CHAPTER I

EVOLUTION OF WARFARE AND ROLE OF ARTILLERY

Warfare

Survival needs of mankind have been enmeshed by conflicts. Since the agrarian revolution of c.6,000 BC, till now; conflict, battles and war have been an constant element in the annals of mankind. It may be a safe prediction to expect war to adapt or be adapted, to technology, economy, social and political changes. The fact however, remains that conflicts, battles and war will continue to survive in future.

War and warfare change its nature in synchronization with the changes in the world order. War is organized violence threatened or waged for political purposes. The renowned strategist Carl von Clausewitz has expressed his opinion in his seminal book. *On War*, ‘war is nothing but a duel on a larger scale’¹. He proceeded to insist that ‘war thus is an act of force to compel our enemy to do our will’. It emerges that by way of contrast to the eternal universal realities of war, warfare’s subjective nature is always changing, albeit at different rates at different times. Historically the most revolutionary effect on warfare took place with the invention of gunpowder. Subsequently, development of small arms like hand held guns followed by artillery pieces changed the course of battles. At conceptual level, Clausewitz’s theory is completely unfazed by the permanence of the impermanence of the character of war. He writes, ‘every age had own kind of war, its own limiting conditions, and its own peculiar preconceptions. Each period, therefore, would have held to its own theory of war’². Warfare and its future, therefore, is greatly dependent upon higher degree of destruction brought about by using technology. Firepower is the most important pillar of this concept. In fact as the time passes and technological progress marches ahead, the levels of violence and destruction that can be brought about by ‘Firepower’ will be much more severe.

War and warfare has the unique ability to change local and regional politics, national alignments and national honour. *War may not ensure national security goals of a nation but defeat certainly guarantee its failure*. The influence of international conflicts and politics has substantial influence in a nation’s domestic safety and security. Involvement of USSR in Afghanistan and the consequence of the US involvement which led to dismantling of USSR as a nation and rise of Taliban, Al-Qaeda and international
terrorism is a case to the point. The resultant effects of these events have changed the international security paradigms for good. World has now become a more unsafe place to live.

The transition of conflict and war from traditional conventional war to non-conventional war became more pronounced once the Cold War ended. Of late, many theories questioning continuation of concepts of conventional war has emerged. Robert Kaplan’s ‘Anarchy Theory’,\(^3\) Michael Brown’s ‘Rationale of Internal Conflict Theory’\(^4\), ‘Wave Theory of Warfare’ propounded by Avin and Heidi Toffler\(^5\), Paul Collier’s ‘Greed versus Grievance Theory’\(^6\) and Samuel P Huntington’s ‘Clash of Civilization’\(^7\) have underlined the various causes, conduct and character of future conflicts and wars. These theories, in a way, have stated that greed, erosion of state authority, ethnicity, demographic fissures and hostility between nations over culture and religion will act as an impelling force in generating violence and conflict. They also underline that various kinds of wars that may be fought in future between nations will follow well-defined sequence as a part of state stratagems and as a function of overall Grand Strategy. Thus, a future conventional war will also represent a multi-spectral asymmetrical conflict.

Chinese writers Qiao Liang and Wang Xiangsui’s in their work entitled, ‘Unrestricted Warfare’\(^8\), published in February 1999, have highlighted the primary fact that even in the present day context, conventional warfare employing massive firepower has not been banished but has only assumed more complex, concealed and subtle forms. Future wars will transcend all boundaries and limits, if international bodies do not intervene and defuse the issues leading to conflicts. India’s national security will be greatly impacted by these developments.

The destruction of the enemy forces is the prime objective in battles and war. While there might be other objectives, viz., the control of terrain, resources, communications etc, so as to confront the enemy in the most marginal and ancillary of engagements, the destruction of the enemy force has always been that really mattered. This destruction is not simply contributory to the final objective of the strategist; it is in itself an intrinsic part of that objective. Artillery has been the key to achieving this aim by causing destruction and attacking the enemy’s capacity to resist by ‘killing of his courage rather than his men only’. In warfare, only after the enemy’s morale had been broken that it becomes possible to inflict much heavier losses on the enemy. This is true of all engagements, large or small, but the greater proportionate effect on enemy morale in a
major engagement much depends upon the shock of heavy bombardment and the resultant losses. Indeed, destruction of the enemy’s main force is the binding parameter of any ‘Grand Strategy’. In land battles only artillery firepower has been able to achieve this necessity. Indian artillery has exhibited and proved every aspect of this battle philosophy wherever it has been employed in India and abroad.

**Artillery**

Firepower and artillery are synonymous. The word *artillery* as used to describe the equipment to fire heavier projectiles over a long distance appears to have been coined around the middle ages. It might have evolved from the French word ‘*attillement*’ meaning ‘equipment’ and ‘*atelier*’ meaning ‘to arrange’. Around the 13th century the word ‘*artiller*’ received currency to describe a builder for any war equipment. Later years saw emergence of the word ‘*artillery*’ covering all kinds of military weapons. In the 18th century the British army coined the word *Honourable Artillery Company* initially as an infantry unit which gradually got referred to as a unit having larger artillery guns. Another school of thought describe emergence of the word ‘*artillery*’ from the Italian word *arte de tirare* or the *art of shooting* coined by one of the first western theorists on the use of artillery as a weapon, Niccolo Tartaglia.

*It is evident from the various events in the history of nations that artillery weapons of one kind or other have changed the course of battles and thus the fortune of kingdoms and nations.* Invention of artillery weapons and their efficacy meant a chain of developments that strengthened the rulers of nation states. New weapons also made the war different, and at times more horrible and devastating. The first recorded use of artillery with gunpowder as propellant for firing shells in a battlefield was to capture a city in Fujian by General Han Zhizhong of the Song Dynasty. These small crude weapons moved to the Middle East and were called *Madfaa*. It finally reached Europe in the 13th Century, in a very limited manner. In Asia, Mongols adopted the Chinese artillery and used it effectively in their great conquests. Genghis Khan, in the course of a relatively short period managed to annihilate over 20 million people in the 13th Century by using his artillery ruthlessly. By late 14th Century AD, Chinese used organized artillery and cavalry to push Mongols out. Use of gunpowder as a weapon in Europe has been recorded in Roger Bacon’s famous manuscript written in 1252, which records of the use of gunpowder. Europe at that time was an ever quarreling amalgamation of citi-states,
dukedoms and principalities who sought to have more modern weapons. Later, Europe
developed the first effective cannons. As small smoothbore tubes, these were initially cast
in iron or bronze around a core, with the first drilled bore ordnance recorded in operation
near Seville in 1247\textsuperscript{15}. They fired lead, iron, or stone balls, sometimes large arrows and on
occasions simply handfuls of whatever scrap came to hand.

The artillery revolution in Europe caught on during the Hundred Years War\textsuperscript{16} and
changed the way that battles were fought. Subsequently, the English used a weapon using
gunpowder in a military campaign against the Scottish Army. However, at this time, the
cannons used in battle were very small and not particularly effective. Cannons were only
useful for the defence of a castle, as demonstrated at Breteuil in 1356, when the besieged
English used cannon to destroy an attacking French assault tower\textsuperscript{17}. By the end of the 14\textsuperscript{th}
century, cannons were still powerful enough to knock in roofs, but could not penetrate
castle walls.

However, a major change occurred between 1420-1430, when artillery became
much more powerful and could now batter strongholds and fortresses quite efficiently. The
English, French, and Burgundians all advanced in military technology, and as a result the
traditional advantage that went to the defence in a siege was lost. The cannons during this
period were elongated, and the recipe for gunpowder was improved to make it three times
as powerful as before. These changes led to the increased power in the artillery weapons
of the time.

Joan of Arc encountered gunpowder weaponry several times when she led the
French against the English at the Battle of Tourelles, in 1430.\textsuperscript{18} She faced heavy
gunpowder fired artillery shots, and yet her troops prevailed in that battle. In addition, she
led assaults against the English-held towns of Jargeau, Meung, and Beaugency, all with
the support of large artillery units. When she led the assault on Paris, Joan faced stiff
artillery fire, especially from the suburb of St. Denis, which ultimately led to her defeat in
this battle.\textsuperscript{19} In April 1430, she went to battle against the Burgundians, whose support was
purchased by the English. At this time, the Burgundians had the strongest and largest
gunpowder arsenal among the European powers, and yet the French, under Joan of Arc’s
leadership, were able to beat back the Burgundians and defend themselves. Most of the
battles of the Hundred Years War that Joan of Arc participated in were fought with
artillery using gunpowder.
The army of Mehmet the Conqueror, which conquered Constantinople in 1453, had both artillery and foot soldiers. The Ottomans brought to the siege sixty-nine guns in fifteen separate batteries and trained them at the walls of the city. The barrage of Ottoman cannon fire lasted forty days, and they are estimated to have fired 29,320 times. Artillery also played a decisive role in the Battle of St. Jakob an der Birs in 1444.

Around this period King Edward III of England invaded France. He was intercepted by King Philip VI near the town of Crecy. Philip had about 12000 men, 8000 of them armoured knights and 4000 Genoese mercenary against King Edward III's army of 10000. As the army of King Philip VI charged, artillery of King Edward III opened up with the fire of three small, primitive cannons known as Bombards. These cannons made more noise and showed more fire than destroying the enemy. Notwithstanding, it made huge impact on the enemy leading to a quick victory. Possibly these instances were precursors of acceptance of efficacy of artillery firepower on the comprehensive military power of a nation state, leading to victory in the battlefield, which in effect enhanced their Comprehensive National Power.

Bombards were of value mainly in sieges. A Turkish ‘Bombard’ used at the siege of Constantinople in 1453 weighed 19 tons. It took 200 men and sixty oxen to emplace, and could fire just seven times a day. According to Sir Charles Oman the Fall of Constantinople was perhaps “the first event of supreme importance whose result was determined by the use of artillery”, when the huge bronze cannons of Mehmed II made by the Hungarian Orban, breached the city's walls, ending the Byzantine Empire.

‘Bombards’ developed in Europe were massive smoothbore weapons distinguished by their lack of a field carriage, immobility once emplaced, highly individual design, and noted unreliability. James II, the King of Scotland was killed in 1460 when a shell exploded at the siege of Roxburgh. Their large size precluded the barrels being cast and were constructed out of metal staves or rods bound together with hoops like a barrel, giving their name to the gun barrel.

The use of the word “cannon” marks the introduction of a dedicated field carriage with axle, trail and animal-drawn limber in the 15th Century which assisted in producing mobile field pieces that could move and support an army in action, rather than being found only in siege and static defences. The reduction in the size of the barrel was due to improvements in both iron technology and gunpowder manufacture, while the development of trunnions – projections at the side of the cannon as an integral part of the
cast – allowed the barrel to be fixed to a more movable base, and also made raising or lowering of the barrel much easier.

The first land-based mobile artillery weapon is usually credited to Jan Zizka, who deployed his oxen-hauled cannon during the Hussite Wars of Bohemia (1418 – 1424). However cannons were still large and cumbersome. With the rise of musketry in the 16th Century, cannons were largely (though not entirely) displaced from the battlefield. The cannons were too slow and cumbersome to be used and too easily lost to a rapid enemy advance. Arms race between the French and Burgundians during the latter part of the Hundred Years War saw introduction of bronze cannon firing better projectiles. New guns were cast on lugs, called ‘trunnions’ so that they could be elevated to hit targets at varying ranges. The guns were also mounted on wheel carriages so that they could be easily moved. These developments were revolutionary whose impact was to be seen in the military history of the future. In 1450 French and English forces of equal size fought the Battle of Foremingy. As the English set up conventional battle positions with dismounted knights and infantry, ready for the traditional French cavalry charge, the French just hauled up their cannons and blasted the English away. The battle ended before it started.

At Castillon, three years later, when an English army attacked French force that was besieging an English stronghold, the French used their cannons effectively in the defensive battle which resulted in the death of the English Commander, John Talbot and the Hundred Years War effectively ended soon afterwards. Thus artillery or more precisely French cannons can be credited for ending of the Hundred Years War.

In 1494, Charles VIII of France took his artillery to Italy to enforce his claim on Naples. The result was a sort of 15th Century Blitzkrieg. Cities and fortresses surrendered to the French as soon as they saw the French artillery. Although there was some resistance in the Battle of Naples, the fortress of Monte San Giovanni which had previously withstood a siege of seven years, was taken in eight hours due to the French artillery fire. This success inspired an alliance of Spain, Venice, the Papal States and Milan. This projected a new dimension of the power of artillery to inspire national alliances. Field artillery continued to improve well into the 19th Century. It became one of the key elements of warfare and Napoleon’s victories.

The combining of shot and powder into a single unit, a cartridge, occurred in the 1620s with a simple fabric bag, and was quickly adopted by all nations. It speeded loading of the cannon and made it safer, but unexpelled bag fragments were an additional fouling
in the gun barrel and thus a new tool – a worm – was introduced to remove them. King Gustavus Adolphus of Sweden is identified as the commander who made cannon an effective force on the battlefield in the century and pushing for the development of much lighter and smaller guns and deploying them in far greater numbers. The outcome of battles that was still determined by the clash of infantry gradually became artillery centric.

**ARTILLERY EMPLOYED IN INDIA**

*Multi-barrel Ribauldequin*

*Tipu Sultan's Multi-barrel Gun*
ARTILLERY EMPLOYED IN INDIA

7-pounder RML Gun (1865)  
2.5 inch RML Gun (1879)

10-pounder BL Gun (1902)  
2.75 inch Gun (1914)

3.7 inch Gun (1918)  
Abbotabad Mountain Gun (1922)

4.2 inch Mortar (1958)  
120mm Mortar
ARTILLERY EMPLOYED IN INDIA

3.7 inch Mountain Howitzer  
76 mm Yugoslav Mountain Gun

25-pounder Gun  
‘Sexton’ 25-pounder Self Propelled Field Gun

‘Priest’ 105mm Self Propelled Field Gun  
75/24mm Mountain Gun

105mm Abbot Self Propelled Field Gun  
‘Catapult’ 130mm Self Propelled Medium Gun
ARTILLERY EMPLOYED IN INDIA

100mm Field Gun

5.5 inch BL Medium Gun (1948)

7.2 inch Howitzer

122mm Howitzer

105mm LFG

105mm IFG

130mm M-46 Medium Gun

Barrel Rifling
Shells that were explosive-filled fused projectiles were also developed in the 17th Century. The development of specialized pieces – shipboard artillery, howitzers and mortars – was also commenced in this period. More esoteric designs, like the multi-barrel ribauldequin\textsuperscript{35} (known as “organ guns”), were also produced.

The 1650 book by Kazimierz Siemienowicz “Artis Magnae Artilleriae pars prima”\textsuperscript{36} was one of the most important contemporary publications on the subject of artillery. For over two centuries this work was used in Europe as a basic artillery manual. One of the most significant effects of artillery during this period was, however, somewhat more indirect. By easily reducing to rubble any medieval-type fortification or city wall (some which had stood attacks since Roman times), it abolished millennia of siege-warfare strategies and styles of fortification building. This led, among other things, to a frenzy of new bastion-style fortifications to be built over Europe and in its colonies, but also had a strong integrating effect on emerging nation-states, as kings were able to use their newfound artillery superiority to force any local dukes or lords to submit to their will, setting the stage for the emergence of absolutist kingdoms. It thus appears that even in the 17th Century ‘artillery’ had profound impact on military powers of a state.

Cannons continued to become smaller and lighter – Frederick II of Prussia deployed the first genuine light artillery during the Seven Years War.\textsuperscript{37} However, it was not but until the mid-19th Century that improvements in metallurgy, chemistry, manufacturing and other sciences could alter the basic design and operation of a cannon. The earliest battlefield use of indirect artillery fire was probably at Paltzig in July 1759 when the Russian artillery fired over the trees.\textsuperscript{38} Artillery continued to gain prominence in the 18th Century when Jean-Baptiste de Gribeauval, a French artillery engineer introduced the standardization of cannon design.\textsuperscript{39} He developed a 6-inch (150mm) field howitzer whose gun barrel, carriage assembly and ammunition specifications were made uniform for all French cannons. The standardized interchangeable parts of these cannons down to the nuts, bolts and screws that made their mass production and repair much easier. It resulted in lighter and more manageable cannons having better range and efficiency.

Another major change at this time was the development of a flintlock firing mechanism for the cannons. The old method of firing the cannon involved the use of linstock or match to light a small quantity of powder charge in a torch hole drilled into the
breech. This technique was quite faulty because the ignited powder could easily be extinguished by rain and an excess amount of charge could cause the guns to burst. Revolutionary and Napoleonic Wars swept Europe between 1792 and 1815. During this period artillery transformed into a major service capable of dominating battlefields. An example of this was the French army of Italy, which in 1796 had 60 artillery pieces to its credit. Sixteen years later, at the Battle of Borodino, the artillery of opposite sides totalled nearly 1200 guns which fired an average of 15,000 rounds per hour during the course of the days fighting on a mere two mile front.\textsuperscript{40} The period of 1760 onwards was a period of revolution in warfare in Europe, which also had substantial impact on the development of artillery.

The Russians at this time developed Licorn artillery howitzers, which were forerunner of later dual purpose field pieces.\textsuperscript{41} In 1792, Sir William Congreve introduced the block trail to British Royal Artillery which made the cannons even lighter and more manageable to handle. These changes helped to lay the foundation for modern artillery design and employment. He also introduced artillery rockets called Congreve rockets, which some historians state that he had copied from the rockets of Tipu Sultan of India,\textsuperscript{42} against whom he had fought as a young officer.

During the 18\textsuperscript{th} century, Austrian generals used massed artillery at the battles of Marengo and Aspern-Essling.\textsuperscript{43} The Russians did the same in the battlefield at Eylau.\textsuperscript{44} Devastation caused by these cannons resulted in quick victory. Napoleon, himself an artillery officer, and several of his senior generals were experts at maintaining offensive tempo on the battlefield primarily through the efficient coordination of artillery fire. All these factors, coupled with new, relatively lightweight cannons breathed life into the efficacy of artillery in battlefield, turning it into a potent offensive weapon.

In the Battle of Marengo, on 14 June 1800, Napoleon’s French army of 23,700 men and only 23 cannons were caught unaware while crossing river Scriva towards the Austrian town of Alessandria and the nearby village of Marengo by 31,000 Austrians.\textsuperscript{45} Napoleon’s French army rushed to the flank of the huge Austrian army and engaged them with artillery followed by a cavalry charge. Austrians fled the battlefield. Napoleon’s Battle of Austerlitz during December 1805 and at Jena against the Russian army was won primarily due to his excellent handling of artillery.\textsuperscript{46} Similarly, his campaign against the Russian, in June 1812 was an example of combined operations of cavalry charge supported by the artillery. So severe was the battle that it left the French totally exhausted.
and incapable of exploiting the gains. While Napoleon gained on the battlefield at Bordino and opened the road to Moscow, his army was too tired to support him and had to retreat through the terrible Russian winter. The beginning of the nineteenth century saw artillery becoming more and more powerful having the ability to cause great deal of destruction. The Battle of Bordino was notable for the use of land based firepower, mainly artillery.

From the 1860s, a series of rapid technological and operational changes accelerating through the 1870s and thereafter made lasting changes in artillery. The first effective breech-loader gun that allowed a higher rate of fire while keeping the firing detachment behind the gun, was developed in 1855 by Sir William Armstrong, and accepted for British service in 1859.47 This invention is still being used in modern guns. The first cannon to contain all ‘modern’ features is generally considered to be the French 75 gun manufactured in 1897, with its cased ammunition, effective breech-loading system, modern sights, self-contained firing mechanism, and hydro-pneumatic recoil dampening.48

In 1882, a Russian officer, Lieutenant Colonel KG Guk, published a professional artillery book Indirect Fire for Field Artillery49 which provided a practical method of exploiting scientific applications for indirect fire. He described newer technical concepts regarding theory and practice of the essentials of recording of guns, crest clearance, corrections to fire by an observer (observation post) and lot more. A few years later the Richtflache (lining-plane) sight was invented in Germany that provided a means of indirect laying in azimuth that complimented the clinometers for indirect laying in elevation which already existed. In the next fifteen years, new inventions in artillery is characterised by its ability to destroy targets without seeing it through its sights. Indirect fire was the defining characteristic of 20th Century artillery and led to vast changes in artillery; its tactics, organization and techniques, most of which occurred during World War I.

With the advancement in gun manufacture, there was a resultant need to upgrade the technical know-how to fire the guns accurately and in the most cost-effective manner. There was also a need to develop gun-firing data parameters and the fire control system. The movement toward the advancement of technical know-how to fire precision fires did not begin until late in World War I. In 1916, the Russians conducted their first registration point shoot: the adjustment of fire onto one target to identify firing inaccuracy, then switching to another while applying the known correction to achieve accuracy and surprise.50 With this the artillery began to shift away from massed fires towards optimal
and accurate fires. 20th Century witnessed many revolutionary developments in artillery. Early part of the century saw development of ‘Super Guns’ which could blast any fort wall and ensure victory. When during the World War I, the attacking Germans found the Belgian forts at Liege holding their advance, the 305 mm (12.2 inch) howitzers developed by Skoda in Austria were inducted in the battle by the German army. Austria thereafter loaned several of these guns to Germany. Meanwhile, Krupp, Germany’s premier gun maker had been developing one of the biggest guns ever, the 420 mm (16.8 inch) howitzer, the ‘Big Bertha’. On 12 August 1914, nine days after the German troops confronted Liege, the first ‘Big Bertha’ arrived. The huge gun pounded the Belgian forts to pieces. By 16 August 1914 the Germans had captured all the forts in the battle area by effective use of its heavy artillery. In the Eastern Front, the Germans used Skoda heavy mortars to pulverize Russian held field fortifications and forts. Germans also used the ‘Paris Gun’ or the ‘Ding Max’ to fire at Paris from a distance of over 74 miles between 23 March and 9 August 1914 killing 256 people.

By World War II, decades if not centuries of weapons development had settled into maturity on an almost imperceptibly rising plateau. The sciences of ballistics and explosive chemistry had achieved near perfection given the available technology of the age. During the World War II, the Germans took off from where they had stopped making monster guns and produced the biggest and most powerful gun named Dora. The new gun blasted through the French Maginot Line during 1942. It is credited with early French surrender. Super-gun Dora was thereafter moved to the Eastern Front where the strongly fortified city of Sevastopol was holding out. Dora with a barrel almost 90 feet long and bore diameter of 800 mm (31.5 Inches) could fire five-ton explosive shells at targets 29 miles away. It pulverized the Russian forts. German army commander Marshal Erich Von Manstein, called it ‘a miracle of technical achievement’.

In the Indian context, artillery guns were the mainstay of all the British Expeditionary Forces to the restive North West Frontier Provinces (NWFP), Afghanistan and Central India. Thereafter, during the World War I and the World War II, it was extensively employed by the British Indian army. Its exploits in the Battle of Bir Hachiem in Libya against Rommel’s Panzer army on 27 May 1941 was proudly mentioned in the British Parliament by Sir Winston Churchill on the next day. Many such successes came to the Indian artillery thereafter. Artillery guns and artillery men are often called ‘gunners’. They were also instrumental for the Indian army’s successes against the
Pakistani riders in 1947-48, Indo-Pak Wars 1965 and 1971. Lack of artillery guns and ammunition during Sino-Indian Conflict 1962 resulted in devastation and defeat. Live telecast of the artillery guns destroying Pakistani army fortifications on ‘Tiger Hill’ and other high mountain ridges in the Kargil region of J&K during 1999 is an example of the efficacy of the artillery guns. These live artillery engagements of the enemy became a rallying point for the nation. A grateful nation has acknowledged the artillery’s prime role for the success in the battles fought during Kargil operations.

Weapons covered by the term ‘modern artillery’ include “cannon” artillery such as the howitzer, mortar, field gun, rocket artillery and cruise missiles. Certain smaller-calibre mortars are more appropriately designated infantry pieces rather than artillery, albeit it uses indirect-fire methods viz., 81 mm mortars etc. This term also came to include coastal artillery which traditionally defended coastal areas against seaborne attack and controlled the passage of ships. With the advent of powered flight at the start of the 20th Century, artillery also included ground-based anti-aircraft batteries and battlefield surveillance equipment. Artillery also got light aeroplane as their observation post so that they can identify targets from the air and destroy them, using ground based artillery guns. They are called Air Observation Posts (Air OP).

Artillery firepower is the mainstay of any land battle, not only in India but across the continents since the ancient times. It reflects the military power of an army and the nation. It also puts caution and fear in the minds of the enemy. It was for nothing that Emperor Babur stated, “Cannons are the locks and key of a Kingdom”. Stalin after World War II stated “Artillery is the God of War”.59

With the passing of times artillery came to represent the ‘arm of military service’ that operates artillery guns. It is also referred to as a combat arm in most of the military services, when used organisationally to describe subunits and units having larger and heavier guns. In real terms, it means a troop representing three guns, battery representing two troops and regiment representing three batteries and an artillery brigade representing four to five regiments. In India, Artillery Divisions consisting of three artillery brigades also form part of the Indian army. Roughly, a troop is equal to an infantry platoon, a battery equivalent to an infantry company or an armoured squadron and a regiment that of an infantry battalion or an armoured regiment. Artillery batteries, regiment and brigade are often allotted to larger military organizations like infantry brigades, divisions and corps for operational and administrative purposes. In Indian army synonymous to the artillery is the
word ‘gunner’. Gunner represents all those who are associated in operation of an artillery piece. However in organizational structure a ‘gunner’ represents the soldier who forms part of the gun crew and assists in firing or operation of the gun or other artillery equipment.

Modern artillery guns are categorized in terms of range, projectile warhead (munitions), ability to fire at various angles etc. Accordingly, they are categorized as guns, howitzer, mortar, rocket artillery, missiles etc. These fire various kinds of projectiles ranging from high explosive to smoke, air burst etc. Guns and howitzers are also categorized as heavy, medium and field, based on the calibre of the barrel and the weight of projectiles that they fire. In this manner, a 105mm Indian Field Gun (IFG) is a ‘Field Gun’, Bofors 155mm howitzer is a ‘Medium Gun’ and US 203mm gun a ‘Heavy Gun’. Rocket artillery is not fired from a gun barrel but from rocket tubes. Indian artillery possesses 122mm BM 21 rocket artillery having 40 tubes which can fire 40 rockets at the same time like a hail. The Russian Smerch rocket artillery system that can reach upto a distance of 90 km and the Indian manufactured Pinaka rocket artillery system that can reach upto 38 kms are the latest inductions in the Indian artillery, this was followed by the induction of supersonic cruise missile ‘BrahMos’, which can reach to a distance of 290 km with great accuracy.

Another categorization of artillery differentiates the naval, air defence and field artillery. Naval artillery is employed both from the ships and from the coast. They are generally employed against ships and coastal targets. Air defence artillery is employed against airborne targets. They are sometimes employed against ground targets as well. However field artillery which forms part of the Indian Regiment of Artillery is the one that is specifically employed by the Indian Army against the ground based enemy. Their operational responsibilities and spectrum of employment is therefore much wider and decisive. Indian artillery of the present represents the field artillery.

Field artillery provides close support to infantry and tanks in the battlefield. It also destroys enemy’s fortifications, communication centres etc., On a stand-alone mode by delivering high explosive munitions accurately on the selected targets. The munitions that bursts on falling to the ground is called ground burst ammunition, and that bursts in the air causing casualty through fragments is called air burst ammunition. These two types of ammunition are utilized to cause destruction through blast and fragments, effectively destroying enemy fortifications, moving troops, tanks, equipment, vehicles etc. They can
also be employed to spread mines and propaganda leaflets in the battlefield, make smoke
screen, cause avalanches and landslides as well as cause ground fire. Different kinds of
projectiles are employed for different tasks. In fact, if the firepower of artillery is
optimally utilized then it can be the primary reason for comparatively easy victory in the
battlefield by the infantry and the tanks. Military history stands testimony to this fact.

Artillery performs its role in conjunction with armour, infantry and mechanized
infantry. It operates in all terrains viz., coastal regions, desert, plains, forests, hills,
mountains, high altitude and super high altitude areas. Artillery guns in India operate from
the sea levels to super high altitudes of approximately 21,000 feet in the Siachen region in
Ladakh. It is also employed in some of the most inhospitable terrains in the world. To
undertake such multidimensional tasks it uses two distinct gun systems: the towed and the
self propelled artillery systems. As the name suggest, the towed guns are towed by a larger
vehicle called gun tractor whereas a self propelled gun is akin to a tank and moves on its
own propulsion. The self propelled guns accompany mobile forces and provide fire
support primarily to armoured columns. These operational requirements have influenced
the development and modernization of the gun systems, logistic and organizational
requirements. Among its main limitations of employment, safety factor pertaining to own
troops is considered noteworthy since bursting artillery shells have large spread of
splinters which can cause substantial destruction and casualty. It cannot, therefore, be
utilized effectively in close quarter and hand to hand fights.

Classification of Artillery

There are various kinds of artillery in service like Field artillery, Air Defence
artillery, Coastal artillery etc. Ground based artillery which takes part in land warfare is
termed as Field artillery.

Field Artillery weapon systems are predominantly classified based on size, bore
diameter, weight, mobility and its suitability of employment. These are as follows :-

- **Infantry Support Guns.** These are direct firing weapons of higher caliber
  viz., 106mm recoilless rifle (RCL), automatic grenade launcher (AGL)
  81mm mortars etc.
- **Mountain Guns.** These are light weight guns which can be moved through
  inhospitable mountainous terrain. Indian manufactured 75/24 howitzers and
  British 3.7 inch howitzers are examples of mountain guns. Such guns can
be dismantled and taken on mules or even physically carried by the soldiers.

- **Field Guns.** These are capable of firing over long ranges. They generally fire at low angle upto 45 degree elevation. The Russian 100mm gun and 130mm guns and the British 25 pounder gun are examples of field guns.

- **Howitzers.** These are the guns which can fire both in low and high angle. Such guns are capable of engaging targets behind hills and ridges where field guns cannot succeed. Almost all the modern gun systems are howitzers.

- **Mortar.** Mortars fire only in high angle. They look different than a gun. Typically they are short barreled, high trajectory weapons with range substantially less than field guns.

- **Rocket Artillery.** These are rocket propelled artillery systems with large warhead. They are used to destroy specific area on the ground. During the Indo-Pak Conflict 1999 in Kargil, Indian artillery utilized Russian BM 21 rocket artillery system in direct firing role on Tiger Hill with devastating effect.

- **Cruise Missile.** These are later addition to artillery. They use combination of rockets and advanced inertial navigation systems with large warheads to destroy targets upto 300 km. Indian BrahMos supersonic cruise missile and US subsonic Tomahawk are examples of this artillery system.

- **Surface to Surface Missile.** These transcend conventional and strategic spectrum. Indian Prithvi and Agni missiles both with conventional and nuclear warheads, can engage targets over long distances upto 5000 km. The Chinese have DF-11 (300 km), DF-15 (600 km), CSS-4 (900 km), DF-25 (2400 km) and DF31A (2700 km) in this category.

**Ammunition**

An artillery gun is of no use unless it has complementary ammunition to fire. The artillery ammunition is called by different nomenclature viz., round, projectiles, shell, shot etc., in different contexts. A round of artillery ammunition consists of a fuze, the projectile, cartridge, propellant and the primer. Shell or the projectile is that part of ammunition which carries the explosive warhead. It can also carry smoke canisters,
nuclear devices, chemical and biological warfare products, anti-tank explosives, specialized canisters carrying mines, propaganda material, chaff to jam radars, shrapnel etc.

The flight of projectiles is stabilized by providing it spin at the time of firing. This is achieved by ensuring rifling in the gun barrel. In some cases, stabilization is achieved by providing deployable fins. A combination of spin and fin for projectiles has also been introduced. Mortars on the other hand are smooth bore artillery using fin for stabilization.

The fuze forms part of the projectile and is affixed to the front of it. Different types of fuzes include: impact, mechanical and electronic timed, ground and air burst etc.

The propellant is a low intensity explosive which deflagrates on explosion instead of detonation. It, however, produces extremely high pressure gases which propels the projectile to the target. Propellant charges for field artillery guns can be provided either by placing it in charge bags or in metal cartridge cases.

The primer is the igniter which when activated either mechanically, electrically or electronically fires the propellant charge. The primers are specifically made for the quantum of propellant that need to be ignited within a specific time so as to ensure optimal gas is produced to project the projectile.

**Application of Artillery Firepower**

Modern Warfare is a complex system of incorporation, coordination and application of multifarious systems, technology and decision making process. Since battles do not generally follow a set procedure, field artillery too has adapted many specializations and centres of excellence to cater in all kinds of eventualities. The kind of field artillery fires that are likely to be called during the various stages of battles are as follows :-

- **Pre-arranged Fire.** These are such artillery engagements that are planned in advance with a view to cause desired levels of neutralization and destruction of the enemy.

- **Opportunity Fire.** These are artillery engagements based on fleeting opportunities to take advantage of an operational situation. Generally, in such engagements limited numbers of guns are employed.

- **Observed Fire.** These can be pre-arranged or opportunity fires. The artillery observers engage the enemy by observing the landing of the
artillery shells near the enemy and correcting it by using various methods and technology.

- **Predicted Fire.** These are unobserved fires. Technical firing data for such fires are worked out much in advance by using various technical means. Larger numbers of guns are employed in predicted fire, viz., artillery “Fire Plan” to support an attack by infantry or tanks. It provides maximum surprise on the enemy.

- **Degradation Fire.** These artillery engagements aim towards degrading the enemy’s operational capability prior to the offensive operations. Use of airpower in conjunction with artillery firepower also forms part of degradation fire.

- **Counter Bombardment.** It aims in engaging and silencing enemy guns and other artillery weapon systems in an operational situation.

- **Interdiction Fire.** It aims at interdicting enemy’s movements, preparation for battle, tank harbours, logistics areas etc., with a view to substantially degrade its combat power by causing heavy losses.

- **Covering Fire.** It is the provision of artillery cover to movement of own troops in battle and during close combat, so that enemy’s fire delivery means are made ineffective.

- **Defensive Fire.** It is the provision of artillery support to own forces in defensive battles. It aims to cause heavy damage to enemy’s forces attacking own defences.

- **Harassing Fire.** It aims to harass the enemy by engaging it at odd times and situations, so as not to give it the comfort of safety and creating the fear of the unknown in their mind. It aims towards affecting the morale and mental strength of the enemy. It has both short and long term adverse effect on the enemy soldiers.

- **Preparatory Fire.** These artillery engagements are used prior to commencement of attacks on the enemy. These can be observed or predicted.

The battlefields of 21st century are likely to be of high intensity and technology driven. The future warfare will demand generation of massive firepower asymmetries over the adversary through ground-based and aerially delivered firepower and ballistic missile
systems. Multi-dimensional firepower is necessary to maximize shock and disruption. The primary equipment to achieve this level of operational violence in land battles are the artillery weapon systems. Among this firepower delivery platforms the ground-based artillery systems take prominence due to its large numbers and variety of firing platforms and its ability to influence ground battles.

If the aim of warfare is to ensure strategic dislocation of the enemy, firepower asymmetries must achieve not only supremacy in the battlefield, but also offset the lack of adequate numerical superiorities of other arms viz., infantry and armour in the battlefield.

Notably the conceptual aspects of modern artillery duels has witnessed the thrust shifting from manoeuvre to attrition, neutralization to destruction, harassing fire to degradation, linear operations to simultaneity of engagement and from ‘dumb’ to smart/intelligent ammunitions. Modern warfare dictates that while ground based artillery firepower would continue to dominate the battlefields, nations would be forced to take a systems view regarding delivery and application of firepower, thereby optimizing the firepower resources. Future wars are likely to be limited in nature. It thus becomes critical for the success in the battlefield to achieve large firepower asymmetries vis-à-vis the enemy. In order to ensure minimum collateral damage specially in urban warfare and for countering terrorists, small warheads with high precision would also be necessary. Modern technology will have to keep pace with the 21st century warfare requirements since no war can be won without sufficient firepower.

4. ibid, pp. 38.
6. Paul Collier, *Doing Well Out of War : The Economic Perspective*, pp. 34. (Chapter 5 of “Greed and Grievance: Economic Agendas in Civil Wars”) http://books.google.co.in/books?id=tNnF3j3o04C&pg=PA91&dq=greed%20and%20grievances%20economic%20agendas%20in%20civil%20wars&hl=en&sa=X&ei=UpNeUYakMs2Orgec6oGABg&ved=0CEwQ6AEweBQ#v=onepage&q=greed%20and%20grievances%20economic%20agendas%20in%20civil%20wars&f=false.


*Artillery*.  

Ibid.  

Ibid.  

Ibid.  


Ibid.  


