



# Russian Logistics in the Ukrainian War: Can Operational Failures be Attributed to logistics?

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COLLECTION:  
UKRAINE — A  
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## ABSTRACT

The lacking Russian progress in war in Ukraine is often attributed to failing logistics, yet the logistics and its eventual failure is not explained. The purpose with this paper is to present some logistics principles that can be used to describe the Russian way of logistics planning, and to infer whether failing logistics slowed down the military operations or if failing operational conduct led to revised operational plans that could not be sustained logistically. The initial Russian Course of Action (COA) to take Kyiv was probably well supported logistically. When the COA failed, contingency plans most likely did not take into consideration the logistical challenges of supporting another type of operation, partly because of the logistics vacuum resulting from the preceding exercises. In the southeast the logistical concept seems to build on the echelon principle, which fits poorly with the lack of operational success. Adding to this is successful Ukrainian tactics of targeting Russian logistics resources which significantly reduces the Russian fighting power. This assessment is based on openly accessible information about the Russian campaign. Reporting from an ongoing war poses challenges of verifying data. Both warring parties and other stakeholders pursue their own interest through strategic communication. Yet, by combining different sources we believe that our findings are quite robust. For future research, archival studies both in Ukraine and Russia, combined with interviews with logistics personnel at both sides would add new dimensions to the research. We realise though that such data sources will not be accessible for quite some time.

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## INTRODUCTION

On February 24, 2022, Russia began the “special military operation” to demilitarize and “denazify” Ukraine. From the outside, it seemed as if the Kremlin planned this to be a short blitzkrieg type of operation in which Russian forces would capture and depose the president and the Ukrainian leadership within a few days. The war started on two fronts with what seemed to be two different operational objectives. On the north-west, the objective was to capture Kyiv; in the east and south-east, the aim was to capturing the Donbas region and establish a land-corridor between the Donbas and Crimea.

Russia’s war aims have not eventuated. The operation in the east and south-east progresses much slower than anticipated; the Kyiv campaign was a failure. After four weeks of fighting, Russian forces withdrew from the Kyiv region to reinforce the operation in the east and south-east; the success of this shift of operational focus has yet to be established.

In Western media, commentators frequently attribute the surprisingly slow operational progress to logistical failures, although with little explanation of what these potential failures might be. Associate Professor of the U.S. Army War College Ilmari Kähkö, for example, writes: “It surprises how poor Russia has been on logistics and operational planning” (SVT, 2022). Michael Kofman, director of Russia Studies at the Center for Naval Analyses in Virginia, has similarly stated that, taken by surprise by the intensity of Ukrainian resistance, “we can suspect [the Russians] did not properly organize the logistics necessary for an effective Plan B, which was to have an actual, serious fight in what is the largest country in Europe outside of Russia” (Berkowitz & Galocha, 2022).

We will therefore analyse Russian logistics in the war to assess the ways in which relevant preconditions may affect the conflict’s outcome and what Ukrainian forces have done to obstruct Russian logistical operations. Our purpose is to compile openly accessible data and information about the war and to link this to theoretical logistics principles. We will demonstrate that one can only partially attribute operational failures to logistics, and that the lack of operational success can principally be explained by unrealistic planning assumptions on the part of Russian command. Even the best logistics plan cannot make up for a failing operational plan.

In the following section, we discuss methodological considerations. Since there are non-logisticians among this article’s audience, we explain logistics principles relevant to the Russian operation in the section following that; we then discuss Russian logistics in three different phases of the war: planning and preparation, the Kyiv operation, and the Donbas/Crimea operation. We continue with a section describing how Ukrainian forces may have weakened Russian logistics capabilities. Finally, we discuss our findings and present both our conclusions and implications for the future.

## METHODOLOGICAL CONSIDERATIONS

Researching an ongoing conflict from the outside, with unreliable data, brings with it methodological issues which warrant discussion.

In line with Åsvoll (2014), we conducted a two-step study in which the first step was inductive, the second deductive. In the first step, we collected data various public sources to build a baseline about both Russian logistics and Ukrainian measures to hinder them conducted during the conflict’s first three months. For this, we relied on published intelligence reports such as those of the British Ministry of Defence<sup>1</sup> and expert opinions distributed in publicly available media such as Swedish public service radio (SR, 2022) and television (SVT, 2022). We acknowledge that available data are both incomplete and subject to strategic communication from both sides of the conflict. We are aware that the warring parties and other stakeholders in the conflict all narrate their version of the truth. While it is thus difficult to verify single pieces of information, by combining many sources with our knowledge of the field, we identify patterns that help us to better understand Russian logistics principles and their importance for operational progress.

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<sup>1</sup> The British Ministry of Defence has published regular intelligence reports on Twitter. See, for example: <https://twitter.com/DefenceHQ/status/1542015593011871744>.

The authors of this paper all hold doctoral degrees in defence logistics, teach defence logistics at master's level, and conduct defence logistics research. We followed the recommendation made by Croicu and Kreutz (2017) to proceed with caution when analysing such data. In addition to discussing and interpreting the data among ourselves, we also discussed the matter, and our analysis, with experts on Russian military strategy and Russian politics from the Swedish Defence University, the Norwegian Defence University College, and with experts from the Swedish and Norwegian Defence Research Institutes. This is in line with Weidmann (2015, 2016), who recommends combining and discussing different sources to construct reliable patterns and to avoid bias in secondary information.

In the second step, we developed a conceptual framework, underpinned by established logistics principles from theory and practise, including Kress (2016), which we as logistics experts consider relevant for the Russian logistics in connection to the purpose of the paper. We used our conceptual framework to analyse our empirical findings. This analysis improves our capacity to explain what has happened logistically and the effect this has had on the progress of the war.

Methodologically, we consider our results to be trustworthy (Schwandt et al., 2007), since other experts in related fields concur with our results, with minor suggestions or comments.

In the following three sections, we present three logistical principles: operational logistics in a Western military tradition, operational logistics in the Soviet Armed Forces, and the state of logistical failure known as *culmination*. Logistics culmination is of special interest since commentators claim that the Russian forces may reach culmination in the late summer or early autumn of 2022.

## MILITARY LOGISTICS: WESTERN LOGISTICS PRINCIPLES

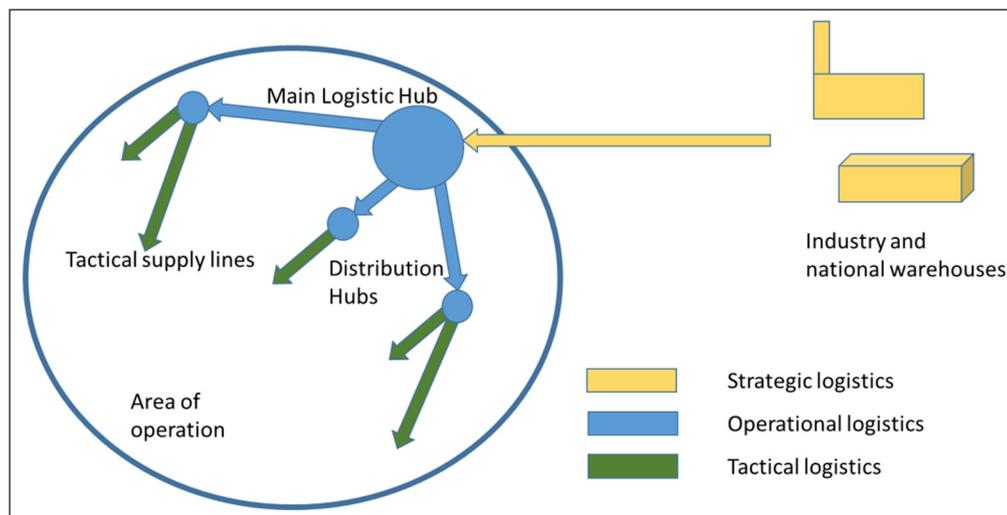
Military logistics create and sustain military capability (Peppers, 1988, p. iv); the military supply chain connects the industrial base to the soldier in the field (Eccles, 1959, p. 10). Logistics are conducted at strategic, operational, and tactical levels (Kress, 2016, pp. 17–26). At the strategic level, defence logistics is about decisions ensuring sufficient national industrial capacity to cover the needs of the armed forces, adequate national preparedness, and access to strategic resources from other nations (Eccles, 1959). Strategic logistics determine which operations are possible to execute and the tempo at which they may be executed (Erbel & Kinsey, 2018). A trustworthy logistics base is an integral part of a nation's deterrence. Military logistics at the operational and tactical levels are a matter of both designing and establishing supply networks, and moving and sustaining combat units in the area of operation (Kress, 2016, pp. 42–43). Military logistics ensure that the material elements of combat capability merge at the right place and time and in the right configuration to be useful (Swartz & Johnson, 2004). The military forces nations can deploy to an operational theatre, the time it will take to deliver that force, the scale and scope of forces nations can support once deployed, and the tempo of operations, are consequently derived from logistics capabilities (Uttley & Kinsey, 2012, p. 401).

At the operational level, the logisticians plan, prioritize and distribute resources to logistics hubs, from where resources are transferred to the tactical logistics units. These units then support the operation by distributing supplies and maintenance to the combat units – that is, by ensuring that the right supplies reach the right place and recipient, at the right time, in the right quantity and in the right condition (Foxton, 1994).

Armed forces can support their deployed military units in three ways. Military units can bring supplies with them, logistics units can establish supply lines from depots in safe areas to the fighting forces, or the deployed units can “live off the land” by procuring locally or looting in the area of operations. Logisticians combine these three principles in different ways in different phases of the war (Kress, 2016). Throughout history, logistics considerations regarding such combinations have dictated the planning and execution of many military operations (see, for example, van Creveld, 1977).

Figure 1 shows the principles of logistics distribution from industry and national warehouses to the combat units. It does not distinguish between demands forecasted in the operational plan (push-based logistics) or actual demands from the fighting units (pull-based logistics) that work as a trigger for supply. Availability of supplies varies depending on different requirements for procurement, packaging, storage, handling, and transport, where these

requirements are based on factors such as safety, environment, weight or volume, risk, longevity, durability, procurement principles, and so on. It also depends on lead times for production and distribution. Market-generic supply items, such as sustenance, may be readily available off-the-shelf. In contrast, military-specific supply items significantly limit the number of potential suppliers, and may involve lead times ranging from weeks, months, or even years for ammunition, mines, and explosives, to several years for major equipment (Ekström, 2020, p. 31). Furthermore, consumption rates vary depending on operational activities conducted by all parties to the conflict, which adds to the forecasting complexity. The logistics planning must therefore take into account the four Ds: the demand for different supplies, the distance the supplies are to be transported, the destination of these supplies, and the duration of a specific demand (Kress, 2016).



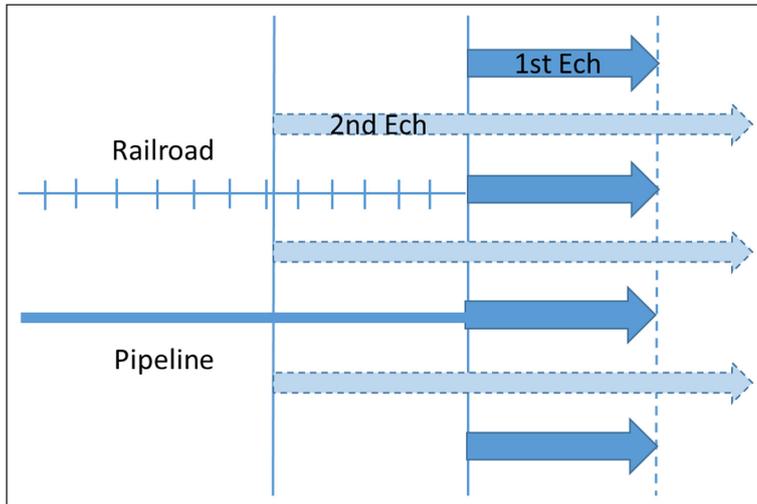
**Figure 1** Principles of logistics distribution.

## MILITARY LOGISTICS: RUSSIAN LOGISTICS PRINCIPLES

During the Soviet era, the concept for offensive operations was based on the “echelon principle,” according to which one echelon fought while another was ready to be deployed to the frontline when the first echelon was exhausted (see Figure 2). Once replaced, the first echelon would reorganize and be refitted with personnel, equipment, and consumables to again be combat-ready. The echelon principles build on army groups supported by one or more Material Technical Support brigades (MTS). The fighting units have some organic capacity to retrieve supplies from the rear but depend on the MTS for strategic and operational logistics (Edmondson, 1989; Vakas, 1990). The main means of transportation is the railway system; fuel and water are carried through pipelines. The MTS brigades include units that build and maintain railways and pipelines to support the forward-marching forces. Modern Russia does not have the capability to mobilize and sustain a multi-echelon force for a prolonged war, however (McDermott, 2013, p. 16), which means that deployed forces do not have a second echelon. There is only one opportunity to secure victory (McDermott, 2013, p. 32).

The Russian Armed Forces operational concept, inherited from the Soviet Union, was modernized during the major transformation in 2009, as discussed in Grau and Bartles (2016). In parallel, Russia replaced the obsolete Soviet logistics system with a leaner one, involving significant downsizing and outsourcing (Westerlund & Oxenstierna, 2019, p. 26), largely untested in combat operations (McDermott, 2013, p. 37). Despite foreseeing an improved logistics capability (Westerlund & Oxenstierna, 2019, p. 127), a recent assessment of the future development of Russian military capability asserts that the main restriction of the Russian Armed Forces will not be availability of forces, but logistics (Westerlund & Oxenstierna, 2019, p. 141).

As throughout Russian society more generally, military planning follows a strict hierarchical, top-down, structure. The Force Commander chooses the course of action (COA), and the commander’s staff details how to proceed with this COA. According to Grau and Bartles (2016), the military staffs are smaller than those of NATO. The logistics planning often follows predefined principles, well-exercised scenarios, and calculations of ammunition consumption, attrition, and so on. Logistics on the army group and brigade levels are hence standardized and largely follow the same principles as they did in the Soviet era.

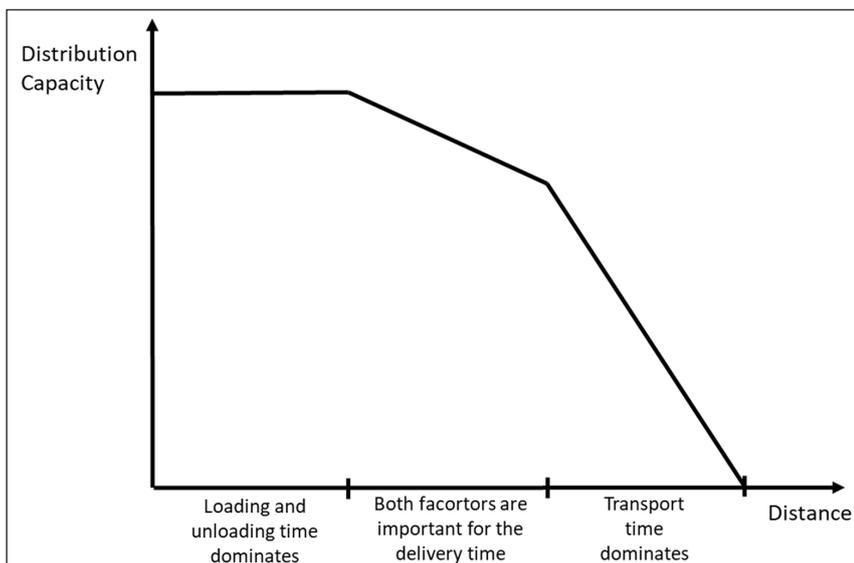


**Figure 2** The echelon principle and logistics.

## MILITARY LOGISTICS: LOGISTICS CULMINATION

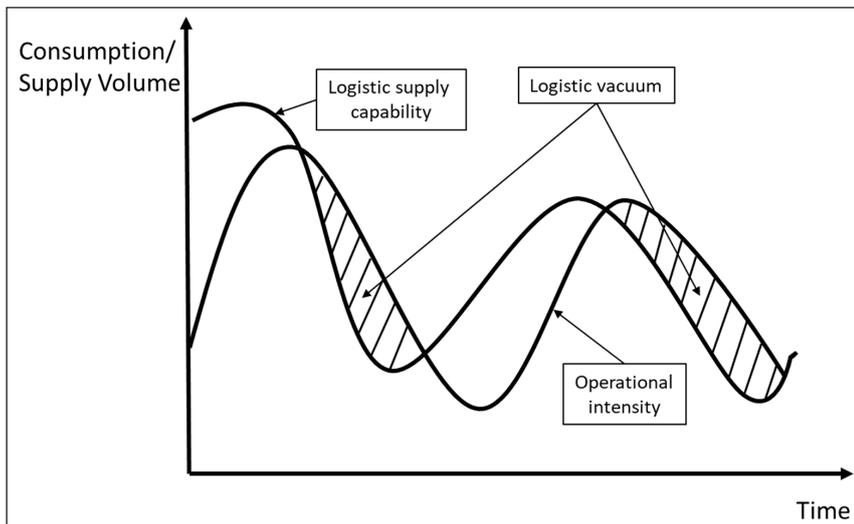
If logistics cannot keep up with the operational pace, logistics culmination occurs (Kress, 2016). Logistics culmination, signifying that logistical resources are exhausted, happens for different reasons. As the area of operation grows geographically, more transport resources are required to cover greater transportation distances. If the pace of operations is higher than anticipated, logistics may struggle to keep pace. Operation Desert Storm in Kuwait clearly demonstrated this in 1991, when the U.S.-led coalition halted operations after 100 hours as operational speed exceeded the logistics capabilities (Hallman, 1993). Adding to this, an opponent can target the supply lines to eliminate both supplies and transport resources (Glas et al., 2013). The consequences of logistics culmination depend on the type of operation and on the types of supply that becomes unavailable (Ekström, 2022). Put simply, without fuel, a moving military unit must halt. Without specified type of ammunition, the fighting units must use substitutes with lower quality and precision.

Prebilič (2006) shows that logistics effectiveness decreases as the distance that must be covered increases (Figure 3). To illustrate this point, in a convoy travelling 50 kilometres at an average speed of 50 km/h, each truck driver can make three turns a day (one hour to drive each way, one hour to load, and one hour to unload makes a 12-hour day). If the distance between the depot and the frontline doubles to 100 km, the capacity decreases by 33%. Moving another 50 kilometres into the area of operations, transport capacity is down to just 33% of original capacity – in total six hours of driving, two hours of loading/unloading (Listou & Ekström, 2022). Beyond this point, logistics will always fall short because the driver will not make it back to base in time, even assuming that the driver is allowed proper rest and the vehicle receives necessary maintenance (Vershining, 2021).



**Figure 3** Relation between supply distances and transport capacity (modified from Prebilič, 2006).

Prebilič (2006) also points to another significant challenge of military logistics: given the unpredictable nature of war, logistics can become undersized. Stochastic variations in the ordering and delivery cycle tend to amplify one another and accumulate throughout the supply chain (a phenomenon called the Bullwhip effect: see, for example, Forrester, 1958), which could lead to a logistics vacuum (Figure 4). If logistics are not aligned with the operational pace, supplies ordered to close the gap will eventually surpass the needs of the combatants on account of a tendency to order more than required, “just in case,” to cover for uncertainties in distribution time, supply opportunities, and actual demand. Consequently, fighting units receive too much supply at the wrong time and place, which could congest supply lines and fill up storage capacity.



**Figure 4** Logistics vacuum  
(modified from Prebilič, 2006).

The third reason why logistics culmination occurs is a question of the friction of war. Supply chains are the Achilles heel of any military operation. They are likely targets (Glas et al., 2013), and attacks against them not only deny an adversary its supplies and reduce its transport capacity but tie up resources for force protection of the supply convoys.

To minimize the negative effects of logistics culmination and logistics vacuum, the logistics system must be resilient, which means that it should be able to return to its original state, or move to a new, more desirable state, after being disturbed (Christopher & Peck, 2004). Academics propose combinations of flexibility, agility, collaboration, and redundancy strategies to achieve supply chain resilience (Shekarian & Mellat Parast, 2021).

## ZAPAD-2021: PLANNING AND PREPARING LOGISTICS FOR A WAR?

Military exercises and operations require logistics. Russian exercises conducted along the Ukrainian border before the war are certainly pertinent to this analysis, touching on logistical preparedness for the invasion that was subsequently launched.

The Russian build-up along the border went on for a long time. As the spring exercises of 2021 concluded, the Russians left a substantial amount of equipment in the exercise areas close to Ukraine (Kofman, 2021). When the exercise activities resumed as the joint Russian-Belarusian exercise Zapad-2021, the forces supplemented these with more equipment. According to the Russian Ministry of Defence, around 200,000 servicemen participated in the different exercises in Russia and Belarus.<sup>2</sup>

Such large-scale exercises require a detailed exercise plan, including a logistics plan for supply, maintenance, medical services, and transportation. For Zapad-2021, logistics units were deployed well in advance of the exercise itself, with preparatory activities already taking place in July and August of 2021 (Kofman, 2021). If the Zapad logistics plan only covered the exercise and not the coming war, the final phase in the plan would be the repatriation of materiel and

<sup>2</sup> “About 200 thousand servicemen from the CSTO and SCO countries will take part in the strategic exercises ‘Zapad 2021’.” [https://function.mil.ru/news\\_page/country/more.htm?id=12381883@egNews](https://function.mil.ru/news_page/country/more.htm?id=12381883@egNews).

personnel, and the refurbishment and maintenance of materiel upon return to home bases. To avoid a massive surge of supplies coming into the exercise areas after ENDEX (end of exercise), the Russian logisticians would plan and carry out the logistics activities to culminate as the exercise ended.

According to open intelligence reports such as those published by the United States and NATO, the exercises were indeed preparations for an invasion. As commented by Kofman (2021), “months of exercises by associated commands make the entire affair less a large-scale readiness test and more an event that is regimented or scripted in nature.” Even though the Kremlin denied it, in February 2022 even claiming they were stepping down, the intelligence reports turned out to be correct.

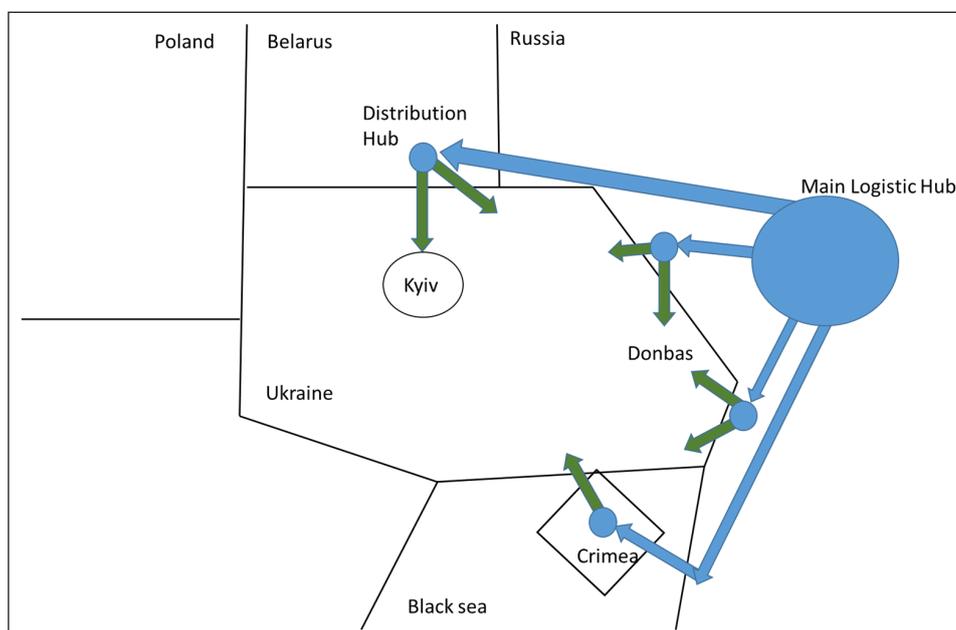
When transitioning from exercise to war, the conditions and dynamics of logistics change. Logistical demands are a function of the selected COA and the dynamics of the war. The requirements for the re-supply of ammunition, spare parts, and other supplies are inherently unpredictable. A full-scale war includes casualties and damaged equipment, leading to increased demands for transportation, medical treatment, and maintenance.

As Grau and Bartles (2016) observe, Russian operational planning is conducted on a higher hierarchical level than that of logistical planning. Based on the Force Commander’s chosen COA, logisticians plan the volumes and distribution of the different resources needed.

While the invasion plan must have been known beforehand at some levels in the command chain, logistics may not have been involved. If the detailed logistics plans for Zapad-2021 were made merely for the exercise, continuing into a war would create a logistics vacuum after the intended ENDEX. Even if there existed aggregated plans for transport and sustainment for the invasion, there was no time for the maintenance and refurbishment of the equipment used during the exercises. Adding to this is the surprisingly low standard of Russian logistics vehicles.

Based on the reported logistical problems in the early phase of the war, it thus seems that the Russian logisticians had planned for the exercise alone, with little or limited insight into the projected logistics vacuum. This had a negative impact on the Russian military capability in the first phase of the war. The looting by Russian forces of sustenance and objects of value alike is in line with the principle of “living off the land” set out by Kress (2016). Whether or not this is a consequence of poor logistical planning or a deliberate logistics strategy, it is still criminal act.

The initial logistics plan as established at the outset of the Russian invasion can be depicted as in Figure 5. One or more major supply hubs would be located at strategic railway junctions at a safe distance from the Ukrainian border with railways going in directions of the area of operations. The loading and unloading of cargo trains is a labour-intensive and time-consuming operation, which means that logisticians want as few railheads as possible. From the railheads, supplies will be distributed by trucks. New distribution hubs would be established inside Ukraine as the Russian campaign was supposed to progress.



**Figure 5** Probable initial Russian logistics plan.

## RUSSIAN LOGISTICS IN THE KYIV REGION

The Russian war in the Kyiv region was apparently planned to be short. As the first step in the operation, the taking of the Antonov Airport, failed, logistics were suddenly required to play a different role.

We can assume that there existed an aggregated logistics plan to support the chosen COAs when the operation started on 24 February. The Kyiv COA was to replace the political leadership of Ukraine within a few days. Taking the Antonov Airport in Hostomel near Kyiv through an airborne operation was a crucial component of this plan. The Russians probably intended to use this airport as a logistical hub. Such a COA would build on the assumption that the intense part of the war would be over in a few days; if so, the operation did not have to put much effort into logistics other than ensuring that the forces involved could bring along all the equipment and supplies for the initial phase (Ekström, 2022). Typically, Russian forces carry supplies for three to five days (Grau & Bartles, 2016, p. 329). Fuel and ammunition are the volume drivers, and a short operation would reduce the required volumes significantly. The follow-up logistics would have been coordinated from Hostomel or another suitable position once the Russian troops had gained control of the area.

When this COA failed, it appears that there was no contingency plan for the forces. Since the Russian general staff gives detailed orders instead of operational intent, the commanders on the tactical level did not know what to do. The infamous convoy north of Kyiv was described in media reports as a hastily formed Plan B to go by road instead of by air. Seen from a logistics point of view, however, this makes little sense. Planning and organizing a convoy of this size would take several days, maybe weeks. Trucks, fuel tanks, ammunition, spare parts, food, force protection, and so on, need to align with the force to be sustained and brought into position. Rather than being a Plan B, this was most likely a part of Plan A. The part of the Zapad exercise that took place in Belarus was probably meant to prepare resupplies to a Russian stronghold outside Kyiv. Based on available photographs and organization charts, it seems that the convoy consisted of a reduced MTS brigade enforced with a mechanized battalion. The armed force was not only escorting the convoy, it was intended to protect a planned logistics base at the Antonov airport, itself intended to serve as a tactical distribution hub for the next stage of the operation. The convoy halted because it had nowhere to go. It stopped to wait for new orders from the operational command, who in turn waited for orders from the general staff. Once stalled, the convoy became a sitting duck. Without air superiority, and with a terrain not suited for the vehicles in the convoy, they lacked protection against the agile Ukrainian forces using drones and light mortars to inflict damage to the protection force and the logistics vehicles alike. This significantly reduced Russian logistics capacity and robustness, leading to a logistics culmination for the forces now facing a scenario completely different to that originally planned. The logistics culmination was probably a significant factor in Russia's decision to withdraw from the Kyiv area.

## THE RUSSIAN LOGISTICS IN EAST AND SOUTH

Russian forces had ample time to prepare operations in the eastern and southern parts of Ukraine after years of support to the separatists in the Donbas region and Crimea. But here, too, the war proved to be more difficult than expected.

From the time of the annexation of Crimea in 2014, Russia was able to start to build military and logistics capacity sufficient to wage a war against Ukraine. In spite of this, during the first weeks, Russian forces progressed only slowly. The unsuccessful fulfilment of the initial COA significantly altered the preconditions for logistics to sustain the force.

A Russian campaign following the echelon principle would have a logistics concept based on the same principle: to supply and refurbish one echelon at the time, and to use the railway and pipelines to move supplies to the tactical logistics bases. Deploying one echelon at the time before fresh forces replace it works if there is more than one echelon in the force structure (see Figure 2). In the first phase, before Russia withdrew from the Kyiv area, it seems that only one echelon was employed in the south-eastern part of Ukraine. This put heavy strain on the logistics, since the combat forces started to run out of supplies after four to five days. Adding to this, resupplying the force by road required more logistics vehicles in good shape than the

combat units and the MTS could provide. To illustrate, shelling Mariupol with rocket artillery requires one truck for the transport of the ammunition for each round fired; if, for example, the 8th Guards Combined Arms Army, then active in the Mariupol area, fires all its units, it requires an estimated 60 to 90 trucks to refill a single round. According to Grau and Bartles (2016), this is half of the transport capacity of an MTS brigade.

Russian forces slowly gain terrain in eastern and southern Ukraine. As the area of operations widens, the tactical supply lines stretch out, in turn reducing the speed of the deliveries and the operational pace. Building on the estimation of Vershining (2021), a travel distance of 100 km would allow two turnaround transports a day. The Russian MTS brigades do not have the capacity to sustain the forces by truck if they are more than 150 km from the distribution hubs. When moving forward, it is thus crucial for the Russian Forces to be able to use railways close to the combat forces. As will be explained in the next section, targeting the supply lines is an effective way of slowing down an attacking opponent. What we see is the result of Russia's desire to modernize logistics through outsourcing and downsizing, which has never been tested in combat (Westerlund & Oxenstierna, 2019). Russia has a new and untested logistics system that, to a large degree, still relies on the old principles for echelon logistics. The logistics system had a capacity too limited to support the combat forces, especially when the supply lines were stretched, which caused periods of logistics vacuum.

## UKRAINE TARGETING RUSSIAN LOGISTICS

Our data show that the Ukrainian forces have targeted Russian logistics resources at all levels (see, for example, Borger, 2022). As illustrated in Figure 4, reduced logistical capability combined with high operational intensity ultimately leads to logistics culmination.

Of special interest is how Ukrainian forces combine old and new technologies to attack the Russian supply lines, reducing Russian logistic capability generally.

According to the reports we have studied, the combination of drones, small calibre mortars with short range, and surveillance drones permitting visual observation of the effects, seems to be very effective. In these activities, we see the development of new threats against logistics units. While these attacks recall the methods of special operations, to our understanding, they are carried out by regular units. Clearly, logistics are a priority target for the Ukrainian forces. In the data we have studied, we cannot find any successful countermeasures from the Russian side – perhaps on account of the lack of air superiority.

Ukraine invested similar effort in the destruction of railways and other infrastructure as an A2/AD (Anti Access/Area Denial) action to obstruct Russian supply convoys. The railway network in the former Soviet Union was well developed, with the same track gauge in both Russia, Belarus, and Ukraine. By crippling railway infrastructure, especially bridges over the rivers in the early phase of the war, Russian movements were effectively obstructed. Even though Russia has 10 railway brigades that build, secure, and repair railway lines (Grau & Bartles, 2016, p. 327) it takes time to make repairs, especially where railway bridges have been destroyed. Denying access to the railway system increases the distance from depot to tactical unit, which leads to either a slower operational pace or a logistics culmination.

## DISCUSSION AND CONCLUSIONS

Given what we have seen, we can begin to address the question of what was expected of Russian logistics in this war and the changes we might expect to see in the next.

According to our analysis, the logistics for the exercises were only partially coordinated with the planning of the invasion. The interval between the exercises and the war did not permit necessary maintenance and refurbishment, severely reducing operational availability. The looting of the civilian infrastructure can be seen as an indication that sustenance was not supplied in the volume required for a military campaign lasting more than a short week. The logistics principle was built on railway distribution as close to the combat units as possible, and wheel-based distribution for the last mile only. But the capacity for this final distribution by road was, evidently, too limited.

There are several possible explanations for these challenges. The armed forces did not expect Putin to actually invade Ukraine, so maintenance was scheduled to take place once the equipment was back on the bases, for example; the outsourcing of logistics and downsizing of organic logistics (see, for example, [Westerlund & Oxenstierna, 2019](#)) reduced the logistics capacity in ways that were not anticipated during the war planning; the “special operation” was planned as a short campaign with only minor logistical needs, with local sourcing and looting and with the Antonov Airport in Hostomel as a logistical hub for the Kyiv region. The quality and quantity of logistics assets were lower than anticipated because of corruption at all levels in the command chain. Based on available data, we cannot pinpoint one main factor. It is most likely that all these factors contributed.

The performance of Russian logistics in this war has to some degree surprised us. After the transformation in 2009, one would expect the Russian army logistics to support manoeuvre-based operational principles. It seems, however, that logistically Russia still plans to refurbish one echelon at the time, and to subsequently reorganize the first echelon with new supplies, equipment, and personnel – but now with a logistics system smaller and more dependent on external logistics resources.

The Ukrainian forces have understood the importance of targeting the Russian supply lines. They have combined modern and traditional technologies to achieve reductions of the Russian logistical capability in ways sharing much with Special Forces operations. We see two lessons to be learned from this. Firstly, that by combining high- and low-tech assets, regular forces can effectively apply special forces tactics to fight logistics units; secondly, such agile and flexible tactics require new defensive tactics to protect the supply lines, and new logistics technologies to minimize the damages to one’s own logistics.

As claimed by Grau and Bartles ([2016](#)), we see that the Russian operational logistics is not fully integrated in the planning process. Logistics-planning seems to take place after a course of action has been decided. Hence, the raising of a hand to argue that a COA is not feasible from a logistics point of view seems to be beyond the remit of the logistician. Consequently, any operational shortcomings arising from logistical barriers will take longer time to solve compared to a flexible logistics solution.

The Russian logisticians demonstrated that they were able to sustain the forces during the scripted exercises before the war. Likewise, the massive shelling in the eastern and southern parts of Ukraine tell us that Russian logistics still is able to support a Cold War type of operation with massive use of artillery and large volumes of ammunition distributed by rail. When the requirements changed as the Kyiv COA failed, however, logistics did not have the flexibility to change accordingly.

We have seen that Ukraine’s defence tactics to engage and destroy logistics vehicles and infrastructure have been essential in reducing Russian capability. The experiences from these activities must be further evaluated from both offensive and defensive perspectives.

One important question to ask is if logistics will similarly underperform in the next war. As it is debatable if the Russian army will ever admit a logistics failure, only minor adjustments of the logistics doctrine are likely to result. McDermott ([2013](#)) argue that the logistics reform was aimed to support a new type of warfare based on high-tech systems and precision munition, what Slipchenko terms sixth-generation warfare. This pinpoints a mismatch between the existing logistics capability and how the war actually played out. If the Russian army, based on their experiences from Ukraine, revise their view on the sixth-generation warfare and reach the conclusion that boots on the ground is required, then their logistics concepts are likely to be adjusted accordingly.

To answer our initial question, we would claim that one can partially attribute the Russian operational failures in the Ukrainian war to logistics. The shortcomings of Russian logistics are due to previous reductions, insufficient maintenance, an untested logistical system, and the fact that logistics is not an integrated part of Russian decision-making at every level. But for the most part, the operational failures are associated with unrealistic planning assumptions. The operation was not over within days; it escalated to a full-scale war presenting logistics with challenges it was not prepared for. Russian logisticians have demonstrated an ability to adapt and support this escalation, particularly on the east and south-east fronts, principally,

perhaps, because of the access to a working railway system, and because the war now follows an established stratagem: destroying everything before slowly moving forward.

This study builds on ambiguous data collected in an ongoing war. In war, the first casualty is the truth. It must consequently be re-evaluated at a later stage, when and if data can be verified. We think that at present, however, the picture we have painted is as close as we can come to the truth from an outside perspective.

## COMPETING INTERESTS

The authors have no competing interests to declare.

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