#GIDSresearch 6 / 2024

Sebastian Nannt and Hendrik Remmel

Innovation and Adaptability as Key Factors for Military Success

Strategic Insights from the Russia-Ukraine War

#GIDSresearch | No. 6 / 2024 | December 2024 | ISSN 2699-4380

GIDS GERMAN INSTITUTE FOR DEFENCE AND STRATEGIC STUDIES

The German National Library lists this publication in the German National Bibliography; detailed bibliographic information can be obtained online via http://dnb.dnb.de

ISSN 2699-4380

This #GIDSresearch is published by the German Institute for Defence and Strategic Studies (GIDS) – DSSF (Directorate Strategic Studies and Research).

Contributions may be retrieved free of charge from the GIDS website: www.gids-hamburg.de

Proposed citation:
Sebastian Nannt/Hendrik Remmel, Innovation and Adaptability as Key Factors for Military Success. Strategic Insights from the Russia-Ukraine War, #GIDSresearch 6/2024, GIDS: Hamburg.

GIDS
German Institute for Defence and Strategic Studies
Führungsakademie der Bundeswehr
Manteuffelstraße 20 · 22587 Hamburg
Tel.: +49 (0)40 8667 6801
buero@gids-hamburg.de · www.gids-hamburg.de

Content

Lieutenant Colonel (GS) Sebastian Nannt* and Captain Hendrik Remmel**

Innovation and Adaptability as Key Factors for Military Success

Strategic Insights from the Russia-Ukraine War

1 Introduction

After more than ten years of war and more than 1,000 days after the beginning of Russia's full-scale invasion of Ukraine, media coverage and research relating to the conflict are often event-driven and largely disregard the military-strategic level. Minimal territorial gains and losses made by the two warring parties, long-running discussions regarding the supply of certain weapon systems, and the recently invigorated controversy surrounding the usefulness, timing and objective of peace negotiations are dominating the current debate in Germany. However, the medium and long-term military-strategic implications of this conflict for the European security architecture are hardly discussed at all by the general public, despite the fact that there will be far-reaching consequences. In Ukraine, the concept of total war has re-emerged, with the war affecting all aspects of life. Because of this and the rapid technological advancement of military and non-military means as well as the simultaneousness of their use, the tactical, operational and, above all, strategic evaluation of the Russia-Ukraine War is imperative. What strategic insights can be drawn from the analysis of the war between Russia, the most relevant military adversary of Germany and its European allies for the foreseeable future, and Ukraine, whose successful defence was considered impossible at the beginning of the war?

The present study works from the assumption that the course of the war to date indicates two strategic factors that are basic prerequisites for successfully navigating modern conflicts and that Germany urgently needs to review in more depth: The ability to change through adaptation[1] and innovation.[2]

However, these concepts are not new, neither from a military nor a scientific perspective. Numerous research papers[3], the White Papers[4] of the past three decades,

* Sebastian Nannt is a general staff officer in the German Army. Both during his studies of Economics and of Military Leadership and International Security, he concerned himself with the strategic importance of technology and innovation management in the defence sector.

** Hendrik Remmel is a Research Fellow at the German Institute for Defence and Strategic Studies. He has several years of experience as a combat officer in the Bundeswehr and his research is primarily concerned with the conflict analysis of the Russia-Ukraine War. Having studied history and sociology, he is currently pursuing a doctorate focusing on the strategic culture in Germany.

1 In this paper, adaptation refers to the ability to react to changing military threats in terms of doctrine and/or technology. It is therefore primarily relevant in the event of a conflict.

2 Innovation in this context refers to the ability to develop doctrinal and/or technological innovations and implement them in the armed forces, thus creating a strategic advantage in a military conflict. Military innovation is possible both in peacetime and during times of tension or conflict.

3 Howard 1983; Rosen 1991; Hoffman 2009; Murray 2011; Marcus 2014.

4 Bundesministerium der Verteidigung [Federal Ministry of Defence] 1994: 88 f.;

drawn up under the auspices of the German Federal Ministry of Defence (Bundesministerium der Verteidigung – BMVg), and, most recently, the German National Security Strategy[5] have pointed to the need for improving capabilities to adapt and develop armed forces, economies and societies before and during modern conflicts and wars.

And with good reason: ever since the Industrial Revolution, historical examples have shown that technological, economic and even overall social capabilities have an influence on military adaptability and innovation.[6] Consequently, in the past, the economic and technological decline of a nation was often accompanied by military stagnation.[7] Traditionally, the development of both civilian and military technology followed the same paradigms and both sectors were mutually dependent on each other over long periods of time.[8] Without a strong economy in conjunction with outstanding scientific developments, it was not possible to use military innovation to confront the enemy with strategic challenges in the event of a conflict or to credibly deter this enemy in advance through innovation superiority, nor to adapt to enemy military innovation flexibly, quickly and successfully.

In the following, we will present these predominantly strategic capabilities for change in a cursory manner using the categories of innovation and adaptation to be observed in the Russian and Ukrainian armed forces. Subsequently, we will provide an overview of the present military-strategic capabilities for change in Germany with regard to innovation and adaptation. Finally, we will identify measures to improve Germany's ability to adapt and innovate, based on lessons learned from the Russia-Ukraine War.

In doing so, we focus on the doctrinal and technological dynamics of the war, but do not deny the importance of the tactical and operational level and corresponding evaluations. Our aim is to provide an impetus for the debate on the military-strategic insights Germany can gain from the Russia-Ukraine War, and we hope to generally encourage the continuation of military-strategic evaluations of third-party wars.

2 Russian Approaches to Adaptation and Innovation

Russia's capabilities for military-strategic change during the war against Ukraine are primarily doctrinal in nature and involve only limited technological innovations. The latter have so far been limited to the implementation and scaling of already battle-proven and slightly modified military assets and weapon systems.

The initial Russian approach aimed at overpowering Ukraine in February 2022 was planned as a rapid seizure of Kyiv using airborne forces that were highly mobile, but unable to sustain longer combat operations. At the same time, largely self-sufficient tactical formations – called Battalion Tactical Groups (BTGs) – were employed to break the purportedly weak resistance of the Ukrainian armed forces. In order for the 'special

Bundesministerium der Verteidigung [Federal Ministry of Defence] 2006: 98 f.; Die Bundesregierung [The Federal Government] 98 f., 133 f.

5 Die Bundesregierung [The Federal Government] 2023: 15, 54, 57 f.

6 Murray (2011: 5 f.) lists the American Civil War and World Wars I and II as examples for this.

7 Bonvillian 2019: 78.

8 Ibid.

military operation' to be successful, Russia had made efforts to weaken the Ukrainian military prior to the conflict and to destabilise the Ukrainian population both through hybrid[9] and conventional means. Since occupying parts of the Donbas region and Crimea, if not before, Russia had been attempting to undermine the resistance of the Ukrainian population and the armed forces through disinformation campaigns[10], cyber attacks[11], intelligence activities[12] and acts of sabotage[13]. Additionally, Russia methodically radicalised and instrumentalised the political opposition. The deliberate destabilisation of the country and the delegitimisation of the pro-Western government were ultimately intended to provide a pretext for the deployment of Russian troops.[14] These approaches followed established Soviet non-linear warfare practices, the roots of which can be traced back to the October Revolution.[15]

The electromagnetic, maritime, air and land attacks on command and control facilities, industrial facilities, depots as well as radar and antiaircraft sites conducted immediately prior to the invasion were intended to minimize the military potential of the Ukrainian armed forces and to guarantee the Russian ground forces an invasion of Ukraine with minimal losses. On the eve of the full-scale invasion, Russia assessed both its hybrid and conventional preparatory measures as sufficiently successful. However, due to the dispersed deployment of Ukrainian units immediately before the start of the attack and the negligence on the part of the Russian armed forces to perform proper *battle damage assessment*[16], these preparations proved to be far less effective than expected by the Russian general staff.[17] This strategic miscalculation is the reason why, as is widely known, Russia's initial strategy of overpowering Ukraine failed.

At the beginning of the invasion, Ukraine was neither paralysed by shock, nor were there signs of disintegration among the Ukrainian armed forces. Consequently, the Ukrainian government did not capitulate. The well-trained and well-equipped Russian airborne forces were destroyed north of the Ukrainian capital Kyiv shortly after their initially successful assault on Hostomel Airport. Neither they, nor the BTGs responsible for reinforcement and relief, most of which were ambushed and destroyed or bogged down, had been equipped or trained for prolonged fighting.

After the failed attempt at overpowering Ukraine, the Russian military and political leadership managed to adapt to the overall strategic situation over the course of 2022. Russia's change of strategy was based on the assumption that they had more military and economic potential to draw from than their Ukrainian adversary and would therefore be able to wear down both the Ukrainian military and the civilian population. In this

9 In the following, hybrid warfare refers to the use of non-military means for military purposes in disregard of the international law applicable to international armed conflicts. For the different hybrid approaches, see Koval et al. 2023: 4–18.
10 Gherman 2023: 199 f.
11 Przetacznik/Tarpova 2022: 3 f.
12 Watling et al. 2024: 4.
13 Zabrodskyi et al. 2022: 16.
14 Watling et al. 2024: 6 f.
15 Erhart 2014: 26–32. 'Non-linear' warfare, referred to by the West as 'hybrid' warfare in its broadest sense, is the Russian concept of using both military **and** non-military means to achieve a strategic goal (cf.: Koval et al. 2023: 9 f.).
16 Battle damage assessment is an analysis process that evaluates the damage caused by lethal and non-lethal military means.
17 Zabrodskyi et al. 2022: 23.

context, military innovation, i.e. the development and implementation of new technologies in the armed forces to achieve military effects, initially played only a minor role.

Rather, doctrinal adaptability and the increased deployment of battle-tested systems formed the cornerstones of Russia's military-strategic approach.[18] With no quick victory in sight, Russia's political leadership prepared the country for a long-term war. In December 2022, a comprehensive military reform, the so-called *Shoigu* reform, was adopted, which envisaged a significant expansion of the Russian armed forces to 1.5 million servicemembers (2021: 900,000 troops). In the first half of 2023 alone, the number of military personnel active in Ukraine grew from 360,000 to 410,000 thanks to significant financial incentives for those recruited, thus removing the need for a second partial mobilisation.[19] The previous military reform of 2009, the so-called *Serdyukov* reform, had aimed at shifting the focus of the armed forces towards international and national crisis management, reducing them in size and making them rapidly deployable, yet unsuited to high-intensity combat. Now, these ideas were largely discarded. Instead, a doctrine was adopted that relied less on the tactical agility and self-sufficiency of BTGs, but instead aimed at operationally exploiting the Russian forces' quantitative, and partly qualitative, relative superiority over the Ukrainian army in terms of combat power. Much of the Russian army returned to traditional Soviet regiment, division and army group structures.[20]

Since then, at the cost of significant personnel and materiel losses on their side, Russian military operations have been specifically targeting Ukrainian force groupings, destroying them by exploiting Russia's superior fire rates and operating at a slow, but steady pace along overextended front lines.[21] In addition, Russia has been intensifying its constant attacks on Ukrainian infrastructure over the winter months. This primarily aims at laying waste to Ukraine's energy supply and destroying vital civilian facilities in densely-populated urban areas, using long-range air-launched or sea-based weapons such as glide bombs, rockets and cruise missiles in order to break the Ukrainians' resistance and weaken industries that are vital to the war effort.

In order to maintain the approach of wearing down Ukraine's military as well as the country's civilian population, economy and infrastructure in the medium term, Russia has made several strategic adjustments on a military and economic level. Relatively soon after the initial overpowering strategy had proved a failure, the Russian defence industry largely transitioned to wartime production in order to compensate for materiel losses at the front and to equip newly mobilised military forces. In addition to the production of new major defence equipment, the Russian armed forces have so far been able to primarily use existing weapon stocks to compensate for most of their losses at the front. Approximately 80% of the 1,500 battle tanks and 3,000 infantry fighting vehicles produced each year are Soviet systems that have been reactivated and upgraded.[22] Additionally, the direct supplies of weapons and ammunition from Iran[23]

18 Ryan 2024.
19 Watling/Reynolds 2024.
20 Ibid.
21 Jones et al. 2023: 2 f.
22 Watling/Reynolds 2024.
23 Notte/Lamson 2024.

and North Korea[24] help to mitigate the consequences of Russia's attrition strategy on Russia itself.[25] Russia has found ways to circumvent some of the Western sanctions and embargoes through cooperation with third-party countries like Kazakhstan and Armenia, and trade relations with China and Hong Kong as well as with India and countries of the 'Global South' have been intensified, in part to compensate for the loss of Western energy feedstock markets.[26] Effective Ukrainian innovations that initially caused massive losses to Russian troops have been successfully adopted. Most notably, this includes the large-scale use of small, relatively inexpensive drones. In fact, Russia has not only adopted these technologies, but also massively increased domestic production and successfully integrated the large-scale use of drones into their own military doctrine. According to Russian sources, by the end of 2024 the number of drones produced in Russia will have increased tenfold compared to 2023.[27]

Russia's electronic warfare capabilities, which had presumably been overestimated prior to the war and were relatively ineffective at the beginning, were quickly adapted to Ukrainian innovations and expanded in terms of quantity. This significantly reduced the effectiveness of the Western precision ammunition delivered to Ukraine. In addition, these capabilities were used to counter drones and combined with physical makeshift solutions for platform protection ('cope cages' or 'turtle tanks').[28] Later on, Russia equipped abundantly available conventional weapons and bombs with quickly improvised, relatively simple control mechanisms to increase their range as well as their penetrating power (FAB-500 or glide bombs).[29] Thus, Russian combat aircraft were able to operate outside the range of Ukrainian air defence systems that were provided by, among others, Western countries supporting Ukraine.

All in all, the Russian approach relies on doctrinal adaptation and the technological modification of existing capabilities and numerous existing (legacy) systems.

3 Ukrainian Approaches to Adaptation and Innovation

The versatility of the Ukrainian armed forces, on the other hand, primarily involves technological adaptation and innovation. The Ukrainians were able to successfully defend themselves at the beginning of the full-scale invasion in February 2022 because, after the shock of the annexation of Crimea and the partial occupation of the Donbas region in 2014, they had made preparations for the unconventional defence of their country, involving all parts of society. This included the expansion of the regular Ukrainian armed forces and the reserve in terms of personnel and materiel. Additionally, the law 'On the Basics of National Resistance' led to the establishment of Territorial Defence Forces, consisting of active military personnel and reservists, provided for the creation of a network for a civilian resistance movement against a potential Russian

24 International Institute for Strategic Studies 2023.
25 Watling/Reynolds 2024.
26 Astrov et al. 2024.
27 Denisova 2024.
28 Watling/Reynolds 2023: 18 f.
29 Ibid.: III.

occupation, and envisaged the option for the civilian population to receive military training.[30]

However, in view of its inferiority in numbers ('outmanned and outgunned'), Ukraine placed its main focus on an area where it believed to have an advantage over Russia: technology.[31] The strengthening of the national defence industry and the funding of research facilities led to the creation of Ukrainian innovation hubs closely linked to the defence sector.[32] Recognising its conventional inferiority compared to Russia, Ukraine sought to produce, procure and stock weapon systems for asymmetric warfare. Even before the full-scale invasion, Ukraine began not only to stock up on conventional military assets[33] but also to purchase and produce military drones, e.g. the Turkish *Bayraktar TB-2* and the Ukrainian *A1-SM Furia*, and to integrate commercially available systems such as the *DJI Mavic quadcopter*. The use of drones alone is not an innovative concept and has been part of modern conventional warfare since the Nagorno-Karabakh conflict in 2020. However, the widespread and heterogeneous use of these systems, i.e. their implementation even on the lowest tactical level, is undoubtedly an innovation that has been a driving force for doctrinal changes. In this context, it should be emphasised that, in light of the technological opportunities of drone warfare, top-ranking Ukrainian military personnel, most notably the former commander-in-chief of Ukraine's armed forces Valerii Zaluzhnyi as well as his successor Oleksandr Syrskyi, have called for doctrinal adjustments in the form of a 'new design of operations'[34] in the Ukrainian armed forces. Initial results are already starting to show on the battlefield.[35] In contrast to the Russian armed forces, who largely returned to the doctrines of Soviet times, most notably with regard to structures and types of operations, the Ukrainian efforts of doctrinal preparation and adaptation were technology-driven, unprecedented and therefore innovative.

In addition to traditional combat and reconnaissance operations, drones are used by the Ukrainian army for artillery target identification and adjustments, battle damage assessment, the supply of encircled or hard-to-reach units and for achieving effects in the information sphere using drone footage.[36] The connection with disruptive technologies, such as AI-powered drone swarms, forms the last cycle of innovation that the Ukrainian armed forces are currently planning in this area. To support this process, Germany is providing partial solutions designed by innovative start-up companies.

Apart from the innovative use of drones, there are numerous other examples illustrating the Ukrainian armed forces' novel approach. For instance, the *Mineral-U* radar system, developed by the Ukrainian state-owned Scientific Research Institute of Radar Systems *Kvant-Radiolokatsija* (Quantum-Radiolocation), has enabled the reconnaissance of surface objects in the Black Sea up to a distance of 600 kilometres. This, in conjunction with the *Neptune* anti-ship missile, which was also produced in

30 Shpura et al. 2023: 90–99.
31 Schmidt 2023.
32 The most prominent example of this is the platform BRAVE 1: https://brave1.gov.ua/en/, last accessed on: 03-12-2024.
33 Between 2014 and 2019, for example, the number of active Ukrainian artillery battalions doubled; 500 of the 900 battle tanks available to the Ukrainian armed forces at the beginning of the full-scale invasion were put into service between 2015 and 2019 (Zabrodskyi et al. 2022: 15).
34 Zaluzhnyi 2024: 3.
35 Rapp 2024: 3, 7.
36 Jones et al. 2023: 8.

Ukraine, caused considerable losses to Russia's Black Sea Fleet, complemented by successful operations involving unmanned 'kamikaze' surface vehicles such as the *Sea Baby* drones.[37]

Modernised *Igla-1* man-portable surface-to-air missiles and their implementation into Ukrainian units as well as *Stugna-P* and *Corsar* anti-tank guided missiles produced in Ukraine enabled the successful engagement of Russian combat vehicles and helicopters, especially at the beginning of Russia's full-scale invasion.[38] Software for the areas of reconnaissance, C2 and support, often developed by volunteers outside the Ukrainian armed forces, greatly increases the effectiveness of limited Ukrainian conventional means. One of the most prominent examples is the *Kropyva* application, a user-friendly mapping software combining drone reconnaissance results, position reports of friendly units and contact reports. It enables command and control as well as the coordination of fire and movement at the tactical and operational level almost in real time.[39] Ukraine was also able to quickly integrate its systems with commercially available, space-based data links ('Starlink') to ensure comprehensive frontline command and support. Closely tied to this innovative spirit is another aspect: Ukraine is currently moving away from the Soviet-influenced centralised command structure, granting tactical military leaders and support forces more freedom of action and even integrating (partially) automated digital command and control information systems.[40] For example, modern strategic and operative *wargames* in conjunction with the simultaneous development of scenarios regarding possible Russian attacks currently serve to improve the decision-making skills of the members of the Ukrainian General Staff.[41] Nevertheless, Ukraine's armed forces and its population are still faced with their opponent's *attrition warfare*[42], allowing Russia to maintain the strategic initiative. In order to break out of this adverse dynamic, Ukraine has also taken steps towards doctrinal adaptation. However, the weapons and ammunition provided by the Western supporting countries so far and the results of national mobilisation efforts are not yet enough for Ukraine to attrite Russian forces and increase their losses to a level that is unacceptable to the aggressors. Ukrainian attempts at implementing an overpowering strategy on their part by means of space-oriented, highly mobile surprise (counter) offensives (*manoeuvre warfare*[43]) did prove both tactically and operationally successful in Kharkiv and Kherson in the autumn of 2022, and also in Kursk in the summer of 2024. However, they did not succeed in causing a strategic dilemma for Russia.

Additionally, Ukraine's innovative bottom-up approach lacks wide-spread operationalisation for all deployed brigades as well as scaling efforts, i.e. procurement in necessary quantities. Restrictions within the military on the use of civilian technologies or their integration in military structures remain an obstacle to the wide-spread implementation of innovative technologies.[44] As a result, at the beginning of the

37 Redford 2024: 1 f.
38 Zabrodskyi et al. 2022: 17 f.
39 Jones et al. 2023: 8 f.
40 Hordiichuk et al. 2023: 46 f.
41 Zabrodskyi et al. 2022: 17 f.
42 Gady/Kofman 2023: 7 f.
43 Ibid.
44 Jones et al. 2023: 9.

war it often happened that individual brigades independently procured civilian technologies, especially drones, with the support of private donors.[45]

Overall, Ukraine's technological and partly doctrinal innovations, which were initiated even before the invasion and are now being further intensified as the war goes on, have so far allowed the country to asymmetrically counter Russia's continuing (relative) quantitative superiority in terms of almost all military capacities, enabling Ukraine to (still) survive an ultimately symmetric conflict.

4 Germany's Adaptation and Innovation Deficit

Russia's full-scale invasion of Ukraine, which has now lasted for more than 1,000 days, shows that it is adaptive and innovative capabilities that enable us to survive in a modern military conflict. In Germany, both elements have been neglected over the past three decades.

Ever since the end of the Cold War, declining financial resources (measured in terms of gross domestic product) have led to a situation in which fewer and fewer militarily relevant technologies have been commissioned, let alone developed, by the Bundeswehr itself due to a specific doctrinal need. Instead, the availability and development of technologies have shaped doctrinal changes. As a result, the *dual-use* approach entailed extensive reliance on commercially available technologies, which were used as the basis to further develop military capabilities. These civilian technologies were adapted to often highly specific military requirements, which was complicated (and expensive) for a relatively small number of military assets.[46] Consequently, military innovations and adaptations were only partially geared to the specific and challenging combat situations to be encountered when facing an equally capable opponent. As regards the Russian war against Ukraine, but also the general trends in the development of disruptive technologies and their military utilisation, this dynamic has several significant and currently predominantly negative consequences for the Bundeswehr.

4.1 Intellectual Property in Private Hands

First, the core components of advanced technology (often associated with software and sophisticated hardware) are usually the intellectual property of private companies, so they cannot be simply purchased and deployed like aircraft or combat vehicles.[47] Using the example of artificial intelligence (AI) development, which today is closely connected with drone technology in the military sector[48], it can be shown that the key actors in the field of research and development in Germany are rooted in civil environments.[49] As a result, the required technology has tended to be used under license

45 See, for example, the calls for donations for the procurement of drones for the 47th Mechanised Brigade by the European Resilience Initiative Center (ERIC).
46 Finkel 2011: 28.
47 In innovation management, a distinction is therefore made between two case groups: armament on the one hand and software on the other.
48 Bendett/Pinelis 2024.
49 For example, the AI software company Helsing, which made a significant contribution to the implementation of AI-based swarm technology in the combat drones delivered by Germany to Ukraine.

at high cost, under strict conditions and without full knowledge of its possibilities and limitations; with the additional difficulty that external experts are not necessarily available in the event of war.[50] Purely military-oriented high-technology projects such as the *Future Combat Air System* (FCAS) operate in a narrow space of military-specific research and development, which has so far only been able to benefit to a limited extent from the transfer of civilian technology.

4.2 Dual-Use Regulations

Secondly, the separation between civil and military use is reinforced, even in clear dual-use cases, by regulations.[51] Even though the German government's Strategy Paper on Strengthening the Security and Defence Industry[52] describes civil research as a key driver of military capabilities involving the latest technologies, the gap between civil and military development in Germany is far greater than in allied countries such as France, the United Kingdom and the United States.[53] For example, many countries have government innovation agencies equipped with extensive financial resources.[54] Over the past decades, measures such as civil clauses at German universities have further manifested this separation between civil and military research.[55] This is accompanied by so-called ESG (environmental, social and governance) standards, which prevent venture capital companies in particular from investing in start-ups focusing on primarily military areas of applications.[56] At the same time, thresholds in EU public procurement law require the Bundeswehr to limit procurements from civilian companies to 221,000 euros (excluding VAT) per firm, even though start-ups in particular are becoming increasingly relevant to disruptive innovations.[57] Moreover, the national Procurement Regulation on Defence and Security does not provide for the direct support of start-ups and further complicates state promotion of innovation in the field of defence.

4.3 The Armed Forces As (Just) Another Customer

Thirdly, in global innovation ecosystems armed forces have to compete with numerous other customers and buyers.[58] Often, even large technology companies, and these perhaps in particular, simply no longer see the need to contribute to the defence industry market, which has shrunk over decades and has a bad reputation as well as highly complex tendering procedures.[59] As a result, the Bundeswehr, on the one hand, is experiencing a growing technological dependence on dual-use technologies, but, on the

50 For instance, neither women nor employees without German citizenship could be obliged to cooperate under the Emergency Labour Control Act (cf. Müller 2024).
51 Barker/Hagebölling 2022: 98 ff.
52 Die Bundesregierung [The Federal Government] 2020: 5.
53 Barker/Hagebölling 2022: 100.
54 For example, DARPA in the US or SVI in France.
55 Barker/Hagebölling 2022: 27.
56 Nannt 2024: 60.
57 European Union 2014 in conjunction with the Regulation of the EU Commission 2023/2495 (European Union 2023).
58 Dew/Lewis 2022: 5.
59 Hachey et al. 2020: 20 f.

other hand, as a military organisation, can hardly assume an active, let alone leading role in the corresponding innovation ecosystem.[60]

4.4 Increasing Technology Dynamics

Fourthly, the speed of development of disruptive technologies such as AI or quantum systems represents a growing challenge for the personnel and financial resources of most state research institutions, even in basic research. To date, government research funding in the dual-use sector has been rather weak. Despite new approaches that have been pursued for some years (innovation hubs, etc.), the rapid implementation of new technologies for the Bundeswehr clashes with established procurement processes, which are still geared more towards the medium to long-term acquisition of military equipment and commodities of all kinds under conditions of legal and financial certainty. This is made even more difficult by the complexity of modern weapons systems and the associated dependence on a multitude of (sub-)technologies contained therein and, accordingly, on civil companies and complex value chains. For example, a single military drone may contain elements of AI, robotics, advanced software and new materials, all of which are being developed through commercial and independent markets and value chains.[61]

As a result of the four dynamics described above, there is a fundamental innovation deficit in the German armed forces that persists despite all efforts, even in routine or peacetime operations. This lack of innovation, in turn, means the Bundeswehr is in poor shape to adapt to an enemy's military capabilities flexibly and effectively in the event of a conflict. In Germany, a more intensive integration and more targeted cooperation between industry, the scientific community and the military seems unlikely at present, neither through a state-imposed top-down approach, comparable to the Russian way, nor through the intrinsically motivated bottom-up approach that is used by Ukraine. In the event of war, a technology-oriented, tactical-operational and strategic ability to adapt and innovate across the entire capability spectrum would therefore only be possible in Germany with considerable delay and/or great efforts and major cuts. After decades of austerity measures (peace dividend), even extensive recourse to strategic reserves, whether in terms of critical resources or military equipment, as in the case of Russia, would hardly be possible in Germany. The long reduction of conventional military capabilities in favour of lower operating and personnel costs and the focus on international crisis management, including the abandonment of strategic stockpiling in almost all areas, complicates the situation further. Even if access to resources was secured, Germany would, in present circumstances, not be able to compensate for the time required to complete the necessary transformation process in the fields of science and industry in case of war by using strategic reserves.

On the one hand, the description of the situation in Germany shows considerable deficits in terms of innovation and adaptation capability and, at the same time, proves that this is not a challenge that can be met by the Bundeswehr alone. It affects the military just as much as society, politics and the scientific community. The answer to

60 Dew/Lewis 2022: 6.
61 Gallo 2018: 6.

the question of how Germany can survive and prevail in a comprehensive, existential military conflict using the most modern means – a question that has been considered irrelevant for three decades – must therefore be accompanied by an increase in adaptability and innovation not only in the Bundeswehr, but also in the German industry and science community at large.

5 Conclusions and Deductions: An Integrated Approach to Innovative and Adaptable Armed Forces

The need to be highly innovative and capable of adaptation before and during military conflicts is undisputed with regard to the Russian war in Ukraine and confirms the strategic insights gained in the long series of military conflicts since the Industrial Revolution. The approaches pursued by Russia and Ukraine illustrate that these capabilities cannot be developed when a conflict is already underway, but that it is necessary to establish them well beforehand during 'phase zero'. In order for Germany to be adaptive and innovative in war, measures would have to be taken that enable an immediate and sustained flexible and scalable adaptation to the prevailing situation, which constantly changes in the course of a conflict and for which one's own armed forces can only be prepared to a certain extent.

In view of the fact that disruptive technological developments in the civil sector are on the increase and that they will be used by the military in the future, the ability to be innovative and adaptive both before and during a conflict or war will become more and more important.[62] Close networking between industry, science and the military makes it possible, on the one hand, to find adaptive solutions in response to innovations implemented by military opponents and, on the other, to achieve and constantly renew a certain superiority in terms of effectiveness, availability of information and leadership on the battlefield through superior technologies.

The prerequisite for developing capabilities for adaptation and innovation is a clear perception of threat across society as a whole. This generates a need for action and change with regard to the array of issues described above. In addition to Ukraine, there are Taiwan, Estonia, South Korea and Israel as good examples of countries where a constant security threat from one or more geopolitical opponents is perceived by most of the population. Based on such a shared awareness across society, interdisciplinary approaches to state-funded (defence) research are just as much a consensus as preventive measures to increase the resilience and adaptability of society as a whole.[63]

Population surveys conducted in Germany in 2024, however, clearly indicate that there is no societal consensus on the implementation of an innovation and adaptation culture against the background of Russia's challenge to the European security architecture. Immediately after the beginning of the Russian invasion, the majority of the population surveyed by the Bundeswehr Centre of Military History and Social Sciences considered Russia to be a threat to Germany's security (65 percent in 2024[64], 61 to 64 percent in the previous year[65]). Yet, at the same time, just over half of the

62 Allied Command Transformation 2023: 35 f.
63 Barker/Hagebölling 2022: 32.
64 Graf 2024b: 5.
65 Graf 2024a: 12.

respondents were in favour of specific preventive measures such as the reintroduction of compulsory military service (49 percent in 2024[66], 52 percent in the previous year[67]), and even fewer advocated personal commitment in the event of a conflict (42 percent in 2024[68], 39 percent in the previous year[69]). Therefore, there is a need for a cross-departmental and long-term communication strategy that outlines to the population both the conflict and threat scenarios that can be expected across the entire spectrum and the need for action to increase Germany's capacity for adaptation and innovation. With a population that, for the most part, remains interested in matters of foreign and security policy, the basic prerequisites for such an undertaking would be met.[70]

At the strategic level, the armed forces are dependent on the innovative and adaptive strength of industry, the scientific community and society. With and despite the growing importance of digitalisation in conflicts, German innovation capabilities have increasingly developed outside the traditional defence industry. On the procurement side, it is therefore important to shift the focus from military platforms to weapon systems software in line with a software-defined defence approach[71] and to open up the defence equipment market to new participants. In addition, the Bundeswehr must proactively network with research and innovation centres in order to promote promising technologies, even if this means accepting failed projects, and to enable the scalability of innovations to the mutual benefit of both sides through economic cooperation. Approaches that need to be sustained include the creation of competence centres as contact points for start-ups, the conduct of experimentation series with commercially available products in the armed forces and the establishment of the research and innovation hub at the Federal Ministry of Defence.

Specifically, there is also a need to identify new industries relevant in times of crises and war and to actively incorporate them into the concept of integrated security, which includes expanding the list of national key technologies. In addition, defence research – especially disruptive and exploratory research – must also be actively promoted in a dual-use approach, and the restrictive attitude of civil research institutions towards such projects must be further overcome through cross-departmental incentives, for example through research funding. Moreover, it is important to further expand other government-initiated approaches to promote the development of disruptive technologies, such as the 'digital hubs' for military use in the respective technology fields. Innovation agencies – including those operating across departments – are already bringing military users together with innovative manufacturers, even under difficult conditions such as civil clauses and the restrictions of public procurement law, thereby contributing to the opening of the armed forces. Newly designed industry dialogue formats, the creation of experimental spaces and an active civil and military role for reservists as links between

66 Graf 2024b: 34.
67 Graf 2024a: 31.
68 Graf 2024b: 39.
69 Graf 2024a: 31.
70 Bunde/Hammelehle 2020: 107.
71 Bundesministerium der Verteidigung/Bundesverband der Deutschen Sicherheits- und Verteidigungsindustrie e.V./Bundesverband der Deutschen Luft- und Raumfahrtindustrie e.V./Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e.V. [Federal Ministry of Defence/Federal Association of the German Security and Defence Industry/German Aerospace Industries Association/Federal Association for Information Technology, Telecommunications and New Media] (2023).

the armed forces and society are further examples of the necessary opening of the Bundeswehr to relevant areas of industry, science and research. It is also vital for the armed forces to continue to promote innovations in times that are relatively peaceful by supporting (young) visionary soldiers, such as through the *founders@unibw*[72] programme at the Bundeswehr University in Munich.[73]

Currently, Ukraine is facing a strategic challenge: due to Russia's ability to constantly improve its adaptation and scaling cycles, any advantages resulting from Ukrainian innovations are quickly lost. Although the Ukrainian bottom-up approach allows for an edge in innovation over Russia, insufficient scaling prevents the generation of a strategic advantage over successful Russian top-down adaptations. As a result, given the massive imbalance of available military resources in Russia's favour, the Ukrainian armed forces will, for the foreseeable future, remain strategically on the defensive. This clearly shows that while the pure ability to innovate is an important aspect, it is not the decisive, and only, factor in deciding a military conflict at the strategic level.[74] The ability to adapt is therefore closely linked to the necessary increase in resilience throughout society, which will enable Germany and the Bundeswehr to be adaptive and, ultimately, persevere in the event of a conflict. In times of peace, however, given the limited financial resources on the one hand and the ever-faster innovation cycles on the other, we must not succumb to the illusion that we can provide a tailor-made adaptation to every military innovation of our opponents and rivals. Rather, we must create the basic conditions that make adaptation and innovation possible in the event of a conflict.

In view of the recent military conflicts involving conventional armed forces on both sides, and especially the Russian war in Ukraine, top priority must be given to the decentralisation of state and civil communication channels in C4I2 (command, control, communication, computers, information, intelligence) together with the involvement of commercial providers and the strengthening of cyber infrastructure, especially in view of Russia's already ongoing hybrid warfare campaign against Germany. The identification of war-relevant goods and their stockpiling (e.g. food, medicines, fuels and lubricants, energy sources, ammunition, major defence equipment) is necessary in the medium and long term both to give industry and science time to transition to war production in the event of a crisis or conflict and to provide them with the necessary resources to ensure scalable adaptation, and ultimately, to enable them to be innovative. The same applies to the creation of redundancies in the transport and energy infrastructure and the diversification of value chains, in particular with the aim of reducing the dependence on raw materials from certain countries.

In summary, we may conclude that adaptation is of paramount importance in modern conflicts to avoid falling behind strategically due to enemy innovations. The intensive promotion of disruptive innovations in technology fields that are relevant to the armed forces can even lead to a situation in which a military opponent is strategically surprised and one's own forces can gain and maintain the initiative – in other words, disruptive innovations can have a deterrent effect. Germany has a strong economy and is home to excellent scientific institutions, world-leading corporations, medium-sized

72 Information on the programme is available at the following website: https://www.unibw.de/entrepreneurship, last accessed on: 03-12-2024.
73 Dombrowski/Gholz 2006: 12.
74 Farrell 2012: 130.

companies and a well-developed university landscape. So theoretically, it has all the prerequisites to bring about changes in the event of crises and conflicts. One of the Bundeswehr's main tasks at hand is creating an environment in which Germany can tap into its potential to keep achieving a permanent leadership, effectiveness and information superiority of its armed forces through fundamental innovation superiority, especially with regard to Russia. Set against the backdrop of credible conditions for rapid adaptation as well as targeted innovation in the event of a conflict, both capabilities form the mainstay of consistent deterrence.

The National Security and Defence Industry Strategy[75], published on 4 December 2024 by the Federal Ministry of Defence and the Federal Ministry for Economic Affairs and Climate Action, can help to initiate the urgently needed development process – if the measures listed in the document are implemented consistently.

List of References

Allied Command Transformation (2023): Strategic Foresight Analysis, Norfolk.

Astrov, Vasily/Scheckenhofer, Lisa/Semelet, Camille/Teti, Feodora (2024): Monitoring the Impact of Sanctions on the Russian Economy, in: EconPOL Policy Report Vol. 8, https://www.econpol.eu/sites/default/files/2024-02/EconPol-PolicyReport_47.pdf, last accessed on: 12-09-2024.

Barker, Tyson/Hagebölling, David (2022): A German Digital Grand Strategy – Integrating Digital Technology, Economic Competitiveness, and National Security in Times of Geopolitical Change (DGAP Report No. 7), https://dgap.org/system/files/article_pdfs/DGAP-Report-2022-07-EN_0.pdf, last accessed on: 01-11-2024.

Bendett, Samuel/Pinelis, Jane (2024): How the West Can Match Russia in Drone Innovation, in: War on the Rocks, 25-01-2024, https://warontherocks.com/2024/01/how-the-west-can-match-russia-in-drone-innovation/, last accessed on: 24-02-2024.

Bonvillian, William Boone (2019): The Connected Science Model for Innovation – The DARPA Model, in: William Boone Bonvillian, Richard Van Atta and Patrick Windham (eds.), The DARPA Model for Transformative Technologies: Perspectives on the U.S. Defense Advanced Research Projects Agency, Open Book Publishers: Cambridge, pp. 77–118.

Bunde, Tobias/Hammelehle, Julia (2020): Public Opinion – Folk Wisdom, in: Tobias Bunde, Laura Hartmann, Franziska Stärk, Randolf Carr, Christoph Erber, Julia Hammelehle and Juliane Kabus (eds.), Zeitenwende/Wendezeiten. Special Edition of the Munich Security Report on German Foreign and Security Policy. Munich Security Conference, pp. 106–143 https://securityconference.org/assets/01_Bilder_Inhalte/03_Medien/02_Publikationen/MSC_Germany_Report_10-2020_Engl.pdf, last accessed on: 28-10-2024.

Bundesministerium der Verteidigung [Federal Ministry of Defence] (1994): Weißbuch 1994. Weißbuch zur Sicherheit der Bundesrepublik Deutschland und zur Lage und Zukunft der Bundeswehr, Bonn.

Bundesministerium der Verteidigung [Federal Ministry of Defence] (2006): White Paper 2006. On German Security Policy and the Future of the Bundeswehr, Bonn.

Bundesministerium der Verteidigung/Bundesministerium für Wirtschaft und

75 Bundesministerium der Verteidigung/Bundesministerium für Wirtschaft und Klimaschutz [Federal Ministry of Defence/Federal Ministry for Economic Affairs and Climate Action] 2024.

Klimaschutz [Federal Ministry of Defence/Federal Ministry for Economic Affairs and Climate Action] (2024): National Security and Defence Industry Strategy, Berlin.

Bundesministerium der Verteidigung/Bundesverband der Deutschen Sicherheits- und Verteidigungsindustrie e.V./Bundesverband der Deutschen Luft- und Raumfahrtindustrie e.V./Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e.V. [Federal Ministry of Defence/Federal Association of the German Security and Defence Industry/German Aerospace Industries Association/Federal Association for Information Technology, Telecommunications and New Media] (2023): Position Paper, Software Defined Defence: Berlin.

Die Bundesregierung [The Federal Government] (2016): White Paper 2016. On German Security Policy and the Future of the Bundeswehr, Berlin.

Die Bundesregierung [The Federal Government] (2020): Strategiepapier der Bundesregierung zur Stärkung der Sicherheits- und Verteidigungsindustrie [The Federal Government's Strategy Paper on Strengthening the Security and Defence Industry], Berlin.

Die Bundesregierung [The Federal Government] (2023): Robust. Resilient. Sustainable. Integrated Security for Germany – National Security Strategy, Auswärtiges Amt [Federal Foreign Office]: Berlin, https://www.nationalesicherheitsstrategie.de/National-Security-Strategy-EN.pdf, last accessed on: 12-09-2024.

Denisova, Kateryna (2024): Russia Aims to Increase Drone Production Tenfold in 2024, Putin Claims, in: Kyiv Independent, 19-09-2024, https://kyivindependent.com/russia-aims-to-increase-drone-production-tenfold-putin-claims/, last accessed on: 23-11-2024.

Dew, Nicholas/Lewis, Ira (2022): System-on-System Competition in Defense Innovation, Marine Corps University Press: Quantico.

Dombrowski, Peter/Gholz, Eugene (2006): Buying Military Transformation – Technological Innovation and the Defense Industry, Columbia University Press: New York.

Erhart, Hans-Georg (2014): Russlands unkonventioneller Krieg in der Ukraine: zum Wandel kollektiver Gewalt, in: APuZ 45-46, pp. 26–32.

European Union (2014): Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC, Brussels, https://eur-lex.europa.eu/eli/dir/2014/24/oj/eng, last accessed on: 03-11-2024.

European Union (2023): Commission Delegated Regulation (EU) 2023/2495 of 15 November 2023 amending Directive 2014/24/EU of the European Parliament and of the Council in respect of the thresholds for public supply, service and works contracts, and design contests, Brussels, https://eur-lex.europa.eu/eli/reg_del/2023/2495/oj, last accessed on: 03-11-2024.

Farrell, Theo (2012): Improving in War. Military Adaptation and the British in Helmand, 2006–2009, in: Dmitry Adamsky and Kjell Inge Bjerga (eds.), Contemporary Military Innovation. Between Anticipation and Adaptation, Routledge Taylor&Francis Group: London/New York, pp. 130–152.

Finkel, Meir (2011): On Flexibility. Recovery from Technological and Doctrinal Surprise on the Battlefield, Stanford University Press: Stanford.

Gady, Franz-Stefan/Kofman, Michael (2023): Ukraine's Strategy of Attrition, in: Survival, Vol. 65, No. 2, pp. 7–22.

Gallo, Marcy (2018): The Global Research and Development Landscape and Implications for the Department of Defense (R45403), Congressional Research Service: Washington D.C.

Gherman, Marin (2023): The Evolution of the Russian Federation's Official Anti-Ukraine Discourse (2014-2022), in: Codrul Cosminului, Vol. 29, No. 1, pp. 193–216.

Graf, Timo (2024a): Was bleibt von der Zeitenwende in den Köpfen? Sicherheits- und verteidigungspolitisches Meinungsbild in der Bundesrepublik Deutschland 2023, Research Report 136 of the Bundeswehr Centre of Military History and Social Sciences, Potsdam.

Graf, Timo (2024b): Zwischen Kriegsangst und Kriegstauglichkeit. Sicherheits- und verteidigungspolitisches Meinungsbild in der Bundesrepublik Deutschland 2024, Research Report 137 of the Bundeswehr Centre of Military History and Social Sciences, Potsdam.

Hachey, Krystal/Libel, Tamir/Partington, Zackory (2020): The Impact of Artificial Intelligence on the Military Profession, in: Krystal Hachey, Tamir Libel and Waylon Dean (eds.), Rethinking Military Professionalism for the Changing Armed Forces: Ottawa, pp. 201–212.

Hoffman, Jon T. (2009): A History of Innovation: U.S. Army Adaptation in War and Peace, Military Bookshop: Washington.

Hordiichuck, Valerii/Andriianova, Nina/Peredrii, Oleksandr (2023): Joint All-Domain Command and Control System as a Basis of the Multi-Domain Operations Concept for Ukraine Defence, in: Mykhailo Koval (ed.), Theoretical and Applied Aspects of the Russian-Ukrainian War: Hybrid Aggression and National Resilience, Technology Center PC: Kharkiv, pp. 37–43.

Howard, Michael (1983): The Uses and Abuses of Military History, in: Michael Howard (ed.), The Causes of War and Other Essays, Harvard University Press: Cambridge, pp. 188–197.

International Institute for Strategic Studies (2023): The Surge of Activity in Relations Between North Korea and Russia, in: Strategic Comments Vol. 29, Comment 30, October 2023, https://www.iiss.org/globalassets/media-library---content--migration/files/publications/strategic-comments-delta/2023/10/29-30-the-surge-of-activity-in-relations-between-north-korea-and-russia.pdf, last accessed on: 12-09-2024.

Jones, Seth/McCabe, Riley/Palmer, Alexander (2023): Ukrainian Innovation in a War of Attrition (CSIS Briefs), in: Center for Strategic and International Studies, 27-02-2023, https://www.csis.org/analysis/ukrainian-innovation-war-attrition, last accessed on: 11-09-2024.

Koval, Mykhailo/Ivashchenko, Andrii/Telelym, Vasyl (2023): Hybrid Warfare: Strategies and Countermeasures, in: Mykhailo Koval (ed.), Theoretical and Applied Aspects of the Russian-Ukrainian War: Hybrid Aggression and National Resilience, Technology Center PC: Kharkiv, pp. 4–19.

Marcus, Raphael (2014): Military Innovation and Tactical Adaptations in the Israel-Hizballah Conflict: The Institutionalization of Lesson-Learning in the IDF, in: Journal of Strategic Studies 38 (4), pp. 500–528.

Müller, Wolfgang (2024): Die Wehrpflicht muss weg – im Arbeitssicherstellungsgesetz! Personalbedarfsdeckung im Spannungsfeld zwischen militärischer und ziviler Verteidigung (#GIDSstatement 3/2024), GIDS: Hamburg, https://gids-hamburg.de/wp-content/uploads/2024/06/GIDSStatement2024_03_Mueller_20240611.pdf, last accessed on: 01-11-2024.

Murray, Williamson (2011): Military Adaptation in War: With Fear of Change, Cambridge University Press: Cambridge.

Nannt, Sebastian (2024): Die Zusammenarbeit mit Innovations-Ökosystemen als Weg für technologiebasierte Strategie-Entwicklung am Beispiel der Drohnentechnologie (MFIS final thesis), Helmut Schmidt University/Bundeswehr University

Hamburg (unpublished).
Notte, Hanna/Lamson, Jim (2024): The Uncomfortable Reality of Russia and Iran's New Defense Relationship, in: War on the Rocks, 24-07-2024, https://warontherocks.com/2024/07/the-uncomfortable-reality-of-russia-and-irans-new-defense-relationship/, last accessed on: 12-09-2024.
Przetacznik, Jakub/Tarpova, Simona (2022): Russia's War on Ukraine: Timeline of Cyber-Attacks (EPRS Briefing), in: European Parliamentary Research Service Briefing of June 2022, https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733549/EPRS_BRI(2022)733549_EN.pdf, last accessed on: 12-09-2024.
Rapp, Andreas (2024): Die „Saluschnyj-Doktrin". Lehren aus der ukrainischen Offensive 2023 und die Zukunft der Drohnenkriegsführung (#GIDSstatement 9/2024), GIDS: Hamburg, https://gids-hamburg.de/wp-content/uploads/2024/09/GIDSstatement2024_09_Rapp_240930.pdf, last accessed on: 01-11-2024.
Redford, Duncan (2024): Maritime Lessons from the Ukraine-Russia Conflict: USVs and the Applicability to the Baltic and High North (#GIDSstatement 11/2024), GIDS: Hamburg, https://gids-hamburg.de/wp-content/uploads/2024/10/GIDSstatement2024_11_Redford_engl_240926.pdf, last accessed on: 28-11-2024.
Rosen, Stephen (1991): Winning the Next War: Innovation and the Modern Military, Cornell University Press: Ithaca/London.
Ryan, Mick (2024): Russia's Adaption Advantages: Early in the War, Moscow Struggled to Shift Gears – but Now It's Outlearning Kyiv, in: Foreign Affairs, 05-02-2024, https://www.foreignaffairs.com/ukraine/russias-adaptation-advantage, last accessed on: 12-09-2024.
Schmidt, Eric (2023): Innovation Power: Why Technology Will Define the Future of Geopolitics, in: Foreign Affairs, 28-02-2023, https://www.foreignaffairs.com/united-states/eric-schmidt-innovation-power-technology-geopolitics, last accessed on: 05-02-2024.
Shpura, Mykola/Andriianova, Nina/Lobko, Mykhailo (2023): National Resistance as a Component of Countermeasures in the Russian-Ukrainian War, in: Mykhailo Koval (ed.), Theoretical and Applied Aspects of the Russian-Ukrainian War: Hybrid Aggression and National Resilience, Technology Center PC: Kharkiv, pp. 90–99.
Watling, Jack/Danylyuk, Oleksandr V/Reynolds, Nick (2024): The Threat from Russia's Unconventional Warfare Beyond Ukraine, 2022-24 (RUSI Special Report), in: Royal United Services Institute for Defence and Security Studies, February 2024, https://static.rusi.org/SR-Russian-Unconventional-Weapons-final-web.pdf, last accessed on: 11-09-2024.
Watling, Jack/Reynolds, Nick (2023): Meatgrinder: Russian Tactics in the Second Year of Its Invasion of Ukraine (RUSI Special Report), in: Royal United Services Institute for Defence and Security Studies, 19-05-2023, https://static.rusi.org/403-SR-Russian-Tactics-web-final.pdf, last accessed on: 28-11-2024.
Watling, Jack/Reynolds, Nick (2024): Russian Military Objectives and Capacity in Ukraine Through 2024 (RUSI Commentary), in: Royal United Services Institute for Defence and Security Studies, 13-02-2024, https://www.rusi.org/explore-our-research/publications/commentary/russian-military-objectives-and-capacity-ukraine-through-2024, last accessed on: 11-09-2024.
Zabrodskyi, Mykhaylo/Watling, Jack/Danylyuk, Oleksandr V/Reynolds, Nick (2022): Preliminary Lessons in Conventional Warfighting from Russia's Invasion of

Ukraine: February–July 2022 (RUSI Special Report), in: Royal United Services Institute for Defence and Security Studies, 30-11-2022, https://static.rusi.org/359-SR-Ukraine-Preliminary-Lessons-Feb-July-2022-web-final.pdf, last accessed on: 11-09-2024.

Zaluzhnyi, Valerii (2024): On the Modern Design of Military Operations in Russo-Ukrainian War: In the Fight for the Initiative, 01-02-2024, https://s3.document-cloud.org/documents/24400154/ukraine-valerii-zaluzhnyi-essay-design-of-war.pdf, last accessed on: 01-11-2024.