ANCIENT LOGISTICS – HISTORICAL TIMELINE AND ETYMOLOGY

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The phenomenon of logistics has an exceptional genesis. According to the findings presented in this paper, logistics dates back to Late Bronze Age (LBA), to ancient times. The bases for logistics development were an evolution of metrics systems, first of all numerical systems. The grounds of Mesopotamian and Egyptian numerical systems were used for commercial purposes by the Phoenicians. In that time the numbers were not displayed as symbols but as pictures. Primary meaning of the word logos was to count. The etymology of the word logistic was drawn from two words, the counting and the picture or the knowing of "numeric skills through images". The detailed analysis of the oldest known shipwreck – Uluburun, proved intensive production and commercial activities in the LBA period in the Mediterranean. These activities could be realized only with the support of intensive logistic activities. The analysis of the logistics change, given below, shows that the definition of logistics starts far in the period of BC. The famous Pythagoras was the first logistician to be appointed.

Keywords: definition, etymology, Late Bronze Age, logistics, Phoenicians

1 Introduction

The capital work "Logistics Systems" [1] synthesized all human activities and demonstrated that each was a separate logistic sub-system. Furthermore, the origin of the word "logistics" is based on the view that its genesis temporally correlates with the invention of steam engine in the eighteenth century (1764). Thus, the genesis of the concept of logistics is directly related to industrial revolution, although the phenomenon of production and trade dates back to much earlier times.

Presently, the prevalent view is that the term logistics was first used by the Swiss General Baron de Jomini (1779 – 1869). There are two versions of the genesis of the word logistics, both of French origin. The first, "logistique", is derived from military rank "Marechal de logis" and refers to the organization of the military support troops. The other, "loger", refers to a spatial military organization – camping. At the end of the nineteenth century, the term logistics "arrived" to the United States, and their military literature adopted the term "logistics", referring to the science of military support services, i.e. transport and supply for the troops. In the Second World War, the term "logistics" was used in relation to the planning and management process in providing (re-populating) and supplying the allied troops.

During the 1960s, the term logistics was first used in the civilian sector in the trade industry. In the United States, the term logistics referred to planning and implementation of physical distribution. In 1974, Hans-Christian Pfohl provided the characteristic areas of logistics tasks, conceptualized and shaped logistic axiomatics and developed logistics as a science.

The obvious ancient genesis of logistics contains in its root the Greek word "logos", primarily used in the context of principles of correct thought and action. It is often forgotten that one of the meanings of the word "logos" is account! The second part of the word logistics has origins in the Greek word "icon", which means – painting. In the literal translation from Greek, logistics means "art of calculus with pictures". Thus, the compound word "logos + icon" is a phonological and morphological adaptation which yielded its current international form.

The earliest written records on logistics were preserved in the history of the famous Greek philosopher and mathematician Pythagoras of Samos. From Chaldeans and Egyptians, he learned astronomy, mage mystic rites, and the Phoenicians informed him on logistics [2] and geometry. According to this source, the famous Pythagoras was the first appointed logistician, and the concept of logistics moved to 500 BC, almost 2200 years later than its actual etymology.

For an explanation of the theory that Pythagoras was the first appointed logistician, it is necessary to go even further back in history, 3000 years BC, to the beginning of the Bronze Age.

2 Early temporal and spatial metrology

During the fifth and fourth millennium, in the late Neolithic period (Ubaid period, 5500 – 4000 BC) the advanced communal and societal planning appeared on the banks of major rivers of Africa and Asia – Nile, Tigris and Euphrates. The inception of their characteristic epistemic foundation is still a subject of many anthropological discussions.

Sexagesimal system dates back to the Sumerians. There are several theories on the origin of the numerical system with base 60. One of the practical reasons could be the fact
The Egyptian number system had seven main digits, which were degrees of 10, and were a precursor of the modern decimal positioning system. These are numbers (symbols): 10° (vertical stroke), 10′ (hell-bone arch), 10″ (coil of rope), 10′′ (lotus flower), 10′′′ (pointing finger), 10′′′′ (burbot fish) and 10′′′′′ (astonished man) (Fig. 2). In practical applications of metric bijections, the Egyptian system was much more convenient to use, especially in algebra.

![Figure 2 Examples of the symbols of Egyptian hieroglyphic numbers](image2.png)

Slika 2. Primjeri simbola egipatskih brojeva na hijeroglifima

Through their differences, Babylonian and Egyptian number systems provided two metrologic bases – Babylonian for temporal, and Egyptian for spatial measurements. This is the foundation for measuring spatial-temporal transformation of material goods. These transformations are fundamental to logistics processes. The analogy of spatial transformation is transportation, whereas storage represents temporal transformation. Thus, the synthesis of these two number systems provided the platform for the evolution of logistics.

3 Uluburun shipwreck and the Bronze Age logistics

Olupina broda Uluburun i logistika brončanog doba

The Mediterranean is an area where the earliest civilizations, the main religions and cultures were formed. Development of Mediterranean civilizations and their progress has always been intrinsically linked to the production in qualitative and quantitative terms. Geographic distribution of resources defined the domination of one civilization in the production of particular commodity groups. Trade as the phenomenon appears with the aim to enable purposeful civilizational interaction – exchange of goods. Mediterranean civilizations were the first to establish organized trade. Bronze Age and intensive metallurgy advancements have also prompted an intensive development of trade. The earliest civilizational interactions within an established trade network in the Mediterranean date back to 5000 BC [4] and are linked to port infrastructure in the Middle and Late Bronze Age (LBA) [5, 6].

The excavation of a LBA (1200 BC) cargo vessel off southern Turkey's Cape Gelidonya in 1960 was the world's first scientific underwater dig. It was located in 1954, and the excavation began in 1960.

The excavation of Cape Gelidonya shipwreck asked for significant reconsideration of the history of nautical commerce in the LBA Mediterranean. The presumed domination of Micenea culture was moved toward Phoenicians and the history of the nautical commerce was moved to the farther history.
Significance of this knowledge redefined the central commerce zone on the east coast of the Mediterranean – with ports of Ugarit, Bilbos, Sidon, Tyre, Akko, Ascolon and Tell el-Ajjul, due to the continental links with Babylon. The network of other major Mediterranean ports includes Miceneae in the present day continental part of Greece, Troy, Miletus, Bodrum and Kas, Knossos and Kommos on Crete, Kyrenia and Kition on Cyprus, Mersa Matruh in the northern Egypt. Inevitably, the River Nile at Amarna (Upper Egypt) joins these Mediterranean sites, as the most important inland port (Fig. 3).

The ship cargo included 354 ingots of raw copper and 121 oval copper ingots, one ton of tin, 149 Canaanite jars, Blackwood from Africa and unprocessed ivory (tusks). In addition, ostrich eggshells, Cypriot pottery and oil lamps, amber pearls of Baltic origin, quartz, agate, stone anchors, 175 glass ingots of cobalt blue turquoise and lavender (the earliest intact glass ingots known), and many more items were found.

Based on the cargo content analysis, the bronze total weight was determined to be 11 tons. Quantity and weight of amphorae contents was not established. The reconstruction of load distribution indicates the concentration of copper ingots towards the aft (stern) of the ship.

The total weight of copper ingots (Fig. 5) was about 10 tons, and the balance was established by other heavy payload: amphorae, tin, glass ingots, anchors, etc. Thus, the approximate Uluburun ship cargo weight was probably over 20 tons!

The exploring results from Cape Gelidonya shipwreck significantly moved forward and gave direction to the further archeological knowledge of the LBA period. The value of these results is at the same time the basis for the real historical dates and the ground for the reconstruction of the LBA period. The significance of the shipwreck concept was a starting point for further explorations in the Mediterranean and in the meantime a great number of shipwrecks was discovered. Two very new significant discoveries were made in 1997 and 2007.

In 1997, the U. S. Navy submarine NR-1 searched for the lost Israeli submarine, Dakar, in the eastern Mediterranean Sea. The NR-1’s crew did not find Dakar, but did locate two ancient shipwrecks from the 8th century BC off the Levantine coast, west of Gaza. These two ships were found in the depth of 400 m. In the year 2007 the newest exploration of 2000-year-old shipwreck was realized by Kizilburun, 322 km away on an island in Turkey's Sea of Marmara.

The most concrete information about the Bronze Age market system in the Mediterranean is provided by the famous Uluburun shipwreck [7] from the LBA (14th century BC), discovered off Uluburun, located about 6 miles due southeast of Kas (Fig. 3), in south-western Turkey. A boat, 15 to 16 meters in length (Fig. 4a), was submerged at a depth of 44 to 52 meters (Fig. 4b).

Eleven consecutive campaigns of three to four months duration took place from 1984 to 1994 totaling 22,413 dives, revealing one of the most spectacular LBA artifact collections to have emerged from the Mediterranean Sea.

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The formation of lading (bill of loading) of a complex assortment of 20 tons of cargo, even in the modern times, would require knowledge and skill, responsibility and routine.

Three samples of the glass ingots from the Uluburun shipwreck show a common trace element composition, consistent with glass manufactured in Egypt. This evidence shows a direct link from general regional location of manufacture, through the production of ingots, to the end.
at ports, establishing a new balance of the ship (Fig. 7) regular reconsolidation of cargo and so on. These complex activities required a synthesis of skills and knowledge of the navigation and weather conditions, the ship technical characteristics, expert knowledge on the properties of the wide range of goods, organization of transfer (four handed copper ingots customized for reloading), market demands for raw materials, intermediate and finished products, trading preferences, risk assessment and much more.

Despite this deficit, the system of transport activities, handling, storage, packaging and order delivery was successfully carried out by the Uluburun ship (Fig. 8). All the key elements of modern logistics can be found in this example from the LBA.

The Phoenicians are credited for the invention of the slender ship channel, anchors, many achievements in cartography and navigation, establishing colonies in the Mediterranean Sea (Cadiz, Marseille, Sardinia, Corsica, Carthage, etc.) as well as exploratory missions in search of tin, which had taken them through Gibraltar to the North Sea.

Most importantly, the Phoenicians introduced a universal medium of exchange − money. First, the shells were used, then gold, and later, due to its reduced wear, silver was introduced into circulation. These most progressive and versatile traders of ancient times were characterized by the absence of honest business conduct. As a nation, they were unpopular among the other Mediterranean nations.

Their trading skills were supported by the sophisticated new alphabet (Fig. 9a) and the number system (Fig. 9b). The innovation in the Phoenician numerical system was the introduction of duodecimal basis that combined differentiated number symbols. These ranged from the Egyptian numerical system that represented numbers under nine with vertical lines (I, II, III, IIII, ..., IIIIIIIII), to the symbol for the number 10 and the symbolic analogy of
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other advanced elements of the transportation system, the
insurance for transportation systems and cargo, as well as
electronic commerce, advanced security systems and
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Conclusion
Zaključak

Even at a time of global communication, satellite
positioning of transport and multiple navigation systems,
electronic commerce, advanced security systems and
insurance for transportation systems and cargo, as well as
other advanced elements of the transportation system, the
essence of logistics remains unchanged. Only its form is
extended to the inclusion of modern numerical system and
data processing. The root is still the same, "logos" whereby
the images are replaced by electronic records. Logistics has
precise etymological semantics, which is not easily
discerned and can be understood only after the analysis of
the evolution of the numerical system and by expanding
knowledge of trade system of ancient times.
The extensive analysis has proven that logistics has
ancient origins. Over time, the priority of the original
meaning of the word "logos" has taken secondary position
and is primarily placed in the context of philosophy after the
discovery of Plato's works. As Pythagoras (575 – 495 BC)
was older than Plato (428 – 348 BC), given the information
that Pythagoras was familiar with the logistics, it can be
concluded that the primary meaning of the word "logos" was
account!

Logistics is largely responsible for the evolution and
advancements in the numerical system. Its history is tied to
the great ancient times, mainly to Pythagoras, and probably
dates back to 600 BC – as indicated by the findings from the
Uluburun shipwreck.

However, due to the theoretically most complete
analysis of the phenomenon of logistics, the systematic
approach remains the dominant choice [1]. The detailed
analysis of the concept of the Uluburun shipwreck extends
beyond an isolated trading process and has all the
characteristics of the current logistics systems. In ancient
times, the logistics streamlined production-distribution
processes, generating quantum leap in the scientific
knowledge.

Quantum leap in the previously isolated scientific fields of
ancient times was, in fact, made possible by the
development of logistics. At the same time, the increased
body of knowledge prompted the need for differentiation of
science, during which philosophy took precedence over
logistics. Thus, in the scientific differentiation, philosophy
completely absorbed logistics, even though the logistics
was the foundation of philosophy.

The dialectic connection and integration of individual
scientific disciplines in the nineteenth and early twentieth
century excluded logistics until the mid-twentieth century.
However, the philosophical platform was insufficient for
meeting the complex demands of the modern production
and distribution systems. The solution was achieved
through the development of logistics systems with the
greatest degree of integration of differentiated sciences.
Thus, the modern logistics systems bring us back to the
beginning of scientific development – the period of unity –
albeit with much higher quantum of knowledge.

Despite the unquestionable value of philosophy, logistics – as a science – is back to the well-deserved
pedestal. The differentiation of logistics systems, combined
with the internal quantum of knowledge on logistics, now
plays a dominant role in all processes and spheres of life, as
was the case in ancient times. Therefore, the etymological
genesis of logistics is essential and fully applicable in the
modern times.

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