

Mechanisms of Systemic Integration in a Globalized World

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The paper discusses some aspects of integration of different regions and societies in the course of historical globalization. Within historical globalization one can observe a close correlation between such important processes as technological transformations, urbanization, political integration, struggle for political hegemony, etc. In the paper we analyze these correlations to associate historical globalization with phases of expansion. Within the expansion process we point out seven levels from the local level through the planetary one. The most significant changes were associated with crucial technological breakthroughs, or production revolutions, and other related transformations like the Urban Revolution. The latter can be regarded as a phase transition of the Afroeurasian world-system to a qualitatively new level of complexity. There are also several periods which one can define as landmarks in the world-system history. The paper also offers some theoretical ideas about cycles of divergence and convergence.

Keywords: systemic boundaries, technology, Afroeurasian world-system, mathematical modeling, demography, population, history of globalization, the World System, domesticates.

The present study continues previous publications in this journal (Grinin and Korotayev 2014a) as well as on our other works (Grinin 2007a, 2011; Grinin and Korotayev 2006, 2012a; Korotayev and Grinin 2006). The task of the article is to describe the processes of systemic integration. In particular, I would like to show the complex character of World System development as well as the interrelation between the development of some important variables (including production, technology, politics, and urbanization), and growing spatial links. This paper cannot discuss each of these variables and interactions in detail. Thus, many ideas are briefly or even schematically outlined here via tables. The paper seeks to unite a number of conclusions made in other works (see above) into a general concept. Only when offering new conclusions or introducing new terms do I provide a more comprehensive analysis.

1. The Systemic Properties and Landmarks of the World-System History

The rise or decline of individual societies and regions, shifts of the developmental centers, some rapid common and almost simultaneous transformations throughout vast territories (with account of inevitable time lag) as well as many other phenomena can be also (or chiefly) explained just by the systemic properties of the Afroeurasian world-system in a respective epoch.¹ These systemic properties imply interdependence between the parts and constituents, as well as the presence of a certain structure which reproduces itself over quite a long period of time. This structure may also change and launch a dramatic transformation within a world system. This is the way a fundamental systemic property (wherein the whole is more than just a sum of its parts) is realized within world-systems.² These *impulse transformations*, which can be manifested in various forms, can produce some rather unexpected consequences. Such systemic properties account for the presence of long-lasting positive and negative feedbacks that can be traced in technological or demographic indicators.

One should pay special attention to Chase-Dunn and Hall's idea that a world-system is constituted by a whole set of intersocietal interactions, and the level of analysis which is of greatest importance for our understanding of social development is not the one of societies and states, but the one of the world-system as a whole (Chase-Dunn and Hall 1997: xi–xii). Undoubtedly, these systemic properties appear quite evident within the evolution of the Afroeurasian world-system.

Even a brief analysis proves that the systemic properties of *world-systems* and all the more of the World System surpass the common level (even of complex systems) and transform into supersystemic properties determined by the vast temporal and spatial dimensions which we already discussed in some of our previous works (Grinin and Korotayev 2009, 2012a). This demands new theoretical and conceptual frameworks. And although much has been done in this respect there is still much to do. The present article attempts at making a theoretical and conceptual contribution to the studies of the World System's systemic properties, in particular, by suggesting the notions of divergence and convergence.

Within a world-system one can point out landmarks (integral points) which define peculiar forms and characteristics. These can be both spatial points (specific regions and subregions which constitute the most important communication links and confronting forces), and temporal points which are the periods when the most intensive and important transformations and bifurcations occur. When the most important temporal and spatial points overlap we observe the emergence of historical spatial-temporal nodes which generate dramatic transformations in different regions and environments. There have been quite a few such spatial-temporal nodes in the world history. If to bring them together within a conventional timeline they can show the mainstream pattern of the World System development.

One of the first such nodes could be traced in South Mesopotamia in the fourth millennium BCE. The urbanization that started in South Mesopotamia launched many processes which gave birth to civilizations and contributed to the emergence of politics in the present sense of the word and of political institutions. It also promoted the struggle for hegemony, intensified trade relations, and created the first systems of money circulation.

That was one of the crucial phase transitions, actually its start that had lasted for almost three millennia in the Afroeurasian world-system. As a result *the period from the second half of the fourth millennium BCE to the first half of the first millennium CE was*

of outstanding importance. It witnessed the main technological, urban, political and cultural transformations in the Afroeurasian world-system and triggered historical globalization.

Another spatial-temporal node was surely the late Middle Ages and early Modern Age in Europe which gave birth to modern economy and statehood. Between the defined two nodes there lies the node of the second third and middle first millennium BCE (that Karl Jaspers [1953] called the Axial Age), which created a background for the emergence of new philosophies, ideologies, religions, arts, and forms of statehood. The core of this node was situated in the Western Asia and on the Balkan Peninsula and later also incorporated India and China, thus forming a belt of empires. The development of these nodes increased the divergence between regions while the distribution of innovations implied convergence, as will be discussed in the last section of this paper.

2. Periodization on the Basis of Expanding Spatial Links and Phases of the Afroeurasian World System

The students of world-systems always paid much attention to spatial links (*e.g.*, Chase-Dunn and Hall 1997; Hall 2014; Chase-Dunn 2014) whose scale (length) can be measured. Individual world-systems and the World System vary both in scale (length) of these links, as well as in their intensity and complexity. In this paper we present a concept of the evolution of these links in the form of periodization of globalization as defined by the expanding spatial links. This periodization can be correlated with others in order to show the complex character of the World System development, the interactions between some other important variables (production, technology, politics, and urbanization), and the growth of spatial links. We have already discussed both the procedure and various approaches to periodization of historical globalization.³

Our ideas of the main phases of historical globalization are presented in Table 1 which distinguishes seven periods. The expansion and integration of interacting networks moves from the local level through the level of transcontinental links, to the planetary one. One can speak about historical globalization starting from the third phase when the regional-continental links originated which by the early nineteenth century had become truly global.

Table 1

Growth of globalization level in historical process

Period number	Type of spatial links (globalization level)	Period dates
1	Local links	Before the 7 th – 6 th millennium BCE
2	Local-regional links	From the 7 th – 6 th millennium to the second half of the 4 th millennium BCE
3	Regional-continental links	From the second half of the 4 th millennium BCE to the first half of the 1 st millennium BCE
4	Transcontinental links	From the second half of the 1 st millennium BCE to the late 15 th century CE
5	Intercontinental (Oceanic) links	From the late 15 th century to the early 19 th century
6	Global links	From the early 19 th century to the 1960s and 1970s
7	Planetary links	From the last third of the 20 th century to the mid-21 st century

These periods are summarized below:

1) From the eighth to the fourth millennia BCE – the formation of contours and structure of the Middle Eastern core of the Afroeurasian world-system. This was the period of completing the Agrarian Revolution in the Near East (also see Table 3). It evidenced the formation of long-distance and permanent information and exchange links which was accompanied by the emergence of medium-complexity early agrarian societies, relatively complex polities, and settlements that (in terms of their size and structure) slightly resembled cities (*e.g.*, Kenyon 1981; Wenke 1990: 325; Schultz and Lavenda 1998: 214).

In the fifth millennium BCE, in Southern Mesopotamia there emerged the Ubaid culture. The Uruk culture that succeeded the Ubaid was characterized by the presence of a considerable number of large settlements. The Ubaid and the Uruk cultures laid the material and social basis for the development of the Sumerian civilization. By the end of the Uruk period we observe the emergence of urbanized societies (Bernbeck and Pollock 2005: 17), as well as of the first early states and their analogues (Grinin and Korotayev 2006; Grinin 2003, 2008), and civilizations. By the end of this period the 'Urban Revolution' took place within Afroeurasian world-system. This can be regarded as a phase transition to a qualitatively new level of social, political, cultural, demographic, and technological complexity (Berezkin 2007).

2) The third and second millennia BCE – the development of the Afroeurasian world-system centers during the Bronze Age. This is a period of a rapidly growing population and agricultural intensity in the Afroeurasian world-system. One of the most important outcomes of this period was the growing political integration of core societies, which was a consequence of rather complex military-political and other interactions.

In the West-Asian region the prestige good trade network achieved a high level of development and was often supported by states. Some European regions were involved in the communication network of the Afroeurasian world-system, while the trade links with South Asia were established through the Persian Gulf.

3) From the first millennium BCE to 200 BCE – the Afroeurasian world-system as a belt of expanding empires and new civilizations. This is the time of the early Iron Age. The Agrarian Revolution had been completed through the diffusion of the technology of plow non-irrigation agriculture and usage of tools with iron parts (Korotayev and Grinin 2006, 2012). The end of the period evidenced the formation of empires both in the Far West (Rome) and the Far East (China). The West Asian center was finally integrated with the Mediterranean world, whereas the European areas of the barbarian periphery were linked more actively with Afroeurasian world-system centers through military, trade, and cultural links.

4) From 200 BCE to the early seventh century CE – the Afroeurasian world-system is integrated with the steppe periphery. *During this period the links within this world-system became transcontinental.* Around the second century BCE, relatively stable trade links (albeit involving preciousness rather than bulk goods) were established between the 'marcher empires' through the so-called Silk Route, whose significant part went through the territories of the nomadic periphery and semi-periphery. The periphery closed the circuit of Afroeurasian world-system trade links. For a long time the Afroeurasian world-system expansion proceeded to a considerable extent through the expanding interaction between civilizations and their barbarian peripheries. The disintegration of the Western Roman Empire, the weakening of the Eastern Roman Empire, the diffusion of Christianity in the west, a new rise of the Chinese Empire in its eastern part, prepared

the Afroeurasian world-system for major geopolitical changes and new levels of complexity.

5) From the seventh to the fourteenth centuries CE – the Afroeurasian world-system apogee: world religions and world trade. In this period the level of development of the world-system reached the limits of what could be achieved on the agrarian basis. One could also observe the formation of important preconditions for the transformation of the Afroeurasian world-system into the planetary capitalist World System.

One should particularly note: a) the formation of especially dense oceanic trade links in the second half of the first millennium CE in the Indian Ocean Basin; b) the creation of vigorous major transcontinental land routes through the territory of the Mongol states that connected the main Afroeurasian world-system centers; and c) the started expansion of an urbanized zone from Northern Italy through Southern Germany to the Netherlands, where the commodity production became the dominant economic pattern (Bernal 1965; Wallerstein 1974; Blockmans 1989: 734; Grinin and Korotayev 2015).

6) From the fifteenth to eighteenth centuries CE – the transformation of the Afroeurasian world-system into the planetary World System. This phase was associated with the initial phase of the Industrial Revolution (see Table 3) that drives the transformation of the Afroeurasian world-system into a world-system of planetary scale (on the one hand) of capitalist nature (on the other hand).⁴ The planetary scale of the world-system could be evidenced, for example, by the price revolution that resulted from the mass import of gold and silver from the New World to the Old World (see, *e.g.*, Barkan and McCarthy 1975; Goldstone 1984, 1988; Hathaway 1998: 34).

7) From the beginning of the nineteenth century to the twentieth century CE – the industrial World System and mature globalization. Great Geographic discoveries sharply extended the Afroeurasian world-system's contact zone. As a result a new structure of this world-system (alongside with the European technological breakthrough) started to originate. The trade-capitalist core emerged in Europe while the previous world-system centers (in particular, the South Asian one) had been transformed into an exploited periphery (this process became even more active at the subsequent phase of the World-System evolution). Thus, the world-system periphery experienced a significant transformation (see Grinin and Korotayev 2015 for more details).

The subsequent World-System's development is connected directly with the final phase of the Industrial Revolution (between the last third of the eighteenth century and the first half of the nineteenth century). Changes in transportation and communication had a revolutionizing effect on the development of the world-system links.

In the twentieth century, the World System's development (after the World Wars and decolonization) was associated with the Cybernetic revolution of the second half of the twentieth century. The world became tightly interconnected as has been recently demonstrated by the global financial-economic crisis. By the late twentieth century, the idea that our world is experiencing 'globalization' became a common point.

Table 2 shows the correlation between the phases of historical globalization and the development of the Afroeurasian world-system whose evolution has evidently provided the basis for the qualitative development of globalization.

Table 2

The increasing level of globalization and the rise of the Afroeurasian world-system

Type of spatial links (globalization level)	Period	Phases of development of the Afroeurasian world-system
Local links	Till the 7 th – 6 th millennium BCE	
Local-regional links	From the 7 th – 6 th millennium to the second half of the 4 th millennium BCE	the first phase: from the 8 th – 4 th millennia BCE – the formation of contours and structure of the Middle Eastern core of the Afroeurasian world-system
Regional-continental links	From the second half of the 4 th millennium BCE to the first half of the 1 st millennium BCE	the second and third phases: the 3 rd and 2 nd millennia BCE – the development of the Afroeurasian world-system centers during the Bronze Age (the second phase). From the first millennium BCE to 200 BCE – the Afroeurasian world-system as a belt of expanding empires and new civilizations (the third phase)
Transcontinental links	From the second half of the 1 st millennium BCE to the late 15 th century CE	the fourth and fifth phases: from 200 BCE to the 14 th century CE – the Afroeurasian world-system is integrated by the steppe periphery; the Afroeurasian world-system apogee: world religions and world trade
Intercontinental (Oceanic) links	From the late 15 th century to the early 19 th century	the sixth phase: from the 15 th to the 18 th centuries – the transformation of the Afroeurasian world-system into the planetary World System
Global links	From the early 19 th century to the 1960s and 1970s	the seventh phase: from the beginning of the 19 th century to the 20 th century – the industrial World System and mature globalization
Planetary links	From the last third of the 20 th century to the mid-21 st century	subsequent phases: mature and integrated World System

3. The Correlation between Spatial Links, Technological Level, and Political Organization

The most significant changes within the World System and its globalization were definitely associated with dramatic technological breakthroughs or production revolutions, namely, *Agrarian (or Neolithic)*, *Industrial*, and *Cybernetic* (see Endnote 4 for this literature).

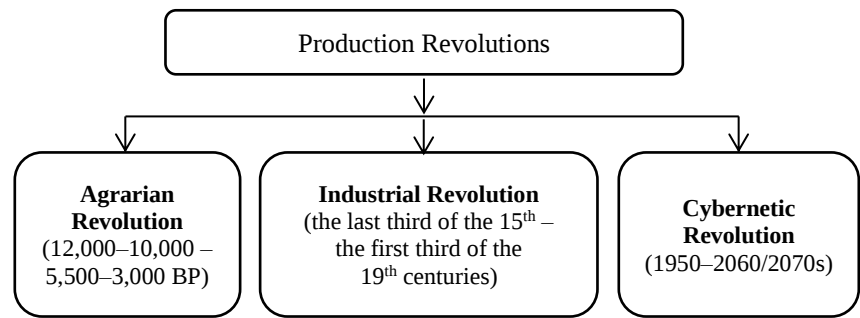


Fig. 1. Production revolutions in history

Each production revolution launches a new production principle and passes through three phases: two innovative phases and between them – a modernization one (see Fig. 2).

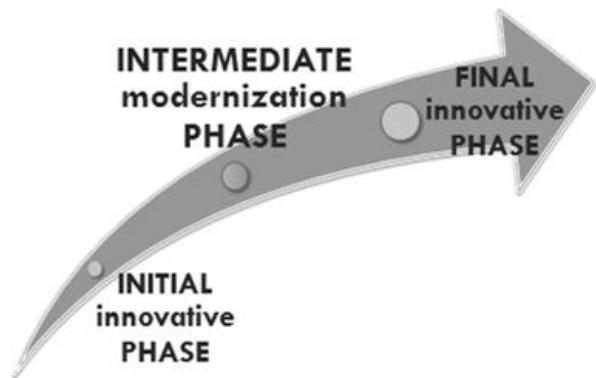


Fig. 2. Phases of production revolutions

The phases of the production revolutions can be conceptualized as in Table 3.

Table 3

The phases of the Agrarian, Industrial and Cybernetic Revolutions

Phases of the Agrarian Revolution				
Phases	Type	Name	Dates	Changes
Initial	Innova-tive	Manual farming	12,000–9,000 BP	Transition to primitive manual (hoe) ag-riculture and cattle-breeding
Interme-diate	Modern-ization	Distribution of agricul-ture	9,000–5,500 BP	Emergence of new domesticated plants and animals, development of complex agriculture, emergence of a complete set of agricultural instruments
Final	Innova-tive	Irrigated and plough agriculture	5,500–3,500 BP (in Europe up to 500 BCE)	Transition to irrigative or non-irrigated plow agriculture

Phases of the Industrial Revolution				
Phases	Type	Name	Dates	Changes
Initial	Innovative	Manufacturing	15 th – 16 th centuries	Development of shipping, technology and mechanization on the basis of water engine, manufacture based on the division of labor and mechanization
Intermediate	Modernization	Primary industry	17 th – early 18 th centuries	Formation of a complex industrial sector and capitalist economy, increasing mechanization and division of labor
Final	Innovative	Machinery	1730–1830s	Formation of sectors with the machine production cycle with steam energy
Phases of the Cybernetic Revolution				
Initial	Innovative	scientific-cybernetic	from the 1950s to the 1990s	Breakthroughs occurred in the spheres of automation, energy production, synthetic materials production, and especially in the development of electronic control facilities, communication and information
Intermediate	Modernization	the phase of digital electronics	from the 1990s to the 2020s	The development and wide diffusion of user-friendly computers, communication technologies, cell phones and so on. Medicine and biotechnologies as well as some other innovative fields have also made great advance
Final	Innovative	the phase of self-regulating system	from the 2030s to the 2070s	Creation of self-controlled systems or systems indirectly controlled either via other systems or by means of point impact and correction

Note that every phase of historical globalization closely correlates with a new level of development of productive forces. The origins of globalization and formation of regional-continental links correlate with the final phase of the Agrarian revolution, which spread in many parts of the Afroeurasian world-system in the period from the fourth to the first millennia BCE. The Age of Discovery and the formation of intercontinental links correlate with the initial phase of the Industrial Revolution. (See Endnote 4 for a review of this our work on these phenomena.)

The correlation between different variables and the correlations between the periods of globalization and such variables as spatial links, political organization, and level of technological development, are demonstrated in Table 4.

Table 4

Correlation between spatial links, political organization and level of technological development

Type of socio-spatial links	Period	Forms of political organization	Level of technology (production principles and production revolutions)
Local (Local-Regional) links	Until the second half of the 4 th millennium BCE	Pre-state (simple and medium complexity) political forms, the first complex polities	Hunter-gatherer production principle. The initial and middle phases of the Agrarian revolution
Regional-Continental links	The second half of the 4 th millennium BCE – the first half of the 1 st millennium BCE	Early states and their analogues; the first empires	The final phase of the Agrarian revolution (from Mesopotamia to Europe)
Continental/Transcontinental links	The second half of the 1 st millennium BCE – the late 15 th century CE	Rise of developed states and empires	Agrarian production principle reaches its maturity
Intercontinental (oceanic) links	The late 15 th century – the early 19 th century	Rise of developed states, first mature states	The initial phase of the Industrial Revolution
Global links	The early 19 th century – the 1960s and 1970s	Mature states and early forms of supranational entities	The final phase of the Industrial Revolution. Maturity of the Industrial production principle
Planetary links	Starting from the last third of the 20 th century	Formation of supranational entities, washing out of state sovereignty, search for new types of political alliances and entities, planetary governance forms	The start and development of the Cybernetic revolution, whose final phase is forecasted for the 2030s and 2040s

4. The Correlation between Urbanization and Political Processes

Urbanization is closely connected with technological and political transformations. In the fourth millennium BCE, the Urban Revolution (the term was coined by Childe [1950; 1952]) took place in South Mesopotamia (Adams 1966, 1981; Bernbeck and Pollock 2005: 17; Pollock 2001: 45; Rothman 2004). This revolution built upon the Agrarian Revolution, which spread throughout Mesopotamia and beyond, can be regarded as a multi-dimensional phase transition of the Afroeurasian world-system to a qualitatively new level of complexity.

The correlation between urbanization and political processes is beyond doubt. The 'urban' pattern of the early state formation was one of the most common. Urbanization was connected with the concentration of people due to the forced merger of a few settlements, usually under the pressure of military or other threats. Such a situation was typical in many regions in the late fourth and third millennia BCE (Dyakonov 1983: 110; 2000: 46; Kottak 1980; Claessen 2002). In Greece this process was called *synoikismos*.

Population concentration also contributed to increasing complexity. In particular, the contact density within a polity is a very important factor for state formation. Archaeologists note that population concentration leads to a spatial structuring of settlements (Adams 1966; Wright and Johnson 1975). The larger the population density, the more pronounced is the structuring of society, including its spatial organization (Girenko 1991: 91).

Since the density in urban communities is usually higher than in rural societies, the politogenetic processes within the former have certain peculiarities in comparison with rural societies. The patterns of statehood development are also different due to the presence or lack of cities' political dominance over rural neighborhood.

This explains why we disagree with Robert Carneiro's circumscription theory, which ignores the urban pattern of state-formation and thereby neglects the fact that in cities the population and resource concentration plays a different role than it is described in his theory (Carneiro 1970, 2012; Grinin and Korotayev 2012b). In the agrarian polity the increasing population density may bring the land shortage, social tension and wars, while in cities the increasing population density may rather bring the emergence of new forms of government and statehood.

Let us consider now the relation between the size of the territory controlled by developed and mature states and their analogues, and the world urban population. In Fig. 3 we can see a close correlation between urbanization and political integration.

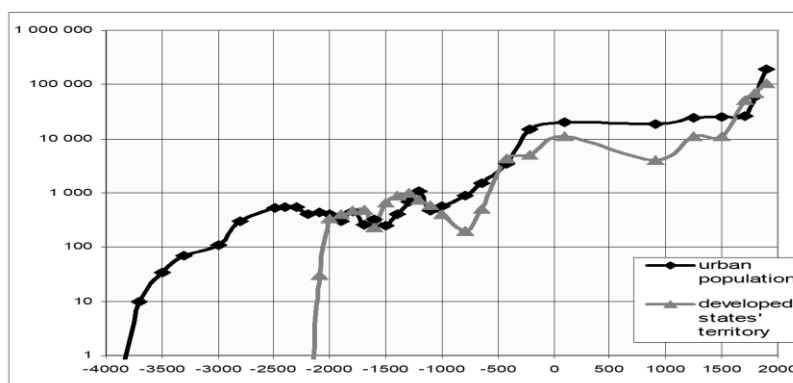


Fig. 3. Dynamics of World Urban Population (thousands) and the Size of the Territory Controlled by the Developed and Mature States and Their Analogues (thousands km²), till 1900 CE, logarithmic scale

Source: Korotayev and Grinin 2013 (based on data from Taagepera 1978a, 1978b, 1979, 1997).

Several conclusions may be offered. First, a relatively rapid process of the emergence and growth of cities in the Afroeurasian world-system was observed in the second half of the fourth millennium and *especially* in the first half of the third millennium BCE.

In the same period we observe the rise of the first states in Mesopotamia, Egypt, in the Minoan civilization on Crete, in Phoenicia, and Harappa. Urbanization was not uniformly dominant in the process of state formation. For example, in Egypt the process of political centralization had started earlier than in Mesopotamia due to the unique environment of the Nile valley.

Second, by the first millennium BCE the urbanization had slowed down. During this period we observe a growing political integration among the Afroeurasian world-system core societies, while an increasing political complexity of cities and small polities gave way to large early and developed states (Grinin 2008, 2011, 2012). In Fig. 3 we can observe the dramatic rise of this new type of states starting from the late third millennium BCE. This rise of states and the emergence of the first empires generated the upswings and downswings of the cycles of political hegemony after the third millennium BCE (Frank and Gills 1993; see also Chase-Dunn *et al.* 2010; Grinin, Ilyin, and Andreev 2016). In the late third and second millennia BCE, in Mesopotamia one could observe the succession of the Akkadian Empire, the third Dynasty of Ur Kingdom, and Old Babylonian Kingdom, followed by the Assyrian Kingdom. In the second half of the second millennium BCE, one could see a vigorous hegemonic struggle between Assyria, New Kingdom of Egypt, Mitanni, and the Hittite Kingdom. Some of these powers would unite against others (in Fig. 3 the period of oscillations in the second millennium BCE correlates with the period of the struggle for political hegemony [about various theories of cycles of political hegemony see *e.g.*, Modelski and Thompson 1996; Thompson 1988]).

Thus, a rapid urbanization in the fourth and third millennia BCE contributed to the emergence of new political structures (early states and their analogues).⁵ However, the transition to maturing political forms required no further increase in urbanization; thus, although the political integration in the third and second millennia proceeded rather actively, one does not observe any transition of urbanization to a new attractor. In the second half of the second millennium we observe a certain rise that is accounted for by Egypt, where urbanization, unlike in Mesopotamia, actually followed the political process.

The slowdown of urbanization was also caused by the uncompleted Agrarian revolution in Europe. It could complete through the diffusion of plow non-irrigation agriculture based on the use of cultivation tools with iron parts. The diffusion of iron, together with population growth in Europe and other parts of the Afroeurasian world-system, brought a new increase both of urbanization and of state-formation (first, of the early states, and later – of the developed ones).⁶ As a result, in the second half of the first century BCE and in the first century CE we can also find a belt of expanding empires and new civilizations.

It is worth noting a very remarkable phenomenon of East/West synchrony in growth and decline of the population sizes of the largest cities from 500 BCE to 1500 CE in West Asia and of those in East Asia (Chase-Dunn and Manning 2002). There is a similar synchrony in the territorial sizes of the largest empires (Hall, Chase-Dunn, and Niemeyer 2009).

One observes the third wave of explosive growth of cities and mature states in connection with the Industrial Revolution whose start we date to the end of the fifteenth century (see Table 3) and which completed in the early nineteenth century (that actually coincides with the transition to the true globalization).⁷ The increasing number of developed states in the sixteenth century was connected with the so-called Gunpowder

Revolution and other changes in the military arts which forced the European and Asian States to change their organization (Duffy 1980; Downing 1992; Andrade 2016; see also McNeill 1982).

5. System Integration in Terms of Divergences and Convergences

In world-system terms, the integration is generated by an array of complex processes. Increasing interactions promote complexity by means of diffusing innovations, interactions, and impacts of various kinds, as well as expansion of the most active regions or societies, and resistance to this expansion. These interactions also influence the restructuring of the system due to the emergence of new dynamically developing competitive centers. Within this flow of interactions one can trace a manifestation of the law of uneven development of societies. Development has always been spatially uneven (Chase-Dunn and Hall 1997: xiii; see also Harvey 1996; Marx 1972; Ilyushechkin 1986, 1990, 1996). In particular, this law is manifested in alternating periods of fast development of certain regions (which, therefore, surpass other regions), and of the distribution of achievements of the leading region far beyond its boundaries. Consequently, there occurs a levelling between different regions. The described cyclical uneven development leads to a powerful expansion of the world system or of its developed regions, as well as to increasing contact density and complexity levels, and to a general acceleration of its development.

The fluctuation phases within uneven social development can be presented as alternations of divergences and convergences. A group of global historians (the 'California School') denoted the nineteenth-century breakaway between Western Europe and the Asian societies as a 'great divergence' (see Goldstone 1991, 2002, 2008a, 2008b; Pomeranz 2000, 2002; Wong 1997; Frank 1998; Marks 2002; Vries 2003, 2010). Following this approach we find it appropriate to call the epoch beginning between 1950 and the 1970s, and lasting until the present day, the 'great convergence', since during this period the periphery and semi-periphery have been catching up with the world-system core (Grinin and Korotayev 2014b, 2015). In our co-authored monograph *Great Divergence and Great Convergence: A Global Perspective* (Grinin and Korotayev 2015) we analyzed the processes of divergence and convergence, having covered the period starting from the twelfth century CE. Moreover, this analysis has been made to a large extent within the world-system paradigm. We also analyzed additional mechanisms of both divergence and convergence, as well as transformation of the former into the latter.

In this context we have come to the conclusion that alternations of these processes can be also discovered in other periods of World-System history starting from the ninth and eighth centuries BCE, that is at least from the moment of the formation of the World-System core in accordance with our chronology (Grinin and Korotayev 2016).

Divergences and convergences have been accompanying the development throughout historical process. They appear at different levels and different scales. Divergence and convergence are respectively a discrepancy or closing up of evolutionary patterns; meanwhile, the developmental level of societies evolving along divergent or convergent trajectories could remain different as well as become generally comparable. Divergence in some aspects can combine with convergence in other aspects if societies maintain a close contact. We described a similar type of development for Europe of the fifteenth to eighteenth centuries CE and called it a 'catching-up divergence' (Grinin and Korotayev 2015). A number of Asian states borrowed (converged with) European military technologies in the early Modern period. Convergence can also be alternated by divergence and vice versa.

Divergence occurs both among affined and unrelated societies. The divergence among societies with common ancestry is especially evident if, for example, these societies' developmental trajectories diverge or they develop in different social and geographical environments. For example, after the fifth century CE the development of the Saxons who intruded in Britain and of the Saxons staying on the European continent unfolded in essentially different ways (for more details see Grinin 2011: 17–21). Along with a number of other factors the religious divergence between Orthodox and Roman Catholic Christianity generated essential developmental differences between the Western European societies and Orthodox Eastern Europe. Divergence underlies the idea that new civilizations can appear on the basis of a mother civilization. However, divergence can never be completed and it always affects only some aspects of life in society.⁸

Great divergence and great convergence are discrepancies or rapprochements which respectively reveal either a radical gap between societies, or the reaching of the leaders' level by previously lagging societies. At the same time *great divergence was quite often preceded by large convergence* when a lagging society would quickly catch up the leaders, and then, still possessing a huge potential, would start running ahead following a new developmental trajectory.

There were few great divergences and great convergences in history, and they were associated with technological breakthroughs starting from the invention of agriculture up to digital electronics. The development of farming led to the emergence of a new type of societies in the Near East which resulted in the formation of the Afroeurasian world-system as well as in the general divergence between early agricultural societies and hunter-gatherers.⁹ And the final phase of the Agrarian revolution, the transition to a large-scale irrigation in the second half of the fourth to the beginning of the third millennia BCE, gave birth to the first states, civilizations, and urbanized societies, and also brought about the divergence between states/civilized areas and barbarian societies. In a certain sense it was the first great divergence between the East and the West as the East began to surpass the West in many respects during the third and second millennia BC.¹⁰

This great divergence between the East and the West was preceded by the important divergence in the Middle East, which can be traced starting from the fifth millennium BCE when the Southern Mesopotamia started to advance. Then during the third and second millennia BCE a powerful convergence occurred in the Near East which simultaneously turned a great divergence between the East and the West. Thus, the described processes determined the dynamics of the World System development for two millennia. Thus, the important characteristics of the integral spatial-temporal point described in the present article (the Southern Mesopotamia of the around fourth century BCE) can be elaborated by the idea that it launched one of the major divergences in the history of the World System.

We can trace another divergence when the East rushed ahead. It occurred after the fall of the Western Roman Empire during the so-called Dark Ages in Europe. The period from the fifth to the twelfth centuries CE was the time of prosperity in many oriental societies. During this period the East outpaced the West. Thus, the divergence of the first millennium CE prepared the background for the great convergence of the nineteenth century which was preceded by the convergence of the twelfth to fourteenth centuries CE when Europe started to catch up with the achievements of the East.

The above-described great divergence connected with the European industrial breakthrough was also the result of the revolution of industrial production that lasted from the fifteenth – sixteenth centuries to the eighteenth and early nineteenth century.

As with previous divergences, this one also brought about a radical gap in the production level and amount of surplus product, as well as radical demographic changes. Its result was the establishment of new types of political systems, a radical increase in the level of armaments and military art, culture, *etc.*

Convergence, or rapprochement, is also a very common evolutionary pattern when societies borrow each other's achievements. Great convergences always associate with the necessity to borrow new technologies and to adapt them to peculiar environment. One of the most important great convergences occurred in the second half of the first millennium CE. It was connected with the completing Agrarian Revolution in Europe due to the distribution of iron and iron tools in farming. In Europe the distribution of iron and plow farming along with the usage of iron for military purposes led to the emergence of ancient civilization. This generated the convergence between the East and the West as Europe began to catch up with Asia in urbanization, development of public administration, military arts, culture, and science, and to outpace it in some respects (as evidenced by the well-known campaign of Alexander the Great, and Roman victories). The divergence brought the rise of a belt of Hellenistic empires between the end of the fourth and third centuries BCE.

However, their decline along with the development of the Chinese and Indian centers of the World System at the end of the first millennium BCE and the beginning of the first millennium CE makes one speak about new divergence between the East and the West which is manifested in establishing various new types of culture, philosophy, science, and political systems. This divergence cannot be considered 'great' since it failed to create a large gap between societies, although one may speak about some superiority of the West over the East in terms of the military and state superiority until the decline of the Western Roman Empire.

Another important convergence (between the twelfth and fourteenth centuries CE), is connected with the rise of Europe whose developmental level had strongly decreased after the fall of the Western Roman Empire and barbarization during the period of the Dark Ages of the first millennium CE (between the seventh and ninth centuries). This rise in different spheres was largely promoted by an active borrowing, adaptation and creative development of the achievements of the Middle East, North Africa, China, India and other Asian societies (Al-Hasan and Hill 1991: 278–280; Ashtor 1978: 295; Raychaudhuri and Habib 1982: 47–52, 285; Elvin 1973: 85, 113–130, 167; Lal 1988: 48; Mokyr 1990: 23–24; Needham 1981: 13–14; Watson 1981: 29–30; Pacey 1990; Hall 1980; Goldstone 2009; Grinin and Korotayev 2015). This period lasting from the twelfth to the fifteenth centuries can be extended in some aspects also to the eleventh century, and even much earlier if to account the military borrowings resulting in the creation of well-known heavy knightly cavalry (see, *e.g.*, Cardini 1987). The same also refers to some technological innovations like watermills, *etc.*

Speaking about the current great convergence, when countries of the South begin to catch up with those of the North, one should note that together with imitation and introduction of western technologies, the catching-up countries of Asia become more and more actively involved in technological and other innovations. This can be evidenced, for example, by the increasing number of patentable inventions in nano- and microtechnologies in Asia (see Fig. 4).

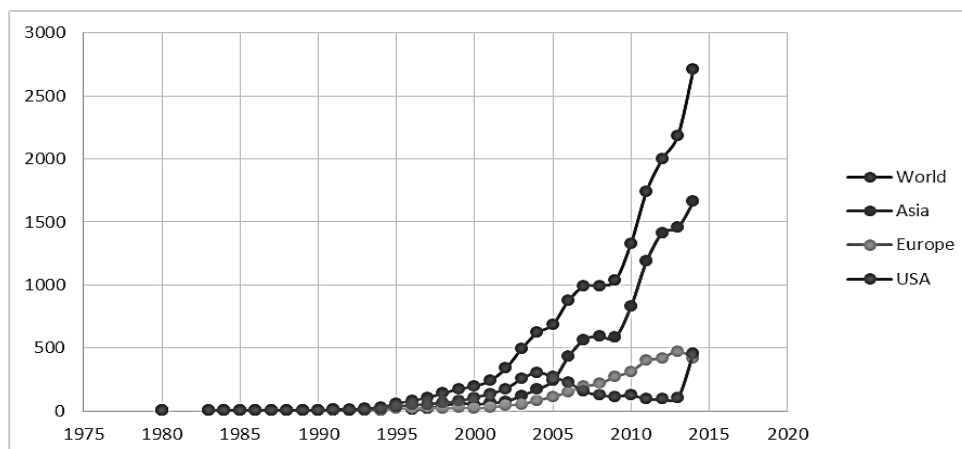


Fig. 4. The dynamics of the number of patents in micro- and nano-technologies for the world, Asia, Europe, and the USA in 1980–2014

Source: WIPO IP Statistics Data Center. WIPO statistics database. URL: <http://ipstats.wipo.int/ipstatv2/index.htm>.

Thus, the great convergence arises as a simple borrowing of technologies, and then there begins a creative adaptation to peculiar conditions along with active learning from the more advanced societies. Powerful innovations result in higher developmental rates, and then in a significant divergence. Thereafter, the innovations made by the region that takes the lead become a model and material for subsequent borrowings.

Thus, divergences and convergences between the East and the West, alternating over thousands years, at the same time reveal a similarity between Western and Eastern societies. This similarity allows them to adopt and adapt many of each other's achievements. This similarity does not predetermine the success or backwardness of *separate* civilizations and regions (*cf.* Vasilyev 1993). But on the other hand, it shows that the rising societies do not (and probably cannot) simply imitate the advanced societies. A successful convergence can take place only under the conditions of a really creative adaptation and transformation.

* * *

Even a brief analysis of systemic properties of the Afroeurasian world-system and of the current planetary World System show their infinite aspects, as well as their efficiency and fruitfulness for the explanation of the complex processes of historical globalization. During the whole period of historical globalization one can observe a close correlation between such important phenomena as technological transformations, spatial expansion of contact area, urbanization, and political integration. There is also a correlation between the abovementioned variables and the struggle for political hegemony, which promoted the formation of the world order in different periods of historical globalization (Grinin, Ilyin, and Andreev 2016). The above mentioned approach also enriches our perceptions of the 'structure' of historical process and the course of globalization, and of the rhythms of development of the World System which are expressed in synchrony and asynchrony, in divergence and convergence, as well as in increasing integration or its weakening, among others.

NOTES

¹ See about some examples of such synchrony in the Section 4.

Barfield (1989) argues that large steppe confederacies usually cycle synchronously with the rise and fall of the large sedentary agrarian states that they raid. These cycles are a hypothesized mechanism of systemic linkages between East and West Asia (*Ibid.*). Such synchronized processes within the Afroeurasian world-system have been also detected by the students of the Bronze Age and earlier periods (Chernykh 1992; Frank 1993; Frank and Thompson 2005). One can also mention as salient examples of such synchronized processes the Axial Age transformations of the first millennium BCE (Jaspers 1953) or the military revolution and formation of a new type of statehood in Europe and Asia in the late fifteenth and sixteenth centuries CE that produced a colossal influence upon the formation of the modern World-System (see McNeill 1982; Grinin 2012; Grinin and Korotayev 2015). The asynchrony of a number of processes is explained in the last section of the article.

² To a certain extent this idea can be conveyed by the term ‘emergence’, which in systems theory means a process whereby larger entities, patterns, and regularities arise through interactions among smaller or simpler entities that themselves do not exhibit such properties.

³ See Grinin 2007a, 2007b, 2012; Grinin L. and Grinin A. 2015, 2016; Grinin and Korotayev 2009, 2013a, 2013b.

⁴ This aspect of the World System congruent with capitalism satisfies rather well Wallerstein's notion of the world-system (Wallerstein 1974, 1980, 1987, 1988, 2004), since its development involved mass movements of bulk goods. About the Industrial revolution (see, *e.g.*, Cipolla 1976; Allen 2009; Goldstone 2009; Mokyr 2010; for our approach see Grinin 2007a; Grinin L. and Grinin A. 2015, 2016; Grinin and Korotayev 2015).

⁵ *Early states* are insufficiently centralized and politically organized societies with underdeveloped social, class and, frequently, administrative-political structures. *Analogues of early state* are various forms of complex, stateless societies that are comparable to early states in terms of their size, sociocultural and/or political complexity, functional differentiation, and the scale of tasks they have to accomplish, but lacking at least one of the necessary features of the early state (for more details about early states see Claessen and Skalník 1978; 1981; Claessen and van de Velde 1987; Grinin 2004, 2011, 2012; about the analogues of early state see Grinin 2003, 2004, 2011, 2012).

⁶ *Developed states* are the formed centralized states of Late Antiquity, Middle Ages, and Early Modern period, which politically organize societies with distinct estate-class stratification (for more details see Grinin 2008, 2012; Grinin and Korotayev 2006).

⁷ *The mature states* of the industrial epoch politically organize the societies where estates have disappeared, the bourgeois and working classes have formed, nations have developed, and representative democracy has proliferated (see Grinin 2008, 2012; Grinin and Korotayev 2006).

⁸ So does the convergence. When in the 1960s Pitirim Sorokin (1960) and John Galbraith (1967) started the discussion on the convergence between socialism and capitalism they meant the similarity outlined only in some spheres.

⁹ But one of the differences in the described great divergence (in the comparison with the following ones) was that there was no radical gap in individual labor capacity between hunting and gathering, on the one hand, and farming, on the other. A hunter-gatherer could have even larger capacity than the farmer (Marshall Sahlins not without a reason called many primitive societies ‘affluent societies’ [Sahlins 1972]). Meanwhile, in the nineteenth century the distinction in labor productivity between an industrial worker and a peasant became huge.

¹⁰ Though, we should also note that the Creto-Mycenean civilization rose in the second millennium BC; however, it was not ‘western’ in proper civilizational sense of the word yet, and more likely it was intermediate between the East and the West.

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