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Technology- War and Their Interdependency: Nature of Future Battle

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ABSTRACT

Warfare used technology for its purpose. The nature of warfare has also been largely determined by contemporary technology. War and technology have always influence each other. The nature of warfare has been changed from early warfare to the modern warfare. The warfare revolution took place in the 20th century. Due to war many new technologies have come up. American civil war, World War I and II and recent Gulf War got direct influence on the technological inventions. The nature of future warfare will be different from the present day's warfare. The future war will be multidirectional and multidimensional where information technology will have a very important role. The improved technologies are always changing the nature of warfare. The emerging technologies will also have impact on future warfare.

INTRODUCTION

1.   War has been a part of culture for thousands of years. As long as people have been living together in communities they have been fighting wars to protect those communities. War developed out of simple fighting when people realized that they could fight more effectively as organized groups. Organization is the first part of the technology of war. Once people started organizing into armies they began to develop more effective methods of fighting to defeat their enemy with as little loss to themselves as possible. So began the progression of the technology of war. If one side developed a new advantage then the other side would develop something else to regain the advantage. The cycle of advantage counter advantage continued for thousands of years.

2.   The nature of warfare has always been largely determined by contemporary technology. Instances of technological change under taken for the sake of military advantage have also been relatively common in history. The rapid technological changes since World War I and World War II in energy sources, materials, transportation, automations qualify as a revolution. As science and technology advances with ever increasing speed, the nature of warfare will also continue to change in many ways.

3.   The technology and war is interdependent. The nature of future battle will be different from the present one due to technological developments. Technology has always been used to produce improved tools of warfare. In this paper an effort will be made to examine the interdependency of technology and war in light of past and present day context to see its effects in future battlefield.

AGES OF WARFARE

Early Warfare

4.   Armies were armies as soon as they could march together. Organized combat proved much more efficient then random fighting. These first armies were limited in their ability because their weapons, such as swords, knives, or clubs, were only useful in hand to hand combat. Battles had to be fought first hand. Armies met on the battlefield and fought until one was defeated. People not fighting on the field were not effected immediately except for the loss of someone who was fighting. War still had important consequences. People still died. The loser still lost land, resources, and often freedom. War was not just an event it was a part of life. The Romans developed an effective organization, which they used to conquer huge amounts of land. From thousands of years BC all the way to the Middle Ages, warfare changed little. The weapons armies developed were inefficient, new swords still only killed one man at a time. Most of the technological advances in war came in the form of organizations and tactics. The best organized, best trained, and most well motivated army won victory. The size of an army was very important as outnumbering an enemy.

The Warfare Revolution

5.   In the Middle Ages, people discovered how to propel a projectile by harnessing the explosion of gunpowder. Early cannons could only be fired every several minutes and were limited in range and accuracy. As a result, these weapons remained inefficient. The real revolution came with the invention of three things: the rifled barrel, the bullet and the breach loading cannon. Along with new, faster loading techniques these weapons became fast firing and deadly accurate at great distances. The United States Civil War became the testing ground for these weapons. The North, with its superior numbers and industrial capacity, expected quick victory. What they found was the South with rifles and artillery that had exploding shells and was already using them effectively. The North's quick victory soon became a war of attrition.

Twentieth Century: Modern Warfare

6.   At the onset of World War I, all parties involved expected quick victory. What they quickly found themselves doing was digging down into trenches for a very long war of attrition. Both sides had the new machine guns and better artillery. A stalemate was created. Someone had to develop a new advantage to break the stalemate. The very beginnings of several new technologies came near the end of the war: the tank, the fighter/bomber aircraft, and chemical weapons. The loss of hundreds of thousands or even millions of men combined with financial debt left almost all parties involved in chaos. During the period between World War I and II, The technologies like the tank, plane, and chemical weapons had been reexamined. The period following World War II all the way until the fall of the USSR (SOVIET RUSSIA) in 1989 showed a new type of war, cold war. The atomic bomb represented a doomsday weapon, only two have ever been used for direct military action, those dropped on Hiroshima and Nagasaki at the end of World War II. What came out of the Cold War was a new set of attitudes toward war. People saw war as evil, something that could easily destroy the way of life they loved. People saw the threat of nuclear war as a loss of control over their own lives. The government could end the world with the push of a button, and the public did not like it.

The Gulf War: the Post-Modern Era

7.   The United States spent billions of dollars to have the best equipped army in the world. In the Gulf War they proved it. The U.S. suffered minimum casualties compared to Iraqi casualties. Modern Warfare saw a distancing of opponents and an enlarging of armies. When the U.S. struck Iraq in Desert Storm, the soldiers were nowhere near the battlefield. The most sophisticated aircraft in the world dropped precision bombs on targets. The precision bombs and cruise missiles neutralized the weapons of mass destruction which Saddam Hussein wished to use against the coalition forces. When the ground war came, the allies' superiority in tank, missile, and air technology quickly defeated the third largest army in the world.

TECHNOLOGICAL DEVELOPMENT DUE TO WAR

Inventions During American Civil War

8.   The Civil War in America was first modern war partly due to the introduction of many new types of technology. Many of these new war machines were first seen in combat during the Peninsula Campaign. The civil war changed naval warfare. No longer would wooden ships rule the waves — ironclads became the key to naval superiority. Union's gas balloons were launched almost daily to observe Confederate defenses. The Confederates also introduced the first anti-aircraft guns as they elevated artillery to send shot and shell against Union aerial observers. When the Confederates retreated from their defenses, they left behind land mines. These innovative anti-personnel weapon slowed the Union advance. The Civil War witnessed the introduction of new weapons and other industrial technology that would change warfare forever.

9.   **AGER'S "Coffee Mill" Gun**. The Ager's Coffee Mill Gun, designed by Wilson Ager, was a multi-cylinder, rapid fire weapon of small-arm caliber. It was not a machine gun, as it was powered by an external hand crank.

10.   **Balloons**. The Union forces used balloons to observe the Confederate defensive positions. The balloons were also used for map making duties and sending telegraph to communicate important information immediately to the ground.

11.   **Land Mines**. The first use of land mines in warfare occurred when Confederates evacuated their defensive lines. They ordered their men to bury 8 and 10 inch shells a few inches below the ground. They were primed with fulminate or with an ordinary artillery friction primer, and set to explode when stepped upon or moved. The "torpedoes" slowed the Federal advance into the Confederate fortifications.

12.   **Ironclads**. Ironclads were first introduced in the American's civil war. The Union's ironclad was a totally new concept in naval architecture. Naval warfare had been changed forever due to the introduction of ironclads.

Inventions During World War - I

13.   **Aircraft and Air Warfare**. Balloons had been used in earlier wars, but serious directed and controlled flight above the ground was still in its infancy when World War I broke out. Rapid improvements in Allied airplanes enabled them to climb to the high altitude. Most aerial warfare consisted of individual combats, bearing little relation the ground battles.

14.   **The Submarine**. Americans in the Revolutionary and Civil wars pioneered submarine warfare. However effective military submersibles only made their appearance in World War I.

15.   **The Tank**. A dramatic and important a new weapon, the tank, also demonstrated a potential that would come to be fully realised only in subsequent warfare. By the end of World War I the tank was becoming a major force in ground battles. Although slow, cumbersome, and vulnerable to hostile artillery, it could provide mobility and firepower to the attacker.[1]

16.   **The Machine Gun**. Like the airplane and the submarine, the machine gun was an American invention that was improved in Europe.

17.   **Artillery and High Explosives**. New developments immediately before World War I, like high-explosive shells that could sweep large areas with destructive blasts and jagged splinters of steel, restored artillery to its place as the arbiter of battles. Tube artillery weapons also approached their full potential of lethality during World War I.

18.   **Electronic Communications**. Field telephones provided instantaneous communication between commanders and field units. Few improvements have been made in field telephones since World War I; improvements in radio transmission, however, have been continuous.

Inventions During World War - II

19.   The twentieth century made great advances in terms of technology, but perhaps one of technology's quickest developments has been the evolution of weaponry. World War I began interests in developing weaponry, so the amount of new weaponry created was greater than any other period in history. However, this meant World War I 's weaponry had great potential, but the actual quality of the weaponry was not of a high standard. World War II was the time when military leaders seized the potential of the original weapons, and refined them into major killing machines.

20.   **Communication Technology**. This is what was the key to the World Wars. Field telephones provided instant communication between units and their commanders. Ten years after the phone, the radio was developed. The invisible radio waves could not be cut, although means of jamming signals were soon found. Improvements in radio transmissions were continuous with future potential unlimited.

21.   **Aircraft**. Before World War II the full potential of aircraft was realized. All world powers developed their own air fleets. Such as long range bombers, dive bombers - very specific forms of aircraft. The Aircraft Carrier had showed its' importance in Pacific war actions.

22.   **Radar**. In 1937, the Air ministry of Britain began to build a line of chain Home Radar Stations. It was this system that was used to defend Britain from German aircraft in during World War II. The radar measured range accurately and helped to find enemy planes long before they had reached their destination.

23.   **Atomic Bomb**. Most destructive military weapon humanity has ever conceived was the Atomic Bomb. In World War II scientists discovered that splitting atoms created an immense amount of power. The US Atomic bomb program had 3000 people working together with no contact from the outside world to build the ultimate weapon. This was the largest scientific project in history. The project was a success. The atomic bomb eventually ended the war. The race for the atom bomb was so that a country could be wiped out by the press of a button.

Cold War - A Strong Influence on Technology Space Race

24.   **Space Exploration** : The Final Frontier at a Glimpse. Space technology and its predecessor, rocket technology, have been greatly influenced by wars. In the years between 1954 and 1975 the Cold War between the United States and the Soviet Union especially influenced the development and progress of space technology.

NATURE OF FUTURE BATTLE

Multidimensional and Multidirectional Battle

25.   The fighting capabilities of modern weaponry have been greatly increased, making it possible for armed forces with modern weapons to fight in great depth, in multidimensions and in multidirections. Operations can be carried out against an enemy target not only from a short range, but also from a long range, super long range or even from any corner of the globe. An important developing trend for the land battle is the interlacing of fighting in the far and near distances. Operations will be carried out on the land, on the sea surface, under the water, in the air, or even in space. The attacking weapons at different levels of altitude will be able to strike land targets from optimum altitude. Air strikes and mobility have become the main methods of cooperation with land operations. The differences of front, rear, and side will be mitigated, the front and rear of the battle field will be attacked simultaneously. The battle front will not be fixed, the fight will be waged in all directions. Bombers and tactical missiles can cover a fighting radius of several hundred or thousands of kilometers.

New Meanings of Time and Space

26.   Modern science and technology have greatly improved the fighting capabilities of weaponry, and the concept of time and speed on the battlefield has greatly changed. Time equals force, and speed is power. Time on the battlefield has been shortened, and operational activities will become faster. Modern weapons make the speed of the operational activities much faster. Armed forces use the high efficiency and high-speed mobile transportation tools not only for fast tactical and campaign mobility, but also for strategic mobility. Various kinds of weapons will shorten the time of reaction and in very short time will carry out fire power mobility and support and transfer, replacing manpower to a large degree. Operational activities will become all-weather, all-time, and continuous activities. Modern optics, electronics and other sensor equipment have become popular and are widely used, which greatly increases the fighting capability of weaponry and forces at night or in unfavorable weather conditions. Different army corps and their main weapons systems will have high-level and continuous fighting ability at all times and in all weather conditions. Operational activities will proceed at an unprecedented speed over all battle areas.

The Power and Accuracy of Strike

27.   The operational activities of the army have always been restricted by time and other conditions. In the industrial era, the fighting capability of the army was manifested mainly in huge armed forces and mechanized weapons. The objective of the battle was to destroy enemy forces and weaponry in large numbers. The destruction of the enemy transportation system and supply line was to create better conditions for the destruction of the enemy forces. With the development of electronics technology, armed forces interfere with an enemy's command system through electromagnetic jamming and can destroy the coordination among enemy forces, creating even better conditions for their destruction. Warfare, the primary objective of the battle will mainly be the destruction of enemy command, control, and weapons systems through the combination of counter information and fire power attack. Increased firepower range and accuracy make the choosing of battle objectives more flexible and more threatening. Smart weapons carry a small strike load. They are highly accurate and destructive, which makes small-scale operational activities highly efficient.

Information Superiority

28.   The wide application of electronic information technology in the military sphere will integrate information with firepower. With digital communication as the means, the information network collects and processes the data on the battlefield and utilizes these data in the weapon system to ensure efficient attacks against enemy forces. Under the conditions of information warfare, armed forces will use satellites, high-altitude aircraft, helicopters and unmanned flying equipment, and sensors to collect and process information. They use digital communication techniques to transmit computer data within the information network. They also use digital modulators and demodulators to retrieve various information and command or control information, so that the various command organs and units of the armed forces will have relevant intelligence regarding the fighting task. The main activities will be the collection and processing, transfer and utilization, competition for and countering of battle information. This will be the case during the whole process of the battle. The supremacy of information will replace the supremacy of forces and weapons and will be the key in winning the upper hand in the land operations.

Joint Operations

29.   The combination of land fighting forces with the air and sea forces will become an integrated fighting force connected by a battle information network. It will be possible to destroy important military and economic facilities of the enemy without contact with the enemy at the front, and make the enemy lose its ability to resist.

Digitization Battlefield

30.   On the digital battle field, the units of the armed forces, through a digital information network, will receive orders and decisional information from the commanding organization. They will feed back the situation on the battle field, exchange information with other units, and carry out a close cooperation. Within the network the various units of the armed forces will be able to use different support weapons systems beside their own weapons.

IMPACT OF TECHNOLOGY ON NATURE OF WAR

Extension of Range

31.   The introduction of rifling extended the range and accuracy of individual weapons and artillery guns. The development forced individuals to go to the ground and disperse. Increased lethality and dispersion had direct effects on organization, tactics, doctrine, equipment, force mix and methods of command and control. These changes, in turn had effects on training, soldiers and leaders. The Gulf War saw a quantum increase in dispersion and improvements in the ability to deliver long-range lethal fires. The inter-continental ballistic missiles which can target almost any place on the globe. Increased ranges and enlarged dispersion create the requirement to communicate over greater distances, to maneuver more quickly and to use firepower from various type of platforms. This trend will place a greater premium on the commander's ability to make decisions quickly.

Volume of Fire

32.   The machine gun with its heavy volume of fire reaped havoc in World War I. World War II saw massed artillery fires being brought down on the enemy to pulverize the enemy's defences and to cause maximum destruction to the enemy's assets. The Battle of El Alamein in North Africa witnessed moving barrages of artillery fire behind which Allied troops advanced and which caused devastating effects on German forces in defence. The trend of bringing down a very high volume of fire with improved effectiveness continued after World War II. Heavier calibers of guns, increased rates of fire and improved effectiveness of munitions changed the nature of the battlefield. The development of technology to locate the enemy's guns and mortars was aimed to counter the effects of the adversary's heavy volume of artillery fire. These trends gave rise to the use of entrenchments and field fortifications in the battlefield. Development of tanks and infantry combat vehicles provided mobility, protection, survivability and added fire power. The Germans exploited the characteristics of tanks fully in the initial stages of World War II when they carried out their Blitzkrieg campaigns.

Guided Weapons

33.   The lack of accuracy of various weapon systems was sought to be compensated by heavy volume of fire but the development of guided weapons added a new dimension to the battlefield. The purpose of guided weapons was to economize on the size of forces by substituting accuracy. Induction of various kinds of missiles, laser-aimed weapons, laser target designators that guide artillery rounds and development of smart munitions confirms the trend towards precision fire.

System Integration

34.   Advances in communications technology, computers, information systems, surveillance and target acquisition systems have given rise to improved means of command and control to a commander. Systems integration creates force multiplication and gives a high level of precision to the overall force. Introduction of radio and aviation expanded the scope of integrative technology. During the Gulf War, the use of links between scout and attack helicopters, between forward observers and indirect fire systems produced a quantum leap in systems integration. The future battlefield will depend largely on digital data, voice and video communication.

Force Multipliers and Concentration of Effects

35.   It is evident that services in both defensive and offensive operations depend upon the ability to field a favorable combat superiority at the place of one's own choosing. This in turn requires physical mobility and ability to overcome battlefield friction. This ability is conceptually achieved by shaping the battlefield in one's favor with help of force multipliers. Therefore, weapons and high-tech systems of modern technology which attempt to substitute "mass" and provide greater "effect" are generally termed as "force multipliers". Force multipliers improve the combat effectiveness of the force across the full range of military activity. With the trends in compressing greater fire power, a well integrated smaller size force/unit could achieve

greater and decisive effects. Increased lethality and accuracy, mobility and extended ranges of weapon systems give small forces a lethal and forceful punch. A smaller units can create decisive effects is in organizational mixing of arms within a formation. Maneuver is another way that smaller units can create decisive effects due to increased mobility. Improved maneuver capability contributed to the commander's capability to move over increasingly dispersed areas and converge quickly at the decisive point.

Transparency

36.   For a long time, detect ability in the battlefield was limited to line of sight, scouts, spies and cavalry. It progressed, thereafter, to field glasses and balloons. In the beginning of the 19th century, battlefield information was passed on telephones and with the invention of radio it could be transmitted almost instantaneously. With the introduction of radars and various kind of electronic devices, electronic means of intelligence and deception were developed and they continued to be evolved after World War II. In the late Sixties, computers, based on electronic chips, were provided with direct links, either through line or radio. Computers could not only store vast amount of data, they could also be utilized to process the data based on pre-determined criteria. The purpose of all these endeavors was to improve the ability to obtain a real-time picture of the battlefield. Advanced technological and human intelligence systems will continue to expand the commanders detection range, improve the quality of information and disseminate the data to required levels. The battlefield, therefore, is becoming more transparent while attempting to make it more opaque for the adversary.

Information Technologies and Information Warfare

37.   Information Technology (IT) and Information Warfare (IW) help us to focus on key battle winning aspects. The entire concept of IW is based on the lethality of the digitized battlefield. The prime aim of IW would be the gaining of electro-magnetic superiority with a view to neutralize the adversary's command, control, communication, computer, surveillance, intelligence and information acquisition systems. In IW, a deliberate attempt is made to gain access to information and information systems of the adversary; at the same time preventing him from doing the same to own side. The electro-magnetic spectrum would become the new "high ground" to be captured for success of operations. Battlefield interdiction would also include electronic isolation of a force. The aim of future wars will be towards psychological paralysis and not destruction of forces or capture of territory. The armed forces would strive to achieve information deterrence against likely or visualized adversaries.

Tooth and Tail Effects

38.   Another impact of technology on war is called Tooth and Tail effect. In the early warfare most of the troops were combatants. Now a days in the advanced countries only 15%-20% is combatant and rest is support element. Each new equipment introduced needed its own backup support in terms of logistics, maintenance, training, co-ordination and integration. Thus the comparative size of fighting force is reduced in comparison to service support size.

Emerging Technologies

39.   Necessity is the mother of invention. Emerging technologies are always coming up. Some of the emerging technologies are briefly discussed below:

      a.   **Electronic Weapons**. In future, the enemy would be attacked by computer viruses, logic bombs, jamming TV broadcasts with propaganda massages, giving phony orders to field troops etc.[2]

      b.   **Bio and Nano Technologies**. Bio-technology aims at developing small size robots walking around any place undetected to collect information. Nano technology aims to develop machine small enough to work on a molecule in the bloodstream.[3]

      c.   **Acoustic Weapons**. Acoustic weapons generates frequency which covers audio, infra and ultra sound region. This volume of frequency is capable of braking window panes, damaging ear drums, incapacitating men temporarily or permanently.

      e.   **Engineers Equipment**. Robotic minesweepers has been invented to clear minefield without involving soldiers. Ground penetrating radar can even detect the odors of explosive vapors emanating from buried charges.

      f.   **Robotics**. Robotics is not a new concept. The advantage in using robots in the battlefield is that they are NBC proof. They don't need any kind of training. Only the software is needed for robots. Robotics can effectively be used in non combat roles. Their uses as soldiers have already been identified. Their uses in the battlefield will bring a new dimension in the battlefield.[4]

CONCLUSION

40.   In the early warfare battles had to be fought first hand. Armies met on the battlefield and fought until one was defeated. War still had important consequences. The weapons developed were inefficient. The United State civil war became the testing ground for those weapons. During the period between World War I and II, the technologies like the tank, plane, and chemical weapons had be reexamine. These technologies were also tested in World War I and II. The period following World War II all the way until the fall of USSR showed a new type of war cold war. The out come of cold war was a new set of attitudes towards war which were destructive towards human life. Gulf war was the place for demonstration of advanced equipments and armaments. It was a distancing battle where super powers destroyed Iraqi forces from a distance.

41.   Modern weapons have got great capabilities of fighting in great depth, in multi-dimensions and in multi-directions. The future battle front will not be fixed, the fight will be waged in all directions. The new meaning of time and speed has come on war. Time equals force and speed is power. Modern weapons make the speed of the operational activities much faster. Operational activities will be all time, all weather and continuous. In the industrial era, the fighting capability was manifested in huge armed forces and mechanized weapons. Now the primary objective of the battle will be the destruction of enemy command, control and weapons systems. Increased firepower and accuracy of strike make the choosing of battle objectives more flexible and more threatening.

42.   Technology has always been used to produce improved tools of warfare. The introduction of rifling extended the range and accuracy of individual weapons and artillery guns. Increased lethality and dispersion had effects on training, soldiers and leaders. The Gulf War is the example of using long range lethal fires. The trend of bringing down a very high volume of fire with improved effectiveness continued in both the World Wars. Heavy caliber guns, increased rates of fire and improved effectiveness of munitions changed the nature of battlefield. The development of guided weapons added new dimension to the battlefield.

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