

The Role of Tanks in Today's Warfare: Adapting to Innovations

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Abstract

The capabilities of tanks have significantly changed due to the emergence of new technologies and evolving tactical requirements on the modern battlefield. These changes have raised debates about whether tanks can adapt to contemporary warfare or whether their era is coming to an end. Despite increasing vulnerability to unmanned aerial vehicles, loitering munitions, and advanced anti-tank guided missiles, tanks continue to play an important role in land operations. This article argues that the survival and relevance of tanks in modern warfare depend on continuous innovation in protection, firepower, and mobility. Drawing on historical theory, recent conflicts, and modern technological developments, the written work demonstrates that tanks remain a decisive component of combined-arms operations when properly modernized.

Keywords: *tanks, modern warfare, protection, firepower, mobility, innovations.*

Introduction

Tanks' capabilities have extremely changed when new technologies and tactical requirements occurred on the battlefield. This fact increasingly influenced today's warfare. Rapid transformation of battlefield caused discussions about whether tanks can adapt to new forms of warfare or whether their era is coming to an end. Vehicles once designed to dominate the battlefield have become increasingly vulnerable to unmanned aerial vehicles (UAVs), loitering munitions, and advanced anti-tank guided missiles. Heavy losses in recent conflicts, made possible by relatively low-cost systems, have raised doubts about the continued effectiveness and survivability of tanks [4].

From a historical perspective, tanks have always played a crucial and influential role at the theoretical and practical levels. Discussions about tanks and their implementation actively started at 20th century's first half when military theoreticians and high rank officers started developing ideas about armored warfare. British military theorist and strategist J. F. C. Fuller noted that tanks „...*has come not only to stay but to revolutionise...*“ [6]. He believed that the future of tanks has not only be fulfilled, but will become a completely new form of warfare. J. F. C. Fuller argued that tanks should be used as independent strike forces with integrated firepower, mobility and protection [6]. This idea was supported by B. Liddel Hart, who linked armored forces with surprise and ability to restore mobility to the battlefield. Furthermore, B. Liddel Hart identified necessity to implement combined arms force with artillery and infantry units with armored warfare. As well, H. Guderian in his works argued that success of military operations and war is large tank formations supported by motorized infantry and aviation units and it emphasized combined arms importance. This idea was known as *Blitzkrieg* or „lightning war“, because of rely on speed and surprise in order to achieve decisive victories by concentrating forces for a breakthrough [15].

Historical facts show that the role of tanks has always been

significant. In World War I tanks served as a solution in trench warfare, offering the armored firepower and mobility necessary to break through enemy defenses. Their primary function was to conduct offensive operations, create breaches in defensive lines, and support infantry advances. During World War II and later wars, tanks, as heavy armor vehicles, provided vital protection for troops and became a decisive element of mechanized warfare by combining mobility, firepower, and protection [3]. In general, tanks played an important role in ground operations by building troop confidence, maintaining the momentum of attacks, and acting as a mean of deterrence [7].

However, in the 21st century tanks faced new challenges as modern technologies and new tactical requirements had appeared. Tanks moved from being mainly offensive weapons to multi-role platforms; their threats shifted from tank-to-tank battles to dangers from the air, especially drones, loitering munitions, and advanced anti-tank missiles. Furthermore, tanks battles moved from open terrain to complex urban areas and in order to minimize civilian casualties' tanks have to be supported from additional units.

Tanks could be called as functional combat machines which combine protection, firepower and mobility in order to kill as many enemies as possible, as quickly as possible and in most destructive way. The recent conflicts and military industry show that tanks, as heavily armored and dominant battlefield vehicles, are not disappearing. These heavily armored machines are undergoing processes that create new-generation tanks and improve key characteristics of it – protection, firepower and mobility. Also, integration of modern digital systems allows tanks to counter growing threats from advanced technologies. Thus, ongoing evolution is crucial for maintaining tanks as a decisive and flexible component on the contemporary battlefield. This writing assignment will cover the thesis: tanks' survival in today's warfare depends on continuous innovations to improve its protection, firepower, and mobility, enabling to face the growing threats and remain as the primary battle vehicle.

Protection

Protection is a feature of tanks that allows them to secure their crew and equipment and improves the ability to operate effectively on the battlefield. Tanks with integral protection means could close with enemy forces while they are in battle and engage them without harm to itself [8]. Nevertheless, in the 21st century, armor is not enough. Tanks' survivability depends on their ability to adapt to constantly evolving battlefield threats by integrating new technologies such as drones, advanced anti-tank guided missiles, and loitering munitions. These new technologies challenged the protection capabilities of heavy armored vehicles by increasing their weaknesses, which were less seen in earlier wars.

Active protection systems is one of the newest tanks survivability means. Different than passive armor, these systems do not deflect or absorb enemy forces hits. Active protection systems (APS) use electronic or optical countermeasures against anti-tank guided missiles (ATGMs); also act as a shield, which detects incoming threats and neutralizes them seconds before the strike. Most known APS integrated in tanks are Iron Fist, Trophy and Rheinmetall's *StrikeShield* [14]. For example, newest version on Leopard 2A8 and Merkava Mk4 tanks have integrated *Trophy* APS; newest development of Rheinmetall's Panther KF51 (prototype) will be equipped with *StrikeShield* [9]. Looking at the recent conflicts, especially the war in Ukraine, have shown that tanks without APS are highly vulnerable to first person view (FPV) drones and ATGMs. These drones attack from above, where tank armor is weakest. While tanks equipped with APS such as the Israeli Merkava Mk4 have demonstrated significantly higher survivability in Gaza, where APS *Trophy* intercepted multiple incoming threats. These battlefield results, shows that APS is not just a niche technology nowadays but is a vital necessity. It could improve tanks protection during performance in a battlefield and operational environment. Although, APS integration to older tanks faces challenges. Existing tanks platform has constrained due to their weight, size and power, so not all of old-fashioned tanks could

be easily modified. In order to utilize and apply APS in existing tanks installation requires suitable logistical considerations and balanced technological solutions. Thus, proper APS integration would allow tanks to remain equal with innovative threats [14].

Precise networking and coordination system could be additionally used as protection mean. Modern warfare requires tanks to operate as one platform within joint command and control system, relying on satellites, drones and sensor networking. These communication web helps to conducts reconnaissance tasks and ensure early warning. This synthase enables tank crews to call for fires support, avoid ambushes or maintain mobility in operational environment filled with threats. For example, with its new Abrams tanks, Poland received the *SitaWare* command and control system which commonly used by NATO and other partner nations; Izreal Sabrah tank has integrated *TORCH-X* battle management system made by Elbit [2]. These systems enable multi-domain warfare and enhance operational effectiveness in all levels: tactical, operational and strategical. The same systems usage in units or even forces or higher levels are meaningful and changing technology which convert tanks from being free-standing symbol of cruel force to fully unified platform within combined arms operations. So, survivability is not just about the strength in the steel, but in a constant understanding of situational awareness, adaptability, and cooperation with infantry, artillery, and other assets in joint operation area in order to protect not only self but also friendly units [11].

These points allow to argue that protection innovations are essential for tank survival today. Tanks as battlefield actors must continuously improve their protection to survive modern threats. Passive armor alone in recent conflicts is no longer sufficient for survivability. Active defense systems, modern electronic tools to confuse enemy, and integral command and control systems directly improves tank survivability against the most common modern threats. Ability to adopt and implement new technologies into tanks allow them to become more versatile and stay resilient component of a broader combat system.

Firepower

Firepower is the capability to use the entire force against an enemy, involving the full range of available weapons [5]. At all times, firepower is considered as offensive power applied from a distance to suppress enemy and break his will to fight. Maneuver warfare shows that exact time and concentrated firepower is key element in decisive activities and weapons which has huge firepower is crucial assets. Tanks and their main guns could be considered as one of the key elements in conventional, open-terrain, and breakthrough battles where their firepower can be fully exploited [8]. However, today, firepower depends not only on the size of the gun or the number of shells a tank carries, but also on the integration of new systems and the development of technologies.

Modern battle tanks, like Leopard 2A8, Merkava MK4 or K2 Black Panther, are well equipped and have a variety of weapons systems to manage various threats. Their main gun can fire multi-purpose shells, high-explosive rounds, and other special ammunition to hit both heavily armored targets and softer ones. One of the newest Leopard 2A8 tank has integrated three-man turret armed with a 120 mm/L55 smoothbore gun. Updated version of the gun allows to fire at higher initial speed to improve extend range, accuracy, and increase penetration [1]. Tanks also have secondary weapons like machine guns, which provide flexibility and tactical options the main gun cannot. As well as, K2 Black Panther has 7.62 mm NATO coaxial machine gun and 12.7 mm K6 heavy machine gun; Merkava Mk4 has two machine guns and one 60 mm internal mortar and etc. [12]. Based on those points, war in Ukraine has shown that tanks with modern fire control systems, such as Leopard 2A6 or Challenger 2, are able to engage enemy armor and fortified positions with high accuracy even while moving, giving them a decisive advantage over older Russian models whose crews often struggle with outdated optics. So, this layered firepower system enables tanks to operate effectively in places where threats are dispersed, mobile, and are difficult to detect and engage them at multiple ranges.

Targeting and C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) systems enable firepower in a modern battlefield. When assets with huge capabilities are used wisely, relying on the targeting process it allows tanks to exploit their firepower at the exact time and place. Advanced fire control systems, integrate thermal imaging, laser rangefinders, and ballistic computers could support calculations of firing under various conditions, including poor visibility, nighttime, and movement on rough terrain. For example, new model of the French Leclerc tank can track multiple targets simultaneously, allowing operators to engage high-speed mechanized threats with minimal delay. In this way, firepower is not only destructive; it allows tanks to strike effectively [10]. Also, integrated C4ISR network allows tanks' crew to receive targeting data from drones, forward observers, or other units, enhancing situational awareness and enabling coordinated strikes [11]. For example, in M1 Abrams allows real-time situation monitoring, use of drones and coordination of actions with infantry and artillery; Leopard 2A7 tank supports data-sharing with other units, drones, and higher command; KF51 Panther (prototype) has fully digitized platform, AI-assisted targeting, networked battlefield awareness [9]. In Ukraine, drone-assisted targeting has become usual thing: tank crews increasingly rely on drones' feeds to adjust fire, identify hidden ATGM positions, and coordinate with artillery. This confirms that firepower is no longer determined only by the gun, but by the ability to integrate information from multiple sensors across the battlefield. Digital technologies integration into operational environment positively affects modern tanks firepower. This is because firepower is enabled not only through physical weapons but also through information-gathering and command-and-control capabilities.

In conclusion, the firepower of modern tanks is a versatile concept. It includes advanced primary and secondary weapons, precision targeting, guided munitions, network coordination, and continuous adaptation to upcoming threats. Firepower enables

survivability: tanks must strike effectively, thereby reducing enemy combat power. The effectiveness of firepower is influenced by sensors, active defense systems, and interaction with other units. By improving in these ways, tanks remain crucial on the modern battlefield, not as brute force weapons, but as flexible, comprehensive combat system components. So, their firepower allows them to engage a variety of threats, support joint operations, and maintain a decisive role in modern warfare.

Mobility

Mobility is a vital part of modern warfare; getting units to the right place at the right time makes the difference between winning and losing the battle. Mobility, in military terms, refers to the ability of a weapon system, combat unit, or armed force to move from place to place toward a military objective [13]. Tanks are one of the best examples of mobility on a battlefield, sometimes facing no competitor. Speed in open and limited restriction areas give them an advantage over slower, less mobile, or static forces [3]. Although in modern warfare, where technologies and innovations take important steps into the battle space, tanks are at risk of becoming slow and easy targets in an age of fast, multi-domain operations.

First of all, mobility is not only about the speed, but also about the ability to move across different types of terrain, keep up with the tempo, and coordinate movement with other forces. Modern tanks are equipped with well-developed engines, advanced suspension systems, and improved track structures and compositions in order to be capable of moving in deserts, forests, cities full of rubble, and crossing manmade or natural obstacles. Tracks also provide greater resistance to enemy fire, thus offering better protection [7]. For example, the Leopard 2A8 has a hydropneumatics suspension system that helps it fire accurately while moving, and the Abrams uses a gas turbine engine with adaptive transmission to stay fast on tough ground without losing reliability. This tactical mobility enables tanks to outflank enemies, support infantry attacks, or

retreat, when necessary, while still maintaining the ability to fight. The war in Ukraine has shown that static or slow-moving tanks are rapidly detected and destroyed by drones or precision artillery. Units that constantly reposition and use short, fast movements and terrain masking – survive significantly longer. So, mobility also increases survivability. Without it, even powerful tanks are at risk of becoming easy targets for anti-tank missiles, drones, or artillery. A tank that can accelerate quickly, change direction, and use cover is much harder to hit with modern weapons systems [7].

Advanced technologies inside tanks exploit its mobility. Tanks now use advanced navigation, terrain analysis, and driver-assist systems (advanced suspension system, electronic engine control) that help tank crews' move faster and safer under stress or bad weather conditions. Thermal sights, night vision, screens, and cameras allow them to fight at day or night time, during rainy or snowy weather, keeping the element of surprise. Modern systems like automated terrain mapping and GPS navigation help tanks choose the best routes, avoid restricted areas, and stay effective even in unknown terrain. Some tanks, like the Merkava Mk.4, use digital route-planning systems to coordinate movements not only with other tanks but with infantry or artillery units. The Merkava IV is designed to be effective in both conventional warfare and counterinsurgency operations, making it a versatile platform. It has been instrumental in urban warfare in Gaza, where it supports dismounted infantry. Also, the K2 Black Panther has an advanced suspension system called the In-arm Suspension Unit which allows each track to be controlled independently. This allows the tank to lower itself so that the main gun can be lowered to -10° [1]. These technologies get informational awareness, improve both survival and combat power, making tanks flexible and maneuverable units in combined-arms warfare.

After all, mobility is also about the crew, which enables the tank's effectiveness. A well-trained crew that understands terrain, enemy tactics, and combined-arms doctrine can utilize mobility to its full advantage. Training helps crews choose the best routes,

react quickly, and work with others in operational environment.

Overall, mobility is one of the main pillars of tank effectiveness, which is a mix of mechanical design, modern technologies, and human skills. This lets tanks move fast, survive modern threats, and keep up with allies. In this way tanks could exploit opportunities, escape enemy, and keep the initiative in battles where opposite forces use advanced systems. So, mobility is also a necessity for tanks survival and continued effectiveness in future conflicts.

Conclusions

Throughout their history, tanks have repeatedly adapted to shifts of technologies and battlefield requirements, and this continues in modern warfare. Just as early theorists such as J. F. C. Fuller, B. Liddell Hart, and H. Guderian envisioned tanks as mobile, protected, and offensively oriented strike forces capable of reshaping warfare, today's forces are confronted with a similar need to determine armored capabilities in response to rapidly evolving threats.

Tanks combine protection, mobility, and firepower in a way that no other land system fully replaces. Their protection allows them to survive against a growing number of threats such as UAVs, loitering munitions, and advanced anti-tank guided missiles. Their mobility enables them to maneuver across different terrains, avoid enemy detection, and support rapid operational tempo. Their firepower provides the ability to engage both armored and unarmored targets, contributing to offensive breakthroughs or strengthening defensive positions. When these capabilities are supported by modern digital systems – such as integrated targeting tools, command-and-control networks, and improved situational awareness technologies – tanks can operate more effectively within combined-arms and multi-domain operations.

Evidence from recent conflicts, especially the war in Ukraine, shows that tanks remain relevant when they are adapted to current threats. This has led to upgrades such as active protection systems,

additional drone protection measures, improved fire control, and more advanced mobility solutions.

Furthermore, it can be seen that the continuous development of new-generation tanks also reflects an ongoing technological competition among states. Each of them is seeking to maintain an advantage through innovation and have one of the key assets for deterrence. Tanks are receiving new and better protections means, more sophisticated firing and target acquisition systems and become faster and mobile in battlefield. So, that is why one country are upgrading and modernizing tanks that they have, other countries buying new ones. This shows that tanks are still relevant and won't vanish from the battlefield for at least several decades.

Overall, tanks are not becoming obsolete; instead, their effectiveness depends on continuous modernization and adaptation. Firepower, mobility and protection are fundamental on the battlefield. So that's why modern warfare still requires systems that can move, shoot, and survive under difficult conditions, and tanks remain a platform which is capable of fulfilling these requirements. It is aggregable, that the role of tanks will remain essential as a mean of deterrence with significant psychological effect; as well as an asset for both defensive and offensive operations to reclaim land.

Recommendations

Due to changes of battlefield, it is important to do changes in armored warfare in order to exploit tank capabilities and minimize losses of it.

1. Existing tank versions must be updated and the latest technologies must be constantly implemented.

2. Interoperability with UAV assets must be ensured to enhance situational awareness and targeting process.

3. Tanks should be seen in the battlefield only before the strike by exploiting tempo and aggressiveness to maintain battlefield momentum.

4. Tanks have to be embedded into coordinated military

formations within combinedarms operations.

Therefore, if these recommendations would be implemented in modern warfare – where tanks still play a significant role – tank could be more crucial tool in battlefield. In that case, the modernization of tanks would not be in vain, and it would provide an important course of future battles.

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