CHAPTER 12
THE INTELLECTUAL-KNOWLEDGE IMPERATIVE OF THE GLOBAL ECONOMY IN THE 21ST CENTURY

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INTRODUCTION
The end of the twentieth century marked the formation of a global model of economic development as a result of gradual fundamental transformation processes in the world economy. The combination of world economic entities in a single international economic system in accordance with the trends of global economic development (integration, transnationalization, socialization, institutionalization and strategic orientation to innovation) defines the new disposition of countries on the economic map of the world. Sovereign states are forced to adjust foreign policy, develop strategies to adapt to current performance criteria, to find their place in the new model of international distribution of labor and their own niche in international markets.

But at the turn of the second and third millennium, the world economy faced information and communication technologies revolution, resulting in cheaper and more reliable communications, new information management software, powerful personal computers the proliferation of which is growing rapidly. If in the mid-1990s the number of mobile cellular subscribers averaged 2 per 100 people, and the proportion of those using the Internet fluctuated within 1% of the total population, in 2000 the value of these indicators reached 17 people and 9% respectively. In the first half of 2010, the upward trend in these indicators accelerated due to the emergence of mobile, portable devices that provided Internet access and the gradual decline of fixed telephony technologies. In 2017, the percentage of the world population using the Internet came close to 45%, and the proportion of mobile cellular subscribers per 100 people exceeded 100%.

Under new conditions, there is a redistribution of world economic power: the triad countries that formed the core of the world economy

of the twentieth century (the USA, Japan and the European Union) are inferior to global markets for countries that are effectively implementing strategies of intellectual breakthrough and maximum mobilization of the national resource base undergoing the formation of branches of the sixth technological way (China, India, Hong Kong, Brazil, Singapore, India, South Korea, and some countries in the Middle East). Modification of the model of world economic power is accompanied by exacerbation of socio-economic contradictions between the subjects of the global economy, which is manifested in the following: stratification of segments of the economy by technological structures (parallel existence of agrarian raw materials, industrial and postindustrial), and specific enclaves and innovation economics; complicity of the structure of the economic system based on the differentiation of sectoral sectors (development of the virtual sector and creative industries) and subjects of the global economy (national states, integration groups, international organizations, cities-leaders, clusters, international companies and individuals which are able to influence the dynamics of global economic development scientists, Nobel laureates, university professors, prominent financiers, entrepreneurs, etc.)

Taking into account these changes, it is appropriate, in our view, to analyze innovative developments in today's global markets; methodological identification of key concepts of global economy intellectualization process and identification of features of extended reproduction cycle of an intellectual product.

### 12.1. Innovative shifts in today's global markets

According to the world institutions dealing with issues of globalization, since the beginning of the 21st century. The fourth phase of economic globalization has begun, the peculiarities of which are the multipolarity of the world economy and the use of digital technologies in production, services.

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The defining direction of civilizational development since the end of the second millennium AD is the innovative vector\(^4\). Noting that innovations «... lead to deterioration in product performance, at least in the short term», but subsequently become «fully competitive in the same market» due to being «cheaper, simpler, smaller in size and easier to use, even if «the product improvement pace outstrips the growth of consumer needs», we are witnessing a breakthrough in new technologies\(^5\). To illustrate his statement, K. Christensen cites the emergence of light motorcycles Honda, Kawasaki and Yamaha in the markets of North America and Europe, which are considered as breakthrough technology for powerful Harley off-road motorcycles Davidson and BMW, the invention of transistors breakthrough, vacuum tubes Targeted and Walmart merchandise for supermarket purchases. Identifying the term «innovation» as «any combination of activities or technologies that breaks existing trade-offs to achieve results in such a way as to widen the scope of the possible»\(^6\), the nature of innovation can be recognized as destructive to the existing, established order. Movement and change, as a consequence, are typical phenomena of history, and therefore of economics. In our view, the movement to any direction, to any landmark, has, in the end, certain changes, adaptation to which promotes invention and development, which can be measured by economic indicators of income and expenses.

The steady tendency to invest in the development of science and technology has led to the end of 20\(^{th}\) beginning of 21\(^{st}\) century a significant change in the global landscape of research, education and business, which is considered the beginning of a new civilization era – postindustrial. The value reorientation of society from the dominant economic features of the industrial development system to the «system of intellectually-creative coordinates»\(^7\), defines the new

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foundations of civilizational progress: the broad intellectualization of production, the priority development of science, the development of complex intellectual labor. The information-technological mode of production, which dominates at the present stage of civilizational development, is characterized by processes of informatization, electrification, computerization and robotization. Intellectual works, especially research in the field of science and technology and their commercialization, become the basis of modern economics, and the economy itself becomes intellectual, knowledge- and scientifically intensive.

The strategic orientation of the global economy to innovation tightly links the competitiveness of national economies with the effectiveness of adherence to technological progress, which dramatically altered the distribution of economic opportunities. Recognizing innovation as a major lever of economic growth today, it is impossible to ignore the destabilizing effects of super-rapid technological development, known as digitization, digitalisation of the global economy, or the Economy 4.0 phenomenon\(^8\). Among the interventions that increase «fragility» in the technological sphere, N. Taleb calls neomania, «the love of change and the new for the sake of change and the new; predicting the future by adding, not subtracting,» which can also result in alienation and dulling\(^9\).

Digital technologies, along with geopolitical and socio-economic shifts, have changed the course of globalization and led to contradictory facts about its development. According to the World Bank Group, the recession of the global economy continues during 2010-2019: the growth rate of the global gross product decreases (in 2017 3.2%, in 2018 3.0%, in 2019 (preliminary data) 2.4%), world trade volume (in 2018 4.0%, 2019 (preliminary data) 1.4%) and investment flows\(^10\). On the other hand, during this same period, fundamentally new forms of business emerged, which were able to predict and capture models of innovative destruction in global markets in a timely manner (Table 1).

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<td>Customer relationship management systems; «SaaS», «PaaS», «IaaS» models; server computers</td>
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<td>Products integration</td>
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<td>Invention and standardization based on smaller, faster, cheaper components; from desire to get the best to adopting a basic, more affordable, universal product</td>
<td>Need to eliminate existing production facilities; Perception change of consumer value and form-factor</td>
<td>Microchips and wireless units; smartphones, portable navigation devices</td>
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* summarized by author from sources

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The analysis of the Table 1 allows us to argue that the main catalysts for innovation in today's global marketplace are the proliferation of digital technologies as the basis for digital infrastructure, the emergence of a platform business model and the rethinking of consumer roles. As an example of businesses that emerged from the successful acquisition of catalysts for innovative change and a rethinking of strategic vision, unicorns, organizations specializing in the development of exponential technologies, and a platform business model can be called.

Technology companies operate on the principle of «smaller, faster, more powerful, but also cheaper», which results in the destruction of businesses with less technologically ready competitors. The amount and real amount of money raised by private companies tech startups that, according to PitchBook, CB Insights, Fortune news feeds and own research, have crossed the $1 billion limit. As of January 2015, the number of «unicorns» was 80 companies¹², and in January 2016, their number exceeded 170 companies¹³, and formed a group of so-called «Decacorns» companies whose valuation exceeded $10 billion¹⁴. The first “decayer” venture capitalists call Facebook, the value of which reached $10 billion in 2013. In January 2016, the Decare Group had 13 companies, led by Uber worth $62 billion.

Exponential organizations embody a business model that predicts exponential growth in productivity, profitability, and market share while reducing the number of working and used physical resources, lacking business experience, and abandoning standard competitive strategies. Due to this, a significant increase in the performance characteristics and functionality of each subsequent generation of the product is ensured with a slow increase in its price (i.e., an increase in productivity by orders of magnitude higher than the price increase). Greater flexibility and dynamism compared to large linear companies allows exponential organizations to be competitive even in the following circumstances: the loss of business competence has been reduced from 30 years in 1984 to 5 years in 2014, the average lifespan of companies in the list The S&P 500 ranged from 67 in 1920 to 15 in 2014, with Fortune 500 companies reaching $1 billion in market cap. USA from, on average, 20 years in the twentieth century, up to, in some cases, 1 year in the second decade of the 21st century.¹⁵

The list of unicorn companies is closely intertwined with the list of exponential companies, so the risks of further development are common to them. Venture capital market experts acknowledge that the expectations of significant returns and rapid market capitalization on them by tech start-up investors are comparable to the degree of vulnerability of this business. In particular, Hortonworks' aggressive investment fundraiser specializing in open source software development, Box storage and the Fab e-commerce site failed to deliver «unicorns» of declared cost metrics.¹⁶ The facts indicate the disproportionate impact of today's technology companies on macroeconomic dynamics: Google and Amazon represent the relevant global markets;¹⁷ the market capitalization of the largest technology companies largely determines the state of the global stock market, since during the period from August 2018 to January 2020, their value reached $1 trillion. United States: Apple $1.38 trillion, Microsoft $1.27 trillion, Alphabet $1.001 trillion, Amazon $931 billion.¹⁸ Such

high market value indicators have so far been recorded only with the oil companies PetroChina and Saudi Aramco\textsuperscript{19}.

\textbf{12.2. Identification of key concepts of the global economy intellectualization}

As a result of the World Economic Forum (WEF) meetings in November 2019, economic growth in both developed and developing countries is projected to be 80-90\% driven by productivity gains over the next four decades. This turn is directly dependent on innovation. However, against the backdrop of this dynamic, there are three problems associated with innovation. First, in the years 2001-2013, the economy widened in performance by star companies that were able to take advantage of global presence (access to investment, resources, markets, talent) and all other companies that were stagnant (mostly in the service sector). The 5:95 star-to-other ratio has led to a slower overall productivity growth rate in the global economy and, in some countries, to nearly 0\textsuperscript{20}. Secondly, the predominance of private interests in the innovation activity of global business structures, while continuing to not interfere in solving social problems of society (climate change, education, health care, etc.) has led to the decline of the basic sciences, the distortion of the orientations of civilizational development, and underpinning many national economies, making them fragile. And third, the unpredictability, unmanageability of a particular group of innovations threatens the ethical norms of society (in particular, the invention and development of artificial intelligence, the recognition of work by people by gender and ethnicity, genetic engineering, etc.).

Relying on research\textsuperscript{21}, we consider it advisable to speak about the intensification of the processes of intellectualization of the global


economy and its acquisition of the characteristics of the intellectual. In accordance with this statement, we propose the author's methodological identification of key concepts of the process of intellectualization of the global economy (Figure 1).

Intellectual leadership is based on the intellectual benefits that are formed within the intellectual ecosystem. That is, systems for which the creation, use and development of intellectual capital is a natural process. The different ability of national intellectual ecosystems to promote the development of intellectual capital determines the intellectual advantages of one country and the intellectual uncertainty of others.

The function of providing the intellectual ecosystem with intellectual capital is performed by the intellectual platform. The intellectual platform is composed of intellectual resources, both actually and potentially created by the ecosystem, and mechanisms of the intellectual property institute.

The effectiveness of an intellectual property institute can be assessed by the speed of transformation of an intellectual product into intellectual capital using intellectual technologies.

The ability of the intellectual platform to generate an intellectual product is largely dependent on the degree of intellectual comfort that can be described as the presence of conditions for: the development of an individual's intellectual ability; realization of human intellectual abilities in the process of intellectual work; awareness of the need to transform the intellectual work of man into the intellectual activity of economic entities of the intellectual ecosystem.

According to M.V. Polyakov, the basis for studying the knowledge economy is the following processes in relation to its basic unit knowledge: obtaining (acquiring accumulated or generating new knowledge); absorption from different sources; knowledge transfer such as dissemination, movement, sale, etc.; use (mainly for innovation and management)\(^\text{22}\). The implementation of this approach in an intellectually intensive, science intensive economy, in our view, can be represented by the following scheme (Figure 2).

Figure 1. Methodological identification of key concepts of the global economy of intellectualization process

Source: developed by the author
The classical process of expanded reproduction of a social product in the economy is described as a sequence of stages: production → distribution → consumption → expanded production. But in our view, an intellectual economy has certain features that are determined by the characteristics of the dominant economic features of the system.

Firstly, the process of expanded reproduction in the intellectual economy is carried out in the informational way and develops cyclically in a spiral. The advent of revolutionary technologies (intellectual product) marks the beginning of a new cycle, in which the technologies of the previous cycle are already considered pre-revolutionary. The intellectual potential created and accumulated in the economy during each previous intellectual cycle constitutes an information resource for each subsequent cycle. Considering the transition to higher (more sophisticated) technologies and the accumulation (increase, increase) of intellectual potential, it can be argued that each coil turn is a new intellectual cycle.
Secondly, each turn of the spiral decreases the total duration of the intellectual reproduction cycle, which is explained by global factor mobility, the acceleration of the life cycle of intellectual products (in particular, it is about exponential technologies; on each subsequent cycle. That is, if the duration of the full cycle of extended reproduction in the intellectual economy is equal to $T$, then for each cycle $N$ is inequality: $T_N < T_{N-1}$.

Thirdly, because of the unpredictable nature of scientific and technological progress (in particular, the spontaneity of inventions and discoveries), the distance between intellectual cycles varies considerably. Referring to the so-called «Moore's Law», it can be argued that during 1965-1998 the emergence of revolutionary technologies in the electronics industry occurred no less than every two years\(^{23}\). Therefore, the distance between the turns of the intellectual cycles is considered by the author to be very small, dense. During the period 1999-2007, the distance between cycles began to increase as the potential of silicon ICT was gradually exhausted by the overheating problem of ultrafast PCs. In view of G. Moore's slowdown in the development of the electronic industry since 2007, the distance between neighboring intellectual cycles is gradually increasing. The reason for this slowdown in the second decade of the XXI century G. Moore sees in the natural physical limitations: the speed of light and the atomic nature of materials\(^{24}\). In our opinion, today the basis of the intellectual cycle is not technologies aimed at improving the productivity and speed of operations, but intellectual products that optimize already developed technologies. Such products are differentiated by size, compactness, ergonomics, methods of cooling of technological units, quality of information visualization, degree of mobility, energy consumption level, etc.\(^{25}\) The next round of progress may be driven by the quantum technologies, using graphene, etc. that the ICT market is already waiting for.

Fourthly, based on the concept of the «center and periphery» of the global economy, according to the author, each coil of the spiral of


expanded reproduction in fig. 2 has a tendency to gradually increase the radius of propagation. The Intellectual Center (the subjects of the global economy are intellectual leaders), as the intellectual potential increases, begins a new intellectual cycle, actively developing it. Having received an effect (profit, knowledge, intellectual advantage) that is sufficient to start a new cycle, the «intellectual center» moves from cycle N to cycle (N + 1). On the one hand, intellectual leaders are interested in the rapid development of the cycle (N + 1), that is, in reducing its duration T, and on the other, in the global distribution of the intellectual product of previous cycles 1, 2, ..., (N-1), N from the center to the periphery. Extension of the duration of the previous cycles due to the time for geographical spread in the global economy (in fact, in «catching up», «pursuing» economies, developing economies, etc.) and heterogeneity of economic entities in terms of readiness for new technologies, spiral of expanded reproduction in intelligence the economy takes the form of an «intellectual tornado» centered on intellectual leaders, and on the periphery, which gradually increases its radius, the countries that follow the previous «pre-revolutionary» and intellectual products (Figure 3).

1 – «Intellectual center»  2 – Periphery of intellectual uncertainty  3 – Rising streams of intellectual potential

**Figure 3. Intellectual Tornado Spiral in Intellectual Economy**

*Source: developed by author*
The author explains the radius increase of the intellectual cycle by the increase in the number of groups of countries (and, consequently, by the increase of geographical distances, planes), imitating products, technologies of the intellectual center (usually represented by a limited number of national economies).

Fifthly, the subjects of the global intellectual economy that imitate the technologies of intellectual leaders are significantly differentiated in their level of readiness for these technologies. Given the complexity of the concept of «level of readiness for intellectual technology», it can be argued that its implementation occurs in conditions of intellectual uncertainty. World Bank experts have concluded that the global economy is systematically moving national economies between types of integration into global value chains based on their technological specialization. Movement is possible in two directions: from the supply of primary raw materials and further, to more technologically complex types, and in the opposite direction from the innovative to the more simplified. In particular, during the period 1960-2015, the countries of Austria, Canada, Finland, Ireland, Israel, Italy, the Republic of Korea, Singapore, Spain and the Czech Republic took innovative positions. China is also showing rapid technological growth, with the total number of researchers tripling between 1995 and 2007. In the opposite direction, to the type of primary commodities, Jordan and Lesotho moved, and the whole group of countries during this period was characterized by a double movement in both directions (Swaziland, Botswana, Jamaica, Democratic People’s Republic of Korea, Nicaragua and Senegal). The revealed facts, according to the author, confirm the existence of conditions of intellectual uncertainty, which explain the disposition of national economies according to the concept of «center periphery».

CONCLUSIONS

The leitmotif of the current stage of development of the global economy is the processes of its intellectualization, in particular the
emergence of the phenomenon «Economy 4.0». Digital infrastructure, platform interaction and rethinking the role of consumers are accelerating innovative disruption in global markets: agreements are concluded «anytime, anywhere»; rights of use prevail over property rights; platform businesses «create the foundation for the development of others»; solving complex economic problems is realized through «trust-based interaction»; the best samples are received by the global market as a way of «bringing many to the development of a single»; consumers prefer a personalized product, without «unnecessary»; value chains are shrinking as Industry 4.0 evolves; product prices are formed as a result of the service, the «terms of use»; the product combines numerous features.

The key to competitiveness of countries in global markets is intellectual leadership, which is ensured by the effectiveness of the national intellectual ecosystem and intellectual benefits. Strategic priorities of national economies are to create an environment of intellectual comfort and improve the conditions for realizing intellectual potential. The reproduction of intellectual capital in today's economy can be represented as a spiral process: the advent of revolutionary technologies initiates a new intellectual cycle; each subsequent intellectual cycle is less time-consuming than the previous one due to the exponential development of technology.

Based on the concept of «center and periphery» of the global economy, we can assume that the spiral of reproduction of intellectual capital consists of the following elements: «intellectual center», represented by a small number of countries innovative leaders; The «periphery of intellectual uncertainty» of the country, which imitates the intellectual technologies of the «center», but due to their number and heterogeneity in the level of technological, network readiness, geographical remoteness, etc., demonstrate different speed of acquisition of intellectual products of the current cycle.

As a prospect for further scientific research, the author sees the study of factors and methods of classification of countries «periphery of intellectual uncertainty», in order to clarify the intellectual disposition of countries of the global economy.

**SUMMARY**
Contradictory facts of the global economy development during the recession period of 2010-2019 are revealed. Catalysts and models of innovative destruction in the modern global markets are analyzed. The
business models that emerged as a result of innovative destruction and intensification of intellectualization processes are considered. The key concepts of the process of intellectualization of the global economy have been identified. The cycle of extended reproduction in the intellectual economy is schematically depicted. The assumptions about the features of intellectual cycles in the global economy are made. The hypothesis of the size and heterogeneity of a group of countries forming the «periphery of intellectual uncertainty» has been put forward.

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