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Sergey D. Bodrunov
S.Y. Witte Institute for New Industrial Development (Saint Petersburg, Russia)

SCIENTIFIC AND TECHNOLOGICAL PROGRESS AND TRANSFORMATION OF SOCIETY: NOONOMY AND NOOSOCIETY. PART 1[1]

Abstract: the theory of Noonomy, based on the study of modern trends in technological and socio-economic development, allows us to identify the causes of the contradictions that modern civilization faces – economic, social, environmental, moral contradictions. However, noonomy not only reveals the background of these contradictions, but also shows the maturing objective possibilities of getting out of these contradictions, overcoming civilizational dead ends, choosing a path at civilizational forks. The opportunities created by modern technology create the prospect of a transition from economics to noonomy, which means abandoning economic rationality, leading to an unrestrained pursuit of increasing production and consumption. The place of economic rationality is occupied by rationality based on the criteria of knowledge and culture. However, such a transition from economics to noonomy should be based on a change in the totality of social relations, and noonomy can be strengthened only within the framework of an integral system of the noosociety. The very nature of public relations and public relations of people, the nature of human socialization and socialization of society will orient social development to these new criteria. The ideological orientation of such a reformatting of society can be the ideology of solidarity, which grows out of the emerging opportunities to overcome the discord of socio-economic interests of people based on the struggle for material resources.
Keywords: noonomy, noosociety, civilization, needs, knowledge, planning, culture, socialization, solidarity.

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博德鲁诺夫 S. D.
新兴工业发展研究所，俄罗斯圣彼得堡

科学技术进步和社会转型：智力经济和智力社会（第一部分）

摘要：基于对当前技术和社会经济发展趋势的研究，运用智力经济学理论我们能够确定产生现代文明所面临的矛盾的原因，包括经济、社会、环境和道德方面的矛盾。智力经济学不仅揭示了这些矛盾的背景，而且还显示出克服这些矛盾、走出文明死胡同、在文明发展的十字路口选择正确道路的客观可能性，这种可能性正走向成熟。现代技术为所有权范式变化以及从

[1] This article is based on the author's previous publications, primarily [Bodrunov, 2021].

传统经济到智力经济的过渡带来了机会和前景，这意味着摆脱对经济合理性的追求——这种追求导致无限制地增加生产和消费，经济合理性被基于知识和文化标准的合理性所取代。但这种从传统经济到智力经济的过渡依赖于整个社会关系的变化，而智力经济只有在智力社会的完整体系中才能得以巩固。人们的社会关系和社会联系的性质、人的社会化和社会的社会化的性质决定社会发展将面向这些新的知识和文化标准。随着人们对基于物质资源争夺的人们之间社会经济利益不和谐的克服，团结主义的意识形态将成为这种社会重塑进程的指导思想。
关键词： 智力经济、智力社会、文明、需求、知识、计划、文化、社会化、团结主义。

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Introduction. Civilization before the crisis

Today we see unmistakable signs of a growing crisis in human civilization. All the elements of this civilization – its economic system, its social structure, the basic features of modern human existence – are undergoing profound erosion.

The relations of production and the economic institutions on which our productive activity is based are increasingly questioning their ability to ensure the long-term stable development of human society. And this concerns first and foremost the mechanisms of self-regulation of the market. The market's notorious «invisible hand» continues to point in the direction of rampant financial speculation that undermines the stability of the market system itself, and the ongoing predatory takeover of resources, rather than the path of harmonious human development and overcoming long-standing social ills. Academician B.N. Porfiriev (RAS) states, «With the deterioration of the quality of natural, productive and human capital, which form the material basis of financial capital, and the deepening gap between them, the risks of new financial bubbles, large and deep crises will increase significantly» [Porfiriev, 2016, p. 13].

Social polarization is increasing, and the institutions of political democracy are aimed more at political manipulation of the electorate than at revealing people's real social aspirations. Political and ideological technologies, aided by digital technologies and the increasing power of the media to influence people's minds, are used not in the interest of progress but to avoid solving urgent problems while maintaining their political status.

International socioeconomic relations (what Canadian professor Radhika Desai calls geopolitical economics [Desai, 2013]) are also experiencing a period of increasing turbulence. The intensifying struggle for global hegemony collides with an increasing tendency toward de-globalization, the «annihilation» of nation-states by transnational capital meets increasing tendencies toward sovereignty, and the claims of some states to national exclusivity meet resistance from others defending their national interests. All this is leading to profound changes in the geopolitical and economic configuration of the world, the consequences of which are difficult to predict, but which are clearly not helping to stabilize civilizational development and prevent dramatic upheavals of crisis.

What is most disturbing is that all these processes lead to the destruction of people's moral and spiritual health. At the same time, they try to find a justification for the loss of cultural and

moral reference points in the rejection of «grand narratives» (i.e., essentially a holistic view of reality from certain positions), in the declaration that the criteria of truth, progress, goodness, and beauty are questionable. With the current paradigm of economic development, technological progress also leads to more and more possibilities to «fake» reality, to the point that reality is completely replaced by fakes and illusions.

There are many visible signs of a growing crisis in the economy. In the last fifteen years we have experienced the second devastating financial and economic crisis. And these crises are noticeably deeper than those experienced by the world economy in the last quarter of the twentieth century. It is, of course, possible to write off the 2020 crisis to the COVID -19 pandemic, but the reality is that both the downturn in the economy and the stock market crash were expected by economists as early as 2018, and by early 2020 the signs of the coming crisis were already quite clear. The pandemic was only a trigger for the crisis and a factor that significantly changed it, but not its cause. Such a trigger had to come – if not this one, then another. To use Nassim Taleb's image of the «black swan» [Taleb, 2007] (an unexpected, situation-changing event), there are times in economic and social development when the «black swan» will inevitably arrive. And in what form it will occur – a question of secondary importance.

Main results and discussion: Part I. A paradigm shift in civilizational development
Change the development model

We have long pointed out the bias of the current model of human development. In this model, market criteria take on a hypertrophic importance on which not only the economy is based. The market approach is imposed on all spheres of society, all manifestations of this life are gradually measured by commercial standards – the creative spirit of culture and art, the concern for education and upbringing, the struggle for human health, the inquisitiveness of the scientific mind, the protection of rights, etc.

Economic relations extend to the sphere of production, the fundamental sphere of human society that creates the material foundations of human existence.

But does this mean that economics has the right to apply the principles of economic relations to all other spheres of society? After all, this approach prioritizes economic and especially financial outcomes, even where commercialization is directly contraindicated. As a result, it becomes a means of excluding people from access to common social goods and of bringing about a competition that serves not the struggle for efficiency but the aggravation of social discord that deforms people's consciousness, values and cultural attitudes. As our American colleague James K. Galbraith points out, «The financial counterrevolution overthrew decades of developmental industrialization around the world, forcing much of the world into a new dependency on the American market as the one sure source of global purchasing power and financial self-defense». [Galbraith, 2019, p. 211].

The sharpness of the contradictions accumulating at the present stage of the development of human civilization has been known for a long time. As early as the 1990s, strategically-minded public figures, academics, and politicians agreed on the need to address a number of urgent problems, the accumulation of which poses a serious threat. As a result, the famous «Millennium Declaration» was adopted in 2000, which included goals related to social development, poverty eradication, and environmental protection [Declaration, 2000]. After the partial achievement of the goals of this program in 2015 the General Assembly UN adopted a resolution that set 17 Sustainable Development Goals [Transforming our world, 2015].

However, appropriate goal setting and an understanding of the necessary ways to achieve them are only possible if the causes of the problems facing our civilization are scientifically examined.

It is impossible to resolve these issues in the realm of archaically trivial, if not ridiculous, chatter as to whether the current problems lie in excessive interference with the mechanisms of market self-regulation, as neoliberal economists believe, or, conversely, whether the key to the solution lies in developing and improving the mechanisms of state regulation of the economy, as various strains of Keynesianism and some other heterodox theories tend to do.

This controversy may have been relevant 50-80 years ago; today it may exist only to some extent in research. But that is not enough today, because in recent decades, under the influence of advances in the understanding of knowledge and technological development, the world has changed fundamentally – not to put too fine a point on it – and continues to change rapidly. This brings not only «joys» but also problems, many of which can be fatal to human civilization. And to find the right answers in the face of growing threats and escalating contradictions, we need to start asking different questions.

For starters, we need to agree that we do not primarily need an answer to the question of which model of capitalism – more liberal or more regulated – should be pursued. Nor is the question of whether capitalism has exhausted its development potential the main issue any longer.

Rather, we are faced with a much more fundamental question: are we witnessing the exhaustion of the entire previous paradigm of human civilization, which was based on the principles of an economic society?

There is much to suggest that we are. And the pursuit of this paradigm of development is no longer associated only with an acceleration of these problems, but with a very real catastrophe.

However, we believe that it is not necessary to fall into alarmism. Man is by no means a rampant destroyer of everything and everyone, including himself. He is capable of understanding the problems he faces and overcoming them practically, while going beyond the possibilities achieved today. Therefore, the key to solving the problems of the coming crisis of civilization lies both in the study and understanding of this crisis and in the search for ideas and practical solutions based both on this understanding and on the awareness of our own capabilities.

Modern society is in urgent need of socially responsible and theoretically sound solutions. This is all the more necessary as our civilization moves toward a point where we have a choice: Either we cross the line beyond which the threat to the existence of civilization becomes irreversible (be it an ecological catastrophe or the use of weapons of mass destruction or the destruction of human beings through irrational interference with our own nature, etc.), or we find ways to overcome the growing crisis of civilization and enter a qualitatively new stage of development. And this point of «rupture,» of «bifurcation,» is due to the level of technological power that humanity has now reached (for the first time in the history of civilization!) and that enables the irrational use of that power for self-destruction.

So far, neither neoclassical economic theory nor Marxist political economy have uncovered these possibilities, despite all their attempts to find theoretical answers to the most acute problems of our time. Nor have other social sciences been particularly successful in this direction. In practice, the response of scholars and public figures has often been to pay more attention to social, humanitarian, and environmental problems, but without addressing the fundamental causes

of these problems. This is evident, for example, in the ideas of «sustainable development» that form the basis for decisions made by UN.

But it is impossible to create qualitatively new ways of overcoming the crisis of civilization without a transition to a qualitatively new state of society. The way to this new qualitative state, as well as its own certainty, has been outlined in our developments of recent years. This is the path via the second generation of the New Industrial Society (NIS.2) to Noonomy.

The theory of Noonomy, developed by the author of these lines and discussed for many years at scientific seminars of the St. Petersburg S.Y. Witte INID, was a logical continuation of the author's long cycle of research on the problems of technological progress, including knowledge-intensive industries, informatization of society, intellectual property, etc. (1995-2010), the reindustrialization of the economy, trends in industrial production [Bodrunov 2013a; 2016b] and their impact on the social structure. Recently, a considerable number of publications by the author on these topics have appeared, in which he presents the findings [Bodrunov, 2017a; 2018b; 2018c], etc., explaining the theoretical aspects of the proposed approach.

These results were also presented on a regular basis in the publications of the S.Y. Witte INID, devoted to particular aspects of the theory of Noonomy [New Industrial Society …, 2019][1].

Ideas and various elements of this concept continue to be presented in articles, in seminars and at scientific colloquia organized by the S.Y. Witte INID with its partners from the Russian Academy of Sciences and foreign colleagues, at various conferences and congresses. Moreover, after the publication of the author's main works on the new industrial society of the second generation and on noonomy, there were numerous discussions and multiple discussions on the theory proposed by the author at various universities, at dissertation councils, in various expert communities, including international ones, in educational laboratories (the theory of noonomy found its way into the curricula of a number of Russian universities). All this also contributed to the development and refinement of the theoretical platform of noonomy.

The main platform for the presentation and discussion of the ideas of noonomy is one of the largest in Russia, the International Economic Congress in St. Petersburg (SPEC), which is organized annually by INID specifically for this purpose. In recent years, the problems of noonomy have also been discussed at various leading forums in Moscow and other Russian cities, as well as outside Russia – the theory of noonomy has been examined by a sophisticated and demanding international scientific community: in Cambridge, Lille, Mexico City, Vienna, Lisbon, New York, Beijing, etc.

The work done to develop and deepen the noonomy theory allows us today to present its fundamental aspects more clearly, more clearly and more reasonably.

The decisive role of material production

It is important to rely on the right methodological approaches, on certain ideas about the role of material production, its product, the nature of industrial production and its place in the socio-economic structure of society. The understanding that it is material production that underlies the life of human society, and that, accordingly, it is the changes in material production that determine the development of society, is the starting point for understanding the prospects for the development of the social order.

[1] See also similar collections: Volume IV, 2020, and Volume V, 2021.

It is important to take into account all the components of production: the specifics of the technological process, the nature of the product of production, the content of labor, the organizational forms of production. Only all these elements together make it possible to develop a holistic understanding of the changes taking place in production.

In its historical development, the material-technical basis of the economy passes through two main stages: pre-industrial and industrial production. Of course, different stages can be distinguished within these phases, but by and large, no other variants in the development of material production can yet be identified apart from these two stages. The hypothetical «post-industrial» production has never become reality. Industry does not disappear from the economy – only its nature changes. The modern economy still relies firmly on industrial material production, despite the overwhelming weight of the so-called «service sector» (which, often mistakenly, encompasses many of the modern effects of industrial activity).

Industrial production in particular is known to be characterized by some of the following features that distinguish it from pre-industrial production;

– the use of complex means of production instead of hand tools;

– the recourse not to natural energy sources (human and animal muscular power, the energy of the natural movement of water and wind), but to universal artificial energy sources (various types of steam engines, internal combustion engines, electric motors, jet engines, etc.);

– the use of technologies based primarily not on empirical production experience, but on scientific knowledge that enables the transformation of various natural processes into controlled and man-controlled technological processes;

– the ability to enable both mass production of standardized products and their adaptation to the needs of individual consumers.

It is worth emphasizing that the development of the so-called «knowledge economy» is not about replacing material production with knowledge, but about the growing importance of knowledge as an integral part of material production. It is not for nothing that experts focus on this point. Our Chinese colleague Professor E. Cheng rightly points out that all immaterial work involves to some extent the transformation of the material world and is the activity of creating the material world [E. Cheng, S. Gao, 2021, p. 194].

Therefore, the position clearly advocated in the theory of Noonomy is the recognition of the fact that industry remains firmly in the place of the productive and technological core of the modern economy; as such, it will remain in the perspective of the transition to NIS. Industrial production creates the necessary material conditions for the development of all other sectors of the economy – construction, agriculture, and the entire service sector – by supplying them with various materials, machinery, and equipment, and by developing technological processes. It is the development of industry that has largely determined the shifts in the socioeconomic structure of society over the past 250 years. This development takes place through the transition from one technological mode to another.

Technological layouts

The concept of technological modes arose as a natural continuation of research trends in world science. It is known that J. Schumpeter considered the innovative activity of entrepreneurs, leading to technological renewal of production, as a factor in gaining competitive advantage and as the main engine of economic development [Schumpeter, 1982], concluding that innovative

activity is unevenly distributed over time. Schumpeter called the new technology complexes that emerge during periods of innovation surges clusters (bundles) [Menshikov, 2014], but the term «*innovation waves*» is more established [Blaug, 2008].

The West German scientist G. Mensch, [Mensch, 1975] studied the patterns of technological stagnation, characterized by the prevalence of incremental or even imaginary innovations, with periods of introduction of fundamentally new (basic) technological solutions. Like Schumpeter, he also wrote about clusters of basic innovations leading to industrial metamorphosis. In the 1970s and 1980s, the English economist C. Freeman formulated the concepts of «technological system» and «techno-economic paradigm», which was further developed by his student K. Peres [Peres, 2011]. The concept of «technological pattern» used in domestic economics is in some ways a symbiotic analog of the concepts of «waves of innovation», «techno-economic paradigm» and «technological system», but significantly expands them by introducing the concepts of production chains, cohesion of production cooperation and many others into the study, forming the idea of an integral phase of industrial development as a pattern, defining a new fundamental basis for the study of these processes. It was first published in 1986 by academicians D.S. L'vov and S.Yu. Glaziev [L'vov, Glaziev, 1986].

According to Glaziev's definition, the technological pattern is a holistic, sustainable formation within which a closed cycle begins with the extraction and production of primary resources and ends with the production of final products that correspond to the nature of social consumption.

Now the world is beginning the process of transition from the fifth technological mode, which emerged in the 1950s to 1980s and is currently the leader (but only in the most developed countries), to the sixth. The conditions for the sixth technological mode in the field of scientific research began to take shape in the 1980s and 1990s, and the first applied technologies began to spread at the beginning of the XXI century and so far occupy a rather modest but rapidly «expanding» place.

However, the movement of the modern economy towards the sixth technological mode brings us not only to a change of modes, but to the threshold of a new technological revolution. Moreover, in his recent works, academician Glaziev even characterizes the emerging situation as the emergence of a new world economic order.

What is the sixth technological stage? Its holistic, «all-encompassing» description has not yet been presented in the scientific literature. However, many of the fundamental technologies that define it are already known and are actively changing the paradigm of industrial development, the face of the economy, and the state of public institutions.

These include Industry 4.0 [Germany ..., 2018], which is based on the creation of so-called smart factories. A key component of this is the Internet of Things, more specifically the Industrial Internet of Things [Boyes et al., 2018], which enables both the interaction of autonomous technical devices with each other and human control over them. For the purpose of such control, embedded sensors and systems for processing large amounts of information (Big Data) from these sensors are being developed on a large scale.

Directly in the realm of production technology, the shift from distractive (subtractive) technology, based on sawing, shearing, milling material from the original workpiece, to additive technology[1], based on adding or combining raw materials, is beginning. Among such technologies, 3D printing – a system of layer-by-layer buildup of source materials, based on the use of three-dimen-

[1] For an overview of the possibilities of additive technologies, see: (Prosvirnov, 2012).

sional computer models of the finished product – is rapidly gaining weight. In 2017, more than 400 thousand 3D printers were sold worldwide [Adams, 2018]. In 2018, the number of 3D printers sold decreased by a few percent, but revenue by value increased by 27 percent and vendor profits increased by 44 percent. This points to the evolution of the technology toward its complexity. The decline was in the desktop 3D printer segment for home use, while sales of industrial and design devices showed strong growth, accounting for about 70 percent of the market [Greenwood, 2019].

The synthesis of nano-, bio-, information- and cognitive technologies, the so-called NBIC convergence, opens broad perspectives [Converging…, 2005]. Recently, S, social sciences, was quite rightly added to NBIC to make NBICS [Spohrer, 2004]. This is an absolutely fixed tendency of this process and, in fact, of the movement of our civilizational development.

It is worth emphasizing again that what we are experiencing is not just a transition to the next stage of technological development, not just a transition from the fifth technological mode to the sixth. What is the most important feature of the sixth technological mode that allows us to speak of the industrial revolution?

The fact is that the hallmark of the new technological revolution becomes a leap in the application of new knowledge. The share of knowledge-intensive costs is increasing, and the share of material resource costs is relatively decreasing. If we follow this trend, we can expect what was discussed in our 2010-2015 papers, the author's books «The Coming. The New Industrial Society of the Second Generation: Resetting» [Bodrunov, 2016] and «Noonomy» [Bodrunov, 2018a] – that we will move toward a level of production where knowledge will dominate the cost of production in any variant – however it may be counted, in whatever units one may try to explore. Knowledge and its carrier, man, will become the most important productive resource of the next stage of development. The understanding of this fact is already reflected in economic theory. «Although at all times no worker could do without knowledge and skills, in recent decades education and science, the skill level of workers have become a determining factor of progress,» notes the famous Russian economist A.A. Porokhovsky [Porokhovsky, 2016, p. 16]. And this is already the case today in many industries.

Another position that must be outlined is that to achieve this new quality of production requires not only a technological leap, but also the improvement of all components of modern material production. This is because production consists of not just one, but four components. In addition to technology, production also includes labor, the means of production (simply put, all the material resources used in production, from raw materials to machinery), and the organizational forms of production.

Of course, when people talk about a technological leap, they usually mean technology first and foremost. In fact, however, this is not the case at all. The whole of material production is changing, and if we interpret the term «technology» broadly, then we are changing, for example, the technology of labor, the technology of the organization of production. From this point of view, we can speak of a technological revolution. But if we start from our understanding of the content of production, then of course we must speak of a larger, more comprehensive, «complex» industrial/industrial revolution, with far-reaching consequences for the development of society.

The coming industrial revolution. Transition to the NIS.2

What will be the result of this coming industrial revolution? If we speak of a qualitative change in all aspects of industrial production, it must mean the transition of industrial society to a new

stage of development. Thus, the result of this revolution will be a new state of industrial society. If the previous industrial era (in the sense of John K. Galbraith) is considered as the new industrial society of the first generation, then the transition to the next generation, the second generation, lies ahead. And it will be a new generation of industrial society: it will remain essentially industrial because it will continue to be based on industrial activity. We have called such a society NIS.2 – the New Industrial Society of the Second Generation.

The main difference between this generation of industrial production is the change in the main economic resource. This role of the main resource and the main source of development is transferred to knowledge, scientific knowledge of the human environment.

The nature of material production is largely determined by where we get our resources. In the past we got them directly from nature – we got edible animals and plants, dug in the earth for minerals. And now we will «dig» for knowledge, because it is a fundamental resource from which the growth of our ability to meet our needs will grow in significant, fundamental ways.

The new industrial mode of production is so knowledge-intensive that it will displace the cost of materials and human labor and create a knowledge-intensive product based on the use of knowledge-intensive technology. However, this does not mean that production ceases to be material – it takes on a new quality and becomes knowledge-intensive material production. It has been clear for a long time that the coming technological revolution can by no means be reduced to an information revolution: «We are witnessing the emergence in industrialized countries of a truly 'new' economy that encompasses the entire industrial base of society, not just the information and communications sector, as has been imagined in the recent past» [Tolkachev, Kulakov, 2016, p. 86].

Finally, knowledge (like any other resource) does not replace the process of material production itself, even if it becomes its most important resource; it has economic value only when it is used technologically in production, not by itself. The vice president of the World Political Economy Association (WAPE), A. Freeman, expresses this fact very figuratively and at the same time precisely: «…spiritual objects gain access to the down-to-earth spheres of production and consumption only in physical form. Like the gods of Olympus, they communicate with men only in corporeal form, which becomes the gross physical vehicle of their ethereal existence» [Freeman, 2021, p. 221].

The growth of knowledge-intensive production and the transformation of the production process into a technological application of science, into an «experimental science, materially creative and objectively embodied science,» as Marx classically put it [Marx, 1969, p. 221], is responsible for another important trend. It is about the «withdrawal of man from the process of immediate production,» the transition of the worker into the role of «controller and regulator» of the production process, which is transformed «from a simple labor process into a scientific process that puts the forces of nature at its service and forces them to act in the service of human needs» [Marx, 1969, p. 208].

And we see that the sixth technological mode leads at least to a strong reduction of direct human participation in the process of material transformation of raw materials. The functions of goal setting and control are increasingly left to humans, while the direct manipulation of natural substance is increasingly carried out by autonomous technical beings. The widespread use of industrial robots is only the first step on this path. Surgical robots are no longer uncommon, robotic drivers are on the roads, drones are in the airspace, artificial intelligence is increasingly replacing humans in interactions with customers of retail and banking companies; examples abound.

«The Internet of Things and similar technologies are bringing fundamental change to many currently traditional areas of economic activity – from commerce to services to construction (which, we should note in passing, is itself the foundation, a powerful base, for future innovation). The synergistic potential inherent in modern technology, conditioned by the nature of knowledge as a phenomenon, not only does not diminish in practice, but increases: a striking example is the development of information technology, where increasing the efficiency of the «hard» increases the efficiency of the «software», and improving the «software» increases the capacity of the «hard».

The application of knowledge-intensive technologies leads to fundamental changes that also occur in a component of the industrial process such as the organization of production. Production management systems are improved, product design is changed to 3D modeling, transport/material/information flows etc. are optimized, management decisions are automated/»internetized» – the system administrator becomes the plant manager! – and much more.

Sixth century cognitive technology, through the use of self-learning artificial intelligence (AI) systems, is also penetrating areas where there was previously no alternative to using human labor. Searching, collecting, sorting and comparing information to make decisions based on is something AI systems can do. And such technologies are increasingly being used not only in manufacturing, but in other areas of human activity as well. As the scientific leaders of CEMI RAS rightly point out, «…the exponential growth of the total volume of data related to human activities and the need to develop a new generation of analytical data mining systems necessary for predicting social phenomena and events necessitate the use of supercomputing technology [Makarov, Bakhtizin, Sushko, 2016, p. 12].

It is cognitive technology that, through the use of advances in biotechnology and information and communication technology, creates the possibility of direct human interaction with ongoing unmanned technological processes (human-machine interfaces, human-machine systems, human-machine networks[1]). On this basis, the production of robotics, which is becoming increasingly flexible, adaptable and productive, receives a new impetus.

A civilizational fork

The next thesis is that the growth of technological capabilities to satisfy needs presents humanity with a dilemma in civilizational development. We often say that an ecological crisis is imminent: We have covered the whole world with plastic, mutants are appearing in the zoo world (even in the «micro zoo world», of which the recent viruses that have caused great local epidemics and pandemics are a frightening testimony), dozens and hundreds of species of living beings are disappearing every day, or technological beings appear, «multiplying» much faster than nature created this world (the growth rate of the so-called technological beings – in analogy to the terminology of geobiocoenoses – is growing rapidly. By analogy with the terminology of geobiocoenoses, the growth rate of the so-called technological beings – if we speak of the creatures inhabiting technocoenoses – is growing rapidly).

The latter is worth a special mention. The elements of technocenosis, which we call «technological beings» due to the fact that they exist and occupy a certain place in our space, occupy this place more and more. They displace the natural essences of nature, and man, their creator, today

[1] Review on this topic see.: Tsvetkova, Yasseri, Meyer, Brian, Engen, Walland, Luders, Følstad, Bravos, 2015.

has already become (if we follow Vernadsky, even in Vernadsky's time) a significant geological force, not to say a «biological» force. The total amount of all that man has done in the last five thousand years of his existence, or the weight of the technosphere, i.e., all that man has created through technology in his active history*, is estimated at 30 trillion tons in 2010* [Zalasiewicz, Williams, Waters, etc, 2017, pp. 9-22], *while according to biologists, the weight of biota, i.e. everything that living nature has created in the 4.5 billion years of its existence, is about 2.5 trillion tons* [Korogodin, Korogodina, 2000, p. 106].

There is a danger of progressive loss of biodiversity. About 3 species of living beings disappear every hour on Earth, more than 70 species every day. Of course, there has always been a natural process of species extinction without human intervention. However, this natural process is estimated at a loss rate of about one species per million per year. And «…estimates of current species diversity range from, say, 2 million species to 30 or even 100 million,» is how Dr. Braulio Diaz, Executive Secretary of the Convention on Biological Diversity, describes the problem [Skobeeva, 2016]. It is not difficult to calculate that even at the highest estimate, the current rate of extinction of biota would be 262 species per year out of one million, which is a hundred times higher than the natural rate. And at the same time, humans have created many more engineered species than nature has produced species of living things – about a billion [Zalasiewicz, Williams, Colin, etc., 2017, p. 12].

And as we can see, technological diversity has not only surpassed biological diversity, but it is suppressing it. The human Creator, made «in the image and likeness of God,» has already surpassed the Creator many times over in terms of the «quantity» of «things created» (which is not always the case when it comes to the «quality» of those things). So, if we are talking about the biological side of the question, then, in general, nature has probably not yet created the creatures that would destroy living nature more than man.

The reasons for the increase of this destructive side of technological progress are at the level of socio-economic relations. Not only environmentalists, but also eminent economists are sounding the alarm. «Before our eyes is being destroyed the habitat of man, who has begun to reap the fruits of his own reckless interference with nature,» writes RAS Corresponding Member R.S. Grinberg. – Therefore, to prevent the onset of climate catastrophe, the two phenomena that threaten man – hyperindividualism on the one hand and hyperconsumerism on the other – must somehow be curtailed [Grinberg, 2020, p. 72].

The continuation and inflation of such an evolutionary trend is becoming more and more obvious, leading to a serious crisis in many areas, such as the biological crisis or the genomic crisis, in which humans can both interfere with themselves and create beings that might be beyond human control, and much more.

This is no longer fiction. The Massachusetts Institute of Technology (USA), for example, is already editing the genes in the human embryo by removing (turning off) some and adding others! And another American institute (The Scripps Research Institute, TSRI) has gone even further: To the four nitrogenous bases that make up DNA in nature - adenine, thymine, guanine, and cytosine (which make up all living things from bacteria to whales), the researchers added two more artificial ones not found in our nature, incorporated them into the DNA of living cells, and made them successfully replicate, passing on acquired (embedded) properties as inherited and producing semi-synthetic proteins [Medvedev, 2017]. Even what appears to be an unquestionable good can carry significant risks. For example, the relatively cheap «decoding of the human genome in

4-5 years will cause a lot of ethical and other problems. Any insurance company, any bank may require its customer to decode his genome, which means invading the inner physical world of a human being and making him vulnerable to outside intervention. Human cloning, cyberterrorism on the Internet, trafficking in internal organs, etc., could be the byproducts of the rapid, uncontrolled development of new technologies» [Dynkin, Pantin, 2010, p. 8].

Clearly, scientists expanding the horizons of scientific knowledge are driven by good intentions, such as creating new pharmaceutical forms or correcting genetic anomalies. But they do not deny that these scientific advances can also be used to create new life forms and to «edit» the very biosubstance of humans.

The same reasoning can be applied to many modern technologies whose careless and indiscriminate use can radically alter our environment, our living conditions, and ourselves.

Is this path definitely positive? Or is it fraught with fundamental dangers for human beings? The answer seems clear. At the very least, we need to think about this growing challenge of developmental uncertainty and civilizational risk.

(To be continued)

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Information about the author

Sergey D. Bodrunov

Dr. Sc. (Econ.), Professor, Director of the S.Y. Witte Institute for New Industrial Development (INID), President of the Commission of the Union of Economists, President of the Free Economic Society of Russia, expert of the Russian Academy of Science (Bol'shaya Monetnay Str. 16, St. Petersburg, 197101, Russia)

E-mail: inir@inir.ru