UDC 332.05+338.124.4, LBC 65.011.151

Singular technology – the research area promoting the country's sustainable noosphere development in Belarus, Russia and other CIS nations

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Abstract. The article is devoted to nano- and femtotechnology as the basis for sustainable noosphere development of the global socio-economic mega system "nature–man–society" in its relation with the Universe (cosmos) in Belarus, Kazakhstan, Russia, Ukraine and other CIS nations.

Such factors as the formation of a new (noospheric) political and economic outlook and the changes in scientific and technological structure of economy are gaining paramount importance under the action of the law of time and the adequate need to change the logic of socio-economic behavior of the population of planet Earth.

Singular technology can become a strategic priority in finding practical solutions to these issues. When creating new productive forces and relations of production, these technologies act as a synergetic and bifurcation (unpredictable) interaction of the three system technologies: artificial intelligence, molecular nanotechnology and molecular biotechnology.

As soon as man grasps the essence of singular technology, it will be possible to create a new structure of matter at the nano- and femtotechnology levels, and to exercise control over this process. The new structure of matter is the basis for the creation of new productive forces and relations of production in the noosphere economy.

Technological singularity originated in the mapping of the human genome, creation of a self-replicating organism, and a self-replicating machine. The nearest strategic objective (2020–2030s) of singular technology is to create an artificial brain – a "digital man" on the basis of nano-and femtotechnology.

This research area and practice will open the way to new forms of energy, productive forces, industrial relations and socio-economic noosphere systems in general. The wide application of singular technology in the economy will contribute to the conservation and civilizational development of the planetary megasystem "cosmos–nature–man–society".

Key words: law of the time, sustainable noosphere innovation development, noosphere economy, megasystem "cosmos–nature–man–society", socio-economic system, productive forces, relations of production, mind, consciousness, singular technology, nano- and femtotechnology, biotechnology, artificial intelligence, computer science, genetics, genetic engineering, stem cells, unresponsiveness to innovation, innovation economic efficiency, power corruption, currency corruption, offshore capital, taxes, levies.

At present, in accordance with the law of the time, humanity stands on the threshold of a paradigm change or, in other words, a series of rapid socio-economic and science-and-technology progress, which entails the change of worldview, socio-economic behavior, values, research and technological tools, etc. This factor, of course, should be taken into account in the formation of civilizational, intellectual, moral and spiritual processes in the world.

Nowadays there is also a need for a new global ideological science-and-technology paradigm. Within its framework it is necessary to formulate an underlying task that can highlight a new vector of development for our countries and for mankind in general, and to facilitate the science-and-technology revolution [1].

A priority of the new ideology should be the need for the use of breakthrough singular technology for the improvement of man and his environment [2]. This is associated with the fact that today the society has developed a new research area named technological singularity. It is a moment in time, after which advances in technology will become so rapid and complex that they will be beyond human comprehension. As Michael Deering says, singularity is the most significant event in the history of mankind. It will come as the result of simultaneous action of three advanced technologies: artificial intelligence, molecular nanotechnology and molecular biotechnology. The rate of progress to the point of singularity increases gradually at first, but the mechanism of feedback with every shortening cycle leads us to singularity more and more rapidly. When singularity is reached, the capabilities of mankind will become really stunning – full control over the structure of matter at the atomic level, the thorough knowledge of biological processes from macro- to micro- and molecular levels, and superhuman artificial intelligence [3].

The starting point of technological singularity is considered to be the mapping (the sequencing?) of the human genome by Celera Genomics in 2000 and the construction of the first living self-replicating organism in 2010 (Craig Venter). Actually Venter created the first self-replicating machine.

The second point of technological singularity can arise from the development of nanotechnology, which was discussed in the 2007 report by the Commission for Economic Policy of the US Congress. The predicted date of singularity is said to be 2020 or even 2030. Currently, the creation of the artificial brain – a "digital man"– is the principal area in the formation of singularity.

The development of femtotechnology can be the third point of singularity. Femtotechnology studies matter in the range from nanometers to femtometers, i.e. from the atom to the nucleus (in the energy equivalent from electronvolts to megaelectronvolts). This science is the basis of nanotechnology and opens the way to new forms of energy and new kinds of communication.

At present, unrestrained consumption of natural resources is aggravating and, as a consequence, the destruction of biosphere can become irrevocable. Thus, mankind is faced with the actual possibility of a global ecological catastrophe with further socio-economic development; this uses are discussed thoroughly in the UN documents. The Earth Charter is a telling example of an international framework document on the issues of sustainable development. It is an international declaration of fundamental principles and values for establishing a just, sustainable and peaceful global society in the 21st century. One of its sections is devoted to social and economic justice. It includes the following provisions:

- eradicate poverty as an ethical, social and environmental imperative;
- ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner;
- affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care and economic opportunity;
- uphold the right of all, without discrimination, to a natural and social environment.

All these principles should lead to sustainable development of mankind – to the right, balanced development, when the exploitation of natural resources, the direction of investments, the focus of science-and-technology development, personal development and institutional change are coordinated with each other and strengthen the current and future potential to meet human needs and aspirations without compromising the ability of future generations to meet their own needs.

In the future, sustainable development will be based on the oriented resource-saving and human-preservation economy, in which all goods and services must be accessible to all. At the same time, land, energy, and money should not be private goods and private property.

Nowadays modern society in developed countries owns high technology and can provide food, clothing, housing, medical care and education to all the inhabitants of the planet. However, they do not yet possess the technology for producing renewable green energy sources in unlimited quantity. Besides, their extremely productive economy demands that overconsumption be made the way of life. This is implemented with the help of two factors – planned and forced obsolescence[1]. Planned obsolescence is technological in its nature, but forced obsolescence is regulated by a dominant fashion trend and mass culture.

Macroeconomic trends in the world economy development

The theory of macroeconomics argues that the economy of any country usually undergoes four stages of development: chaos, investment, innovation, wealth. For example, the Republic of Venice went through all of these four stages at the time. After the stage of wealth the Republic disappeared as an independent state. In the 1960s the "golden billion" countries [the term is used mainly in the Russian-speaking world, referring to industrially developed nations, or the West – *translator's note*] began to move from the most effective stage – the stage of innovation – to the stage of wealth, dominated by private financial capital. The prestige of science and engineering labor is falling. Leaving the stage of wealth is a very long and complicated

[1] Planned obsolescence is obsolescence before the time, when it is really needed. Forced obsolescence occurs when things that are still useful are thrown out (editor's note).

process: for example, Japan has been trying to get out of it for over 15 years. And the zero banking rate is of no help here.

In its time the Soviet Union was in the stage of planned state investments with some patches of innovation phases in its defense industry. Trying to shift the entire economy in the stage of innovation on the basis of market relations ended with the stage of chaos. This stage is characterized by high inflation, corruption and loss of state control of the economy.

Negative macroeconomic change in the advanced countries, i.e. the transition from the stage of innovation to the stage of wealth have led to the fact that from the mid-1960s the progress in such key sectors of human activity as astronautics, aviation, land transport, nuclear physics and energy has virtually stopped. The remnants of positive trends are still observed in microelectronics, computer science and genetics. According to Academician D.S. Lvov, the age of great discoveries is a thing of the past, now is the age of the great "screwdriver and assembling" technologies.

For example, the USA began showing the signs of movement to the stage of wealth in the mid-1960s. This is evidenced by the fact that in the 1960s the total pretax income of the private financial sector (service sector) amounted to 14% of all corporate taxes. This share has increased to 40% by 2008. For example, in the pre-crisis period, the largest company General Electric obtained 80% of the profit from its financial dividends instead of developing its production and gaining profit from that.

Under the pressure from the US and European Union, the leaders of 20 advanced countries adopted the "high-tech" way out of the global crisis (only in words so far): they have decided to support their economies and allocate four trillion US dollars for the development of high-tech products, and clean energy, and one trillion US dollars for the International Monetary Fund to support the markets of developing countries. But all this is only wishful thinking. As Mr. Khazin points out, the number of manufacturing facilities in the world already exceeds consumers' capabilities for purchasing manufactured goods. And if we take into account that even this demand is significantly subsidized at the expense of targeted emissions of dollars, it becomes clear that *to establish production in a developing country would be simply unprofitable*. The plans to get the leading countries out of the crisis do not include the CIS nations.

Multinational corporations (MNCs) play an important role in the globalization of the economy. On the one hand, globalization facilitates economic interaction between countries, creates conditions for their access to advanced achievements of mankind, ensures resource conservation, facilitates world progress. On the other hand, globalization has a negative impact, for example: the maintenance of the peripheral model of economy, the loss of their own resources by the countries outside the "golden billion". Globalization spreads competition among all the participants, including developing countries, which leads to the shakeout of small businesses, deterioration of living standards and so on.

For example, the prominent economist J. Stiglitz proves with numerous facts and examples that globalization is destroying industry, contributes to the growth of unemployment and poverty, hampers the progress in science and technology, and aggravates environmental disasters on the planet. He criticizes the policy of global institutions – the WTO, the IMF, which use globalization and its ideology (free trade, free access to raw materials, the world patent law, the use of "paper" US dollar and Euro as the world's currencies, the intervention of international institutions in domestic policy, etc.) in the interests of several most developed countries to the detriment of most of the other countries.

Thus, it can be concluded that *the CIS countries can rely on MNCs only to a limited extent*. The case of Russia is a telling example. Not a single high-tech production with MNC participation has been organized for 20 years. They have only established various assembly factories to promote their obsolete products, and also used the Russian Federation as a source of raw materials and highly qualified specialists. The situation is no better in other CIS nations.

At present, MNCs mainly seek to gain profit and super-profit by expanding markets at the expense of developing countries and using their resources.

The main internal barriers to civilizational development in the CIS countries

We have discussed several external factors influencing the development of the CIS countries; let us now consider the internal problems that can slow down the transition of our countries to the innovation stage and to the sixth technological mode.

Paradox of plenty. When countries with an abundance of natural resources, are often considered to be less economically developed than the countries that have fewer natural resources or do not have them at all. This is hypothesized to happen for many different reasons, including a decline in the competitiveness of other economic sectors caused by appreciation of the real exchange rate as resource revenues enter an economy, volatility of revenues from the sales of natural resources in the global market, government mismanagement, or development of corruption due to the inflow of "easy" money in the economy.

Government corruption. Since the activity of authorities is dynamic, diverse and complex, it faces the emergence and functioning of the institutions crucial to the development of society, state and individuals. They become especially important under volatile, uncertain and imitating condition of political and other institutions. One of these institutions is "political corruption", which, like other concepts reflecting the actual phenomena of political reality, has been uncovered on a mass scale at the different levels of power.

The World Bank calls such practice of political parties (the practice of selling state, national and economic interests) "state capture". The World Bank has the evidence that about 20% of the total number of the world's population suffers from political corruption that spreads through the adoption of laws in the Parliament (the "purchase of laws") and the financing of political parties.

The fact of political corruption can be proved indirectly by the following criteria.

1. The outflow of capital from the state is higher than its inflow.

2. The lack of "long-term" money for funding advanced technologies. Sergey Glazyev provides the following example: while exporting hundreds of billions of dollars of savings at 2–3% per annum, Russia attracts foreign capital at 7–8% per annum. In so doing, we actually change our "long-term" cheap money earned by exporting goods on expensive short-term loans from foreign emission centers. This policy resulted in the fact that Russia's financial system suffered direct loss of 20–50 billion dollars a year, only because of the difference in the interest allocated for maintaining American financial pyramids. However, Mr. Glazyev ignores an important factor – the Keynesian multiplier. Each exported dollar leads to a fivefold reduction of industrial capital in the economy and a 25-fold reduction of "high-tech" capital. It is this factor that has destroyed the most science-intensive industries in Russia: aeronautics and defense, since they are tied to foreign currencies.

3. Inappropriate use of budget funds. "Handwaving" with no practical result. The use of budget funds for financing outdated (junk) technologies with the purpose of

suppression of advanced industries. The direct suppression of competitive industries like electronics, microelectronics, aircraft building, nuclear (atto), nano- and femtotechnology, etc.

Unresponsiveness to innovation. A gravest problem in the development of civilizational processes is the immunity of the CIS economies to novel solutions, as well as widespread underestimation of efficiency and quality of production, science and technology achievements, i.e. unresponsiveness to innovation. It can be overcome by changing the government policy, the activity of management bodies of enterprises and organizations. These changes should be focused on the use of innovation solutions, technology, products and services for accelerating modernization process in the economy and social sphere. The extent of unresponsiveness to innovation is measured by the Global Innovation Index – a composite index measuring the level of innovation in the country, developed jointly by The Boston Consulting Group, the National Association of Manufacturers (NAM) and The Manufacturing Institute, the NAM's nonpartisan research affiliate. NAM describes it as the "largest and most comprehensive global index of its kind".

The Global Innovation Index is part of a large research study that looked at both the business outcomes of innovation and government's ability to encourage and support innovation through public policy. The study comprised a survey of more than 1.000 senior executives from NAM member companies across all industries; in-depth interviews with 30 of the executives; and a comparison of the "innovation friendliness" of 110 countries and all 50 U.S. states. The findings are published in the report "The Innovation Imperative in Manufacturing: How the United States Can Restore Its Edge".

The report discusses not only country performance but also what companies are doing and should be doing to spur innovation. It looks at new policy indicators for innovation, including tax incentives and policies for immigration, education and intellectual property. The index was last published in March 2009. To rank the countries, the study measured both innovation inputs and outputs. Innovation inputs included government and fiscal policy, education policy and the innovation environment. Outputs included patents, technology transfer, and other R&D results; business performance, such as labor productivity and total shareholder returns; and the impact of innovation on business migration and economic growth. The following is a list of the twenty largest countries by the Global Innovation Index, published in 2012:

Belarus is not included in the list, since there was no reliable information about its innovation development.

Table 1 shows that in this respect the situation in the CIS countries is catastrophic. For example, in Russia, the share of organizations implementing technological innovations is 8.0%. The share of innovation goods (works, services) in the total industrial production volume is 0.4%. Innovation-active enterprises practice a widespread import of technology, which often means in Russia obsolete junk technologies.

There are several conditional types of innovation according to the degree of their novelty:

- radical/breakthrough (strategic innovation that facilitate a breakthrough in theory and practice);
- modifying (enhance individual elements of existing systems);
- conditional (represent a new combination of old elements);
- combined (combine the features of all the above).

These four types of innovation result from different types of related research and development. The most radical strategic innovation generally requires the complete innovation cycle: fundamental and applied

Table 1. The Global Innovation Index http://ru.wikipedia.org/

Rank	Country	Overall	Innovation inputs	Innovation performance
1	Singapore	2.45	2.74	1.92
2	South Korea	2.26	1.75	2.55
3	Switzerland	2.23	1.51	2.74
6	Hong Kong	1.88	1.61	1.97
7	Finland	1.87	1.76	1.81
8	United States	1.80	1.28	2.16
9	Japan	1.79	1.16	2.25
15	United Kingdom	1.42	1.33	1.37
16	Israel	1.36	1.26	1.35
19	Germany	1.12	1.05	1.09
27	China	0.73	0.07	1.32
46	India	0.06	0.14	-0.02
49	Russia	-0.09	-0.02	-0.16
60	Kazakhstan	-0.23	-0.51	0.07
64	Ukraine	-0.45	-0.13	-0.73

research, development, implementation and dissemination (market penetration) of innovations. Other types of innovation do not require new achievements of fundamental science, but they often need applied research and they always need developments (bringing innovation to production) and implementation, and, except for certain cases, market penetration. Let us note once again that the most radical strategic innovation is based on the achievements of fundamental science [5].

The required performance level of new R&D may be provided only through the appropriate level of research environment, for which the necessary conditions are created by the government.

Inefficiency of special economic zones. Since 2005, Belarus, Russia and other CIS countries consider special economic zones (SEZ) as centers for crystallization of a new economy based on high technology. These centers were believed to become an effective tool for the commercialization of R&D results, the growth of R&D and science-intensive products and services, the development of innovation infrastructure, as well as a tool for attracting foreign investment and increasing exports of high-tech products.

The world experience proves that to create a new workplace in high-tech sphere requires not less than 100 thousand dollars of capital expenses; meanwhile, the creation of a new workplace in IT-sphere is cheaper by 1–2 orders of magnitude: it requires a table and a computer. This was the reason for a rapid development of IT in science and technology parks, instead of the real development of high technology.

For example, in 2006–2010 Russia implemented the state program for the creation of science and technology parks in high-tech sphere approved by the Government on March 10, 2006. According to the program, for the four-year-period, from 2007 to 2010, up to 29 billion rubles of the total public funding were to be allocated for the construction of a network of 27 parks in seven regions of Russia. It means that only 10 thousand high-tech jobs were created in all of Russia for 4 years!

It was estimated that by 2011, the total production output by hosted companies in science and technology parks could amount to 100 billion rubles, and the average revenue per one employee of a science and technology park could be about one and a half million rubles. In fact, according to the data for the third quarter of 2011, the revenue was only 33 billion rubles and the number of employees in all industrial parks amounted to 11 thousand, the number of hosted companies – about 440. Out of the 27 industrial parks that were planned to be constructed, only four are actually functioning. The project development is impeded by the following factors: lack of preferential taxation; financial difficulties; dependence on higher education institutions; high monopolization of the economy. As a result, the share of high-tech products in the country's GDP has not increased so far.

At present, there is also a massive replication of demonstrative strategies in the scientific environment that imitate their relation to advanced technology [6]. Recent years have seen a rapid increase in the number of projects and works, the names of which are purposefully supplemented with the "grant-promising" prefix "nano" to make them look more attractive for receiving grants and investments. If nanotechnology secures the status of a national strategic priority, it will cause respective changes in the policy of grantors. Researchers use this situation to their advantage; such actions can be called "marketing mimicry", i.e. changing the name without upgrading the content of their developments. "Pseudoindustrialization" is especially dangerous due to the underdevelopment of the expert community in the field of nanotechnology in RUSNANO and SKOLKOVO.

In such conditions, Russia's ambitious plans to create 25 million jobs will not be implemented.

Belarus has also tried to establish a high-tech park; however, in fact, it was turned into a park of information technology, and it specializes only in offshore software that is justified on this stage of development.

On the other hand, innovation policy in Belarus has a positive feature: all its territory was declared the offshore zone for high and advanced technology, as it is shown in *table 2.* The Belarus Government creates economic zones with even more favorable terms for attracting strategic investors.

Paragraph 38 of the Decree of the President of Belarus [7] states that *the entire territory of the Republic of Belarus is an offshore zone for high technology*. "Legal entities of the Republic of Belarus, which are not residents of the High Technology Park, who are implementing (intending to implement) business projects in the field of new and high technology in the areas of activity of the Park, including those not related to the activities specified in paragraph 3 hereof (hereinafter – non-residents of the High Technology Park), and who have registered such projects, have the right to use the benefits contained in paragraphs 48–52 of this Provision".

Tactics of Belarus and the CIS

The main goal of our countries is to move from the fifth to the sixth technological mode, i.e. to a postindustrial society.

The key factor in the sixth technological mode is singular technology that includes nano-technology, femtotechnology, nuclear (atto) technology, biotechnology, genetic engineering, information technology, green energy.

Table 2. Tax benefits and charges for the residents of the Chinese-Belarusian Science and Technology Park, the Park of High Technology, the Free Economic Zone "Minsk"

<table>
<tr><th>Government taxes and levies</th><th>Republic of Belarus as a whole</th><th>Chinese-Belarusian Science and Technology Park</th><th>Park of High Technology</th><th>Free Economic Zone "Minsk"</th></tr>
<tr><td>Profit tax</td><td>18%</td><td rowspan="3">During the ten calendar years after registration the taxes are not levied, in the following ten years – 50% of the rate</td><td>Is not levied</td><td>The tax is not levied during the first five years after the disclosure of profit, then – 50% of the rate</td></tr>
<tr><td>Land tax</td><td>According to the cadastral value of the land plot and its designated purpose</td><td>For the period of construction, but not more than three years</td><td>According to the cadastral value of the land plot and its designated purpose</td></tr>
<tr><td>Real estate tax</td><td>1%</td><td>Is not levied</td><td>Is not levied</td></tr>
<tr><td>Value added tax</td><td>20%</td><td>Is not levied</td><td>Is not levied</td><td>20% (50% of the rate for goods of own production and for those that are import-substituting)</td></tr>
<tr><td>Assignments to payroll fund</td><td>35% of the wage and salaries fund</td><td colspan="2">Assigned from the national average</td><td>35% of the wage and salaries fund</td></tr>
<tr><td>Individual income tax</td><td>12%</td><td>9% for everyone up to 2027</td><td>9%</td><td>According to the rates of 12%</td></tr>
<tr><td>Customs duties and levies</td><td>According to Belarus legislation</td><td>Is not levied</td><td>Is not levied</td><td>Is levied</td></tr>
<tr><td>Local taxes and levies</td><td>According to Belarus legislation</td><td>Is not levied</td><td>Is not levied</td><td>Is levied</td></tr>
</table>

Transition to the sixth technological mode should be facilitated by promoting the development of breakthrough singular technology through the establishment of the centers for technological crystallization of the sixth technological mode.

This requires the following government incentives:

1. To revise the legislation of the CIS nations for abolishing internal and external barriers to innovation responsiveness: elimination of political corruption by cancelling international (including confidential) agreements that impede the development of new and high technology.

2. To declare, at least for a 20-year period, the entire territory of each country of the CIS a special economic zone for the development of new and high technology – the offshore high-tech, and to optimize the regional (local) tax policy.

3. To create the register of investment projects based on the new and high technology assessment criteria. The criterion adopted in the Republic of Belarus can be taken as an example [8].

4. To provide state support to the creation of infrastructure in the centers for breakthrough technology crystallization.

5. To create centers for common use of sophisticated technological equipment.

6. To promote the development of small and easily adjustable industries, focused on the limited resources of our countries with a low threshold of access to the world hi-tech markets.

7. To stop the outflow of personnel, to organize their training and retraining for new and high technology.

8. To organize cooperation between the CIS countries and developed countries of the world in the field of technology, information and education.

9. To shape public opinion concerning the necessity of innovation development of the country.

Prerequisites for funding and its sources

- direct and indirect (tax) government support;
- attraction of internal and external resources under exceptionally favorable tax conditions taking into account a higher risk of investments in the established directions, than that of investments in innovation;
- cooperation with MNCs on the terms advantageous for our countries;
- creation of specialized development banks with the issue of "long-term" money with minimum interest rates for purchasing technological equipment and construction of infrastructure and centers for common use;
- introduction of tax amnesty for "runaway" capital from offshore zones to transform "monetary treasures" in the working national means of payment; this measure is a real chance to save the accumulations in case of transition to some other world currency like amero and so on. The research conducted by the Tax Justice Network shows that the volume of offshore money can reach 32 trillion US dollars. Billions of dollars out of Russia (798), Ukraine (167), Kazakhstan (138), and Belarus (75) have been transferred to offshores [9].

A path of implementation

The first steps. One of the ways to choose promising innovation projects can be the creation of a world map of breakthrough singular technology. It can be drafted by analogy with the world map of promising technologies developed by Quid. It is a map of the world progress with tips. Which technology will be an instant success, and which would be a waste of effort? Which idea should be supported financially? The authors of the map, believing that it will help find the answers to these questions, have created a program which, using certain algorithms, systematizes knowledge about different companies, their products and experiments. The Quid software works with patents, news, websites of firms, laboratories, organizations, their press releases, research publications, employee lists and vacancies, documents on government grants, posts in Twitter and so on. From all this, the software retrieves key words and phrases that describe the main ideas of projects (working groups, including start-ups), their relation to a certain field of knowledge and technology. These key phrases (hundreds per company) can be considered as genes. Accordingly, it turns out that every company has a unique set of technological genes, but different companies can have many common genes as well.

When comparing these genetic codes, one can sometimes find the links that have been previously overlooked; the bundles of lines work according to the "principle of gravitation" – the more threads of similarity between the companies – the stronger their attraction to each other. Thus, similar enterprises and projects form large clusters (engineering, finance, physics, computer science, biochemistry, design...), which, in turn, are subdivided into sections. The Quid database grows by 120 thousand documents every day. No man can read all of them, and, therefore, no man can find any patterns, coincidences and intersections, it is only computers that are able to do that. They derive something useful from these tangles of linkages. Within the rules invented by people, Quid shows interest in companies and organizations that are located at the intersection of fields. Interesting things often happen here, that could potentially lead to a breakthrough. And it is only one point on the "genetic map" of world technology, while there are many thousands of them all in all. The most interesting thing happens when the points begin to emerge one by one in some blank space [10].

We should see *our goal* in the development of an advanced map of civilizational processes that is based on promising technology and breakthrough singular technology. Our countries have accumulated enough national wealth to finance all the promising and singular technologies.

We can take the Resolution of the Council of Ministers of the Republic of Belarus as a basic document on the criteria for assessing new and high technology [8].

Immediate landmarks. As we have mentioned above, humanity is standing on the threshold of a paradigm change or, in other words, a series of science-and-technology revolutions that will cause a change in the set of beliefs, value systems, technical equipment, etc. No doubt, this factor must be considered in the road map of civilizational processes in the CIS nations. Revolutionary breakthroughs are expected in artificial intelligence technology, molecular nanotechnology and molecular biotechnology.

The mind, consciousness, human brain and the whole mental process do not fit into the classical theories of information transmission and processing. Working (information) temperature of the brain has proved to be significantly lower than the thermal noise originating from physiological functioning of the brain with power consumption of 20 W. The cerebral cortex alone contains 10^{10} neurons, and each neuron has an average of 10^4 connections, at a clock frequency of 100 actuations (counts?) per second. It is 10^{18} operations per second with power consumption of just a few joules, which is close to thermodynamic limit. The thermodynamic limit is determined by the work performed in the synapses, and is approximately 10^{17} operations per joule.

IBM experts are trying to design a complete computer model of human brain functioning using their own supercomputer Blue Gene. At present, this model uses 147456 parallel processors of the supercomputer.

According to the IBM experts' forecasts, to make a mathematical model capable of reproducing what is in the head of each person will require the resources of 880 thousand processors designed according to the von Neumann architecture. IBM is planning to achieve such value of computing power not earlier than by 2019. Unfortunately, these systems with exaflop productivity will consume no less than 100–500 MW, which is comparable with the power consumption of a small city. But it is these machines that can be compared in performance with the human mind, consciousness and brain. It is a question of energy consumption and reliability of these machines, which limits the operation of modern supercomputers to a few dozens of hours.

Several groups of American scientists participating in the program "Ubiquitous High-Performance Computing" under the U.S. Defense Advanced Research Projects Agency (DARPA) are trying to solve these issues. Their goal is to create a computer complex, which would operate at the speeds in the petaFLOPS range, and consume not more than 57 kW of power.

We have to engage in this process immediately; otherwise we will fall behind forever.

The second direction (research area) of technological singularity can be a research into the mechanism of energy of supernovae as the basis of the new clean energy.

It is connected with femtotechnology – a new research field in science. In 2011 Russia began to develop femtotechnology as a mega science, in comparison to which nanotechnology will be yesterday's science. As V. Putin points out, successful solution of large-scale research issues "is not just a matter of national prestige; they promote the concentration of resources in priority areas and, in fact, they facilitate a breakthrough into the future, first in fundamental knowledge, and then – in technology" [13].

We believe that nano- and femtotechnology can become one of the main driving forces that can bring Belarus, Russia and other CIS countries to a new development level by creating new materials and devices in electronics, energy production and transport. This will facilitate the reformation of the world markets and at the same time handle a large number of environmental issues, which cannot be solved by modern technology. In the future, the development of femtotechnology will create fundamentally new sources of clean energy. Note that the modern approach to obtaining energy by controlled nuclear fusion in the plasma has insurmountable fundamental problems that prevented the artificial Sun to be lighted up on the Earth, although the attempts have been going on for more than 40 years. And we will have to wait another 40 years, according to the international program ITER.

The energy femtotechnology can "shut down" nuclear and thermonuclear energy, the scourge of which is life threatening neutrons and radioactive isotopes.

On the other hand, femtotechnology opens a new class of information technology based on gravitational interactions. The 19th century was the century of studying and using sound waves. The 20th century was the century of electromagnetic waves. The 21st century should be focused on the development of gravitational waves, which have already been discovered for stars and galaxies in the form of jets. Only an in-depth development of femto-physics (internal structure of atoms) will allow us to find new information channels [14].

At present, it is most relevant for the CIS countries to develop nano- and femtotechnology for the most energy-intensive industries – power engineering and transport as well as for the electronic industry.

Conclusion

The world faces the changes in technological and economic paradigms that are inextricably linked to each other.

Economic paradigms are connected with the processes of globalization, alignment of the economies of developed and developing countries that leads to alignment of the prices for products and labor services. So far, developed countries, by inertia, are willing to maintain overconsumption at the expense of developing countries with the help of international financial and technological mechanisms by issuing their own currencies and through technological advantages. This mechanism causes a withdrawal of additional value from developing countries in the form of inflation-emission tax of 4% of the world GDP. Excessive selfishness of the "golden billion" countries is impeding the development of the CIS countries. The policy of the developed countries in the sphere of technology financing has caused their transition from the stage of real innovation to the stage of financial wealth. Thy are trying to preserve their level of consumption and their power by the uncontrolled emission of currency, which leads to further robbery of developing countries due to the high interest rate on the loan capital.

A collective demand to eliminate offshore zones abroad, which will make the "fugitive" capital work for the people of its country, should become a short-time objective of the CIS nations.

The establishment of internal development banks on the basis of accumulated national wealth should promote the long-term break-through projects, first of all, nanotechnology and femtotechnology, nuclear (atto) technology, new materials, energy saving technology and green energy, and biotechnology.

This can become a reality, if we unite our efforts for an efficient cooperation within the CIS and with other economies of the world.

We are living in the time of change. But this should not prevent us from seeing a reasonable, moral and spiritual future of humanity, based on the understanding of the achievements and prospects of science, the future that recognizes the possibility and desirability of fundamental changes in human life through advanced technology seeking to eliminate the suffering and aging of people and to greatly enhance their physical, mental and psychological capabilities.

In the course of time, technology should become cleaner and more efficient. Such spheres as nano-, femto- and biotechnology, will provide the tools for a comprehensive restoration of the environment and for new clean energy. It is only science and technology that will allow humanity to overcome the deadlock and reach progressive development, avoiding the catastrophic consequences of global risks.

We can predict with a high degree of probability that in 2020–2025 the development of humanity will go through a number of points of singularity:

- Further development of nanoelectronics will lead to the creation of 3D neurochips that will provide the shift from von Neumann's computers to neural computers for wide use. This would liberate man from routine production and management processes.
- Femtotechnology will open the energy source of supernovae, which will make it possible to create small, harmless power installations available to each inhabitant of the Earth. New sources of energy will play an important part in the development of natural resources: sand, carbon dioxide, etc., which are available to everyone. Using nanotechnology together with these sources, one can create a wide range of new construction materials. In addition, it will be possible to solve the problem of clean water shortage.
- Femtotechnology will make it possible to solve many tasks of nanotechnology, which cannot be solved at the present-day level of science, for example, the problems of friction that causes deterioration and destruction of mechanisms and transport systems. On this basis it will be possible to create new types of transport systems, and a new class of hypersonic aircraft, which will increase the communication capabilities of mankind.
- Genetic engineering and biotechnology will be used by factories that will produce unlimited number of protein from all available resources (water, carbon dioxide, sunlight).
- On the basis of cell technology (stem cells and other) it will be possible to create "spare parts" for man, which will make life longer and enhance its quality.

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