INTRODUCTION

Reverberations of roar of cannons, clash of swords and the sound of bugles despicable as it may seem, recorded man’s urge for self preservation and passion to dominate. It also stroked the development of machines of war capable of phenomenal accretion of power of devastation. As the time rolled by, it was realised that the most successful path of gaining victory was to engage the enemy with firepower from greater distance to gain tactical advantage and win battles. This singular event in military history became a forerunner for development of artillery guns.

Indian mythology is replete with examples of use of artillery of various dimensions as weapons of mass destruction. The combat between Rama and Ravana forms a prominent part in the epic Ramayana. It states, ‘Rama set arrows to the bow and drew the string. Those arrows pierced the King of Lanka like five-hooded serpents, and fell hissing on the ground; but Ravana lifted up a dreadful aura weapon and let fly at Rama a shower of arrows having animal faces belching fire. Rama too replied appropriately with arrows giving lighting flashes, meteors etc., destroying the arrow of Ravana. Then Ravana fought with other celestial weapons, and used a Rudra shaft, irresistible and flaming, which stuck Lakshmana and laid him low’.

In the Mahabharata, there exists a notion of divine lighting and ray weapons, even of a king with hypnotic weapon. Among the offensive weapons mentioned in Mahabharata, weapons (astra) like Brahmastra\(^3\), Pashupatastra\(^3\), Agneyastra\(^4\) and Amoghastra\(^5\) were one kind of artillery or other. Probably Brahmastra was a nuclear weapon as the description of this weapon in Mahabharata matches closer to that of a nuclear strike. It is reported that this similarity was noted by Prof. Oppenheimer, the father of modern atomic bomb when the Americans exploded the test version of the first atomic bomb before using it on Japan. He had read Mahabharata and could relate what he saw and what he had read in these ancient texts\(^6\). Perhaps what Dr. Oppenheimer said was symbolic in nature.

It is reported that Mohenjodaro, an ancient, heavily populated city now in Pakistan was instantly destroyed 2,000 years before Christ by an incredible explosion that could only been caused by a device akin to an atomic bomb. This mind boggling conclusion was reached by a British researcher, David Davenport, who spent 12 years studying ancient Hindu scripts and evidence at the site where Mohenjodaro once stood. In a detailed
research paper David Davenport who happened to be an Englishman of Indian origin stated that a thermonuclear explosion at Mohenjodaro isn't a far hypothesis at all\textsuperscript{7}. The descriptions of the immense power of such a weapon have been described in the Mahabharata, describing a weapon called "Agneya" which was like a shiny rocket whose heat burned the world like a fever, followed by cold winds. When Davenport came back from Pakistan with some sample remains from the city and got them analysed, it amazed the researchers as these appeared to be fused and glassified by a heat as high as 1500°C, followed by a sudden cooling. Scientifically it is known that no natural phenomena can do the same. For Davenport, the destruction described in the Ramayana of the Danda Kingdom were nothing but the end of Mohenjodaro, also identified as Lanka, meaning "isle" on which Mohenjodaro was built on. What was found at the site of Mohenjodaro corresponds quite akin to Nagasaki, declared Davenport, who published his startling findings\textsuperscript{8}. He stated that, “there was an epicenter about 50 yards wide where everything was crystallized, fused or melted. Sixty yards from the center the bricks are melted on one side indicating a blast.” The mysterious event of 4,000 years that leveled Mohenjodaro has been recorded in Mahabharata, wherein it is stated that the white hot smoke that was thousand times brighter than the sun rose in infinite brilliance and reduced the city to ashes. It further accounts water boiled...horses and war chariots were burned by the thousands... the corpses of the fallen were mutilated by the terrible heat so that they no longer looked like human beings.’ The description concludes: it was a terrible sight to see... never before have we seen such a ghastly weapon.

Davenport's intriguing theory met with intense interest in the scientific community. Nationally known expert William Sturm said: the melting of bricks at Mohenjodaro could not have been caused by a normal fire...\textsuperscript{9} Added professor Antonio Castellani\textsuperscript{10}, a space engineer in Rome: it's possible that what happened at Mohenjodaro was not a natural phenomenon.

The first reference of use of some kind of machine discharging primitive projectiles for causing destruction is believed to be invented during 1\textsuperscript{st} AD in Alexandria\textsuperscript{11}. These were not cannons or artillery pieces as we know now; but nevertheless they employed the concept of throwing an object by a kind of machine to cause casualty on the enemy. Later such contraptions were called ‘engines of war’\textsuperscript{12}. It appears that such devices were widely employed by the ‘Roman Legions’. Such devices were constructed mostly with local materials and were at best, temporary in nature.
Gunpowder was invented much later and till then in Europe the ‘engines of war’ used mechanical energy to operate these machines, which limited the size of the projectiles and the distance to which it could be thrown. So as to generate high quantum of mechanical energy these machines had to be very large and unmovable. The projectiles were manufactured from a variety of materials, viz., stone, iron, brass, copper, alloys etc. It also came in a variety of shapes and sizes. Subsequent ‘engines of war’ were represented by devices like catapult, onager, trebuchet, and ballista. These devices are often termed as the initial artillery pieces.

Callinicus flame thrower known as the ‘Greek Fire’ is supposed to have changed the course of warfare and expansion initiatives of the Arab Empire in 672 AD. It destroyed the huge Muslim fleet in 672 AD in the sea of Marmara, almost at the gate of Constantinople. ‘Greek Fire’ not only burned the Arab ships, it greatly damaged fleets attacking the city. In describing the destruction of the Muslim fleet, the East Roman Chronicler Theophanes wrote, “Then it was that Callinicus, the architect of Heliopolis in Syria, who invented a marine fire, set alight to the vessels of the Arabs and burned them utterly, together with their crews”.

No weapons in history have caused more speculation than the ‘Greek Fire’. The formula for it was zealously guarded for centuries, because the Eastern Romans considered it a gift from God to the people of the Roman Empire – the eastern bastion of Christianity against Islam and paganism. At that time the Roman Empire alone had the ‘Greek Fire’, but after introduction of gun powder the miracle weapon gradually fell out of use and was forgotten. However the ‘Greek Fire’ did change warfare in the Eastern Mediterranean for centuries. Perhaps if Callinicus had not invented the ship based artillery called the ‘Greek Fire’, Islam might have swept over Europe as it did over the Near East, North Africa and Central Asia.

In land warfare the delivery of Firepower can be undertaken from numerous platforms. These constitute an entire array of weaponry like artillery guns, rockets, missiles, mortars, infantry weapon systems and attack helicopters of the army. They are supported by aircraft and naval ship delivered artillery fire through the employment of rocket, missiles, cannons etc, wherever possible. Ammunition is the singular payload of weapon systems for delivery of firepower. It assists in decimating the target, which is achieved by fire assaults. A well executed fire assault, primarily by the artillery in land battle will pave for a situation wherein the infantry and the mechanized forces would only
need to mop up and capture the objective. In effect artillery firepower in land battles is an essential element to achieve and maintain Deterrence and Dissuasion of a nation.

A geographical scan of India’s border dispute with China and Pakistan indicates that future war is more likely to be in the mountains which may later extend to the plains. As wars do not occur along predicted lines, assurance towards victory in the battlefield will largely depend on asymmetrical preponderance of firepower, mostly by effective use of artillery in land battles. Land battles in Iraq, Afghanistan, Kargil and elsewhere are examples of the efficacy of artillery fire which did result in breaking the enemy’s will to fight, thereby paving the way for victory.

**Research Objective**

The main objectives of the scholar in conducting this research are as follows:

- Study the evolution of cannons and artillery guns with special emphasis on Indian Artillery.
- Study the effect of artillery weapons and connected systems that changed the course of battles thus the fortune of kingdoms and nations.
- Study the evolution of the Indian Artillery’s Mountain Batteries under the British Rule and its role in establishment and strengthening of ‘British Rule’ in India. Also, how this development subsequently resulted in the establishment of modern Indian artillery in India.
- Study the role of Indian Artillery during the World War I and World War II which enhanced the power of the British Army not only in the Indian subcontinent but also internationally.
- Study the efficacy of the Indian Artillery during the post independence period when Jammu and Kashmir was under the threat of capture by Pakistani raiders, so as to confirm its role as a force multiplier to Indian Army.
- Study whether the lack of artillery guns and ammunition during the India-China War 1962 resulted in Indian army’s defeat, if so to what extent.
- Study the efficacy of Indian artillery leading to victory by the Indian Army over Pakistani army during Indo-Pak Wars of 1965 and 1971. Indo-Pak Conflict in Kargil in 1999 related to the role of artillery to achieve military victory in high mountains will also be studied.
• Study other roles of the Indian artillery which assisted in enhancing the operational and combat power of the Indian Army.

• Study if the Indian artillery has been a key element towards effectively enhancing the Comprehensive Military Power of the Indian Army, and to what extent.

• Study the likely role and effectiveness of the Indian Artillery in the modern battlefield in the 21st Century and whether it would enhance the India’s Comprehensive Military Power and thus the National Power.

• Suggest actions and way ahead to further empower the Indian Artillery to make it even more relevant and effective towards enhancing the Comprehensive Military Power of India in the 21st Century, so that aspirations of the nation towards safety and security of its borders is ensured at all times.

Scope of Study

The Time Element/Period of Study. Violence, battles and wars has been intrinsic part of the evolution of civilization. Indian mythology has described use of firepower in Ramayana, Mahabharata and other historical events of that period. However, the real usage of artillery firepower commenced with the invention of ‘gunpowder’. The motive of the study by the scholar is driven by the felt need to examine the efficacy of Indian Artillery as a primary element towards enhancement of the ‘Comprehensive Military Power’ of the Indian Army, which has substantial effect on India’s National Power and more specifically its ‘Hard Power’. Accordingly, the research extends from the time of Mughal Empire around the 18th Century to the 21st Century. The study commences with the use of artillery firepower in the 18th Century, the establishment of Indian Mountain Batteries and its exploits as an expeditionary force, subsequent raising of the Indian Regiment of Artillery and its role as a force multiplier to the Indian Army’s military might. The role of artillery consequent to India’s Independence and subsequently during the Indo-Pak Conflict 1947-48, Indo-Pak War 1965 and 1971, the conquest of the Pakistani Army at Kargil 1999, and the intense battles in high mountains have been prominently researched and explained by the scholar. The role of Indian Artillery against militants, punitive actions by artillery guns against the Pakistani army from time to time.
has been included in this thesis to analyse multiple roles undertaken by artillery, and to
draw lessons.

**Area of Study**

Artillery has been the tool for military success since the advent of gunpowder.
Accordingly, this study has covered the evolution of artillery in India, its function under
the British Empire and thereafter as one of the primary components of the Indian army
after India’s independence. The geographical area of study extends across the Indian
subcontinent and overseas. Conceptually the spread of the study extends from basic
cannons to the highly sophisticated artillery guns, howitzers, rockets, missiles and other
systems as well as complex ammunition systems of the 21st Century that has immensely
increased the destructive power of artillery fire. The effect of artillery on India’s tactical,
operational and strategic battle space has also been studied by the scholar to draw a link
between the evolution of the Indian artillery and success in the battles that it participated,
thereby resulting in the strengthening of the combat power of the Indian army. While
doing so, the scholar studied and analysed the defeat of the Indian Army during the Indo-
China War 1962, which exemplified lack of artillery amongst the main causes of the
defeat. The scope of this study has been extended to cover the expanded role of Indian
Artillery in the 21st Century, accordingly, steps have been suggested for enhancement of
its power so as to ensure strengthening of the Comprehensive Military Power of the Indian
Army.

**Identification of the Research Problem**

Firepower is intrinsic to success in battles and wars. History is replete with the
examples of battles having being won by the adversary who had better firepower and used
it well. Artillery firepower in India was perhaps first used by Bahmini kings in the Battle
of Adoni during 1368 AD. However, some historians recognise the first use of artillery
guns in the Battle of Panipat-I by Emperor Babur against Ibrahim Lodi during 1526. Since
then successive Emperors, Kings and Chieftains in India have used artillery for decisive
success in the battlefield. Babur is said to have stated that artillery was ‘locks and keys’ of
an empire. Much later, Stalin was to state that artillery was the ‘God of War’.

Advent of Europeans in India during 18th century saw influx of artillery pieces in
India. However the credit of establishing a modern artillery force in India goes to the
British Army. While they were circumspect of leaving the precious artillery pieces and ammunition in the hands of the natives, the circumstances forced them to raise the first artillery units with Indian soldiers to be led by British officers. Around 1628, the British placed 12 guns near village Armegaon along the coast of Coromandel. The gunners who manned the guns included natives and were called Topasses from the Portuguese word ‘Tope’. The aim was then to create awe in the hearts of natives and thus assist in expanding British rule of India. Later in 1668 two companies of East India Company’s artillery were formed at Bombay with native ‘Topasses’ manning the guns. More of such artillery was raised by the British, Portuguese and French in their respective areas with the view to extend their domination in the Indian subcontinent. These events were a landmark in the history of the Indian Army. Once the first Indian Artillery unit, the 5 (Bombay) Mountain Battery of the Royal Artillery was raised on 28 September 1827, the Indian Artillery expanded rapidly in the form of ‘Mountain Batteries’ and became a major force supporting the British Expeditionary Forces in untamable Afghanistan, North West Frontier Provinces, Burma, Tibet and Bhutan, paving the way for success after success in the battlefields and thus helping in expanding of the ‘British Rule’ in the Indian subcontinent and its neighbourhood. The stupendous role played by the Indian Artillery in the World War I and it being awarded Battle and Theatre Honours like Afghanistan 1878-80, Kabul 1879, Burma 1885-87, Gallipoli 1915, India 1915, East Africa 1916-18, Kilimanjaro, Megiddo, Palestine 1918, Suez Canal, Mesopotamia etc., is a tribute to its ability to decisively influence battlefields. World War II saw the power of battle domination of the Indian Regiment of Artillery, where battles after battle were won due to its support, across the continents. In line with the Royal Artillery traditions the British Army introduced Honour Titles for the Indian Artillery units during 1920’s, in place of Theatre and Battle Honours. Soon Indian Artillery started to be awarded Honour Titles due to its exemplary performance. During the early part of the World War II, tribute was given to the Indian Artillery by the then British Prime Minister Sir Winston Churchill on 28 May 1942 in the House of Commons, London when he stated, ‘The full brunt of the enemy’s actual advance to the east of Bir Hachiem (present day Libya) was taken by 3 Indian Motor Brigade Group (it had Indian Artillery units), but not until after it had inflicted heavy casualties on the enemy and seriously impeded his advance’. In another statement on the same day, the British Prime Minister rose from his seat in the House of Commons to pay tribute to the Indian Artillery in Bir Hachiem under 3 Indian Mortar
Brigade Group (2 Indian Field Regiment and 1 Anti-tank Regiment) for their decisive role in the Battle of Bir Hachiem resulting in heavy casualties to the Panzer Army led by Field Marshal Rommel\(^1\). 2 Indian Field Regiment was awarded Honour Title ‘Point 171’ by the British Government. Since then the power and efficacy of Indian Artillery during its tour of duty has grown by leaps and bounds. It has become amongst the principal battle winning elements for any initiative or intervention by the army as part of national initiative.

Artillery has a substantial role in defending India’s land borders. It is also poised to undertake overseas responsibilities, should the nation so warrant. It is also well established that developing of a cohesive and effective force has lot to do with history, traditions, equipment, leadership, modernization and ability to move with the times and its understanding of future challenges. It is therefore necessary to study the history and events leading to success of the Indian Artillery since the time of its inception and its role towards enhancing the Indian Army’s Comprehensive Military Power from time to time. A study of this nature needs to conclude with recommendations to make the Indian Artillery an even more effective arm of decision in the battlefield.

**STATEMENT OF PROBLEM**

This study attempts to trace historical development and analyse the role played by the Indian Artillery during different periods of Indian history, as also attempt to find out to what extent Indian Artillery has impacted India’s Comprehensive Military Power and would suggest steps need to be taken to ensure that the nation’s projection of hard power through Indian Artillery remains relevant in the face of 21st Century challenges in the battlefield.

**HYPOTHESIS**

Evolution of Indian Artillery is a saga of the emergence of hard power of the nation that has helped the governments of the period to rule and win battles. The Indian artillery reflects the emergence of the Indian Army as the country’s most potent hard power. This thesis will attempt to establish whether Indian Artillery contributed towards
enhanced ‘Comprehensive Military Power’ of the nation, by charting its evolution and its relevance during the different periods of modern Indian history, its role in Indian army’s success in battlefield and other areas of responsibilities, as also, suggest initiatives necessary to ensure its greater relevance towards the complex external security environment facing India in the 21st Century.

**ALTERNATE HYPOTHESIS**

Warfare has impacted security and prestige of nations. It has also helped in making and breaking of kingdoms and nations. Since its advent, Indian Artillery has become an effective tool of India’s military power. In the Indian context it has proved its multidimensional effectiveness on warfare in the Indian subcontinent and course of Indian history where artillery has been employed. This thesis will attempt to bring out the various stages of development of Indian Artillery in modern times and its impact on India’s Comprehensive Military Power and its role as the battle winning element over different periods of modern Indian history.

**NULL HYPOTHESIS**

Artillery has limited employment value due to very high collateral damage content, high cost and being escalatory in nature.

**RESEARCH TASKS**

The following research tasks have been undertaken to establish and verify the above stated hypotheses :-

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Research Design</th>
<th>Sources</th>
<th>Method of Data Collection</th>
</tr>
</thead>
</table>
| (a)    | Hypothesis related information | - Expert opinions.  
- Journals.  
- Books.  
- Publications.  
- Unclassified Government Papers.  
- Internet. | - Reading.  
- Examination.  
- Interview.  
- Discussions.  
- Seminars. |
<table>
<thead>
<tr>
<th>Ser No</th>
<th>Research Design</th>
<th>Sources</th>
<th>Method of Data Collection</th>
</tr>
</thead>
</table>
| (b)    | Background study on firepower and artillery | - Published sources.  
- Internet.  
- Attending seminars and delivering talks on the subject in India and abroad by the scholar and undertaking discussions with experts.  
- Visit to foreign military establishments and discussions with experts. | - Questionnaire.  
- Reading.  
- Internet Browsing.  
- Question, answers and discussions on the subject at the Defence Command and Staff College, Gaborone, Botswana and Command and Staff College (CASC), Rome, Italy.  
- Discussion with Army Chief of Sri Lanka & Defence Secretary Sri Lanka as part of National Defence College delegation. |
| (c)    | Evolution of Artillery in India         | - Published sources.  
- Original documents held in the Regiment of Artillery Association (RAA) archives, Nasik.  
- Documents held with Artillery Records, Nasik.  
- Internet. | - Questionnaire.  
- Reading.  
- Analysing.  
- Discussion with experts at the School of Artillery, Devlali, Maharashtra.  
- Discussions with retired army officers. |
| (d)    | Battles fought by Indian Artillery      | - Published sources.  
- Documents held with Regiment of Artillery Association.  
- Artillery history books on the subject.  
- Interviews.  
- Questionnaire.  
- Internet.  
- Ministry of Defence Library.  
- Declassified After Action Reports of individual battles. | - Documents.  
- Examination.  
- Reading.  
- Browsing.  
- Interviews.  
- Questionnaire. |
<table>
<thead>
<tr>
<th>Ser No</th>
<th>Research Design</th>
<th>Sources</th>
<th>Method of Data Collection</th>
</tr>
</thead>
</table>
| (e)    | Effect of the Indian Artillery on India's Comprehensive Military Power | - Declassified Battle reports.  
- Documents pertaining to the Indian Artillery from Mughal era onwards till date, held with the Regiment of Artillery Association, Nasik.  
- Research papers pertaining to the artillery of the Mughals, Sikhs and Marathas held with the Artillery Archives, New Delhi.  
- Research Papers of military institutions viz CLAWS\textsuperscript{21}, IDSA\textsuperscript{22}, USI\textsuperscript{23} in New Delhi.  
- Newspaper reports of Indo-Pak and Indo-China Wars.  
- Books and periodicals.  
- Expert opinions. | - Questionnaire.  
- Expert talks.  
- Interviews and discussions.  
- Domain knowledge.  
- Internet Browsing.  
- Reading. |
| (f)    | Efficacy of Indian Artillery as force multiplier in battles in Mountains and in Counter Insurgency Operations | - Field visits.  
- Interviews with important personalities on ground.  
- Historical details held with units and HQs.  
- Analysis of documents and interviews. | - Questionnaire.  
- Expert talks/Seminars.  
- Discussions.  
- Domain knowledge.  
- Internet Browsing.  
- Reading. |
| (g)    | India’s multiple security challenges and Role of Indian Artillery towards enhancing its military power. | - Experts views.  
- Discussions with experts, past Directors General of Artillery of Indian Army.  
- Domain knowledge.  
- Published sources.  
- Newspaper articles.  
- Publication and magazines.  
- Internet. | - Questionnaire.  
- Expert talks.  
- Discussions.  
- Domain knowledge.  
- Internet Browsing.  
- Seminars.  
- Reading. |
| (h)    | Data Analysis and Interpretation | - Questionnaire.  
- Discussions.  
- Think Tank. | - Mathematical.  
- Statistical.  
- Modelling.  
- Domain knowledge.  
- Experts. |
| (j)    | Conclusion | - Expert opinions.  
- Publications.  
- Domain Knowledge. | - Questionnaire.  
- Seminar.  
- Journals.  
- Reading. |
Sampling Design

Collection of Data Related to Hypothesis. The scholar met large number of officers serving in the army, retired senior army officers who had taken part in wars fought by India, Secretary/Curator of the Regiment of Artillery Museum and Library, visiting faculty in the National Defence College, New Delhi including Ambassadors, Chiefs of Armies of many countries, researchers, think tanks and military history experts etc., to seek their views on variety of issues concerning the evolution of Indian Artillery and the impact of artillery of any country towards enhancement of its comprehensive military power, with special reference to the Indian artillery. The discussions also included India’s national security perspective and threats, battlefield milieu in the Indian sub-continent in the 21st Century and necessary modernisation and transformation of the Indian Artillery. The scholar also delivered talks during June 2011 at the International Seminar on “Future Artillery – India”, covering Modernisation Strategy for Artillery and challenges of major procurements in the Army. In this process, a great deal of valuable information was gathered which substantially helped the scholar to interpret and analyse the subject in depth. However, all of it could not be objectively used to verify the Hypothesis. Hence four sets of questionnaires, placed as Annexures Q 1, Q 2, Q 3 and Q 4 to this thesis, were designed to collect primary data directly related to the hypothesis, with the following objectives in mind :-

- **Questionnaire 1.** Administered among the officers attending training courses in the School of Artillery, serving/retired artillery officers and Secretary, Regiment of Artillery Library to ascertain evolution of warfare, and the role that Indian Artillery played across the globe towards enhancing the combat power and their experiences. Persons who responded to the questionnaire numbered 321, over one year period.

- **Questionnaire 2.** Administered among the Curator of the Artillery Museum and Library, Nasik, Maharashtra, student officers attending Long Gunnery Staff Course, a higher level artillery course at the School of Artillery, Devlali and retired artillery officers to ascertain the inter-se-relationship between artillery evolution and its effect on India’s Comprehensive Military Power. The respondents numbered 125 over one year.
• **Questionnaire 3.** Administered among retired army officers who had served in mountains bordering India with China and Pakistan and in insurgency ridden areas in the north and the northeast states to ascertain the relevance of artillery in such situations. The respondents numbered 42.

• **Questionnaire 4.** Administered among visiting and regular faculty in the National Defence College, New Delhi, senior serving and retired army officers, experts and the members of think tank faculty in Delhi to understand the battlefield scenarios and military challenges confronting India in the 21st Century, elements that enhance the army’s combat power and importance of the Indian artillery as a force multiplier. These were mainly through discussions over one year period. The respondents numbered 18. Since no structured response could be obtained, the inputs were in the form of expert opinions which were filtered by the scholar to refine the research project.

‘Convenience sampling’ was the method used for developing sampling data. The questions were kept simple but specific, so that the overall response was definitive. The questions were both subjective and objective types. Questions were placed on a Likert Scale which is psychometric scale commonly used in questionnaires, and is the most widely used scale in survey research. A Likert item is a statement which the respondents are requested to evaluate according to subjective or objective criteria. In the questionnaires used in the survey, level of agreements or disagreements with the statement is measured on a scale of 1 to 3. Least preferable situation is depicted by Choice 1 and the most desirable situation by Choice 3. A column for remarks was also included in all written questionnaires while it was perceived through discussions with the experts and others with whom the sampling took the route of personal interactions – formal or informal. A simple rating system with one mark for each affirmative response was awarded and negative marking was avoided by design. Widely insufficient responses were segregated, analysed and, if necessary, disregarded. No complicated statistical tool was considered necessary. Percentage of respondents to each choice was calculated and data was analysed as explained later under the Chapter “Data Analysis & Interpretation”.

Hypothesis Matching

Questionnaire 1 was framed to evaluate Complementary Hypothesis 1 (CH 1) as stated below :

“Evolution of modern Indian Artillery was amongst the most important facets of the nation’s military power. It helped Mughal and British rulers establish and extend their domination of India. After independence artillery has been amongst most potent power for defending India’s sovereignty. Artillery thus substantially enhanced to nation’s Comprehensive Military Power and thus its ‘Hard Power’.”

Questionnaire 2 was framed to evaluate Complementary Hypothesis 2 (CH 2) as stated below :

“Indian geographical border is dotted with high and low mountains, jungles and deserts, mostly inaccessible. It thus provides avenues for the enemy to penetrate and occupy Indian Territory. To get timely intelligence and to secure border by fire domination, artillery is the most potent weapon system. It will remain so in the future.”

Questionnaire 3 was framed to evaluate Complementary Hypothesis 3 (CH 3) as stated below :

“Indian Artillery has played key role in counter insurgency operations since 1960’s. It substantially improved the army’s operational capabilities. Its role in mountains has been that of force multiplier. While heavy added responsibilities have been placed on Indian artillery in recent times, due to its inherent organisational strength, it can effectively undertake multi-terrain and multi-dimensional conventional and asymmetrical operations at the same time.”

Questionnaire 4 was framed to evaluate Corresponding Hypothesis 4 (CH 4) as below :

“India’s 21st century external security challenges mainly emanate from China and Pakistan. Pakistan’s desire to deny Indian pre-eminence in the region suits Chinese strategic designs to keep India embroiled with Pakistan. Artillery will have to prepare itself to play major role in conventional battlefield in order to impose unfavourable force co-relationship on the enemy.” Modernisation and doctrinal
evolution of the Indian Army is necessary for it to face the present century challenges.

Framing of the questions were aimed to represent critical attributes of the chapter which were considered necessary for scientific analysis of the theme of the chapter and thus provided clear, quantifiable answers. Both subjective and objective methods were employed for the Questionnaire 1 to 3. The high levels of targeted respondents aimed for the Questionnaire 4 could only be addressed by personal discussion wherein opinions and comments were obtained. These were further collated, sifted and analysed to get answers within statistical framework.

**LITERATURE SURVEY**

All records and data pertaining to this research have been drawn from a variety of published sources since very little is available on Internet on the primary subject. It has also been found that the subject of this research has not been previously researched except for few books by the scholar in his personal capacity and hence negligible other published materials are presently available which directly attempts to address the topic of research. To further the research and to reach to its logical conclusion, assistance was taken from declassified military documents available in the archives of the Regiment of Artillery Museum and Library, archives of the Artillery Records and Artillery Centre, Nasik, and Directorate General of Artillery, Army Headquarters, New Delhi. The declassified After Action Reports of battles fought by the Indian Army held with the Ministry of Defence Library, Divisions, Brigades and Units of the Indian Army were studied for its link with the subject of the thesis and for authentication of collected data. Notes left by the British officers pertaining to various battles they fought as part of the Indian Army during the World War II were gleaned in some of the artillery units who have preserved them.

**Primary Sources.**

- **Regiment of Artillery Museum and Library.** The library houses archives of the Indian Artillery and functions under the Regiment of Artillery Association (RAA). The library meticulously collates declassified information pertaining to each unit of the Regiment of Artillery and maintains separate folders. The archives also have extensive documents pertaining to the artillery of the pre-
independence periods. RAA has undertaken short research projects of artillery, mostly pertaining to Maratha, Shivaji, Tipu Sultan, Sikhs and few others. Publications pertaining to artillery operations, ethos, traditions and technology of 19th and early 20th Century are also found in this library. It, therefore, helped in the research of the chapter on evolution of the Indian Artillery and some of the battles fought for the period under research.

- **Artillery Records.** It houses official records pertaining to artillery personnel below officers. It assisted the scholar with information regarding individual acts of gallantry in which artillery personnel had taken part. It also assisted in verifying the authenticity of some of the researched documents.

- **Artillery Centre, Nasik.** It is the training centre for recruits in the Regiment of Artillery. It also houses official documents and photographs pertaining to the Indian Artillery dating from the beginning of the 20th Century. These documents helped in covering the gaps in research and for authenticity checks.

- **Artillery Directorate, New Delhi.** This Department of the Army Headquarters is the repository of all artillery matters. Unclassified papers/magazines pertaining to all the chapters in this thesis were gleaned at the Artillery Directorate. It provided substantial input on the researched subject.

- **Ministry of Defence Archives.** The Archives holds official ‘After Action Reports’ of the battles that the Indian Army has taken part since 19th Century. The archival information available was used to fill in the gaps in the research work.

- **Research Material.** The scholar also took material from his personal research leading to publishing of following books authored by him :-

  - *Har Maidan Fateh* – History of 2 Field Regiment. Published in 1997.
  - *A Few Good Men* – History of Army Aviation in India. Published in 2007.
Secondary Sources

- **Visits and Seminars.** Study tours were undertaken in India and abroad to obtain information. Since the scholar was posted on the faculty of the National Defence College, New Delhi, he had the opportunity to lead study tours abroad. The institutions visited included Army Headquarters and military training institutions at Rome (Italy), The Hague (Netherlands), Dar-E-Salam (Tanzania), Colombo (Sri Lanka), Kathmandu (Nepal) and Thimpu (Bhutan). The scholar was invited to deliver talks on ‘Firepower’ at the Defence Command and Staff College, Gaborone, Botswana on 10 May 2010 and at CASC (Defence College), Italian Ministry of Defence, Rome, Italy on 16 May 2010 where he spoke on the role of artillery as force multiplier towards Comprehensive Military Power. In India, the scholar was invited to deliver talk on ‘National Security and Strategy’ by the Department of Defence and Strategic studies, Madras University, Chennai on 26 March 2012. He also addressed an International Seminar on ‘Future Artillery 2012’ organized by IQPC, London and South Asia Defence and Strategic Review where gave keynote address on *India’s Current Artillery Modernisation Strategy and Challenges*. In another session he spoke on *Opportunities in Defence Procurement in India*. The scholar also delivered lecture on ‘Indian Artillery and Its Role Towards Enhancing Comprehensive Military Power’ and on ‘Modernisation in the Army’ at the Army War College, Mhow and the College of Materials Management, Jabalpur in Madhya Pradesh. At the National Defence College, New Delhi (a constituent institution of the Madras University for M Phil and PhD) the scholar addressed the student officers on the subject as part of the Integrated Analysis Group (IAG) discussions. The scholar also addressed the
student officers and teaching staff at the School of Artillery, Devlali on Artillery Firepower and Its Effect on Tactics and Strategy on overall frame work of Comprehensive Military Power. In all these talks and discussions, the questions and answers session provided sufficient input that could be included in the study. The author’s interviews on the subject were published in the South Asia Defence and Strategic Review April 2012 and May 2013. The details of attendance of the scholar in seminars or as guest faculty as well as interviews are as per Appendix ‘A’.

- **Interviews.** In a research study as undertaken in this thesis where comprehensive published work is not readily available other than few books on military history pertaining to artillery, few books by this scholar; interviews of serving and retired officers became key to the study. However these had to be verified through written documents. The list of persons interviewed is as per Appendix ‘B’.

- **Internet.** While the Internet did not provided comprehensive material on the research subject, information of specific sectors of the research could be obtained from the Internet.

- **Domain Knowledge.** The scholar is tenanting the appointment of the Director General of Artillery, Indian Army. He is, therefore, deeply involved in tactical, technical and human resource issues pertaining to Indian Artillery. He also spearheads Indian Artillery’s modernization programme in conjunction with the Army Headquarters, Ministry of Defence, Ministry of Finance and other departments of the Central Government. He has also taken part in Indo-Pak Conflict at Kargil and actual operations with the Pakistani Army in Poonch Sector (J&K) during, Counter Insurgency Operations in J&K during 1991-92 and 2001-2002, North East India during 1990, 2003-2005. Only unclassified and open domain information has been utilized in this research project.

- **Other Secondary Sources.** A number of newspapers reports, news articles, published articles in various defence and strategy related magazines, photographs and CD ROMs were made use of during the course of research. White Papers published by the Chinese Government and available in the internet have also been referred by the scholar.
Research Gap

The subject being newly introduced by the author, only limited reference material could be obtained from published and unpublished sources. The subject ‘Comprehensive Military Power of a Nation’ and the effect of ‘Artillery’ on the same is perhaps a new dimension of research anywhere, hence there may be some research gap despite the best effort by the scholar.

Limitations of the Research Work

As the subject of research borders the factual knowledge held within the military, little is available in the public domain. The research had to be undertaken with the information available in the public domain. Confidential data, analysis and inferences of specific nature held with the Ministry of Defence and its constituent units could not be researched and included in the project. In addition, lack of previous investigative research work on the subject posed significant limitation.

OVERVIEW OF CHAPTERS

The progress of chapters has been kept in synchronisation with the evolutionary elements of warfare, role of artillery in matters warfare, evolution of the Indian Artillery. This was followed by its increasing significance in wars and battle situations that the Indian Army faced over two centuries or so. The study was then progressed to the battle scenarios confronting India and role of the Indian Artillery towards enhancing India’s military power in the present context. As a natural progression, the study addressed the issues pertaining to optimising efficiency of the Indian Artillery in the 21st Century warfare. An analysed and workable recommendation has been offered to complete this research project and included in the Conclusion chapter. The distribution of chapters are as follows :-

Chapter I : Evolution of Warfare and Role of Artillery. Civilisation bears testimony that the need for survival and power has been enmeshed by conflicts. It is well established that conflicts, battles and wars adapt to the changes in world order. The most important pillar of warfare since advent of gunpowder has been the use of artillery weapons. The army and thus its artillery provide security to a nation, kingdom or principality that has this resource. In effect artillery is a tool for expansion of the nation’s
hard power. A brief analysis of historical evidence across the continents in this chapter has proven that artillery weapons of one kind or other have changed the course of battles and thus fortune of nations. The chapter has focused and analysed relationship between success in battles and use of artillery with the reference to many battles fought across continents since the 13th Century. Role of artillery and challenges it faces in this century has also been studied and analysed in this Chapter.

Chapter II : Evolution of Indian Artillery and its Effect on India’s Comprehensive Military Power. The concept of Comprehensive Military Power has, perhaps, been defined and taken up in this thesis for the first time. Chinese scholars have earlier dealt with Comprehensive National Power, a term that has been further defined and researched across the world. However, the definition and understanding of Comprehensive Military Power is different in its scope and application for different countries. The term is connected with ‘Comprehensive Security’ of a nation through hard power and has many dimensions but mostly aligned to military and its effectiveness. Yet, it has a subdued relationship with the Comprehensive National Power due to its applicability with national security. Artillery means firepower, and is amongst the most important facets of a nation’s military power. The evolution of ‘Indian Artillery’ is also connected with the evolution of military powers of Indian principalities, states and kingdoms. Use of different kinds of ‘agni-astra’ or fire arms in Mahabharata & Ramayana has been written in great detail in Indian scriptures. In modern Indian history, perhaps for the first time, artillery demonstrated its power during the reign of Bahmani Kings during 14th Century. Its power increased during the Mughal period when Mughal king Babur brought artillery to India. Developments of artillery in India during this period became forerunner of its close association with success in battlefield, expansion of the Mughal Empire and assertion of its Military Power. The artillery of the East India Company and thereafter British Army in India has a colourful spectrum of evolution. ‘Tope’ or the artillery gun became synonymous with the ‘Hard Power’ of the British rulers. It was used primarily to subjugate the natives and expansion of British rule in India and neighbouring countries. Indian Artillery’s force multiplier effect post-independence was exhibited in substantial measure during the war’s that India fought with Pakistan during 1947-48, 1965, 1971 and at Kargil in 1999. Lack of artillery strength resulting in defeat was exhibited during India-China War 1962. This chapter has attempted to trace the history and evolution of the ‘Topekhana’ or Regiment of Artillery in India and its efficacy in battlefield and thus
develop a link to prove that artillery in India substantially enhanced its Comprehensive Military Power.

Chapter III: Indian Artillery: Army’s Force Multiplier in Mountains
Perhaps India is the only nation in the world where its armed forces, particularly the army, is entrusted with the responsibility to defend all the possible kinds of terrain under most challenging conditions along its borders. Army is also intensely involved in active duties involving actual use of its artillery firepower on regular basis. However, the most challenging part of the army’s task is in high mountains ranging up to altitudes of over 21,000 feet. Even under such difficult conditions the Indian Artillery has proven itself as a major force multiplier. Who can forget the electronic media coverage on effectiveness of artillery in such high mountains during the Indo-Pak Conflict in Kargil in 1999. This chapter has provided details of artillery battles in mountains with special reference to Kargil battles and analysed its effectiveness.

Chapter IV: Relevance of Indian Artillery in Counter Insurgency Operations and Case Studies
India has been affected by insurgency and terrorism since independence, particularly in the north-eastern and the northern states of the country. Since 1960s artillery has been involved in countering this menace. Initially it was employed in its primary role against the insurgents in Mizoram and Nagaland. Subsequently the artillery units operated like infantry and undertook infantry tasks. Historical evidence exists that artillery proved its worth under most trying circumstances. This chapter elucidates the role of artillery units and personnel to defeat the anti-national forces aiming towards disrupting nation’s peace through violence aimed to divide the nation. As a part of the research, individual and unit valour and sacrifices have been included. This chapter also includes two case studies, one each of the Russian army and the British Army in Afghanistan during different periods, so as to analyse the efficacy of artillery towards empowering the army it supports and to draw out the extent that it enhances Military Power.

Chapter V: India’s Multiple Security Challenges and Role of Indian Artillery Towards Enhancing Its Military Power
India is transcending 21st Century’s Supra form of violence. It has disputes regarding land borders with China & Pakistan. Both these countries are in illegal occupation of large chunks of Indian territories and lay claims to more. South Asian region extending towards the Middle-East is the most unstable and violent region in the World. The stability in the region may also deteriorate with
International Security Assistance Force (ISAF) led by the US Army withdrawing from Afghanistan in the near future. Thus, India faces highly complex security situation in the 21st Century. The spectrum of conflict that India is likely to face extends from unrestricted non-military counter insurgency to nuclear war. At the conventional level in the Indian context, wars will be characterized by ground, air and sea based high lethality weapon systems and operations in a compressed time frame. Indian artillery will play a significant role in all future conventional battles in the Indian sub continent. This Chapter focuses on the relevance of artillery to overcome national security challenges in the 21st Century battlefield.

**Chapter VI : Data Analysis and Interpretation.** This chapter describes the concept and method of data collection, collation, analysis and interpretation with the aim to get accurate inputs to conduct research in view of the stated objective of the research.

**Chapter VII : Conclusion.** In the 21st Century complex security situation in the Indian subcontinent, India's greatest security challenges will emerge from China and Pakistan. It is worth noting that the Chinese peace façade is backed by the ‘Doctrine of Preemption and Surprise’, which is essentially a threat in disguise. China is rapidly modernising its armed forces. This has strategic implications for India, not only along the Tibetan border but also in the Indian Ocean Region. Pakistan’s belligerence towards India and its policy of ‘state sponsored terrorism’ that can bring both the countries to the brink of conventional war cannot be ruled out. Pakistan’s stated policy of first nuclear strike against India’s no first nuclear strike is ominous. Under these circumstances India needs to modernize its artillery rapidly, as also revisit the strategic and operational plans so that its long range firepower, specially its artillery, is more effective and dominates future battlefield. This Chapter dwells upon these issues and recommends way ahead making the Indian artillery more relevant and forcing multiplier in the service of the nation and thus enhancing the Comprehensive Military Power of the Indian Army.

**PLAN OF THESIS**

The thesis will include in following chapters :-

- **Chapter I** : Evolution of Warfare and Role of Artillery.
• **Chapter II** : Evolution of the Indian Artillery and its Effect on India’s Comprehensive Military Power.

• **Chapter III** : The Indian Artillery: Army’s Force Multiplier in Mountains.

• **Chapter IV** : Relevance of the Indian Artillery in Counter Insurgency Operations and Case Studies.

• **Chapter V** : India’s Multiple Security Challenges and Role of Indian Artillery towards Enhancing its Military Power.

• **Chapter VI** : Data Analysis and Interpretation.

• **Chapter VII** : Conclusion.

---


3. ibid.


5. ibid.


7. ibid.


10. Antonio Castellani, Atomic Bomb Destroyed City 4000 Years Ago, [http://www.bibliotecapleyades.net/arqueologia/esp_mohenjo_daro_1.htm](http://www.bibliotecapleyades.net/arqueologia/esp_mohenjo_daro_1.htm) and [http://www.anomalies.net/archive/Text-Archive/txt1/324.html](http://www.anomalies.net/archive/Text-Archive/txt1/324.html).


20 Individual Artillery Regiment History Folders held with Regiment of Artillery Association, Nasik.

21 CLAWS – Centre for Land Warfare Studies, New Delhi.

22 IDSA – Institute for Defence Studies and Analyses, New Delhi.

23 USI – United Service Institution, New Delhi.