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FORESIGHT IN GLOBAL TECHNOLOGICAL DEVELOPMENT
ПРОФЕССИОНАЛЬНОЕ РАЗВИТИЕ ГЛОБАЛЬНОГО ТЕХНОЛОГИЧЕСКОГО РАЗВИТИЯ

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Abstract. The article is devoted to the study of foresight role and essence in modern technological development and global security provision. Foresight methods for prioritizing scientific policy and industrial security have become mandatory in most developed countries of the world. Advantage is given to state support of fundamental technological solutions, based on which a specific applied product so-called generative technologies can be created. The technological foresight is aimed at identifying national priorities for scientific and technological development, which are most likely to maintain a high level of competitiveness of the country on the world market, a satisfactory quality of life for the population, sustainable economic development in the conditions of the world situation expected for the next 10-20 years, provision of industrial security. In the process of foresight research meta-tendencies are revealed in the development of modern technologies, which have a significant impact on human life, its sustainable development and security.

Key words: foresight, innovation, technological development, security, sustainable development.

Introduction.

The modern world is characterized by the growing globalization of the technology, economy, politics and culture and the emergence of management of these spheres not only at national level, but at the international and even global one. Globalization concerns technology, labor, capital, knowledge, production, markets. It becomes a clause and an important factor of further development.

It should be noted that solutions to most of the world's problems are largely related to the success of the technologies development and their application. In the conditions of modern technologic civilization at the stage of its globalization, practically all foresight species necessarily include a scientific and technological component as a particularly significant factor and an element for working out solutions in many vital areas. This includes ecology, the problems of providing fresh water, food and fuel, as well as the problems of the development of communications, education, human potential, and, even more, the problems of war and peace.

Foresight in modern world of technologies.

It is not by chance that, with reference to modernity, leading analysts use the term "technological revolution" and, more accurately, "the global technological revolution" [1, 2].

This term emphasizes and adequately expresses the role of science and technology based on it in the modern world. In contrast to the technology of the previous times, based primarily on practical handicraft discoveries and skills just with rare exceptions, the modern technological revolution is based first on scientific

research and developments, and is not just a product of simple industrial or craft improvements; and secondly, there is a category of top technologies in it, which is the apex of sophisticated technologies that integrate thousands of simple and even elementary technologies. With the development of top technologies, there are significant hopes for solving urgent pressing problems, and the greatest progress in them is related to the search and creative finds at the junction of these technologies; moreover, they penetrate many other, simpler technologies, and their impact is predicted to be even higher. Among the world's top technologies are: biotechnology, information technology, efficient and renewable energy supply systems, nanotechnology and, finally, complex systems management [1].

The global scientific and technological foresight research conducted by RAND Corporation (USA) is very indicative. In the report of RAND Corporation Technology Revolution 2015 [1], the main top-technologies with the greatest impact and prospects in the modern world were analyzed. First and foremost is the development of top technologies that provides answers to the main global challenges of our time, concerning health, ecology, and provision of basic resources (fuel, food, water). And the peculiarity of the present moment is the refusal of the disciplinary binding of technologies, since the top technologies penetrate many other technologies. For example, nanotechnologies based on discoveries in the field of the microworld are used in information technologies, in the creation of new materials, in biotechnology, in medicine there are at least a few dozen, more than 40 directions of their use.

Top-technologies are applied in all key technology groups that are important for solving global world problems. There are 15-16 of such technological clusters or directions of application, which is noted, for example, in the RAND Corporation report [2]. These applications of top technologies are a response to the needs of social development or challenges of the time.

New technologies are the realization of the possibilities of humanity within the limits of the set tasks. They concern the full biological and socio-cultural reproduction of mankind on the planet. First of all, we are talking about technologies that help to solve problems in the field of energy, communication, information, network management, production of cheap and safe materials, food production, public health, clean ecology etc.

In the national plans of scientific, technological and innovative development of the most developed countries like USA, EU countries, Japan, and for a number of technologies, for example, nanotechnology – Australia, Brazil, India, China, and others, these priorities are reflected. This indicates the correlation of independent expert studies in the field of world technological priorities and the application of technology, the main global problems and opportunities of humankind as well as real political decisions based on forecasts in the scientific and technological sphere. In addition, these coincidences also reflect the growth of global interaction in the economic and political spheres, in scientific and technological, and especially in innovation policy.

As it is important not only to identify the problems and directions of their technological solutions, but also to consider the social context of their development

and application, these factors can be conditionally divided into groups that reflect:

- the ability to develop technology;
- opportunities for the development of technology;
- the level of implementation of technological development, especially in the field of innovation.

These factors are taken into account in the technological foresight by experts and analysts of RAND Corporation and get interesting results both for individual countries and subregions, and for technological development of the world as a whole.

When analyzing the ability of a national innovation system of a country to develop a key technology, it is necessary to take into account:

– national policy in the field of science, technology and innovation as well as in specific technologies i.e. the necessary level of funding, the provision of research and development by human resources, international cooperation;
– developed legislation in the intellectual sphere;
– the level of human development, which reflects the state of economic development, the national system of education and health;
– in general, the society's readiness for modern development including at the level of values and orientations;
– and a number of other factors.

Analysis of the capabilities of the national innovation system to develop and implement one of the key technologies or their totality should take into account the level of development and motivation of all links of the national innovation system, including the research and development sector, production, infrastructure – organizational, informational, financial, educational, as well as government and society in the technology development. All this is reflected in innovation and economic policy and public opinion. Important indicators are the level and scale of financing, scientific and technological priorities of the country, the saturation of the scientific and technological sphere with personnel one, the quality of the country's human potential as a whole.

It should be noted that in order to capture the capabilities and level of technologies implementation and application, RAND experts use both quantitative and qualitative indicators, both absolute and, more often, relative indicators. It can also be noted that in the process of foresight research, some meta-tendencies are revealed in the development of modern technologies themselves, which have such a significant impact on human and planet life, namely:

• Acceleration of the pace of technological change. The accelerating pace of technological change combined with the creative destruction of traditional industries will increase the importance of cultural adaptation, long-term education and training. Economic need, social requirements and resource opportunities will affect the rate of technological development in each industry and society in the next 15-20 years.

• The growing multidisciplinary nature of technology. Many technologies were created through multidisciplinary interactions. Therefore, engineers are increasingly turning to biologists to understand how living organisms solve problems in the natural environment in order to reproduce it with regard to inanimate objects.

• Competition for leadership in the development of technology. Leadership and development participation in each technical field will depend on a variety of factors, including future regional economic aspects (e.g. the European Union as a global force), international intellectual property rights and their protection, the nature of future multinational corporations and the private sector, investment in scientific research and development.

• Continuing globalization. Information technologies, which exert a strong influence on other technologies, strengthen the process of globalization of economies and societies.

Many countries use foresight in determining their own policies, especially in the scientific and technological sphere. Now the number of such countries is about 50: OECD countries and the EU in the first place. In OECD countries foresight research is considered to be an obligatory tool for successful scientific, technological and innovation policy [3, 4]. The European Commission also recognized foresight as effective and necessary for both internal development and global interaction, especially in the light of the decision to form a unified scientific and innovative space for the European Union.

The peculiarity of new foresights in developed countries since the 2000s is the consideration of such trends and problems of modern development as:

- globalization,
- development of the knowledge economy,
- formation and consolidation of the information society,
- management of environmental resources,
- transformation of health care,
- growth of regional differences.

Currently, European countries adhere to the selective strategy of scientific and technological development, identifying for themselves priority research directions of an innovative nature, the development of which allows for effective use of available financial and intellectual resources and thereby expand and strengthen their positions in global technology markets in the context of globalization.

Experience shows that the priority is given to work carried out jointly with public sector organizations such as universities and national research centers and private / corporate capital i.e. centers for the development of industrial enterprises based on equity financing as well as work of an interdisciplinary nature.

Over the past decade, governments at the national and local levels, companies mostly large, but also some representatives of small and medium-sized businesses and other types of organizations like charitable, trade associations have carried out a huge amount of foresight research. The results of foresight conducted by public organizations are generally public, while the results of private firms are kept in secret.

Foresight varies in different countries according to initiators of a research, tasks, participants, methods used.

The initiators usually are:

- government or any central state body: ministry, council, committee, fund;
- regional bodies;

- corporations;
- clusters, etc.

Foresight methods for prioritizing scientific policy have become mandatory in most OECD countries. Advantage is given to state support of fundamental technological solutions, based on which a specific applied product (so-called generative technologies) can be created. In a number of European countries to determine the list of the most promising technologies of this class, foresight research is widely used, the meaning of which in this context can be interpreted as a "perspective".

The so-called technological foresight is aimed at identifying national priorities for scientific and technological development, which are most likely to maintain a high level of competitiveness of the country on the world market, a satisfactory quality of life for the population, sustainable economic development in the conditions of the world situation expected for the next 10-20 years. The basis of the final recommendations is an analysis of the country's real resources, both material and intellectual, as well as the opportunities for their strengthening and expansion.

Conclusions.

In all developed and in many developing countries, strategic planning of priority areas of research, development and innovation is carried out. National plans and projects for the development of science and technology are being formed. Taking into account the fact that technologies strongly influence not only production, which is important in itself, as it changes the character and productivity of labor, it requires qualitative special education and skills, etc., but their influence is more extensive.

Technologies affect nature and society and individuals, including in the domestic sphere, healthcare, the sphere of communication and leisure, etc. in general, the conditions of work and life. The spread and influence of technology on the life of man and society is strengthened by the development of globalization, the rapid spread of technologies and their successful applications in all major spheres of life.

One way or another, both the local and the national foresight are facing global problems of human development and a technological revolution. Risks that can be grouped into the following classes are hazard to man, danger to culture, danger to management, danger to nature.

Many mechanisms and tools, especially in decision-making, facilitate the success of development in a globalizing world. At the same time, the price of solutions is becoming increasingly high, especially with the acceleration of development rate and the diversity of social consequences of modern technologies application. Foresight is the true technology to minimize the risk of such decisions.

References:

1. Anton, P. S., Silberglitt, R., & Schneider, J. (2001). The Global Technology Revolution. Bio/Nano/Materials Trends and Their Synergies with Information Technology by 2015. (p. 86, Rep. No. MR-1307-NIC). RAND Corporation. Retrieved from https://www.rand.org/pubs/monograph_reports/MR1307.html.

2. The Global Technology Revolution 2020, Executive Summary: Bio/Nano/Materials/Information Trends, Drivers, Barriers and Social Implications,

MG-475-NIC (pp. 1-4, Rep.). (2006). RAND Corporation. Retrieved from http://www.foresight-platform.eu/wp-content/uploads/2011/04/EFMN-Brief-No.-90-Global-Technology-Revolution-2020.pdf.

3. OECD (2016), OECD Science, Technology and Innovation Outlook 2016, OECD Publishing, Paris. http://dx.doi.org/10.1787/sti_in_outlook-2016-en.

4. OECD (2017), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264268821-en.

Анотація. *Стаття присвячена дослідженню ролі та суті форсайт-технологій у технологічному та безпечному глобальному розвитку суспільства. На сучасному етапі цивілізаційного розвитку застосування методів прогнозування, зокрема форсайту, для визначення пріоритетів наукової політики та промислової безпеки стали обов'язковими в більшості розвинених країн світу. Перевага надається державній підтримці фундаментальних технологічних рішень, на основі яких можуть бути створені конкретні загальні технології. Технологічний форсайт спрямований на визначення національних пріоритетів науково-технічного розвитку, які, найімовірніше, збережуть високий рівень конкурентоспроможності країни на світовому ринку, задовільну якість життя населення, стійкий економічний розвиток в умовах прогнозованого світового розвитку на наступні 10-20 років, забезпечення промислової безпеки. У процесі прогнозування дослідницькі мета-тенденції виявляються при розробці сучасних технологій, що суттєво впливають на життєдіяльність людей, сталий розвиток держав і забезпечення промислової та технологічної безпеки.*

Ключові слова: *передбачення, інновації, технологічний розвиток, безпека, сталий розвиток.*

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