ROMANIAN MILITARY THINKING

THE ROLE OF HEAVY ARMOUR IN MODERN WARFARE

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The end of the Cold War called an at least temporary halt to the idea of a conventional armed confrontation between two or more states with relatively equal capabilities. The need to manage unconventional and asymmetrical conflicts has led to a recalibration of military capabilities to respond effectively to new challenges. Western militaries have thus focused their efforts on achieving flexible and versatile capabilities. This new reality has naturally led to the constant neglect of heavy armoured forces. It is due to their relatively low utility in stability operations. However, recent conflicts, such as those in Nagorno-Karabakh and Ukraine, are bringing the need and desirability of using heavy armour in ground operations back to the forefront. Against this background, and with the unprecedented development of multi-spectral sensors, long-range, high-precision weapons and various unmanned platforms, the question arises as to whether heavy armoured capabilities still have a place in today's conflicts. The meticulous analysis of the current military phenomenon, in particular the Russian-Ukrainian conflict, has made it possible to obtain relevant results regarding the future and the possibilities for their development. The results are valuable in view of the initiatives taken by the Romanian Armed Forces to strengthen the armoured capabilities, in particular the steps taken to acquire new tanks, infantry fighting machines and self-propelled artillery.

Keywords: contemporary battlefield; heavy armoured formations; mobility; protection; firepower;

INTRODUCTION

NATO doctrine for land operations identifies three main types of tactical forces: *heavy forces*, *medium forces* and *light forces* (Allied Joint Publication, AJP-3.2 2022, B-1). While this categorisation of forces is not strict and mandatory for member states, it recognises that there are differences in the inclusion of forces in a particular category. Heavy forces are highly versatile, but their main role is to act in specific armed combat operations, carrying out a series of violent actions to defeat the enemy (Reynolds, 2023, p. 11). The description and assessment of the effects produced by these types of forces are based on the following parameters: *protection*, *firepower* and *mobility (figure 1)*. The way in which these three characteristics are balanced provides military commanders with options on how to conduct operations as well as warnings on the limitations, vulnerabilities and training needs of these forces.

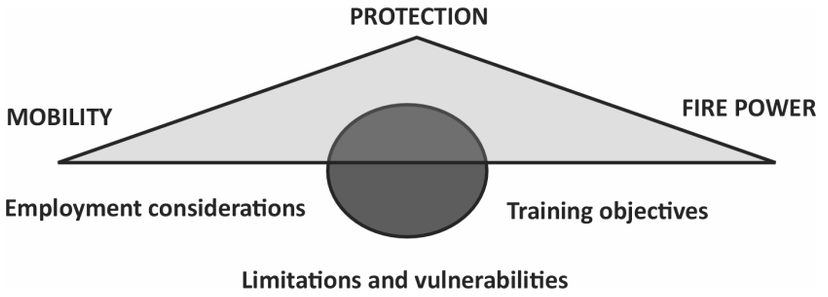

Figure 1: Determinants of heavy armoured forces (author's design)

Heavy forces include, in particular, tactical formations equipped with tanks, but also infantry forces operating on board heavily armoured infantry fighting machines and armoured combat search elements. As a general rule, the configuration of heavy armoured tactical formations aims to achieve a mix between tanks and armoured infantry units, the proportion depending on requirements and available capabilities. The main characteristics of this type of force are high firepower, extensive protection against enemy firepower,

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and high tactical mobility. These forces have a high degree of flexibility and shock capability, and their physical presence demoralises the enemy. However, despite these advantages, heavy armoured forces also have a number of limitations, such as reduced operational-strategic mobility, the ability to operate autonomously in restricted environments, special maintenance and supply requirements, and limited numbers of personnel who can operate as land forces. Reducing existing vulnerabilities means achieving a mix of heavy, medium and light forces operating in restricted terrain and training with these forces. With these considerations in mind, heavy armoured forces have generally been engaged in major offensive operations aimed at breaking through the enemy's defences, penetrating deep into the enemy's defences, then exploiting their success and pursuing them. Over the years, they have also proven their effectiveness in defensive operations, particularly in executing counterattacks or blocking the enemy.

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The usefulness of armoured capabilities, particularly tank formations, is currently being debated by the scientific community (Buzzard, 2023). Their raison d'être is being questioned in the context of a battlefield contested on all fronts, where multispectral sensors and precision weapons severely limit manoeuvrability (Johnson, 2022). The question of whether it is still cost-effective to develop an armoured platform amounting to about $5-6 million when it can be destroyed by an anti-tank missile that is up to twenty times less expensive makes therefore sense. In this context, both military experts and defence industry developers are assessing the performance of tanks and armoured vehicles in the heavy category. These assessments are aimed at reducing their vulnerability to anti-tank systems, in particular guided missiles, high-precision artillery rounds and air-launched attack vectors.

From the perspective of the aforementioned problematisation, the primary objective is to ascertain the role that heavy armour plays and will continue to play in contemporary conventional conflicts. In order to achieve this objective, we have conducted qualitative research, employing a longitudinal methodology to explore how heavy armour is used in operations. This approach has enabled us to identify critical situations in which these capabilities can generate a tactical advantage.

Additionally, the interpretative analysis of the contemporary military phenomenon has allowed us to identify threats and vulnerabilities to tank formations, as well as solutions for their reduction, including viable alternatives. In order to direct the research process, we have established the following primary research question:

- *In the future, will heavy forces be a key capability in warfare and, if so, what role will they play?*

This is corroborated by a series of subsequent inquiries, the responses to which are instrumental in achieving the research objective:

- *What are the principal threats to heavy armoured forces in the contemporary battlefield?*
- *What measures can be taken to mitigate the impact of threats to heavy armoured forces?*
- *What are the advantages of heavy armoured formations and how can they be effectively utilised?*

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Recent assessments of the Russian-Ukrainian conflict have revealed that the two opponents employ their heavy armoured units in disparate situations, striving to identify solutions that enhance the efficacy of their actions (Biddle, 2022). From this starting point, we are interested in examining how their doctrine, organisation and composition need to be recalibrated in order to meet the new requirements of the battlefield. The subject is a benchmark of interest in the context of the significant efforts being made by the allied states, including Romania, to strengthen existing military capabilities, including the creation of new capabilities, such as heavy armoured formations.

A HISTORICAL ANALYSIS OF THE EVOLUTION OF HEAVY ARMOUR

The tank, like the aeroplane, had a relatively limited initial deployment on the battlefield in the First World War, with these new capabilities being used intermittently and without a discernible impact on the overall operational landscape. The tank, initially a cumbersome platform, was designed to create corridors through the networks of non-explosive obstacles typical of that period *"trench warfare"*. Despite the significant impact it had on enemy morale, it was nevertheless relatively easy to counter, and the relatively small number of tanks available meant that they were only able to support

infantry in their assaults. However, both the tank and the aeroplane underwent steady development throughout the interwar period, thereby confirming their effectiveness during the Second World War. The German armed forces integrated the manoeuvring operations of armoured divisions with dive-bomber actions, marking the inaugural instance of such a combination in history. It established the foundations for the concept of *air-to-ground* operations, and the *tank-airplane* pair became the essential benchmark in the execution of conventional combat operations in the aftermath of the Great War. Consequently, most states engaged in an arms race invested heavily in developing such capabilities. The efficacy of these weapons was once again evidenced during the 1967 Six-Day War between Israel and Egypt. IDF (*Israeli Defence Force*) tank divisions, following a series of pre-emptive and destructive air strikes, overpowered the Egyptian defences, occupying the Sinai Peninsula. (Bowen, 2017). Nevertheless, the invincibility of Israel's tank divisions and air force was subsequently tested during the 1973 Yom Kippur War. New technologies provided manual or semi-automated guidance for guided anti-tank missiles[1], thus creating the conditions for the defeat of Israeli armoured structures. At the same time, the integration of new mobile surface-to-air missiles systems[2] in the Egyptian ground forces nullified the qualitative advantage of the enemy air force. The failure of the Israeli forces to assess the potential impact of the new technologies and to implement the concept of *"combined arms"* contributed to their inability to effectively engage with the initial phase of the conflict (Chorev, 1996). However, the IDF was able to achieve a doctrinal adaptation that drastically reduced the effectiveness of Egyptian operations due to the flexible approach. The Israelis reconfigured their formations to meet the requirements of the *"combined arms"* concept, and they also reconsidered their tactics in order to effectively hit Egyptian anti-tank teams, thereby reducing their effectiveness. (Bensahel, 2020, p. 62).

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In light of the accelerated development of cutting-edge technologies typical of the second half of the 20th century, the arms-versus-arms competition has persisted. Major competing powers have analysed the impact of new technologies on the development of military organisation and introduced the concept of a *Revolution in Military Affairs/RMA* to mark the beginning of a period in which technological supremacy becomes a fundamental benchmark for success on the battlefield (Sloan, 2008, p. 8). In the context of armoured formations, which constituted the dominant capabilities during the Cold War, specialists have concentrated their efforts on enhancing their armour plating, as well as increasing their mobility and firepower. New protective systems are being developed, such as *explosive-reactive armour/ERA*, which serves to diminish the effectiveness of anti-tank missiles. The countermeasure has been intrinsic and comprised the development of missiles with dual tandem warheads, which permit penetration of the ERA. Furthermore, attack helicopters, equipped with such missiles, facilitate the striking of armour from considerably greater distances than ground-based platforms. However, technological advancement has once again ensured the continued viability of armoured capabilities. US Army military doctrine, developed in the late 1980s and known as *AirLand Battle*, identifies technological superiority as the primary factor in compensating for a quantitative inferiority (Douglas, 1998, p. 11). The doctrine in question was predicated on the utilisation of sophisticated technologies, including advanced communications, satellite positioning and navigation systems, stealth technology, laser, radio wave, thermal spectrum and GPS guidance systems. Despite its ostensible purpose of providing a solution to counter potential Soviet aggression in Europe, the AirLand Battle doctrine was successfully tested in the 1991 Gulf War. The integration of new capabilities at the joint level facilitated new capabilities synergising at the battlefield level, while simultaneously reducing the vulnerability of heavy armoured formations. Consequently, the deployment of novel weaponry, including the M1 Abrams tank, the M2 Bradley infantry fighting vehicle, and the MIM-104 Patriot air defence system, supported by AH-64 Apache and UH-60 Black Hawk helicopters, collectively constituted *the big five* concept, being the prerequisites for a swift victory in Operation Desert Storm. (Ortiz, 2021).

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[1] Soviet Malyutka (NATO code AT-3 Sagger) Anti-Tank Guided Missile/ATGM of Soviet origin (A.N.).

[2] Soviet 2K12 *"KUB"* (SA-6 *"Gainful"*) mobile surface-to-air missile system of Soviet origin (A.N.).

THREATS TO HEAVY ARMOURED FORMATIONS

In this section, we will return to the role of heavy armoured formations in the context of the modern battlefield. We will attempt to ascertain the extent to which new threats have called the utility of such formation into question. The analysis of the conflicts in Nagorno-Karabakh, Ukraine and the Gaza Strip demonstrates the continued maintenance of heavy armoured capabilities and the tendency of armies to employ them in both offensive and defensive operations. Furthermore, these conflicts illustrate the emergence of novel threats that challenge the efficacy of heavy armoured capabilities on the battlefield, as well as the maintenance and adaptation of existing ones. The threat spectrum encompasses a range of sophisticated technologies, including state-of-the-art guided anti-tank missiles, precision munitions, ISR and UAS capabilities with strike capabilities, loitering munitions and minefields.

Top-attack or flying top-attack functions permit the targeting of armour from a high position, focusing on the vulnerable upper portion of the armoured platform.

❖ *The guided anti-tank missiles*

The advent of new technologies has enabled guided anti-tank missiles to develop capabilities that permit strikes on tanks from distances exceeding 4,000 metres and in innovative ways that exploit the vulnerabilities of armour. *Top-attack* or *flying top-attack* functions permit the targeting of armour from a high position, focusing on the vulnerable upper portion of the armoured platform. The dual tandem searchlights of the latest-generation missiles facilitate the neutralisation of additional protective measures, such as the ERA or the renowned Russian *"cages"*. The missile's *fire* and *forget* function enables its launch without the direct involvement of the launch team, who can then be extracted immediately after launch, rendering countermeasures against them ineffective.

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❖ *High precision ammunition*

Smart munitions, with their high accuracy and extended range, make it possible to engage enemy armoured vehicles outside the contact zone. The lethality of in-theatre attacks is directly proportional to the accuracy of the ammunition and the weapon system. To increase accuracy, two essential conditions must be met: *the process of identifying, monitoring and engaging a target through the utilisation of various intelligence, surveillance and reconnaissance*

(ISR) systems, coupled with *the deployment of in-flight munitions guidance technologies, employed to guarantee that the intended target is successfully engaged.* The advent of high technology in recent decades has facilitated the development of artillery ammunition with an extended range of up to 50 km and high accuracy, achieved through the integration of GPS-INS (inertial navigation system) technology. A notable example of this category of ammunition is the US Army's Excalibur M982 artillery projectile, which is also being developed in various variants for other NATO militaries. The advantages of this type of ammunition are considerable, as it can be used with conventional weapon systems (155 mm calibre howitzers), allowing them to be guided by GPS. The Guided Multiple Launch Rocket System (GMLRS) is also considered a game changer, with its capacity to strike targets with precision and at ranges that are competitive with other systems. It is notable for its ability to outperform similar systems that are more massive and less accurate. (RAND Corporation 2015, p. 15). These weapon systems are designed for deployment at the division and corps levels. They offer high mobility and high firepower, and are available in both tracked and wheeled configurations. The modern variants integrate GPS-INS munitions technology, which enables the munitions to be guided to the target location, with a circular probable error/CEP of 5-10 meters for the US Army GMLRS systems. (Ib., p. 32). Both smart munitions artillery systems and GMLRS provides a distinct advantage upon the defending force in the context of a battle against armoured vehicles. It is due to their capacity to facilitate early engagement of artillery in the event of successful detection and the temporary blocking of enemy columns.

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❖ *ISR Capabilities*

The diversity of multispectral sensors presents a significant challenge to the armoured formation's concealment. Ensuring the security of these operations was challenging due to the extensive multispectral footprint. Furthermore, ISR capabilities provide not only information about the presence of enemy forces in specific areas but also detailed information about their nature, value, capabilities, and even intentions. A surveillance system calibrated to cover all operational domains while connected to strike systems through a sensor-to-shooter relationship can streamline the target engagement and destruction cycle.

❖ *Unmanned Aerial Systems/UAS with strike capabilities*

These systems, whether intended for reconnaissance and/or attack, can play an important role in the battle against armoured vehicles. They can do so by gaining intelligence on enemy operations and correcting the fire of their own forces, and by striking at the enemy's armoured capabilities. Their deployment has been successfully demonstrated in low-intensity conflicts over the past two decades. The effectiveness of these systems was evidenced in counter-insurgency operations in Iraq and Afghanistan, as well as in large-scale operations against ISIS in Mosul and Raqqa. Unmanned Aerial Vehicles (UAVs) gained notoriety in 2020, during the Nagorno-Karabakh armed conflict, for their effectiveness in combat operations. The successful deployment of the Turkish-built Bayraktar TB2 attack drones by the Azerbaijani army has prompted an academic debate as to whether these systems are indeed a *"tool"* that will significantly shape the way combat operations are conducted in the future. (Hecht, 2022). In an analysis of the Nagorno-Karabakh conflict, Israeli expert Uzi Rubin, the founder of *Israel's Long-Range Missile Defence Program*, emphasized the crucial role played by the Bayraktar TB 2 systems: *"Azerbaijani systems were instrumental in the destruction of Armenian air defence capabilities and the subsequent decimation of manoeuvre forces, including tanks, artillery and logistical support vehicles. These violent attacks forced Armenia to accept a humiliating peace deal imposed by Russia".* (Rubin, 2020).

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The versatile capabilities of this type of UAS have also been successfully demonstrated in Ukraine, particularly during the initial phase of the conflict. The inconsistent anti-aircraft defences of Russian forces engaged in offensive operations permitted the infiltration of Ukrainian Bayraktar TB 2 systems and the striking of Russian armoured vehicles. Despite the prolongation of the Russian-Ukrainian conflict, which has resulted in a continuous adaptation of both combatants to counter UAS, it is anticipated that these capabilities will become a significant shaping vector on the battlefield in the future, including in the battle against armour.

❖ *Loitering ammunition*

While loitering munitions are capable of generating effects at all levels of operations, they play a predominantly shaping role in armour combat. Their relatively low strike vector mass and platform targeting limitations result in a notable reduction in their overall effectiveness (Pettyjohn, 2024). Consequently, the impact of these types of munitions is relatively limited in terms of impeding the manoeuvring capabilities of armoured units. However, they can cause significant destruction and demoralisation, particularly for isolated manoeuvre elements engaged in tactical defensive operations. Despite the view of military experts that their role in combat against armoured vehicles is not decisive, they can nevertheless generate a number of effects with the objective of harassing the enemy, temporarily blocking their movement, disorganising their operations and affecting the cohesion of their actions. They can be effective against small armoured elements, whether stationary or moving, which do not benefit from adequate anti-aircraft defences. Second echelon, armoured elements or armoured reserves deployed in rear areas can be successfully hit by tactical systems, even at night. Such munitions were employed by the Azerbaijani army in the Nagorno-Karabakh conflict and are also being utilised in combat operations in Ukraine. It is inevitable that they will continue to evolve, becoming increasingly versatile and generating more diverse and profound effects on the configuration and dynamics of the battlespace.

❖ *The minefields*

Minefields represent the optimal solution for creating an obstacle in flat terrain, with effectiveness contingent upon depth, density, and fire cover possibilities. The Ukrainian counteroffensive in the summer of 2023 exemplifies the efficacy of these defensive tactics and their capacity to block armoured vehicles. The increased depth and density of the minefields constructed by the Russians exemplify the effectiveness of defensive lines built in accordance with tactical adaptations derived from experience gained in the initial year of the conflict (Reynolds, p. 15).

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SOLUTIONS TO REDUCE THE THREAT'S IMPACT

The initial phase of the conflict in Ukraine revealed the vulnerabilities of Russian armoured units, which suffered significant losses, particularly on the Belarus-Kyiv and Belgorod-Kharkiv offensive fronts. However, the failure of the Russian Federation's tank formations was more likely attributable to inadequate planning and integration

of offensive operations at the joint level throughout the course of the operation (Lee, 2022). The commanders of the armoured units failed to anticipate a staggered and layered defence of the Ukrainians. Consequently, they advanced independently in several offensive directions, their actions being inadequately coordinated by the higher echelon. Furthermore, the accelerated pace of the offensive resulted in the lack of synchronisation between manoeuvre forces and combat and logistical support forces. The inadequate artillery, air defence and electronic warfare capabilities, which were already insufficient, were unable to maintain the same pace of the offensive, and the same difficulties were encountered in the logistics. The lack of integration at the joint level had significant ramifications for the Russian battlegroups/BTGs: manoeuvre forces lacking combat support were subjected to Ukrainian artillery and drone attacks; the scarcity of fuel and spare parts compelled crews to abandon their tanks and combat vehicles; support elements were persistently targeted by Ukrainian light infantry infiltrating the area. A review of data from the *Oryx blog* suggests that, as of early April 2022, over 30% of the tanks lost by the Russians were due to either failure or abandonment. (Janovsky, 2022). It provides further evidence in support of the hypothesis that the offensive operation was poorly planned and executed. The inadequate composition of the Russian BTGs, in particular the lack of infantry elements, also created dysfunctions that manifested in the inability to effectively execute tactical cover, surveillance and close protection missions (Lee, ib.).

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In the context of the Nagorno-Karabakh conflict, Oryx reports that Armenia lost 255 tanks, 146 of which were destroyed by Turkish Bayraktar TB2 systems. The remaining tanks were neutralised by artillery and anti-tank missiles, following the exploitation of intelligence gathered by drones (Janovsky, 2020). While these systems were responsible for over 85% of the Armenian heavy armoured losses, their poor performance was not the sole cause. Western analyses indicate that Bayraktar TB2 platforms were only engaged decisively after the destruction of the Armenian forces' anti-aircraft defences, with air supremacy being a crucial factor (Jones, 2022).

In light of the aforementioned considerations, it can be concluded that heavy armour will play a role in future conventional armed confrontations. Gaining a tactical advantage through the use of heavy

armour formations depends, in particular, on the ability to use them intelligently, reducing their vulnerabilities. The following section presents several potential solutions that can increase the effectiveness of heavy armour formations in combat operations.

The effective exploitation of heavy armour requires a robust foundation in the form of a well-defined manoeuvre approach to operations. This approach must be integrated at the unit level to ensure its successful implementation. In large-scale offensive operations, tanks must be adequately supported by heavy and medium infantry units. Artillery support and air defence capabilities can be achieved through the integration of self-propelled platforms that offer comparable levels of protection and mobility. It is imperative that robust search and combat engineering capabilities should be in place to guarantee the mobility of the main forces, threat warning and battlefield shaping. When operating in restricted terrain (mountainous environment, urban environment), dismounted infantry elements provide invaluable support to heavy armour operations, as do anti-ambush teams or air defence teams equipped with Man-Portable Air-Defence Systems/MANPAD. The incorporation of unmanned aerial systems/UAS elements into heavy armoured units offers the potential for early warning and fire coordination capabilities, which could be employed to neutralise threats. Finally, electronic warfare/EW systems may be useful for neutralising threats whose effects depend on the possibility of exploiting the electromagnetic spectrum, including drones and guided anti-tank missiles.

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In order to neutralise or reduce the level of threat posed by anti-tank missiles, both *hard kill* and *soft kill* measures are integrated into blast. *Hard kill* measures entail the integration of an active protection system/APS within the platform. This system employs a short-range radar to detect and track the threat, utilising electron-optical sensors to identify the threat in the vicinity of the target, and employing explosive measures (projectile or charge) to neutralise the target, detonating the strike before impact. The objective of *soft kill* measures is to disrupt the guidance channel of anti-tank or smart munitions, either at the point of initial launch or during the flight to the target. It is achieved by jamming the radio link, short-circuiting the electro-optical link or the communication unit.

To counter extended-range, high-precision strike capabilities, the first step is to intensify efforts to neutralise enemy ISR elements that provide information on the location and armoured forces' activities. It will be achieved by concentrating the efforts of air defence and EW capabilities. Force camouflage is also a solution, as are false works (including mock-ups) and deception operations to increase protection from enemy attack. However, these operations, under the umbrella of C2D2 (cover and concealment, decoy and deception), must be consistent and viable in all operational areas where their effects can be intercepted and assessed (Toroi, 2024). For instance, scale models must be credible in terms of their visual, thermal and electromagnetic representation. Furthermore, the deployment of a significant military unit in a particular area must be reflected in media activities and on specific social networks.

In anticipation of the Ukrainian counteroffensive in the summer of 2023, Russian forces had several months to establish an elaborate fortification system in the Zaporizhzhya region. Similarly to the Battle of Kursk 80 years ago, the Russians were able to mitigate the impact of the enemy's offensive actions. In both instances, the culmination of the attack occurred weeks later.

The overcoming of minefields and the achievement of a breakthrough necessitate the coordinated action of all available capabilities at the operational level. Consequently, this challenging task commences with aerial reconnaissance of the penetration area, the neutralisation of the enemy's anti-aircraft defences and the striking of the enemy's artillery and missile systems. Thereafter, a heavy armoured force, supported by engineer elements, creates the requisite corridors through the minefields and ensures the safety of these corridors, thus facilitating the introduction of the main forces into the fight. The success of this action is contingent upon the swift execution of operations and the effective collaboration of supporting arms with manoeuvre forces. The implementation of concealment is of paramount importance for enhancing the probability of success. Conversely, it is imperative to underscore that constraining the time available to the defending force for the construction of defensive lines increases the chances of success for the offensive. In anticipation of the Ukrainian counteroffensive in the summer of 2023, Russian forces had several months to establish an elaborate fortification system in the Zaporizhzhya region. Similarly to the Battle of Kursk 80 years ago, the Russians were able to mitigate the impact of the enemy's offensive actions. In both instances, the culmination of the attack occurred weeks later.

THE ADVANTAGES OF MAINTAINING AND DEVELOPING HEAVY ARMOURED FORMATIONS

The specific design of heavy armour provides a high degree of stability for ground forces. Concurrently, their high lethality and capacity to instil shock serve as a deterrent to potential aggressors, exemplifying a willingness to utilize lethal measures when necessary. Consequently, they become a symbol of the state's military strength. However, the maintenance and advancement of these capabilities by potential adversaries necessitates a counterbalancing response, which can be achieved through the development of robust anti-tank capabilities and the creation of analogous armoured capabilities.

This type of force, comprising tanks, mechanised infantry, combat reconnaissance and armoured engineer elements, represents an effective solution for the opening of a theatre of operations. Furthermore, in the context of the rapid development of offensive operations, these forces can be formed into forward detachments whose missions are to penetrate the enemy's equipment, intercept enemy communication routes, and capture and hold important objectives. They are the only viable solution for breaching enemy minefields. Furthermore, they permit the operation to evolve in a gradual and controlled manner, enhancing preliminary strikes, disrupting adversarial defences, and rapidly capitalizing on emerging opportunities. Finally, with the support of combat helicopters, self-propelled artillery, mechanized infantry, and engineer elements, they are capable of successfully conduct pursuit operations.

The deployment of heavy armoured forces serves to reinforce the defensive position. Their objective is to rapidly address any gaps created by enemy action and to launch counter-attacks with the aim of restoring the original defensive perimeter and recapturing lost territory. Heavy armoured forces are the primary means of impeding the advancement of enemy tanks.

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Despite their vulnerability in urban environments when operating without infantry support, these forces are highly effective when the enemy has a robust defence with fortified strong points. The combined action of tanks, tank support infantry and dismounted infantry significantly enhances the probability of armoured survival in the urban combat environment (Allied Tactical Publication, 2022, p. 31). Infantry provides close protection, while tanks destroy hardened fighting positions and machine gun nests. The deployment of heavy armour in peace-enforcement operations in environments dominated by insurgent action is also a viable option. The high ballistic protection and mine resistance inherent to this type of armour affords them a distinct advantage in this respect.

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Over time, solutions have been sought to replace and/or substitute these capabilities. Medium forces demonstrate relatively the same lethality and tactical mobility while being more versatile in terms of transportation and employment in restricted environments. However, their lower protection compared to that of heavy forces would result in a significantly higher number of human casualties, which could outweigh the advantages of their use in missions that require the capabilities of heavy armoured forces. The deployment of light forces, with their capacity to form agile anti-tank units, can have a decisive impact in armoured combat, although their role is primarily that of a shaping force. The synchronised application of tactics and techniques to counter anti-tank ambushes can significantly reduce their effectiveness. Consequently, the strategic use of heavy armour can provide commanders, particularly in large-scale conventional operations, with clear advantage.

CONCLUSIONS

This approach offers a solution to the research questions that serve as the foundation for the study's objectives. It seems probable that heavy armour will continue to play a significant role on the modern battlefield. The advantages offered by these robust capabilities as well as the existing trends in platform modernisation, adaptation and doctrines empirically validate this assumption. Furthermore, efforts by an increasing number of states to strengthen these capabilities reinforce this idea. However, in order to maximise their chances of success in a major armed conflict, a number of considerations need to be taken into account by both political-military decision-makers and military commanders.

The enhancement of strategic mobility for heavy armour represents a critical concern in the development and sustainment of these types of military forces. The relatively low speed of movement, high platform wear and tear, and infrastructure constraints imposed by the use of tanks significantly restrict their operational capabilities. Consequently, the transportation of these capabilities along various communication routes must be calibrated to ensure the protection of personnel during transit, adhere to time constraints, and facilitate rapid operational deployment. While air transportation is the most expedient mode of travel, its availability is constrained by the aircraft capacity. Although maritime transportation is an efficient mode of transport, it is important to consider the necessity for ports and port infrastructure, as well as the availability of post-landing transportation options. Of the land transportation options, rail is probably the most efficient, although it is important to consider traffic fluidity and protection during movement. A reduction in the mass of armour, particularly that of heavy tanks, is an important factor in operational-strategic mobility. However, it should not result in a detrimental compromise in terms of protection and firepower. Consequently, the tank and other heavy armoured vehicles must retain their main assets in terms of *design* and performance, namely the ability to destroy other tanks and maintain *momentum* in the offensive operation.

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From an operational standpoint, it is crucial to adopt a joint perspective at the tactical level when approaching land operations, as well as to integrate tactical land operations at the joint operation level. This approach can enhance the survivability of heavy armoured units and facilitate the exploitation of their potential. It is therefore essential that these capabilities retain their status as the principal means of conducting major combat operations. The ability to maintain a high level of force dispersion while also rapidly concentrating to execute missions is crucial for the survival of armoured forces on a battlefield. The integration of sophisticated technologies designed to identify and neutralise threats enhances the probability of success. Furthermore, the advancement of active and passive *hard* and *soft kill* protection

systems represents a significant step towards aligning heavy armour with the demands of emerging technologies.

It seems inevitable that the tank-anti-tank competition will persist. The tactical adaptation will facilitate the expeditious resolution of particular issues encountered on the battlefield, whereas institutional adaptation will facilitate the formulation of strategies for the advancement of armoured capabilities and the development of doctrines that will underpin their employment. Nevertheless, as the Javelin and NLAW guided anti-tank missiles have not resulted in effects of greater magnitude than those achieved by the Sagger in the Yom Kippur War, there is no guarantee that future systems will definitively and irrevocably defeat heavy armoured forces. The essence of warfare is enduring, being characterised by violence. Heavy armoured capabilities represent weapons that, when deployed effectively, can inflict significant levels of destruction in order to achieve defined military goals. The research findings validate their continued relevance on the contemporary battlefield, as well as the capacity of the military organisation to adapt them to meet the demands of the evolving nature of warfare.

The essence of warfare is enduring, being characterised by violence. Heavy armoured capabilities represent weapons that, when deployed effectively, can inflict significant levels of destruction in order to achieve defined military goals.

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