



# Science and Innovation Underpin Belarus' Long-Term Competitiveness

*Belarus is now drafting programs to pave the way for its social and economic progress in the next five years*

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The world financial crisis has heralded a shift in the global technological paradigm and showed that no nation, however powerful, is now in position to ensure a long-term sustainable growth of welfare for its people by sticking to orthodox business techniques and technology. The prospects are rather bleak for the nations whose exports are poorly diversified and mostly destined for traditional markets. It is therefore vital for Belarus to speed up the work on modernizing its economy, making it increasingly laissez-faire, and investing in innovation.

## Global Economy after the Crisis

Belarusian experts are now working on the fundamental documents that will steer the country in its socio-economic development in the next five years and underpin the nation's competitive power. These documents are the national socio-economic development program, the innovative development program, and the rural territories development program for 2011-2015. In pursuance of the presidential orders, experts are also preparing a new draft of the national security concept of Belarus. These as well as other documents take into account the post-crisis global trends in economy and technology, the new economic configuration in the world: a transition from the unipolar to the multipolar system of economic relations, fiercer competition for natural resources, new financial architecture, wider use of technical barriers to trade, which is becoming an increasingly effective tool of hampering international com-

merce. Within the scope of just one year following the G20 summit when participants declared their commitment to avoiding protectionist measures, these countries have imposed 184 protectionist measures. The unquestioned leader was the European Union which members imposed a total of 90 such measures.

This is a clear signal telling us that the manufacturers who stay out of the orbit of transnational companies will be the first to suffer from discrimination and economic restrictions. In this respect, specialists at the National Academy of Sciences of Belarus believe that integrating Belarusian businesses with the world's leading companies into translational corporations should be a priority while moving along the way of economic modernization.

Having studied the current global trends in economy and technology, the Academy designed a Scientific Research Strategy for the period ending in 2015, which got a vote of approval at the General Meeting of the National Academy



of Sciences. Working in collaboration with the State Committee for Science and Technology, the Academy has identified the near-term research priorities which will be submitted to the President of the Republic of Belarus for approval and will underpin national research programs in the next five years. The most promising lines of business today are biotechnology, space exploration and research, pharmacy, information and communications. The main objective now is to create an institutional framework, infrastructure, a system of economic incentives to promote a rapid growth of innovation and innovation-based business.

Organizationally, the Academy is well prepared for this work. Nearly every research institution has the appropriate infrastructure to run experimental production projects to test innovations



and produce batches of goods for sale. In 2009 our institutions produced a total of nearly Br300 billion worth of innovation products, including Br80 billion equipment and production lines and Br60 billion bio- and medical products.

In 2009 we established seven research and production centers focused on LED research, pharmacology and biochemistry, microbiology, DNA testing, food research and control, animal breeding center and permanent grasses seed growing center. All of these institutions have been fitted out with the latest equipment.

This year we are planning to start more than a dozen of new innovation-oriented projects. Unique substances and biological components based on the products of research conducted at the institutes of bioorganic chemistry and meat and dairy industry will be put in mass production by using the institutes' own production facilities for both domestic consumption and export. We are talking here about that long missing link – innovation link – between science and production, which we are now recreating.

Yet, there are many areas of research where there is no need in reinventing the wheel. In such things as scientific research, design, testing and production we should cooperate closely with our European colleagues. It is this combination of creating something on our own and localizing what has already been achieved that we will use in our Scientific Research Strategy.

The application of the management-by-objectives method has proved extremely effective in science. It suggests shifting the emphasis towards comprehensive interdisciplinary applied research which products could be used in the national economy. As of now, 85% of funds allocated for science are channeled into applied research carried out under comprehensive scientific research projects with the aim of creating a single innovation cycle. We have achieved very good results that



will underpin the progress of science and economy in the next five years.

### Power Industry and Energy Efficiency

Experts of several ministries together with scientists of the National Academy of Sciences of Belarus have found solutions to the fundamental issues of the Belarusian nuclear power plant construction, such as the selection of the site, reactor, and development of the legal framework of nuclear power engineering. Energy efficiency is one of the main priorities of the Belarusian science and real production sector. For example, BelAZ, MAZ and Atlant have designed Belarus' first samples of automated thermal furnaces which efficiency ratio reaches up to 50% hence enabling reducing natural gas consumption from four to five times. The new solutions offered by Belarusian scientists allow upgrading up to 80% of

thermal furnaces in Belarus. The Vodorod (Hydrogen) program is very promising too. After the nuclear plant is constructed in Belarus there will be excess of cheap energy. These groundbreaking technologies will greatly benefit the power industry.

In the long-term perspective, we are aiming to halve the GDP energy intensity by 2015 as against 2005, to reduce the worn out capacities of the power industry to 50%, and increase the share of local and renewable fuel in the boiler and furnace fuels consumption mix to 25%. We also plan to provide scientific support to the launch of the 2-million kW nuclear plant. When the plant operates at its full capacity, it will be possible to annually replace 4.65 billion of cubic meters of natural gas with nuclear power. By 2020, the plant will satisfy about 27% of the power demand in Belarus, hence bringing the share of now predominant natural gas to 58-64%.

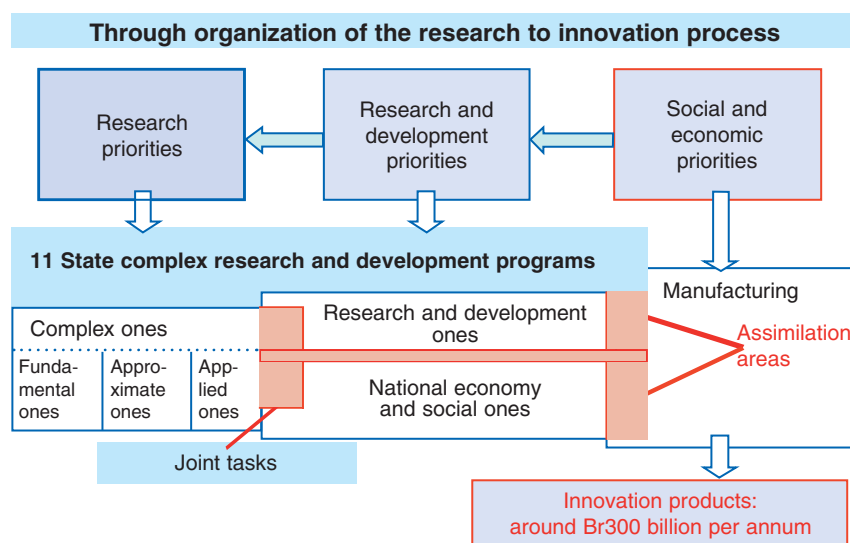
This year, as never before, we will need the talent and expertise of Belarusian scientific workers, President of Belarus Alexander Lukashenko said during a ceremony of conferring the doctor of science diplomas and professor certificates on professionals in science and education. January 2010



One of the key goals of the power industry for the next five years is the promotion of energy saving photodiode equipment, setting up production of photodiode goods, meeting the domestic demand and boosting exports. This avenue became very promising after the European Union had introduced restrictions on the sale of incandescent bulbs. Photodiode equipment is expected to help save 1.1 billion kWh in 2010-2015 which in turn will alleviate generating capacities of the Belarusian power industry. The main goal of the five-year period is to reach the same energy consumption rates as in Central Europe.

### Chemical Technologies

The Chemical Products and Technologies program has been bringing the greatest economic benefits in Belarus. In three years new solutions in this area have generated Br 35 billion worth of revenues. Technologies of selec-



tive extraction of low vein potassium salts allowed significantly boosting mineral extraction and introducing domestic reagents. In 2010, a new technology of granulated fertilizers production will be launched to raise competitiveness of Belaruskali in the global market.

Meanwhile some issues still require solutions. First of all, it pertains to launching the production of science-intensive chemical reagents, materials for road and housing construction, vanishes and paint industry, woodworking, documents and securities protection. Another promising area is production of various goods of low-tonnage chemistry provided that the main intermediate products and raw materials are made in Belarus. We also aim at strengthening scientific and production cooperation with producers of commodities with high value added (polymers, compound materials, polymer fabrics, etc).

#### Domestic demand satisfaction rate for biotechnological products according to the Innovation Biotechnologies master plan

	2009	2012	2015
Vegetable protein rich fodder	80	90	100
Bacterial concentrates for the dairy industry	3	30	100
Biological pesticides	1	40	80
Plant raw materials for herbal medicine	65	85	95
Herbal medicines	24	50	70
Testing systems based on DNA technologies	0	10	60
Veterinary products: testing systems, diagnostic preparations, vaccines, sera	20	30	85
<b>Feed supplements:</b>			
– adsorbents	0	0	100
– probiotics	0	0	100
– milk powder	10	100	100
Blood plasma drugs	0	20	100
Streptokinase	0	80	100
Bone marrow transplants	0	5	25
<b>Biofuel:</b>			
– composite biodiesel fuel made from fatty acid methyl esters	0	3	12*
– pellet fuels from plant raw materials	5	20	100

\*On the level of the EU target.

### Biotechnologies and Pharmaceuticals

In 2009, two new state programs were launched. They are the Innovation Biotechnologies and Import-Substituting Pharmaceuticals (pic. 2) which envisage establishment of five companies, 39 production facilities and over 150 technologies by 2014. The programs are expected to result in the production of over \$200 million worth of import substituting products and over \$190 million worth of exports. They will also lay the foundation for entering markets that will be the most rapidly growing in the post-crisis period and generating the most value added. Suffice it to say that revenues of the pharmaceutical



production are similar to those of petrochemical industry (pic. 3).

The Experimental Veterinary Institute of the Academy of Sciences transferred 15 and 18 new original veterinary preparations to Vitebsk Biofactory in 2009 and 2010 respectively. In Western countries it takes decades and huge funds to develop and launch production of new preparations. Our scientists managed to do it in three years with quite limited funding. In the next three to four years about 30 new veterinary preparations will be developed. This will help meet 70% of the domestic demand and start exporting some of the new products.

### Information, Communication and Space Technologies

Winning new markets and retaining old customers is impossible without cutting-edge technologies. Within the frames of the Innovation Technologies program MTZ, BelAZ, Vityas and other companies have introduced CALS technologies which allowed a 20% reduction of cost and time spent on paperwork when launching the manufacture of new products. Our goal is to introduce CALS technologies in all the major manufactures of Belarus. At the same time it has to be noted that IT, planning and management methods are still underused in Belarus, which is one of the main reasons for low productivity. Import monitoring shows that Belarus imports tens of millions US dollar worth of software which can be designed by Belarusian software engineers.

As for information and communication technologies, the Academy of Sciences focuses on systemic projects determining the national security, competitiveness of products and living standards of Belarusians. For example, the United Institute of Informatics Problems has developed telemedicine technologies that are now used for distant consultations in over one half of Minsk hospitals. The e-declaration system devel-

oped for the State Customs Committee is indeed a project of the international scale. The project was piloted in 2009. E-declarations for the export of goods now account for over 50% of all export declarations; some 500 companies now use this form of customs declarations. This attests to the real progress on the way to the information economy.

The year 2010 is a landmark year for the development of Belarusian space technologies. We are completing the creation of a satellite, a flight control center and other ground control infrastructure facilities. The space industry of Belarus has set a task to reach its designed capacity by 2015. This pertains to the ground infrastructure facilities to operate the new Belarusian space vehicle as part of a group of Russian satellites, and a separate ground control of the Belarusian space system of the earth remote sensing which will receive, process, distribute and sell (export) space information.

We might get an opportunity to use the Russian global navigation satellite system (GLONASS), and develop space communications which will allow us to introduce cutting-edge digital television and telemedicine technologies. Space technologies should get into our daily routine helping us make

commercial and managerial decisions in agriculture, forestry, water management and melioration, emergencies prevention and response, exploration works, upgrading of surface contour maps.

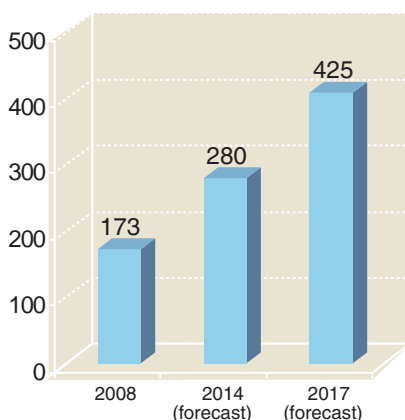
### Innovative Technologies in Industry

In 2009 alone \$7 million worth of electronic and optical products were produced using the know-how of scientists and R&D specialists of industrial enterprises. Domestically produced telecommunications devices were installed at the State Border Committee, Defense Ministry, and the Beltransgaz company. New laser medical apparatuses have been certified, while the existing production capacities can fully meet the country's needs for such devices. In 2009, the organizations affiliated with the Academy of Sciences churned out laser medical apparatuses worth Br3 billion, a third of them were exported.

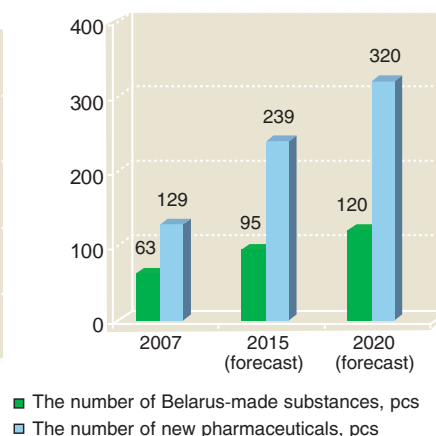
By 2015, we are to establish a competitive state-of-the-art economic sector based on submicron technologies of solid-state electronics. This sector is expected to push the export of high technology products by 1.5-2 times compared with 2010, enhance the competitiveness of electronic devices and systems on the international market by means of improving

#### Overall figures of import-substituting pharmaceuticals

Pharmaceuticals output increase in million USD



Domestic pharmaceuticals volume increase





### Innovative objects of the agriculture industry, 2011-2015

Description	Quantity, units
Dairy complexes	476
Pig-breeding complexes	38
Poultry factories	6
Modernization of agricultural machines depots	1000
New grain cleaning and drying facilities	600
Modernization of the existing grain cleaning and drying facilities	250

their operational parameters. These are high-tech low-energy and low-material-intensive products; their global (export) market is growing extremely fast. The microelectronics industry is a priority, if not to say the face of the new Belarusian economy. We believe that the establishment of another high-tech park will provide a considerable boost to the advancement of this industry, as well as to the laser and optical production. This park will develop know-how for the organizations affiliated with the Industry Ministry and State Military and Industrial Committee.

The Machine Building program exemplifies fruitful collaboration between R&D specialists of industrial enterprises and scholars who make the major contribution to the implementation of this program. This collaboration resulted in the production of a lineup of MAZ buses, Belarus 3022 tractors, logging machines, grain harvesters and other machinery. Today the Institute of Metal Technology uses its own design solutions and premises to produce import-substituting products worth about Br3 billion per annum for Belarusian Steel Works, Mogilevliftmash, Mogilevkhimvolokno, Borisov Aggregates Plant and other enterprises.

The plan for the forthcoming five-year period envisages the total renovation of the lineup and improvement of the operational properties of mechanical transport, including the production of Euro-4 and Tier 3a level engines, switching from the development of individual models of agricul-

tural machines to complete complexes for the plant growing and cattle breeding industries.

### New Materials

An important area of work is the development of new compositions and technologies of obtaining hard alloys with enhanced physical and mechanical properties. Last year we launched the production of forming tools for Belarusian Steel Works and Minsk Engine Works which completely solved the issues of the import of these instruments. We have designed and introduced sophisticated plasma cutting equipment to fully satisfy the country's needs. This equipment is of top quality, and more reasonably priced than its foreign analogues.

The challenge the national science faces in the next five-year period is the development and production of materials that will enhance the strength of connection joints and aggregates by 20-25%, operational properties by 10-30%, service life by 10-15%, and substitute of the import of glass materials, biocompatible, composite and polymer materials by 50%.

Other promising projects include the development and production of construction materials and structures with enhanced (by 15-20%) physical and mechanical properties to erect relocatable buildings and other facilities; heat insulating materials based on mineral and polymer raw materials, polystyrol foam concrete, foam glass, chemical production waste that helps extend the service life of the construction materials and structures by 10-20%;

extraction of granite, dolomite and other mineral resources to produce construction materials using industrial emulsion explosives. The scientific support for these projects is stipulated in the research promotion strategy to run until 2015.

### Innovative Technologies in Agriculture

The Academy of Sciences applies a complex and system-based approach to addressing a variety of issues. For instance, in line with the rural development program, machines are designed for each individual crop and operation, not separately but in complex for the whole technological cycle. By now, we have developed over 65% of the list of agricultural machines. Of course, a number of machines have some flaws, we have to increase the localization ratio and address other problems. But we have chosen the right way. Our managers want to get comprehensive services and domestically produced machinery.

Another example: ten years ago there was virtually no such crop as rape in Belarus. Today we produce around 600,000 tonnes of rapeseeds and fully satisfy the domestic demand for this vegetable oil. We have also managed to reduce the import of protein meal. We also meet 100% of domestic needs for brewer's barley. For the first time in Belarus' history we have bred a cold-resistant early-season variety of corn hybrids which are half as expensive as imported varieties. Now 50% of Belarus' needs for seeds of this crop are met.

Scientists suggest feasible scenarios of transition to the economic management methods in agriculture. Relevant research has been made. We believe it is time we explored the advantages of the public-private partnership. Export growth targets should be emphasized as we create new agricultural capacities.

In the next five-year period we suggest creating efficient cattle-breeding complexes with the



use of home-grown and adjusted technologies and increasing the technological level of agricultural production (pic. 4). We believe that this will help cut down on unit costs of farm production, make it more efficient by dint of reducing the prime costs and improving the quality. In this way we will be able to wipe out the deficit of foreign trade in farm produce which we are having now and reach a \$1 billion surplus.

The Academy of Sciences has proposed a draft program of rural territories development for 2011-2015, which will complete the formation of the innovation-receptive efficient agricultural sector of Belarus.

### Forging a National Innovation System

To implement big system-based projects we need not only scientific and technological achievements. We need finances, infrastructure,

legislation, human resources, in other words, an effective national innovation system. Unfortunately, the issues of laying the legal groundwork for the innovation development have not been tackled fully.

Yet, I would like to note that quite a few legislative initiatives were introduced last year. Decree No 441 of the President of the Republic of Belarus of 4 August 2009 enforced a multi-level flexible system of research incentives. For example, scholars engaged in most important research and development can expect their base rate to go up 2.5 times and bonuses as high as five monthly wages. These are the wages of the European level. Amendments have been introduced to the existing by-laws on scientific, sci-tech and innovation activities (Decree No. 9 of the President of the Republic of Belarus of 4 August 2009). The draft law “On amendments and addi-

tions to some laws of the Republic of Belarus governing scientific, sci-tech and innovation activities” has been prepared for the second reading.

Meanwhile we need to enforce the legislation governing the turnover of the intellectual property rights. R&D achievements have not yet become a marketable product in Belarus. The problems here are numerous. For example, who is the owner of the R&D product or a patent? On what terms and at what price do we sell an intellectual property object and related technologies, especially abroad? Due to the drawbacks in legislation our R&D institutions sometimes prefer to sit back showing the lack of international cooperation initiatives. When looking into the priority areas that need to be regulated by law we have identified three blocks of issues.

1. The innovative-technological block. Being the biggest proprie-





tor, the state needs to forecast the technological development of the economy taking into account the existing manufactures as well as the promising economic sectors which will generate added value in the 21st century. For that, the priorities are identified in social and economic development, R&D and management.

2. The organizational and economic block. It deals with the innovative infrastructure, a system of market transactions in intellectual property objects and rights. The issues of intellectual property rights are closely interrelated with the issues of price formation. We need brand new laws here. As these issues are addressed successfully we will be able to tackle the human resources problems in science more efficiently.

3. The financial block. The key goal is to create the legal en-

vironment governing the flow of foreign and national capital into innovative projects. This is a priority task today. We believe the emphasis should be made not only on direct support in the form of state subsidies or subventions but also on indirect instruments. This is an internationally recognized practice.

We need to formalize venture investment, the role of expert analysis, the responsibility of contractors and executing agencies of promising programs, mechanisms of their financing.

The Republic of Belarus was the first among the former Soviet Union republics to declare the innovative development policy as its main development strategy (Pic. 5). Our neighbors have chosen the same path which shows that we have made the right choice. Today the most important

thing is to further the advancement. What is needed today are progressive decisions, efficient consistent work on implementing the instructions of the President of the Republic of Belarus to liberalize the economy and diversify exports, to prioritize economy and thrift, strengthen public security and discipline.

Our priority goals are to enhance the responsibility and discipline. We also need to concentrate on system-based solutions that will put us on a pathway of growth. On the whole the main strategic goals should be development and economic growth. This is how Belarus will be able to come out of the global crisis stronger, with more efficient industry and higher living standards. This is how we can lay down the solid foundation for the economic growth driven by innovations in the next five years. ■

Specialists of the Institute of Pharmacology and Biochemistry of the National Academy of Sciences of Belarus and the Academpharm enterprise have designed the antivirus preparation Fluestop which can also be used to treat A/H1N1

