

Review

# Evolution of Military Logistics

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**Abstract:** *Background:* Military logistics has been present from the moment a soldier was created, and its evolution has been influenced by the technology used. Indeed, it has been observed over time that every military revolution was intrinsically caused by a military logistics revolution, directly promoted by the technology applied to the manner of making war. Few papers have been written about military logistics in relation to the development of war itself. Its application was conceptualized in two dimensions: as an art and as a science, interdependent on decision-making. With the evolution of human beings, the way of making war also evolved and therefore a transformation was generated. This makes it necessary to deepen the application of mathematical modeling, statistics, and new technologies in military logistics, promoting the application of concepts based on technology to improve the effectiveness of armies. The aim of this paper is to review the evolution of military logistics. *Methods:* A systematic approach to the literature review is followed. The backgrounds of the military logistics thought, key authors, trends and a new definition of military logistics is presented, among others. *Results:* The findings allow us to identify a set of 21 definitions of military logistics since 1792.

**Keywords:** military logistics; military revolution; transformation; evolution; military logistics thought; technology; art and science

## 1. Introduction

Thought on military logistics arose in two dimensions: as an art and as a science, a transcendent issue for the operational and subsistence dynamics of armies [1]. The above is important because without effective logistics for the support of combat forces, it would be impossible to arm, feed, repair, move, or support the soldier, sailor, or airman in the development of a conflict or future event [2]. The development of military logistics is justified by and related to each period of military logistics revolution (MLR), considering that changing the way an army operates influences the way in which troops are logistically supported [3]. In turn, the MLR emerges from a deep, prompt, and destabilizing change [4], a concept that has been treated by different researchers due to its importance in the relationship between army, states, and the society.

Analysis of military logistics thinking led to the identification of logistics engineering oriented to the economy and businesses, as presented in [5]. In contrast, in military logistics, the study approach was limited to supplying the basic needs of the soldier, such as accommodation, clothing, transportation, food, etc. [6]. The foregoing is due to the insufficiency of economic resources, which is an aspect that led to the neglect of the need to adapt military logistics to the dynamics of the new ways of waging war [7]. Additionally, the evident interdependence between military logistics and technology makes it necessary to develop scientific research projects that allow the implementation of new knowledge [8].

Based on the above, it is necessary to study and to concisely describe the evolution of military logistics thinking through the history of armies, in order to establish current trends and to propose a new military logistics concept. To achieve this objective, the current article distinguishes dimensions, definitions, and practices, and identifies the influence on military revolutions and their relationships with technology, in order to propose a conceptual



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framework for thinking about military logistics, emphasizing the notable aspects that have driven its development, history, and relevance in military logistics literature. This paper also shows points of view of the main specialists in military logistics. Finally, the results are discussed, as well as future opportunities and trends. Therefore, in addition to providing historical definitions and proposing an up-to-date one of military logistics, the contribution of this paper is that it reviews and synthesizes definitions and information not collected before in the academic literature, all found independently in military manuals and doctrinal documents that are not readily available in the published scientific literature.

This paper is organized as follows. Section 2 explains the review methodology, while Section 3 presents the findings. Section 4 presents the fundamental concepts of the context and develops the discussions. The paper ends in Section 5 by presenting the conclusions and the summary of findings.

## 2. Review Methodology

As pointed out in [9], the research methodology employed in this article can be defined as a qualitative approach, inductive process, with narrative design, where a documentary review technique is used to collect data. The development of the theoretical perspective is carried out in two stages: (a) the *analytical review of the literature*, which began with the background check regarding the evolution of military logistics thought through history, and (b) the *construction of the theoretical framework*, using a taxonomical method, with limited and specific background to continue with the investigation process.

A systematic search of references was carried out using the following databases: Scopus, Web of Science, Emerald, Oxford University Press, Taylor and Francis, ProQuest, and Dimensions. This choice will give access to a large amount of literature, including working papers written by specialists in periodical publications, books, book chapters, technical reports, research reports, doctoral dissertations, and archival documents. Keywords such as military logistics, focused logistics, military logistics revolution, military revolution, multi-domain, war domains, and new wars were employed to collect documents. The search strings were used in title, keywords, and abstracts.

A total of 90 documents were selected, corresponding to: 28 journal articles, 9 magazine articles, 2 encyclopedias, 37 books, 3 technical manual, 7 reports, 2 book sections, and 2 doctoral theses. Among this total number of documents, 61 were written in English and 29 in Spanish; 43 were written in the United States, 20 in Spain, 8 in England, 6 in Colombia, 5 in Israel, 2 in Brazil, 2 in Germany, 1 in Canada, 1 in China, 1 in Mexico, and 1 in Denmark.

The following sections present both the findings and their analysis. Key events in the evolution of military logistics are presented; the knowledge included is from prominent authors and their respective studies, as well as the publication and contribution dates, dating from 1991 B.C. until 2022, as indicated in each case.

## 3. Analysis of Findings

As per the review of collected literature, the term military logistics appeared for the first time in the academic literature in 1792, as presented in [10,11]. It was found that there is extensive literature on the development of military history, but the same does not happen with the evolution of military logistical thinking [12]. No research was found that refers to the evolution of military logistics thinking through history, while few articles discuss the evolution of military logistics practice. Other works deal with the decline of military logistics entrepreneurship but emphasize the expansion of its field of action [13]. Some books or encyclopedias deal with the subject in a general way, without keeping technical traceability for follow-up and consultation.

According to the findings of this review, three aspects of the evolution of military logistics thinking emerge from the literature. The first is the timeframe of the military logistics thought, which was documented for the first time in the period of 1991–1785 B.C., during the Ancient Egyptian Middle Empire. The second aspect is related to the definitions

of military logistics, which originated in the first writings dating back to 1792 where the functions of “*Officier de Logis*” were identified. The third aspect is the relationship between military logistics and the military revolutions that includes a first period in the 16th–17th century and explains five periods where the event is also presented. In addition to the description extracted from the literature, the points of view of prominent academics are described as a contribution to the evolution of military logistics thinking.

In order to facilitate the organization of concepts, definitions, dates, events, etc., the information is presented within tables and figures (see below). It is important to specify that the information was structured based on documentary evidence and the contribution to knowledge of this paper is based on the analysis actually carried out.

The findings are summarized next. As an overview, the reader will find information about:

- 21 definitions of military logistics, starting in 1792 until 2019 (see Table 1);
- two dimensions of military logistics, as art and as science (see Table 2);
- seven classic authors of contemporary military logistics with date, work, and contribution (see Table 3);
- 32 antecedents of the military logistic thinking, stating year, event, and contribution (see Table 4);
- the context of the historiographic change (see Table 5); and
- the relationship between military revolution and military logistics (see Table 6).

**Table 1.** Definitions of military logistics.

Year	Definition
1792	Military logistics is limited to the function formerly exercised by the <i>Major General of Logis</i> , who is the officer in charge of lodging or camping the troops, directing the columns, and placing them on the field [14]. This function was also found in the French Army and carried out by the <i>Maréchal Général de Logis</i> , who is in charge of the marches, camps, lodging, green fodder, correspondence with spies, and issuing instructions for the general officers and private commissioners in campaign [10].
1832	Subordinate services which are not part of the development of war [15].
1838	The art of moving armies, including orders and details of marches and field camps, lodging, and supply of the troops [16].
1859	ML is the procurement of men, supplies, and the provision of services to the operating military forces [17].
1863	ML is the art of moving and placing troops, supported by reconnaissance, the art of investigating everything related to the enemy, the territory and the people. For the operation to succeed, it is mandatory to know castration and the art of camping, military positioning, strategy and tactics, as well as all the administrative issues that sustain and provide the army, at all the points it travels, with what is necessary for life and to wage war [18].
1916	ML is defined as science, as “pure” and “applied” concepts. “Pure logistics” is scientific research based on the theory of logistics: its scope and function are in the science of war, with a broad outline of its structure. “Applied logistics” is based on the findings of “pure logistics” and is responsible, according to general principles, for dividing the work in the logistics field, preparing for war and maintaining the war during its duration, including, among others: subsistence and other supplies, transportation, war finance, shipbuilding, ammunition manufacturing, etc. [19].
1965	ML is the process that determines the structure of the force, at the strategic level; supplies the requirements of usable military assets, at the support level; and, at the operational level, deals with the distribution and application of assets, as well as provides the wide range of services and facilities necessary for the movement and sustained support of the combat force [20], as cited in [21].
1988	ML is a special system that creates and supports the military defense capabilities of the armed forces [22].

**Table 1.** *Cont.*

Year	Definition
1991	In the 1991 Gulf War, the Customer Satisfaction business concept was applied, where the soldier was the most important element, for whom fidelity and loyalty were to be earned [23]. With a charismatic and operational philosophy, ML implemented modern procedures to store and transport supplies quickly, coordinating the entire logistics chain to benefit Customer Satisfaction: the soldiers [24].
1995	ML is the process of planning and executing movements and sustaining operational forces; it is the foundation of combat power; it is the bridge that connects the national industrial base with its operational forces [25].
2000	ML is the science that aims to provide the armed forces with the necessary means for war through the logistics cycle [26].
2001	ML is the business of moving, supplying, and maintaining military forces [27].
2002	ML is the discipline that integrates the resources necessary to maintain means of the military process (operations) aimed at achieving the expected results [28].
2002	ML is a multidimensional and complex entity that constitutes one of the most important and essential components of war [29].
2005	ML is a component of the art of war, whose purpose is to provide the Armed Forces with the necessary resources to satisfy in a timely manner and in the necessary quantity the demands of any confrontation [30].
2011	ML provides the basis of combat power for the forces and describes how the nation's economy connects with the fighting forces; likewise, it conceives the process of planning and executing the movement and sustenance of the operating forces in the execution of a military strategy [31].
2011	ML is a complex process, which involves collaboration and coordination between organizations and companies that are geographically distributed and are in charge of supply and transport activities [32].
2016	ML is the set of activities inherent to the transportation, supply, and troop lodging [33].
2019	ML is an area of knowledge that addresses the problem of forecasting and provisioning of supplies and services necessary to ensure or regulate the operation of operating systems [34].
2019	ML is the planning and execution of the movement of forces and their support [35].
2019	ML is a complex process where response times, uncertainty of demand, wide variety of material references, and profitability are decisive for combat ability [36].

Authors' own elaboration.

**Table 2.** Dimensions of military logistics.

Artistic or Qualitative Focus	Scientific or Quantitative Focus
The practical application of the art of moving armies is considered [14].	It is the science, discipline, and technique that deals with the administration, organization, and maintenance of flows of materials, merchandise (goods and services), energy, information, and waste to and from the point of consumption [37].
Volatile and uncertain environments require creativity and flexibility approaches, as a manifestation of leadership, imagination, intuition, common sense, mental flexibility, determination, anticipation, and experience [28].	Activities that refer to the management of resources on the battlefield, based on physical factors, quantitative relationships between parameters and formal rules, computation, and mathematical modeling [28].

Table 2. Cont.

Artistic or Qualitative Focus	Scientific or Quantitative Focus
It is defined as the component of the art of war that aims to provide armies with the necessary supplies to face the demands of war [26].	It is in charge of preparing, obtaining, storing, distributing, and managing the personnel, material, and services resources required by the military forces for their operation in times of peace and for the execution of their operations in times of war [26].
	It was established as extremely important for young German logistics officers to receive war science training, subjects such as arithmetic and geometry, geography (map reading); in addition to field work (practical field exercises) [38].

Authors' own elaboration.

Table 3. Classic authors of contemporary military logistics.

Authors and Year	Work and Contribution
Carl Von Clausewitz (1780–1831)	In <i>De la Guerra</i> , he establishes differences between strategy and tactics, affirming that they have rules that depend on the structure of society, its resources, its productive capacities, and its technological genius [15].
Antoine-Henri Jomini (1779–1869)	In <i>Summary of the Art of War</i> , he determined three levels in military technique: (a) strategy decides where to act; (b) the logistics carry the troops at the designated point; and (c) the tactic determines the method used at the decisive point; likewise, it extended the range of functions of the general staff in movement and support, planning, administration, supply, cantonment, camping, and constructions, reconnaissance, and intelligence [14].
Alfred Thayer Mahan (1840–1914)	In <i>The Influence of Sea Power Upon History</i> , this author links logistics with industrial mobilization and war economy [39].
Emory Upton (1839–1881)	Considered the Mahan of the US Army, reformer and military strategist. In 1904, with his work <i>The Military Policy of the United States</i> , he introduced reforms to advanced military education, a system of military personnel evaluation and promotions by examination, reforms to the army general staff introducing the Prussian army model, among others. His works contributed to the high level of effectiveness of the US Army in World War I.
Henry Effingham Eccles (1898–1986)	In <i>Logistics in the National Defense</i> [17], <i>Military concepts and Philosophy</i> [40], and <i>Military Power in the Free Society</i> [41], this author expands Thorpe's trinity to five components: Strategy, Tactic, Logistics, Intelligence, and Communications. The logistics function stands out as (a) a military element that articulates with the national economy, (b) an economic element that articulates with military operations.
Cyrus Thorpe (1875–1936)	In <i>Pure logistics: The science of war preparation</i> , he outlines pure and applied logistics; he considers the trinity: Strategy, Tactic, and Logistics [19].
William G. Pagonis (1941–)	<i>The Gulf War</i> highlighted by the transition from a distributed logistics command to a unified logistics command in the theater of operations, to be responsible for sustaining operations. Pagonis was in charge of the reception and distribution of supplies; he established logistics bases in key positions near supply routes, and he delegated powers to its commanders to replenish forces and protect supply and hauling lines. This was an innovative proposal that guaranteed a quick response to the critical requirements of the troops in the vanguard; he adapted the logistics to the operational concept and conceptualized the deployment in five phases, which were flexible and fast in applying the initiative; he achieved the historical accumulation of material, with rapid distribution and redistribution [42].

Authors' own elaboration. Note: Some authors who have functioned as the most outstanding reformers in contested logistics are listed, because they have contributed with applications of business logistics to military logistics, such as: Elihu Root (US Secretary of State 1905–1909, Secretary of War 1899–1903); James Huston (Military Historian, Professor, Director for the National Defense Education, Act History Institute at Purdue University, Member of the faculty at the National War College, Washington D.C.); Robert McNamara (Businessman, Politician and US Secretary of Defense between 1961–1968); John Keegan (Military Historian, Professor of Military History at the Royal Military Academy Sandhurst, Princeton University and Vassar College, Daily Telegraph Defense Correspondent); and Henry Kissinger (National Security Adviser 1969–1975, Secretary of State 1973–1977).

**Table 4.** Background of military logistics thinking.

Year	Event	Contribution
1991–1785 B.C.	<i>Ancient Egypt Middle Empire</i> : the warriors fight bare-chested and barefoot, they only carry light shields; warrior technology is outdated for the time; their endowment weapons were flint-tipped sticks and spears [43]. Scarce rudimentary military logistics provides food for men and animals.	Evidence of weaponry for the warrior, light shields, sticks, and spears with a stony point, rudimentary logistics.
9th century–610 B.C.	<i>Assyrian Army</i> used chariots (with two horses) as the main method of displacement, primitive units of engineers are identified which facilitated the passage of rivers, disposition of siege weapons, and the installation of mines under enemy walls; equipment was available that allowed warriors to be manned and supplied, recruited by way of cabs (compulsory service), feudal militias, and auxiliary troops were used [44]. Provisioning for transport columns and <i>pontoneros</i> brigades, the Assyrian army was the first force capable of campaigning nearly five hundred kilometers from its base, moving at a speed that would not be exceeded until the appearance of the internal combustion engine; the war material, chariots and horses are centralized in warehouses called <i>Ekal Masharti</i> (palace of the place of order of forces) [45].	The logistical support in mission development is primitive, using means for mobility and transportation; small units of engineers were used, equipment and supplies were established; activities for the recruitment of troops were decreed.  Outstanding logistics preparation for supplying and transportation with movement and speed capacity, the war material and transportation are centralized in warehouses.
700 B.C.	<i>Assyrian Army</i> , applied a logistics organization to the army, provided fundamental logistical support in the development of the military campaigns, planning its actions according to the harvest season [46].	Evidence of the first application of logistics organization in an army; initial planning of supply routes is shown.
480 B.C.	<i>Greek Army Battle of Salamis</i> : supply routes are stipulated and secured, two pontoons were built in the Helespondo Strait guaranteeing supply [47].	The supply routes were defined, construction or improvement of the supply routes and disposition of security units are evidently key factors to win the battle, according to the logistician.
400 B.C.	Sun Tzu in the book <i>The Art of War</i> outlines the logistical support strategy for a country and its army [48].	The logistics support strategy is defined.
338 B.C.	Filipo II of Macedonia establishes the personal equipment for the soldier, with the purpose of acquiring greater mobility and less dependence on animal cargo; reduction of soldiers' servers, each soldier carried his victuals. Technical or engineering services were identified (assault towers on wheels, catapults, and material for river passages), luggage train, quartermaster, doctors, surveyors, and postal service [49]. The use of the sarissa stands out as the most characteristic weapon of the Macedonian army [50].	Organization of the soldier's personal equipment.  Implementation of technical services, quartermaster, health service support, engineers, and communications.  The use of technology in weapons is highlighted.

Table 4. Cont.

Year	Event	Contribution
510 B.C.–190 A.D.	<p><i>Roman Military Supply</i>, two supply systems for the army are typified: campaign and static; the baggage for the troops in the campaign was formed (<i>impedimenta</i>) without limiting their maneuver and warfare; the autonomy of the military unit was identified according to the carrying capacity per soldier, being about 60 pounds (20 kg) without weapons. In addition to weapons carried by animals and carts for the campaign, a soldier carried his/her own weapons (18–22 kg), clothes, kitchen equipment, and food rations. At the end of the 2nd century B.C., C. Marius was the precursor of the military reform that reduced the common baggage to a greater weight per soldier for 15 days in the campaign.</p>	
	<p>The <i>Cursus Publicum</i> communication network (mail) system was created, carried out by the young, who traveled long distances; sometimes horse-drawn carriages or carts were also available which also transported officers; in principle, no one responsible for the mail was known, but later such a function was assigned to the <i>Praefectus Vehiculorum</i>.</p>	<p>Classification of supply for troops into two categories: campaign and static; autonomy of the troops.</p> <p>Communication and mail systems are created and used for the troops in front line.</p>
	<p>At the time of Claudio-Nerón or Vespasian, the position of <i>Praefectura Vehiculorum</i> was created, which is reconciled at least twice with that of <i>cura copiarum exercitus</i> (supplying), in the first and second German campaigns in the time of Marco Aurelio, to manage the public mail service, personnel, transportation, and infrastructure and with the irrefutable function of supplying the army.</p>	<p>The provisioning position of the army is designated <i>Praefectura Vehiculorum</i>, an important advance for transportation.</p>
	<p>The position of supplier of the army is created in the period of Marco Aurelio (<i>praepositus copiarum expeditionis Germanicae secundae</i>) in charge of Claudius Candidus, aided by an imperial slave (<i>dispensator rationum copiaum</i>).</p>	<p>Designation of the post of army provider and dispensator (administration and supply of a field army, at various levels of organization).</p>
	<p>Management and supply levels of a campaign army are identified, a <i>praepositus</i> located in the theater of operations examines logistical needs, turns to a dispensing supplier to obtain supplies through purchase or seizure, while leaning on the <i>Praefectus Vehiculorum</i> to obtain supplies from remote points and move them to the required point [51].</p>	

Table 4. Cont.

Year	Event	Contribution
356–323 B.C.	<p>Alejandro Magno, supply routes, supply cycles, and supplies for the army are implemented. Likewise, strategies are developed based on terrain characteristics for the supply of troops.</p> <p>The practice of preserving suppliers and supplies for the army is used, the soldiers used to acquire food from the merchants. The supply cycle was controlled by General Eumenes de Cardia, secretary general of the army; records of the troops were kept, food deliveries and equipment payment were regulated. Optimization of the logistics support train, the presence of children and women was prohibited on certain routes, combat trains were reduced, and their load was defined. The load capacity of man in relation to that of the horse is specified. The soldier's equipment for the war is defined, consisting of a helmet, shield, leather breastplate, his spear or <i>sarissa</i>, and utensils; the heavy infantry wore a metal breastplate and a bronze leather fishnet skirt [49].</p>	<p>Prioritization and optimization of the army's logistics support, selection of routes, preservation of suppliers, optimization of the logistics support train, determination of the man-load capacity vs. horse-load capacity, definition of war equipment for a field army, classification of the soldier's equipment according to his branch.</p> <p>He integrated logistical requirements in every facet of his military theory, doctrine, strategy, tactics, and administration [52].</p>
218–201 B.C.	<p>Anibal Barca, the logistics supply system had a sophisticated method that allowed them to source all the materials and food they required during the campaign. Military logistics consisted of three phases: the acquisition of the product, its transportation, and its distribution; the acquisition was made through hunting and gathering (daily activities soldiers), the nearby populations would represent the main point of obtaining supplies (agreed with the local elites or obtained violently).</p> <p>At the start of the Second Punic War, 20 percent of the Roman legions' troops were servants in charge of taking care of the baggage (getting water and firewood); Each soldier carried a baggage pack of personal items (a glass to drink and a bowl to eat) that weighed around 01 kg; in addition to food and fuel; rations for three days, each weighing 1 kg, plus 2 L of water or wine daily; he also had to carry part of the equipment of a tent, including his sleeping mat (3 kg), lochos (1 kg), and his personal belongings (1 kg), to that weight he must add the clothing and weapons that completed his equipment (between 20 and 31 kg); its troops carried out tasks of quartermaster maintenance [53].</p>	<p>Organization of the logistics supply system, structuring of the military logistics in phases (acquisition, transportation, and distribution).</p> <p>Standardization of the soldier's field feeding gear.</p> <p>Selection of suppliers and supply areas for the troops.</p>
49 B.C.	<p>Pompeian Troops of Ilerda had rations in campaign for 22 days, Cicerón for 15 days, Severo Alejandro 17 days and the Emperor Juliano from 17 to 20 days; in one day of march the soldiers walked approximately 40 km, the radius of action of the Roman troops was 320 km maximum, and they returned to their starting point, with a time of 8 days between the departure and return [51].</p>	<p>Organization of campaign rations for soldiers from 15 to 20 days, considering not limiting the campaign's ongoing maneuver.</p>
5 B.C.	<p><i>German Campaigns of Tiberius</i>: logistics was conceived through provisioning parallel to movement routes (river, sea, or land), through the Elbe River and the North Sea coast [51].</p>	<p>The campaign strategy is conceived with the influence of supply routes, provisioning parallel to the axes of advance (waterway, sea, land).</p>

Table 4. Cont.

Year	Event	Contribution
A.D. 501–1460	<i>Army of the Byzantine Empire:</i> supplies were provided by the populations, the troops carried out tasks of keeping the mayor in charge; they had indigenous military engineers, capable of crossing rivers with boats and of establishing bridgeheads under the protection of crossbow machines; likewise, they had organized the transport of the intendency and the sanitary service. The army was divided into combat troops and troops for the services; they had all kinds of equipment, a supply column and a first aid corps; the recruitment of native Byzantines for the service was complex, so the units were made up of mercenaries [48].	<p>Planning and location of supply areas, equipment maintenance is stipulated for each soldier.</p> <p>Creation of military engineer units with defined capabilities.</p> <p>Campaign training for the means of transportation, quartermaster and the health service in the campaign.</p> <p>Organization of army troops (combat and services); activities for the recruitment of troops are identified.</p>
1561–1600	<i>Military logistics during the Renaissance:</i> armies have greater dependence on resources, high number of fortified places or warehouses, produced a dispersal of troops, logistics reduced the mobility of armies by having to transport the equipment with them, an army is not only mediated by the number of soldiers but also by the camp followers. In 1643, the quartermaster branch was created with the purpose of supplying these armies, the selection of safe supply routes was evident, the geography irrigated by channels and rivers determined the choice of marching routes, and logistics became a factor of the first order in the art of war [49].	<p>Organization of logistics in the theater of operations, in 1643 the quartermaster for the supply of armies was created, safe supply routes were established, characteristics of the terrain key aspect in the selection of supply routes.</p>
1740–1821	<i>Revolutionary time:</i> the logistics system was based on dependence on warehouses, the agricultural revolution freed the armies from fixed points, the rivers were no longer obligatory points, the entire theater of operations was used, and the defense tactics of fixed deposits changed to the protection of communication lines [49].	<p>Greater mobility of armies due to greater availability of resources, use of the entire theater of operations, change of tactics from defense of warehouses to protection of communication lines.</p>
1853–1856	<i>Crimean War:</i> advances were made in the strategy of supplies, generating a greater need for coordination in logistics functions; assuming greater importance communications, the telegraph and a greater emphasis on training for officers in land navigation, training of officers of the administrative corps of the logistics branch, knowledge in strategy and tactics, medical care for the wounded, creation of bases of logistical support [46].	<p>Advances in supply strategies, greater use of communication equipment for logistics activities, differential training for logistics officers and incorporation of administrative officers in the logistics service and the creation of the bases for logistics support.</p>
1861–1865	<i>The American Civil War:</i> adequate logistical infrastructure is used for the support of mass armies, recruitment, troop training, equipment, supply, evacuation system for the wounded; likewise, advanced first aid centers are activated and the number of surgeons, nurses and stretcher bearers regulated by military units; there is a significant use of the railway for the supply and movement of troops; the development of the war glimpsed logistical demands of future wars [46].	<p>The approach of a new logistics strategy was evident in accompaniment to the combat system for the development of new wars, the federal organization and logistical support was highlighted by European observers [53].</p> <p>The supply lines in the theater of operations were extended due to the use of the railroad.</p>

Table 4. Cont.

Year	Event	Contribution
19th century	<p>Military logistics and supply were between the traditional system of trains and warehouses or obtaining supplies on the field, the use of the railway is identified: (1) in Great Britain (1825) as a way of transporting mines; (2) for the transfer of armies over long distances (500 km per day); (3) supplies of necessary forces and movements to the meeting area. Canning cans are created in 1810, with massive use in military logistics in 1870 [49].</p> <p>Modern European military logistics is divided into two periods: (1) according to the supply systems used which divide logistics into the period of the standing armies and the period of the predatory war (use of trains for supplies); and (2) means of transportation, which divides military logistics into the period of horse-drawn carriages and the period of the railway and the age of the motorized truck [54].</p>	<p>Evolution in the mobility of the armies and extension of the supply lines or routes with the use of the railroad and the age of the motorized trucks to transport the supplies of the troops.</p> <p>The use of tin cans in troop supplies.</p>
1914–1918	<p><i>First World War</i>: the maintenance of the combat positions allowed the building of tracks, warehouses, workshops, hospitals, and docks for supplies loading and unloading. The development of logistics was increased to help the difficult conditions of the combatants (post office, rotating permits, rest areas, amusement areas, first tests of psychological support); transportation also showed a notable development in light and mechanical vehicles. In 1917, motorized transport became generalized and the use of the railway network increased [49].</p> <p>The great increase in the consumption of supplies (ammunition) created demands that could only be supplied consecutively from an industrial base [55].</p>	<p>Logistics presented an accelerated growth; the use of railways became general for the requirements of the troops and the war.</p> <p>The well-being of the troops was used, and the logistics were used for that purpose.</p>
1916	<p>The concept of pure logistics was born, as a theoretical, abstract, and scientific field, with a scope to function in the science of war and a broad organization scheme similar to scientific research in its application, which like other sciences was divided into pure and applied [19].</p>	<p>In the postwar time the concept and its implementation had a notable effect on the American military establishment.</p>

Table 4. Cont.

Year	Event	Contribution
1939–1945	<p><i>World War II</i>: enormous efforts are made in logistics maintenance, transportation, and supplies; extended supply lines are presented where the use of the railroad and the use of canned goods was massive; motorized transport was integrated with the railway lines and allowed the movement of products to the meeting areas of the armies; the road network was increased, especially in Germany; the term logistical collapse is used due to the operation of mechanical vehicles and the impossibility of supplying fuels; a logistical revolution is generated due to the need to supply large contingents, especially in the theater of operations. The North Americans include business visions, a matter that advanced the logistical art, increasing the logistical capacity of the armies, by keeping them endowed and with sufficient supplies for the war, developing the concept of the logistic base, which incorporated ports, airports, and railway terminals front line army level. There was mass use of elements such as forklifts, cargo pallets, standardized containers, prefabricated warehouses, and mobile artificial docks; industrial capacity was at the service of armies; supplies were shipped above actual needs; there was massive employment of military engineers to facilitate the mobility of motorized and armored troops [49].</p>	<p>Impressive development of logistics, including maintenance, transportation and supplies, massive use of rail and canning in campaign rations for troops, integration of means of transportation with supply routes, first use of the term collapse logistics, a logistics revolution is conceived in the face of the need to meet the requirements of the troops.</p> <p>Business visions are incorporated into military logistics, giving rise to logistics by capabilities; the concept of logistics base is applied.</p> <p>Massive development of military engineers to facilitate the mobility of troops.</p>
1945–1991	<p><i>The Cold War</i>: new organizations were created for the handling of new weapons, logistics was governed by huge budgets destined for the arms race, the concept of operational logistics was born as an intermediate level between the concepts of strategic logistics and tactical logistics; the need to maintain a military industrial base was created; the use of containers for cargo transportation and the improvement of the evacuation and hospitalization system was massive; mobile surgical hospitals (MASH) were created to reduce the combat death rate; likewise, the intensive use of helicopters is generated for all kinds of operations, especially in the <i>Korean War</i> (1950–1953). It is important to highlight the massive use of helicopters as a means of transporting supplies and troops. With the creation of portable hospitals and the use of sliding pallets for loading and unloading aircraft, fixed landing for unloading was avoided. <i>Vietnam War</i> (1964–1975): the participation of civil agents in logistical support increases, to the extent that the civilian reserve fleet, companies and civilian equipment, transported around 30% of the cargo and 90% of the airborne troop; also, before starting the offensive, huge amounts of resources were accumulated, until completion of the 60 days of autonomy that had been set as the objective of the First Persian Gulf War [49].</p>	<p>The concept of operational logistics is born as an intermediate level between the concepts of strategic logistics and tactical logistics.</p> <p>Development of the evacuation and hospitalization system, creation of mobile surgical hospitals (MASH)</p> <p>Aerial means are used to transport supplies for the troops.</p> <p>Increased participation of civilian agents in the logistical support of the troops.</p> <p>Accumulation of huge amounts of resources to guarantee autonomy according to planning.</p>

Table 4. Cont.

Year	Event	Contribution
1988	Peppers [22] emphasizes the interdependence between strategy, tactics, and logistics, highlighting the necessary coordination between air, land, and sea forces, considering limited resources and highlighting the importance of logistics infrastructure and its planning for the performance of military capacity [56].	The interdependence between strategy, tactics, and military logistics is academically evident, as well as the importance of logistics planning to strengthen combat capabilities.
1990–1991	<i>Gulf War</i> : involved the systematic labeling of everything that moved to have an exact knowledge of the resources available or in transit (capacity, availability, and immediate rerouting of resources). American forces applied the principle of distribution-based logistics: the concept aims to ensure support for deployed forces through speed and precision in distribution; to reduce the number of resources to accumulate without reducing the capacity of effective support, the new system is based on three basic pillars: visibility, capacity, and control. The transportation requirements guaranteed the units that their logistical needs would be met with opportunity from the rear, which implies a very powerful, more agile and flexible transportation system; the logistics units were integrated with the tactical command and control system to be able to know the situation of the units and even anticipate their needs. The knowledge allowed them to apply anticipatory logistics; the new operational logistics and the use of modern technologies allowed logistics companies to fulfill the purpose of executing adequate support at the required time and place, based on updated and anticipated information [57].	<p>The principle of distribution-based logistics is applied, based on three pillars: visibility, capacity, and control.</p> <p>The new operational logistics used technology to redirect supplies, which is why the logistics units were integrated with the tactical command and control system.</p>
1995	<i>Focused logistics (FL)</i> is an operational concept that integrates logistics, information, technologies, and transportation, generating a rapid response to face a crisis, deployment, and/or sustainability [57]. It was implemented by the United States Army in pursuit of transformation, to achieve new capabilities of the future joint force, across the spectrum of conflict, in the course of military war operations and in non-war military operations, enabled by information technology and superiority. A total of four concepts were developed: (1) the dominant maneuver, (2) precision combat, (3) full-dimension protection, and (4) focused logistics [58,59].	With the implementation of FL, an operational advantage was obtained, favoring the operations of the dominant maneuver, that is, facilitating the concentration of forces quickly, as well as their dispersion, in multiple scenarios.
	FL was defined as the ability to provide the armed forces, personnel, equipment, and supplies required, in the right place, at the right time, in the quantity mentioned, throughout the spectrum of military operations, through a real-time and network-based information system [60].	

Table 4. Cont.

Year	Event	Contribution
1999	Unrestricted war, also called unlimited combined war [61]. Based on six principles: omnidirectionality, synchrony, limited objectives, unlimited measurements, asymmetry, multidimensional control, adjustment and complete control of the process, and minimum consumption; the latter proposes the use of resources under a logistics defined by technology, with three conceptual conditions: the rationality of the use of resources, the form of combat is the determining criterion that conditions consumption for combat, and employing more (measures) to pursue less (consumption); that is, achieve the objective by minimizing the consumption of resources [62].	The logistical approach refers to exercising control over the consumption of resources when making war, emphasizing that the correct way to save resources is by making rational use of them, an aspect that the author calls economizing.
2000	Expansion of operational concepts, in search of transformation, the United States Army expanded concepts from 4 to 6: (1) dominant maneuver, (2) precision combat, (3) focused logistics, (4) full-dimension protection, (5) informational operations, and (6) joint command and control [63].	Improved in: (a) the ability to organize the troops and provide them with what is necessary at the point of origin or advanced strategic bases, transport the forces and provide logistical support in the theater of operations and direct assault on targets, reinforce initial troop forces, maintain forces in protracted combat operations with supplies and reinforcements; (b) a rapid response was achieved considering that as the size of the army decreases, the logistical requirements and, in turn, the needs for strategic reserves increase; (c) allowed the use of lower levels of pre-positioning.
2005	<i>Swarming War</i> occurs when multiple units perform a converging attack on a target from multiple axes; attacks can be long range or short range, the swarming can be planned or opportunistic, attacking units quickly converge on the target and then scatter, using swarming maneuvers to disorganize the enemy and undermine their will to fight [64].	Smaller logistics units, with a smaller logistics footprint or queue, less logistics dependency, temporarily operating outside of communications to carry out convergent attacks, application of the focused logistics concept.
2007	Focused logistics adapted to the <i>Diffuse War</i> , as a concept of the virtual mass (units scattered throughout the battlefield, independent, with firepower and communications), using technology supplies the necessary resources to the molecule (combat unit) according to the changing needs during the battle, in real time and quickly, with the ability to supply transportation and the necessary equipment for repositioning in the theater of operations; it uses the command and control system; as well as the redistribution at the precise moment so as not to affect the diffuse structure of the units, which are independent and move at the same time [65].	Using technology, a focused, dynamic, versatile, and fast logistics is used, with the capacity to provide the resources to the units at the right time, in the required quantity, throughout the theater of operations and without affecting the capabilities of the virtual mass structure.
2017	<i>Multidomain Battle</i> : a concept that allows the deterrence and defeat of the strategies of the adversary physically, virtually, and cognitively, using combined arms in and across all domains (land, sea, air, space, electromagnetic, and cyber) in contemporary warfare jointly exploiting initiatives to achieve campaign goals [66].	It requires logistics and sustainment with joint functions, with the ability to deploy and sustain forces through a global network of fixed and mobile bases (expeditionary and clandestine), to allow sustained operations at the necessary rate for the required duration.

Table 4. Cont.

Year	Event	Contribution
2017	<i>Mosaic War</i> is based on the recognition of the asymmetric technological advantage of the United States, harnesses the power of dynamic, coordinated, and autonomous composable systems, enabling complex strategic moves by composing multiple contributing systems, in which individual components can respond to needs in real time; the goal is to fight as a network, to create a chain of (non-linear) network effects to deter and defeat the adversary in all domains (sea, land, air, space, and cyberspace) [67].	In logistics, cost and footprint are reduced, due to the use of smaller and more disaggregated platforms than the conventional trunk and branch refueling system [68]. Capable of redirecting quickly, allowing the development of new maneuvers based on decision, speed, and with multiple courses of action, application of the <i>focused logistics</i> concept in the development of processes and tools.
2019	<i>Joint Warfighting Concept</i> , built around the National Defense Strategy (2019). The concept foresees potential conflict with symmetrical adversaries who possess the capabilities to threaten all domains.	The concept describes a conflict of such magnitude that not even the national territory of the main military powers can be challenged [69].
2019	As part of <i>Joint Warfighting Concept</i> , the <i>Joint Concept for Contested Logistics</i> was introduced, which aims to achieve agile and resilient military logistics to achieve the three main aspects: Resilient Integrated Logistics Command and Control; assured Joint Power Projection and Sustainment for Distributed Operations.  “ <i>Contested Logistics Environment</i> is defined as an environment in which the Armed Forces Engage in conflict with an adversary presents challenges in all Domain and Directly Targets logistics operations, facilities and activities in the Unites States, abroad or in transit from one location to the other”.	The US national strategy anticipates the need in adverse environments not previously contemplated or experienced. The objective is to Shorten “Targeting Cycle 2O/DA” (observe, orient/decide, act), significantly achieving the speed that guarantees to overwhelm the opponent to create security in the theater of operations and in turn break 2A/AD (anti-access/area denial) of the opponents.  These new conditions require the military services to seize and develop next-generation capabilities in the field of strategic, operational, and tactical military logistics implementing the cutting-edge technologies of the Third Compensation Strategy such as learning machines, human-machine combat teaming, network enabled autonomous platforms, among others, with the aim of prevailing in a multi-domain contested environment [70].

Authors’ own elaboration.

From the analyzed literature, we observed that the military logistics concept refers to the technical services and sustenance of the troops of an army. Table 1 presents an historical review of definitions of military logistics, starting from 1792. It is important to note that, according to our analysis, authors have placed logistics in two dimensions: as art with qualitative focus, and as science with quantitative focus, as summarized in Table 2. This table presents the concepts, which refer to each discipline; their performance is not evaluated, because their effectiveness is considered to lie in the application depending on the situation or context of the event in actual decision-making.

Six authors were also identified who, due to their works and contributions, have stood out in the evolution of military logistics thinking. The contribution of each of them is explained in Table 3. These authors, each at a given time in history, contributed to the current understanding of contemporary military logistics. Table 4 presents a chronological relationship of the background, stating year, event, and contribution, where the participation of the logistics system in support of the central missionary system is highlighted, emphasizing the evolution in the different scenarios, technology, and the evident adaptation in each period to the related historical context. This evolution is also graphically depicted in Figure 1, with timeline and events in military logistics evolution.

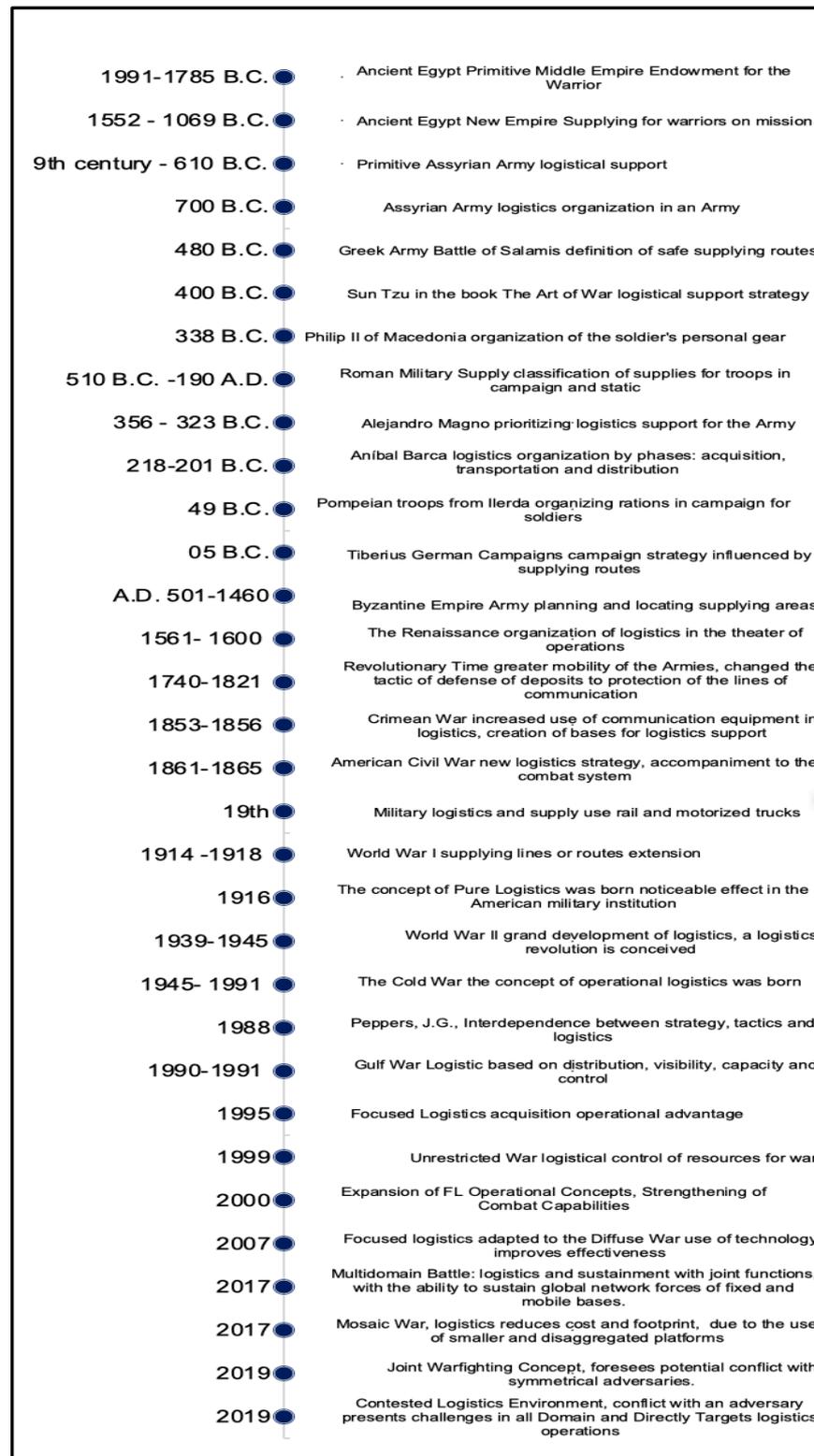


Figure 1. Timeline and event in military logistics evolution.

After studying the background in military logistics, it is possible to identify a relationship between a concept in military logistics and the period in which a military revolution (MR) was presented, as also pointed out in [71]. As a matter of fact, Table 5 presents the changes of definitions in context, the concepts considered necessary to identify the context and later the previously reported relationship as evidence from the review of literature.

With the purpose of determining the existence of the military logistics revolution in the periods of time in which a military revolution occurred, the information obtained from historical data is compared with reference to the development of military logistics in such periods of time. The conceptual developments supporting this statement are mentioned.

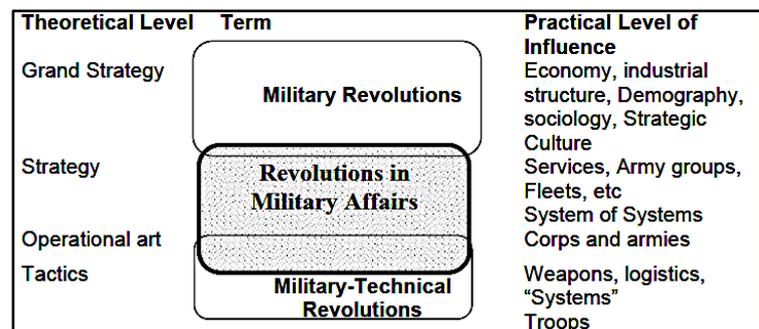
**Table 5.** Definitions to contextualize the change.

Year	Type	Definition
1980	Technical-Military Revolution (TMR)	Change of operational and tactical consequence, exclusively military, caused by the entry into service of a new weapons system, with an impact on the tactical and operational conduct of the war [72].
1993	Revolution in Military Affairs (RMA)	Change in the nature of war, derived from the application of new technologies that, combined with changes in military doctrine and operational concepts, fundamentally alter the nature and conduct of war [73].
1995	Military Revolution (MR)	They profoundly alter the structure of war by profoundly transforming society, the state, and military organizations, modifying their capacity to create and project their military power [74].
1997	Transformation (T)	Process by which the armed forces adapt to the technological, strategic, operational, and tactical requirements of the 21st century world [75].

Authors’ own elaboration.

#### 4. Fundamental Concepts of the Context and Development of the Discussions

Next, RMA, RM, and TMR concepts are explained, stating that, for the development of the current paper, the focus will be on the MR concept, considering that it is transcendental to notice events in the military field that changed the dynamics of waging war, its relationship with society, and the state and the contribution of military logistics, in each event formulated. Figure 2 presents a comparison of the terms described in Table 5, to perceive the participation of RMA and TMR in global contexts and to understand the deep transformations that have historically occurred in the military field and their influence on the state and society.



**Figure 2.** Comparative Terminology in TMR-RMA-MR (source: [76], p. 11), adapted by [77].

It is necessary to identify the relationship between MR, RMA, and TMR, in order to understand the influence of logistics on MR. Indeed, it is necessary to cite authors such as Andrew Marshall, who states that “Technological innovation can make a military revolution possible, but it will only happen when new operational concepts and new forms of military organization are developed” [72]. Evidencing that in order to create a new form of organization logistical adaptation is necessary to assume this new capacity, MR with global reach alters the relationship between state, society, and war [74].

The TMR takes on importance as the predecessor of RMA and considers technology as a factor of change, considering that in some events weaponry or technology have changed the way war is waged [78]. The RMA, derived directly from the TRM, was incorporated by Andrew Marshall in 1993, to describe “changes in procedures, tactics, doctrines and organization in the armed forces as a result of the use of information technologies”. It is a transformation limited to the military scope, with strategic scope optimizing the method of making war [78].

Authors, such as Colom [77,79], identify the following military revolutions, explaining in each period where an MR was presented in a prudent and independent way. The change between one and the other is significant and, as in any evolutionary process, events in the military field that involved aspects such as technology, needs and strengthening the capabilities of an army, contributed to the evolutionary process. Table 6 describes the relationship between military revolution and military logistics. When reviewing the progress of the military logistics evident in each MR, it is observed that, in each period, a military logistics revolution occurred, which makes it necessary to (re-)define the concept.

**Table 6.** Military revolution and military logistics.

Military Revolution	Military Logistics Development
The creation of the state and modern armies (XV and XVI century)	<p>Use of new technology represented in firearms, harquebus, bows, greater use of cannons, use of gunpowder, and the use of mathematical calculations, such as ballistics, allowed the construction of parts and ammunition, use of lighter cannons, use of interchangeable parts in the barrels, technological innovation that generated logistical innovation, and later the substitution of the arquebus for the musket [80].</p> <p>Greater mobility of armies, development of supply and supply tasks for troops [46].</p> <p>Organization of logistics in the theater of operations, creating the quartermaster for the provision of professional armies, safe supply routes are established (safety supply routes), planning for selection of supply routes, defense deposits [49].</p>
The French revolution and the industrial revolution (late XVIII and early XIX centuries)	<p>Greater troop transport capacity is acquired, supply lines are extended, there is a complex recruitment system, greater availability of resources, use of the entire theater of operations, and change of tactics from defense of deposits to protection of communication lines [46].</p> <p>Greater use of communication equipment for logistics activities, creation of the bases for logistics support, proposal of a new logistics strategy, in support of the combat system, for the development of new wars, use of the railroad to transport supplies of the troops generates the evolution in the mobility of the armies and the use of tin cans in the supplies of the troops [49].</p> <p>Development of precision rifles and cannons, the machine gun and the explosion engine emerged, innovation with the telegraph [50].</p>

**Table 6.** *Cont.*

Military Revolution	Military Logistics Development
World War I (1914–1918)	<p>Logistics showed an accelerated growth, the use of railways became general for the requirements of the troops and the development of the war, logistics was used for the well-being of the troops, there were technological advances (internal combustion vehicles, airplanes, or submarines), maintenance, transportation and supplies, massive use of rail, canned supplies were used in rations for troops, integration of means of transport routes to supply, and logistics revolution was conceived from the need to meet army requirements [49].</p> <p>Business visions are incorporated into military logistics, giving rise to logistics by capabilities, the concept of logistics base is applied, massive development of military engineers to facilitate the mobility of troops [81].</p>
The nuclear revolution	<p>The concept of operational logistics was born, an evacuation and hospitalization system were developed, the creation of mobile surgical hospitals (MASH), the use of aerial means to transport troops supplies, increased participation of civilian agents in the logistical support of troops, the principle of distribution-based logistics was applied, based on three pillars: visibility, capacity and control, and use of weapons of mass destruction [49].</p> <p>Use of logistics technology for the rerouting of supplies, integrated with the tactical command and control system [57].</p>
Postmodern Military Revolution	<p>It involves a transformation that institutes tactical, social, political, organizational, and technological changes that, created by the military revolution, lead to a new conceptual approach to the phenomenon of war [74]. The transformation can be brought about by a revolution in the power structure of the international system, an economic and technological revolution, social, cultural, and demographic transformations and a socio-political revolution. They promote a different concept of how to develop conflicts, given the increase in military capabilities resulting from the use of new information and communication technologies; the Gulf war is an example of this [82].</p>

Authors’ own elaboration.

#### 4.1. Military Logistics Revolution (MLR)

According to Eric K. Shinseki, “the goal of the transformation is to deploy a force that is strategically responsive and dominant at every point on the spectrum of operations” and he determines that supporting that vision requires army logistics to make a quantum leap in strategic response, stating that this change is called the revolution in military logistics and is nothing other than knowing what the soldier needs before requesting it [3]. The MLR focuses on improvements in automation, communications, business practices, command, and control restructuring to provide a better command unit and a lower logistics footprint. Distribution technologies were also developed that facilitated better performance and continued maintenance while the army built its future objective force [59].

#### 4.2. Current Trend in Military Logistics: Focused Logistics

The application of the concept of focused logistics (FL) was identified in the review. It is defined as the ability to provide the armed forces with the appropriate personnel, equipment, and supplies in the right place, at the right time, in the right amount, in all the spectra of military operations [63]. It is necessary that, in conjunction with FL, the integration be strengthened with the use of available technologies at the service of military logistics and the defense sector, to be used in future logistics operations, changing the traditional way of responding to the requirements of soldiers [83]. Strengthening the discipline of decision-making in the logistics area was statistically validated [84].

### 5. Summary and Conclusions

The development of this paper highlighted the fact that military logistics has not been technically studied in detail historically. Although there is extensive literature regarding the evolution of the science of war, no documents were found that show chronological evidence of the systematic development of military logistics. It was evident that, with the passage of time, the evolution of logistics thinking is found in the literature but oriented towards the economy and business.

The study of military logistics in many armies is limited to the basic needs of the soldier, such as: lodging, clothing, transportation, food, etc. [6]. This is due to the fact that the needs of the troops in this sense have evolved slowly, especially in the armies that, due to the economic conditions of their countries, do not obtain sufficient resources and those assigned are scarcely enough for their operation, neglecting the need to adapt military logistics to the dynamics of the new way of making war [7]. They lack the resources for investment that would allow them to generate innovation, research, and development [84,85].

The present investigation contributes to the knowledge of this new article where the evolution of thought in military logistics through history is studied in a technical and detailed way. A total of 31 periods of time were found where the participation of military logistics was evidenced, a matter that allowed us to build a scenario to present the evolution of military logistics thinking from the years 1991–1785 B.C. until the year 2019. The information was analyzed and processed by the authors, and tables and figures are presented where the evolution of military logistics thinking is evidenced and the contribution to knowledge, focused on military logistics, was made from the analysis carried out and was provided in each case. The result of this research serves as a basis for future research that intends to delve into the topics described or include new topics.

Military logistics was developed in two dimensions, as an art and as a science, applying, according to its nature, different historically evidenced concepts, which were useful for the support of armies. However, today, it is necessary to develop a mixed discipline that integrates the two dimensions mentioned and has the capacity to respond to the needs of the troops before they are required, applying avant-garde concepts such as focused logistics, in order for the operation of an army to be improved and its cost and benefit optimized.

Based on the literature review, a new concept in military logistics is proposed and defined as the science that continuously studies, plans, manages, and systematically executes the process of timely supply of the necessary resources for the operation of armed forces, in the domains of war, using the technologies and means available to dynamically contribute to the development of the operation and the maneuverability of the units.

It is evident in the literature that every time a military revolution occurred, a military logistics revolution occurred, which allowed states to acquire, maintain, and/or improve the capabilities of the army to wage war. The military logistics revolution is closely related to the available technology [86]. The reason why is because, historically, the use of technology has allowed military logistics to respond to the requirements of the troops, increasing the capacity of the army and changing the state [87,88].

The application of the concept of focused logistics (FL) was identified as a current trend in military logistics, defined as the ability to provide the armed forces with adequate

personnel, equipment, and supplies in the right place, at the right time, in the right amount, across the spectrum of military operations [63].

It is necessary to deepen the application of concepts such as focused logistics, identifying the benefits for military logistics, its contribution to the improvement and strengthening of the capabilities of an army, and its relationship with technology and the military logistics revolution. Additionally, the interdependence between military logistics and technology makes it necessary to develop research projects that allow the development of new practices covering the entire spectrum of science and advancing the knowledge of military logistics [8].

Military logistics has a future challenge and is to acquire the capacity to provide support in the new dimension of war strategies, considering that the organization of war is dynamic, the needs are changing, and the structure of the force is diffuse. Diffused warfare has fast, independent, and powerful units, which are at the same time vulnerable (once discovered), which is why it is necessary to provide real-time support, applying the just-in-time concept [88], with an immediate response to the requirements of the combatants without affecting the development of the situation in the conflict; that is, in this new way of waging war, military logistics is linked to the network and uses the command-and-control system, where, unlike in previous periods, aspects such as re-ammunition, maintenance, and supplies should not interfere in the development of the battle, where everything happens at the same time and the design of logistics support must be effective [65].

Military logistics must interoperate with the technology and means available to reduce the cost of sustenance and the logistics footprint in developing operations, in all domains (sea, land, air, space, and cyberspace) [89], to strengthen logistics capabilities and respond to future battle concepts, including multi-domain battle and mosaic warfare, with the application of the focused logistics concept in the development of processes and new tools. It is necessary to acquire the ability to deploy and sustain forces across a global network of fixed and mobile bases (expeditionary and clandestine) and to support the development of sustained operations at the necessary pace and for the required duration. This makes it necessary to use smaller and more disaggregated logistics platforms unlike the conventional trunk and branch refueling system [67], capable of quickly redirecting without affecting the development of the operation and the conduct of the maneuver and fulfilling the intention in decision making.

On a more current trend, the concept of contested logistics is being accepted by armed forces of advanced military organizations. Contested logistics aims to guarantee an agile and resilient logistics, integrating three main aspects: resilient integrated logistics command and control, projection, and assured joint energy sustaining for distributed operations. Finally, it is important to highlight the similarities and differences between business logistics and military logistics, as pointed out by several works in the literature (e.g., [86,89]).

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## References

- Shrader, C.R. *United States Army Logistics, 1775–1992 An Anthology*, 1st ed.; Center of Military History, Ed.; Center of Military History: Washington, DC, USA, 1997; Volume 1. Available online: <http://gen.lib.rus.ec/book/index.php?md5=560AEE57D815E87F40B6234A1652000A> (accessed on 22 October 2022).
- Schneider, B.R.; Grinter, L.E. *Battlefield of the Future: 21st Century Warfare Issues*, 1st ed.; Library of Congress Cataloging-in-Publication Data, Ed.; Air War College Maxwell Air Force Base: Montgomery, AL, USA, 1998.
- Piggee, A.F. *Transformation—Revolution in Military Logistics*; Usawc Strategy Research Project: Carlisle Barracks, PA, USA, 2002; pp. 1–2. Available online: [http://www.iwar.org.uk/rma/resources/logistics/Piggee\\_A\\_F\\_02.pdf](http://www.iwar.org.uk/rma/resources/logistics/Piggee_A_F_02.pdf) (accessed on 22 October 2022).
- Vickers, M.G.; Martinage, R.C. *The Revolution in War*, 1st ed.; Center for Strategic and Budgetary Assessments, Ed.; Center for Strategic and Budgetary Assessments: Washington, DC, USA, 2004. Available online: [www.csbaonline.org](http://www.csbaonline.org) (accessed on 22 October 2022).
- Kent, J.; Flint, D. Perspectives on the evolution of logistics thought. *J. Bus. Logist.* **1997**, *18*, 15. [CrossRef]
- Kaspersen, I.S. New societies, new soldiers? A soldier typology. *Small Wars Insur.* **2021**, *32*, 1–25. [CrossRef]
- Bados, V.; Duran, M. Las “Nuevas Guerras”: Una propuesta metodológica para su análisis. *Rev. UNISCI/UNISCI J.* **2015**, *38*, 10. Available online: <https://www.ucm.es/data/cont/media/www/pag-72452/UNISCIDP38-1BADOS-DURAN.pdf> (accessed on 22 October 2022). [CrossRef]
- Zsidisin, G.A.; Bresler, A.; Hazen, B.; Snider, K.F.; Wilkerson, T.H. Research in defense logistics: Where are we and where are we going? *J. Def. Anal. Logist.* **2020**, *4*, 3–17. [CrossRef]
- Roberto, H.S.; Sampieri, R.H. Metodología de la investigación. In *Metodología de la Investigación*, 6th ed.; Education McGraw-Hill, Ed.; LATAM HE Estadística para Negocios y Economía; Edamsa Impresiones: Ciudad de México, Mexico, 2014.
- Castañón, L. *Enciclopedia Metódica, Geografía Moderna*, 2nd ed.; la Imprenta de Sancha, E., Ed.; Imprenta de Sancha: Valencia, Spain, 1792. Available online: [https://play.google.com/books/reader?id=V24raoBTRowC&hl=es\\_419&pg=GBS.PP7](https://play.google.com/books/reader?id=V24raoBTRowC&hl=es_419&pg=GBS.PP7) (accessed on 22 October 2022).
- Rider, G.W. Evolution of the Concept of Logistics. *Nav. War Coll. Rev.* **1970**, *23*, 24–33. Available online: <https://digital-commons.usnwc.edu/nwc-review/vol23/iss10/4> (accessed on 22 October 2022).
- Prebilič, V. Theoretical aspects of military logistics. *Def. Secur. Anal.* **2006**, *22*, 159–177. [CrossRef]
- Torres-Sánchez, R.; Brandon, P.; ‘t Hart, M. War and economy. Rediscovering the eighteenth-century military entrepreneur. *Bus. Hist.* **2018**, *60*, 4–22. [CrossRef]
- Jomini, A.d.H. *Compendio del Arte de la Guerra ó Nuevo Cuadro Analítico, de las Principales Combinaciones de la Estrategia, de la Táctica Sublime y de la Política Militar-Segunda Parte*, 1st ed.; de Burgos, I.D., Ed.; Librería de D.A. Pérez: Madrid, Spain, 1840. Available online: <https://bibliotecavirtual.defensa.gob.es/BVMDefensa/es/consulta/registro.do?id=43078> (accessed on 22 October 2022).
- Clausewitz, K.V. *De la Guerra*, 1st ed.; Aleman, E., Ed.; 1832; Available online: <https://biblioteca.org.ar/libros/153741.pdf> (accessed on 22 October 2022).
- Kneebone, R. The art of war. *Lancet* **1862**, *384*, 200–209. [CrossRef]
- Eccles, H.E. Logistics in the National Defense. *Mil. Aff.* **1959**, *12*, 5. [CrossRef]
- Villamartín, F. *Nociones del Arte Militar*, 1st ed.; Villamartín, F., Ed.; Imprenta Militar de Montero, Plazuela del Camen: Oaxaca de Juárez, Mexico, 1863.
- Thorpe, G. *Pure Logistics*, 2nd ed.; Mizelle, W.R., Ed.; Library of Congress Cataloging-in-Publication Data; Library of Congress: Washington, DC, USA, 1986. Available online: <https://catalogue.nla.gov.au/Record/3838107> (accessed on 22 October 2022).
- Stoner, J.R. Air University Review. *Prof. J. United States Air Force* **1967**, *18*, 94. Available online: [https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/1967\\_Vol18\\_No1-6/1967\\_Vol19\\_No1.pdf](https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/1967_Vol18_No1-6/1967_Vol19_No1.pdf) (accessed on 22 October 2022).
- Williams Richard, C.; Breeding Robert, L. Unpublished Master’s Thesis at the School of Systems and Logistics. Master’s Thesis, Ohio Air Force Institute of Technology, Wright-Patterson AFB, OH, USA, 1965.
- Peppers, J. *History of the United States Military Logistics, 1935–1985*, 1st ed.; Engineers, S.L., Ed.; Society of Logistics Engineers: Laurel, MD, USA, 1988. Available online: <https://www.amazon.com.au/History-United-Military-Logistics-1935--1985/dp/0945488009> (accessed on 22 October 2022).
- Tom, A. Lt. General Gus Pagonis: “The Military’ s Gift to Logistics is Its People”. *Mater. Handl. Logist.* **2014**, *37*, 1–3. Available online: <https://content.ebscohost.com/ContentServer.asp?T=P&P=AN&K=96886199&S=R&D=bth&EbscoContent=dGJyMMv17ESeqLc4yOvsOLCmsEiep7ZSr6m4TLKWxWXS&ContentCustomer=dGJyMPGvslGzrrjOuePfgex43zx> (accessed on 22 October 2022).
- San Román, V. La logística en las batallas de todos los tiempos. *Visión Conjunta* **2011**, *3*, 20–29. Available online: <http://www.cefadigital.edu.ar/bitstream/1847939/65/1/VC%205-2011%20SAN%20ROMAN.pdf> (accessed on 22 October 2022).
- Department of Army. *FM 100-16 Army Operational Support, Headquarters*, 1st ed.; Department of the Army: Washington, DC, USA, 1995. Available online: <https://www.globalsecurity.org/military/library/policy/army/fm/100-16/index.html> (accessed on 22 October 2022).
- Posada, E. *La Logística Militar y Sus Aplicaciones en la Logística Empresarial*, 1st ed.; Logística naval operacional Colombiana, Ed.; 2002; p. 4. Available online: [https://www.google.com/search?client=safari&rls=en&q=ingenieria.udea.edu.co/grupos/logistica/Docs/LOGISTICA\\_MILITAR.doc&ie=UTF-8&oe=UTF-8](https://www.google.com/search?client=safari&rls=en&q=ingenieria.udea.edu.co/grupos/logistica/Docs/LOGISTICA_MILITAR.doc&ie=UTF-8&oe=UTF-8) (accessed on 22 October 2022).

27. Kane, T.M. *Military Logistics and Strategic Performance*, 1st ed.; University of Hull, Ed.; Routledge: Oxfordshire, UK, 2001. Available online: <https://www.taylorfrancis.com/books/9780203357873> (accessed on 22 October 2022).
28. Kress, M. *Operational Logistics*, 1st ed.; Springer Science Business Media, Ed.; Springer: Midtown Manhattan, NY, USA, 2002; Volume 23.
29. Kress, M. *Operational Logistics*, 2nd ed.; Springer Cham Heidelberg, Ed.; Springer: Midtown Manhattan, NY, USA, 2016. [CrossRef]
30. Ballesteros Silva, P.P.; Ballesteros Riveros, D.P. ¿Cómo los empresarios aplican la logística militar en sus organizaciones? *Sci. Et Tech.* **2005**, *2*, 139–144. [CrossRef]
31. Gale, M.-P.-R.R. *Manual de Logística del Ejército*; Sampers, H.J.L., Ed.; Ejército Nacional: Bogota, Colombia, 2011.
32. Kaddoussi, A.; Zoghalmi, N.; Zgaya, H.; Hammadi, S.; Bretauudeau, F. Disruption Management Optimization for Military Logistics. In *Artificial Intelligence Applications and Innovations*; Iliadis, L., Maglogiannis, I., Papadopoulos, H., Eds.; Springer: Heidelberg/Berlin, Germany, 2011; p. 63. [CrossRef]
33. Correa Malagón, C.M.; Marcela, C.; Malagón, C. Una revisión conceptual de la percepción del servicio al cliente en la logística militar. *Criterio Libre* **2016**, *24*, 133–134. [CrossRef]
34. da Costa Pereira, A. Logística da defesa: Fundamentos da gestão de processos logísticos e transformação no Exército Brasileiro. *Coleção Meira Mattos* **2019**, *13*, 301–302. [CrossRef]
35. Jefe de Estado Mayor Conjunto (CJCS) U.S. *Joint Publication 4-0 Joint Logistics*; Jefe de Estado Mayor Conjunto (CJCS) U.S., Ed.; Joint Logistics (Issue May 2019); Department of the Army and Department of the Navy: Washington, DC, USA, 2019. Available online: [https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp4\\_0ch1.pdf?ver=2019-05-10-120259-860](https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp4_0ch1.pdf?ver=2019-05-10-120259-860) (accessed on 22 October 2022).
36. Acero, R.; Torralba, M.; Pérez-Moya, R.; Pozo, J.A. Value Stream Analysis in Military Logistics: The Improvement in Order Processing Procedure. *Appl. Sci.* **2020**, *10*, 106. [CrossRef]
37. Ospina Díaz, M.R.; Sanabria Rangel, P.E. Marco general de análisis de la formación logística en Colombia. *Rev. Científica Gen. José María Córdova* **2017**, *15*, 237. [CrossRef]
38. Von Clausewitz, C. *On War*; Howard, M., Paret, P., Eds.; Princeton University Press: Princeton, NJ, USA, 1984.
39. Mahan, A. The Influence of Sea Power Upon History 1660–1783. *Sci. Mil. S. Afr. J. Mil. Stud.* **2012**, *14*, 246. [CrossRef]
40. Eccles, H.E. *Military Concepts and Philosophy*; Rutgers, U.P., Ed.; Naval War College Review; Universidad de California: Oakland, CA, USA, 1965; Volume 19. Available online: [https://books.google.com.co/books/about/Military\\_concepts\\_and\\_philosophy.html?id=QsqUnQEACAAJ&redir\\_esc=y](https://books.google.com.co/books/about/Military_concepts_and_philosophy.html?id=QsqUnQEACAAJ&redir_esc=y) (accessed on 22 October 2022).
41. Eccles, H.E. *Military Power in a Free Society*; Naval War College Press, Ed.; Navy Department: Washington, DC, USA, 1979. Available online: <https://books.google.com.co/books?hl=es&id=kMegt2U6aAwC&dq=Military+Power+in+the+Free+Society&focus=searchwithinvolume&q=Military+Power+in+the+Free+Society> (accessed on 22 October 2022).
42. Pagonis, W.G. El efecto Pagonis: El futuro de la doctrina para el puesto de mando del área de apoyo. *Mil. Rev.* **2018**, *3*, 45–55. Available online: <https://www.armyupress.army.mil/Portals/7/military-review/Archives/Spanish/el-efecto-pagonis-el-futuro-de-la-doctrina-para-el-puesto-de-mando-del-area-de-apoyo.pdf> (accessed on 22 October 2022).
43. Kemp, B.J. *Ancient Egypt Anatomy of a Civilization*, 2nd ed.; Taylor & Francis Routledge: Oxfordshire, UK, 2007. Available online: <https://b-ok.lat/book/1063196/09dd2e> (accessed on 22 October 2022).
44. Sáez Abad, R. El ejército del imperio neosirio: Las primeras máquinas de asedio. Espacio Tiempo y Forma. Serie II. *Hist. Antig.* **2005**, *18*, 17–18. [CrossRef]
45. Keegan, J. *A History of Warfare*, 1st ed.; Keegan, J., Ed.; Alfred A. Knopf Inc.: Broadway, NY, USA, 1993. Available online: <https://b-ok.lat/book/1059816/8f3a76> (accessed on 22 October 2022).
46. Kalenatic, D.; Rueda, F.; González, L.; Amilcar, C. Aspectos Históricos de la Logística Militar. In *Logística Focalizada una Respuesta Ante Ambientes de Asimetría, Incertidumbre y Volatidad (Kalenatic)*; de la Sabana, U., Ed.; Publicaciones La Sabana: San José, Costa Rica, 2013; p. 167.
47. Connolly, P. *Los Ejércitos Griegos*; Espasa-Calpe, S., Espasa-Calpe, S.A., Eds.; Espasa-Cal: Madrid, Spain, 1981. Available online: <https://es.scribd.com/document/2490536/Peter-Connolly-Los-Ejercitos-Griegos> (accessed on 13 February 2023).
48. Sawyer, R.D. *The Art of War*, 1st ed.; Westview Press, Ed.; Westview Press: Boulder, CO, USA, 1994. Available online: [www.westviewpress.com](http://www.westviewpress.com) (accessed on 13 February 2023).
49. Martínez, A.; Romero, J.; Calvo, J. *Enciclopedia del Arte de la Guerra*, 1st ed.; Planeta, S.E., Ed.; Planeta Group: Barcelona, Spain, 2001; p. 602. Available online: [http://biblioteca.sivec.espe.edu.ec/upload/LL\\_CRNL\\_2\\_3\\_enciclopedia\\_del\\_arte\\_de\\_la\\_guerra.pdf](http://biblioteca.sivec.espe.edu.ec/upload/LL_CRNL_2_3_enciclopedia_del_arte_de_la_guerra.pdf) (accessed on 13 February 2023).
50. Gajate, M.; Laura, B.; Piote, G. *Guerra y Tecnología Interacción desde la Antigüedad al Presente*; Fundación Ramón Areces: Madrid, Spain, 2017. Available online: <https://www.fundacionareces.es/recursos/doc/portal/2018/03/19/guerra-y-tecnologiapdf.pdf> (accessed on 13 February 2023).
51. Carreras, C. Aprovisionamiento del soldado romano en campaña: La figura del praefectus vehiculorum. *Habis* **2004**, *35*, 291–311.
52. Air Force Logistics Management Agency. *The Logistic of the War a Historical Perspective*, 1st ed.; Air Force Journal Logistics, Ed.; Air Force Journal Logistics Agency: Montgomery, AL, USA, 2000.
53. Cabezas, G. Aproximación a la logística militar del ejército de Aníbal. *HistoriaE* **2013**, *10*, 91–119. Available online: <http://www.raco.cat/index.php/Historiae/article/view/286605/374818> (accessed on 13 February 2023).

54. Huston, J.A. *The Sinews of War: Army Logistics, 1775–1953*, 1st ed.; Conn, S., Ed.; Army historical series; Library of Congress Cataloging-in-Publication Data; Office of the Chief of Military History, United States Army: Washington, DC, USA, 1966. Available online: <https://books.google.co.uk/books?hl=en&lr=&id=Y8pabWzrsocC&oi=fnd&pg=PA1&dq=Huston,+A.,+The+Sinews+of+War:+Army+Logistics+1775--1953,+Washington+DC,+1966&ots=UiMuFDIUCb&sig=52RJ3eFc30WGZXKkNjloS2OMYtk> (accessed on 13 February 2023).
55. van Creveld, M. *Supplying War: Logistics from Wallenstein to Patton*, 2nd ed.; Cambridge University Press, Ed.; University of Chicago Press: Chicago, IL, USA, 2004; Volume 51. Available online: <https://www.cambridge.org/co/academic/subjects/history/european-history-general-interest/supplying-war-logistics-wallenstein-patton-2nd-edition?format=PB&isbn=9780521837446> (accessed on 13 February 2023).
56. McGinnis, M.A. Military Logistics: Insights for Business Logistics. *Int. J. Phys. Distrib. Logist. Manag.* **1992**, *22*, 22–32. [CrossRef]
57. Ruiz Arévalo, J.M. Nueva doctrina logística: Criterios para su desarrollo. *Ejército De Tierra Español* **2010**, *835*, 84–93. Available online: [https://ejercito.defensa.gob.es/Galerias/multimedia/revista-ejercito/2010/Revista\\_Ejercito\\_835.pdf](https://ejercito.defensa.gob.es/Galerias/multimedia/revista-ejercito/2010/Revista_Ejercito_835.pdf) (accessed on 13 February 2023).
58. Army Medical Dept Center and School. *Focused Logistics Joint Vision 2010: A Joint Logistics Roadmap*; Defense Technical Information Center: Fort Belvoir, VA, USA, 1998. Available online: <https://apps.dtic.mil/sti/pdfs/ADA402776.pdf> (accessed on 28 March 2023).
59. Department of Defense. Joint Vision 2010. In *Chairman of the Joint Chiefs of Staff*; 1995. Available online: <https://apps.dtic.mil/dtic/tr/fulltext/u2/a426703.pdf> (accessed on 13 February 2023).
60. Department of Defense. Department of Defense Logistics Transformation Strategy Strategy—Achieving Knowledge-Enabled Logistics, Washington, DC, USA, 2004. Available online: <https://www.acqnotes.com/Attachments/DoD%20Logistics%20Transformation%20Strategy%20\T1\textquotedblleftAchieving%20Knowledge-Enabled%20Logistics\T1\textquotedblright%2010%20Dec%202004.pdf> (accessed on 13 February 2023).
61. Faundes, C. *Sobre los Principios de la Guerra Irrestricita*; Academia de Guerra de Ejercito, Departamento de Posgrado e Investigación: La Reina, Región Metropolitana, Chile, 2009; p. 11. Available online: <http://centroestudiosinternacionales.uc.cl/2012/> (accessed on 13 February 2023).
62. Liang, Q.; Xiangsui, L. *Unrestricted Warfare: China's Master Plan to Destroy America*, 2nd ed.; Liang, Q., Xiangsui, L., Eds.; Independently published; 2017. Available online: <http://gen.lib.rus.ec/book/index.php?md5=76E6BD6D5866F3FD49B17B45851F526D> (accessed on 13 February 2023).
63. Shelton, H. Department of Defense. Joint Vision 2020. 2000. Available online: <https://apps.dtic.mil/dtic/tr/fulltext/u2/a526044.pdf> (accessed on 13 February 2023).
64. Edwards, S.J. *Swarming and the Future of Warfare*; The Pardee RAND Graduate School: Santa Monica, CA, USA, 2005. Available online: [https://www.rand.org/content/dam/rand/pubs/rgs\\_dissertations/2005/RAND\\_RGSD189.pdf](https://www.rand.org/content/dam/rand/pubs/rgs_dissertations/2005/RAND_RGSD189.pdf) (accessed on 13 February 2023).
65. Assa, H.; Groll, Y. *Diffused Warfare the Concept of Virtual Mass*, 1st ed.; Yoselevich, N., Ed.; Yediot Aharonot Press: HaMerkaz, Israel, 2007. Available online: <https://pdfs.semanticscholar.org/14e0/05cc2e9f382847d0b6e16e7ff846a4378b8f.pdf> (accessed on 13 February 2023).
66. Army Center Capabilities Integration TRADOC. *Multi-Domain Battle: Evolution of Combined Arms for the 21st Century 2025–2040*; Army Center Capabilities Integration TRADOC: Fort Eustis, VA, USA, 2017; pp. 1–17. Available online: [https://www.tradoc.army.mil/wp-content/uploads/2020/10/MDB\\_Evolutionfor21st.pdf](https://www.tradoc.army.mil/wp-content/uploads/2020/10/MDB_Evolutionfor21st.pdf) (accessed on 13 February 2023).
67. Glas, A.; Hofmann, E.; Essing, M. Performance -based Logistics: A portfolio for contracting military supply. *Int. J. Phys. Distrib. Logist. Manag.* **2013**, *43*, 97–115. [CrossRef]
68. Pulido, G. *Guerra Multidominio y Mosaico el Nuevo Pensamiento Militar Estadounidense*; Los Libros de la Catarata, Ed.; Kindle; Los libros de la Catarata: Madrid, Spain, 2021. Available online: [https://www.catarata.org/libro/guerra-multidominio-y-mosaico\\_133474/](https://www.catarata.org/libro/guerra-multidominio-y-mosaico_133474/) (accessed on 13 February 2023).
69. Wolfe, F. Joint Warfighting Concept Assumes “Contested Logistics”, Defense Daily. Available online: <https://www.defensedaily.com/joint-warfighting-concept-assumes-contested-logistics/pentagon/> (accessed on 31 January 2023).
70. Benfield, P.; Grant, G. Improving Joint Operational Concept Development within the U.S. Department of Defense. Defense (CNAS). Available online: <https://www.cnas.org/publications/reports/improving-joint-operational-concept> (accessed on 31 January 2023).
71. Rutner, S.M.; Aviles, M.; Cox, S. Logistics evolution: A comparison of military and commercial logistics thought. *Int. J. Logist. Manag.* **2012**, *23*, 96–118. [CrossRef]
72. Murray, W. *The Dynamics of Military Revolution, 1300–2050*, 1st ed.; Knox, M., Murray, W., Eds.; Cambridge University Press: Cambridge, UK, 2001; Volume 219. [CrossRef]
73. Mazarr, M.; Shaffer, J.; Ederington, B. *The Military Technical Revolution: A Structural Framework*; Center for Strategic and International Studies, Ed.; Center for Strategic and International Studies: Washington, DC, USA, 1993. Available online: <https://www.osti.gov/biblio/6210775-military-technical-revolution-structural-framework-final-report> (accessed on 13 February 2023).
74. Murray, W. Thinking About Revolutions in Military Affairs. *Jt. Forces Q.* **1997**, *16*, 69–74. Available online: <https://ndupress.ndu.edu/portals/68/Documents/jfq/jfq-16.pdf> (accessed on 13 February 2023).

75. Roxborough, I. From Revolution to Transformation the State of the Field. In *Military Affairs*; National Defense University: Washington, DC, USA, 2002; pp. 68–75. Available online: <https://apps.dtic.mil/dtic/tr/fulltext/u2/a483679.pdf> (accessed on 13 February 2023).
76. Møller, B. The Revolution in Military Affairs: Myth or Reality? *Peace Res. Abstr.* **2003**, *40*, 1–94. Available online: <http://www.copri.dk/publications/Wp/WP2002/15-2002.doc> (accessed on 13 February 2023).
77. Colom, G. Una Aproximación a las Revoluciones Militares, Técnico-Militares y en los Asuntos Militares (Issue Historia Militar). 2006. Available online: <https://es.scribd.com/document/374910830/Dialnet-UnaAproximacionALasRevolucionesMilitaresTecnicomil-4574803> (accessed on 13 February 2023).
78. Kagan, F. *Finding the Target: The Transformation of American Military Policy*, 1st ed.; Encounter Books, Ed.; Encounter Books: San Francisco, CA, USA, 2006. Available online: <https://books.google.bi/books?id=jt8Nn61bdx0C> (accessed on 13 February 2023).
79. Guillen, C. *Entre “Ares y Atenea” el Debate Sobre la Revolución en los Asuntos Militares*, In *Instituto Universitario General Gutiérrez Mellado*; Reprografía Doppel, S.L.: Madrid, Spain, 2008; Volume 1. Available online: [https://iugm.es/wp-content/uploads/2016/07/Libro\\_Entre\\_ares.pdf](https://iugm.es/wp-content/uploads/2016/07/Libro_Entre_ares.pdf) (accessed on 13 February 2023).
80. McNeill, W.H. *Búsqueda del Poder. Tecnología, Fuerzas Armadas y Sociedad Desde el 1000 d.C.*, 1st ed.; Siglo XXI Editores México, Ed.; Siglo XXI Editores Mexico: CDMX, Mexico, 1989. Available online: <https://www.amazon.com/-/es/William-H-McNeill/dp/9682315123> (accessed on 13 February 2023).
81. Kalenatic, D.; Sarmiento, A. *Logística Focalizada una Respuesta Ante Ambientes de Asimetría, Incertidumbre y Volatilidad*, 1st ed.; Kalenatic, D., Ed.; Universidad de La Sabana: Cundinamarca, Colombia, 2013. Available online: <https://intellectum.unisabana.edu.co/handle/10818/27785/> (accessed on 13 February 2023).
82. Guillem, C. Entre la Revolución y la Transformación la Revolución en los Asuntos Militares y la Configuración de los Pilares Estratégicos de Estados Unidos Para el Siglo XXI [Instituto Universitario General Gutiérrez Mellado]. In *Instituto Universitario General Gutiérrez Mellado*. 2009. Available online: [https://www.academia.edu/25961634/Entre\\_la\\_Revolución\\_y\\_la\\_Transformación\\_La\\_Revolución\\_en\\_los\\_Asuntos\\_Militares\\_y\\_la\\_Configuración\\_de\\_los\\_Pilares\\_Estratégicos\\_de\\_Estados\\_Unidos\\_para\\_el\\_Siglo\\_XXI](https://www.academia.edu/25961634/Entre_la_Revolución_y_la_Transformación_La_Revolución_en_los_Asuntos_Militares_y_la_Configuración_de_los_Pilares_Estratégicos_de_Estados_Unidos_para_el_Siglo_XXI) (accessed on 13 February 2023).
83. Sah, B.; Gupta, R.; Bani-Hani, D. Analysis of barriers to implement drone logistics. *Int. J. Logist. Res. Appl.* **2020**, *24*, 531–550. [[CrossRef](#)]
84. Zeimpekis, V.; Kaimakamis, G.; Daras, N.J. Military Logistics Research Advances and Future Trends. In *Operations Research/Computer Science Interfaces Series*, 56th ed.; Zeimpekis, V., Kaimakamis, G., Daras, N.J., Eds.; Springer International Publishing: Midtown Manhattan, NY, USA, 2015; Volume 56. [[CrossRef](#)]
85. Ocón, A.L.; Da Ponte, A. Política Internacional y Defensa en el Siglo XXI: Entre la incertidumbre, la ciencia ficción y las nuevas dinámicas tecnológicas. *Relac. Int.* **2019**, *28*, 112. [[CrossRef](#)]
86. Martí, C. Tecnología de la defensa: Análisis de la situación española. In *Tecnología de la Defensa, Análisis de la Situación Española*; Sempere, C., Ed.; Instituto Universitario “General Gutiérrez Mellado” de investigaciones sobre la Paz, la Seguridad y la Defensa Madrid, UNED: Madrid, Spain, 2006. Available online: [http://iugm.es/uploads/tx\\_iugm/libro\\_en\\_red.pdf](http://iugm.es/uploads/tx_iugm/libro_en_red.pdf) (accessed on 13 February 2023).
87. Brick, E.S. A conceptual framework for defense logistics. *Gestão Produção* **2019**, *26*, 1–16. [[CrossRef](#)]
88. Lai, K.-H.; Cheng, T.C.E. Just-in-Time Logistics. In *Climate Change 2013—The Physical Science Basis*, 1st ed.; Intergovernmental Panel on Climate Change, Ed.; Cambridge University Press: Cambridge, UK, 2009; Volume 53. [[CrossRef](#)]
89. Defense Advanced Research Projects Agency DARPA. Strategic Technology Office Outlines Vision for “Mosaic Warfare”. In *Strategic Technology Office Outlines Vision for “Mosaic Warfare”*; Strategic Technology Office, Ed.; Defense Advanced Research Projects Agency Strategic Technology Office: Arlington, VA, USA, 2017; p. 5. Available online: <https://www.darpa.mil/news-events/2017-08-04> (accessed on 13 February 2023).

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