The Early Stages of Globalization Evolution: Networks of Diffusion and Exchange of Domesticates, Technologies, and Luxury Goods*

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ABSTRACT

The paper looks into the evolution of globalization at its earliest stages (from the Neolithic Revolution to the Urban Revolution). Building on the approach by Frank, Chase-Dunn, and Hall to defining the age of the World System, we view the network space of the ancient World System which secured its cohesion. This network space served to transmit and diffuse the most important innovations of that time, such as domesticates, technologies, and prestigious goods. For each of these categories we give a number of examples which, taken together, provide sufficient evidence for the emergence of the World System as early as the Neolithic Revolution (and, indeed, in close connection with it).

There are various approaches to defining the age of the World System. According to Immanuel Wallerstein (1974, 1980, 1988, 2004), the modern World System emerged in the long 16th century. According to Andre Gunder Frank, the World System emerged

5,000 years ago as a result of the merger of the Mesopotamian and Egyptian world-systems (Frank 1990; Gills and Frank 1993). Later this World System experienced a series of expansions and contractions, but finally it encompassed the whole globe, whereas the modern World System is a direct successor of the ancient World System that emerged in the Near East 5,000 years ago (Frank 1990; Gills and Frank 1993). Note that for the period preceding the long 16th century Frank's notion of the World System is very close to the notion of the Afroeurasian world-system as interpreted by Christopher Chase-Dunn and Thomas Hall who believe that this world system emerged 2,000 years ago with the formation of the Great Silk Route network (Chase-Dunn and Hall 1997; see also Chase-Dunn 2014; Hall 2014).

Earlier it has been suggested by Andrey Korotayev and Leonid Grinin that the World System might be even older than was suggested by Frank, that it actually emerged around 10000 years ago in West Asia in direct connection with the Neolithic Revolution (Korotayev 2005, 2006, 2007, 2008, 2012; Korotayev, Malkov, and Khaltourina 2006a, 2006b; Korotayev and Khaltourina 2006; Grinin and Korotayev 2014). The idea of the emergence of the World System in the Near East in the times of the Neolithic Revolution is supported by the criterion of the diffusion of innovations – a number of plant and animal species were domesticated here (and spread from here to other parts of the World System), and numerous important technologies diffused from here across the ancient world. Later on, with the Urban Revolution, information networks were supplemented by rather stably functioning trade networks. In this paper we will view some examples of the diffusion of domesticates, technologies, and goods through the ancient World System.

DIFFUSION OF DOMESTICATES

One of the earliest examples of diffusion through the information network of the World System is the spread of domesticated plants and animals from their initial location of domestication. Several such locations are currently known (see Table 1), the most ancient one with the greatest number of domestications being the Near East. The so-called Near Eastern founder crop package includes emmer wheat, einkorn wheat, barley, pea, lentil, chickpea, bitter vetch, and one technical plant, namely linen[1] (Zohary and Hopf 2000: 241–242). These primary domesticates spread wide from the

Near East across the Central and Southern Asia about 8,000 BP (Zohary and Hopf 2000) and reached the major part of Europe about 7,000 BP (Brown *et al.* 2009: 108).

Table 1

Approximate domestication dates for the basic cultivars (crops and starches)

Species	Domestication time, BP
Southwest Asia	
Emmer wheat, einkorn wheat, barley	11500–10000
Rye	10000[1]
China	
Millet	11000[2]–8000
Rice	9000[3]–8000
Soya beans	9000–8600
Buckwheat	8000[4]–5500[5]
Mexico	
Corn	9000–7000
South America	
Sweet potato	10000–8000[6]
Manioc	8000
Potato	7000
New Guinea	
Yam, banana, taro	7000[7]
Africa	
Sorghum	4000

Source: Price and Bar-Yosef 2011: 170–171 unless stated otherwise in the footnotes.

Notes:

[1] In Abu-Hureira the first examples of rye with phenotypical features of domestication belong to 12,500 BP (Hillman *et al.* 2001).

[2] Yang *et al.* 2012.

[3] Molina *et al.* 2011; Liu *et al.* 2007.

[4] Ohnishi 1998; Amézqueta 2013.

[5] Li *et al.* 2009.

[6] Roullier *et al.* 2013.

[7] Denham *et al.* 2003; Perrier *et al.* 2011.

Let us consider the spread of some of the cultivars mentioned in Table 1 in more detail. The geographic diffusion of the emmer wheat was tightly related to human migration. The Balkan and

Asiatic groups of wheat come from south-western Anatolia, whereas the European group originates from Levant (Badaeva *et al.* 2015: 13–14). Cytogenetic analysis reveals four main ways of wheat diffusion throughout the Afro-Eurasian World System:

– the 'Balkan way' goes from south-eastern Anatolia to the Balkans, and further on to the Eastern Europe, the Volga region, and the Urals;

– the 'Asian way' also starts in south-eastern Anatolia and goes through Transcaucasia and the Volga region into Europe; another 'branch' of this way passes Iran on to South Asia and India;

– the 'European way' starts in Southern Levant and goes through the Iberian Peninsula to Europe; archeological evidence supports the existence of two waves of agricultural diffusion into Europe, the first passing Turkey, the Balkans, and Central Europe up the river systems into Western Europe, and the second going through the seas into Southern Europe;

– the fourth way starts in Iran and Iraq to pass Oman, and therefrom to get to Ethiopia and India (Badaeva *et al.* 2015: 13–17).

Along with wheat, barley was domesticated in the Near East about 10,500 BP (Zohary and Hopf 2000; Diamond 2002). However, currently there is enough evidence to support the hypothesis that the domestication of barley occurred more than once (Morrell and Clegg 2007; Jones *et al.* 2013). Research on the difference in haplotype frequency reveals two centers of barley domestication, one in the Fertile Crescent, and one 1500–3000 km further to the East, probably in Zagros mountains or even further to the East [Morrell and Clegg 2007; Saisho and Purugganan 2007], probably in Tibet (see Dai *et al.* 2012; Ren *et al.* 2013). The barley domesticated in the Fertile Crescent contributed the majority of diversity in European and American cultivars. The second domestication contributed most of the diversity in barley from Central Asia to the Far East (Morrell and Clegg 2007; Saisho and Purugganan 2007).

Another independent center of domestication (nearly as ancient as the Fertile Crescent one) existed in China. Millet, rice, soya beans, and later on buckwheat were all domesticated in the territory of modern China (Yang *et al.* 2012). Among these cultures, the greatest impact on the global nutrition landscape belongs to rice. Rice was domesticated around 9000 BP (Molina *et al.* 2011; Liu *et al.* 2007). Currently the most recent archeological and genetic research localizes rice domestication in the Lower Yangtze river valley (for a substantial review see Gross and Zhao 2014), and recognizes a later separate domestication in Africa[2] (Vaughan, Lu, and Tomooka 2008; Li, Zheng, and Ge 2011; Molina *et al.* 2011; Huang *et al.* 2012). Rice domestication in India has been under great discussion until recently, the main question being whether there was one more separate domestication of rice in this country (apart from the two domestications mentioned above). The latest genetic research shows that though rice domestication started separately in the Lower Yangtze valley and in India, this process only finalized in the latter after the fully domesticated rice from the former reached it (Fuller 2011; Huang *et al.* 2012; Gross and Zhao 2014).

Let us now briefly view the history of the diffusion of domesticated rice across the Afro-Eurasian World System. About 5000–4500 BP domesticated rice went up the Yangtze river, reaching Sichuan and later on Yunnan (Fuller 2011). Around 4,500 BP this cultivar reached Taiwan and spread further to the south, both into coastal and inner regions of South-Eastern Asia. In India the first evidence of the presence of Chinese domesticated rice can be traced back to the epoch of Harappa (4500–4000 BP).[3] Around 4000–3000 BP domesticated rice reached Japan and Korea (Gross and Zhao 2014).

Having reached India and South-East Asia, rice spread further on to the Near East (about 3,000 BP) and diffused from Persia to the various regions of the Persian Empire; Europeans got to know rice thanks to the Alexander the Great's campaign in India (Chang 2000).

As regards animal domestication, the major part of the modern diversity in domesticated animals goes up to one or several (but very few) initial domestication localities, wherefrom they gradually diffused through the World System. Thus, mitochondrial DNA analysis (supporting earlier archeological data) shows that almost all domesticated goats descend from Eastern Anatolia and northern and central Zagros (Naderi *et al.* 2008; see Zeder and Hesse 2000). As for pig domestication, mitochondrial DNA analysis localizes it in the Near East about 10,500 BP. Later on (about 6,000 BP) domesticated pigs reached Europe through two ways: via the Danube and the Rhine river valleys into the northwestern Europe, and via the southern sea way into the Mediterranean region (Larson *et al.* 2007, 2010). Simultaneously, Europe started to domesticate its own wild pig population, and rather soon these domesticated pigs prevailed on the Near Eastern ones (Larson *et al.* 2007).

For many years scientists have been discussing the ways how domesticates reached new regions – whether they came with new settlers, or it was information exchange between various population groups (*i.e.* the information networks of the ancient World System) that transferred new knowledge on domestication of various species. Currently there exists enough scientific evidence to support both hypotheses (Zeder 2011: 202). Thus, the diffusion of emmer wheat is strongly linked to human migration, whereas, for example, the diffusion of domesticated pigs looks much more like an information exchange.

DIFFUSION OF TECHNOLOGIES

The technological space of the World System before the Silk Road was relatively small as compared to later periods. However, the sustenance of the increasingly complex agrarian societies, chiefdoms, temple communities, early states, and later on agrarian empires, was based on a set of constantly improved technologies. Sets of technologies existed in production of luxury and bulk goods, construction, land and sea transportation *etc.* Some basic technologies of the ancient World System (such as pottery production) were independently invented in a number of different places (Kuzmin 2013); other technologies, say, in metallurgy (smelting of copper, bronze, and iron) and warfare (chariots) had a single place of invention, wherefrom they diffused throughout the World System. Let us view these two examples in greater detail.

Copper, bronze, and iron metallurgy

Scholars unanimously agree on the fundamental role of metallurgy in the sociopolitical and socioeconomic development of the ancient societies.

> The emergence of early metal production, including mining, smelting and exchange, can be seen as a key element in the development of more complex social and political orders in the ancient world … Metal production marked an important transition towards increasing regional and interregional trade and the inno-

> vation and diffusion of new technologies, and routinely provided the material setting for wealth accumulation among emerging elite factions within early societies … Such conditions have been seen as contributing to the development of early ranked societies in Eurasia … and the rise and expansion of early states and empires from the 4^{th} to early 2^{nd} millennia BC in the Near East (Hanks and Doonan 2009: 329–330).

Copper. The earliest evidence of the usage of natural copper and copper-based minerals appears in the Near East and Iran in 14,000–13,000 BP; in these regions copper becomes widely used between 10,000 and 9,000 BP (for a review see Killick and Fenn 2012: 562). However, the first evidence for copper smelting – the real start of copper metallurgy – is currently found in two regions, Iran, dating to 7,500 BP (Frame 2004: 1; Thornton 2009: 308), and Serbia, dating to 7,000 BP (Radivojević *et al.* 2010, 2013). By 6,000 BP copper metallurgy spread into east Turkey, southern Levant, and Central Europe (Roberts, Thornton, and Pigott 2009: 1014). As regards the spread of metallurgy from the Near East into the Far East, two most likely ways are suggested in literature, both starting in Anatolia and Iran. One way goes through the Caucasus and Eurasian steppe, the other passes the Amu-Darya river, Tianshan, and Kashgar (Tylecote 1976:14; Linduff and Mei 2009: 275).

Bronze. The earliest tin-smelted bronze (found in the mountainous west of Iran) dates back to 6,000–5,000 BP. Around 5,000 BP the technology of tin-bronze smelting spread from here into Sumer, Arabia, the Mediterranean, then further on to Central Asia and Central Europe, and even to China (Darling 2002: 59–60; Roberts, Thornton, and Pigott 2009: 1015–1016). South-Eastern Asia received this technology via its contacts with the population of the Yellow and Yangtze river valleys (Higham *et al.* 2011: 227). Thus, all these regions appear to be part of a united network of information exchanges covering the whole of Eurasia.

Iron. Smelting iron ore was first carried out by the Hittites living in Anatolia about 3,500 BP (Headrick 2009: 36). Initially iron was inferior to bronze in terms of cracking and rusting, but superior to it thanks to the abundance of iron ore deposits and, consequently, relative cheapness of iron tools and weapons. In 3,200 BP, after the collapse of Hittite empire, the technology of iron ore smelting spread among the Near Eastern societies. Around 3,000 BP it got from Mesopotamia to India, in 2,800 BP from Arabia to Ethiopia, in 2,700 to Egypt and China, where it was substantially improved (Headrick 2009: 36–37).

Thus, all three technologies of metallurgy described above diffused through the World System very fast, reaching rather remote areas in just several centuries. In our opinion, this can be taken as a valid proof of the existence of a substantial information network tying together the World System far before the Silk Road came to existence.

Invention and diffusion of the war chariots

In the words of the Russian historian Chechushkov: 'Chariot complex is one of the most large-scale historical phenomena, geographically spreading in the vast territories of Eurasia, and chronologically embracing a major part of the Bronze Age' (Chechushkov 2011: 62). The role of wheeled vehicles in ancient Eurasia was huge (especially among the pastoralists). Not only did they serve as the main means of transportation, but also were widely used in warfare (Hudyakov 2002: 139).

The earliest usage of two-wheeled vehicles is documented for the Near East in the 3^{rd} millennium BCE (Chechushkov 2011: 63). However, these vehicles were still far from light war chariots. A number of innovations was required, first of all, spoked wheel (instead of the earlier cross-bar wheels), and the domestication of horse (to replace donkeys). Thus, chariots as a whole technological complex appear in the Near East only in the seventeenth and sixteenth centuries BCE, when Egypt was conquered by the Hyksos (Chechushkov 2011: 63).

The prime of chariots and the rapid spread of this complex technology starts around 3,600 BP. *In just a little more than a century light chariots spread throughout the territory stretching from Greece to India, from Russia to southern Egypt* (Moorey 1986: 196). The massive use of chariots is recorded about 1457 BCE in the Battle of Megiddo. Around 3,200 BP the chariot technology reached China (Shaughnessy 1988). The speed of spread of a rather sophisticated technology and the close similarity of the forms of chariots on the entire Eurasian territory point to the diffusion of this technology (as opposed to the multiple inventions). Moreover, it is commonly hypothesized that this spread has been associated with a particular group of people (the Indo-Aryans) (Moorey 1986: 196).

LONG-DISTANCE TRADE: DIFFUSION OF TOOLS AND LUXURY GOODS

According to Philip Curtin: 'Trade and exchange across cultural lines have played a crucial role in human history, being perhaps the most important external stimuli to change, leaving aside the unmeasurable and less-benign influence of military conquest. External stimulation, in turn, has been the most important single source of change and development in art, science, and technology' (Curtin 1984: 1).

The prototype of trade in primitive societies (100,000–130,000 BP) took the form of exchange between related groups. It was through exchange (albeit quite rare and non-systematic) that the tools made of volcanic glass (obsidian), were, as shown by Tanzanian archaeological data, obtained by the groups who lived 200 miles away from the deposits of obsidian, which is several times greater than the distance which the gatherers commonly passed in their search for resources (Smith 2008: 13).

After the Neolithic revolution, trade exchanges became more active, and their structure changed – the population engaged in agriculture could exchange its grain and pottery for honey and the meat of wild animals from hunters and gatherers, as well as for dairy products, meat and skin from pastoralists.

It is in the late Neolithic that the long-distance trade starts to emerge. Prior to that goods moved chain-wise from one community to another; however, by 7,000 – 6,000 BC some products appear to have directly travelled rather long distances – for example, in this period the shells from the Indian Ocean find their way to Syria, almost 1,000 miles away from the place of their appearance (Smith 2008: 17).

A new impetus to the development of long-distance trade and the emergence of the first inter-regional network of systematic trade flows is associated with the Urban Revolution. Although the majority of population still earned a livelihood from agriculture, livestock, and/or fishing, and consumed food, clothing and other goods either produced by themselves or received from the immediate neighborhood, and did not directly benefit from the long-distance trade, still 'the importance of trade was disproportionate to its scale. Trade became an engine in driving socio-political complexity' (Smith 2008: 24).

Indeed, specialized markets appeared in the cities for the first time (Aubet 2013: 144–146). The rise of inequality and nobility contributed to the growth of prestigious goods consumption and thus intensified the trade; the prestige of goods was often closely linked to how long a way they had to pass before reaching the place of final consumption. Trade in strategic goods, such as wood and metals, was also rapidly developing. The establishment of control over trade routes becomes the most important factor in the growth of city-states (and later on empires).

Consider the structure of the trade networks in more detail.

The trade network of the World-System in the epoch of city-states stretched from Egypt to Afghanistan. Its central hub and the largest importer of many commodities was Mesopotamia. With its irrigation agriculture, Sumer could produce and sell food surplus; its main export items were also woolen cloth and some prestigious goods, such as jewelry, ceremonial objects, weapons, and aromatic oils. However, the region did not have deposits of metals, and its wood was not suitable for construction; those goods had to be imported. In the East (modern Iran) Sumer bought copper and silver; Syria and Lebanon were the main suppliers of cedar and other types of wood (Saggs 1989: 129; Smith 2008: 25; Pearson 2003: 50). About 5,000 BP the Sumerians practiced sailing in the Persian Gulf, where their main trading partners were the islands and coastal areas from Kuwait to Bahrain. To these regions Mesopotamia supplied grains (especially barley), wool and woolen cloth in return for copper, gold, ivory, pearl, and nacre (Smith 2008: 32). The Indus Valley sold to Mesopotamia its hard wood, tin, lead, copper, gold, silver, pearls and ivory, and exotic animals (Asthana 1993: 271–282; Pearson 2003: 50). The most important source of tin (necessary for the manufacture of bronze) was Anatolia (Howard 2010: 110).

Unlike Mesopotamia, Egypt was fairly well supplied with its own metals; however, wood still had to be bought from Lebanon and Syria; due to this trade connection with Levant, Egypt became integrated into the trading network that stretched from Afghanistan to Anatolia. Transit goods passed Levant to reach Egypt which, in turn, paid for them in gold, papyrus, glass, jewelry, and perfumes (Smith 2008: 41–47; Saggs 1989: 137–138). Egypt also traded with the 'Punt land' (the territory of modern Somaliland), sending expeditions which brought frankincense and myrrh, wood, ivory, gold *etc.* (Liverani 2001: 166–169; Aubet 2013: 213–238; Saggs 1989: 133–135). We fully agree with Michael Pearson, who states that

> [t]he rise of early civilizations in the Tigris-Euphrates area, and in northwest India, that is those of Mesopotamia and the Indus valley, had profound effects for trade, including that by sea. We can now begin to write about relatively routine and organized trade using the Indian Ocean as a highway. Indeed, it is clear that the main economic connections between these two civilizations was by sea (Pearson 2003: 49; see also Wright 2010: 221).

A rather sustainable network of trade ways emerged, which retained its significance in the age of empires as well. Moreover, during the age of empires this network expanded to carry not only prestigious goods, but also some bulk goods as well.

CONCLUSION

Andre Gunder Frank directly attributed the emergence of the World System to the Urban Revolution, when the formation of several clusters of cities dramatically increased the breadth and depth of connections between the corresponding regions. Indeed, when numerous city centers expanded simultaneously, their contact zones invariably overlapped, while the chains of economic and cultural connections and interrelations extended to cover increasingly wider territories. However, we suppose that the Urban Revolution caused not exactly the emergence of the World System (which occurred several thousand years before that), but its transition to a principally new level of complexity. Thus, it is more correct to say that during the Urban Revolution the World System experienced on of the most important phase transitions in its history (Grinin and Korotayev 2009).

NOTES

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[1] Triticum dicoccum Schübl., Triticum monococcum L., Hordeum vulgare L., Pisum sativum L., Lens culinaris Medik., Cicer arietinum L., Vicia ervilia (L.) Willd., Linum usitatissimum L.

[2] Domestication of African rice is localized in Sahel, Upper Niger (Li, Zheng, and Ge 2011).

[3] About 4,000 BP a number of other Chinese species reach the north-western regions of India and Pakistan, such as peach, apricot, millet, *etc*. (Fuller 2011).

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