Reforming the Research & Development Sector in Belarus: Challenges and Possible Solutions

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Executive summary

- Since 2008 Belarus has experienced a “black decade” in the development of its research and development sector (R&D sector). This has negatively impacted almost all the main indicators of scientific development. The growth of the Belarusian economy in 2017 and 2018 has contributed to a slight increase in research investment, however the effects of a long-term crisis have not yet passed, and the recent positive trends cannot be considered sustainable.

- To build a modern economy, and increase research spending to at least 2008 levels ($240 million). However, any increase in public budgetary spending needs to be supported by appropriate reforms in science and higher education in order to increase the efficiency of public spending. The most pressing issues include: increasing transparency across the R&D sector; increasing the role of open competitions for the state’s scientific grants; changing the model of financial incentives; resolving conflicts of interest in research management; developing research in higher education; and changing the principles used to evaluate the results of scientific activities.

- The major conflict of interest in the R&D sector relates to the special status and powers of the National Academy of Sciences of Belarus.

- Universities should expand their research activities through either unification with research institutions, or a significant increase in spending on science.

- The basis for evaluating the results of scientific activities among researchers should be through publications included in international citation indices (especially Web of Science and Scopus). At the same time, there should be developed mechanisms minimising the negative effects that may occur from the adoption of international assessment systems, in particular for individual disciplines and academic communities.
Introduction

Since 2008 Belarus has experienced a “black decade” in the development of its Research and Development Sector (R&D sector), which negatively impacted almost all the main indicators of scientific development. In light of this, realistic expectations for the coming years should focus on recovery from deep crisis rather than emphasise the rapid growth of the sector. The crisis has been the toughest that Belarusian science has faced since the 1990s. The growth of the Belarusian economy in 2017 and 2018 (by 2.5% and 3% respectively) contributed to some improvement in the situation and investments in research activities have increased. Nevertheless, the effects of a long-term crisis cannot be considered as overcome, and this recent positive trend is not sustainable.

R&D expenditures. Over the past five years (2013–2017) the average contribution from R&D to the country’s GDP was 0.55%.

The comparable figure for leading countries, such as South Korea and Japan, stands at 3.5–4% of GDP or higher. In larger developed countries, such as Germany or the USA, the indicator is at the level of 2.5–3%, and the average for EU member states is about 2%. In most countries neighbouring Belarus (Poland, Lithuania, Russia) it exceeds 1% of GDP. Belarus’s position only compares well with Ukraine, Moldova and Latvia (see Figure 1).

At the same time, the main national Programmes for Social and Economic Development (PoSED) all set a goal for achieving much higher – and unrealistic – levels of R&D intensity. The PoSED for 2001–2005 predicted that R&D expenditure as a percentage of GDP in 2005 would be 1.8%, and that intramural expenditure on R&D would increase by 1.9–2 times compared with 2000.

2 Указ Президента Республики Беларусь от 08.08.2001 N 427 «Об утверждении Программы социально-экономического развития Республики Беларусь на 2001 - 2005 годы» (Decree of the
Reforming the Research & Development Sector in Belarus: Challenges and Possible Solutions

2006–2010 assumed an increase in funding for research and innovation by no less than 2.5–3 times, while the PoSED for 2011–2015 forecast an increase in R&D intensity to 2%.

The PoSED for 2016–2020 sets an unrealistic target that would increase spending on scientific, technical and innovative activities by 2020 to 2.5% of GDP, including government budget appropriations or outlays on R&D – up to 1% of GDP. The Belarus 2020: Science and Economics development plan, prepared by the National Academy of Sciences in 2015, suggested even more unrealistic scenario. Expenditures on R&D “should be gradually increased to 3% of GDP in the next three years.”

In reality, such level of expenditures has never been achieved. In 2005 R&D intensity was 0.68% of GDP, in 2010 - 0.7% of GDP, and in 2015 - 0.5% of GDP. The best year was 2007, when the figure reached 0.96% of GDP, a record since 1993, but it fell the following year to 0.74%. For 2009–2013 the figure varied in the range of 0.64–0.68% and, with a new wave of crisis in 2014, it fell back to a historical minimum for Belarus since independence - 0.5% of GDP. It seems realistic to assume that R&D expenditures will, at best, achieve 0.7% of GDP by 2020 and will be in the range of 0.5–0.7% over the subsequent five years. Under President of the Republic of Belarus, 8.8.2001, No, 427 “Approval of the Programme of Social and Economic Development for the Republic of Belarus, 2001-2005.”

The Program of socio-economic development of the Republic of Belarus in 2006-2010 was approved by Decree No. 3841, 2006, but was never published in full. If we proceed from the various publications related to it, as well as the draft program, the funding of research and innovation activities by 2010 was to increase by at least 2.5-3 times. The programme did not specify whether it was concerned with R&D expenses in general or specifically budget expenditures.

In 2006 research spending amounted to $244 million (0.66% GDP), which means that, by 2010, it should have grown to $610–732 million, which would be about 1.1–1.3% of GDP. Nevertheless, expenses amounted to only $383 million or 0.69% of GDP.

The actual R&D intensity at the end of the period. The figure for 2020 is a forecast.

In the beginning of 2018, speaking to representatives of the scientific community, the Deputy Prime Minister outlined a more realistic goal of spending reaching 1% of GDP by 2022 and 2.5% by 2030 (Семашко 2018).

The actual R&D intensity at the end of the period.

In 2015 R&D intensity was 0.5% of GDP, in 2016 - 0.55% of GDP, and in 2017 - 0.53% of GDP. The best year was 2014, when the figure reached 0.65% of GDP, a record since 1993, but it fell the following year to 0.54%. For 2018–2020 the figure varied in the range of 0.53–0.57% and, with a new wave of crisis in 2021, it fell back to a historical minimum for Belarus since independence - 0.5% of GDP. It seems realistic to assume that R&D expenditures will, at best, achieve 0.7% of GDP by 2020 and will be in the range of 0.5–0.7% over the subsequent five years. Under

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6 Беларусь 2020: наука и экономика. Концепция комплексного прогноза научно-технического прогресса и приоритетных направлений научно-технической деятельности в Республике Беларусь на период до 2020 года. Мин. С. 13 (Belarus 2020: Science and the Economy: Forecasts and Concepts of Scientific and Technological Progress and Priorities for the Direction of Scientific and Technological Activities in Belarus during the Period to 2020). In the beginning of 2018, speaking to representatives of the scientific community, the Deputy Prime Minister outlined a more realistic goal of spending reaching 1% of GDP by 2022 and 2.5% by 2030 (Семашко 2018).

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8 Беларусь будучыні. Экспертнае апытанне Цэнтра новых ідэй, available at <https://ideaby.org/index/>
the most optimistic scenario, one can expect an increase in R&D spending to 1–1.5% of GDP in the same period.

If we take into account expenditure in absolute numbers, the effects of the crisis become even more obvious. In 2008 total expenditure on R&D amounted to $450 million; in 2009 it fell by almost a third. Unstable growth continued until 2014, then a deep recession occurred. In 2014 R&D expenses dropped by a further 19% compared to the previous year, in 2015 they had fallen by 30% from the 2008 figure, and in 2016 by an additional 15%. True, in 2017 the situation began to improve and actual expenses increased by 33% in comparison with 2016. Nevertheless, in 2017 spending amounted to only $ 319 million, which is 30% less than in 2008. Based on the level of financing for 2008, the total losses for the sector have made up around $ 742 million.

[Figure 3. Growth (decline) of R&D expenditure in comparison with 2008 as a percentage of GDP]

A similar trend can be seen in budget expenditure. If in 2008 they amounted to $238 million, in 2017 they declined to $133 million; hence a reduction of more than $100 million. The total budgetary cuts over the 10 years up to 2018 amounted to $547 million.

The only positive trend in the development of the sector over the last 10 years is the growth of external funding for R&D. In 2008–2009 the share of external funding was less than 10%, in 2016–2017 it increased to 14–16%. In 2008 revenues from this source amounted to $25.9 million, and in 2017 rose further to $45 million. If we would take 2008 as a baseline year, then the R&D sector received additional external financing of $100 million in 2009–2017.

R&D personnel. Since the beginning of the century, the maximum number of people employed in the R&D sector in Belarus was 32,400 (in 2009). Until the beginning of 2018, the country’s R&D personnel decreased by six thousand and amounted to 26,400 employees. To some extent the decline in jobs was due to the cutting down of technical staff, which may be due to automation and other forms of labour optimisation. However, the period also witnessed a significant reduction in the number of researchers: from roughly 20,500 to 17,000. That represents a decline of 17%, or 3,454 persons. At the same time, it is difficult to determine accurately the level of personnel losses due to the lack of national statistics and the average annual official exchange rate of the National Bank of Belarus [source: https://www.nbrb.by].

9 Hereinafter, the figures in US dollars for Belarus are the result of authors’ calculations based on official statistics and the average annual official exchange rate of the National Bank of Belarus [source: https://www.nbrb.by].

statistics, which provide the total number of researchers (head count) without taking into account full and part-time employment. Unfortunately, there are no statistics on the full-time equivalent, so it is hard to say how much the decrease in the number of persons employed in the sector is due to the consolidation of full-time positions and how much due to their cutback.

In any case, the recent dynamics in the sector have been negative. From 2008 to 2017 the share of employment in the sector among the total number employed in the country fell from 0.68% to 0.61%. The average employment rate in the R&D sector in EU countries is 1.8–1.9% (2015), while in many developed countries it exceeds 2%.

Salaries. The wage income in the research sector over the past ten years has been stagnant. The current level of salaries (in US dollars equivalent) approximately corresponds to the 2008 level. In 2009, the average salary per employee in the R&D sector was $4,470 per year. In 2017 this figure was almost the same – $4,480. It should be noted that in 2009–2014 the salary expenses per employee of the sector were significantly higher and were in the range of $5,000–$6,200.

Business and state agencies in research funding. It remains difficult to attract private funds to the research sector. In the leading R&D countries, the share of state funds among total research spending is 20–30%, in southern Europe it reaches about 40%, and in post-communist countries it can be up to 70% (for instance in Russia). The average level in Europe is 31%. The share of business, respectively, in the leading countries is much higher (60–70%); the EU average is 57% (2016).

In Belarus, the share of government funding in research expenditure has decreased significantly compared to 2008 (53%) and especially 2009 (62%), but still is above 40%. The average level over the past five years (2013–2017) was 45%, in 2017 it was about 42%. The share of business (“own funds”) has slightly increased since 2008 (27%) and even more since 2009 (13%), but remains comparatively low at 31% (2017). The average level for 2013–2017 was 23%. At the same time, although there is no exact data, most of the commercial organisations that are included in the statistics are state-owned. Therefore, the level of actual government spending on research and development can be much higher than 40% and may approximately correspond to the level in Russia.

The growth of business spending on R&D should be one of the main sources of growth in the sector, not least if the target of 2% or more R&D intensity of GDP is to be achieved. Nevertheless, the activity of commercial organisations in financing R&D remains low.

The last ten years have been hard time for the Belarusian R&D sector. The Belarusian state, if it intends to build a modern economy, has no option but to increase spending on R&D from the state budget. At the same time, reforms of the R&D sector are the necessary condition alongside any funding increase. Otherwise, the effectiveness of investments and public spending will be low and increased funding will not bring positive outcomes. Government spending on research should take into account the economic conditions, research infrastructure and the possibilities to use funds efficiently.

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11 Calculated on the basis of official data on wage costs in R&D sector and number of people employed in the sector.
The most important issues that should be solved include: insufficient transparency of funds’ spending; the deficient role of open competitions and project-based funding; providing new financial schemes to promote motivation; resolving conflicts of interests in research management; addressing the insufficient research activity in higher education institutions; and improving the standards and methods used to evaluate research activity outcomes.

1. Transparency of spending

The first problem facing public spending on R&D is transparency. In Belarus, many details about spending are not transparent, neither to the public nor to the majority of the academic community. People included in the R&D sector at the management level have a general idea of the situation, but often based on informal information and rumour rather than facts and documents. This reduces the quality of management decisions and also creates conditions for corruption, 
corruption schemes and sinecures of various kinds.

A general breakdown of public funds spent on research can be seen in the budget law. As well, the budget determines the volume of funding for national research programmes. Yet more detailed information on the expenditure of funds (for example, their distribution between the different institutes of the Academy of Sciences and universities subordinate to the Ministry of Education) is missing. Financial reports on the implementation of research programmes and the distribution and expenditure of public funds are either unavailable or available selectively.

The same applies to the narrative reports on the work carried out and the results obtained. Such reports are compiled and published non-systemically, and only by a few organisations. A similar problem concerns the results of open contests for funding. For example, the Belarusian National Foundation for Basic Researches (BRFFR) publishes only the title of projects and the name of the project manager without specifying the total amount received or details about the research team involved in the project being funded. The expenditure of funds through open competitions should be more transparent. Information about the entire research team that received the grant, as well as the total amount received for the project, should be made public.14

14 See the results of the competitions for 2018: BRFFR http://fond.bas-net.by/itconc.html
2. Competitive and project-based fund allocation

There are two main mechanisms for allocating public funds for R&D: project-based financing and institutional financing. The practice of separating the two approaches has a long tradition, as well as developed quantitative analysis approaches.15

Project-based financing supposes allocation of funds to groups or individuals to conduct a study limited in scope, budget and time. The main features of the mechanism are the following: funds are sent directly to research groups, not to organisations, the scope and duration of research is limited, funds are distributed by organisations (foundations or agencies) that are external to (that is, institutionally unrelated to) the research group.16

A common trend in countries with a developed R&D sector is the growing role of project-based funding and, more generally, competition to win funds for research and development. The main goal is to increase openness, competition, the exchange of ideas, and the overall activity of research groups and communities. The policies of different countries concerning the allocation of funds through open competitions or institutional support vary considerably. Nevertheless, role of project-based competitions is growing. Expanding the practice of competitive funding is seen as an important mechanism to improve the quality of public spending.17

Institutional funding is allocated to research organisations (government research institutions and higher education institutions) to carry out ongoing activities. At the same time, institutional funding is aimed at providing organisations with a stable basis for their research activity and to serve as a starting point for obtaining funds from other sources, as well as providing a certain autonomy when choosing research topics.18 The main problem of this approach is that it reduces the motivation of researchers and organisations, although formally, and sometimes in practice, institutional support may contain elements of competition.

A comparative study of public funding of R&D sector shows that, on average, about 37% of budget funds are distributed through open project-based competitions.19 For many European countries, this indicator in 2014 was above 50% (namely Belgium, Czech Republic, Estonia, Ireland, Poland, United Kingdom), for most others it is in the range of 30-50% (Germany, Norway, Sweden, Finland, inter alia). In the USA it is about 65%; in Israel – about 45%.20

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19 Calculated according to: Reale, 2017: 42. Here and later in this section data from this study of public financing of the R&D sector, conducted by the Joint Research Center of the European Commission, are taken.
20 See Reale, p.42
Assessing the situation in Belarus presents challenges. At the same time, it is obvious that institutional funding through national research programmes and direct budget financing are the most important mechanisms. According to incomplete data, only about 10% of funds are distributed through open competitions. Among developed countries, this level is typical only for Italy, which cannot be considered an exemplar for the development of an R&D sector.

Formally, Belarusian legislation establishes that practically all budgetary funds for research should be distributed through competitive selection mechanisms. However, the distribution of funds through national research programmes cannot be considered competitive. First, the established practice sees funds distributed based on approval of proposals submitted by the governmental research organisations. Secondly, the research scope and tasks usually envisage a given public organisation as a performer. Thus, despite the principles declared in the legislation, the distribution of funds for research through the national research programmes, if they do not include re-granting, should be treated as an instance of the institution-based approach to funding.

In Belarus there are two main mechanisms for distributing funds through open competitions – the BRFFR competitions (basic research) and the State Committee for Science and Technologies (SCST) contests (for applied R&D). During the period 2013-2017 BRFFR allocated $4.4-5.8 million through research and other grants. In 2017 the BRFFR grants amounted to 4% of the total governmental (budget) for R&D expenditure, or 11% of the budget expenditures for basic research. Unfortunately, it is not possible from the available data to determine the level of competitive distribution of funds for applied research. At the same time, there is no indication that it is much higher. Thus, the total share of budgetary funds distribution through open competitions is about 8-10%, which is extremely small for the effective development of the research sector.

Figure 4. The ratio of institutional support (X axis) and project-based financing (Y axis) as percentages

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21 See in particular (Закон №2105-XII, 1993: ст. 11; Постановление №1065, 2003; Постановление №961, 2005: п. 6).
22 The average funding level for 2013-2017 was $5.1 million. In 2017 the funding level was $5.4 million. Calculated according to: О состоянии, 2018: 223.
24 Reale, 2017, p.42. For Belarus the figures used are based on the authors’ assessment.
The role of competition in the distribution of budgetary funds for research in Belarus remains limited. At the same time, this mechanism should be an important means to increasing the efficiency in the distribution of public funds. Open competitions are necessary to maximise access to public finances for different research organisations and teams.

Improving efficiency in the distribution of public funds requires increasing the role of open competitions to at least 25-30% of total budget appropriations on R&D. This is especially true for social sciences and humanities. Most research projects within these disciplines do not require expensive equipment and can be implemented by small teams. This means that competition between researchers and teams can significantly improve research outcomes. Accordingly, the role of institutional funding through national research programmes and direct budget funding should be reduced. Where separation of research tasks is possible, government programmes should provide a mechanism for re-granting instead of administrative distribution.

3. Projects and contests as incentives

A further increase in the efficiency of spending could be achieved by changing the incentives for research activities. The need for such measures is a recurring theme in discussions about R&D policies. Most notably, the greatest emphasis in such public discussions focuses on low salaries in the research sector, which leads to the loss of personnel and a general decrease in the motivation of researchers.25

The average monthly salary in the research sector, according to official statistics, stood at $610 in 2017 ($506 in 2016).26 If we take into account the costs of research expenditure that must be covered by those wages, then the average salary in the sector in 2017 was about $373 (in 2016 – $321),27 which is not a high figure. At the same time, we should take into account the significant imbalances between different disciplines, as well as the fact that this covers both young scientists and those who are at the highest levels of a career. At the top end of the system, wages can go up to $1,500 and ever higher.

Thus, the question is not simply about raising wages. The mechanisms of redistribution are also important. Currently, only administrative job and commercial contracts can maximise the income of a researcher. Additionally, various surcharges and premiums are currently regarded as the main incentives. In particular, Decree №467 provides for the possibility of increasing salaries of employees in budgetary research organisations by 200% or even 300%.28 At the same

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25 See, for example, Вадзім, Мажэйка. Тры прычыны, чаму беларуская навука жудасна старэе. 22 траўня 2018, https://ideaby.org/old-science/ (Vadzim Mazhejka, Three Reasons Why Belarusian Science Has Aged Dreadfully, 22 May 2018)
26 The figure reflects the level of nominal monthly wages of employees in Research and development sector. If we proceed from those employed in professional, scientific and technical activities (Труд и занятость, 2018: 235), nominal wages would be $576 in 2017, and $496 in 2016.
27 In this case, the national statistics does not allow to determine how many employees in the sector have a part-time, and how many full-time employment.
28 Указ президента Республики Беларусь от 28 декабря 2017 г. № 467 Об оплате труда работников бюджетных научных организаций (Decree of the President of Belarus, 28 December 2017, No.467, “The Remuneration of Workets in Budgetary Research Organisations”)
time, such salary increase is tied to the decisions of the management and executive structures. The Decree additionally strengthens the administrative principles of management and, in fact, does not change the approach to incentives.

It is necessary to rely less on administrative incentives, and rather to change the schema. Building an effective research sector requires expanding opportunities for researchers to receive additional funds for their research work through participation in open competitions and research projects, as well as the creation of temporary research teams. It seems that the expansion of such opportunities should be a priority compared to administrative incentives and mechanical wage increases in budgetary research organisations.

4. Conflicts of interest in the public R&D Sector

Formally, the SCST, the Higher Attestation Commission and the Belarusian National Academy of Sciences govern the R&D sector. If SCST and the Higher Attestation Commission perform mainly administrative functions, then the National Academy of Sciences (NAS) is a much more complex institution.

In accordance with its legal status, the NAS of Belarus is the highest public research institution. Its responsibilities include: organising and coordinating basic and applied research activities; carrying out basic and applied research; organising, conducting and coordinating the state’s scientific expertise; and acting as the leading organisation for information. At the same time, the Academy of Sciences performs “certain functions of the national government body”, which means that it has the ability to issue regulations, determine research policy, monitor activities of other organisations, and distribute funds among other functions.

The special legal status of the Academy originates from the Soviet model of the R&D sector, whereby it operated as both a conglomerate of research institutes and a government body with the authority of the ministry. The system was formed in the USSR after the Second World War at a time of rapid progress in all areas of science, huge defence expenditure (R&D expenditures in the Belarusian SSR amounted to 2.11% of GDP in 1990), and a general strengthening of the state’s role in society and the economy. The rapid development of science and large-scale investments in the research sector smoothed the costs of the system. The cost became apparent after collapse of the USSR as it dealt with the emergence of a market economy and reduction of state funding.

29 An increase to 200% can be approved by the heads of public research organization. Over 200% can be approved by the governmental bodies to which the public research organisation is subordinated.

30 Декрет Президента Республики Беларусь от 5 марта 2002 года №7. О совершенствовании государственного управления в сфере науки. From an administrative point of view, the National Academy of Sciences is subordinated to the president and accountable to the Council of Ministers.

31 See Закон Республики Беларусь №159-З от 5 мая 1998 г. «О Национальной академии наук Беларуси», ст.1; Указ президента Республики Беларусь от 3 февраля 2003 г. № 56 О некоторых вопросах Национальной академии наук Беларуси.

After collapse of the USSR, the special role of the Academies of Sciences in the research sector was typical for almost all post-Soviet states (e.g. Moldova, Russia, and Ukraine). Only in the three Baltic countries (Lithuania, Latvia and Estonia) were rapid and deep reforms carried out. The main problem of the Soviet model of R&D sector was the significant conflicts of interest in entailed: the same organisation simultaneously controlled and distributed funds, assessed the quality of research and was itself the largest research centre, in some areas it had a monopoly on research.

Reforms aimed at increasing the efficiency of the research sector provide for the separation of government and research activities. A clear separation between public administration, redistribution of funds for research and research activities itself can be considered as one of the key principles in countries with well-developed R&D sector.

In Belarus there have been several attempted reforms aimed at separating the functions of public administration and research, in particular through the creation of the Committee on Science and Technology under the Council of Ministers in 1993. In 1994 the committee merged with the Ministry of Education and Science. In 1997 a separate State Committee on Science and Technology was established, which in 2001 once again became the Committee on Science under the Council of Ministers. An independent committee was re-established in 2004, and since that time its role in differentiation of public administration and research activities has been strengthened. Nevertheless, the consistent separation of public administration (SCST and other ministries) and research activities (Academy of Sciences, universities) has not been achieved. The existing model of the R&D sector retains deep conflicts of interest, which reduces the effectiveness of research activity and spending on science.

Currently, the National Academy of Sciences of Belarus (NAS) is the largest research institution that receives resources in the field of R&D. In the state budget for 2018, the Academy accounted for almost 80% of all budget expenditure for basic research and about 30% for applied research. In addition, the Academy of Sciences employs about 60% of all workers engaged in R&D. Thus, the organisation is the largest consumer of public funds allocated to science.

At the same time, the NAS performs multiple functions of public administration. In particular, it coordinates basic and applied research carried out by all research institutions. This rule is not always clearly observed, but it gives to the Academy additional opportunities to advance its interests and control the research sector.

35 In 2018, about 20% of R&D expenditure was allocated to the Ministry of Industry, 17% to the SCST, 12% to Ministry of Health, expenditures to other organisations did not exceed 5%. Calculated based on: Закон №86-3, 2017 (Law No.86-3, 2017).
36 Calculated according to the total number of people employed in the sector for 2017 and number of persons employed at the Academy of Sciences (Национальная академия наук Беларуси/National Academy of Sciences of Belarus).
In addition, the NAS has authority to request information on the current state of and outcomes from basic and applied research at all research institutions and higher education establishments performing research at the expense of the national budget. It also has the authority to conduct inspections of these institutions. All this further reinforces the ability of the NAS to influence the redistribution of administrative and financial resources.

The position of the coordinating authority is complemented by significant control functions. Together with SCST, the NAS oversees the efficient use of public funds allocated to basic and applied research and development.

In addition, the Academy realises the redistribution of state funds for basic research through the BRFFR. The BRFFR depends on the NAS not only from a formal point of view. Representatives of the NAS also dominate its governing bodies. In the Board of the Fund, 27 out of 36 members represent the NAS and even five or twelve representatives on the Supervisory Board belong to the NAS.

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<tr>
<th>General number of members</th>
<th>NAS employee</th>
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<tbody>
<tr>
<td>Board of the BRFFR</td>
<td>36</td>
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<td>Supervisory Board</td>
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As already noted, the BRFFR distributes between $3 million and $5 million per year\(^{38}\) and this comprises almost entirely public funds for basic research that are distributed on a competitive basis. Obviously, the NAS is the main recipient of these funds. Although the exact amounts are not publicly available, the distribution of grants in 2015–2018 shows that the absolute majority of funded projects are led by researchers at the NAS – 55.1% in 2017\(^{39}\).

The NAS has the authority to develop and approve national research programmes; prospective and annual plans for the most important research activities in Belarus. The NAS also has many opportunities to influence research priorities, the amount of funding and the provision of state-funded contracts. It can use such influence to the advantage of its own structural units. This again creates a conflict of interest and places unequal conditions upon universities and other research centres. In addition, the NAS together with the SCST, carries out state scientific and technical expertise work.

Thus, the government of the R&D sector in Belarus includes an obvious conflict of interest. The main problem is that the NAS simultaneously determines the policy in the field, monitors it, redistributes funds for research and serves as the largest research organisation to which most of the state funds are spent. Among other problems, such a system subjects other research centres, primarily the universities, to unequal conditions and provides additional resources for the Academy to lobby and promote its sectoral interests.


\(^{38}\) Calculated according to: О состоянии и перспективах, 2018: 223 (On the Condition of Science and Perspectives…).

Despite the recent reduction in management and control functions of the Academy, the problem of separating public administration, redistribution of funds and research activities remains. Building an efficient R&D sector, as well as improving the efficiency of budgetary spending, requires a clear separation of these functions.

The authority for coordinating research activities, controlling budgetary spending, redistributing funds, defining government programmes, examining and certifying must be transferred to administrative bodies (mainly to SCST). The BRFFR should also be reorganised and subordinated to the Council of Ministers or SCST. In turn, the Academy should concentrate on solving research problems and academic activities.

5. The divide between research and higher education

An even more complex and controversial problem is the organisational, personnel and economic distance between the R&D sector and higher education. The system consists in a clear separation between research organisations engaged in science and development, and universities engaged in higher education. At present, such a dual system fully determines the development of science and higher education in Belarus and has significant negative consequences.

Despite the fact that research is an important component in the quality of education, many departments and faculties, and even entire universities, do not actually conduct research. More precisely, research is purely formal, lacking time and resources. At the same time, international practice confirms that only lecturers who have research or practical experience in their field can impart high-level knowledge and skills to students.

The main statistical indicators reflect the weakness of research activity. Currently, fewer than three thousand researchers work in higher education. This comprises only 11.2% of the total body of researchers in Belarus. In the public sector (mainly NAS) 6,800 researchers are employed, comprising 25.7% of the total.

Only 9.36% of R&D expenditure came to the higher education sector in 2017 (cf. 23% to the public sector). In countries with a developed R&D sector, universities

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40 For example, the practice of independent publication of normative legal acts by the Academy of Sciences has been reduced. Currently, such acts, as a rule, are issued jointly by the National Academy of Sciences of Belarus and the State Committee for Science and Technology.

41 2,964 persons as of 2017.

42 National statistics define the public sector as government bodies, as well as non-profit organisations subordinate to government bodies and other government organisations, with the exception of organisations belonging to the higher education sector. In this case, the status of the Academy of Sciences and its subordinate organisations is not completely clear. According to the official website, the staff of the Academy of Sciences totals 16,000 researchers and technical staff, which should be 60% of the total. The number of researchers working in the Academy of Sciences is 5,350 (although the information on the site allows other interpretations), that is 31.3% of the total. These data are not completely consistent with the official statistics. If the statistics presented are correct, the discrepancies can be explained by the fact that in official statistics some of the staff of the Academy of Sciences are counted as employees of the public sector, and part of the commercial.

43 The average for the last five years (2013–2017) is 10.45%. 
are much more involved in research. On average, universities account for 22.1% of spending on research in the EU. In some countries, this level is much higher. More than 30% in Poland and Denmark, more than 40% in Latvia.

In some developed and developing countries, universities account for less than 20% of research expenses (e.g. USA, Germany, South Korea, China), but this is combined with a small role of the public sector as well (typically 9–15%). This reflects the dominance of commercial enterprises in R&D sector.

Table 4. The share of higher education and the public sector (non-profit organisations) in the cost of R & D (2017).

<table>
<thead>
<tr>
<th>Country</th>
<th>Higher education sector</th>
<th>Government sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poland</td>
<td>32.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Denmark</td>
<td>32.1</td>
<td>3.0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>23.7</td>
<td>6.5</td>
</tr>
<tr>
<td>Estonia</td>
<td>39.6</td>
<td>11.8</td>
</tr>
<tr>
<td>Finland</td>
<td>25.4</td>
<td>8.5</td>
</tr>
<tr>
<td>EU (28 countries)</td>
<td>22.1</td>
<td>11.2</td>
</tr>
<tr>
<td>Japan</td>
<td>12.0</td>
<td>7.8</td>
</tr>
<tr>
<td>USA</td>
<td>13.0</td>
<td>9.7</td>
</tr>
<tr>
<td>Germany</td>
<td>17.3</td>
<td>13.4</td>
</tr>
<tr>
<td>Lithuania</td>
<td>35.8</td>
<td>28.3</td>
</tr>
<tr>
<td>S. Korea</td>
<td>8.5</td>
<td>10.7</td>
</tr>
<tr>
<td>China (without Hong Kong)</td>
<td>7.2</td>
<td>15.2</td>
</tr>
<tr>
<td>Belarus</td>
<td>9.4</td>
<td>23.0</td>
</tr>
<tr>
<td>Romania</td>
<td>10.6</td>
<td>32.4</td>
</tr>
<tr>
<td>Russia</td>
<td>9.0</td>
<td>30.4</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>5.7</td>
<td>23.2</td>
</tr>
</tbody>
</table>

*Source: Eurostat.*

International assessments of research institutions confirms this situation. In 2018 in Scimago Institutions Rankings, Belarus was represented by only three universities: the Belarusian State University (658th place), the Belarusian National Technical University (735th place), and the Belarusian State University of Informatics and Radio electronics (745th place). Additionally, the NAS is represented in the ranking (705th place). For comparison, there are 58 universities from Poland, eleven Ukraine and seven from Lithuania.

At the same time, in most international university rankings, research activity is one of the main variables used in evaluations. As a result, low international ratings and the quality of education reduce the attractiveness of Belarusian higher educational institutions not only for foreign but also for Belarusian students. This

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44 Scimago Institutions Rankings, https://www.scimagoir.com
Reforming the Research & Development Sector in Belarus: Challenges and Possible Solutions

poses a threat to the financial sustainability of higher education in the country. Increasing universities’ research activity is a prerequisite for the formation of a competitive higher education sector.

With the existence of a dual system separating science from higher education, the hundreds of publications and the high competence of many employees in research organisations fails to contribute to the competitiveness of the educational sector, which reduces the effectiveness of public spending on science and education. In addition, the integration of research and educational activities could increase the financial sustainability of research institutions and reduce administrative costs.

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The problem of separation of education and science can be solved in two main ways: (i) the incorporation of research institutes into universities; or (ii) the redistribution of budgetary expenditure on science in favour of universities. The second scenario may entail a significant reduction in funding for the Academy of Sciences and other specialised research institutions.

The re-subordination of the institutes of the Academy of Sciences into universities – and such reform has already been discussed in Belarus – represents a radical step. A similar model has been applied in some developed countries (e.g. the USA and Great Britain). Among post-Soviet states, it has been most consistently implemented in Estonia. The advantages of the model are that it increases the financial sustainability of both research institutes and universities, increases the level of competence and quality of education, and will potentially increase the universities’ position in international ratings. The disadvantages of the reform are the risk of breaking up research teams, decreasing the scientific activity of researchers (due to switching from research to teaching), and a decrease in opportunities for advancing and upholding the interests of the research sector.

The redistribution of budget finances in favour of universities does not suppose structural reorganisation. At the same time, it may have no less significant consequences for the R&D sector. Achieving parity between universities and the Academy of Sciences for basic research expenditures, if they remain at level of 2018, will require a reduction in financial revenues to public research institutions by $15 million per year or an increase in budget expenditure by $25–$30 million.

In addition to the redistribution of funding, the reform should include the creation of equal conditions for universities and the elimination of conflicts of interest in the governance of the R&D sector. Redistribution of funds for research through competitions should be significantly increased, and mechanisms should be elaborated to ensure the autonomy and independence of redistribution agencies and foundations. Universities should receive greater representation in these agencies’ governing bodies. Universities should also be more involved in the elaboration and implementation of state R&D programmes and decision-making concerning R&D policies.


46 Based on the level of expenditure in the budget for 2019.
6. Assessing the results of scientific activities (humanities and social sciences)

Introduction. In most countries of the world, the impact/visibility of scientists is measured by their publication activities at the international level. The activities are stimulated by financial methods, cash bonuses and salaries, as well as administrative methods. International publications are necessary for holding academic positions and obtaining both academic titles and degrees.47

Belarusian scientists who work in the field of natural and technical sciences publish the results of their research in journals included in international databases. Researchers in Physics, Biology, Medicine and Materials Science have proven the most successful in their international representation. As for the humanities and social sciences, the situation is complicated or even critical (see Figure 5).

Belarusian scientists who work in the field of natural and technical sciences publish the results of their research in journals included in international databases.

Figure 5. Publications by Belarusian researchers in a Scopus database, 2016

Figure 5. Publications by Belarusian researchers in a Scopus database, 2016


48 Total number of published texts (documents), only leading journals are counted (Q1). Scimago Journal & Country Rank, https://www.scimagojr.com
In Belarusian universities, in the field of the humanities and social sciences, there is a practice whereby scientific activities are pushed to the periphery of attention; scientific activities do not play an important role either professionally or financially. Lecturers focus their attention primarily on teaching because it is rational from a financial perspective: more lectures equates to higher salaries. As a result, there are practically no Belarusian scientists representing the humanities and social sciences to be found in international databases. There are practically no Belarusian journals in international databases either (see Table 3).

Table 3. The presence of Belarusian journals in the international databases, 2017

<table>
<thead>
<tr>
<th>Country</th>
<th>Total journals in Scopus database</th>
<th>Scopus-listed journals also included in Web of Science</th>
<th>Social science journals in Scopus database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>397</td>
<td>183</td>
<td>56</td>
</tr>
<tr>
<td>Poland</td>
<td>355</td>
<td>192</td>
<td>58</td>
</tr>
<tr>
<td>Slovakia</td>
<td>67</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>Sweden</td>
<td>55</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Lithuania</td>
<td>51</td>
<td>28</td>
<td>16</td>
</tr>
<tr>
<td>Ukraine</td>
<td>51</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Estonia</td>
<td>31</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Latvia</td>
<td>11</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Georgia</td>
<td>7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>7</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Belarus</strong></td>
<td><strong>7</strong></td>
<td><strong>1</strong></td>
<td><strong>0</strong></td>
</tr>
<tr>
<td>Moldova</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Armenia</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


51 Общее количество наименований журналов. Scimago Journal & Country Rank, URL: https://scimagojr.com

52 Scopus is the largest database of abstracts and citations of peer-reviewed literature: scientific journals, books and conference materials. The database provides a comprehensive review of scientific activities around the world in following fields: technology, medicine, humanities and social sciences. Elsevier, URL: https://service.elsevier.com/app/answers/detail/a_id/15534/supporthub/scopus/tips

53 Web of Science is the database connects Web of Science Core Collection to regional citation indexes, patent data and index of research data sets, total over 33,000 journals covering all disciplines. Clarivate Analytics, URL: https://clarivate.com/products/web-of-science/
Since its independence, Belarus has taken the Soviet and Russian model of higher education and science as its example. Lately, however, we can observe a growing gap between Russia and Belarus. Russia is increasingly integrating into international science practices, while Belarus remains isolated. Since 2012, the state programme "5-100" has been implemented in Russia, the essence of which is to integrate Russian higher education and science into the international scientific community.

The programme has brought significant change to Russian higher education and science, and now an academic’s status and income depends on citations indexed in the international databases. Part of the Russian scientific community took advantage of new opportunities at the international level and began actively to publish in English. Also, Russia created its own national citation database, the Russian Index of Science Citation (RISC). The RISC helps to follow trends and the level of development of the Russian-speaking scientific community, to develop internal competition, to maintain communication, to exchange of experience, and, last but not least, to fight plagiarism.

In the 1990s Belarus chose Russia as the example to follow partly due to its low level of English proficiency. Nowadays, Belarus lags behind Russia for multiple reasons: it has neither its own databases, nor the necessary language competencies, nor the firm desire to integrate into the international science community.

The isolation of Belarus should be explained mainly by a lack of political will. Reforming the system will necessarily entail the redistribution of power and financing. Many representatives of the Belarusian academic community, which influences decision-making and the distribution of finances in the scientific sphere (especially in the field of the humanities and social sciences), are not sufficiently integrated into international science. Therefore, from their perspective, the reforms may lead to a loss of income, influence and diminished career prospects.

Assessment of scientific publications: comparative analysis. Assessment the quality of research requires quantitative measures and/or qualitative indicators designed to evaluate research outputs and their impacts (Research England). At the moment, there is no generally accepted assessment system in the field of the humanities and social sciences, with approaches varying from country to country.

There are two main models for assessing the quality of research. The first model, the most popular, provides for partial or complete integration of the national system into the international system (e.g. Latvia, Lithuania, Poland, Russia, Ukraine and Sweden). The second model involves the creation its own national assessment system (e.g. Great Britain).

Since the 1950s in North America, and now in most member countries of the Bologna Process, an indicator-based model is used to measure the quality of research, primarily through a bibliometric analysis of the visibility and impact

54 One of the main goals of the “5-100” programme is inclusion by 2020 of at least five Russian universities in the top hundred leading universities according to the World University Rankings (Указ Президента №599, 2012; Presidential Decree No.599, 2012).
55 RISC is the national bibliographic database which accumulates over twelve million publications by Russian authors. For further details, see: https://elibrary.ru/project_risc.asp
of research. According to this model, scientific research is successful if its outputs are published in authoritative journals included in the international databases, first of all in Web of Science and Scopus, and other authors published in these journals cite the research in their own works. An authoritative journal is understood as one that has a high impact factor (IF). That is, the more often articles are cited, the more authoritative the journal. Accordingly, the more the article is cited, the more visible the article is and the greater its impact.

Of course, this model has its drawbacks, especially in relation to the humanities and social sciences. For instance, a publication in English on a global, resonant topic is more likely to have impact than a publication in Belarusian or Russian on a topic related to internal issues of Belarus. This problem affects all non-English speaking countries.

In response to the justified criticism regarding the use of the indicator-based model for assessing the quality of research in the field of humanities and social sciences, scientists have begun to use an expert-based model. The expert-based model is an assessment of the quality of research by leading experts (expert review). The advantage of expert review is that the method helps to fight plagiarism. Besides, a mixed assessment model (combining quantitative and qualitative methods) has become increasingly popular in recent years.

In Eastern Europe, the indicator-based model is the most common model, especially in Poland, Russia and Ukraine. In these countries, a basic indicator of the quality of research is the indexation of a journal in the international databases, primarily in Web of Science and Scopus. In Poland and Russia the impact factor of a journal is also important. While in Russia and Ukraine the main bibliometric indicator is the number of citations an article receives.

In Australia, France, Poland, Spain and many other countries, scientific journals are ranked according to their own scientific authority. For instance, in Poland there are three groups of journals: group A – scientific journals with impact factor included in a JCR database (15-50 points); group B – scientific journals included in the ERIH PLUS database; group C – scientific journals with impact factor lower than 15 points. The ERIH PLUS database is also widespread in Poland. ERIH PLUS is a database containing only scientific periodicals/journals within the humanities and social sciences published all over Europe (see: Norwegian Centre for Research Data).

Bibliometrics are measures of an author’s impact. Citation analysis is a field of bibliometrics research in which citations in scientific articles are used to establish relationships between authors or articles. Impact factor and h-index are two most frequently used bibliometrics (see: Cold Spring Harbor Laboratory).

IF is a measure of the frequency with which the average article has been cited in a particular period. Impact factor is used to measure the authority or rank of a journal by calculating the frequency of citing its articles (see: The University of Illinois at Chicago, <https://researchguides.uic.edu/if/impact>).


Kulczycki and Rozkosz, 2017


62 European Reference Index for the Humanities (ERIH PLUS) is also widespread in Poland. ERIH PLUS is a database containing only scientific periodicals/journals within the humanities and social sciences published all over Europe (see: Norwegian Centre for Research Data).


Kulczycki and Rozkosz, 2017

JCR database provides quantitative tools for ranking, assessing, categorising and comparing journals.
The mixed model is more common in the Baltic and Scandinavian regions: in Latvia, Lithuania and Sweden.

In Lithuania, as well as in Sweden, both the quantitative and qualitative assessment methods are used, in particular, the Scopus bibliometrics (citation impact and international co-authorship) and self-assessment reports. In Lithuania assessments of the quality of research is mainly based on international standards. Thus, high-quality research is research that is published in leading international journals in the relevant discipline, has a quality sufficient to meet the highest international quality standards in terms of originality, significance and rigour, has a significant impact on the development of the discipline all over the world, and has economic and social impacts in Lithuania.

In Latvia, the quality of research is assessed by the bibliometrics, peer review (with the involvement of the international scientific community) and reports from scientists. As in neighbouring Lithuania, assessments as to the quality of research involve taking into account the impact of research on the development of the discipline, the scientific environment, economy and society.
Unlike all the countries listed above, in Great Britain only peer review is used to measure research quality. In assessments the experts pay attention to: a) outputs, b) impact, and c) the scientific environment. The quality of research outputs is assessed in terms of their originality, significance and rigour (65% of the overall outcome). The impact is assessed according to the reach and significance of impacts on the economy, society and/or culture (20%). In turn, the scientific environment is assessed in terms of its vitality and sustainability (15%).

Belarusian practice. As for Belarus, it is a separate case. If in all the countries reviewed above the international criteria for assessing the quality of research are used in one way or another, Belarus in the field of the humanities and social sciences is characterised by its limited inclusion in the international scientific environment.

As of 2017, only 4.5% of all R&D expenses are spent on economics, the humanities and social sciences.

This can partly be explained by the lack of deep-rooted traditions and low attention to the development of the humanities and social sciences. For instance, among twelve implementing state programmes of scientific research only one links to the humanities and social sciences – ‘Economy and the Humanitarian Development of Belarusian Society’. As of 2017, only 4.5% of all R&D expenses are spent on economics, the humanities and social sciences. The sector employs 1,770 academics (10.4% of the total).

In Belarus, according to the law ‘On Scientific Activity’, in assessing the quality of research attention is paid to the novelty, objectivity, validity and rigour of research, as well as its significance for the science and practice. According to the decree of the National Academy of Sciences of Belarus and the State Committee on Science and Technology, the indicators listed above supply the main criteria for assessing the results of basic research.

The international criteria for assessing research quality are used only as additional criteria for individual scientific teams and scientists working in the field of the basic research. Among them are the following: total number of publications; number of publications in journals included in the Web of Science and Scopus databases; total number of citations; number of publications in journals and the impact factor; average citation per publication; and the author’s h-index.

The approach mentioned above has a general scientific nature and includes various exceptions. In practice, the international criteria in the field of the humanities and social sciences are almost never used or used in only a limited way.

In Belarus, unlike most of the countries mentioned above, there are no requirements for publications in international journals included in the Web of Science. This can partly be explained by the lack of deep-rooted traditions and low attention to the development of the humanities and social sciences. For instance, among twelve implementing state programmes of scientific research only one links to the humanities and social sciences – ‘Economy and the Humanitarian Development of Belarusian Society’.

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In Belarus, unlike most of the countries mentioned above, there are no requirements for publications in international journals included in the Web of Science.
Science and Scopus databases when obtaining academic degrees, applying for an academic job, or when receiving research grants. This partly explains why the presence of Belarusian scientists in the international journals is extremely low.

For instance, in 2017, the faculty of the Belarusian State Economic University (BSEU) (according to the RISC, the BSEU ranks 24th among 414 Belarusian scientific organisations and institutions of higher education) published 1,452 articles, only eight of which were published in journals included in the Scopus database and one also included in the Web of Science database. Thus, the share of the total number of the publications in the Scopus and Web of Science databases is only 0.6%. However, the BSEU declares its intention to increase the number of publications in the RISC, Scopus and Web of Science databases up to 20% by 2020.79

As the last example shows, Belarus in the development of science continues to focus on Russia and, in particular, on the Russian database. This strategy is contradictory since the Russian-speaking scientific environment is smaller than the English-speaking environment. Moreover, the international criteria for assessing the quality of scientific activities are increasingly being used in Russia.

Instead, Belarus needs to develop the practice of publishing research in internationally-recognised journals. In addition to this, it is necessary to create a national database of publications and citations. Among other things, such a database should serve as a platform for communication, the exchange of experience and foster the establishment of contacts between scientists for further research. This could help develop internal competition between both scientists and research and/or educational institutions. It would also help to track the overall development of Belarusian science and, ultimately, fight plagiarism.

Another reason why the presence of Belarusian scientists in the international journals is extremely low is their insufficient language competence. A number of Belarusian universities are trying to address this problem. For instance, at the Yanka Kupala State University of Grodno (UKSUG), scientists publishing an article in English have the opportunity to receive financing (up to $600) to cover the costs of its translation into English and publication in high-impact journals.

In the UKSUG,80 BSU81 and the Belarusian State University of Transport, the faculty receive cash bonuses for publications in leading international journals. Such practices can indeed stimulate scientists to publish in English, but they do not solve the problem of the language competence in general. To remedy the problem, the

80 Remuneration rates of the UKSUG faculty for publications in high-impact journals: 1) article in a journal with impact factor included in the Scopus and/or Web of Science databases - $200, and extra $40 for each full unit of impact factor of a journal; 2) article in a journal included in the RISC - $80; 3) monograph, a review of which is published in a journal with impact factor included in the Scopus and/or Web of Science databases - $900 (see: ГрГУ).
81 Приказ “Об утверждении Положения о премировании работников структурных подразделений Белорусского государственного университета за публикации в ведущих международных журналах” от 15 октября 2012 г. № 535-ОД, <https://law.bsu.by/pub/7/Pologenie.pdf> - Another good example from the Belarusian practice - in the BSU there is the Group of Certified Scientometrics Experts (see: БГУ).
situation, fundamental changes in the principles of organising the teaching of foreign languages for scientists and lecturers are needed.

The existing international assessment system should be adopted by Belarus as a basis for assessing the quality of scientific activities, including in the field of humanities and social sciences. Above all else, this means engaging with the bibliometrics of the Web of Science and Scopus databases. At the same time, a combination of the quantitative and qualitative assessment methods is necessary. This practice is becoming more common and influential around the world. Consequently, taking into account international experience, it remains only to adapt it to the Belarusian context.
Conclusions and recommendations

1. **Research and development expenditures.** Since 2008 Belarusian science has developed under adverse conditions associated with a significant reduction in public and private funding. In order to preserve and develop the country’s research potential in the coming years, it is necessary to increase budgetary expenditure on R&D at least to the level of 2008 ($240 million), as well as stimulate spending on R&D from commercial organisations. The increase in expenditure should be accompanied by reforms aimed at increasing the efficiency of public funds’ allocation: increasing transparency; strengthening the role of competitive and project financing mechanisms; eliminating conflicts of interest in management; developing science in the higher education sector; and introducing international systems for evaluating the results of scientific activities.

2. **Forecasts.** Forecasting the development of R&D sector should be more realistic and not set unattainable objectives - in particular, not aiming at the rapid growth of R&D to 2% of GDP or higher. It seems that in the short-term perspective, one should concentrate on compensating for the losses of the R&D sector crisis after 2008 and achieving 1% R&D intensity (as a proportion of GDP). Over the next five years, achieving expenditure on research and development in the range 1–1.5% of GDP should be considered as an optimistic scenario.

3. **Transparency.** The R&D sector should become more transparent, and the distribution of finance more understandable and open to members of the research community, as well as to society as a whole. It is necessary to oblige state-funded research institutions to publish narrative and financial reports. Additionally, financial reports and detailed narrative reports should be published upon completion of all national research programmes. The allocation of funds through open competitions (in particular, the BRFFR and SCST) should also be more transparent. In particular, through publishing a full list of team members that received a grant, as well as the total amount received by the research team.

4. **Competitive and project-based financing.** In coming years, the role of competitive and project-based funding should be significantly increased (to 25–30% of total budget expenditures). Accordingly, the budget of the BRFFR should be increased, and the Foundation itself should be reorganised and subordinated to the Council of Ministers or to the relevant ministry.

5. **Conflicts of interest.** In R&D sector conflicts of interests should be excluded, primarily related to the special status of the National Academy of Sciences of Belarus. Its authority to coordinate research, to control budget spending, to redistribute funds, to define national research programmes, and to certify should be transferred to the ministries, primarily the State Committee for Science and Technologies. In turn, the Academy should concentrate on research activities and solving other scientific problems.

6. **Science in universities.** The greatest challenge for Belarusian R&D sector is a clear administrative and economic separation between the field of science and higher education. There is an acute need to return research activity to universities. This is badly needed if the quality of education and the competitiveness of the higher education are to improve. This can
be done either through the incorporation of research organisations into universities, or through significant increase of expenditure on research activity in universities. It would be better to increase the support of science in universities through competitive project-financing mechanisms (including through new programmes within the framework of the reorganised BRFFR), rather than direct institutional support.

7. **Criteria for assessment of research activity.** The main criteria for assessment of research activities should be publication and citation indices in international scientific publications (primarily Web of Science and Scopus). In doing so, mechanisms should be developed that would minimise the negative effects of the international assessment system for individual disciplines and academic communities. Evaluation of the results of scientific activity should affect career prospects and the level of wages in the system of higher education and academic research institutions. At the same time, special incentives should be developed to increase the number of publications in English.

8. **Nationwide research database.** It is necessary to create a nationwide database of publications and citations. Such a platform can be useful not only for scientists, universities, research institutes, but also for periodicals and regulatory bodies.

9. **Development of language skills.** It is necessary to change completely the approach to the linguistic training of graduate students and scientists, including by compensating the costs of commercial courses for the most active researches. Language skills of researches must be confirmed using the international testing system (for example, IELTS and TOEFL).

10. **National statistics.** National statistics should process and publish information not only about the number of researchers and other employees in R&D sector, but also the full-time equivalent figure. Existing statistics do not allow a comprehensive analysis of expenditure and human resources in Belarusian science. The collection and publication of data on institutional and project-based funding of the R&D sector (following the example of Eurostat) is also necessary.
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