Hellberg et al., 2025). By doing this, both militaries and governments can be resilient, maintain operational advantage, and be prepared for future high-intensity conflict.

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