**Second Innovation Performance Review of Belarus**

Main findings and recommendations

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Chapter 2: policy frameworks, programming and initiatives

Innovation policy and practice in Belarus was given a significant new impetus with the adoption in 2012 of the new Law on State Innovation Policy and Innovation Activity (LSIPIA). LSIPIA instituted the concept of National Innovation System (NIS) and defined the State Programme for Innovative Development as the main programmatic document supporting the implementation of the main directions of state innovation policy.

LSIPIA acknowledged risk a key feature of innovation activity which needs to be taken into account when planning, managing and financing the innovation process. Respectively, the Law defines categories such as “innovation projects” and “innovative goods” which can be subject to specific treatment by legislation and regulation. LSIPIA also deals with innovation infrastructure and support institutions. It defines the categories of “techno-park”, “technology transfer centre” and “venture organisation” which can also be subject to specific regulatory measures. The part dealing with the financing of innovation activity is probably the weakest part in the new law as LSIPIA falls short of identifying new sources of funding or specifying new funding instruments.

As stipulated in LSIPIA, the State Programmes for Innovative Development (SPID) are envisaged as the programmatic means of operationalizing public innovation strategy and policy, in accordance with the general 5-year government planning cycle in Belarus.

Belarus has already implemented two such programmes: SPID 2008-2010 (with a shorter timeline as it was introduced in the middle of the regular planning cycle) and SPID 2011-2015. At the moment of writing, the Belarusian authorities were still deliberating the draft SPID 2016-2020. SPID 2016-2020 contains a range of ambitious objectives and targets for modernizing the Belarusian economy and raising its international competitiveness. However, in practical terms, SPID 2016-202 largely follows the conceptual design, format and structure of the past two such programmes. Due to that, de facto it is an eclectic mix of some concrete policy measures supported by earmarked budgetary funding and a wider policy framework defining the general policy orientation and desired steps to operationalize these steps without, however, concrete budgetary commitments for their implementation.

The SPID part referring to “the most important projects for establishing new enterprises and production facilities with foremost importance for innovative development” is where the largest share of public financial resources earmarked for innovation is concentrated. In principle this part has clear objectives: putting into operation of concrete, new for the country technologies and production facilities. Judging from past experience, these policies have achieved some of their declared objectives.

However, from the perspective of the modern conceptual understanding of innovation as a systemic process which involves complex interaction among many actors and stakeholders, SPID 2016-2020 is somewhat biased towards a more outdated conceptual understanding of innovation as a linear process from the phase of R&D towards a subsequent phase of commercializing the results of research. One example of this is the declared intention in SPID 2016-2020 to launch within the programme special “innovation projects” for the commercialization of “no less than 50 per cent of the results of SPID 2011-2015”. The experience of other countries suggests that such an approach has proven to be inefficient in the current dynamic, fast changing globalized economy as by the time these results will be pushed forward to the market, most of them will probably be outdated.

Modern innovation policy is mostly horizontal: it provides open-ended innovation support opportunities across the board, without pre-defining who may have access to it. The selection of projects to be funded is done on the basis of open competitive calls, with no discrimination among the bidders, and funding is allocated to the most successful bids in the process. In contrast, the analysis of the current situation in Belarus indicates that vertical policies still largely dominate the innovation policy mix: such elements prevail both in SPID and in the state programmes for scientific research and the state S&T programmes.

Whereas the SPID contains a detailed list of such candidate projects for the period 2016-2020, the evaluation and screening envisaged in the programme is only a mechanism of short-listing projects for actual funding from the long list but does not contain mechanisms of funding alternative projects that are not included in the predefined long list.

Rather than following such a “linear paradigm”, the programme could try to reinforce the requirements for commercialization as an integral and essential element of the new innovation projects whereby the envisaged practical steps towards the market uptake of the R&D results would have to be planned in advance. What is essential, however, is to incorporate in these instruments certain degrees of risk tolerance (in contrast to the current funding instruments supporting S&T projects). As noted above, the absence of risk tolerance may discourage genuinely innovative project proposals from participating in the bids and hence result in adverse selection of projects for funding, biased towards low risk modernisation projects.

SPID contains also a number of broader objectives such as the further development of the NIS and innovation support institutions, the upgrading of innovation infrastructure, stimulating innovative entrepreneurship, etc. It also puts a special focus on the objective to raise the export activity of Belarusian firms. However it does not specify the policy and funding instruments for the pursuit of such broader objectives.

It is expected that SPID will be predominantly financed by bank credit (some 2/3 of the total funding) and from the participating firms’ own sources (some 18 per cent of the total). However, such a distinction may be somewhat misleading as the majoring of commercial banks in Belarus are state-owned. Among the programmatic novelties in SPID 2016-2020 is the envisaged establishment of a centralized “innovation fund”, which will be managed by SCST and will integrate the previously existing 25 sector and 7 regional innovation funds which were launched in 2012.

The further development of innovation support infrastructure remains a strategic direction in SPID 2016-2020, which envisages concrete plans for public investment in the development and modernization of six techno-parks in Belarus. At the same time, some important objectives and targets of SPID 2016-2020 remain in the “grey area” of ambiguous funding. Despite this declared intention, the programme does not envisage any concrete policy instruments to support innovative entrepreneurship and does not indicate specific public funds earmarked for this purpose.

Despite the upgrading of its status, SPID is not exhaustive in its coverage of innovation activity in the broader sense. Thus, key ingredients of the innovation process such as R&D activities and their governance have been completely left out of the scope of SPID and are addressed by other policy documents. Science and R&D activities are governed by separate legislative documents via two types of funding programmes: 1) State programmes for scientific research (in the past also referred to as “fundamental research”) and 2) State science and technology programmes (in the past also referred to as “applied research”). Both types of programmes provide grant funding to R&D projects in selected research areas in accordance with the policy priorities of the country in the respective funding period.

Thus, policy practice distinguishes between the so called “S&T projects” (those that are governed by the state S&T programmes) and “innovation projects” (those included in the SPID but also operated under other policy instruments – by BelInFund and, earlier, by the sectoral and regional innovation funds). However, a more in-depth look at the nature of the two types of projects would reveal that in many cases there is no difference in their nature while in other cases the current names are just misleading because de facto many of the “science and technology projects” are by their nature high risk innovation projects (bringing a new product to the market), while many “innovation projects” are just low risk investment projects targeting modernisation.

The existing categorisation also creates some confusion as regards the role of SPID as the main programmatic document for operationalizing innovation policy because, on the one hand, the “science and technology projects” that are key ingredients of innovation activity in the country are left out of its scope while, on the other hand, SPID caters to many projects that are in principle on the periphery of innovation activity.

Another conceptual issue of chronic character is the lasting focus of innovation policy practice on technological innovation and little or no attention to other types of innovation. In recent years there have been certain shifts in the declared policy intentions as reflected in important policy documents such as SPID. The National Statistical Committee has also expanded the coverage of innovation and innovation activity in its innovation surveys in accordance with the Oslo Manual (see chapters 3 and 4). However, the changed rhetoric has not been accompanied by matching changes in policy practice: all other types of innovation apart from technological innovation de facto still remain outside the outreach of the existing innovation policy instruments.

The formation of the actual programmes is preceded by a complex and staged foresight process with the participation of the National Academy of Sciences, other R&D centres and the government. The funding of the two types of state R&D programmes comes directly from the Republican budget and is not part of the public funding under SPID.

One piece of legislation adopted in 2013 introduced new regulatory norms aimed at stimulating innovation activity and the commercialization of research results. Presidential Edict No. 59 was a positive development in the regulation of ownership of the intellectual property rights stemming from the results of R&D activity supported with public funds. Still, the unsettled legal status of IPRs is a major obstacle for the process of their further commercialization.

Practical experience since the introduction of Edict 59 has indicated that the regulatory norms contained in it are not sufficient for the efficient management of IPRs. In particular, these norms do not contain sufficient provisions for identifying the actual legal owners of the IPRs originating form R&D activity supported by public funding. Due to the existing ambiguities, even the leading R&D institutes performing S&T projects under the state S&T programmes still face difficulties in claiming legal ownership of such IPRs.

Thus while R&D institutes are in principle entitled to the IPRs originating in R&D activities they undertook, these institutes are not in a position to sell the IPRs or engage in follow-up commercialization activities with third parties as they cannot obtain the legal titles on these IPRs[[1]](#footnote-1). The experience of other countries indicates that properly settled IPR ownership for individual researchers and research teams has been a major driver of innovative entrepreneurship through the establishment of start-ups and spinoffs based on such IPRs. Opening up the potential of this driver in Belarus could provide a much needed additional impetus to entrepreneurship and enterprise development in the country.

Another Edict of 2013 introduced for the first time in Belarus the possibility to use public grant funding instruments (innovation vouchers and grants). The new funding instruments are to be operated mainly by the Belarusian Innovation Foundation but also by the Belarusian Fund for Financial Support of Entrepreneurs (see below).

In 2014, the government of Belarus endorsed a policy document aimed at stimulating cluster development in the country, featuring clusters centred on innovation activity. As with many other policy initiatives in Belarus, this document puts the emphasis on a top-down approach to the formation of industrial clusters with a leading role of the public sector and outlines a range of initiatives that public bodies are encouraged to undertake for the formation of innovation-centred clusters. The implied presumption is that large state-owned firms would take the lead and initiative in establishing such “clusters”.

Finally another new policy development with an impact on innovation policies was the recently adopted state programme on education and youth policy in 2016-2020 years. It places a special emphasis on better linking higher education, on the one hand, with the system of secondary education and, on the other hand on better matching university education with the needs of the society and the economy. The programme also calls for further alignment of curricula of university education in Belarus with international good practice.

National Innovation System and innovation governance: current state

Belarus has a relatively well developed system of public institutions supporting innovation activity which form the backbone of the National Innovation System (NIS). There we no radical changes in the composition of such public bodies compared to the situation in 2010[[2]](#footnote-2), however, there was some evolution in their functional responsibilities. Many of the essential NIS building blocks are already in place, especially as regards the role of the public sector. The portfolio of policy instruments supporting innovation activity was enriched with new ones, specifically tailored to the specificity of early stage financing. The public bodies in the NIS have well defined functional responsibilities and roles in innovation governance. In addition, the information brokerage functions performed by these institutions (such as support to R&D and technology oriented forums, exhibitions, fairs, etc.) facilitate linkages and match-making between innovation stakeholders thus contributing to the generation of new business opportunities targeting innovation.

However, poor linkages and insufficient connectivity of innovation stakeholders and lacking spontaneous, bottom-up collaboration among them is probably one of the serious weaknesses in its functioning. At the same time, the current innovation policy mix in Belarus includes very few instruments addressing such systemic failures. Enriching this portfolio could thus be one specific objective for the SPIP but, more generally, for innovation policy making in the country.

Belarus has an excellent record of openness and transparency as regards the documents reflecting public sector rules and regulations. All public bodies, including those dealing with innovation policy and its implementation, have very well organised websites which provide easy access to all relevant documents. The enriching of the information content of the SCST and BelISA websites and the launching of the National S&T Portal made an important contribution towards better informing innovation practitioners and entrepreneurs of the opportunities to implement and pursue their projects.

The State Committee for Science and Technology (SCST) is a public body under the Council of Ministers of the Republic of Belarus which is tasked with a range of important responsibilities in the area of innovation policy and governance. Following the adoption of the LSIPIA, SCST was mandated with additional responsibilities, including those related to the implementation of the SPID and the coordination of the “unified system of state scientific and state science and technology expertise”. The system is administratively managed by State Committee for Science and Technology while the National Academy of Sciences provides expert support. However, even after these changes, SCST has mostly coordinating functions in the area of policy implementation and almost no decision-making authority in this area. Importantly, SCST has no autonomous authority in the allocation of funds earmarked for S&T and innovation activity, nor for the management of financial policy instruments in this area apart form a small budget for the funding of R&D projects supporting its own activity. In reality, funding decision for projects under the state programmes are usually being taken as the outcome of complex bureaucratic processes involving a range of different public bodies with distributed authority, concentrated at higher levels of governance (the National Assembly, the President’s Office and the Council of Ministers).

In addition to its core functions, STSC also controls several subordinate bodies with related responsibilities. The Belarusian Institute of System Analysis and Information Support of S&T Sphere (BelISA) is a research institute whose operations should support SCST in performing its core functions, including a system of monitoring the implementation of state R&D programmes, information support for S&T and innovation activities in Belarus and support to Belarus’s international S&T cooperation.

The National Innovation Foundation (BelInFund) is a public body whose core mission is the support of innovative entrepreneurship in Belarus. BelInFund provides opportunities for early stage financing of innovative SMEs and entrepreneurs using budgetary funding. An important and commendable recent initiative by SCST and BelInFund is the organisation of annual national competitions for innovative projects which target young innovators. These competitions promote awareness raising on innovative entrepreneurship among young people while the winners are awarded small grants to support their further work on the projects.

The National Center of Intellectual Property (NCIP) is a public body whose main mission is the implementation of public policy for the protection of intellectual property rights (IPR) in Belarus.

The National Academy of Sciences of Belarus (NAS) is a complex hierarchical structure which brings together the most important R&D organisations in the country. The organisational structure of NAS includes some 70 research organisations as well as a number of laboratories, design bureaus, production facilities, experimental stations and other support bodies. Formally NAS has a very high administrative status, equivalent to that of a ministry: it reports directly to the President of the Republic of Belarus and the Council of Ministers.

An important recent trend in NAS’s overall activity has been the increasing emphasis on the commercialization of some of its R&D results. This matches a similar change in the general orientation of Belarus’s S&T and innovation policy as reflected in some of the recent legislative and regulatory changes. Thus the existing downstream production facilities within NAS, established with the specific purpose to commercialize NAS R&D results, have been steadily growing in size and in the volume of their commercial output. Another recent development has been the formation of a number of “clusters”, in response to the recent government policy initiative to support cluster development. Many of the NAS research institutes have initiated the formation of their own “clusters” with the participation of businesses with which they have been cooperating traditionally. Reportedly, at the time of writing, some 72 “clusters” were already established or were in the process of being established, with the participation of NAS R&D organisations. These shifts in NAS activity have also associated with changes in the structure and sources of NAS funding, with growing emphasis on NAS’s self-funding.

The entire system of education, including higher education, in Belarus falls under the functional responsibilities of the Ministry of Education. At present, there are 53 higher education institutions in Belarus among which there are 9 private universities. The number of university students in recent years has been on the decline, matching the decline in the country’s population. Within the Ministry of Education there is a Department on Science and Innovation, whose main functional responsibility is the practical implementation of public S&T and innovation policy within the Belarus’s education system as well as the establishment of specific incentives promoting innovative activity in educational institutions.

The Ministry of the Economy is another public body which is mandated with some responsibilities that have an effect on innovation activity. These include participation in the formulation of public S&T and innovation policy as well as the related legislation and regulation and the state R&D programmes. The ministry has a Department of Science and Innovation Activity which coordinates the implementation of such responsibilities within the ministry.

Given the complex structure of public bodies with distributed responsibilities in the conduct of S&T and innovation policy, *innovation governance* in Belarus is a challenging issue. The specificity of Belarus’s policy-making process, which is dominated by the top-down administrative approach, has laid its footprint on innovation governance as well. More often than not, such decision-making is preceded by a lengthy and cumbersome preparatory bureaucratic processing by the institutions involved.

Funding of “scientific research” and “science and technology” projects is done on the basis of bids which are in principle open to local R&D institutes (mostly from the Academy of Sciences but also sectoral R&D institutes and companies). However, another specificity of the Belarusian practice of R&D funding is that the prospective “leading organisations” for the implementation of each “scientific research” and “science and technology” programme are already pre-selected and listed in the respective government decrees approving the programmes. This approach to a large degree predetermines that the leading organisations would also host a large share of the funded projects and, respectively, would receive the bulk of the budget funding allocated to the respective programme.

The public funding of concrete projects under these programmes, as well as those under SPID, comes either directly from the Republican budget or indirectly, through the innovation funds, which are also sourced by the budget. The intention of Belarusian policy makers is to mobilise and channel significant amounts of business investment (including FDI) towards the implementation of R&D and innovation projects. Another mechanism of attracting business investment into this sphere, more specifically, for the early stage financing of innovative companies which is now being operationalized is through the newly established (with public support) venture funds.

Following a historic tradition, the budget funds supporting concrete projects under different state support programmes are pre-allocated to different ministries and other public bodies who act as the “principals” of the respective programmes.

Upon successful screening and evaluation, public funding is extended in the form of grants. To be eligible for funding, S&T project consortia under the state S&T programmes must include both R&D organisations and business partner(s) from the industry. Besides, the business partner must take the commitment for commercializing of the R&D result or technology. The business partners in S&T projects are strongly encouraged to co-finance the project with up to 50 per cent of the total costs.

While public funding is extended in the form of grants both for scientific research and for S&T projects, S&T projects have an important contractual distinction. In case the project partners fail to implement the commercialization phase, the consortium must repay the whole grant funding received for the project. This very strong commercialization pressure and the absence of risk-mitigating financial mechanisms in the now existing instruments create distortions and a selection bias both in the phase of project design and during the screening and ex ante evaluation of proposals.

Belarus is a small open economy and efficient international S&T and economic cooperation are essential for a well-functioning NIS. To facilitate international S&T&I cooperation, SCST and the Belarusian Institute of System Analysis and Information Support of S&T Sphere (BelISA) recently launched a National S&T Portal which provides comprehensive information on the existing international cooperation agreements to which Belarus is party (at present Belarus is party to 56 such agreements) and the acting regulatory framework for such cooperation.

In principle, SME development is also a declared policy priority embodied in the state programmes on SME entrepreneurship in Belarus. Most of this support takes the form of the organisation of forums, exhibitions, fairs, and other forms of information brokerage which facilitate inter-firm linkages and linkages between industry and R&D institutions. There are also some limited sources of financial support for SME development (in the form of repayable loans) through the Belarusian Fund for Financial Support of Entrepreneurs. However, due to the limited amounts of funding and the nature of the funding opportunities, in reality only a handful of entrepreneurs have access to financial support for the implementation of innovative projects.

Best international practice suggests that funding in the earliest (pre-seed and seed) stages of innovative project should be in the form of grants or equity financing rather than repayable credit. But, as noted, the practice of innovation vouchers and grants and equity support in Belarus are still in an experimental phase.

In advanced economies, the private sector also plays an important role in early stage financing. In Belarus, this type of activity is still in its embryonic form. The Business Angels and Venture Investors Network has been in existence in Belarus since 2010 but the cases of actual business angel and venture investment have only been episodic. Some innovation support institutions such as the High Technology Park also provide support services in this area such as match-making between startup firms and prospective private investors. Best international practice suggests that public policy can serve as a catalyst for the invigoration of private early stage financing though appropriate intervention, in particular, through targeted tax incentives.

Another underdeveloped area in the NIS is that of its internal connectivity and the effectiveness of linkages which are also related to the issue of the competitive market environment. Best international practice suggests that some policy instruments can be specifically designed or amended to address such systemic failures, for example, by making the funding of a project conditional on attributes such as connectivity, linkages, stakeholder collaboration. Plus, the explicit requirement to include in the project work programme both the R&D part and the commercialization of its results provides an additional impetus to downstream connectivity.

An important recent integrative development of a more general nature involving Belarus was the establishment in 2014-2015 of the Eurasian Economic Union. The operational regulatory supranational body of the Union is the Eurasian Economic Commission modelled after the European Commission. One of the first practical cooperative steps in the area of innovation support was the establishment of the Eurasian Venture Company “Center for High Technologies”. Its mission is to support high-growth early stage high-tech innovative companies targeting the market of the Eurasian Union.

In addition to that, Belarus participates in the CIS intergovernmental programme of cooperation in the area of innovation until the year 2020. However, this programme is mostly of coordinating nature based on the S&T&I programmes of participant countries and until now has not put forward new international policy instruments or funding sources.

Belarus takes part in EU’s Eastern Partnership initiative and, within this scheme, has been an active participants in the EU Framework Programmes and, currently, in the Horizon 2020 programme. Within FP7, Belarusian researchers took part in 63 international R&D projects, and raised some € 4.22 mn of EU funding. Within H2020, as of the moment of writing, Belarusian participants were part of 20 international projects, raising some € 2.82 mn of EU funding[[3]](#footnote-3). BelISA maintains a National Information Office on EU’s S&T&I programmes which provides technical support to prospective Belarusian in different such EU programmes and coordinates the national networking activities related to this cooperation.

Belarus has a range of bilateral S&T cooperation agreements with a number of countries. The most significant are those within the Union State of Belarus and Russia. These include a number of bilateral cooperative S&T initiatives which are funded within the budget of the Union State. Some other bilateral agreements (e.g. those with India and Lithuania) are also accompanied by instruments for funding of joint bilateral projects in mutually agreed areas.

With regards to the long term strategic development of innovation policies, it is important to highlight that global manufacturing trade nowadays is dominated by large international conglomerates whose production process is grounded on a division of labour that generates economies of scale and economies of scope, which is also the basis of their international competitiveness. Thus, if Belarus wants to pursue meaningfully the objective to boost the export activity of local firms, it would be necessary to consider mechanisms and instruments of implementing this strategy through the channels of global value chains. Such a national strategy should be a separate national undertaking of its own as it would involve a wide range of policy elements, including measures to attract foreign direct investment in the desired sectors of the economy and the establishing of local forward and backward linkages to FDI firms.

In particular, these could be policy instruments stimulating cooperation between local and foreign firms in innovative projects with export orientation. Funding such projects could be made conditional on: 1) cooperation in project implementation between local and foreign manufacturing firms; 2) export orientation. Access to such funding should also be organised through competitive open calls without discrimination as to the nature of the bidders (both large and small firms; both state-owned and private). For greater efficiency and effectiveness, such measures would need to be coordinated with the mechanisms included in the export support programmes.

Knowledge generation and innovation support institutions; industry-science linkages; innovative entrepreneurship and financing

*The role of the enterprise sector: intramural R&D, human resources, science linkages*

Against the background of the worsening of Belarusian`s macroeconomic conditions, pressure on the enterprise sector to increase their international competitiveness remains high, especially with regard to increase their innovative output. However, domestic R&D expenditure as percentage of GDP has decreased from 0.68 per cent in 2005 to 0.52 per cent in 2014. The R&D expenditures in that period could not catch up with the (modest) growth of the economy as a whole.

Regarding the development of *human capital in the business sector,* in 2013, the number amounted to 1.183 (UNESCO Science Report). Compared to countries like Ukraine (511), Azerbaijan (124) or Moldova (73), Belarus therefore ranks high among countries with economies in transition. However, with a view to the overall *employment in high-technology industries and knowledge-intensive services* a decrease since 2010 can be observed[[4]](#footnote-4). The most important high-technology/medium high-technology industries in terms of employment are currently the fields “Manufacture of medical, precision and optical instruments and equipment; watches and clocks” and “Manufacture of machinery and equipment”. Regarding the employment development in knowledge-intensive services, a slight decrease in the period from 2010 (29.8 per cent) to 2014 (29.3 per cent) can be observed.

On the basis of the quantitative indicators, it can be concluded that Belarus went through a phase of stagnation in recent years, partly due to external shocks. On the other hand, structural weaknesses of the Belarusian business sector in general and R&D and its innovation activities in particular prevented a more solid performance. Furthermore, knowledge generation in the Belarusian enterprise sectors is currently limited due to the absence of real growth centres with the potential to initiate *cluster effects* (with the exception of the IT sector). In successful national (or regional) innovation systems clusters of specific industries or technologies are crucial as a critical mass of companies in the same or related industries tends to initiate permanent feedback loops and self-enhancing effects (cluster dynamics). Such cluster effects partly occur along the value chain, but also within the division of labour in the innovation process. The more (highly specialized) partners are involved in the innovation process, the more information and ultimately knowledge circulates within certain industries or sectors. In Belarus, these *spill-over effects* are hampered because of the dominance of large companies within the R&D and innovation process and the fragmentation of the country`s industries (see chapter 3).

*Role of FDI and internationalization*

Foreign direct investment, both inflows and outflows as well as non-equity forms of international production (e.g. subcontracting, licensing, franchising) represent important channels for increasing the innovation and technological output. Relevant underlying mechanisms regarding technology transfer include imported equipment, learning through FDI, direct learning by the labour force working in foreign owned firms and learning form co-operation with foreign firms.

Since 2010, Belarus has made progress to improve the investment environment in the country. In 2014 the *“Law On Investment”* entered into force, which should facilitate the attraction of investments into the Belarusian economy by guaranteeing protection of investors’ rights and interests, as well as non-discrimination, free disposal of profits made from investment and protection against interference in investors’ private affairs. In particular Belarus supports investors and provides incentives in the following areas:

* in the territory of medium, small towns, in the countryside (if doing business on the territory of the Republic of Belarus);
* at the High-Tech Park (Minsk);
* on the territory of Free Economic Zones (FEZ); and
* in the case of entering into an investment agreement with the Republic of Belarus[[5]](#footnote-5).

Concerning the FEZ these have been established since 1996 to foster investment and growth. They offer tax and regulatory incentives including five year exemption from tax. At the time of the fact finding mission for this Review, six of the FEZs are operational covering all strategic areas, both in terms of business sectors and geography. Its members are local entrepreneurs and foreign investors (almost 270 foreign businesses have taken advantage of FEZ)[[6]](#footnote-6).

The current status of net foreign direct inflows for Belarus is displayed in table X. Since 2011 the net foreign direct inflows remain on a very low level (slightly above or below 2 billion USD). Industry wise, the largest inflows are geared to low-tech industries like food, wood, coke, refined petroleum products. Priority medium-technology industries are the manufacture of machinery and manufacture, motor vehicles and equipment and transport/communications. At present the main investors in Belarus are Russia, Great Britain, The Netherlands, Cyprus, Austria, Germany, and China. According to the SCST[[7]](#footnote-7) there are at present 5.000 commercial companies with foreign capital located in Belarus. About 60 companies are affiliates from large, multinational companies.

Table X: Net foreign direct inflows 2008–2014 by main industries (in million USD)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| *Total* | 682.7 | 420.9 | 360.6 | 2159.3 | -88.8 | 1707.3 | 1230.7 |
| of which: |  |  |  |  |  |  |  |
| Industry | 358.2 | 103.8 | 111.8 | 431.2 | 312.4 | 675,6 | 600,6 |
| Manufacture of food products | 71,5 | 51,0 | 5.3 | 86.4 | 66.5 | 59.1 | 134.9 |
| Manufacture of wood products | 7.2 | -5.7 | 4.1 | 15.8 | 77.7 | 80.5 | 95.0 |
| Manufacture of coke, refined petroleum products and nuclear materials | 51.8 | -0.5 | 0.3 | 10.3 | -1.3 | 140.2 | 64.1 |
| Manufacture of chemicals and chemical products | 8.1 | 6.8 | 20.7 | 35.5 | 30.3 | 75.5 | 64.6 |
| Manufacture of motor vehicles and equipment | 13.1 | -0.2 | 1.7 | 70.1 | 38.7 | 66.5 | 64.1 |
| Manufacture of machinery and equipment | 32.7 | 7.1 | 22.0 | 39.9 | -40.8 | 49.4 | 48.3 |
| Trade, household and personal goods | 99.6 | 55.1 | -29.9 | 703.9 | -245.9 | 265.1 | 105,7 |
| Real estate, renting and business services | 59,9 | 107,9 | 10,8 | 250,3 | 144,4 | 299,9 | 195,9 |
| Transport and communications | 106,8 | 119,7 | 251,1 | 674,3 | -442,2 | 222,1 | 88,9 |

Source: National Statistical Committee of the Republic of Belarus: Statistical Yearbook 2015

*Sources of innovation funding – recent developments*

Belarus relies on a banking sector, which is dominated by state-owned institutions, with most decisions on financing innovation in Belarus taken by public authorities. Private initiatives and institutions originated over the last 5 years and are complementary actors in the field of innovation financing. However, since the time of the last Innovation Performance Review in 2010, the Belarusian R&D and innovation financing system has been further developed and adapted to the specific needs of technology-oriented and innovative companies (incl. start-up companies) and to the objectives of national innovation policy as a whole.

For instance, *a Development Bank* was created, which is the newest developmental financial institution in Belarus. It is a specialized financial institution with main directions in the fields of development infrastructure, providing expert support through financing of foreign companies and the support of SMEs. The plans for 2016 indicate that the Development Bank will become the single channel to finance projects under all Government programmes, including possible innovative investment projects. With regard to SME financing[[8]](#footnote-8), credit facilities are provided to 11 partner banks, which act as intermediaries to fund SMEs. Currently, a distinction between innovative and non-innovative products is not carried out. The financial products offered for SMEs are primarily geared towards modernization of production (or services) rather than on the generation of new products or services. In addition to the SME programme, a new product to support start-ups has been launched at the end of 2015 in the form of a loan or credit, typically for up to 5-7 years.

Concerning the *Belarusian Innovation Fund* (BIF), which was already established in 1999, on the whole, the objectives of the fund have not fundamentally changed. They mainly relate to the financial support of innovative projects, financing R&D and production in science- and technology based areas, assistance in the stimulation of foreign economic activity, attracting foreign investment, support of entrepreneurship and marketing oriented activities (e.g. exhibitions, fairs, seminars, conferences, etc). Recent developments relate to a set of new presidential decrees aimed at improving the BIF. On the basis of the legislative changes, the BIF is now able to finance the latest stages of the innovation process (i.e. commercialization, market entry). Furthermore, new instruments are available to support the initial innovation phase (i.e. grants and vouchers).

Since 2010, BIF provides funding to 16-24 projects a year with projects worth of 324,8 billion Roubles for the period 2010-2014. The highest volume was spent in 2012 with 114,6 billion Roubles. For the years 2016 and 2017 65,0 billion Roubles and 52,7 billion Roubles respectively are planned (according to the State Programme on Innovation Development 2016-2020). The core technological field or industries to be offered support are in the fields of pharmaceuticals, mechanical engineering, medical devices, agriculture and devices for research needs. Regarding the selection criteria of the fund, the following criteria are given priority: projects with a focus on energy efficiency; technology focus; job creation for highly qualified specialists; increase of labour efficiency per person; and export orientation.

The new regulation on public grants funding in the form of *vouchers and grants,* which are distributed by BIF as well, pursues the objective to support early stage innovation projects. Applicants for these schemes are typically individuals who have an agreement with a Techno-park (or an incubator) and who have elaborated a business plan to be evaluated in the course of the application procedure. Grants are also distributed among SMEs but only for the design phase (not for the R&D phase).

Both vouchers and grants are awarded on a non-repayable basis. Vouchers are available for two stages: for the preparatory stage, up to 25.000 USD mainly for the development of the business plan, patenting and market research. For the second stage, up to 100.000 USD for creating pilot projects or product samples. Within the last year (2015) there have been 7 applications for grants, but the interest for vouchers meanwhile is much lower. Despite a very sophisticated selection process at the BIF, due to insufficient human resources, almost no actual disbursement has been conducted.

Further recent developments at BIF refer to the establishment or intensification of cooperation activities with different (foreign) organisations, agreements are in place with institutions based in China, Israel and various EU countries, but first and foremost in the former Soviet Union (Russian Federation and Kazakhstan).

The first steps in establishing venture capital companies have been taken in cooperation with Russia and Kazakhstan. The *Russian-Belarusian Fund for Venture Investment* has been set-up on the basis of a long-term programme supported by both countries. The fund acts as a venture company in both countries with a common budget (financed by Belarus (one third) and Russia (two thirds)). Another venture investment company is in its initial stage, a trilateral company with *Russia, Kazakhstan and Belarus*. However, at the time of writing, no activities had been undertaken.

In addition to BIF, the Republican Innovation Funds (or sectoral innovation funds) constitutes an integrated scheme with the R&D funding system of Belarus. In 2015, the Innovation Funds consisted of 25 single funds, which are accumulated by different ministries, state-owned companies and the National Academy of Science. In addition to these 25 funds, another 7 funds are operating as regional or local funds (in Minsk and the 6 provinces). The sectoral ministries use their own established funds to finance innovation in key economic sectors, such as construction, industry and housing. Firms have to apply for these funds in a competitive process. According to the UNESCO Science Report, the most successful of these funds is the one targeting ICT companies (ran by two ministries: the Ministry of Communications and the Ministry of Information), which accounts for 12 per cent of the total expenditure of all 25 funds.

Among these 25 funds, 15 ministries have their own funds. Among them, three ministries account for the bulk of expenditure (state): the Ministry of Transport (24 per cent), the Ministry of Architecture (16 per cent) and the Ministry of Industry (7 per cent). Among the concerns, the Belneftekhim concern with 13 per cent accounts for the largest share.

It is expected that the new *centralized innovation fund* will help better mobilize, select and finance innovative projects and to better align innovation funding to national priorities. The fund will be implemented and managed by the State Committee on Science and Technology and has its own budget line in the current State Programme for Innovative Development 2016-2020.The Fund will have a financial volume of 743,5 billion Rubles for the period 2016-2020[[9]](#footnote-9). The centralized fund will have four operating areas: financing innovation projects from the State Programme; financing R&D aimed at production of new products, services and technologies; funding the development of innovation infrastructure; and funding the development of sector laboratories.

Other changes in the innovation financing system since 2010 concern cooperation activities with the Russian Innovation Centre regarding the financing of young entrepreneurs. A first round of cooperation has been implemented. Furthermore, the support of entrepreneurship within a special programme of the Ministry of Economy focusing on business incubation of start-ups was also launched[[10]](#footnote-10). Finally, the venture tool Business Angels and Venture Investors Network (BAVIN) was developed by the Ministry of Economy, as well as other initiatives, for instance the establishment of different Belarusian crowd-funding platforms[[11]](#footnote-11).

To sum up, the system of R&D and innovation funding has been conceptually improved since the first Innovation Performance Review, especially with regard to the creation of institutions providing venture capital, the creation of a development bank, the setting up of an informal risk capital market, the establishment of foreign partnerships, the revision of the sectoral innovation funds, the setting-up of support schemes offered by the Belarus Innovation Funds, and the set-up of complementary institutions/platforms like business incubators. However, most of these mechanisms are yet to be fully implemented.

*Role of universities and research centres*

The Belarusian Government regards the universities as well the non-university research centres as essential drivers for innovation and knowledge generation. For the Ministry of Education the development of universities and innovation activities is a co-dependant process. Therefore, *legislative changes* since 2010 put emphasis on priority areas, which often resulted in new organisational structures, particularly at the large scientific research organisations like the National Academy of Sciences, the Belarusian State University or the Technical University.

Looking at R&D expenditure of the Higher Education sector according to its sources of funds, the following table shows changes in the composition of the different funding sources since 2005.

Table X: R&D expenditure of Higher education sector by sources of funds (in million Rubles)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2005 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Total R&D expenditure | 75.123 | 144.092 | 199.559 | 354.107 | 474.006 | 475.456 |
| of which by source of funds |  |  |  |  |  |  |
| own funds | 2327 | 2.908 | 3102 | 4549 | 3454 | 4728 |
| budget | 44837 | 96.426 | 132516 | 233668 | 324437 | 311951 |
| extra-budgetary funds | 1714 | 33 | 238 | 191 | 3949 | 2805 |
| foreign investment, incl. foreign credits and loans | 1824 | 7.582 | 15225 | 29919 | 32118 | 29948 |
| funds of other organisations | 24421 | 37135 | 48478 | 85780 | 110048 | 126024 |

Source: National Statistical Committee: Science and innovation activity in the Republic of Belarus 2015

Belarusian universities and research centres have diversified the sources of funding for innovations by setting-up new organisational units, be it internally (e.g. National Academy of Sciences with the different institutions and enterprises subordinated to the NAS), or through improving linkages to external organizations to establish new support infrastructures like Techno-parks, incubators or start-up centres.

For the *National Academy of Sciences of Belarus* (NAS), innovation is on top of the agenda. The main changes since 2010 relate to the implementation of new legislation and regulation. In this regard, the adoption of the law on innovation activities and the presidential edict on commercialization of scientific research resulted in a significant impact on innovation activities in the country[[12]](#footnote-12) .

For instance, as *the* institution still carrying out the bulk of R&D in Belarus, a gradual shift has been made since 2010 from scientific research activities (basic research) to scientific-technical research projects, which are more applied oriented and pursue the goal to provide services for innovation. Due to the existence of commercial enterprises within the NAS sphere (in total, there are 122 different organizations subordinated to the NAS – institutions and enterprises), NAS seeks to encourage own production[[13]](#footnote-13) and to facilitate access to external support for the export of science-based production.

Within the context of a gradual change of NAS from being a purely scientific organization to a more applied organization, *72 innovation centres/clusters have been established* to link scientists and consumers. The rationale behind this approach is that research results are transferred to industry as soon as the results meet the demand. NAS was also involved in the establishment of the new innovation and technology park “BelBiograd” (see below).

With regard to *higher education institutions, universities and facilities*, recent legislative and operative changes put emphasis on strengthening industry-science linkages, for instance by supporting internships, affiliates of university chairs in companies or the creation of joint laboratories with several companies. Furthermore, researchers and student can participate in innovation competitions and can create start-up centres. Four of the seven Techno-parks (see below) are based at universities.

A milestone in recent legislation is that universities are allowed to establish small companies to transfer technologies to the market. The Belarusian State University (BSU) for instance has 9 unitary enterprises as separate legal entities. Furthermore, BSU – and other universities - has a number of production facilities, and also provides research results to existing enterprises and institutions in Belarus. The nine production units at BSU generated a value of 20 million USD in 2015. There is a central fund at BSU, which is used to develop research and new production units. The budget of the fund comes from the companies in BSU`s Techno-park. The companies do not pay rent for the premises, but allocate a share of revenues to the central fund.

Under current regulation the owner of IPR is the Ministry of Education, not the university. However, in all cases the rights are transferred from the Ministry to BSU within the context of a contract agreement. Ownership stakes are divided on a 50:50 ratio between the BSU and the Ministry of Education. The Department of Protection of Intellectual Property is responsible for the management of scientific and innovative activity at BSU, providing legal protection of intellectual property, patent and licensing organization and rationalization of work, and assessment on intellectual property. However, despite some progress in the field of IP legislation in Belarus, there is still no clear-cut mechanism of sharing IP related profits between the contacting party and the developer or inventor.

*Innovation support institutions – the intermediary system*

Apart from the innovation financing institutions (Innovation and Venture Funds, Development Bank) and public innovation related institutions (e.g. State Committee of Science and Technology, National Centre for Intellectual Property), Belarus over the last 5-10 years has established a complementary infrastructure to promote innovation and technology transfer. The promotion of an innovation infrastructure is – according to the State Programme on Innovation Development 2016-2020 - geared towards the realization of the innovation cycle in its entirety, from the invention to market products.

Regarding the Techno-parks[[14]](#footnote-14), the *High-Tech Park* in Minsk the last five years continued to grow impressively. Already a success for quite a while, several technology based enterprises have recorded impressive growth more recently on the international market. Statistics can illustrate the dynamic development of the park. Especially since 2010, significant progress occurred: sales have nearly quadrupled, the export sales show an even more dynamic development. Currently, the total number of employees amounts to 24.037, which is more than twice as much as in 2010.

Table X: Development of the High-Tech Park of Belarus: Some Basic Figures

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2006 | 2010 | 2015 |
| Sales (in 1.000 USD, current prices) | 28148.3 | 197940.9 | 792913.1 |
| Export Sales (in 1.000 USD) | 21859.0 | 161007.4 | 705630.4 |
| Domestic sales (in 1.000 USD) | 6378.9 | 35823.2 | 67433.3 |
| Imports (in 1.000 USD) | 299.8 (2007) | 801.7 | 3325 |
| Total number of employees (Head Count) | 2506 | 9421 | 24037 |
| Number of new employees (Head Count | 795 | 1577 | 3042 |

Source: Belarus High-Tech Park

A new initiative within the High-Tech Park is the foundation of a modern *incubator*, which offers support services for companies in their pre-seed or seed-phase. The innovation support services performed by the incubator/High-Tech Park include pre-incubation, hackathons, matchmaking in early stage fund-raising (e.g. provision of informal venture capital by business angles), trainings regarding IP issues, taxation, business planning, basics of marketing and promotion. In 2015, the incubator started a programme to launch business ideas. Form 100 ideas 7 promising projects have been selected, which became residents of the incubator.

Regarding regulation, no changes have been conducted by the Government since 2010. The idea to expand the Park to include other technologies like nanotechnology, medicine technology, biotechnology, was, however, replaced by the alternative to set-up a separate organisation in these fields. The National Science and Technology Park “BelBiograd” is one such example.

On the basis of the experience with the High-Tech Park, plans have been developed to establish a second, similar Park with a focus on biotechnology at the National Academy of Sciences. The planned *National Science and Technology Park “BelBiograd”* will be founded using the same principles than the High-Tech Park. The objective is to create favourable conditions for the rapid development and high competitiveness of the biotechnology, pharmaceutical and nanotechnology industries, to attract investment for the commercialization of research and development results and to introduce high technologies and production of innovative products. The target group of the park will be companies which carry out fundamental and applied research, experimental design, research and technology, experimental development, design, implementation and development of high technologies aimed at the production of innovative products, materials and equipment. Like the High-Tech Park, BelBiograd will be endowed with an incubator for small businesses.

Another main organisation within the intermediary system of Belarus is*the Republican Centre for Technology Transfer (RCTT),*which has already been founded in 2003 under the auspices of the State Committee for Science and Technologies and the National Academy of Sciences of Belarus. RCTT`s primary objective is to promote the cooperation between developers and users of high technologies and potential investors. The services are offered to domestic actors involved in innovation activities as well as foreign companies and investors.

Recent changes of RCTT relate to the setting up of a separate division inside the centre, which deals with fairs and exhibitions to present the scientific results on the national and international level. The centre directly reports to the chairman of the Academy of Sciences. The general scheme is that the centre develops priority areas for scientific research, which are approved by the Council of Ministries.

In the last 5-6 years, RCTT enlarged its international partner network considerably: in 2011 the structure included 26 branches and 5 divisions (with 2 offices in China). As of March 2016, 32 branches are included, with 82 foreign partners in 28 countries. Similarly, the National Academy of Sciences has established of a new tier of 72 centres at the end of 2015 supporting the commercialization of NAS scientific results.

The *Techno-park at the Technical University (“Polytechnic”)* is explicitly mentioned in the State Programme on Innovation Development 2016-2020". Polytechnic is not a classical Techno-park (like the High-Tech Park), rather than a scientific research organization with different locations. It was founded to commercialize the results of scientific and technical activities of the Belarusian National Technical University (BNTU). The establishment of new innovative enterprises as well as the generation of innovations are the main objectives of Polytechnic. Its activities are strongly connected with complementary priorities of BNTU.

In addition to the parks described so far, the *Minsk City Industrial Park* was founded in 2011 and has around 30 companies. It includes shared labs to facilitate the collective use of equipment. There is a submarket rental rate, a lower corporate tax rate (10 per cent) and exemptions from local taxation. The resident companies are among others engaged in applied electro-optical technologies, data protection systems, aircraft industry and navigation technologies, and nanotechnologies. The park is currently expanding with the construction of a manufacturing building.

Finally, the Government has launched another new project in the last five years: the Belarusian-Chinese Big Stone Techno-park, which is intended to include start-up support. The park will host high-tech and export-oriented companies in electronics, biomedicine, fine chemistry and engineering. Incentives for companies are exemptions from profit, land and real estate taxes granted to all Park`s residents for its first ten years. In addition, the income tax of the employees will be lower than for non-park employees.

Chapter 3: measuring innovation performance

This chapter explores the position of Belarus in different international rankings from the perspective the technology upgrading and growth potential. Belarus is a European country with economy in transition which has managed to significantly preserve its inherited manufacturing capabilities. When compared to 1981, the country’s GDP increased by 2.4 times in 2015. However, the growth of Belarus has significantly slowed down since 2010, and it is not clear that the economy will be able to repeat its previous growth rates. This trend may be strongly impacted by the overall slowdown in the EU and Russia, which have affected Belarus as well. Still, the growth determinants of the Belarusian economy in the future remain uncertain.

In the majority of the European ex-socialist economies, the transition process has been characterised by deindustrialization. Belarus is unique in that respect as it has not deindustrialized to that extent as the share of industry is still above 40 per cent of GDP. This is quite important as the industry is still the main locus of R&D and innovation activities. However, although the level of productivity in Belarusian manufacturing is above CIS economies, it is five times lower than Austrian, 2.5 times lower than in Czech R and two times lower than in Israel. It is interesting that Israel despite being successful high-tech economy has not spread its technological achievements into the rest of manufacturing to the same extent (see Table X). This is a very important lesson for Belarus, which has an aspiration to become high-tech economy focused on ICT.

Table X: Average rate of change of manufacturing value added per capita



Source: UNIDO Industrial Performance Index database

Dynamics of productivity in manufacturing in Belarus is highly uneven which suggest that it is driven by cyclical factors rather than by steady productivity improvements based on new technologies. Although t Belarusian performance in that respect has been above other CIS economies, Belarus has faced dwindling export opportunities in the period post-2008. Overall, the performance of Belarus has been satisfactory regarding growth and productivity. However, its future growth based on productivity and innovation is uncertain. Its preserved industrial capacity needs rejuvenation given the changing nature of the industry where increased service and knowledge content together with automation are changing its nature.

*Benchmarking of Belarus’ NIS:*

The improved international ranking is explicit policy aim of Belarus’ authorities. The NSSID-2030 has targeted reaching improved positions in several of indexes and ratings until 2030. Specifically, the following targets are proposed to be achieved: top 40 countries in HDI; top 30 in Doing Business index; top 30 in ICT index. Also, in 2011, the Council of Ministers established target to enter by 2015 into the top 30 countries of Global Competitiveness Index (GCI); the top 50 countries of Index of Human Development; and the top 70 countries of Economic Freedom Index.

A motivation behind the policy target to improve country’s ranking on a specific index represent a genuine wish to improve country’s performance by taking easily understood benchmark. Also, benchmarking is useful for policy purposes as it provides an international perspective on the position of the country. If used in a smart way it can provide critical and unbiased view of country’s strengths and weaknesses. However, comparisons at face value or without understanding of the underlying conceptual approach, and country differences in terms of levels of income and institutional differences may lead to misleading or irrelevant policy conclusions.

Firstly, indicators are always poor proxies of the real processes, strengths and weaknesses. They are approximations of underlying categories and thus cannot always be used as direct policy targets. For example, increasing R&D in the context of limited local demand for RD may lead to R&D capacities for which there is not real demand. Also, composite indicators and international rankings tend to homogenise and standardise drivers of growth which are very much country, technology and income level specific. For example, innovation rankings ignore far too much non-R&D and non-innovation drivers of productivity and growth which are paramount for middle-income economies.

With this caveats, it is useful to provide an assessment of Belarus position in certain ranking that could enlighten some of the existing challenges affecting the country’s NIS. For instance, the Global innovation index (GII) is comprehensive statistical framework which gathers data from more than 30 sources, covering a vast spectrum of innovation drivers and Its conceptual framework stands on 8 pillars which include inputs (institutions, human capital and research, infrastructure, market sophistication, business sophistication) and outputs (knowledge and technology outputs and creative outputs)[[15]](#footnote-15).

Figure 7 compares Belarus in different dimension of the Global Innovation Index to its three types of peer economies: high income aspiration peers (Austria and Israel), two ex-transition economies of Central Europe (CE) (Poland Czech R), and three CIS economies (Russia, Ukraine and Kazakhstan).

Figure 7: Relative position of Belarus in Global innovation index 2015 in relation to three tiers of comparator economies: aspiration peers, central Europe, and CIS (expressed in GII scores)



Source: Global Innovation Index 2015

The main gaps between Belarus and high-income peers (Austria/Israel) are substantial in all dimensions except for a much smaller gap regarding market sophistication, which includes proxies for credit, investments and trade and competition conditions. When compared to high-income peers Belarus has disproportionally worse credit constraints, as opposed to very favourable trade and competition conditions.

However, the innovation capacity is driven not only by the quality of markets but also by the quality of institutions, infrastructure, human capital and business. When compared to two Central European (CE) peers Belarusians firms face much stronger constraints regarding institutions and business sophistication. This latter dimension includes knowledge intensity of the economy, innovation linkages and knowledge absorption proxies. So, despite better position regarding human capital, Belarusian firms’ face other constraints which undermine their innovation capacity.

The biggest gap between Belarus and its high income and CE peers is in terms of institutions. This factor is in GII decomposed on three dimensions: political, regulatory and business environment. Belarusian business faces business constraints (ease of starting business, of resolving insolvency and of paying taxes) that are not that much different from other peer economies. So, the real differences in terms of institutions are mostly confined on differences in political (political stability, government effectiveness) and regulatory environment (regulatory quality, rule of law and costs of redundancy dismissal).

Belarus also ranks very high regarding human capital and research factors. However, this aggregate hides excellent score in terms of education (education expenditure, government expenditure per pupil, school life expectancy[[16]](#footnote-16), PISA results, pupil-teacher ratio in secondary education) and tertiary education (tertiary enrolment, graduates in Science and Engineering, tertiary inbound mobility[[17]](#footnote-17)) and the lowest position in relation to all peers in terms of R&D (Researchers, GERD, QS university ranking of top 3 universities) (figure 10). This gap between high ranking regarding education and low R&D capacity is a very important structural feature of Belarus, which has a strong impact on the level and nature of innovation capabilities.

Figure 10: Relative position of Belarus in relation to peer economies in terms of GII human capital and research dimensions



Source: Global Innovation Index 2015

The technological upgrading towards knowledge-based activities and high productivity industry based on IT skills depends much more on ICT infrastructure rather than on only physical infrastructure. GII data show that Belarusian general infrastructure[[18]](#footnote-18) is much better when compared to its ICT infrastructure. In fact, when compared to its human capital indicators its ICT is lagging behind despite the emerging islands of growth around software industry. This is quite important as it shows that the software industry may be constrained in its future growth by poor local ICT environment infrastructure which in GII framework is measured by ICT access, ICT use, government’s online services, and online e-participation. Finally, resource efficiency and ecological sustainability are not only public goods but also a complement to knowledge-based growth. In that respect, Belarus is lagging behind and is just slightly ahead of its three CIS peers[[19]](#footnote-19).

Figure 11: Relative position of Belarus in relation to peer economies in terms of GII infrastructure dimensions



Source: Global Innovation Index 2015

In conclusion, Belarus is the most similar to its three CIS peers where it scores very similar regarding institutions, business sophistication, and creative outputs and is ahead of them regarding human capital, infrastructure, market sophistication, and knowledge and technology outputs. In overall, this results in a slightly better score of the country on the GII Index when compared to its CIS peers.

Another ranking, the EU Innovation Scoreboard (IUS), has become a dominant metrics for measuring the progress of EU economies regarding their innovation performance. Its longevity, comparability, and comprehensive coverage have made it standard composite indicator within the EU but also its coverage has spread to other economies. However, we should not forget its limits which are largely in its strong focus on R&D based growth and neglect of other innovation modes which are based on production practices, users’ involvement and engineering[[20]](#footnote-20).

Belarus is not monitored through IUS. However, Belstat has produced 16 IUS indicators based on which Belarus can be compared to the EU. This leaves nine indicators that are not yet available for full comparisons. However, even this partial comparative picture offers very policy-relevant insights.

The IUS considers human resources as one of the key enablers of innovation and in that respect Belarus shows the uneven picture compared to its EU peers. Belarus scores the best regarding the secondary level of education but much less well on tertiary and new doctorates. In the somewhat simplified manner, we can conclude that country is well endowed regarding blue collar skills; it is satisfactory endowed regarding white collar skills but much less so regarding R&D competencies.

A comparison with its EU peers further confirms very low investments in R&D by business and by public sector even when we take into account differences in income levels (figure 13).

Figure 13: R&D expenditures in Belarus and the EU peer economies



Source: Science and innovation activity in the Republic of Belarus, 2015, Statistical book, National statistical committee of the Republic of Belarus, Minsk 2015

Also, GERD has not been increasing but remain at the level of around 0.7 per cent of GDP for the last 20 years (see figure 14). This reflects a lack of strategic approach towards the greater role of R&D in innovation and absorption of foreign knowledge.

Figure 14: GERD as a percentage of GDP



Source: UNESCO S&T statistics database

Unlike Russia and Ukraine, which had to downsize their R&D activities radically during the transition period the shock of the 1990s was much less felt in Belarus R&D as its share of R&D personnel in the labour force has remained at 7 per cent, similar to Poland (see figure 15). This leaves Belarus with the size of R&D sector that seems far too small if it is to grow based on R&D and technological capability.

Figure 15: Total R&D personnel per thousand labour force (Head Count)



Source: UNESCO S&T statistics database

However, what makes Belarus exceptional is that relatively small R&D sector is very strongly oriented around business enterprise sector. The difference with Poland which is very similar regarding relative investments and labour force in R&D is striking. Sixty-four per cent of Belarus R&D personnel are in the business sector (BES) while in Poland it is only 20 per cent according to the UNESCO S&T statistics database. This trend is of recent origin as ten years earlier R&D orientation towards BES was strong but not pronounced to that extent as of today.

Only 26 per cent of Belarusian manufacturing firms’ conduct in-house R&D activities in manufacturing compared to 33 per cent Polish firms at the similar level of relative R&D expenditures (figure 17). The gap is even bigger in training activities where the frequency of these activities is well below Poland. Belarus firms also rely less on external R&D. This feature is even more striking if we take into account that industry structure of Belarus is characterised by much higher share of big business which is usually by and large R&D active.

Figure 17: Share of manufacturing firms that are engaged in in-house, and contract RD and training activities, 2012



Source: UNESCO database

However, as already pointed out in the first innovation performance review of Belarus (UNECE, 2010), when compared to other countries, local firms are innovation-active. Figure 18 below shows that share of innovative companies and the commercial importance of innovation is above Poland and Russia in both respects. Although with a lower share of innovative firms when compared to other EU peer economies the business relevance of innovation activities of Belarusian firms is higher than in Slovenia, Ireland, and Austria. So, Belarusian firms are innovation-active, but the nature of their innovation activities is very much non-R&D oriented (see Table 7).

Figure 18: Frequency vs. commercial importance of innovations, 2014 or the latest available year



Source: Science and innovation activity in the Republic of Belarus, 2015, Statistical book, National statistical committee of the Republic of Belarus, Minsk 2015

Table 7 below shows that innovation activities of Belarus firms are characterised by exceptionally high share of non-R&D innovation expenditures. So, innovation in Belarus is largely about the acquisition of equipment and machinery rather than about intangible activities like R&D and training (see also chapter 4). When Belarus firms innovate their innovation activities are production oriented, i.e., geared towards improved manufacturing processes (see also Table 9 below).

Table 7: Non-R&D innovation expenditures as share of turnover in Belarus and EU Peers

|  |  |
| --- | --- |
|  | Non-R&D innovation expenditure as % of Turnover |
| Belarus | 1.9 |
| Poland | 1.02 |
| Czech Republic | 0.69 |
| Slovenia | 0.56 |
| Spain | 0.39 |
| Austria | 0.35 |

Source: Science and innovation activity in the Republic of Belarus, 2015, Statistical book, National statistical committee of the Republic of Belarus, Minsk 2015

These features of innovation activities are further explained by the fact that innovation activity in Belarus is confined to a small circle of large enterprises. IUS data show a striking feature of Belarusian innovation system which could be described as a ‘black hole’ – a very low share of SMEs that are innovators and that are engaged in any innovation activity (see figure 19). This feature is very strong when compared to all EU peer economies.

Figure 19: SMEs innovative activities: a big ‘black hole’ in Belarusian innovation activities 

Source: Science and innovation activity in the Republic of Belarus, 2015, Statistical book, National statistical committee of the Republic of Belarus, Minsk 2015

This structural deficit in the spectrum of innovation activities may have strong effects on dynamics of innovation activities. First, it shows the lack of small specialised suppliers and the lack of diversity of innovation efforts. These two roles are usually those that cannot be fulfilled by large enterprises. Second, it shows very limited scope for ‘creative destruction’ or opportunities for takeovers of technologically promising small firms by large firms and the scope for experimentation which is possible only at the SMEs level. Finally, it reduces the scope for autonomous and generic expansion of SMEs given a tiny share of innovative SMEs.

So, when compared to other ex-transition economies, especially central European, Belarus is distinct in that it has preserved the organisational capabilities of large firms which are drivers of innovation and R&D activities in developed economies. However, in Belarus, these firms cannot rely on the range of SMEs as specialized suppliers and as co-creators of industry dynamics. So, preservation of organisational capabilities of large firms has been paid by the lacking dynamics of interactions between large and small businesses.

Another important benchmarking instrument is the WEF Global Competitiveness Report. Belarus is not yet part of this system which deprives it of important benchmarking insights and profile. However, as part of its efforts to benchmark itself internationally at least in some components of the WEF GCR framework government has been regularly funding a study which uses WEF data and criteria in positioning Belarus regarding innovation capacity.

Table 8 shows results of the part of WEF survey for 2015 conducted by Belisa, which is by and large based on subjective assessment of the business community. This survey has not been verified by the WEF team, but authors have tried as much as possible to comply with the requirements of the survey and it could be used as a valid comparative tool. It shows the position of Belarus within the context of peer economies regarding several critical dimensions of innovation capacity. Indicators are a mixture of ‘hard’ indicators and rankings from 1-7 in the case of subjective assessments. After considering the relative position of Belarus in relation to its peers as well as on absolute values of evaluations, the following can be concluded.

First, although in absolute terms Belarusian firms evaluate the availability of the latest technologies and firms level technology absorption as satisfactory (assessments are around 4.17 mark) in relative terms, this puts Belarus at the bottom end of the peer economies. Second, the biggest lag of Belarus is regarding companies spending on R&D (only 2.92) which shows that despite a high relative share of R&D expenditures in BES this is far from satisfactory given a very low overall share of R&D expenditures in BES. In this respect, Belarus is quite similar to Poland. This also shows that subjective assessments by a business community well reflect hard data on R&D expenditures in BES. Third, a striking fact is that business perceives that there is a quite high availability of scientists and engineers in the country, but this does not seem to convert into satisfactory collaboration with universities or the quality of scientific research institutes. On the other hand, this may not be a surprise given very low spending for R&D at universities despite several successful attempts to commercialise R&D results through spin-off companies. This is quite worrying as it suggests that R&D institutes are not geared towards needs of the business sector. However, given that Belarusian R&D is by and large oriented towards corporate sector this seems quite counterintuitive and deserves further scrutiny. Finally, Belarus is very marginally involved in world frontier technology activities as demonstrated by extremely low PCT patents per capita. This is partly due to poor IPR protection system and weak government procurement policy but is mainly due to production orientation of Belarusian R&D. Belarusian innovation effort is much around domestic technology effort and production activities than about R&D and technology activity as an independent source of growth. Similar to Russia and Ukraine, the impact of FDI on technology transfer is also low mainly due to low share of FDI.

Table 8: Belarus in ‘innovation part’ of WEF GCR 2015



Source: BELISA 2015 Innovation and Company Survey

The overall conclusion of the comparative analysis of Belarus’ performance in international rankings is three-fold. First, the potential for technology upgrading of Belarus is very firmly rooted in the CIS growth model and thus shares with countries in this region (e.g. Russia, Ukraine and Kazakhstan) several structural features. These economies are characterised by weak production capabilities, weak firm differentiation, marginal world technology frontier activities, and isolated R&D systems. Second, the gap between developed and Central European peers is the biggest in the intensity of technology upgrading as reflected in low production capability, R&D and technology capability. Belarus does well regarding infrastructural (human and physical capital based) but lags regarding lacking structural change and firm-level capabilities. Third, similar to the CIS peers Belarus lags behind regarding intensity of interaction and knowledge exchange with the global economy. It is outside of GVCs, has a low share of FDI though post-2008 it becomes more similar to its peers. It is encouraging that its share of ICT is growing and may become a major driver of macro growth if this sector continues to expand.

*Identifying strength and bottlenecks in Belarus’s innovation performance from a micro-level perspective.*

A national system of innovation of Belarus is very much oriented towards production capability or supporting problem-solving in the business enterprise sector. There is extensive support for new technology-based firms (NTBFs), but these efforts have not yet been reflected in any comparative indicators except in the export of ICT services. Nevertheless, NTBFS are vital as knowledge brokers and specialised suppliers. Their growth is eventually dependent on the growth of large firms especially given that “gazelles” type of NTBFs are still in their early stages of internationalisation with only a few high-profile exceptions.

The production orientation of public R&D is visible in the high share of applied R&D at universities, through a very low proportion of blue sky basic research and close links between companies and universities as well as through commercialization activities of universities. The downside of this is neglect of research excellence at both universities and Academy of Sciences. It seems that the Belarusian R&D system is very much downstream oriented when compared to its peer countries like EU new members states.

Business sector does not have developed in-house R&D and in that respect, the extramural R&D (Academy and universities) plays a role of knowledge-intensive service industry while branch R&D typical for Soviet R&D system and still present in post-Soviet context is de facto not very developed. Business sector R&D is largely funded from public pursue, which together with very limited own R&D at universities and academy creates active but technologically not very dynamic R&D system. The production oriented R&D system is further reinforced by the low-risk approach to public funding of R&D where guaranteed return on budgetary funds is sine qua non.

Since the time of the first Innovation Performance Review, there has been further strengthening of NTBFs path of technology upgrading of Belarus which is to be praised. This is visible through strengthening of two major technology parks and through successful operation of NTBFs and their good performance in export. This is coupled with state support through financial and other incentives. However, a pending challenge is to enhance the other path (large enterprises) and to promote complementarities between two paths.

A new perspective argues that it is an innovation ecosystem rather than NTBFs or large firms per se that are driving innovation. In other words, large firms (such as Apple) interact with small technology-based firms (such as software companies developing apps for Apple products) which innovate based on large enterprises’ stable technology platforms (Mandel, 2011, p.6 ).

Research shows that high growth firms are not necessarily high-tech firms and the capacity of policy or a state modernization project to target such firms is expected to be quite low. An alternative objective would be to think of NTBFs as new actors in industrial and knowledge system which can foster structural change and productivity growth through linkages with other firms. NTBFs may not be high growth firms themselves but act as knowledge suppliers to other enterprises i.e. as specialised suppliers.

Overall, the majority of NTBFs are not a direct and independent source of growth, but rather an indirect source of new knowledge, employment and value added. They require a market (users) for the new technologies produced. The main drivers for the growth of NTBFs are large firms provided that they are innovation oriented. So, instead of only focusing on NTBFs Belarusian RDI policy should focus much more on how to enhance innovation behaviour of large firms. These issues include reconsiderations of corporate governance, competition policy and strengthening links between large and small firms and the inclusion of large firms into global and EU value chains as subcontractors.

The centralization of innovation fund is a great opportunity but equally carries its risks. Its advantages are that funds will not be locked into individual ministries, but there will be more opportunities for reallocations, investments in new areas and thus potentially more structural change. Also, centralization may enable concentration of project competencies and their improvement. On the other hand, risks of poor implementation may lead to much higher overall costs if the unified system does not work effectively.

*Statistics collection*

The first innovation policy review of Belarus had recommended the Government to update its methodology for the collection of innovation statistics with the goal to follow internationally agreed standards in similar areas of statistical practice. Such reform would improve the benchmarking of national innovation performance levels across a broad range of EU and non-EU countries based on a common methodology. In order to introduce important components of internationally-accepted standards, the following measures were proposed:

* adoption of a R&D survey according to the OECD (2002) Frascati Manual, Proposed Standard Practice for Surveys on Research and Experimental Development;
* adoption of the system of monitoring of Government budget appropriations for R&D (i.e. GBOARD which monitors budget spending on S&T based on socio-economic objectives);
* Introduction and harmonization of Innovation Survey Statistics based on the OECD/European Commission (2005) Oslo Manual, Guidelines for Collecting and Interpreting Innovation Data;
* harmonization of Science and Technology Statistics with guidelines in the OECD (1995) Canberra Manual on the Measurement of Human Resources devoted to Science and Technology (S&T);
* and benchmarking the scope within the framework provided by the Community Innovation Survey (CIS) 2008 that is used in the EU for statistics on innovation activities of enterprises.

In addition, to achieve better comparability of the national innovation and R&D statistics it was also recommended to gradually introduce, harmonize or update a number of major classifications which serve as a basis for S&T and innovation statistics, including in the system of national accounts, education, labour, trade as well as on various activities classifications and nomenclatures (see IPR, 2010 p. 18-19).

During the period 2011-2016, the National Statistics Office (Belstat) made significant progress to better align national systems with international practice in line with the recommendations of the report. Important reforms were undertaken, including the adoption of indicators consistent with the EU Innovation Scoreboard and regular innovation surveys at the firm level.

With a view to improve the comparability of statistics, international standards were adopted to improve conceptual definitions, methodologies and approaches in the study of innovation. In particular, guidance by the Organisation for Economic Cooperation and Development (OECD), Eurostat, as well as the UNESCO Institute for statistics was used as a source. Accordingly, new definitions for the gathering of statistics were adopted including the following: definitions of what is innovation (with examples of product, process, organisational and marketing innovation); explanations of the components and range of innovation; and harmonization of existing questionnaires with international practice.

As a result, the questionnaires now contain both quantitative and qualitative data requests about the innovative activity of firms, including classification by type of costs, sources of financing and the impact of innovation on productivity. Also addressed are factors hindering innovation, as well as the ecological aspects of innovations. Given the priority of industrial production in the economic structure of Belarus, the population for the innovation surveys consists of firms belonging to the manufacturing and services sectors (i.e. communications and computer technology).

With regards to international comparisons, work was undertaken to produce indicators that allow for the comparative evaluation of Belarus with the other countries covered by the EU Innovation Scoreboard Union (IUS). Statistics are developed annually and published for 16 of the total 25 indicators.

Finally, methodological harmonization was undertaken to update forms used for statistical reporting by institutions carrying out research and development. At present, the objects of statistical observation are legal entities– and their subdivisions with separate balance sheets- that undertake research and development activities during the year under review. Basic concepts and definitions as well as the institutional classification (i.e. by sector, subject and type of scientific activities) are now based on guidance from the OECD Frascati Manual. The manual was also utilised to harmonize measures of internal research and development expenditures and financing.

Other reforms were also adopted in innovation related statistics. Regarding, the preparation of statistics of the national accounts, the system of national accounts-SNA-2008 was adopted; for education related statistics, the UNESCO International Standard Classification of Education of 2011 was implemented. With regards to labour, Belstat refers to the international classification of occupations contained in the OECD labour statistics of 2007. Reforms were also undertaken on the nomenclature of economic activities and products. Since 1 January 2016, national classifications were harmonized with the latest relevant international versions: by activity (NACE 2008), and by product (CPA -2008). Finally, regarding trade, the commodity nomenclature of economic activities in Belarus was harmonized at the level of the six decimals standard of international trade classification and description of goods and coding of the WTO.

In spite of all the positive efforts to upgrade methodologies and mechanisms for statistics collection, it should also be noted that some important constraints remain in place that need to be removed in order to fully align the measurement of innovation performance with international standards as well as to improve the comparability of national statistics. For instance, with regards to the the preparation of the national innovation survey, although it is formally in line with the Oslo Manual and Eurostat's community Innovation Surveys, there are some substantial differences. With regards to its coverage the Innovation survey used by Besltat is limited. It is focused only on the firms' R&D expenditure and innovation output (i.e.

sales of innovative products), but it does not cover some of the most critical aspects of modern firms' innovation activity as it is the case according to international best practice.

This problem can be best perceived when contrasting the coverage of BelStat's questionnaire with the CIS Harmonised survey questionnaire. Some key subject areas of the innovation process are missing from the questionnaire used in Belarus, including the following aspects:

whether innovations are developed internally or in cooperation with other institutions; whether the innovations are new- to-the-market (i.e. frontier innovation) or new-to-the-firm only (i.e. imitation); the scope of novelties (e.g. local market, regional market, world market); the type of firm’s innovation activities (e.g. in-house R&D, external R&D, acquisition of technology or knowledge, training); type of benefits from public support to innovation; sources of information and co-operation for product and process innovation and collaboration with other innovation stakeholders; and the protection of intellectual property by firms.

Another challenge concerns the population of the national innovation survey in Belarus. As it was mentioned, the questionnaires are distributed only among firms in the manufacturing and high-tech services. By contrast, Eurostat's practice is to cover a representative sample of firms from all sectors. In the most recent surveys, public sector organisation have also been covered as part of a section devoted to public sector innovation.

With regards to other aspects of measuring innovation performance, the Government has not yet adopted the system of monitoring of Government budget appropriations for R&D (i.e. GBOARD, which monitors budget spending on S&T based on socio-economic objectives), neither has it harmonized the available Science and Technology Statistics with modern guidelines in this field (e.g. the OECD (1995) Canberra Manual on the Measurement of Human Resources devoted to Science and Technology (S&T), and the Frascati Manual).

Since 2010, there has also been progress in the collection of world statistics which may also have an impact on the measurement of innovation. For example, the rise of regional and global value chains has contributed to the emergence of an international project on world input-output tables and trade in value added by OECD/WTO that can help inform government strategies on potential benefits and risks of participation in such types of international production. Other more traditional business statistics have also been improved, including the Structural Business Statistics (SBS); Trade by Enterprise Characteristics (TEC), Entrepreneurship Indicators (Business Demography, BD), and Foreign Affiliate Trade Statistics (FATS). Each of these sources of statistical indicators are required for the better understanding of innovation aspects of trade as well as modern entrepreneurship.

Chapter 4: innovation in the enterprise sector

Since the beginning of the transition period, many enterprises were reorganized. Still, fully or significantly Government controlled firms dominate the economic landscape. During the Soviet era, these were large conglomerates (kombinats) of enterprises with strong inside (autarchic) vertical linkages and with very limited, if any, horizontal connections. In recent years, some of these kombinats, which existed under the legal form of republican unitary enterprises,[[21]](#footnote-21) were transformed into joint stock companies with the goal to attract private investment. However, their shares have usually remained state-owned. These firms also have tight links to the supervising ministry, which limits decision-making by business interests.

The majority of organizations that belong to the large public sector use mid-20th century technological modes; their economic management is still hierarchical, and the linkages predominantly vertical between ministries and economic entities. Reorganisation has hardly changed the traditional high degree of concentration which produced many production monopolies. The competition level is still low; and small and medium-sized businesses are developing only slowly[[22]](#footnote-22).

In Belarus many firms are facing the problem of inadequate modernization of equipment. Some of these have a monopoly position in the Belarusian market, which makes them reluctant to innovate. Indeed, competition from imported products is not a strong pressure on local firms. Another factor is that very few large companies are interested in producing knowledge-intensive products. As it was shown in the fact finding mission, large firms prefer to self-finance their modernization and innovation because of the still developing financial market, the scarcity of incentives for innovation and the shortage of funds for governmental programmes. (see case study 1).

The adjustment of Belarus organisations to the increasingly borderless open innovation system is still slow. FDI is limited and neighbouring countries as investors are not sending strong impulses for innovation. Some positive examples for encouraging and supporting innovation and FDI may be seen in in Hi-Tech Park. (See chapter 2). Another positive example of internationalisation is the case of Polimaster spin-off firm from research institute that became a privately-owned internationally group of companies (See Case study 2).

Most spin-offs were created from university faculty or scientific institute. These firms are working in University/Academy-linked technology parks and they were encouraged to continue their commercialization activities in the parks. The key employees of these small firms continue their work at the scientific organisations. The advantages to be in University /Academy linked technology parks are the preferential treatment for residents, such as: lower corporate tax, subsidized or free residential and rental costs, low or near-zero rate local taxes (vary by region), and access to budget funding.

A third case study (Polimag) is a government-owned small company that spinned out from an Institute of Academy and is working in a university linked technology park.

*Findings from quantitative survey analysis*

In addition to the interviews undertaken in the context of the fact finding missions, the analysis of quantitative information can help understand the key challenges to innovation from a broader perspective. The *Belarus innovation survey* has provided important information shedding some light on current processes characterising the innovation performance and behaviour of business organisations. BelStat innovation survey focuses mainly on large- and medium-sized organisations. In 2013, of 411 innovation active organisations, roughly 270 were large.

Table 8. Indicators of intramural innovation and industrial activities

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Indicators* | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Number of innovation-active industrial organisations | 324 | 443 | 437 | 411 | 383 | 342 |
| Share of innovation-active organisations in total industrial organisations surveyed, % | 15.4 | 22.7 | 22.8 | 21.7 | 20.9 | 19.6 |
| Share of shipped innovative output in total industrial output shipped, % | 14.5 | 14.4 | 17.8 | 17.8 | 13.9 | 13.1 |

Source: BelStat Science and Innovation Activity in the Republic of Belarus, Statistical Book, National Committee of the Republic of Belarus, Minsk 2015, table 6.1. and BelStat letter 20/04/2016

Table 8 shows indicators of innovation at the firm level in recent years. The number of industrial active organisations and their share to total industrial organisations has jumped from 2010 to 2012 but started to decline in 2013. The share of innovative firms among industrial organization showed the most impressive progress, increasing from 15.4 to 19.6 per cent. On the other hand, the share of shipped innovative output showed some minor fluctuations between one and three per cent above or below the average of 14.5 per cent in 2010.

Innovation performance may be characterized by one output indicator: the proportion of innovative output to total sales. In the industrial sector, this figure was 14 per cent in 2014, slightly less than in previous years. A large share (60 per cent) of innovative output was exported and 66 per cent of this went to CIS countries.

With regards to the sectoral characteristics of the enterprises, high-tech sectors and emerging sectors are usually more innovative than other sectors. For Belarus the ICT sector is the "innovation driver" and nuclear physics-related sectors are also good performers in novel innovation. The statistical indicators are available only for main sectors on R&D and innovation (table 11). Among selected manufacturing industries the number of innovative firms seems stable or slightly increases over time.

Table 11. Number of innovation active industry organizations in manufacturing and other selected sectors (in 2010 and 2015)

| Sector | Number of organizations | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Surveyed organizations, units | Innovation-active engaged in | | | Surveyed organizations, units | Innovation-active engaged in | | |
| technological costs (product and/or process) innovation | technological, organizational costs, marketing innovations | | technological costs (product and/or process) innovation | technological, organizational costs, marketing innovations | |
| *2010* | | | *2015* | | | |
| Industry total | 2103 | 324 | 381 | | 1745 | 342 | 369 | |
| mining industry | 32 | 5 | 5 | | 31 | 3 | 4 | |
| production and distribution of electricity, gas and water | 191 | 6 | 9 | | 180 | 9 | 9 | |
| processing | 1880 | 313 | 367 | | 1534 | 330 | 356 | |
| Selected high-tech and medium-tech industries | | | | | | | |
| * chemical production | 54 | 24 | 27 | | 51 | 27 | 28 | |
| * + manufacturing of pharmaceutical products | 19 | 10 | 10 | | 16 | 14 | 14 | |
| * manufacture of machinery and equipment | 220 | 72 | 75 | | 208 | 73 | 75 | |
| * manufacture of electrical and optical equipment | 131 | 57 | 57 | | 118 | 58 | 59 | |
| * manufacture of transport equipment | 55 | 23 | 26 | | 56 | 23 | 23 | |

Source: compilation from BelStat Statistics.

Table 12. Share of expenditure on technological innovation by sectors (%)

|  |  |  |  |
| --- | --- | --- | --- |
| *Rank* | *Sectors* | *Share (%)* | *Main financial source (%)* |
| 1 | Manufacture of coke, petroleum products and nuclear materials | 30.9 | own funds (76) |
| 2 | Manufacture of machinery and equipment | 17.4 | own funds (70) |
| 3 | Manufacture of basic metals and fabricated metal products | 15.3 | foreign investment incl. credits and loans (53) |
| 4 | Manufacture of transport vehicle and equipment | 7.5 | own funds (46) |
| 5 | Manufacture of other non-metallic mineral products | 5.9 | own funds (43) |
| 6 | Manufacture of food, beverages and tobacco | 5.6 | credits and loans (66) |
| 7 | Manufacture of electrical, electronic and optical equipment | 4.0 | own funds (64) |
| - | Other sectors | 13.4 | miscellaneous |
| - | Total | 100.0 | own funds (54) |

Source: compilation from BelStat Science and Innovation Activity in the Republic of Belarus, Statistical Book, National Committee of the Republic of Belarus, Minsk 2015 from table 6.20

The highest spending sector is the manufacture of coke, petroleum products and nuclear materials – accounting for 31per cent of total spending in the national economy. Own funds is the most important source of innovation in the majority of sectors (54 per cent for the whole economy) and firms in all sectors have reported having used them in 2014.

The external resources that can share the business risk of innovation are always very important. Table 13 shows the structure of intramural expenditure on technological innovation by source of funds for the industrial sector. Own funds remained the largest source of funding (54.1 per cent), followed by credits and loans for innovation activity (26 per cent). The proportion of these two resources decreased slightly between 2011 and 2014. A third source was foreign investment, including credits and loans (11 per cent). The Republican budget and other State sources provided for roughly 8 per cent of technological innovation expenditure in 2014. Although figures show a substantial increase with respect to 2010, it is still a limited amount in international perspective (see chapter 3).

Table 13. Structure of intramural expenditure on technological innovation in Industry by source of funds (%)

|  |  |  |
| --- | --- | --- |
| *Funds* | *2011* | *2014* |
| Total expenditure on technological innovations | 100 | 100 |
| Own funds | 60.5 | 54.1 |
| Public sources | 4.0 | 8.1 |
| * Republican budget | 3.0 | 6.2 |
| - of which innovation funds | 1.3 | 2.8 |
| * Local budget | 0.1 | 1.4 |
| - of which innovation funds | 0.03 | 1.0 |
| * Budget of the Union State | 0.2 | 0.1 |
| * Extra-budgetary funds | 0.5 | 0.4 |
| Credits and loans | 30.3 | 26.0 |
| Foreign investment, including foreign credits and loans | 5.2 | 11.2 |
| Other sources | 0.2 | 0.6 |

Source: compilation from BelStat Science and Innovation Activity in the Republic of Belarus, Statistical Book, National Committee of the Republic of Belarus, Minsk 2015 table 6.19

Still, the changing ratios of funding show that initial steps have been taken towards a *more innovation-friendly financing structure*. The positive sign is that public resources have increased at the expense of credits and loans. This shift between resources is very important for such risky activities as innovation. However, in Belarus the problem that enterprises are under-capitalized remains significant; and the limited public resources devoted to fill in the gap represent minuscule fractions that are not enough to share the business risks for breakthrough innovation.

It is also important to highlight that innovation performance at enterprise level is strongly influenced by their previous *innovation-related activities*. Table 14 shows how the percentage? of firms performing activities of different types of innovation has changed from 2011 to 2014.

Table 14. Innovation-related activities at innovation-active organisations in Industry (%)

|  |  |  |
| --- | --- | --- |
| *Types of innovation activities* | 2011 | 2014 |
| R&D of new products, services and methods of new processes (either adoptation or development) | 56 | 29 |
| Acquisition of machinery and equipment linked to technological innovation | 55 | 53 |
| Production designing, other pre-production activities for introducing new products or services or methods of their production (transfer) | 38 | 54 |
| Training, retraining and advanced training linked to technological innovations | 13 | 10 |
| Marketing research linked to technological innovation | 9 | 10 |
| Other expenditures on technological innovation | 5 | 9 |
| Acquisition of new and high technologies | 2 | 3 |
| of which acquisition of property rights to inventions, useful models, industrial designs, topology of integrated circuits under assignment agreements; acquisition of rights to their use under licence agreements | 27 | 67 |
| Acquisition of computer software and databases linked to technological innovation | 7 | 6 |

Source: compilation from BelStat Science and Innovation Activity in the Republic of Belarus, Statistical Book, National Committee of the Republic of Belarus, Minsk 2015, table 6.3.

Among the innovation related activities the lowest ranked was *acquisition of new and high technologies*. Within this group, the acquisition of property rights to new and high technologies has increased. At the same time the *production design, other preproduction activities* for introducing new products, services or methods of production (transfer) heavily increased and became the most important for 2014. *Acquisition of machinery and equipment* for technological innovation practically retained its percentage and ranking position. However, these activities might be seen as simple modernization (plug-in) and should not be considered as process innovation according to international standards measuring innovation (see Chapter 3).

*R&D of new products* was largest in 2011, but it decreased sharply by 2014. As discussed above, R& D is only one type of innovation activity and for many firms it is not the most important. On the other hand, many incremental innovations are very important for any enterprise to improve its competitiveness or at least not lose their market. The sources of such innovation may originate from non-R&D persons within the company or be initiated by suppliers, buyers or the result of adaptations.

With regards to the typology of innovations, in industry the number of product and process innovators slightly increased from 2010 to 2015 (from 324 to 342), whilst those numbers involved in organizational or marketing innovation was around double in 2010 than in 2015 (table 15).

Table 15 Number of industry organizations engaged in innovation by type

|  |  |  |
| --- | --- | --- |
| Types of innovations | 2010 | 2015 |
| Product and process innovations | 324 | 342 |
| Organizational innovations | 92 | 43 |
| Marketing innovations | 113 | 61 |
| All innovative firms (with one or more types) | 381 | 369 |

Source: compilation from BelStat statistics.

According to BelStat statistics, 74.7 per cent of manufacturing organisations made expenditure on technological innovation, 9.5 per cent on organisational innovation and 15.8 per cent on marketing innovation in 2014.[[23]](#footnote-23) The various types of innovation support each other and improve the firm’s chances of market success.

With regards to the innovative capacities of SMEs, capturing statistically the knowledge-based and innovative SMEs is not easy. In 2013 there were 12 515 SME industrial organisations of which 605 were medium-sized firms, 3433 small and 8476 micro-entities.[[24]](#footnote-24) The number of micro and small entities increased from 2010 whilst the medium-sized decreased. The volume of industrial production has grown faster in micro-firms than in others (at current prices). In 2010 this group produced 19.8 per cent and in 2013 22.3 per cent of GDP and employed 28 per cent of the workforce.

Only two innovation-related sets of data are published on SMEs in the manufacturing sector: the number of organisations engaged in technological innovation and the share of shipped innovation products of total products. The number of medium sized innovative enterprises was 85 in 2011 and 88 in 2013. In the same years the number of small entities was 57 and decreased to 50. In both size categories the ratio of innovative products to total increased in medium-sized companies from 3.8 per cent to 6.9 per cent and in small firms from 0.8 per cent to 1.3 per cent.

In addition to available national statistics, this report also considers the 2014 BEEPS surve, which has a dedicated innovation module that allows a better understanding of the Belarusian firms as innovators. This survey emulated many of the questions of innovation surveys which thus well complement data by Belisa 2015 survey based on WEF framework (see chapter 3). The interview-based BEEPS sample contained 126 manufacturing firms, of which 78 introduced product and or process innovation.

BEEPS survey shows that the shares of Belarusian firms as innovators are relatively quite high. In fact, shares of R&D active innovators, process, organisational and marketing innovators are the highest in Belarus when compared to CE/CIS peers (Table x). A very large relative share of organisational and marketing innovators suggests that post-2008 Belarusian firms have intensified their non-technological activities as a way to counteract worsening market conditions. This together with a higher proportion of a process than product innovators indicate that they are under financial pressures and searching for innovative ways to maintain their markets.

Table x: Shares of different types of innovators in Belarus and peer economies based on BEEPS 2012-2014 survey



Source: BEEPS 2014

However, this effort remains within their current market orientation towards CIS markets. Namely, they are much less quality certified than would be required in Western markets, they much less rely on foreign knowledge via licences, and are much less connected via email, own much less often website though they are externally audited as a way to maintain external credibility. In a nutshell, they seem to be very technologically and organizationally active but within their traditional market orientation. A low share of quality certified firms and low use of foreign knowledge suggest that similar to Russian firms they are largely outside EU and global value chains.

*Burdening factors of innovation*

According to the BelStat innovation survey and the Belisa report, several factors can be quoted as hampering innovations by firms. Table 17 summarizes the average values of hampering factors according to survey information.

Table 17 Rating of factors hampering innovation in industrial sector in 2014

|  |  |
| --- | --- |
|  | Average value |
| Economic factors | |
| lack of funds within the organisation | 2.31 |
| cost too high | 2.18 |
| excessive perceived risks | 1.98 |
| long payback time of innovations | 1.94 |
| lack of financial support from public sources | 1.79 |
| low consumer demand for new products | 1.71 |
| Production factors | |
| innovation potential insufficient | 1.75 |
| lack of qualified personnel | 1.59 |
| lack of information on markets | 1.42 |
| lack of information on new technology | 1.38 |
| difficulty in finding co-operation partners | 1.35 |
| non-responsiveness of the organisation to innovation | 1.31 |
| Other factors | |
| undeveloped technology market | 1.59 |
| low demand for innovative products | 1.58 |
| uncertainty of the period of innovation process | 1.52 |
| undeveloped innovation infrastructure (intermediary, information, legal, banking and other services) | 1.52 |
| shortcomings in legislation regulating and stimulating innovation activity | 1.43 |

Source: author compilation from BelStat Science and Innovation Activity in the Republic of Belarus, Statistical Book, National Committee of the Republic of Belarus, Minsk 2015, table 6.37

Note:

Applied values: main or crucial =3; significant =2; insignificant =1

Number of firms answering: main or crucial = X3; significant =X2; insignificant =X1

Average value =

The most important hampering factors are economic ones. Lack of funds within the *organisation* is the strongest and that evaluation was confirmed by interviews during the fact finding mission (See Case studies). The lack of *financial support from public resources* was evaluated as a less important factor. These differences in the evaluation of two financial resources highlights again the firms’ wish to finance their modernization and innovation from their own resources and their lack of expectations on the availability of public resources. Among the production factors, the *insufficient innovation potential* and the *lack of qualified personnel* are the main hampering factors to innovation.

Belisa’s report, which is based on surveys among the heads of companies, also identified similar problems.[[25]](#footnote-25) According to this study the organizations have low innovative capacity, shortage of trained personnel (technical and scientific personnel), and limited financial possibilities for development. These problems characterize firms of all sizes.

*Typology of Belarusian firms innovators and challenges of a dual path of technology upgrading*

Belarus has tens of new technology-based firms (NTBFs). Many of them base their success on knowledge from the Soviet period, very often linked to military industry or to the area where local companies had developed unique expertise like in measuring radiation due to Chernobyl disaster, or they are successful due to skilled software engineers in applications where barriers to entry are low. The core knowledge of such firms is their know-how or lead time, much less often patent. These companies understand well user needs and have developed an internal organisation which rewards meeting user needs. Often, they are supported by specific favourable measures like low taxation and discounted rents for premises. Very often they have good cooperation with universities regarding employment of graduates, much less regarding R&D (See Case study). They cooperate in R&D with universities or academy institutes only if they have a specific problem that they cannot resolve. In fact, they cooperate much more with suppliers of materials and often with potential users.

These firms are in technological areas where technology – product gap is small or time required for conversion of technological knowledge into product is quite short. This enables them to convert technological knowledge directly into product or service without long and expensive R&D process. They are in niche areas, not in commodity or standardised product businesses. Their expansion is about finding new niches or new uses of their technological knowledge. Their markets when selling under their name are non-Western markets. They do export to Western markets (US, EU) but largely under different labels. The exporting to Western markets is the main threshold level, which only a few of them managed to cross.

NTBFs differ significantly from large Belarusian industrial enterprises which are still vertically integrated with their design and engineering capacities. This is partly due to lack of specialised domestic suppliers. Their major markets are CIS countries. They are often ISO9001 compliant, but the quality drive is not spread into the rest of economy which limits reliance of large firms on local SMEs.

Technology upgrading of Belarus takes place along two paths: a path of new technology-based businesses and large enterprises.

Among NTBFs, we can differentiate between specialised suppliers and so-called gazelles. Gazelles are high profile firms like EPAM which have grown based on unique technological knowledge and have ‘gone global’. Several small enterprises within Minsk high-tech park have the potential to develop into the similar type of companies. The key future point of disjunction is whether they will continue to develop as standalone firms or they will be able to integrate other local firms into its knowledge network which will generate a critical mass of complementary skills and knowledge which in turn can lead to the formation of clusters. Only then we can expect that this path of technology upgrading will have macroeconomic effects regarding increased productivity, jobs and value added in the economy.

However, the biggest numbers of NTBFs are specialised supplier firms which are of small or medium size serving specific market niches based on their understanding of user needs and accumulated know-how. They usually operate as ‘knowledge brokers’ and are an indispensable part of national knowledge or innovation system. However, they are a rarely independent source of growth but are a necessary ingredient of growth of either gazelles or most often of the large enterprises.

Belarus is one of a few ex-transition economies that managed to preserve its organisational capabilities of large firms, although its industry structure is lacking sufficient growth of SMEs. This represents a potentially significant advantage regarding future growth potential and has been the mainstay of its employment and growth in the past. However, this group of enterprises is in dire need of restructuring if it was to continue to contribute to growth rather than syphon budgetary resources. Some of the large firms have preserved their previous levels of vertical integration which enabled them to produce complex products for the CIS markets at the price of lower productivity and sophistication. Some of them have strong clustering potential which has not yet been realised due to weakness regarding corporate governance, specialisation and the lacking layer of small competitive firms which would operate as subcontractors of the large enterprises. These companies are the major generators of employment which give them privileged position regarding the use of government subsidies and the costs of capital.

These two types of firms are operating relatively independently of each other though in the long term they should be either cooperating or competing. Table 15 below summarises the major challenges of these two types of firms.

**Table 15: Challenges of dual path of technology upgrading of Belarus**

|  |  |  |
| --- | --- | --- |
|  | *New technology based firms* | *Large enterprises* |
| *Focus on technology upgrading* | Meeting user requirements | Improved quality |
| *Clustering* | Not yet present | Not developed links with small firms |
| *Users Clients?* | Large Belarusian enterprises and CIS exports | CIS export except software where export to the West is developing |
| *Growth strategy* | New niches or new user needs | Standardised and low cost products for the CIS customers |
| *Nature of accumulated capabilities* | Accumulated technological know how | Accumulated production capabilities |
| *Competition regime* | State support but competitive foreign markets | Extensive state subsidies but still secure position on CIS markets |
| *Position in relation of global value chains* | Mixed picture: some gazelles are integrating into global supply networks | Outside of Global Value Chains |
| *Competitive advantage* | Understanding of user needs and produce/service differentiation | Standardised products with presumably acceptable value for money |
| *Supporting infrastructure (Techno-parks)* | Developed by public authorities | Not promoters of infrastructure for SMEs |

A summary of their main features in Table 15 shows that the NTBFs have not yet built new ecosystems or have not become the main drivers of growth. So, although significant regarding distinctive RDI capabilities their macroeconomic impacts are still not very significant. Minsk high-tech park is on the way to becoming innovation ecosystem with potential macroeconomic impacts. However, this process is long-term, and it requires shared visions based on consensus building and collective action. So far, the key to the success of HT park - leadership, a close link to the education system and collective action or coordination between different parts of government by providing a stable environment- have been preserved, and it is hoped that they will continue to be present.

A key policy challenge is how to couple and complement two paths of industry upgrading. However, the ongoing orientation of Belarusian RDI policy has not recognised the need to enhance complementarities between these two paths.

Innovation policy of Belarus is strongly oriented towards commercialization of its R&D results. Specifically, the policy is concerned on how to engage more entrepreneurs in innovative activities, how to address weaknesses in the implementation of commercialisation projects, how to shorten the time and improve the effectiveness of commercialization efforts. It has articulated strategic priorities in the area of R&D and innovative development and has a long-standing system of implementation of state S&T programs.

Belarusian R&D and innovation policy were firmly oriented towards commercialization, and hence, the main challenge identified by policy makers are insufficient to support in the process from R&D to commercialise products. Incentives to invest in demanding new products and processes are weak given risk and uncertainty about results but also given weak local demand for such endeavours. This is further exacerbated by the undeveloped market for technological knowledge and weaknesses of supporting infrastructure. On the positive side, one should emphasise the developed legal and financial support framework for growth of new technology-based firms, a high priority given to innovation by top policy makers and by political leadership and several high profile cases of successful technology-based growth.

What underlies much of Belarusian R&D and innovation policy is a simplified model of how R&D and innovation impact economic growth, and how R&D contributes to productivity, employment, and export. The basis of the policy is R&D push model or idea that R&D and knowledge intensive activities can directly generate increased value added, growth and jobs. However, modern innovation policies also requires business enterprises that are in close contact with markets, and that can successfully address different performance - costs trade-offs.

R&D is not the only mode of innovation as many industries operate based on so-called DUI or Doing, Using and Interacting mode of innovation (Jensen, Johnson, Lorenz and Lundvall 2004 ). This is the mode of technology upgrading at firm level which is generated by employees, engineers and enterprises partners in solving ambitious and less ambitious development and production challenges. It is mistakenly assumed that only first mode of innovation – R&D push or STI-mode matters for growth and productivity. Evidence shows that DUI mode is equally important and that both ways of innovation are necessary and should be complementary. R&D is also critical in this mode of innovation but in its absorptive capacity, i.e., firms and country need to undertake R&D not only to generate new products and processes but also to be able to absorb new knowledge and to adapt imported technologies.

This neglect of DUI mode of innovation in Belarusian policy explains diminished importance given to the quality of products, incremental innovations in firms, cost-reduction programs, non-R&D innovation, engineering improvements (process and products engineering), and management practices. These are areas that are not in the policy focus or far from sufficient.

In summary, when compared to supply side or R&D push programs, insufficient attention is given to demand-led innovation or technological activities which firms would need to undertake to meet the quality standards on the most demanding export markets. Instead, there is strong policy focus on commercialisation with the aim to sell ‘disembodied’ technological knowledge in forms of patent licences, and know how despite its minor economic significance regarding value added, job creation and export.

Chapter 5: role of innovation policy in achieving sustainable development

In Belarus, government policies for the promotion of innovation are embedded in the country’s broader sustainable development agenda, which among other goals aims to reduce major negative anthropogenic effects on the environment and promote social inclusion. This chapter presents an assessment of the role of innovation policies in Government strategies and policies for achieving such objectives. The first section considers the country’s national strategy for sustainable development till 2030 in light of recent international initiatives that have highlighted the role of innovation (i.e. the Addis Ababa Action Plan and the 2030 Agenda for Sustainable Development). This section also includes a summary of the country’s recent trends on environmental management and describes the existing legal and institutional frameworks for the implementation of socially and environmentally significant innovations.

Another section describes the emergence of green economies in Belarus and assesses key elements of policies, programmes and recent initiatives to promote energy efficiency and other innovations for sustainable development. Overall, markets for green economies and the “sharing” economy are only incipient in Belarus. However; in some areas important experiences have occurred with the help of international partners that could inform policy making in the longer-run. The recommendations focus on measures to improve innovation performance by national institutions and firms in green sectors as well as on creating awareness in population that could result in enhanced markets for sustainable products.

Innovation policies are embedded in Belarus’ national development strategy, the National Strategy for Sustainable Socio-Economic Development in the Republic of Belarus until 2030 (NSSSED-2030), which is the main policy document that sets the framework for sustainable development in the country. NSSSED-2030 was prepared based on previous policy documents and programmes, including the National Strategy on Socio-Economic Development for Belarus 2016-2020 (NSSD-2020), which was structured around three areas or pillars: economic, social and the environment.

In general, the NSSSED-2030 shows that a comprehensive national development strategy exists, which is further supported by specific strategies and sector development plans. Indeed, many of the objectives for scientific development of the NSSSED-2030 have already been included in specific policy documents by the SCST, as discussed in Chapter 2.

Still, the NSSSED envisages ambitious objectives to be achieved by the year 2030. Some of the few quantitative indicators included show highly optimistic expectations: the share of domestic expenditures on research and development is expected to increase from 0.7 per cent in 2015 to 2.5 per cent in 2030; and the share of non-State funded sources is expected to increase from 55 to 70 per cent. Also, the document lacks sufficient indicators of achievement to measure and account for progress made in many of the measures envisioned. As it was the case with other policy initiatives, the mechanisms for implementing such aspiring transformations are not spelled out in the NSSSED.

Finally, the strategic priority sectors for innovation policies included in the NSSSED have a bias towards sectors were Belarus already counts with significant edge (i.e. hi-tech industries, bio-technology, nuclear energy). Economic activities in other areas could also be prioritised for innovation, especially in sectors that are not capital intensive and could result on high social impact from the point of view of sustainable development through increased job creation and reduced informality (e.g. tourism, agro-industries, industrial manufacturing).

To improve the policy framework for implementation of SDG agendas, the Government may consider establishing an effective mechanism of inter-ministerial coordination based on an understanding of interdependency of different problems and factors, synergy of goals and efforts to effectively resolve cross-cutting issues.

The NSSSED-2030 was launched in parallel to some major international initiatives by the United Nations system that are likely to re-define global development priorities and the role of innovation policies therein. At the United Nations Sustainable Development Summit on 25 September 2015, world leaders adopted the 2030 Agenda for Sustainable Development. This action plan includes a series of actions to end poverty, fight inequality and injustice, and tackle climate change with the goal to achieve measureable outcomes by year 2030. The Addis Ababa Action Agenda (AAAA) was adopted at the Third International Conference on Financing for Development, which took place in Addis Ababa in July 2015. The Declaration adopted by the Conference provides a new global financing framework to mobilize and deliver the resources, technology and partnerships needed for sustainable development. The agenda contains seven thematic areas that cover different aspects of the financing of sustainable development. Unlike the Agenda 2030, one full chapter of the AAAA concerns in particular the area of science, technology, innovation and capacity-building.

*Recent developments on environmental performance in Belarus*

The Ministry of Natural Resources and Environmental Protection (MNREP) is the main agency in charge of environmental policy. This agency has worked with some stability during recent years, which improved the consistency in policy implementation, as well as contribute to the mainstreaming of environmental considerations into sectoral policies and legislation.

In December 2014, MNREP requested that UNECE undertakes a third Environmental Performance Review (EPR) of Belarus, which was carried out in 2015. The report addressed 13 areas: the sustainable management and protection of water resources; waste management; biodiversity and protected areas; energy; forestry; tourism; the relationship between education and the environment; and health.

The EPR found that during recent years several policies were implemented in Belarus that sought to promote sustainable development, encompassing actions to reduce the impact of climate change, protect landscapes and biological diversity, improve energy efficiency and encourage the use of local and renewable sources of energy. The EPR also recognizes key areas for improvement, among which it identifies public participation in strategic planning and the development of legislation, the management of diffuse pollution, the introduction of economic incentives to facilitate the renewal of ageing transport fleet and a reduction in the use of asbestos in construction.

*Economic instruments for the promotion of green economies*

With regards to economic instruments, Belarus applies a range of measures aimed at increasing incentives for sustainable practices in industry and other sectors of the economy. Among “supply” side measures, these include environmental taxes on air pollution and waste management, compensation for damages, and specific charges for pollutants (such as motor fuels), among others.

Taxation is integrated with a system of annual emission limits, which are specified in corresponding environmental permits. An analysis of the implementation of environmental taxation shows that several reforms have taken place since 2011:

* As of the beginning of 2011, a system of payments of compensation for environmental damage in combination with administrative fines was set up, which replaced a special tax that applied to large polluters.
* A number of environmental taxes were abolished in 2010–2011 – including for petroleum refineries, transportation of oil products, and the production and import of goods containing over 50 per cent of volatile organic compounds (VOCs), plastic and paper packaging, and emissions from motor vehicle–, with the general intention to simplify the tax system for enterprises.
* A large number of taxes were replaced by a single tax with a simplified calculation procedure for SMEs.
* The abolition of the Republican and local nature protection funds in 2011.
* The approval of legislation obliging producers and importers of harmful products to assume the responsibility for collecting, neutralizing and/or recycling them.

Compensation for environmental damage has been applied in cases where the existing annual limits to emissions of air pollutants from stationary sources, storage and disposal of production waste and discharge of wastewater exceed predetermined limits. In addition, financial incentives for investments in environmentally friendly technologies have also been implemented.

With regards to government expenditures on environmental protection, these remained marginal with decimal variations around 0.5 per cent of total government spending in recent years, in spite of numerous policy initiatives that were approved to foster green economies.

On the demand side, raising environmental awareness and promoting behavioural change within the population is also a priority for both adaptation and mitigation of climate change. Several agencies (e.g. UNDP, UNECE, UNICEF, UNIDO and UNESCO) have been involved in environmental education and awareness-raising campaigns on the sustainable management of natural resources.

Priorities on the need for mainstreaming green economy principles in education have been formulated in the National Action Plan for the Implementation of the UN Economic Commission for Europe (UNECE) Strategy on Education for Sustainable Development in the Republic of Belarus for 2010–2014 as well as on sectoral education development programs. Priority has been given to the qualitative transformation of the education system covering all types of schools: pre-schools, secondary schools, specialized secondary schools and universities.

*Policy framework for environmentally significant innovations*

The Government has a vertical structure to implement environmental policy through MNREP. According to information provided by the SCST, MNREP has been the implementing agency of significant innovation projects related to improving environmental protection, which were included in the State Program of Innovation Development for the period 2011-2015.

During that period, seven projects involved innovation activities on environmentally significant areas. The total invested funds for the implementation of these projects amounted to 1976 billion roubles, including from both the national budget and other sources. Among the total number of projects, five were in the field of Geology and two on the field of Hydrometeorology.

In addition, funds allocated to the various R&D activities were established in the 2011 Resolution of the Council of Ministers No. 116, approving the list of scientific and technical programmes for 2011–2015. Projects financed covered R&D of innovative technologies for the efficient use of natural resources; sustainable forest management; new technologies for water supply and wastewater treatment and processing of secondary municipal waste, and improvements in energy efficiency (ECE 2016).

MNREP has also developed a programme of its own that involves some R&D activities by research centres and institutes. Namely, the “State Program on Environmental Protection and Sustainable Use of Natural Resources for 2016 – 2020”, which includes 5 sub-programmes . In addition, there are ten other sector strategies related to sustainable development that may involve the promotion of innovations, including on the protection of water resources and pollution.

With regards to the promotion of green economy, the MNREP works in full interaction with the Ministry of Economy. The authorities have identified priority areas where they will focus most resources, some of which involve the funding of innovation related initiatives. Whereas not all projects under the auspices of MNREP are “innovative” as defined in this report (see Chapter 3), the authorities are eager to encourage the development of new technologies that are dynamic and could be instrumental in solving urgent environmental problems faced by the country.

Regarding international cooperation, MNREP enjoys the support of EU and some initiatives have been held to bring expert advice on eco-innovation . The goal has been to set-up a plan for the development of the green economy through the use of incentives for investors. However, whereas MNREP has the research capacity to assist in the development of innovative products, its knowledge of aspects of the commercial viability of green products is limited. Because energy efficiency is a multi-faceted sphere, there is a need for coordinated policy action involving delegates from other ministries not linked directly to environment (e.g. social protection, trade). Such an approach could result in more informed policy making, also with regard to recent international commitments.

With regards to the current State Programme on Innovation Development 2016-2020, the environmental authorities have deemed that about 20 of the approved projects are environmentally significant and additional projects could be initiated in the future. MNREP is considered to be a ”scientific intensive” Ministry in Belarus and the Ministry has a few units that cooperate with the environmental authorities and the NAS in research activities. Notably, these include the RUE “Scientific Production Centre for Geology”, the RUE “Central Research Institute for Complex Use of Water Resources” and the RUE Belarusian Research Centre “Ecology”. In late 2014, the MNREP adopted a “Strategy for the development of scientific, technical and innovative activity on environmental protection and rational use of natural resources in 2014–2015 and for the period until 2025” (2014 Decision of the Ministry’s Board No. 112P), with priority areas in scientific activities including resources and energy saving, public health and environmental protection (See ECE 2016). It is thanks to these interactions that much of the best practice from European experiences became translated into legislation in Belarus (e.g. the introduction of a new water code, with regulations on basin management of water resources).

*The Government’s agenda for the improvement of energy efficiency in Belarus*

*Recent trends and strategies*

The Belarusian economy relies heavily on mineral resources (including crude oil, shale oil, natural gas and peats), which account for over 90 per cent of the country’s production. In addition, Belarus counts with renewable sources in the form of wood, biomass, hydro-energy, wind and waste wood. Significantly, the energy balance is negative and the country needs to import both fuels and energy from the Russian Federation. At present, Belarus also shows lower rates of energy intensity than other countries with economies in transition, particularly among CIS, but the level is still higher than in the average European OECD economies.

The Department of Energy Efficiency of the State Committee for Standardization is the main Government agency implementing policies to promote energy efficiency . In 2009, Belarus became a member of the International Renewable Energy Agency; and since that time it already adopted a Law on Renewable Energy (2010).

In 2010, a National Energy Saving Programme for 2011–2015 was approved by the 2010 Resolution of the Council of Ministers No. 1882 with the goal to reduce the energy intensity of GDP in 2015 by half taking into account environmental requirements, social standards and provisions of energy security indicators. The adoption of another programme followed with a focus on renewable sources of energy; namely, the National Programme for the Development of Local and Renewable Energy Sources for 2011-2015 (PDLRES), which has built on a series of other regulations aiming at improving the energy efficiency of the national economy.

Although PDRES has been deemed overall successful by the authorities, it has not had a transformative impact yet. The share of renewable sources of energy still amounts to only a marginal amount of total supply of energy resources in Belarus, fluctuating between 4 and 5 per cent in recent years (See table X.X.). Also, most standards have not been embraced by private firms. Although the legal framework for private firm certification and eco-labelling is broadly based on modern international standards (i.e. ISO 14024 and EU requirements) the practical implementation of product eco-labelling has lagged and no independent body for environmental certification of products is in place.

Furthermore, the utility sector is dominated by state-owned companies, with Beltpogas and Belenergo being the key dominant players in the energy markets.

The structure of "Belenergo" includes six republican unitary enterprises, including electric the power industry, construction complex, infrastructure, repair and commissioning enterprises, research, design and survey, research and design institute.

Although the domestic private sector involvement in the energy sector remains limited, some national enterprises have become involved in productive activities mainly by acting as intermediaries. In particular, SMEs are involved in such areas as consulting and representing big energy brands, but also on the production of local fuels, with a focus on wood and agricultural waste fuels (See Energy 21i).

However, significant constraints exist to the expansion of energy markets. Tariffs for public utilities are set by the Government based on proposals of the utility providers to the Ministry of Energy and the Ministry of Economy. Notably, residential tariffs for utility services corresponded to only some 30 per cent of actual costs of production. Even-though tariffs have increased since early 2013, the gap between the cost of production and tariffs paid is significant. Expenditures on housing and utility services accounted for only 4.4 per cent of household expenditures in Belarus in 2014, which is low compared to amounts above 10 per cent in neighboring countries such as Lithuania, the Russian Federation and Ukraine. Utility companies have been compensating for the operating losses associated with low residential tariffs by obliging non-residential customers to pay tariffs significantly above the cost recovery level. When cross-subsidies are not sufficient, local governments have provided direct subsidies to their municipal utility companies (e.g. in the district heating sector) (UNECE 2016, p. 82). Most public utilities also suffer from operational losses, which is linked to the unsatisfactory condition of equipment. In the context of financial constraints, this situation is not likely to improve in the near future.

In spite of these constraints, the authorities of Belarus are aware of the potential gains of a smooth transition towards a greener economy, and have signalled that improvements in energy efficiency are priority for science and technology development. A study by UNDP estimated that the energy savings potential in the State sector in Belarus for the period 2011-2015 could amount to between 5 to 6 per cent of gross energy consumption, with the highest potential in the sectors of industrial processing, power, housing, agriculture and construction. At the time of this Review, the Government had recently adopted the Concept on Energy Security of the Republic of Belarus in order to improve environmental performance in the long run. The third edition of the document, which built on previous versions of 2007 and 2014, was approved by the Council of Ministers of the Republic of Belarus on 23 December 2015 (Resolution 1084). The document addresses challenges linked to global trends in the fuel and energy markets and proposes actions to foster energy security in Belarus.

Another recent initiative that will have an impact on energy policy was Belarus’ decision to introduce nuclear power as a national development priority. The authorities have already commissioned the construction of two nuclear power units (2 х 1170) of a power capacity of 2340 MWe, which will be completed by 2021 (See Presidential Decree No. 499 of 2013). Regardless of its potential to increase energy efficiency, the project has been deemed controversial with regards to its sustainable development outcomes due to related risks with the use of nuclear energy. Its successful implementation will also require strengthening the country’s institutional capacities for efficient regulatory oversight and for its safety in line with international standards of IAEA.

To sum-up, the fact that Belarus is a net importer of fuel energy has negatively affected on the country’s competitiveness. This situation has made the transition to green economies more urgent. Fortunately, Belarus has significant potential for developing renewable sources of energy. Looking forward, the development of energy efficient technologies and production of alternative fuels will be an unavoidable feature of a successful strategy for sustainable development. Although it is not envisaged that Belarus will have a specific programme on “green” innovations, there are several projects that imply incremental improvements in the use of existing technologies.

With regards to encouraging private sector involvement, there is a political will to encourage the work of SMEs in the implementation of energy efficient initiatives, but the design of comprehensive policies is still at an early stage. International investors are ready to invest in such type of developments. At the same time, the authorities are also aware of the need to improve the level of entrepreneurship in the country to commercialize green products, since scientific knowledge will not be enough to guarantee their success. Also, existing limits on access to finance have prevented a more rapid development. Because of the risks involved in commercializing green technologies, the Government is highly dependent on external financing, especially by international financial institutions (IFI)s to complement Government funds.

Finally, in spite of government efforts, some legal and institutional constraints have prevented a more rapid expansion of green technologies. Paramount among these is the fact that “Belenergo” remains a monopolistic firm with a dominant position in most components of the national energy sector. Although recent reforms have allowed for the development of independent electric power producers, the country lacks an independent regulatory authority that could ensure transparency and fairness in pricing decisions. Overall, Belarus is still characterised by an over-regulated electricity market with significant price distortions that are the result of heavily subsidized tariffs for electricity and heat; and a lack of awareness in the general population about green products that could increase demand and create more economies of scales for innovative products.

*The role of innovation in the advancement of green economies in Belarus*

R&D programmes have been developed with funding from the national budget during recent years to support innovation in energy efficiency, including new technologies for energy conservation. Among the key programmes, the State research programmes on “Energy Systems, Processes and Technologies for 2016–2020” under the auspices of the National Academy of Sciences and the Ministry of Education is a basic research project that will be undertaken by the Heat and Mass Transfer Institute of the Belarusian National Technical University. The SPID 2016–2020 also contains modernization and innovation projects to be undertaken by companies and research organizations. The SPID has as its goals to develop a national fuel and energy sector and it addresses the needs of industry and households with regards to access to energy.

The SPID also includes priorities for the formation and accelerated development of high-tech sectors of the national economy based on 5th and 6th “technological waves”, including in the following activities; “cloud” technologies; development of space-based remote sensing of the Earth; development of component-based microelectronics base for all industrial activities and transition to production of new components for fabless-Foundry model (Fabless Foundry Model); creation and development of production based on deep processing technology of local renewable raw materials (Woodworking machinery). It also aims at reducing losses of raw material resources for the stages of production and processing; and to implement projects aimed at the replacement of non-renewable resources with renewable, taking into account the dynamics of the depletion of their reserves (See SPIDD, Chapter 8).

However, the actual share of public funding for research activities in the field of energy among total spending remains very limited, with an average of only 5 per cent in recent years. As it is the norm in Belarus, research programmes have been developed in such a way that they cover the whole innovation cycle from ideas to their embodiment in a particular product or service. However, as it was discussed in Chapter 2, a risk-averse approach prevents the development of projects that lack commercialization perspectives. The strict compliance requirements with State funded projects contributed to the shrinking of completion frameworks and goals, which reduces the attractiveness for long term private investments.

In addition to the programmes referred above, innovative funding for innovation activities is available from innovation funds. Since 2001, Belinfund has supported several projects in the field of energy saving, energy efficiency and renewable fuels, including the following: products on air conditioning, ventilation and heating installations with heat recovery on heat pipes and fans for a firm in Brest; a technology for biodiesel production from rapeseed oil in Grodno and biofuel installations in a plant in Mogilev; and developing technologies for the production of composite solid biofuel (pellets) based on rape straw and other garden wastes (See Eenrgi 21). Sector and regional funds are also involved in financing innovation activities for sustainable development.

Other forms of support for innovation for sustainable development include technology parks, tax incentives, business support centers and business incubators and international cooperation. Also, with the help of UNDP and the European Union, some successful initiatives have been undertaken at the local level that involve innovation through the use of green technologies and social platforms (See section 5.2.3 below). Still, available finance from private sources remains limited. The challenges discussed in this review in relation to venture capital and business angels are even more challenging with regards to the promotion of energy efficient technologies due to the lack of sufficient market demand for these products and the institutional challenges related to the energy sector referred in the previous section.

Finally, linkages between research institutes and universities are not yet well developed, especially in the international arena. Foreign partnerships are not common and local scientists are not often participating in international R&D programmes in the field of energy efficiency, even if some results have been remarkable that show potential for future development.

Recommendations:

2.1 Ensure conceptual consistency in the typology of innovation policy targets and align these targets with matching policy instruments. The SCST and other relevant institutions should undertake the following tasks:

* Introduce a strict definition of “innovation projects” for the purposes of the State Programme for Innovative Development (SPID) aligned with the provisions of the Law on state innovation policy and innovation activity (LSIPIA) of 2012. Include in SPID only projects matching this definition;
* In cooperation with the NAS, consider identifying under the state science and technology programmes a separate category of high-risk “innovation projects” aligned with the provisions of LSIPIA and which are funded by a different category of specific instruments tolerating risk;
* In cooperation with the NAS and the Ministry of Economy, develop practical guidelines for the assessment and sharing of risk pertaining to the implementation of innovation projects in accordance with the provisions of LSIPIA; these should cover each of the following aspects:
* Introduce in the instruments for funding risky innovation projects mechanisms for incorporating some degrees of risk tolerance;
* High-risk innovation projects should be organised on the basis of open competitive calls which would stimulate bottom-up initiatives by consortia ready to handle the project risks;
* Ensure that all projects identified as high-risk “innovation projects” as above are screened and evaluated by the similar criteria and procedures even if they originate in different state programmes and are funded by instruments tolerating risk;
* Introduce the definition of “innovative modernisation project” which would cover investment projects for the introduction of new production facilities with a low degree of risk which could be funded with the now existing policy instruments.

2.2 Initiate a gradual transition from predominantly vertical to predominantly horizontal policy mechanisms and instruments in the innovation policy mix. The SCST and other relevant institutions should undertake the following tasks:

* Prepare proposals for gradually reducing the degree of preselection of lead implementing organisations in state R&D programmes and SPID, and leaving more scope for bottom-up initiatives for the implementation of these programmes and projects on the basis of open competitive calls;
* Prepare proposals for the gradual restructuring of the overall budgetary funding of R&D and innovation towards the allocation of more funds for open-ended competitive calls (both in state S&T programmes and in SPID) matching the above shifts;
* Parallel to that, increase the shares of funding of high-risk “innovation projects” and early stage financing of innovative activity while at the same time reducing the share of low risk “innovative modernisation projects”;
* Within public early stage financing, increase substantially the share of grant financing while at the same time reducing the share of loans;
* Align the policy instruments and mechanisms and design new ones for the implementation of horizontal-type innovation policy. In particular, introduce instruments for the organisation and management of open competitive calls.

2.3 Ensure a better match between the strategic objectives of innovative development and the available policy instruments and public funding to pursue such objectives. The SCST and other relevant institutions should undertake the following tasks:

* Undertake a critical review of SPID 2016-2020 objectives with a view to identifying mismatches between strategic objectives and available policy instruments to pursue these objectives;
* In the cases of strategic objectives which are not matched by available policy instruments and funding prepare proposal for the introduction of such instruments backed by adequate funding, to be designed and introduced in the course of the SPID 2016-2020 implementation;
* Consider, among the now missing policy instruments, introducing open horizontal competitive calls for collaborative innovative projects; instruments supporting international linkages with global technology-centred value chains; grants supporting the establishment of innovative University startups or spinoffs based on clearly defined IPRs; instruments catering to the specificity of non-technological innovation;
* Specify in the state S&T programmes and SPID what programmatic activities will be funded by which policy instruments. In particular, make a clear distinction between high-risk “innovation projects” and low risk “innovative modernisation project”;
* Revisit the procedure of developing the SPID and ensure that in the next programmatic cycle strategic objectives are strictly matched by policy instruments backed with adequate funding.

2.4 Streamline innovation governance with a view to rationalizing public sector decision making related to innovation policy implementation:

* SCST should prepare, in consultations with the public bodies concerned (i.e. Ministry of Economy, Council of Ministers, “principal” bodies)proposals for simplifying the screening and evaluation process of innovation and R&D projects from the respective state programmes and the related decision making process for the release of public funds for project financing;
* Prepare, in consultations with the public bodies concerned, proposals for a “one-stop-shop” decision-making process, by delegating respective public bodies with the necessary authority to take final decisions on the release of funding for innovation and R&D projects;
* A possible way of streamlining funding decision-making could be the establishment of a joint Interagency Funding Committee with delegated authority to take the final decision on the release of public funds for all R&D and innovation projects under different programmes.
* Consider measures for better aligning the implementation of the State Science and Technology Programmes with the objectives of the State Programme for Innovative Development, including the allocation of public funds. The joint Interagency Funding Committee could perform coordination functions to this effect.

2.5 SCST in cooperation with Belinfund, NAS and subordinate bodies should initiate measures for the further development and strengthening of the NIS and the enhancement of weak components.

* Define the strengthening of connectivity and collaboration in the NIS as a strategic objective of innovation policy. Introduce policy instruments to pursue this objective in line with Recommendation 2.3. Set up a system of monitoring linkages and collaboration in undertaking innovation activity among innovation stakeholders in the NIS;
* In cooperation with Technology parks, define the strengthening of international linkages leading to global technology-centred value chains as a strategic objective of innovation policy. Introduce policy instruments to pursue this objective in line with Recommendations 2.3 and 2.6. Set up a system of monitoring such international linkages;
* Complement these measures with additional non-financial coordination instruments to support connectivity and linkages, in particular those facilitating networking and information sharing among potential stakeholders;
* In cooperation with the NCIP, strengthen the systemic role of intellectual property rights (IPR). To this effect develop and introduce, in follow-up to Edict 59, detailed regulation and implementation guidelines which allow: a) unambiguous identification of the legal owners of IPRs stemming from research undertaken with public funding; b) straightforward procedures for the sharing of IPR ownership between legal owners, including individual researchers and research teams;
* In cooperation with the Ministry of Economy, design targeted tax incentives to encourage private sector engagement in the early stages (business angel and venture) financing of innovation activity.
* Cluster development is on the agenda of Strategies but the progress is still limited. In cooperation with other public bodies (i.e. Ministry of Economy, NAS) the SCCT should seek further transformation of organisations and incentives need to overcome the fragmented business structure, the shortage of R&D centres in several specialized fields of applied science, a lack of engineering and other innovation service firms, and a weak tradition in open innovation.
* In cooperation with the Belarusian Fund for Financial Support of Entrepreneurs, Launch programmes and supporting schemes to nurture competitive supplier firms around leading innovative companies.

2.6 SCST in cooperation with the Ministry of Economy should set up a system of measures to strengthen innovation-related competition and spur bottom-up entrepreneurial initiatives:

* Introduce the principle of “competitive procurement” based on open competitive calls as the leading method of public support of innovation and R&D programmes and projects. Proposals for other procurement methods of innovation and R&D projects would need to be justified in each case;
* Consider possibly aligning such competitive calls with the Law on public procurement;
* Remove all discriminatory regulatory obstacles (related to ownership, size, legal status) for the participation of local applicants in the open competitive calls for innovation and R&D projects;
* Define stimulating regulatory incentives for the participation of foreign applicants of a desired type (e.g. linked to global technological value chains) in some of the open competitive calls for innovation and R&D projects;
* Define the significant increase of innovative entrepreneurship (in particular, private individual innovative entrepreneurs and SMEs) as a strategic objective of innovation policy and set concrete targets to this effect. Introduce policy instruments to pursue this objective in line with Recommendations 2.3 and 2.5, in particular, for the support of technology-based start-ups and spin-offs. Set up a system of monitoring the development of innovative entrepreneurship and the degree of achievement of targets.

2.7 The system of R&D and innovation funding has been conceptually improved since the first Innovation Performance Review. However, most financial mechanisms are not yet fully implemented. With view to the further improvement of innovation financing, the following measures are recommended:

* The new schemes conceptualized by the Belarusian Innovation Fund (BIF), like the support of early-stage or the initial R&D phase, vouchers and grants as well as venture funding should be implemented, particularly against the background that the BIF has already fulfilled most of the preparatory steps;
* In general, the shift from financing low-risk (infrastructure) projects to (early-stage) high-risk projects should be consequently followed;
* The establishment of foreign partnerships within the context of venture financing is welcome and should be further implemented by BIF; in addition, it is recommended to seek ways to actively attract further foreign investors or set-up respective partnerships – be it formal venture capital companies or business angles;
* The “good practice” example of the incubator established at the High-Tech Park, especially regarding the financing mechanisms of new ventures, should be replicated in other industries/technological fields;

2.8 The Development Bank has recently been founded as a measure to bolster the financial/banking sector in Belarus and to provide complementary innovation and SME related financing products. It is recommended that innovation related loans by new Development Bank, particularly regarding the financing of SMEs and start-ups should be intensified.

2.9 For a small economy like Belarus, the opening to foreign direct investments and good framework conditions for cross-border technology transfer (incl. sub-contracting within global value chains) are essential for increasing the innovative and technological level and ultimately the national competitiveness. To improve both the innovation potential inherent to foreign direct inflows and cross-border technology transfer, the following is recommended:

* Evaluate the mechanisms of the National Agency of investment and Privatization concerning innovation-related and technological issues or science-intensive investments;
* Take necessary steps or instruments to improve international co-operation in technology-transfer activities, including the network approach of the Republican Centre for Technology Transfer, the members of foreign networks of Technology Centres and the institutions responsible for the participation in EU projects;
* Identify “good practice” examples with a view to a successful participation of Belarusian companies in global value chains or regarding the establishment of strategic partnerships with foreign technology oriented companies and identify the critical factors and implications for already implemented measures;

3.1. The National Statistical Committee should work towards fully adopting best international standards in the collection of innovation statistics as reflected in Eurostat's CIS Harmonised survey questionnaire as practiced by Eurostat and the EU member states.

3.2. Training of statisticians is crucial to improve the quality of data and indicators. The National Statistical Committee should consider seeking technical cooperation support in introducing good practice, including through training activities with UNECE Statistical Division, Eurostat, OECD and/or UNESCO statistical office as well as with the participation of international experts with knowledge of CIS economies.

3.3. If the surveyed organisations are not familiar with the terms and logic of questionnaire they will not provide good data. Consider extending the training activities beyond the National Statistical Committee to include also surveyed organisations and potential users to understand better the logic of innovation survey and its indicators.

3.4. The National Statistical Committee should consider widening the scope and coverage of the innovation surveys in line with international best practice:

* The next innovation surveys should consider a broader population of enterprises and the questionnaire should also focus on non-technological innovations.
* More small firms should be included in the targeted population of the innovation survey.
* A more intensive use of the available data to serve the preparation of more indicators (including disaggregation of available information and providing more user-friendly presentations of survey information).
* Consider involving other stakeholders from civil society and the preparation of innovation statistics. For instance, during recent years the European Union developed a pilot databank (ETER) for benchmarking education institutions, which is a typical field where statistical offices and non-governmental organisations can collaborate further.

3.5. With regards to improving the country’s ranking position in innovation performance indexes, it should be acknowledged that the link between the individual indicator and the overall innovation objective is very often vague and mediated through a variety of other factors. Also, indicators are only a proxy of deeper, more complex, social realities. Thus, at the time of designing national strategies and programmes there is no need for Government bodies to target individual specific indicators with the aim to improve the overall ranking on a specific international index. Even if it is of utmost importance that Belarus benchmark itself internationally in as many as possible international rankings, it should be done with the aim to understand better issues and challenges rather than reducing policies on achieving target levels of specific indicators. Indicators should inform policy, but only rarely they should become policy target.

4.1. *Risk-sharing*. Risk sharing is always important between business organisations (including private organisations) and other actors in the field of business R&D and innovation. Naturally R&D-based innovations are more risky than others. Public resources have a distinguished role to encourage innovation through taking on the risky costs. Beyond the public sector some other actors may play a role in funding RDI such as venture capitalists or business angels. Because in Belarus and the latter actors are in practice missing, the state has to create better conditions for financing risky RDI activities and start-ups. The following is recommended to improve risk sharing between firms and Government:

* The SCST and other bodies should be investing in expensive risky innovation from public funds, including through co-financing (see chapter 2).
* For establishing and nurturing financial actors (venture capital, business angels) the Ministry of Economy and BiF should consider options providing seed capital and introduce tax breaks for them, not only for legal persons, but also for individuals. (see Chapter 2).
* The RDI bidding system has to offer equal opportunities to enterprises owned publicly or privately. Pre-determined competition has to be eliminated to make the competition conditions equal for state-owned and private firms including foreign entities operating in Belarus. (see chapter 2)

4.2. *State aid and incentives:* State financial support has to be provided on a larger scale to approach better the critical mass of financial resources for RDI. Adequate financial support from the State was hampered by the recent crisis and a tight budgetary policy, but it will be necessary in the long term to ensure development objectives. With regard to State incentives, at present these are scarce. The following measures are recommended:

* The allocation of public funds for financing innovation should meet development objectives, which involve a holistic approach that considers the phases of R&D, sector diversification and regional development needs (see chapter 2).
* SCST in cooperation with the Ministry of Economy should c workd towards changing the allocation of State support from slowly growing low- and medium-tech sectors to the promising medium-high and high tech sectors.
* SCST and related bodies should work towards modifying RDI support allocation among regions to diminish the distance between advanced and laggard regions.
* Public support is available mainly as repayable funds. The Government has to provide more non-reimbursable financial support for risky projects. Repayment for unsuccessful project means retroactive withdrawal from risk-sharing. This mechanism does not seem to be a good incentive to engage private actors into risk taking, as it puts all risks on the company (SCST in cooperation with the Ministry of Economy may consider introducing the partial re-payment of non-repayable funds if the project is successful) (see Chapter 2)
* Set up with sizeable financial resources the planned schemes in the programmes for nurturing innovative start-ups and further developing innovative SMEs. Government institutions providing finance for innovation activities (i.e. the Development Bank Belinfund, the Belarusian Fund for Financial Support of Entrepreneurs) could consider subsidizing interest rates for the loans in the case of business R&D, early stage innovation, start-ups and SMEs.
* The SCST in cooperation with the Ministry of Economy should consider setting up tax exemptions and tax credits on intramural R&D activities.
* In cooperation with the NCIP and the RCCT, SCST should discuss strategies for obtaining assistance for international patents and incentives for patenting abroad in order to protect Belarus intellectual property.

4.3. *Improve labour and skills development policies.* An adequately educated and trained skilled labour-force is crucial for an innovative economy. The insufficient quantity and quality of human resources may hamper R&D and innovation activities. SCST, in cooperation with the NAS and the Ministry of Education should consider some reforms of the educational system to meet the needs of economic development, including:

* Provide training for manager-practitioners in the field of R&D, innovation, knowledge management, technology transfer for upgrading naturally-talented managers’ capabilities.
* Provide educational, training and consulting services for innovative enterprises and scientific-research organizations involving practitioners and researchers.
* In the phase of knowledge adjustment to modern market economies, attract international experts with complementary knowledge, support on-the-job training and coaching.

5.1 *Enhance R&D capacities on green technologies.* In line with the recommendations to increase government spending on R&D, the SCST should also target this spending in green and eco-innovation projects. In particular, research on energy efficient technologies should be encouraged by competitive allocation of resources.

5.2 *Seek engagement on international initiatives.* Additional financing could be obtained from international climate funds. Also, SCST and NAS should further stimulate cooperation between national and foreign R&D institutes.

5.3 *Further deepen awareness campaigns.* Relevant agencies should build on existing initiatives with UNDP to further improve education about climate change and the sustainable development goals in education institutions and to address the general public.

5.4 *Stimulate demand for eco-innovation*: Green public procurement mechanisms have been considered and could be further developed with the goal to disseminate green products and eco-innovation. In the long run, public procurement processes should be simplified in order to enable SMEs to compete for state contracts on a level playing field.

5.5 *Introduce modern energy-efficiency and fuel-efficiency standards as* *well as building codes and infrastructure resilience parameters in order to improve sustainability*. Move towards the cost-reflective pricing of energy and water services with adequate social protection for the poor in order to enhance incentives for the adoption of progressive adaptation technologies and sustainable use of natural resources.

5.6 *Improve policies for the generation of knowledge, absorptive capacity of the economy. the diffusion of innovation and demand for innovation*. Given the complexity of eco-innovation, there is a need for better and more efficient policy coordination both in design and implementation in this area, including capacity building. Also, the authorities should consider introducing specific mechanisms and instruments that encourage and facilitate linkages among stakeholders, For instance, the creation of “green” technology business incubators and technology transfer agencies could be considered that will promote stronger linkages between FDI firms and local subcontractors;

5.7 *Enhance financial instruments supporting eco-innovation*. Firstly, consider introducing grant schemes to support R&D on eco-innovation; Establish project-based eco-innovation financing instruments that encourage the development of industry-science cooperation and inter-firm linkages including by promoting climate-resilient infrastructure through public-private partnerships.

1. Another related issue that was advanced only halfway is the sharing of ownership of such IPRs between the institutes and the teams of researchers that actually performed the R&D activity. Edict 59 in principle opened the way for the sharing of the legal ownership of such IPRs. However, similarly to the above issue, so far there are no specific regulatory mechanisms for implementing shared ownership, so these provisions still only exist formally but are not being implemented in practice. [↑](#footnote-ref-1)
2. UNECE, *Innovation Performance Review Belarus*, New York and Geneva, 2011. [↑](#footnote-ref-2)
3. Source: http://fp7-nip.org.by/ru/hor20/BelPr/ [↑](#footnote-ref-3)
4. The share of employment in high-technology industries in 2014 amounts to 0,93 per cent compared to 1,25 per cent in 2010; the same applies to medium high-technology industries with a decrease from 7,4 per cent to 6,8 per cent UNESCO (2015): *UNESCO Science Report Towards 2030*. [↑](#footnote-ref-4)
5. See http://belarusfacts.by [↑](#footnote-ref-5)
6. See http://belarusfacts.by [↑](#footnote-ref-6)
7. State Committee on Science and Technology of the Republic of Belarus: Belarus in Figures, Minsk 2015. [↑](#footnote-ref-7)
8. In addition to The Development Bank, the most important Belarusian Banks for SME support are Belgazprom Bank, BPS Sberbank, and MTB Bank. [↑](#footnote-ref-8)
9. The current amount of both funds, innovation and investment fund is 1,5-1,6 trillion Rubles. The 7 regional/local funds will not be touched; the use of these funds is under the supervision of the State Committee on Science and Technology (interview at the State Committee on Science and Technology) [↑](#footnote-ref-9)
10. A draft Programme for Entrepreneurship Development is currently developed. [↑](#footnote-ref-10)
11. According to <http://ictt.by> the following crowd-funding platforms exist: Ulej, StartIdea, MaeSensa and Talaka. [↑](#footnote-ref-11)
12. Respective programmes which have been implemented (and mostly completed in 2015) focus on biotechnology, the creation of high-technology in industry, and the development of new technologies in agriculture. [↑](#footnote-ref-12)
13. Currently, 70 per cent of the total budget of NAS is generated by production facilities, only 30 per cent come from the state-budget. There are 10 such companies, which make a significant contribution to the NAS budget. [↑](#footnote-ref-13)
14. The following Techno-parks, Science parks and Industrial Parks have been established in Belarus: High-Tech Park, Techno-park at Technical University (“Polytechnic”), Minsk City Industrial Park, Minsk Regional Industrial Park, Techno-park “MOGILEV”, Gomel Scientific and Technological Park, Infopark, and Science and Technology Park BOKUP. See <http://ictt.by> (accessed 16 June 2016). [↑](#footnote-ref-14)
15. Although its framework divides indicators into input and output the issue of cause and effect remains unclear. Business sophistication is as much output as input. Also, its innovation outputs are much more representative of the world frontier economies and regions rather than reflection of growth drivers of middle and upper middle income economies. Still, its impressive coverage of the range of innovation activities makes it relevant benchmark for Belarus as long as we recognise that its focus is much more on the variegated nature of innovation activities rather than on links between innovation and growth [↑](#footnote-ref-15)
16. Total number of years of schooling that a child of a certain age can expect to receive in the future, assuming that the probability of his or her being enrolled in school at any particular age is equal to the current enrolment ratio for that age Source: UNESCO/GII [↑](#footnote-ref-16)
17. The number of students from abroad studying in a given country, as a percentage of the total tertiary enrolment in that country. Source: UNESCO/GII [↑](#footnote-ref-17)
18. General infrastructure is measured as composite of electricity output per capita, logistics performance and gross capital formation. [↑](#footnote-ref-18)
19. Ecological sustainability is measured as composite of GDP per energy use, Yale university environmental performance index, and ISO environment certificates. [↑](#footnote-ref-19)
20. On the other hand, IUS does involve non-R&D activities data as much as they are available from the EU innovation surveys. It is important to recognise that growth is a much broader phenomenon, and the IUS is capturing very well its R&D based component. In that respect, its usefulness is relatively smaller for less developed EU economies or middle-income economies when compared to those whose firms operate at technology frontier. [↑](#footnote-ref-20)
21. According to the Civil Code of the Republic of Belarus, a republican unitary enterprise is an organization that belongs to the Republic of Belarus but is managed as an enterprise with commercial purposes. [↑](#footnote-ref-21)
22. See in Regulation the Council of Ministers of the Republic of Belarus, 2014 No. 27, On approval of the concept of formation and development of innovative industrial clusters in the Republic of Belarus and its realization (pp.4-5). [↑](#footnote-ref-22)
23. BelStat Science and Innovation Activity in the Republic of Belarus, Statistical Book, National Committee of the Republic of Belarus, Minsk 2015 from table 6.6 [↑](#footnote-ref-23)
24. Statistical data on SMEs are from *Small and Medium-sized Business in the Republic of* Belarus, Statistical data book, 2014, National Statistical Committee of the Republic of Belarus, Minsk tables 1.1.1, 1.5.3., 1.5.4. 1.5.6, 1.9.1 [↑](#footnote-ref-24)
25. ОТЧЕТ О НАУЧНО-ИССЛЕДОВАТЕЛЬСКОЙ РАБОТЕ «Межстрановая оценка состояния научно-технической и инновационной сферы Республики Беларусь на основе анализа международных статистических данных и рейтингов и предложения по улучшению позиций Республики Беларусь в этих рейтингах» (заключительный) Государственный комитет по науке и технологиям;Республики Беларусь, Государственное учреждение «Белорусский институт системного анализа и информационного обеспечения научно-технической сферы» (ГУ «БелИСА») УДК 339.9:338.1;339.9:330.34;338.2 № госрегистрации 20151401 Инв. [↑](#footnote-ref-25)