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"3rd Party Logistics in Military Logistics"

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PART 1 – GENERAL INFORMATION

1.1 Evolution of Logistics

The term logistics came to be used in English language in 1846, and is presumably derived from French: **logistique**. The term was popularised or used extensively by Swiss military officer and writer Antoine-Henri Jomini, who used the word in his Summary of the Art of War (Précis de l'Art de la Guerre). The term appears in the 1830 edition, then titled Analytic Table (Tableau Analytique). Jomini explained that the term in French means lodgings and he used it to depict a rank in the army notably Marshal of lodgings.

Autrefois les officiers de l'état-major se nommaient : maréchal des logis, major-général des logis; de là est venu le terme de logistique, qu'on emploie pour désigner ce qui se rapporte aux marches d'une armée. (**Formerly the officers of the general staff were named: marshall of lodgings, major-general of lodgings; from there came the term of logistics [logistique], which we employ to designate those who are in charge of the functioning of an army**).

From the humble beginnings and association with lodgings during the times of war in nineteenth century to present day the nature and the connotation of the word logistics has undergone paradigm change. Earlier while it was used only by the military, and referred primarily to the actions conducted during the war or operations, present day usage has been refined further and a great degree of specialisation has been accorded to the word logistics. Thus, inter alia, following types of logistics are used: -

(a) Humanitarian logistics
(b) Military logistics
(c) Green logistics
(d) Reverse logistics
(e) Warehousing
(f) Distribution

Notwithstanding the plethora and different types of logistics which are encountered today, logistics has been defined by various authorities and books as per the functions done under various logistics realm.

Various definitions of Logistics

(a) Oxford English Dictionary. "The branch of military science relating to procuring, maintaining and transporting material, personnel and facilities".
(b) New Oxford American Dictionary. "The detailed coordination of a complex operation involving many people, facilities, or supplies".
(c) Wikipedia. Logistics is a part of supply chain management that deals with the efficient forward and reverse flow of goods, services, and related information from the point of origin to the point of consumption according to the needs of customers.
(d) Encyclopedia Britannica. The things that must be done to plan and organize a complicated activity or event that involves many people.

A summary or gist of all the definitions that have been listed above as well as in the open domain, it can be conclusively said that logistics is: -

(a) A combination of various processes
(b) It involves more than one person
(c) It is concerned with storage and transportation of goods from the point of origin to the point of consumption or final use.
(d) It is the combination of processes like planning and execution of various tasks that

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facilitate transportation of different type and quantity of good from a particular place to the place of requirement and consumption

Geography and physical distances have played an important part in the development of logistics. It can be largely said that they are a limiting factor and decide the reach and comprehensiveness of logistics. But this dictum could be true till about 70-80 years back when the only means of transportation were engines run on steam power or rudimentary CI engines. However, development in technology has had a formidable impact on the development of logistics. Development of information technology has been one of the biggest drivers of the development of logistics. Development in information technology has increased the level of transparency along the entire spectrum of supply chain. Location of any product in the supply chain in the journey from 'Womb to Tomb' can be accessed from anywhere. Bottlenecks can be known and accordingly necessary corrective measures can be taken by supply chain managers. The flow of information has been totally digitized and requirement of receipt of information in physical form is totally extinct nowadays. Information is being stored and shared over cloud which has reduced the lag between originator and recipient to almost negligible time. Improvement in air travel and land travel have impacted the movement of persons as well as goods. The physical separation between people and places are literally redundant. Realtime video conferencing facilities have rendered physical presence redundant. Development in following fields have an important impact on the development and evolution of logistics: -

(a) Surface transport
(b) Air transport
(c) Warehousing and storage
(d) Automation
(e) Information Technology

Rapid globalization has changed the contours of the logistics industry. Proliferation of multinational companies with production and customer bases at different locations or all over the globe have become the order of the day. The logistic infrastructure has therefore evolved to serve this setup. Multi modal transshipment to facilitate movement of goods to the desired location within the required time frame is the most important characteristic of the extant logistic infrastructure.

Globalization has impacted the armies of the world in a big way too. The battlefront has become amorphous with blurred boundaries and is ever shifting and dynamic. Increasingly the armies world over are undertaking operations beyond national boundaries. Multinational coalition armies undertaking operations ranging from peacekeeping ops to anti-terror operations as well as assistance during humanitarian crisis are the order of the day. Such diverse operations require robust and flexible logistics setup for sustenance of these myriad range of operations. Flexibility, redundancy and **Just in Time** are increasingly becoming the hallmark of present-day military logistics.

Military Logistics. By definition "Military Logistics is the discipline of planning and carrying out the movement, supply and maintenance of military force." Logistic processes undertaken to sustain the military operations may be called as military logistics. It is same as logistics support in any other sector except that it is undertaken to accomplish/ support military operations.

1.2 Growth and evolution of Military Logistics

Logistics has always been an integral part of military the world over. The nature of military logistics has, however undergone tremendous change over a period. Besides the nature of the logistics itself, the conduct of the business of military logistics has also undergone significant change. Important timelines and events in evolution of military logistics may be considered as under: -

Title: Timelines for evolution of Military Logistics
Table No 1

Timeline	Events
1991-1785 BC	Ancient Egypt Primitive Middle Empire Endowment for warrior
1552-1069 BC	Ancient Egypt New Empire supplying for warriors on mission
9th Century-610 BC	Primitive Assyrian Army logistical support
700 BC	Assyrian army logistics organisation in an Army

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480 BC	Greek Army Battle of Salamis and definition of safe supplying route
400 BC	Sun Tzu in the Book "The Art of War" logistical Support Strategy
338 BC	Phillip II of Macedonia, organisation of soldier's personal gear
510 BC- 190 AD	Roman military supply classification of supplies for troops in campaign and static
1561-1600	The Renaissance organisation of logistics in the theatre of operations
1861-1865	American Civil War new logistics strategy, accompaniment to the combat system
1914-1918	WW I supplying lines or routes extension
1916	Development of concept of pure logistics in American military institution
1939-1945	WW II grand development of logistics and conception of logistical revolution
1945-1991	The Cold War concept of logistics
1990-91	The gulf War logistics based on distribution, visibility, capacity and control
1995	Focused logistics acquisition operational advantages
1999	Unrestricted War logistical control of resources for war
2017	Multidomain battle: logistics and sustainment with joint functions, with the ability to sustain global network forces of fixed and mobile bases
2017	Mosaic War: logistics reduces cost and footprint due to the use of smaller and disaggregated platforms
2019	Contested logistics environment: Conflict with an adversary presents challenges in all domain and directly targets logistics operations

(Source: Evolution of Military Logistics by Aldemar Serranno, Dusko Kalenatic, Cesar Lopez and Jairo R Montoyo-Torres)

1.3 **Scope of Military Logistics**.

Logistics in military comprises of all processes and actions undertaken in furtherance and support of military operations. Following process may be undertaken under military logistics: -

(a) Design and development
(b) Acquisition
(c) Storage
(d) Movement
(e) Distribution
(f) Maintenance

The scope of military logistics is also dictated by the following: -

(a) Nature of impending operation
(b) Number of troops involved in the operation
(c) Nature of terrain of impending operation
(d) Number of days envisaged for the impending operation
(e) Equipment profile for the impending operation
(f) Time factor for implementation/commencement of logistic operation

Increasingly the armies world over are undertaking expeditionary tasks. The US Army has never engaged in any operation on its soil other than the American Civil War. In modern times all the operations that US Army has undertaken starting from Second World War, Korean War, Vietnam War, Afghanistan War, Gulf War, War against ISIS in Syria to name a few have all been expeditionary in nature. The unique characteristic of the expeditionary operations is the stretched logistic supply chain. Reliability and robustness of the logistic supply chain eventually decides the outcome of the operation.

The Chinese withdrawal from the plain of Assam after the 1962 conflict was also precipitated primarily by their outstretched logistic supply chain. Sustenance of such a long supply chain was not practically feasible and hence it was a operational reason that dictated the withdrawal of the Chinese Army.

During Second World War, in the Asian front, the supply lines of the Japanese forces were stretched tremendously. When they were engaged by the British Army in the jungles of Burma and Arakan, the Japanese forces capitulated because they had nonexistent supply chain. The Japanese troops had

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no ammunition and literally nothing to eat. The creation and management of logistic supply chain therefore plays very important part in sustenance of the troops participating in any operation and thereby the success of the operation itself.

The scope of military logistics can be judged by studying various campaigns and wars. The enormity and the difficulty faced by military logistician to sustain the war theatre can bring out the scale of military logistics.

1.3.1 **Logistics in 1st World War**.

Military logistical system during the First World War relied on the system operational during the 19th century. This system was not capable of sustaining the armies involved in the 1st World War. Rapid industrialization and advancement in technology had enabled raising of large armies across the globe. Improvement in weapon technology had contributed immensely to this phenomenon. However, the logistic process and infrastructures were still rudimentary designed to support the 19th century army. Key characteristic of the logistic processes were: -

(a) The main method of transportation of supplies at the start of the war was still horse based which was partially due to the lack of any other alternatives.

(b) The rail system was very rudimentary and was not capable to support the armies fighting in the front.

(c) Horse and rail based logistic supply system could not operated during the monsoon season as the terrain became boggy and muddy.

(d) Trench warfare eased the pressure off the logistic supply chain as the user or the soldier for whom the supplies were intended were stationary.

(e) Narrow gauge trench railway lines were developed for access to the frontline troops.

(f) Trans-Atlantic shipping lanes developed by US to sustain its troops fighting in the European mainland were easily interdicted by the German Submarine force.

Title: Trench Narrow gauge train
Fig No 1

(Source blog.lidd.ca)

Title: Horse based supplies
Fig No 2

(Source iwm.org)

1.3.2 **Logistics in 2nd World War**.

While it was during the 1st World War that the foundations of modern logistics were laid, it was during the 2nd World War that the true power of logistic operations were realized.

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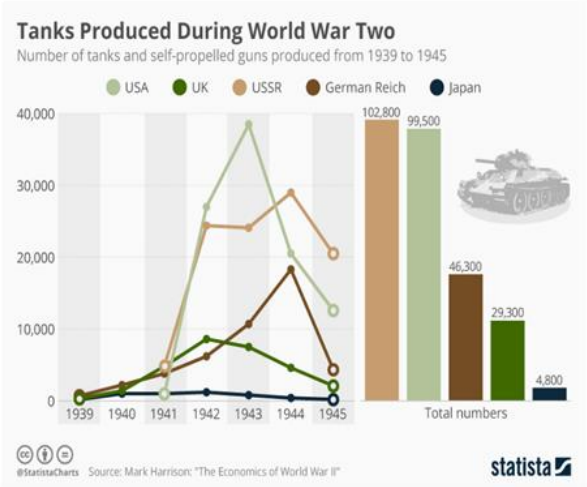
Title: WW II by Numbers
Fig No 3

(Source historical-map.blogspot.com)

Title: Production of Tanks in WW II
Fig No 4



(Source statista)

1.3.3 **Logistics in Second Indo China War**.

The Second Indo China War was fought between North Vietnam and South Vietnam between 1955 and 1975. The war is colloquially also known as the **Vietnam War**.
North Vietnam was supported by Russia and China whereas the South Vietnam was supported by US. The war started on 01 November 1955 and ended with the fall of Saigon on 30 April 1975.
The US had a preponderance of technology and modern equipment as against the communist North Vietnam which had rudimentary equipment and weapon profile.

The communist North Vietnam however won the war due to effective use of the terrain and living off the land. They were able to create a rudimentary yet infallible supply chain whereas the US inspite of overwhelming firepower and technology lost the war because it could not create a robust supply chain to support its troops fighting in the theatre. Notwithstanding the same, scale of the war can be judged by the following figures: -

(a) 352 billion US Dollars spent on the war.

(b) 760,000 tons of supplies arrived each month.

(c) 10 million field rations were consumed each month.

(d) 71,000 tons of ammunition was expended each month.

(e) 124,537 B57 missions

(f) 1,633,035 tons of ordnance dropped

(g) 18 B52S were lost to enemy action with 13 B52S lost in collisions and accident

(h) 750 Aircraft (Fixed Wing) were lost in Vietnam

(i) 12,000 helicopters saw service in Vietnam (all services)

(j) 4,865 Helicopters were downed by Communist ground fire

(k) 5,250,000 cost per helicopter

(l) 2.59 million Americas saw service in Vietnam

(m) 3,500,000 acres of Vietnam was sprayed with 19 million gallons of defoliants the effects that will last 100 years.

(n) 303million liters of petroleum products were consumed each month.

(o) 33,450hectares of airfields were paved

(p) 18,000 hectares of covered and open storage facilities were built

(q) 14,150 cubic meters of refrigerated storage

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created

(r) 4,740 km of roads built

(s) 4,600 meters of bridges constructed

(t) 15 large fortified bases were built in Vietnam

(u) 10,000 artillery rounds expended in one day by the US in Vietnam. $100 Cost per artillery round and $1,000,000 Cost per day for artillery fire

(v) $30,000 Cost of one sortie for a B-52 bomber

(w) $3,000,000,000 of aid provided to North Vietnam by the Soviet Union and China

Left behind at the end of the war

(a) 550 light and medium tanks.

(b) 1,200 Armored Personnel Carriers (APC)

(c) 80 small ships and landing craft.

(d) 1,000 aircraft including 200 fighters and ground attacks aircraft.

(e) 100 transport aircraft and 500 helicopters

Title: US POL supply convoy
Fig No 5

(Source dla.com)

Title: Repair facility of Bell Huey Helicopter
Fig No 6

(Source dla.com)

1.3.4 **Logistics in Gulf War**.

The Gulf War in 1990-91 (Operation Desert Shield and Operation Desert Storm) was a modern-day indicator of the war fought in all the three dimensions i.e., air, water and land. It was short and swift with clearly defined objectives and precise application of force. While WW II was also fought in all three dimensions, it differed from the Gulf War in its longevity, wherein it continued for almost five years. The pressures on the logistics were confined to specific theatres and averaged out over the entire span of the war. The Gulf War on the other hand was fought for a limited time period therefore applied immense pressure on the logistical prelude and buildup to achieve the operational aim. The logistical support in Operation Desert Shield and Operation Desert Storm included materials and services required to support the operations to achieve specific objectives.

To achieve logistical support at optimal levels, all active and reserve resources of United States and its allies were used. The US built up its logistics capability in Saudi Arabia, which was its major ally for the Gulf War, prior to actual commencement of operations, up to a level which was hitherto fore unprecedented and unseen.

The stocking targets achieved by the US during the Gulf War before commencement of the operations were as under: -

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Title: Stocking targets of US Army
Table No 2

Type of Store	Days of Supply (DOS)
Class I (Food and Water)	29.0
Class III (Fuel)	5.2
Class V (Ammunition)	45.0

(Source Special Report Operation Desert Shield and Desert Storm: A Logistical Perspective)

Title: A Comparison of Army Deployment
Table No 3
Sea and Airlift combined

Theatre	Passengers	Cargo (Tonnes)
Korean War	45800	1622200
Vietnam War	168400	1376400
Saudi Arabia	295800	2280000

(Source Special Report Operation Desert Shield and Desert Storm: A Logistical Perspective)

Title: Strategic Lift of Personnel and Cargo during Operation Desert Shield
Table No 4

Mode	Personnel	% of Total	Cargo	% of Total
Airlift	293000	99.05	175000	7.68
Sealift	2800	0.95	2105000	92.32
Total	**295800**	**100**	**2280000**	**100**

(Source Special Report Operation Desert Shield and Desert Storm: A Logistical Perspective)

The level of logistic buildup achieved by US during the Gulf War was beyond the capacity of Department of Defence (DOD). The logistics buildup therefore was complemented in an equal way by the civilian industry. US implemented its Civil Reserve Air Fleet (CRAF) Programme and utilised its contract, prepositioned and Ready Reserve Ship Fleet.

Chartered Commercial ships carried 37% of all unit equipment with distribution of ownership of the ships being as under: -

(a) US flagship - 15%
(b) Foreign flagships - 22%

Industry Support.
Department of Logistics Affairs (DLA) and Army Material Command (AMC) concluded more than 40000 contracts with the industry in support of the operations. The enormity can be judged from the fact that contract for manufacture of 52 million Desert Uniforms for $ 175 Mn and 1.4 million Desert Boots for $ 63.1 Mn were given.

Title: Contracts given by DLA & AMC during Gulf War
Table No 5

Agency	No of Contracts	No of Contractors	Value of Contracts
DLA	35000	>1000	$ 4.6 Bn
AMC	4000	>1500	$ 2 Bn

(Source Special Report Operation Desert Shield and Desert Storm: A Logistical Perspective)

The scope of military logistics is enormous. Its primary characteristic being that it is time critical and is inextricably linked to a nation's war effort. Thus, as soon as the national war machinery and process is commenced, other activities in the nation become a subset to the war effort and are undertaken as an adjunct to it. They are undertaken to complement the war effort.

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Armies all over the world have evolved their own processes and created logistic infrastructure to support their operational plans. The logistic setup is more or less organic and has been created from integral resources. Creation of an organic logistic model affords its own advantages. Some of the major advantages are: -

(a) Unity of command
(b) Integration of resources
(c) Trained manpower on a common platform
(d) Ease of training and onboarding of all logistical resources including manpower
(e) Seamless cooption of logistical elements in operational plan

Integral logistical setup has its own advantages, however, there are certain disadvantages to it also. Some of the major disadvantages are: -

(a) Logistics is not the core task of the army. War fighting is the core task of the army. Logistic is the support element and must evolve as per the operational plan.
(b) Organic logistic setup uses up a sizable amount of resources to remain functional and relevant. This resource includes the human resource which are the most important resource and alternatively can be used for the core task of war fighting.
(c) Organic logistic setup also utilizes a significant amount of fund and monetary resources which otherwise can be used for upgradation and capability creation.
(d) Increasingly in the armies world over, there is an increase in the financial accountability and scrutiny by the government. Profligacy and expenditure into redundancy are being called into question and armies are being exhorted to find out ways and means to cut the costs. Some of the revenue expenditures which have been questioned and are being looked into with greater scrutiny are: -
(i) Pay and allowances
(ii) Pension
(iii) Housing infrastructure
(iv) Land ownership
(v) Resource ownership
(e) Armies world over are being exhorted to explore different ways and means to cut down expenditure by utilizing resources available off the shelf or entering into contractual agreement with civilian service providers.
(f) Resources sharing between different arms and branches of defence is also being explored for cost cutting or reducing the expenditure.

Increased accountability and scrutiny has definitely made a case for exploring the services of 3rd Party Logistic Providers with adequate capability to undertake services and tasks which can be safely divested from the Army.

PART II : PRIMARY STUDY

2.1 Literature Review

To understand and analyse the issue comprehensively, it is very important to have a historical perspective about the issue. Study of the history gives the reader a context and ensures a connectivity. It enable the reader to understand as to how the present setup has evolved and what could be the probable outcomes in the near or distant future. Various sources of knowledge about the history could be as under: -

(a) Books on Military History. Military history books about various operations in the past provide a precise insight into the logistical challenges during the course of those operations. It gives an idea about the task required to be accomplished for a particular type of operation involving the given size of troops in the given terrain condition.

(b) Research Papers. Contemporary research papers analysing the topic by various subject experts and veterans are also a rich source of perspective into the topic. These research papers give a avid insight into the actual happenings at the point of time when the war or the operation were taking place. They also tell the reader as to how the logistics of the day shaped the outcome of the battle and what profound effect they had on the progress of the battle.

(c) Expert opinion. Experts' opinion helps us to understand the topic very clearly. They give a clear insight into complex problems by breaking down a complex problem into small comprehensible topics and ensure a clear understanding of the issue.

2.1.1 **The Art of War by Jomini**. This book was published in 1838 as a complete work. It was written as a military treatise by Antoine-Henri Jomini, who was a Swiss military officer who served as a general in The French army and later in Russian service. He is considered as one of the most celebrated writers on Napoleonic art of war.

His maxims are taught at military academy world over. While with passing of time, Jomini has been overshadowed by his more noted contemporary i.e. Clausewitz, Jomini's work were born out of his personal experience when he served in the French Army or the Russian service. The maxims propounded by Jomini may not hold good in today's time or may not seem relevant, however, if analysed relatively, they offer a precise insight into the Napoleonic War and war fighting at that point of time. Jomini said that Napoleon's failure in the Russian campaign was more due to lack of war time preparations than any other thing.

In The Art of War Jomini has given several Principles of War. The important of these principles were: -

(a) Keeping in mind the military objective, one should carefully select a theater of war that provides all the offensive advantages.

(b) Before engaging the enemy, rivers, mountains, and other topographical features must be used to gain added leverage.

(c) The enemy must be maneuvered into a vulnerable position; one should then launch a massive and concentrated attack upon this critical point.

(d) To maneuver the mass of own army to the point of critical advantage in the decisive point of time in the war.

2.1.2 **Pure Logistics**. This is a book written by Colonel Cyrus Thorpe in 1917, who served in US Marines. He was the first person to talk about the trinity of **Strategy-Tactics and Logistics**.

(a) In this book he has brought out that the function of logistics in war is all encompassing that is to provide all mean, human or material to fight the war. Thus, he has enhanced the scope of logistics in the context of war.

(b) Thorpe says that 'Strategy is to war what the plot is to the play; Tactics is represented by the role of the players; Logistics furnishes the stage management, accessories, and maintenance. The audience, thrilled by the action of the play and the art of the performers, overlooks all the cleverly hidden details of the stage management'. This analogy gives an important framework to the book and the theories defined within.

Pure logistics, as defined by Thorpe, is 'merely a scientific inquiry into the theory of logistics – its scope and function in the science of war, with a broad outline of its organisation'. This is in the context of logistics as a whole, with the missing piece of this theory being applied logistics which examines the finer details and conduct of logistics throughout the conduct of military operations.

2.1.3 **Special Report Operations Desert Shield And Desert Storm: The Logistics Perspective.** Authored by Colonel James D. Blundell, USA Ret., Assistant Director of the AUSA Institute of Land Warfare, the report brings out the broad logistical aspects of Operations Desert Shield and Desert Storm.

(a) While it focuses on the U.S. Army, it recognizes that the conduct of military operations in the Persian Gulf region was a combined operation involving allied forces and a U.S. joint effort of the Army, Navy, Air Force and Marine Corps, all backed by the civilian employees of the Department of Defense, U.S. industry and the American people.

(b) It is a description of the magnitude and complexity of the logistics effort, to include its successes and problems.

(c) In the book, the logistical support of Army operations in the Persian Gulf region is divided into three parts: strategic, theater and division.

(i) The strategic overview involves the movement of personnel, equipment and supplies to the Persian Gulf region to posture them to accomplish their assigned objectives throughout the period of the operation.

(ii) The theater perspective involves the reception and onward movement of personnel, equipment and supplies within the theater of operations, configured in a manner to best support the campaign plan.

(iii) The division level includes the activities of theater, corps, and organic divisional support units to sustain the combat divisions.

2.1.4 **Are the Armed Forces Game for 3PL**. Authored by Colonel Venu Gopal, Research Fellow at the Institute for Defence Studies and Analyses, New Delhi. The research paper focuses more on the relevance of 3rd Party Logistics in Indian Army.

(a) The research paper tries to emphasise that 3rd PL or outsourcing as is commonly known in military is the requirement of the day which can enable military to free its precious human as well as other resources for maintaining and upgrading its operational readiness.

(b) Non-core requirements can be readily outsourced to the service providers which can

contribute to financial economy and savings in the long run.

(c) The research paper suggests various non-core areas which can readily be outsourced: -

(i) Repair/Maintenance/Overhaul of in-service equipment/vehicles or through trade.
(ii) Clothing items.
(iii) Tyres, tubes and batteries
(iv) Dry cleaning Plants
(v) Catering services training establishments
(vi) Building and Maintenance
(vii) Training Facilities

2.1.5 **Logistics in World War II, Final Report of Army Service Force**.

This is a report to the Under Secretary of War and the Chief of Staff by the Director of the Service, Supply, and Procurement Division War Department General Staff. The beauty of the book lies in the fact that it acknowledges that many of the logistical problems faced in World War II may never need to be addressed by a future army, but problems of mobilizing, adjudicating competing demands, and fitting strategic ends to material means will inevitably plague future military leaders. They may have better organizations and tools at their disposal, but they can expect that policy guidance will be vague, expectations of field commanders excessive, and complex logistical systems almost impossible to keep in balance in the midst of war's vagaries. This book provides an overview of the accomplishments of those forgotten heroes who helped produce battlefield victories.

2.1.6 **Military Logistics Efforts during the Vietnam War Supply Chain Management on Both Sides**. This research paper has been written by Hermann Gruenwald of Burapha University International College Chonburi, Thailand. This paper analyses the role of military logistics operations during the Vietnam War. It looks at the technical and strategic role of logistics, and the physical obstacles that had to be overcome in Vietnam. The US had highly sophisticated war machinery that was deployed in a country that lacked not only the transportation infrastructure (roads, ports, airports) but also had extreme terrain and climate conditions. On the other hand, the Vietnamese had a well-oiled supply chain which often was carried on bicycles and literally on the backs of humans not only along the Ho Chi Minh Trail but throughout the north and south of Vietnam.

This paper explores the military logistics issues during the Vietnam War. It looks both at the North Vietnamese logistics efforts of the Viet Cong (VC) and the People's Army of Vietnam (PAVN) also called the North Vietnamese Army and compares and contrasts them to those of the US and the South Vietnamese This paper has been written from a logistics standpoint and is less focussed on military strategy even so they go hand in hand and at times are hard to be viewed in isolation.

2.1.7 **Russian Military Logistics in the Ukraine War, Recent Reforms And Wartime Operations.** This research paper has been published by Paul Schwartz, Anya Fink, Julian Waller, Michael Kofman with contributions by Brooke Lennox and Mary Chesnut.

(a) This paper examines the Russian military logistics system since 2010 with emphasis on its performance in Ukraine.

(b) It includes a detailed assessment of Russia's military logistics system based on major reforms introduced in 2010, highlighted by the merger of the Technical and Logistics Services to form a unified material-technical services (MTO). Over the next decade, Russia's logistics system underwent further reforms including changes in structure, order of battle, command and control, and transportation and storage systems, to improve performance and better align logistics with the new brigade structure introduced after the Georgia War.

(c) The paper further examines the performance of Russian military logistics during the 2022 Ukraine campaign. Russia's MTO forces performed poorly during the initial invasion in part due to deficiencies in force design and doctrine and in part to the immense challenges presented by the initial invasion plan.

(d) Russian logistics fared better once the campaign refocused on the Donbas, which greatly simplified the logistics task.

(e) MTO operations had to adjust further after introduction of US HIMARS, which necessitated moving key logistics nodes further to the rear, and during mobilization, to accommodate the mass influx of new personnel.

(f) Despite many setbacks, Russian logistics has been generally successful in sustaining combat operations in Ukraine, while MTO leaders are now using lessons learned to inform future reform efforts.

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2.2 **Background of the Study**.

As discussed in Part I of the study, it is a well-established fact that armies world over have an organic logistic set up which has evolved over a period of time to support its operational plans. However, it is also a fact that increased financial crunch and scrutiny have forced armies world over to look for avenues to reduce financial burden.

In the search for cost cutting measures, engagement with 3rd Party Logistics provider is a viable alternative which should be explored by the armies. Present day logistic providers have sufficient technological and technical capability to cater to the requirements of the army.

The capability creation in the private logistic sector has also been made possible by improvement in the transportation sector, warehousing sector, enhanced use of AI and robotics and faster passage and processing of information. Therefore, engagement with a private logistic partner enables the army to utilise the technological capabilities of these private players. While the scenario seems perfectly amenable to increased private participation, the same has not been achieved as much as one would like it to be.

The impediments to the increased engagement with private players could possibly lie in the legacy procedural requirements of the army, over adherence to the bureaucratic rules. Can the Army therefore overcome these so-called mental blocks and embrace the existing technology in the right earnestness.

2.3 **Rationale of the Study**. The study is being undertaken with the rationale that better technology and capabilities are available in the logistic sector which can be utilised or adapted by the armies to achieve the following: -

(a) Financial economy
(b) Lean logistic setup
(c) Flexible and capable logistic setup

2.4 **Research Objectives**

The present research is being carried out on the domain of military logistics. The objectives of this research are as under: -

(a) To ascertain whether extant logistic procedures and infrastructure in military can undertake present day logistic challenges in defence.
(b) To ascertain whether certain logistic functions in defence can be offloaded to 3rd Party Logistic provider.
(c) To ascertain if Third Party Logistics provider can provide flexibility and financial economy in defence.

2.5 **Hypotheses**

Can 3rd Party Logistic Providers provide a viable logistic alternative in defence forces?

(a) Null Hypothesis (H_0). 3rd Party Logistic Providers can provide a viable alternative logistic setup in defence forces.
(b) Alternative Hypothesis (H_a). 3rd Party Logistic Providers can not provide a viable alternative logistic setup in the defence forces.

PART 3 RESEARCH METHODOLOGY

3.1 **Research Design**

The Research Design selected for hypotheses testing is design for Descriptive research study. The objective of the present research being to ascertain whether the present logistic policies and procedures are capable enough to overcome the present-day logistic challenges. After ascertaining the same, the research also aims to ascertain whether 3rd Party Logistics provider can be coopted in the logistic matrix in the military and whether such co-option will lead to flexibility and financial economy. The research design will have following important way points: -

(a) Designing methods of data collection
(b) Selecting samples
(c) Data Collection
(d) Processing and analysis of data
(e) Reporting the findings

3.2 **Sources of Data**

The data for this research has primarily been sourced and taken from the following sources: -

(a) Military history books
(b) Old research papers
(c) Internet
(d) Magazines/journals
(e) Peer feedback/ information

3.3 **Data Collection Method**

Following data collection method has been adopted for this research: -

(a) Online questionnaire
(b) Telephonic interview with subject expert
(c) Reading and sifting through literature and websites

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3.4 **Population**

(a) All logistic units in the armies in the world.
(b) All persons involved in decision making capacity in the logistic setup in the armies.
(c) All persons with a fair/some exposure to functioning of logistic industry or working with defence sector.

3.5 **Sampling Methodology**

Non probability method and Purposive Sampling Technique

Rationale

(a) Provides data during the exploratory research period
(b) Helps in more in depth, follow up research.
(c) Provides information quickly and easily.
(d) Uses relatively small sample and avoids other complications associated with random sampling.

3.6 **Sampling Frame**

The topic of research being a niche topic, following sampling frame was applied: -

(a) People already acquainted with the topic.
(b) People who have a some practical and hands on experience and exposure to the topic.
(c) People who have worked in decision making capacity in the logistic sector.

3.7 **Data Collection Instruments**

(a) Online Questionnaire
(b) Telephonic interview
(c) Open-source data available online

3.8 **Online Questionnaire**. Following questionnaire has been prepared. The questionnaire was shared online with the population and the responses were collected and collated: -

(1) Do the Logistics providers in the private sector have the capabilities to take on logistic task which are peculiar to the requirement of army.
(2) Does having an organic logistic infrastructure the most ideal option in light of the advancements made in the private logistics sector.
(3) Will shedding the logistic tasks in army to private players lead to financial saving.
(4) Will shedding the logistics tasks in army to private players lead to savings in the manpower.
(5) Can the latest technology available in the logistic sector be leveraged by the logistic providers in the army.
(6) Name three technology available in private logistic sector that can be readily utilised in military logistics.
(7) Do you think that increased involvement of private players in military logistics will lead to security challenges or compromise security.
(8) Warehousing and transportation are two aspects of logistic supply chain which can be easily given to private players. Do you agree.
(9) Development in infrastructure has led to proliferation of supplier across the length and breadth of the country, even in remote areas. Do you think that there is a case for reduction in the levels of reserves being catered for all kind of stores in the present system.
(10) Is Just in Time model of logistics suitable or feasible for defence.
(11) The involvement of private logistic providers is presently restricted to non core logistic functions that too in hinterland locations. Do you think overall scenario is conducive for migration to core functions and in operational areas too?
(12) Which of the following options do you recommend: -
(a) Adoption of latest technology by integral logistics providers in the military.
(b) Shedding the logistic task completely to Third Party logistic providers.
(13) Will increased involvement of private logistic provider lead to increased legal burden on the military.

(14) Do you think legacy procedures are too restrictive and impede smooth adoption and migration to newer technologies and logistic practices.
(15) In light of increased participation of private logistic providers the importance of Contract Management can not be over emphasized. Do you agree?

3.8.1 **Interpretation of Online Questionnaire**

Online questionnaire was formed and circulated to the respondent with the aim to ascertain following trends/themes: -

(a) Whether increased engagements with private service providers is feasible in the logistic sector in military.
(b) Whether increased engagements with private logistic providers will be driven by the incentives of financial savings and savings in manpower.
(c) Whether the increased engagements with private logistic providers will lead to divesting of core functions in operational areas.

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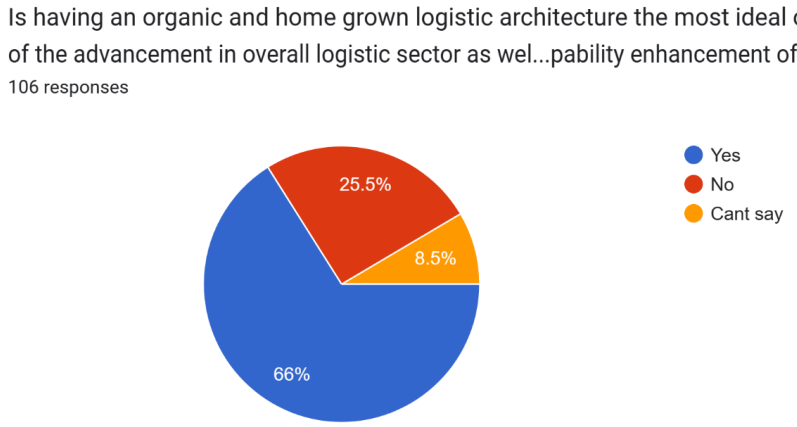
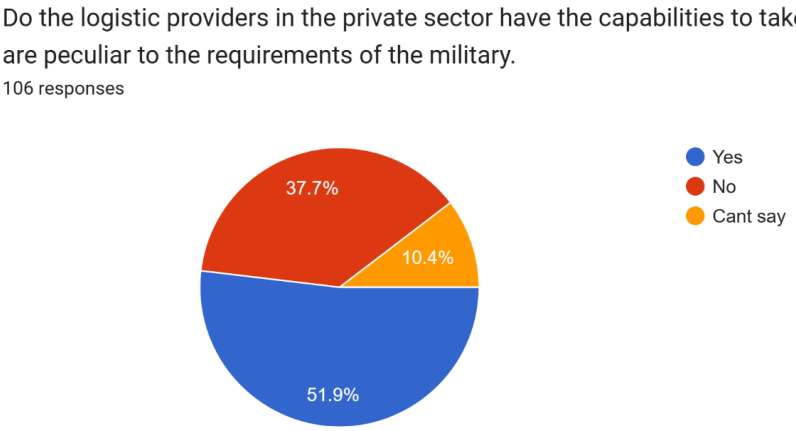
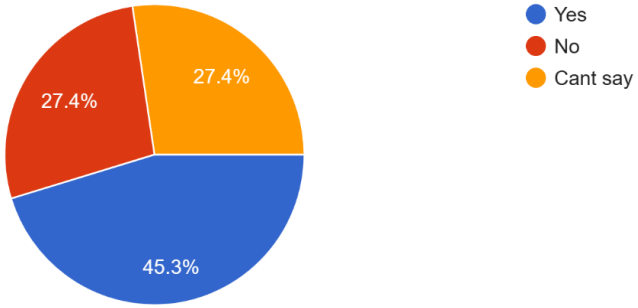
(d) Whether middle of the line approach i.e the logistic architecture being improved by absorption of technological knowhow and upgradation provides a robust alternative to divesting all logistic functions to private players.
(e) Whether the adoption of newer technology faces headwind in form of legacy rules and regulations.
(f) Whether increased engagements with private logistic provider create requirements of niche knowledge domain and expertise.

3.8.2 **Response to Online Questionnaire**

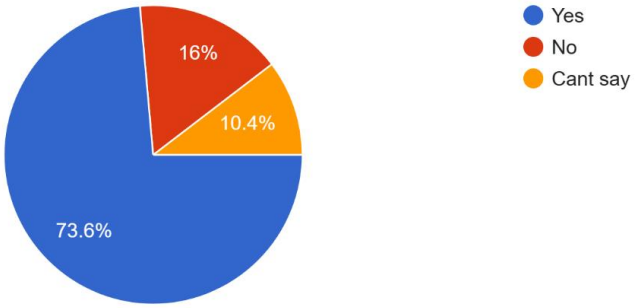




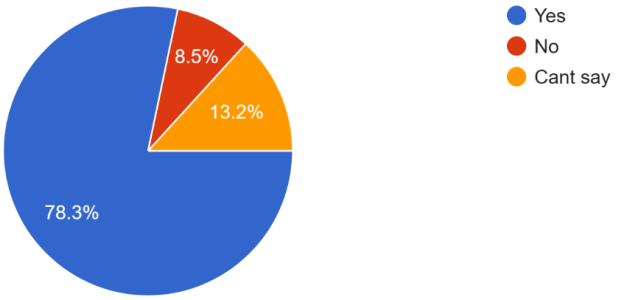
Will shedding the logistic tasks in military to private logistic providers lead to financial saving.
106 responses



Will shedding the logistic tasks to private logistic providers lead to saving in manpower.
106 responses



Can the latest technology available in the logistics sector be leveraged by the logisticians in military.
106 responses



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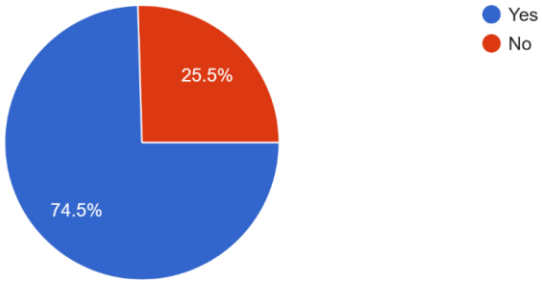
Which of the following option do you recommend

106 responses

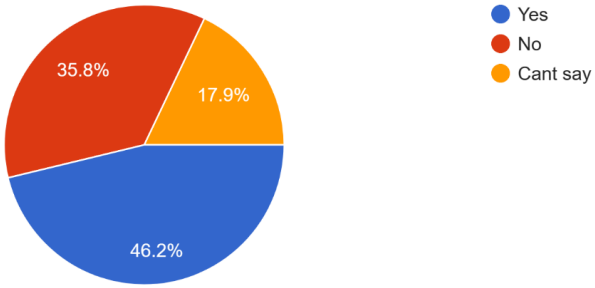
Do you think that increased involvement of private logistic providers will lead to security challenges in military.

106 responses



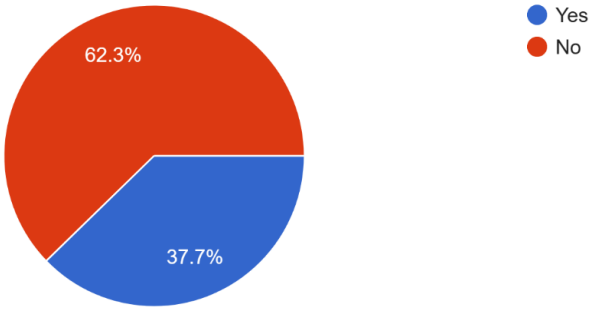
Development of infrastructure has led to proliferation of suppliers and availability of resources across the length and breadth of the country, even in ...held at different level in the military supply chain.

106 responses



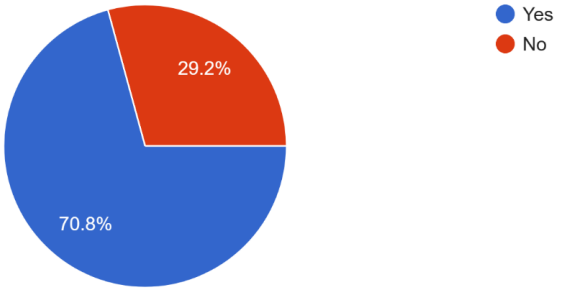
Do you think that Just In Time Model of logistic feasible for military.

106 responses



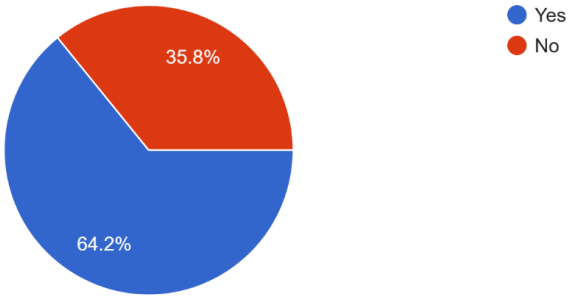
Transportation and Warehousing are two distinct logistics function which can be readily outsourced to private providers. Do you agree.

106 responses

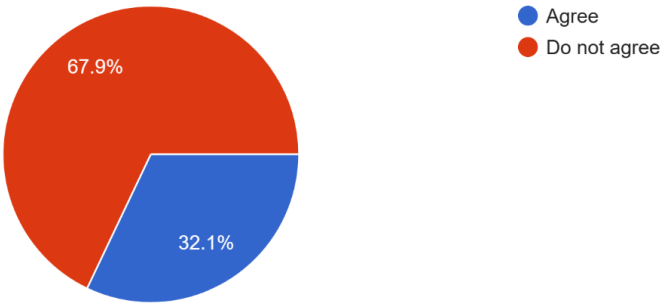


Will increased involvement of private logistics provider lead to increased legal burden on the military.

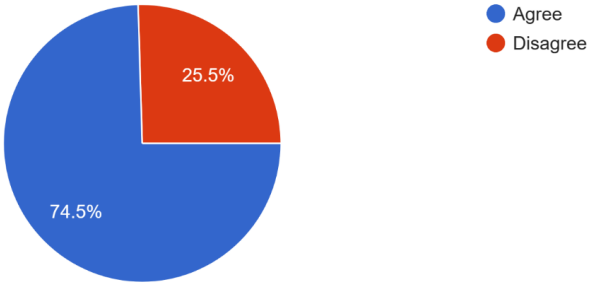
106 responses



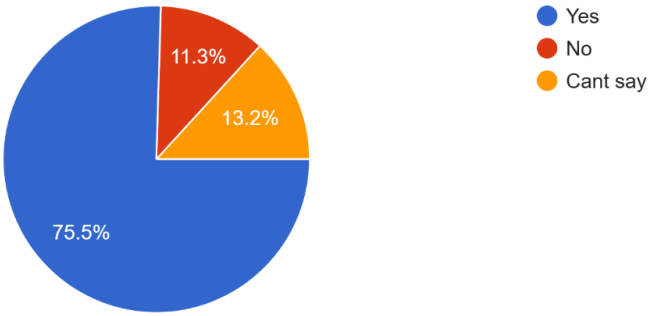
The involvement of private logistic providers is presently restricted to non core functions that too in hinterland locations. Do you think that the overall s...tion to core functions and in operational areas too.
106 responses



Do you think that legacy procedures are too restrictive and impede smooth adoption and migration to newer technologies and logistic practices?
106 responses



In light of increased participation of private logistic providers, the importance of contract management cant be overemphasized. Do you agree?
106 responses



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3.8.3 **Reliability testing of the questionnaire**.

The questionnaire was tested for reliability using the Cronbach Alpha method. The tested gave an Alpha score of 0.65191 with a reliability rating of 'Fair.' The results are attached as **Appx 'A'**.

3.8.4 **Results/Findings**.

(a) Majority of the respondent (**66%**) believed homegrown and organic logistic setup is most ideal for fulfilling the logistic requirements of the armies- **Question 1**

(b) Majority of the respondents (**71.7%**) believed adoption of technology by integral logistic providers was a better option than shedding the logistic task completely to private logistic providers-**Question 6**

(c) **74.5%** of the respondents agreed to the fact that increased involvement with private logistic providers will lead to security challenges and **64.2%** believed that it will lead to increased legal burden on the military- **Question 7 & 11**

(d) **67.9%** of the respondents did not agree to enhancing the role of private logistic players to core function and restricting it to non-core functions- **Question 12**

(e) **78.3%** of the respondents believed that existing logistic setup in armies can leverage the technological advancement in the logistic sector- **Question 5**

(f) While saving in manpower and finances were advantages accrued by shedding the logistic tasks to private logistic players, the advantages of reduction in reserves at different levels as well as migration to Just in Time model of logistic provisioning was not possible- **Question 3,4,8 & 9**

(g) **51.9%** of the respondents believed that private logistics players possess the capability undertake logistic tasks in military, however at the same time only **28.6%** of the respondent believed that logistic tasks can be completely shed to private logistics players- **Question 2 & 6**

(h) A compiled analysis of the responses is attached at **Appx 'B'**.

(i) One of the questions pertained as to what technologies can be used in the field of military logistics. Most of the respondents have however listed out services that can be taken on by private logistics providers. A compiled list of the technology as well as services suggested is attached as **Appx 'C'**.

3.8.5 **Interpretation of Results.**

The result of the survey can be interpreted as under: -

(a) Conflict resolution the world over has moved significantly from kinetic solutions like military intervention or use of physical force to use of subtle yet effective tool of diplomacy. Diplomacy strives to ascertain leverages available to active actors in any situation of stalemate or conflict. Use of these leverages can effectively bring about desired results without the danger of wholesale destruction likely to follow the use of military might. However, this does not render the instrument of military or physical power as redundant but simply relegates it to lesser preferred option.

(b) In this scenario of conundrum and increased relegation of military to less preferred option creates policy dilemma in the minds of the policy makers as to apportioning of national resources to maintain the military, the national resource being the finance or funds. The policy makers therefore are presented with a viable option of conflict resolution through the means of dialogue and diplomacy and the use of the valuable finance or fund for other developmental tasks or agenda which otherwise would have been used for maintain the standing armies.

(c) Fund constraints in the standing armies has become a worldwide phenomenon and has forced the armies world over to look for ways and means to get the maximum benefit out of the meagre allotment of the funds.

(d) The buzzword therefore has become a creation of lean and mean army. However, creation of a lean army does not necessarily translate into dilution of the war fighting potential of the army. Thus, the armies are faced with the contradictory requirements of: -

(i) Increasing the war fighting potential to face the ever changing and dynamic threat scenario. The fulfilment of this requirement leads to modernisation of the army entailing creation of newer verticals with specialised roles and requiring infusion of funds.

(ii) Reduce the footprint of the army to offset the reduced availability of the funds.

(e) Since relegating modernisation would essentially tantamount to reducing the relevance of the army itself, the only recourse left open to the military commanders is to look for ways and means to accomplish the given task within the limited budget available to them.

The ways and means are enormous however the primary tasks which are required to be done is to delineate the tasks being performed by the army into core and non-core.

(f) The shape and dynamics of core and non-core tasks are ever shifting with the so-called non-core tasks assuming increased relevance at some point of time however this defining and categorisation of the task is time related and the time of consideration in the conduct of the operation deciding whether any task is core or non-core.

(g) Logistics in armies is one such area which can be safely legislated to have non-core bearings.

(h) The area of logistics in the private sector has seen developments at amazing pace. Rapid advancements in the technology, lineation of clear-cut supply chains and capability buildup at different interfaces in the supply chain has helped the development of logistic industry in the private sector.

(i) Automation, development of surface mode of transportation, multimodal logistic model, optimising of resources have further helped in development of an intricate web of interdependent logistic setup.

(j) Resource sharing leading to capability buildup has been adopted a big time by the governments across the world wherein the benefit of the resource creation is shared by all stakeholders. Thus, the development of infrastructure resources in the nations have also helped the armies shorten their supply chain and increase their responsiveness.

(k) Outsourcing or utilising the services of a third-party enterprise to perform inherent tasks helps the armies in conservation of resources as well as better application of these resources. There are four compelling factors - cost minimisation/value maximisation, resource access, superior resource leverage, and risk diversification - that incentivise an organisation to go for outsourcing.

(l) Resource sharing is a major advantage of outsourcing of logistic tasks in the armies.

(m) Purely from an evolutionary point of view, it may be argued that the armies world over still suffer from a captive mindset vis-à-vis rules and regulations. Putting rules and regulations on a high pedestal and committing to non-violability of these rules and regulation goes against the fluid nature of exponential development taking place all around. This captive mindset has hindered evolution of reliable partnership with third party logistic providers.

(n) However, fund constraint has been a major driver of unshackling the armies of their over clinging to rules and regulation and opt for more and more multi-faceted partnership with the third-party logistic providers.

(o) Realisation has also dawned upon the policy makers that logistics capability in the private sector should be leveraged to bring in revolution in the domain of military logistics. The approach could be as conservative as transforming the current logistics infrastructure by adoption of best practices in the entire logistics spectrum to as path breaking as divesting the logistics role altogether to third party logistics providers. The divestment part could be however incremental thereby injecting an element of caution.

(p) Reliable partnership with third party logistic provider will definitely result in financial savings as also in saving in manpower. Thus, these precious resources can then be committed to actual modernisation of the war fighting potential of the army.

3.8.6 **Thematic Interpretation of the Results**.

Following themes can be ascertained from the survey: -

(a) Logistics in military or armies across the world faces headwinds form institutional factors like archaic rules and regulations, over adherence to secrecy etc. For logistics in armies to realise its full potential it is important to unshackle it from these institutional barriers. More than institutional reforms, psychological sensitivisation of the hierarchy in armies for adopting a liberal approach is more important.

(b) Logistic sector in the armies world over require upgradation and is required to keep pace with the dynamics of the modern warfare. Capability upgradation can be expeditiously achieved through adopting best business practices in the realms of logistics and exploiting the technology available.

(c) Private players can be an effective tool for financial savings and savings in manpower which is the requirement of the day, in light of the fund squeeze and constraints. However, the environment still is wary of shedding the tasks completely to the private players which essentially is the essence of involvement of private logistic players.

(d) Paradigm shift to lean and agile logistic model like Just in Time logistics even with overall improvement in the infrastructure may not be possible largely because of the uncertain nature of war and the effects it may have on the logistic supply chain. Thus, the armies are likely to be burdened with higher levels of reserves at various

levels in the supply chain which in turn will contribute to the lethargy as well bulk in the supply chain. This may also not support the concept of flexibility which is so essential in the current warfare scenario.

(e) Divesting core functions even in logistic sector completely to the private players has been a no-go area. However, conflicts in recent times, especially the Russo-Ukraine conflict as also the operation against Taliban in Afghanistan has shown the world that active participation in core activities by the private players is possible. The driver for the same will however, be scale of the operations as well as the financial implications.

(f) Military leaders, the world over, however, should take a pragmatic view of defining criteria of core/ non-core functions because all actions undertaken in furtherance of any operations are core function. Assigning relative importance to these functions can be done realistically by binding them to the time when they will be undertaken. Thus, certain functions will reveal them to be relatively more important and certain function may be then given to private players.

(g) Adoption of any new course or approach has its own unique challenges and likely list of pitfalls and hence outsourcing or partnership with third party logistics provider will have its own challenges. However, repetitive iterative cycles and hands on experience will help in overcoming those challenges. Constrictive factors like security etc can be managed by inclusion of appropriate liability clauses in the contracts with the third-party logistics providers.

3.9 **Limitations of the Research**.

The research topic had following limitations: -

(a) The topic pertained to a niche domain.

(b) The criteria for choosing the population required the respondents to have some basic idea and knowledge about the research topic i.e logistics in military. This limited the scope of choosing the population because while the environment has a fair idea about the logistics per se, the evolution, nature and dynamics of logistics in military have certain nuances which common population is not aware of. It becomes even more esoteric due to the interplay of the operational requirements and logistics to match up to the operational requirements which other words imply that logistics is a corollary of operations and not vice versa.

(c) The replies received from the respondents are subjective and based on their personal experience and exposure.

(d) Military logistics is a subset of military operations which completely flow from national interests. Liberal interpretation of rules and regulations resulting in ambiguous interpretation of national interest are not permissible and hence full exploitation of the potential or existing capability in the private logistic sector may not be always possible.

(e) Cost-profit factor in deciding logistic options may not always be the chosen option in military logistics due to the supremacy and pre-eminence of the national interests.

(f) Geo political ambitions and aims shape/limit the scope of the military, thus development of military logistics may also be limited by the same.

PART 4- LATEST TECHNOLOGICAL ADVANCEMENT IN LOGISTIC SECTOR

4.1 **Internet of Things (IoT)**. Internet of Things or IoT as it is popularly known is a connection of all electronic and smart devices over Internet to facilitate seamless transfer and collation of data at all levels and all points of origin. The IoT ensures least human intervention and thus subjectivity in the interpretation of the data. The benefits of IoT are: -

(a) Enhances visibility

(b) Eradicates subjectivity

(c) Improves efficiency of inventory management

(d) Improves efficiency of the supply chain by ensuring real time transparency and visibility.

(e) Enables and facilitates predictive analysis to anticipate demand fluctuation. Helps in route optimisation, savings in fuels etc.

4.1.1 **Areas in which IoT revolutionizes Military Logistics**

(a) Tracking of Supplies, Equipment, and Personnel on real time basis. Extant procedure of manual real time tracking of supplies, equipment, and personnel is very cumbersome and manpower intensive. The requirement of physical reporting is outdated and redundant. Under the umbrella of IoT integration of sensors, cameras, drones etc is carried out which enhances the tracking capabilities and report being generated on real time basis enabling the commanders to take correct decisions and respond to a dynamic and fluid battlefield. Realtime data enables understanding usage pattern and prepositioning of resources for optimization.

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(b) Optimised Supply Chain Management. Though effective usage of IoT, military planners can have real time visibility of all assets in the logistic supply chain which can help them in taking correct decisions about inventory management and minimization of resource wastage. It helps in identifying the bottlenecks and take preventive steps to eliminate the bottleneck thereby increasing the operational efficiency of the supply chain. Visibility of stores inside the warehouses can help in optimization of routes and has an enormous bearing on the success of the operation.

(c) Predictive Maintenance. IoT technology can also help in predicting bottlenecks and possible breakdowns which can enable the decision makers to take preventive measures beforehand. This can help in drastically reducing equipment downtime and thus improving the equipment effectiveness.

(d) Real-Time Situational Awareness. Through effective use of IoT the commanders as well as the soldiers on ground can be aware of the situation on ground and take decisions accordingly.

4.2 **Artificial Intelligence.** Benefits of AI and machine learning are phenomenal in logistic sector. Some of the benefits are as under: -

(a) AI based forecasting help reduce unnecessary accumulation of inventory and thus reduce inventory wastages.

(b) Help in demand predictions as well as anticipating fluctuations.

(c) Optimise route planning and load consolidation resulting in fuel cost savings as well as supporting a sustainable and eco-friendly model of business.

(d) AI-powered robots and drones are being increasingly used for tasks like inventory counting and last-mile delivery and operating in hazardous and contaminated area thus maximising the impact of humanitarian supply chain.

(e) Risk assessment and fraud detection systems to enhance security and compliance in logistics operations.

4.3 **Robotics.** Helps to increase the speed and accuracy of supply chain processes and reduces human error. Robots can work with more efficiency and lesser error than humans. They can thus help in increase the productivity. Robots, however, have to work in collaboration with human and cannot replace humans in a big way in the present technological scenario.

1	TABLE/FIG NOS.	PARTICULARS	PAGE	SOURCE
1	Table No 1	Timelines for Evolution of Military Logistics	4	Evolution of Military Logistics by Aldemar Serrano, Dusko Kalenatics, Cesar Lopez and Jaro R Montoyo Torres
2	Fig No 1	Trench Narrow Gauge Train	7	blog.lidd.ca
3	Fig No 2	Horse Based Supplies	7	Iwm.org
4	Fig No 3	WW II by Numbers	7	historical-map.blogspot.com
5	Fig No 4	Production of Tanks in WW II	7	Statista
6	Fig No 5	US POL Supply Convoy	9	dla.com
7	Fig No 6	Repair Facility of Bell Huey Helicopter	9	dla.com
8	Table No 2	Shipping Targets of US Army	10	Special Report Operation Desert Shield and Desert Storm: A Logistic Perspective
9	Table No 3	A Comparison of Army Deployment	10	Special Report Operation Desert Shield and Desert Storm: A Logistic Perspective
10	Table No 4	Strategic Lift of Personnel and Cargo during Operation Desert Shield	10	Special Report Operation Desert Shield and Desert Storm: A Logistic Perspective
11	Table No 5	Contracts given by DLA & AMC during Gulf War	11	Special Report Operation Desert Shield and Desert Storm: A Logistic

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				Perspective
12	Appx A	Reliability Analysis of Questionnaire		
13	Appx B	Analysis of the Responses		
14	Appx C	Latest Technologies that can used in the field of Military Logistics		

LIST OF TABLES/FIG/APPENDICES/ANNEXURES

LIST OF TABLES/GRAPHS/DIAGRAMS/APPENDICES/ANNEXURES

Appx 'A'

Ref Para 3.8.3 (g)

RELIABILITY ANALYSIS OF THE QUESTIONNAIRE															
Responses	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Total**
R1	1	3	2	1	1	4	1	2	2	1	1	7	6	1	33
R2	1	2	3	2	2	4	1	3	1	2	1	6	6	1	35
R3	1	1	3	1	1	4	1	3	1	1	1	6	6	1	31
R4	2	1	2	1	1	4	2	2	1	2	1	7	6	1	33
R5	1	2	1	1	1	5	1	2	1	1	1	7	6	1	31
R6	1	1	1	1	1	5	1	2	1	1	2	7	6	1	31
R7	1	2	2	2	3	4	1	2	2	1	1	7	7	1	36
R8	1	1	1	1	1	4	1	2	2	1	2	7	7	1	32
R9	1	1	1	1	1	5	2	1	2	1	1	6	6	1	30
R10	1	1	3	1	1	5	1	2	2	1	1	6	6	1	32
R11	1	1	2	1	1	4	1	1	2	1	2	7	6	1	31
R12	2	2	2	2	1	4	1	1	2	2	1	7	7	2	36
R13	1	2	2	2	1	4	1	1	2	2	1	7	7	1	34
R14	2	1	1	1	1	5	2	1	1	1	2	6	6	1	31
R15	2	2	2	2	1	4	1	2	2	2	1	7	7	2	37
R16	2	1	1	1	1	5	2	1	2	1	2	7	7	1	34
R17	1	2	2	2	1	4	1	2	2	2	1	7	6	1	34
R18	3	2	1	1	1	4	1	1	2	1	2	6	6	1	32
R19	1	2	1	1	1	4	1	2	2	2	1	7	7	1	33
R20	1	2	2	2	1	4	1	2	2	2	1	7	6	1	34
R21	1	2	3	1	1	4	1	3	1	2	1	7	7	3	37
R22	1	1	3	2	1	4	1	1	1	2	1	7	6	1	32
R23	2	1	1	1	1	5	2	1	1	1	1	6	6	1	30
R24	1	2	2	2	1	4	1	2	2	1	1	7	6	1	33
R25	2	2	2	1	1	4	1	2	2	2	1	7	7	1	35
R26	2	1	1	1	1	5	2	2	2	1	1	6	6	1	32
R27	3	2	3	3	3	4	1	3	2	2	1	7	7	1	42
R28	1	2	2	1	1	4	1	1	2	1	1	7	7	2	33
R29	1	1	2	2	1	4	1	1	2	2	1	7	7	3	35
R30	2	2	1	1	2	4	1	2	2	1	1	7	6	1	33
R31	2	1	3	3	1	4	2	1	2	2	2	6	6	1	36

R32	1	2	1	1	1	4	1	3	2	1	1	7	6	1	32
R33	1	1	2	1	1	4	1	1	2	1	2	7	6	1	31
R34	1	1	2	1	1	4	1	2	2	2	1	7	6	1	32
R35	2	1	1	1	1	5	2	1	1	1	2	6	6	1	31
R36	1	1	1	1	1	5	2	2	2	1	2	6	6	1	32
R37	1	1	3	3	1	4	1	1	1	1	1	6	6	1	31
R38	1	1	1	1	1	4	1	1	1	1	2	6	6	1	28
R39	1	2	1	1	1	4	2	1	1	1	1	6	6	1	29
R40	1	2	1	1	1	5	1	1	1	1	1	7	6	1	30
R41	1	1	3	1	1	4	1	1	2	1	1	7	6	1	31
R42	3	2	1	2	3	4	2	3	1	1	2	7	7	2	40
R43	1	1	1	1	1	4	1	1	1	1	1	6	6	1	27
R44	2	1	3	2	1	5	1	2	1	1	2	6	7	2	36
R45	1	3	3	2	3	5	1	3	1	1	1	6	6	1	37
R46	1	2	1	1	3	4	1	1	1	1	1	6	6	1	30
R47	2	1	3	1	1	5	1	1	2	1	1	7	6	1	33
R48	1	2	1	1	1	4	1	2	2	1	1	7	7	3	34
R49	1	2	2	1	1	4	1	2	1	2	1	7	7	2	34
R50	1	2	1	1	1	4	1	1	2	1	1	6	6	3	31
R51	2	1	1	1	1	4	1	1	2	1	1	6	6	1	29
R52	1	2	2	2	1	4	1	1	2	2	1	7	6	1	33
R53	1	1	1	1	1	5	1	1	1	1	2	6	6	1	29
R54	1	2	2	1	2	4	1	2	1	2	1	7	6	1	33
R55	1	2	2	1	1	4	1	1	2	2	1	7	6	1	32
R56	1	2	1	1	1	4	1	2	1	1	1	6	6	1	29
R57	1	2	2	1	1	4	1	2	2	2	1	7	7	2	35
R58	2	1	1	1	1	4	2	1	1	1	2	7	6	1	31
R59	1	1	3	1	1	4	2	1	2	1	2	7	6	1	33
R60	1	1	1	1	1	5	1	1	2	1	1	7	6	1	30
R61	1	2	2	1	2	4	1	1	2	1	1	7	6	2	33
R62	1	1	3	1	1	4	1	2	2	2	1	7	6	2	34
R63	1	1	1	1	1	4	2	1	1	1	1	6	6	2	29
R64	1	3	2	1	1	4	1	1	2	1	1	7	6	3	34
R65	1	1	2	1	1	4	1	2	2	2	2	7	7	1	34
R66	1	1	2	2	1	4	1	2	2	2	1	7	6	1	33
R67	1	1	1	1	1	5	1	1	1	1	1	6	6	1	28
R68	1	1	3	1	1	4	1	1	2	1	1	7	6	1	31
R69	1	2	1	1	1	4	1	1	2	1	1	7	6	1	30
R70	3	2	3	1	1	4	1	1	2	1	1	7	6	1	34
R71	1	1	1	1	1	4	1	1	1	1	1	6	6	1	27
R72	1	1	1	1	1	4	1	1	2	1	2	6	7	1	30
R73	2	2	1	1	1	4	2	1	1	1	2	6	7	1	32

R74	1	2	1	1	1	4	1	2	2	2	2	7	6	1	33
R75	1	2	2	2	1	4	1	2	2	1	1	7	6	1	33
R76	2	1	2	1	2	5	1	1	1	1	2	6	6	1	32
R77	2	2	2	1	2	4	2	1	1	1	2	7	6	1	34
R78	1	1	1	1	1	5	2	2	2	1	2	7	6	1	33
R79	2	1	1	1	2	5	2	1	1	1	2	6	6	1	32
R80	1	1	3	3	3	4	1	3	2	1	1	6	6	3	38
R81	1	1	1	1	1	4	1	3	1	1	2	7	7	3	34
R82	2	3	3	3	3	4	2	3	2	1	2	7	6	3	44
R83	3	3	3	3	3	4	1	3	1	1	1	7	7	3	43
R84	1	1	1	1	1	4	1	1	1	1	1	6	6	1	27
R85	2	2	2	2	2	5	2	2	2	2	2	7	7	2	41
R86	2	1	1	1	1	5	2	2	2	1	2	7	6	1	34
R87	1	1	1	1	1	4	1	2	2	1	2	7	6	1	31
R88	1	1	2	1	1	5	1	2	2	1	2	7	6	1	33
R89	2	1	3	1	3	5	2	3	2	1	2	7	6	3	41
R90	1	3	3	1	1	4	1	2	2	2	1	7	6	1	35
R91	2	1	1	1	2	5	2	1	1	1	2	6	6	1	32
R92	1	3	3	1	1	4	1	1	1	2	1	7	6	3	35
R93	3	1	1	1	3	5	2	3	1	1	2	6	6	3	38
R94	1	1	1	1	1	4	1	1	1	1	2	7	6	1	29
R95	1	1	1	1	3	5	2	3	2	1	2	7	6	1	36
R96	1	3	3	1	1	4	1	2	2	2	1	7	6	1	35
R97	1	2	3	3	1	4	1	3	2	1	1	7	6	1	36
R98	2	1	1	1	3	5	2	3	1	1	2	7	6	1	36
R99	2	1	1	1	1	5	2	1	1	1	2	7	6	1	32
R100	1	2	3	3	1	4	1	3	2	1	2	7	7	1	38
R101	3	3	3	3	3	4	1	3	2	2	1	7	7	2	44
R102	1	2	1	1	1	4	1	2	2	1	1	6	6	1	30
R103	2	3	3	1	1	4	1	2	2	1	1	7	7	3	38
R104	1	1	1	1	1	5	1	2	2	1	1	7	6	1	31
R105	3	1	3	3	1	4	1	1	2	2	1	7	7	3	39
R106	3	3	3	3	3	4	1	3	2	2	1	7	6	1	42
Variance	0.4181	0.455	0.701	0.444	0.496	0.205	0.19	0.57	0.237	0.209	0.23	0.22	0.1916	0.504	**12.84897**
Total of variance															**5.070889**

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Cronbach Alpha(α)- 0.65191
Result- Fair Reliability
Ref Range

α=0	There is no consistency between the various items of multiple item scale
α=1	There is complete consistency between various items of a multiple item scale
α lies between 0.80 - 0.95	There is very good reliability between the various items of a multiple item scale
α lies between 0.70 - 0.80	There is a good reliability between various items of a multiple item scale
α lies between 0.60-0.70	There is a fair reliability between various items of a multiple item scale
α ‹ o.60	There is a poor reliability between various items of multiple scale items

Appx 'B'
Ref Para 3.8.3 (h)
ANALYSIS OF THE RESPONSES RECEIVED

Ser No	Question	Total Responses received	Options	Breakdown of responses (in %)		Analysis
1	Do the logistic providers in the private sector have the capabilities to take on logistic tasks which are peculiar to the requirements of the military	106	Yes, No, Cant say	Yes	51.9	Majority of the respondent agree that private logistic providers do possess the capabilities to take on tasks which are peculiar to military
				No	37.7	
				Cant Say	10.4	
2	Is having an organic and home grown logistic architecture the most ideal option for military in light of the advancements and capabilities enhancements achieved in the private sector	106	Yes, No, Can't say	Yes	66	Majority of the respondent favour a home grown and organic logistic setup rather that a superimposed private logistic setup
				No	25.5	
				Can't say	8.5	
3	Will shedding the logistic tasks in military to private logistic providers lead to financial savings	106	Yes, No, Can't Say	Yes	45.3	Majority of the respondents agree that engaging with private logistic providers will lead to financial savings
				No	27.4	
				Cant' Say	27.4	
4	Will shedding the logistic tasks in military to private logistic providers lead to saving in manpower	106	Yes, No, Can't Say	Yes	73.6	Majority of the respondents agree that engaging with private logistic providers will lead to savings in manpower
				No	16	
				Can't say	10.4	
5	Can the latest technology in the logistic sector be leveraged by the logisticians in the military	106	Yes, No, Can't say	Yes	78.3	Overwhelming majority of the respondents believe that the logistician in the military can leverage the latest technology available in the private logistic sector
				No	8.5	
				Can't say	13.2	
6	Do you think that	106	Yes, No	Yes	74.5	Majority of the respondents

	increased involvement of private logistic providers will lead to security challenges in military			No	25.5	agree that increased engagement with private logistic providers will lead to security challenges
7	Transportation and warehousing are two distinct logistics functions which can be readily outsourced to private providers. Do you agree?	106	Yes, No	Yes	70.8	Majority of the respondents agree that transportation and warehousing function can readily be outsourced
				No	29.2	
8	Devp of infrastructure has led to proliferation of suppliers across the length and breadth of the country even in remote areas. Do you think that it can facilitate reduction in reserves (safety Stocks) held at different levels in the military supply chain	106	Yes, No, Can't say	Yes	46.2	While proliferation of suppliers has been achieved due to improvement in infrastructure, opinion is fairly divided as to whether the safety stocks can be reduced at all levels. Majority (46.3%) do believe that it can be reduced. However, a significant proportion of the respondents (41.5%) believe that it will not help in reducing the SS levels
				No	35.8	
				Can't say	17.9	
9	Do you think Just in Time model of logistic is feasible for military	106	Yes, No	Yes	37.7	Overwhelming majority of the respondent believe that Just in Time logistic model is not feasible in military
				No	62.3	

ANALYSIS OF THE RESPONSES RECEIVED (Appx 'B' Contd)

Ser No	Question	Total Responses received	Options	Breakdown of Responses (in %)		Analysis
10	Involvement of private logistic providers is presently restricted to non core functions in hinterland. Do you think the scenario is conducive for migration to core functions in operational areas	106	Yes, No	Yes	32.1	An overwhelming majority believe that core functions in operational areas cannot be given to private players
				No	67.9	
11	Which of the following options do you recommend: - (a) Adoption of latest technology by logistic providers in military (b) Shedding the logistic task completely to private logistic providers	106	(a), (b)	(a)	71.7	Majority of the respondent believe that adoption of latest technology by logistic providers in military is the best way forward to modernize the logistics instead of giving the logistic tasks completely to private
				(b)	28.3	

						players
12	Will increased involvement of private logistic provider lead to increased legal burden on the military	106	Yes, No	Yes	64.2	Majority of the respondents agree that increased engagements with private parties will lead to increased legal burden with the military
				No	35.8	
13	Do you think that legacy procedures are too restrictive and impede smooth adoption and migration to newer technologies and logistic practices	106	Agree, Disagree	Agree	74.5	Majority of the respondents feel that legacy procedures as well as requirements are a major impediment for smooth transition to newer technology and logistic processes.
				Disagree	25.5	
14	In light of the increased participation of private logistic providers, the importance of Contract Management cannot be over emphasized. Do You agree?	106	Yes, No, Cant say	Yes	75.5	Majority of the respondents feel that Contract Management will assume a major role due to increased engagement with private logistic providers
				No	11.3	
				Can't say	13.2	

Appx 'C'
Ref Para 3.8.3 (i)
LATEST TECHNOLOGIES THAT CAN BE USED IN THE FIELD OF MILITARY LOGISTICS

1. GPS based tracking system
2. Automated Warehouse Monitoring System
3. Use of AI in Inventory Management
4. ERP SAP
5. AI enabled SCM
6. Robotics
7. Internet of Things (IoT)
8. Use of drones for transportation of stores
9. RFID Tags, barcoding and QR codes
10. Blockchain technology

SERVICES THAT CAN BE OUTSOURCED TO PRIVATE OR 3RD PARTY LOGISTICS PROVIDERS

1. Conservancy
2. Housekeeping
3. Transportation
4. Catering and associated functions
5. Health services like patient record keeping
6. Certain warehousing functions including cold storage
7. Security of non-critical installations in hinterland locations