STATE INNOVATION IN SCIENCE: NEW FIVE-YEAR PLAN, SOME OLD PROBLEMS

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Summary

The 2011 financial crisis was accompanied by an unprecedented reduction in science budgets. The era of primarily state-financed scientific research is now drawing to a close, thus putting the issue of finding mechanisms to commercialise science onto the agenda. This is in line with recently-emerging trends in science-funding policy, and corresponds to the strategic benchmarks of the *State Innovation Development Program (SIDP) for 2011–2015*, which was adopted in May 2011.

The SIDP 2011–2015 sets practical goals for introducing innovation in legislative, institutional, financial, human resources, and infrastructural reform fields. The unrushed implementation of these reforms during the previous five-year period (SIDP 2007–2010) was replaced by convulsive and radical reform attitudes in late 2011 when, against the backdrop of the financial crisis, the critically low level of science funding began to become painfully obvious.

The initial year of SIDP 2011–2015 was quite productive in terms of legislative improvements in the fields of science, technology and innovation. But the results from implementing innovation projects were less impressive, due to a number of major infrastructural, staffing, and financial challenges.

Trends:

- Increased underfunding for science due to budget sequestrations not refundable from extra-budgetary sources;
- Marginalisation of fundamental research and institutional restructuring (closures and/or merging of departments, institutions, etc.);
- Social sciences and humanities are becoming political instruments;
- Ageing, downsizing and emigration of highly-qualified scientific personnel, while the teaching capacity to train Candidates and Doctors of Science is exhausted;
- Scientific and academic communities are degrading, administrative regulations are tightening, and bureaucracy is expanding;
- Infrastructural, organisational, staffing and financial challenges significantly obstruct productive collaboration between the scientific, technical and innovation sectors;
- Science funding remains at a poor level, while monotonous dependence on such factors as, for example, innovation intensity, is increasing.

Are staff responsible for everything?

The authorities seriously disagreed in their assessments of the implementation of SIDP 2011—2015 in 2011. The head of the State Committee for Science and Technology (SCST), Mr. Voytov, and the chairman of the Presidium of the National Academy of Sciences, Mr. Rusetskiy, were generally positive about last year's results[1], yet the country's president Aleksandr Lukashenko attacked the scientific community with harsh criticism, talked about reducing the National Academy of Sciences' budget by one third, and described a recipe for "survival under the new circumstances".[2] It is hard to ignore the challenge given to the scientific community, because the NAS employs 53% of all researchers, who write 51.3% of all the articles by Belarusian authors cited in the *Web of Science*.[3]

On the other hand, the head of state's radical attitude can be understood if one looks at the cumulative results of the previous five years of innovative reforms. The science funding level in Belarus' GDP (0.8% in 2011) continues to be lower than critical[4] and has still not regained its 2007 level (0.97%). On average, the cost-effectiveness of science ranges between 10 and 12 kopecks per rouble. However, the question remains as to what extent this is the fault of scientists. *After all, scientists will start profiting from their*

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1 Mr. Voytov said that 24 large innovation projects had been implemented during the past year, 4 new regional centres of the National High Technology Park had been opened, 28 state scientific and technical programmes, and over 600 innovation projects in priority areas had been launched: http://gknt.org.by/rus/news/news/20120202/. Mr. Rusetskiy pointed to a 151% increase in the volume of work and services, a 154.3% increase in production growth at the cost of extra-budgetary sources, a 107.7% increase in research and development carried out, a 132.3% increase in goods and services exports, as well as grants and technical assistance received, as compared with identical indicators for January-November 2010. Source: http://news.tut.by/society/267799.html.

2 The president's ultimatum suggests that the National Academy of Sciences either needs to be reformed to become a "scientific and production corporation", or it should be deprived of its leading status and benefits, giving way to new institutional forms of scientific activity which operate successfully in developed societies (science, research and technical parks, corporate universities/holdings, etc.). Source: http://www.belta.by/ru/all_news/president/Lukashenko-predlagaet-peresmotret-strukturu-organizatsii-nauki-v-Belarusi_i_582374.html.

3 Source: http://news.tut.by/it/248962.html.

4 *2% by EU standards*. Source: *Ekonomicheskaya Gazeta* // [E-resource] See: http://www.neg.by/publication/2011_01_28_14163.html?print=1.

ideas when effective coordination between science, technology and innovation segments has been arranged, ensuring the functioning of the entire science and innovation cycle: from idea to practical application. In turn, the successful implementation of this task will depend on favorable conditions in finance, human resources and infrastructure. Were all these conditions favorable in 2011?

A new budget policy approach: from budgetary to extra-budgetary funding, and vice versa

Looking at the outcomes of 2011, the primary striking discrepancy is between projected and real funding. The forecast for 2011 was to increase the science budget to 1.2–1.4% of GDP.[5] However, the most optimistic official figures only quote 0.29% of GDP (or 0.67% of GDP – the "domestic expenditure on research and development" indicator).[6] This figure does not take into account the almost threefold devaluation of the Belarusian rouble, which directly affected the purchasing of materials and equipment for experimental studies.[7]

The greatest impact on fundamental research was made by the sharp reduction in science funding: BYR 324.7 billion were supposed to be allocated in 2011, or 10% of the domestic expenditure on research and development. This was 6.5% less than in 2010, and half of what was allocated in 2005.[8] The situation is even worse in the following sectors of infrastructure: the scientific and technical information system, international cooperation in science and technology, and training of highly-qualified staff, on which 4, 3, and 2.5% of the projected budgets were allocated accordingly.

The projected science budget for 2012 makes it is clear that the financial crisis and budget sequestration of 2011 entailed the introduction of new science funding policies. Thus, according to Mr. Voytov, in 2012, the science budget should only include up to 30% from state budgetary funds, and the remainder should be distributed as follows: 30% from extra-budgetary sources, and 35–40% in revenues from exports.[9] This funding structure is usual practice for science spending in the developed world.[10]

However, the main issue is that there are no relevant extra-budgetary sources in Belarus, and no infrastructure which could make a breakthrough in the development of extra-budgetary funding.[11] On the contrary, over the past six years, funding trends have occurred which could not be reversed within a year, even under the most favorable circumstances. For instance, during 2005 and 2010, the amount of state budgetary funds for the distribution of internal spending on scientific research was 58.1–57.8%. At the same time, the amount of extra-budgetary funds decreased sixfold (from 5.1% to 0.9%), and the amount of other extra-budgetary sources was reduced from 30.5 to 27.7%. The only significant increase was in the amount of foreign investments (including loans) – from 6.3% to 13.6%.[12] However, even combined with export revenues[13], this amount is not even half the projected figure for export revenues.

Therefore, the most realistic of all the projected indicators is a twofold reduction in budgetary funds – from 58% in 2011 down to 30% in 2012. *These science budget cuts will not be compensated by increased contributions from extra-budgetary sources, however.* The only way that state funding of science in 2012 could reach the projected level for 2011 is if the budget volume is increased.[14] This puts the efficiency of the restructured science funding policy into question, however.

5 Source: http://neg.by/publication/2011_01_28_14163.html.
6 Source: http://www.news.date.bs/economics_269965.html.
7 Less than 10% of the science budget is allocated for scientific materials and technical capacity. Source: *The state of national scientific and technical information systems in CIS countries which are members of the Interstate Coordination Board for Scientific and Technical Information (ICBSTI).* Analytical overview. 2009.
8 Source: *Science and Innovation in Belarus.* Minsk, 2011. P. 60. The amount of design and applied research is 86%. Source: http://www.belta.by/ru/all_news/president/Lukashenko-potreboval-do-kontsa-goda-predstavit-emu-kontseptualnye-podxody-k-dalnejshemu-razvitiju-nauchnoj-sfery-v-Belarusi_i_582439.html.

9 Source: http://http.news.date.bs/economics_269965.html.
10 The amount of corporate expenses on research and development as part of the overall expenses on scientific and research activity in the Organisation for Economic Cooperation and Development countries is approximately 70%. Source: http://www.raexpert.ru/researches/expert-inno/part1/.
11 Above all because there is no corporate sector and venture investment is underdeveloped, both of which [normally] play a key role in establishing an effective extra-budgetary funding system.
12 *Science and Innovation*, op. cit., p. 61.
13 The preliminary assessment is that they accounted for less than 5% of overall science expenditures in 2011.
14 First deputy prime minister Semashko said that the Belarusian state science budget would increase by 1.8 times in 2012, as compared to 2011, in order to reach approximately BYR 1.4 trillion, or the projected amount for 2011. Source: http://scienceportal.org.by/news/fca1d478bcddbf51.html.

Infrastructural gaps in the research and production cycle

Specialists say that successful development of innovation potential depends on efficient collaboration between science, business and government. The cornerstone needed to give enterprises incentives to innovate is a competitive environment that would eliminate ineffective business-owners. The year 2011 was also not a turning point for the development of the corporate sector, or for improving the competitive environment.

Another factor interfering with the successful development of innovative capacity is enterprises' lack of their own funds.[15] The currency devaluation washed out a substantial portion of enterprises' working capital, depriving them of even their vaguest hopes of implementing innovations. Such a lack of funding could have been recovered at the cost of venture capital investments, which play a key role in an effective extra-budgetary funding system, but this financial tool is still at a rudimentary stage in Belarus.[16]

The patent system, which is the most significant factor for the commercialisation of intellectual property, was faced with similar problems. While the number of patents issued in the past ten years has almost tripled (from 537 in 2000 to 1222 in 2010), the efficient use of intellectual property has changed very little. Indirectly, this fact was acknowledged by the adoption of a presidential decree on "enhancing intellectual property efficiency" (№ 216 of 26.05.2011).

Launched at the end of 2011, the "Intellectual Property Exchange" can be regarded as a desperate, but as yet unsuccessful attempt to revive this market sector. Due to infrastructural gaps in the scientific innovation cycle, a catastrophic shortage of funds, and the generally low demand for innovation in the Belarusian economy, the quantity of patents is not yet able to find enough

15 See: *Science and Innovation*, op. cit., p. 132.

16 The first Belarusian State Innovation Fund, founded in May 2010 according to Decree № 252 and authorised as a venture fund, announced its first four venture projects at the end of January 2011. Source: http://www.belta.by/ru/all_news/economics/Pervye-venchurnye-proekty-opredeleny-v-Belarusi_i_540280.html. The first non-state "community of business angels and venture investors" (BAVIN) began operating in 2011, uniting 14 Belarusian business angels, and had two success stories by the end of the year: the opening of a premium-quality chocolate boutique *Shocos*, and a home goods delivery project www.giper.by. Source: www.bavin.by.

good-quality applications. As a result, even the few rare solvent enterprises would rather borrow ready-made technology than make their own breakthroughs in innovation.

Perhaps the only truly positive outcome of the year was improved legislation concerning the most challenging issues in the research and production cycle. This brings hope that the situation on the venture capital investment, intellectual property, and innovation markets will change for the better.[17]

The staff behind all the decisions

The year 2011 failed to make up for the personnel losses of 2010, when the overall number of academic staff decreased by 729 persons (from 32 441 to 31 712 people).[18] However, regardless of the financial crisis and declining living standards, the scientific community's losses due to emigration remained as negligible as in 2009—2010. Official statistics report that science lost about 0.1% of its total number of science and higher education faculty employees in 2011, which is about 7—12% of the overall losses. It should be mentioned, however, that the desire to emigrate changed substantially between 2002 to 2010, and the group of potential emigrants has grown considerably: out of the total number of scientists, 1—5% have a firm intention to emigrate, while 11—25% intend to emigrate temporarily.[19] *Yet the lion's share of research personnel downsizing is due to domestic reasons, and originates in the scientific staff-training system.*

First of all, the "loss of scientists" is caused by a steady and systematic decrease in the number of researchers with advanced degrees and, what is worse, by the exhaustion of the capacity to train Candidates and Doctors of Science. The chairman of the Presidium of the National Academy of Sciences, Mr. Rusetskiy, said that for many years it had been impossible to select postgraduates on a competitive basis, since the number of vacancies matched the number of

17 For instance, on January 1, 2012, a law from December 30, 2011 on "amendments to the Tax Code of Belarus" came into force in Belarus, introducing tax benefits to stimulate innovation activity. Source: http://www.scienceportal.org.by/news/cc0324759f2e218f.html.

18 *Science and Innovation in Belarus* // Belarusian National Statistical Committee compilation. Minsk, 2011. P. 20.

19 Artyukhin M.I. Contemporary issues of intellectual migration in Belarus // *Philosophy in Belarus and the prospects for intellectual culture worldwide*. Minsk, 2011. P. 351.

applicants. The National Academy of Sciences' chief secretary for science, Mr. Chizhik, said that the Candidate/Doctor ratio was almost three times lower in the past two years (one Doctor per four Candidates), unlike in the "intrepid nineties", when there were nine to ten Candidates per Doctor).[20] Even official statistics reflect that the overall number of postgraduate research organisations and educational institutions decreased from 5042 in 2005 to 4725 in 2010.[21]

The situation is much worse regarding doctoral studies: in the past six years, the number of doctoral graduates decreased from 116 in 2005 to 45 in 2010. This trend continued in 2011, when Belarusian science gained 520 Candidates and 47 Doctors.[22] The Certification Commission justified this by referring to a "need to maintain standards" and "a marked increase in the prestige of Belarusian diplomas at international level"[23], but it does not compensate for in-country personnel losses, however.

Due to the exhaustion of training capacity and reduced numbers of the most productive and qualified scientific personnel[24], their overall number is stable at a reproducibility threshold level only thanks to scientists aged 60 and over, which means that scientific personnel are becoming older on average. Thus, the average age of Academicians at the National Academy of Sciences is 73.5 years old, and Corresponding Members – 68.5 years old. At the Belarusian State University, 59% of Doctors are of retirement age, and 39% of Candidates.[25] In general, according to Ministry of Education data from 2011, one third of Candidates and almost a half of Doctors are of retirement age.[26]

20 *Certification. Electronic science, theory, information and methodology magazine*. Issue 3. 2011 // [E-resource] See: http://journal.vak.org.by/index.php?go=Pages&in=view&id=1355.

21 See: *Science and Innovation*, op. cit., p. 49.

22 Senkovich Y. A tough selection, but still a selection // *Minsk Kurier* [E-resource] See: http://mk.by/2012/01/25/53584/.

23 The Certification Committee's chief secretary for science, Nina Gulko, said that, after making dissertation requirements tougher, the number of foreigners who successfully defended their theses in Belarus increased from 32 from 9 countries in 2010 to 47 from 13 countries in 2011. Source: http://mk.by/2012/01/25/53584/.

24 See: Artyukhin M.I. Scientific elite: challenges of identification and typology // *Science and Innovation*. 2011. № 1. P. 50–53.

25 *Certification*, op. cit.

26 Listopadov V. Why young people do not become scientists // *Zautra tvajoj krainy* [E-resource] See: http://zautra.by/art.php?sn_nid=8853&sn_cat=19.

The year 2011 saw no significant changes to the administration model in the scientific community – it is still based on an administrative command system, in violation of the principles of autonomy and self-management for scientific and academic communities. Requirements for tighter discipline have already become ritualised and contribute to increased inertia in the entire management system. Non-transparent and weak rotation of managerial personnel has generated clan-based, permanent, ageing managers, and led to an acute shortage of middle-aged managerial reserve staff (40–45 year olds). A disregard for the principles of autonomy and self-management in scientific and academic communities has created an atmosphere of conformism, opportunism and lack of initiative which damages the working environment for scientists. In turn, the degradation of scientific communities strengthens the positions of managers who mobilise passive scientists by applying disciplinary measures.

Conclusion

The development of innovation and the modernisation of science are inevitable. At the same time, it is clear that it will be impossible to change decades of routine in science and overcome the institutional inertia cultivated by institutional and individual habits overnight.

The unimpressive results of the first year of science reforms are due to overoptimistic expectations of huge effects from cosmetic changes against the backdrop of an extremely unfavourable environment, *i.e.* radically-reduced science budgets, underdeveloped innovation infrastructure, staff shortages, and the low efficiency of the administrative command management system. The authorities' efforts to "shift the blame" onto the scientific community, and use fear to encourage it to make money from ideas, are hopeless. Abuse of administrative resources without allocating funds that correspond to the scale and depth of reforms, major changes in infrastructure and management, and developing the country's innovative capacity (faced with newly-simplified rules for labour migration within the Common Economic Space) could result in an exodus of skilled staff, as well as a significant deterioration of the country's scientific and technological potential.