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The Study of the Logistics Ontology by the Historical-Genetic Method

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ABSTRACT

The objective of the study is to establish the origin and evolution of the term «logistics», understood as management of material flows and stocks. The historical-genetic method and content analysis were used in the study of available sources.

The inconsistency of assumptions about the origin of the name «logistics» in the modern interpretation from ancient Greece and the Byzantine Empire is shown. There is also no connection between the mathematical logic developed by Leibniz and the content of logistics in economics and military affairs. The illegitimacy of explaining the evolution of the term «logistics» by random coincidences of words that are homonyms and related to different historical eras and countries has been established.

The priority of G. V. Jomini in formulation of the principles of logistics in his works on the art of war, written after emigration to the Russian Empire, is confirmed. Due to the spread of Jomini's works in the countries of the world, logistics began to develop in its modern form, initially in the military sphere, and then in economic activity.

The reasons that led to intensive development of logistics during the Second World War and in the post-war period are systematized. Differences in priorities during these periods in the countries of the world are studied. Two main trends were identified, one of which was to use the competitive advantages of logistics in a market environment, and the other to ensure spatial connectivity and transport accessibility of territories.

Keywords: logistics, terminology, ontology, historical genetic method.

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INTRODUCTION

There are several dozens of definitions of «logistics» contained in textbooks, manuals, monographs and other publications. Such a discrepancy in understanding what «logistics» is can be perceived as a curiosity, because people have been engaged in organisation of material flows and storage of stocks since emergence of commodity production, i. e. since the Neolithic Revolution. At the same time, creative activity of the authors of published materials, who consider themselves specialists in logistics, has an objective basis. After all, few people think of compiling definitions of physics, astronomy, or mathematics. These branches of knowledge have already been formed.

The abundance of definitions suggests that logistics, which arose at the beginning of development of civilization simultaneously with emergence of a manufacturing economy and trade relations, began to take shape as a science relatively recently. The initial stage of any science is formation of its ontology, terminological base. The traditional understanding of ontology, as a field of philosophy that studies general categories and patterns of being, is increasingly being supplemented by specific subject aspects in the relevant fields of science. Ontology defines the subject area of research, basic concepts and relationships between them. In this sense, ontology is close in its meaning to the term «thesaurus» [1].

At the same time, the concept of «ontology» can have a more complex multi-level hierarchical structure. According to the ontology, the concepts in the chosen field of activity are divided into groups that are in horizontal and vertical relationships with each other. Relations and types of interaction between concepts are characterized. The study of ontology is important for clarifying the semantics (semantic content) of a particular area of activity, contributes to a uniform understanding of the terminology of logistics and establishment of relationships between terms [2].

The objective of the study is to establish the origin and evolution of the term «logistics», understood as management of material flows.

RESULTS

Operational Activities in Logistics and Inconsistency of Assumptions about the Origin of its Name from the Greek Language

When forming the ontology of logistics, one of the tasks is to establish the origin of the very name of this field of activity. In publications of different authors, mutually exclusive versions may be offered at the same time. The main thing is not even that these versions are mutually exclusive and can be placed side by side, for example, in one textbook or study guide. The problem is that the information given in the literature is by no means always related to the coordination of interaction between participants in the supply chain, movement of material flows, formation of stocks, warehousing and other activities that are commonly associated with logistics in its modern sense.

One example of this approach is the search for the origins of the term «logistics» in the Greek language. In particular, its origin is associated with the ancient Greek word **λογιστική** [logistics] – «counting art» [3]. In Athens, logisticians were elected controllers who carried out financial verification of the activities of officials. If abuses were detected, the logisticians prepared materials for judicial review [4]. After reading the treatise of Aristotle (384–322 BC) [4], which mentions the ancient «auditors» and «interrogators», it becomes clear that they had nothing to do with transportation, stock management and other operations related to commodity circulation. Approximately also it is impossible to say that Norbert Wiener (1894–1964), having published his famous book «Cybernetics or Control and Communication in Animal and Machine», devoted it to the issues of navigation, because the Greek word **κυβερνητική** [cybernetics] means «the art of steering the ship», «the art of the helmsman».

Byzantine literary monuments are a valuable historical source. In particular, the work of Emperor Constantine VII Porphyrogenitus (905–959) «On the Administration of the Empire» includes a chapter «On the Dews Departing with Monoxyls from Russia to Constantinople», which contains the first documentary description of the transport support of our country's international trade with Eastern Roman Empire [5].

Greek was the official language of the Byzantine Empire. A thousand years after Aristotle, the work of the Byzantine Emperor Leo VI (866–912) «On Tactics» [6] was written based thereon, which is also often called in modern literature one of the sources for appearance of the term «logistics» in relation to the military sphere. Indeed, the emperor writes about logistics, but he has in mind the solution of personnel and financial issues of supporting the army, and not movement of troops and military equipment. To ensure movement of the Byzantine army on the march, to check the condition of roads and crossings, it was not the

«logistics», but the antikensors (**ἀντικένσωρ**) that were supposed to. Their functions also included determining the need for provisions and equipment for combat operations. The antikensors, together with the minsors (μήνσωρ) or, in another spelling, the minsurators, organized the placement of troops in the camp. Supply functions were assigned to the pallikari (παλλικάριον or πάλλιξ), who served in the wagon train (τοῦλδος [touldos] or τοῦλδον [touldon]). To make sure that the Byzantine «logistics» were not engaged in what is today understood as logistics, incl. in relation to military matters, it is enough to read the work of Leo VI [6].

Quite often in the literature on logistics, it is mentioned that the great mathematician and philosopher Gottfried Wilhelm Leibniz (1646–1716) used the word «logistics» to name mathematical logic, a new direction in science he was developing. What is the meaning of the mention of Leibniz in modern literature on logistics is not clear, because it is obvious that the current content of logistics is in no way connected with mathematical (in other words, symbolic or formal) logic. Perhaps some authors suggest that the indication of the name of the scientist-encyclopedist, who created differential and integral calculus independently of Newton, will give modern logistics greater authority?

Additionally, it can be noted that Leibniz's works on mathematical logic were not published during his lifetime and were practically unknown. Logical calculus was created almost one and a half hundred years after Leibniz's death, and the beginning of work in this direction is associated with the publication in 1847 of the article by George Boole (1815–1964) «Mathematical Analysis of Logic» [7]. D. Buhl, having learned that G. Leibniz anticipated his discoveries, felt «as if Leibniz came and shook his hand through the centuries» [7]. This does credit to the English mathematician, but has nothing to do with logistics, as it is now interpreted.

In the same way, the fact that in 1904, at the suggestion of the participants in the Philosophical Congress in Geneva (one of the proposers was a native of Russia), the name used in Leibniz's manuscripts was assigned to mathematical logic is just as irrelevant to logistics as the management of material flows, – «logistics» [8]. This fact was included in the Soviet «Philosophical Encyclopedia», published in 1960–1970, and since then, for more than half a century, it has been reproduced from there in various editions [8]. At present, if you look at the literature on mathematical logic [9; 10], it can be seen that the term «logistics» is almost never used in relation to it. So the events of the Geneva Congress of 1904 may be of interest for studying the history of philosophical thought, but not for understanding the evolution of logistics as a sphere of economic activity.

If the authors of modern publications on logistics, in search of the origin of this term, delved into ancient philosophy, then they could, relying on the authority of Aristotle, offer another version. The ancient philosopher created a system of deductive reasoning, which he called syllogistic (from the Greek συλλογίζομαι – I count, I think) [10–12]. Fortunately, logistics, as organization of goods movement, is not yet associated with syllogistics.

Also, there are no attempts yet to connect the origin of the term «logistics» with the logistic equation obtained in 1838 by the Belgian mathematician Pierre François Verhulst (1804–1849), which has been used to model population, describe economic dynamics, in ecology and in other areas [13; 14]. Given the universal nature of the logistic equation and the popularity of the logistic curve described by it (sigmoid, sigmoid curve, S-curve), we must pay tribute to the restraint of the authors of publications on logistics.

Finishing the discussion of the lack of connections between the origin of the term «logistics» and the city government of Athens three hundred years before our era, the Byzantine army of the Early Middle Ages, the creation of the foundations of mathematical logic at the turn of XVII–XVIII centuries and the Philosophical Congress at the beginning of XX century, it is appropriate to cite one of the laws of logic, as formulated by Aristotle, the author of this law: «To mean more than one thing means nothing. And if the names are devoid of meanings, then it is impossible to have a conversation with each other, and in truth with oneself … So, as we said at the beginning, the name means something and means one thing» [15, pp. 89–90].

Attempts to explain the term «logistics» by random coincidences of words that have different meanings and refer to different historical eras are fruitless. In different languages there are homonyms – words that are the same in spelling, but different in meaning. For example, in Russian there is the word «quarry» in the meaning of «quarry» (transferred from the French carriere) and there is the word «quarry» in the meaning of «horse gallop» (it is based on the Italian carro in

the meaning of «chariot», «wagon» and the formed from it the Italian carriera – «fast running horse»).

To establish the origin of the concept of «logistics», it is necessary to find when, according to Aristotle, it began to «mean» the same as now, i. e. when its content became close to modern understanding and began to mean the coordination of actions of all parties involved in organization of material flows; execution of transport operations; storage and distribution of stocks and other related operations. Moreover, material flows should be understood not only as movement of various goods, but also as movement of people.

The role of G. V. Jomini in Creation of Logistics as a Modern Science

The emergence of logistics as a science is associated with the name of Genrikh Veniaminovich Jomini (1779–1869). Since Jomini was a professional military man, he developed logistics as one of the components of military art, in which he emphasized strategy, tactics and logistics [16, pp. 29–30; 134;140–141]. No more and no less: in his opinion, in order to win in hostilities, it is necessary to master the strategy, tactics and logistics. Jomini defined logistics as the practical art of moving armies, the detailed organization of marches, the arrangement of camps, the placement of troops in apartments – all this ensures achievement of strategic and tactical goals [16, pp. 140–141]. After the works of Jomini, the term «logistics» began to be used in its modern meaning, first in military affairs, and then to designate the corresponding area of economic activity.

The creator of the science of military logistics, from which modern civilian logistics later grew, deserves at least a few words to describe his life path. Jomini is often referred to in literature as a French military theorist. Surprisingly, sometimes in domestic publications you can even find the English spelling of his last name – «Jomini».

In fact, Antoine-Henri Jomini (Antoine-Henri Jomini, that was his birth name) was born into a wealthy Swiss family. He entered the military service in Switzerland. Soon, as a very young man, he wrote a two-volume work, the title of which cannot fail to impress even in a brief reproduction: Traité des grandes opérations militaires… («Treatise on great hostilities …»). Wanting to publish it, he achieved in 1804 an audience with the French Marshal Ney. He allocated the necessary funds and invited the young Swiss to his service. Thus began his career in the Napoleonic army. Jomini's treatise, subsequently supplemented, was repeatedly reprinted, incl. in Russia, Britain, America [17].

In 1813, the 34-year-old Jomini, who already had the rank of brigadier general since 1811, had a conflict with the chief of staff of the French army, Marshal Berthier. As a result, he decided to emigrate to Russia, where he was promoted to the rank of lieutenant general. He adopted the name Genrikh Veniaminovich, having converted to Orthodoxy, and for 56 years remained a Russian subject, until his death. While living in Russia, he continued to write his works in French, since he never learned Russian. This was not necessary, since French was the common language in Russian high society. However, his works were translated and published in Russian. The most significant work is the «Brief outline of military art», written in 1837, originally «for the instruction of the august person» [16, p. 1] (heir to the throne Alexander Nikolaevich, future Emperor Alexander II). In 1840, 27 years after Jomini's emigration to Russia, it was published in Russian [16]. The book was constantly supplemented and substantially revised by the author, gaining popularity in various countries. In 1939, under the title «Essays on the Art of War», it was published by the People's Commissariat for Defense of the USSR (translated from the original in 1855 in French) [18]. It is in the second volume of this book that the most complete and accurate presentation of Jomini's ideas about military logistics is contained, to which Chapter VI «On Logistics, or on the Practical Art of Setting Armies in Motion» is devoted. In XXI century, the book of Genrikh Veniaminovich Jomini is not forgotten and continues to be republished [19].

Speaking about development of logistics in our country in XIX century, it is appropriate to recall that its name was included by V. I. Dahlt (1801–1872) in his famous «Explanatory Dictionary» (in the explanation to the article «Logic»): «Logistics … a part of tactics, about movement of troops» [20, p. 262]. Knowing about the friendship and constant communication between V. I. Dahl and A. S. Pushkin, it can be assumed that the term «logistics» will someday be found in the creative heritage of the great poet.

Jomini did not exaggerate or underestimate his contribution to logistics. He noted that the first systematic description of military logistics («the first experience of logistics») was given by Jacques-Francois de Chastenet, Marquis de Puysegur (1656–1743) [16, p. 2], author of the

treatise The Art of War, which was published after his death in 1749.

Under the «Sun King», Louis XIV, Puysegur held the position of maréchal général des logis, which translates into Russian approximately as «chief marshal of apartments». In publications on French military history, it is noted that from the second half of XVI century, the functions of this commander included organizing army marches, organizing and building a camp, supplying provisions and ammunition. This is approximately how the functions of the chief of staff are understood in the armies of other countries. As soon as the commander-in-chief determined the final destination of the army, the chief marshal of apartments (maréchal général des logis) carried out reconnaissance of the area, studied the condition of roads and crossings, determined the places for setting up camps and placing the army in apartments, the procedure for providing food and ammunition, compiled maps, after which developed march orders – detailed routes for each column. Mistakes could lead to the loss of a military campaign [21].

To concentrate superior forces in the most important direction in the right place and at the right time, ensuring a decisive advantage over the enemy – this is the principle of the victory of all outstanding commanders: Alexander the Great, Hannibal, Caesar, Rumyantsev, Napoleon, Suvorov, Kutuzov. The opposite is also true: strategic miscalculations in logistics lead, in the end, to military defeat. For this reason, Hannibal defeated the Romans in Italy for 15 years, but was forced to evacuate his troops from there. Two thousand years after Hannibal, the impossibility of logistical support for Napoleon's army led, in combination with other factors, to its complete destruction in Russia. Napoleon abandoned the remnants of his troops and fled to Paris. By the way, the frosts in 1812 began when the French army had practically ceased to exist. The people's memory has preserved the words of M. I. Kutuzov in an address to the troops: «The war is over for the complete extermination of the enemy».

Based on the experience of his predecessors, Jomini wrote: «The word «logistics», as you know, comes from Major general des logis (translated in German as «quartermaster»), i. e. from the name of that category of officers whose duty once consisted in placing troops in apartments or in camps, in the direction of the columns, and in placing them on the spot. This was the end of all the logistics, which, as we see, included the arrangement of ordinary camps. But after the new method of warfare without camps was established, the movements became more complex, and therefore the headquarters also received wider rights and duties … the old logistics is no longer sufficient to designate the science of the headquarters … it needs to be given a different development and make a new science out of it» [18].

The merit of Jomini is that his book gives a clear and unambiguous answer to the question of the origin of the term «logistics».

The term «logistics» in the modern sense comes from the French word le logis – dwelling. This term is associated with the need to provide housing for the army when it moves during marches. Gradually, the content of logistics expanded, and it became, in the words of Jomini, «a new science» [18].

In French, there are other words with the same root and similar meanings, for example, loge – a box, a room, a cell; le logement – housing, apartment. From French, the word das logis meaning dwelling, came into the German language [22, p. 54]. In German, there are also words logieren – (temporarily) to live; lodge; settle; arrange for residence; das lager – warehouse, camp, storage, store. There are cognates of a similar meaning in Russian and other Slavic languages: lair, log, rookery, bed, lie. It can be assumed that the root «log» characterizes the etymological connections of words in the languages of the Indo-European family (in particular, French, German, Russian and other languages of this family) with the meanings of «dwelling» (both for people and for animals), «location», «room», etc. It can be assumed that the Latin word locus (place) also has a similar origin.

The term «logistics» appeared in the French army from the second half of 16th century, long before Jomini, to refer to organization of troop movements, their placement in apartments and camps, the supply of food and military equipment. The enduring significance of Jomini's work also lies in the fact that he formulated the tasks of the «new» logistics, which is fundamentally different from the «old» logistics, from the previous ideas about its content. It is extremely important that all these tasks are very easily interpreted in relation to economic activity in the civilian sphere [23, pp. 16–17], although he himself, as a professional military man, most likely did not think about it.

Doctor of History, Associate Professor of History at the Florida State University (USA), Eman Vovsi, who examined in detail the activities of G. V. Jomini in several scientific papers, cites

information that his ««principles of military art « … laid the foundation for professional military education in Russia, as well as in the countries of Europe and North America in XIX–XX centuries» [17]. After Jomini, logistics acquired its modern significance, first in the military field of the leading countries of the world, and then in the civilian sphere.

Spread of Logistics Technology from the Military to the Economy after World War II

The solution of logistical problems in the military sphere is most important for countries that are forced to provide and coordinate military operations in remote and vast territories. During the Second World War, such a need was especially acute for Germany and Japan, on the one hand, and for the Soviet Union and the United States, reflecting their aggression, on the other hand.

For almost four years, Germany and the Soviet Union waged against each other, mainly ground operations along a huge line with involvement of numerous army formations in need of food and equipment, ammunition and military equipment. It required creation of stocks and transport support. It was necessary to effectively manage logistics, organize the interaction of the front and rear.

In the initial period of the war, the Soviet Union successfully carried out a logistic operation of evacuation of more than 1500 industrial enterprises in Volga region, the Urals, Siberia and the union republics of Central Asia, unprecedented in scale and timing.

The United States had to solve the problems of maritime military logistics in the war with Japan in Southeast Asia and the Pacific, as well as create conditions for combat operations on land in Europe and North Africa. The complex logistical tasks of the US lend-lease program were solved jointly with the USSR and Great Britain. From the Western Hemisphere, supplies to the Soviet Union were carried out along the Pacific route (via Vladivostok, then along the Trans-Siberian Railway), through the ports of the Persian Gulf and the land transport network of Iran, then by the ships of the Caspian military flotilla, and also through Murmansk by Arctic convoys, through Alaska and the Black Sea.

One of the largest logistical operations of the US-British armed forces was the landing in Normandy (1944, Operation Overlord).

Throughout the war, America had a constant challenge to provide efficient maritime and land logistics in theaters of operations located at a considerable distance from its territory.

Difficult logistical tasks after the Second World War faced the United States during the occupation of Germany and Japan, as well as in conflicts in Korea (1950–1953), during the Lebanese crisis (1958), in Vietnam (1955–1975) and in other parts of the globe.

Almost immediately after the war, a network of American military bases began to be created, which currently has more than a thousand facilities in 150 countries [24]. Their infrastructure is growing and requires constant logistics support from the United States.

The continuous complication of the tasks of military logistics has led to the need for the US Army to use the scientific potential of universities, research centers and consulting companies. Military logistics began to penetrate into the civilian sphere, and developments in coordination of material flows, inventory management, and the choice of optimal transport links began to be used in the 1950/60s not only by the army, but also in business to improve supply, organize production and market finished products, to move from solving particular problems to integrated management of movement of goods from suppliers to end consumers.

Along with logistics technologies for coordination of transport and warehouse operations, integrated material management, the corresponding terminology was spread. Literature on logistics began to be published. One of the first publications was an article by Roy Alderson «Marketing effectiveness and the principle of delayed delivery» [25].

Professional associations appeared, one of the tasks of which was development of glossaries and unification of terminology. In 1963, the National Council of Physical Distribution Management was created, reorganized in 1985 into the Council of Logistics Management (CLM). Since 2004, it has changed its name again and currently functions as the Council of Supply Chain Management Professionals (CSCMP) [26].

The process of interaction between business and the army in the United States was bilateral. For example, the entrepreneur Malcom McLean (1913–2001) created the first multimodal transportation scheme in modern containers in 1954. And rapid development of the use of containers occurred when it became necessary to support military operations of the American army in Vietnam, and McLean received a large order for transportation from the US military

department. Pretty soon, this technology spread around the world and was called the «container revolution».

The acquisition of competencies and skills in logistics was also facilitated by the large size of the United States and open access to the Pacific and Atlantic oceans with many ice-free ports on a long coastline.

Period of 1950–60s is characterized not only by intensification of interaction in the US army, science and business in the field of logistics. At this time, the economy began to change.

America has become one of the richest countries in the world. 6 % of the world's population lived in it, and 66 % of all goods produced in the world were produced and consumed. The average American family with several children has become the standard for having a comfortable suburban home, owning two or more cars, and being able to purchase a variety of goods and use a variety of services. Convenient roads were built. Retail chains with large shopping centers appeared and intensively expanded, one example of which was Wal-Mart founded in 1962 [27].

This meant not only an increase in the well-being of US citizens. Residents of country houses, to a much greater extent than those living in apartments, are characterized by an increased demand for cars, household appliances, and furniture. They buy tools for home use, lawn and flower garden maintenance, minor repairs, and the like. Therefore, an increase in construction of individual houses leads to an expansion of trade and the need to deliver a variety of goods to all objects of the commodity distribution network, up to final consumers.

Competition in business began to shift to the area of struggle for the buyer, the assortment of goods increased, and after-sales service spread. Stocks began to increase, the costs of promoting goods to buyers increased, and there was a need to improve logistics. To solve managerial problems, economic and mathematical methods and computer technology began to be used. Logistics has become indispensable in the competitive struggle of enterprises in the market environment, first in the United States, and then around the world.

CONCLUSIONS

1. The analysis of primary sources concerning urban self-government in Athens in IV century BC and the Byzantine army at the turn of IX–X centuries, he established that the assumptions about the Greek origin of the name of logistics, understood as organization of material flows and management of commodity stocks, are unfounded.

2. The term «logistics» began to take shape initially in the French army in XVI–XVII centuries and was associated with a comprehensive solution to the problems of troop movement: organizing marches and camps, providing troops with housing, supplying food, ammunition and military equipment. The position of the head of the service of the General Staff, who dealt with these tasks, was called maréchal général des logis, which translates into Russian as «chief marshal of apartments» (from the French word le logis – dwelling).

3. The principles of military logistics in the modern sense were first formulated by G. V. Jomini in one of the chapters of the book «A Brief Outline of Military Art», written after his emigration to Russia, published in Russian in 1840 and originally intended to teach the basics of military affairs to the heir throne, the future Emperor Alexander II. Subsequently, the book was repeatedly reprinted and proved to be in demand in professional military education not only in Russia, but also in Europe and North America.

4. Military logistics received active development during the Second World War, when military operations were conducted in almost all regions of the globe. Military logistics was of particular importance for the United States in connection with the need to ensure the combat capability of its armed forces in Southeast Asia, the Pacific Ocean, Europe, North Africa and to carry out deliveries under the Lend-Lease program.

5. After the Second World War, military logistics in the United States continued to develop rapidly due to the military operations of their armed forces in different regions of the planet, the occupation of Germany and Japan, and the creation of an extensive network of military bases in 150 countries of the world. The involvement of research organizations to improve military logistics began to lead to the spread of its principles from the military sphere to the economy. The reverse process was also carried out, when business developments in the field of logistics were used by the US Army.

6. The growth in the welfare of the population and rapid development of the economy have led to the fact that in the competitive struggle of enterprises, the emphasis has shifted towards logistics, first in the United States, and then in other countries of the world. Professional

associations began to form and literature on logistics and supply chain management began to be published.

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