

Development of an Innovative Environment for a Knowledge-Driven Economy in Belarus

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ABSTRACT

This paper is intended to investigate the current status and prospects of the development of an innovative environment for a knowledge-driven economy in Belarus. The estimation of the innovative environment is based on Belarusian official statistical indicators and state program documents. The results indicate the need to further improve the environment for the development of innovations in Belarus on the basis of the institutional framework formation for stimulating innovations. The new innovation coordination model in consideration of the “innovation council” is put forward with regard to Belarus. The authors take into consideration the accomplishment of the EU concept towards innovations driving a knowledge-driven economy. The substantial benefits for various Belarusian actors that could be ensured by the open innovative development are determined.

KEYWORDS

Business, “Innovation Council” Model, Innovations, Science, Innovative Activities, Innovative Development, Open Innovative Development, Organisations Engaged in Innovations, R&D Organisations

INTRODUCTION

Innovations relate to many processes in the economic, social and natural spheres and provide conditions for growth, strengthening competitiveness of both business entities and national economies. Clearly, dynamising development of innovations is one of the most promising directions in modern economic and business development. To achieve this ambition various management tools, rules, and disciplines are used. This becomes feasible through the implementation of a public innovation policy which is focused on knowledge, scientific potential of a society, innovative products and services. Innovatively active organisations are more competitive. They create new needs, jobs, ensure investment flows, reduce the cost of goods, improve the company and national image, etc. Manufacturing of high-tech products not only enables but also strengthens the external sector of the economy (improves the trade balance) and finally, it leads to an increase in living standards and protection of the environment.

Innovations of Belarusian enterprises are determined by both internal (enterprises’ innovation capability) and external environments (innovative development at the national level). In fact, the external environment can both create restrictions and promote innovative business development. The authors consider an innovative environment as a part of a changing business environment

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that determines an innovative activity of enterprises (Hrechyshkina & Samakhavets, 2019; Vemić, 2017a; Vemić, 2017b). Our study leads us to conclude that successful innovative development of Belarusian businesses requires an enhancement of an environment for development and dissemination of innovations.

This paper is intended to examine the current situation and development perspectives of an innovative environment for a knowledge-driven economy in the Republic of Belarus. The need to introduce innovative technologies (based on human potential, economy of knowledge and innovations) derives from the scientific and technological changes arising globally and the competitive struggle between countries in the high-tech marketplace (Gusakov, 2015).

As noted earlier (Hrechyshkina & Samakhavets, 2018), human potential of Belarus seems sufficient for the development of intellectual services. However, it is important to use it for the development of the IT sector, innovative clusters, as well as to expand SMEs' potential.

Knowledge, research and development as factors of progress are the main catalysts for enhancing innovations. Knowledge is an inexhaustible source of continuous and dynamic development unlike limited natural resources, resources created by man, and technology.

It is also essential to form a fully-fledged innovative environment for the innovative knowledge-based development of Belarus.

In the opinion of the authors, there exist limitations for improving an innovative environment for a knowledge-driven economy in Belarus. Accomplishing this requires intensified interaction of the business and science sectors through further development of public administration of science and innovations in order to create more comfortable enabling conditions for all subjects of the innovation developing activity.

The paper comprises the following sections. Section one brings a brief literature review about innovative environment and presents the methodological framework of the authors. Section two investigates the features of the current innovative development system of Belarus and directions of its improvement. It also discusses the assessment of science and development of innovations in Belarus. Thirdly, the authors provide an overview of the EU approach and concepts in a knowledge-driven economy and propose a new innovation coordination mechanism in Belarus. The last section contains conclusions and recommendations.

BACKGROUND

Scientific views on innovations (for example, Drucker (1985) and Rogers (2010)) have been anchored in entrepreneurship development since the original groundbreaking ideas of Schumpeter (1934). Freeman (1989) introduced the vision of different levels of innovation systems (2002). Nelson (1993) carried out a comparative analysis and identified the national characteristics of technical innovations and established that a broad spectrum of factors, organisations, and policies affect the firms' capacity to innovate.

Having in mind the nature and purpose of this paper the authors would like to single out the following Belarusian scientists who are engaged in the area of innovations: Babosov (2012), Myasnikovich (2004), Nekhorosheva (2006), Nikitenko (2006), Sechko (2008), Zhukovskaya (2014). Russian authors also actively joined the study of the national innovation system (NIS) to identify different areas of its development (Eremina & Demina, 2015; Golichenko, 2006; Polyinin, 2015; Suglobov & Smirnova, 2015, etc.).

For example, Eremina & Demina (2015) pointed out the problem of weak interaction between science and production and emphasised the contradictory goals and objectives of scientists and investors as some of the main difficulties of Russian innovation system. They saw the State as the leading link in the complex innovation system of interrelations and argued that it should necessarily participate more actively in the development of innovations.

Furthermore, scientists offered various directions for the development of innovation systems. For example, Suglobov & Smirnova (2015) proposed a network model of scientific, educational, industrial, and business organisations. Similarly, Moulaert & Sekia (2003) examined the territorial innovation models; Leydesdorff & Etzkowitz (1998, 2000) offered the model of effective interaction of university, education, industrial production and government sectors, etc.

Important new approaches also include the so-called open innovation model. Originally it was Chesbrough (2003) who defined the term “open innovation”. He discovered that with broad-based dissemination of knowledge and technology companies should not exclusively rely on their internally developed knowledge, ideas, experiences and that they should reap the benefits of applications developed and disseminated within other business enterprises, among their customers, clients and other external stakeholders. Therefore, this concept suggests restructuring or even reengineering companies in order to transition from a closed towards an open strategic model (Chesbrough, Vanhaverbeke, & West, 2006). Consequently, it derives from this approach that open innovation can be defined as business model that combines internal and external business processes benefiting from innovation, research and development. Following his discovery, Chesbrough (2011) originated his theory of an expanded open innovation model suggesting then broader use of “open service innovation” including both product and service innovations in order to practically apply R&D as a way of doing business and achieving competitive development of companies.

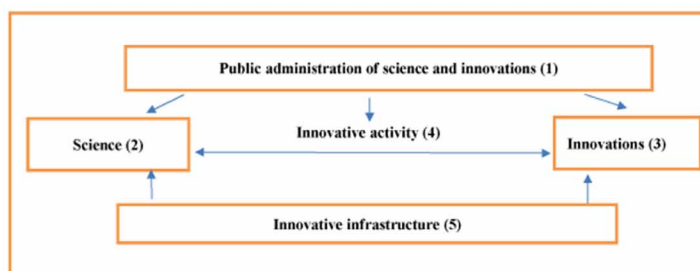
The main characteristics of the innovative environment for a knowledge-driven economy in the Republic of Belarus are discussed by illustrating its current situation and main development perspectives. The study of the innovative environment in the Republic of Belarus is based on the investigation of the modern innovation system, the assessment of scientific and innovative development, and the forecast indicators of the innovative development. Data on the development of science and innovations in the Republic of Belarus is based on the official statistical indicators for the years 2011-2017. In the study and treatment of the presented material, the authors used scientific methods such as systematisation, classification, comparison, scientific abstraction, analytical method and statistical analysis.

MAIN FOCUS OF THE PAPER

The Current State and Trends of Belarusian Environment for Development of Innovations

The environment for development of innovations in Belarus includes a combination of public authorities, business entities and individuals which are related to innovations (National Legal Internet Portal of the Republic of Belarus, 2016). The currently existing Belarusian model of relations between entities in the innovation sector is represented by the authors organisationally as follows (see Figure 1).

Figure 1. The interaction between various participants of Belarusian environment for development of innovations



Source: own study and presentation of the authors

The public administration system (1) includes State administration bodies of science and innovations. The Science and Innovations Policy of Belarusian government (*National Legal Internet Portal of the Republic of Belarus, 2016*) is being implemented in order to create more favourable conditions for innovative development of all economic entities. Specifically, the public administration of science and innovations in Belarus is implemented by the President, the Council of Ministers, the National Academy of Sciences (the NAS of Belarus), etc. and it is mainly achieved through forecasting organisation of technological development, implementation of technical regulations and standardisation, etc.

Science and innovations (conversion of acquired knowledge into practice) are the basis of the NIS. The system of knowledge production (2) is based on interaction of education and science sectors. The knowledge application system (3) includes commercial and non-commercial organisations and incorporates education (including clusters). This block is represented by a large number of organisations and individuals engaged in the implementation and (or) ensuring the interaction of science and innovations in the Republic of Belarus. The interaction of science (2) and innovations (3) occurs through activities involving dissemination of innovations (4). According to the National Legal Internet Portal of the Republic of Belarus (2016), innovation enabling mechanisms (5) include a set of entities engaged in the material, technical, financial, organisational, methodological, informational, and consulting activities. The elements of Belarusian innovative infrastructure involve innovation and engineering centres, innovation funds, venture capital organisations, science parks, technology platforms, etc. In addition, other institutions (legal, financial, and social) ensure the functioning of the innovation system as a whole (e.g. legal regulation of this sphere, the innovative culture of society, etc.).

According to the current Science and Technology Strategy of Belarus development of innovative co-operation by including all participants of the innovative development environment in a single chain of the innovation cycle and strengthening interaction of science (2) and innovations (3) seem to be promising areas for improving the innovative environment of the Republic of Belarus (*Strategiia "Nauka i tekhnologii: 2018-2040": 2017*). As a result, State support system for cluster projects in the high-tech sector will be created with international technical assistance to stimulate this process. Modernisation of public administration of the innovation system (1) is aimed at the State support for the formation of innovative and industrial clusters in the high-tech sector, improvement of planning and evaluation of the innovative development.

Advancement of innovation infrastructure (5) is planned (*Ministry of Economy of the Republic of Belarus, 2017b*) to be carried out through the creation of collective use centres, unique scientific equipment, and industry laboratories for testing and disseminating the scientific results into industry. It is also envisaged to further use the potential of technology platforms, venture organisations, technology transfer networks, engineering centres, and networks of subcontracting centres (*Ministry of Economy of the Republic of Belarus, 2017b*). Start-up events will help to engage the science and business organisations in Belarusian innovative environment actively (the annual number of participants is up to 20 thousand by 2020) (*Ministry of Economy of the Republic of Belarus, 2017b*). Having in mind the emphasised strategic options, authors find it necessary to popularise intellectual creativity and innovative entrepreneurship as prestigious areas of the society.

In addition, it is recommended to create an effective organisational and economic mechanism for the commercialisation of innovations, including through the entry of the Belarusian Innovation Fund into the founding capital of business entities created in this manner.

Analysis of Scientific and Innovative Development in Belarus

R&D organisations in the Republic of Belarus operate in various sectors: public, commercial, non-profit sectors, and in the higher education system. In the observed period, the total number of such organisations in the Republic of Belarus actually decreased by 47 units (9.4%) in 2011-2017 (see Table 1).

Table 1. Dynamics of the R&D organisations in Belarus

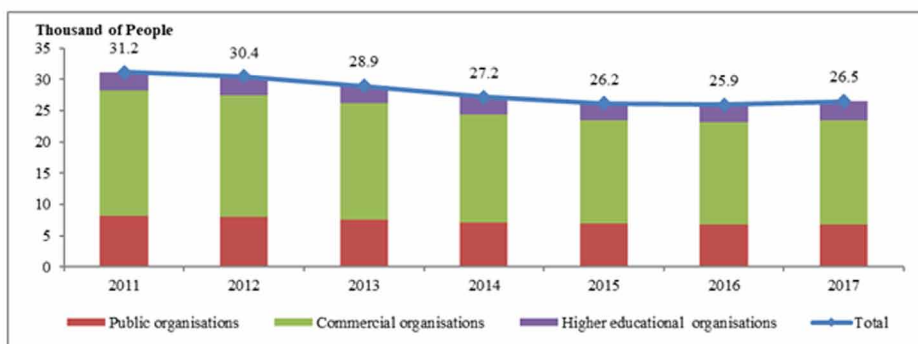
Indicators	2011	2012	2013	2014	2015	2016	2017
R&D organisations, total, units	501	530	482	457	439	431	454
growth rates, %	-	105.8	90.9	94.8	96.1	98.2	105.3
Including							
Public organisations, units	96	104	98	94	87	90	93
growth rates, %	-	108.3	94.2	95.9	92.6	103.4	103.3
Commercial organisations, units	331	352	317	294	286	277	286
growth rates, %	-	106.3	90.1	92.7	97.3	96.9	103.2
Higher educational organisations, units	70	70	64	66	64	61	72
growth rates, %	-	100.0	91.4	103.1	97.0	95.3	118.0
Non-profit organisations, units	4	4	3	3	2	3	3
growth rates, %	-	100.0	75.0	100.0	66.7	150.0	100.0

Source: own study based on the National Statistical Committee of the Republic of Belarus (2018)

The number of public organisations decreased by 3 units (3.1%) and commercial organisations by 45 units (13.6%). The number of higher education organisations increased by 2 units (2.9%). The number of non-profit organisations was small and ranged from 2 to 4 units throughout the studied period. The structure of the scientific complex in the Republic of Belarus almost did not change in the observed period 2011-2017. The share of public organisations in R&D accounted for 20.5%, commercial organisations 63.0%, higher education organisations 15.9%, and non-profit organisations 0.7% in 2017 (2).

The number and dynamics of employees engaged in R&D are presented by the authors (see Figure 2).

Figure 2. Dynamics of R&D employees in Belarus



Source: own study based on the National Statistical Committee of the Republic of Belarus (2018)

As it can be seen from the above data, the total number of R&D employees decreased by 4.71 thousand staff (by 15.1%) for the period 2011-2017. This was a result of staff reductions in the public sector by 1.31 thousand people (16.0%), by 3.32 thousand people (16.6%) in the commercial sector,

and by 0.08 thousand people (2.7%) in the higher education system. The largest number of employees remained hired in the commercial sector (63%). In 2017 25.8% of the staff was employed in the public sector and 11.2% in the higher education system. In the total number of R&D employees, 64.5% were researchers. Experts in technical and natural sciences dominated in the professional structure of scientific staff.

The volume of scientific and technical activities of the R&D organisations is presented by the authors (see Table 2).

Table 2. Volume of scientific and technical activities of the R&D organisations in Belarus

Indicators	2011	2012	2013	2014	2015	2016	2017
Total, BYN ¹	222,561.5	436,809.7	565,127.3	499,413.0	544,323.5	596,634.0	725,777.0
growth rates, %	-	196.3	129.4	88.4	109.0	109.6	121.6
Including by							
Public organisations, BYN	57,488.2	93,412.1	135,277.4	137,504.3	132,968.7	132,138.0	169,738.0
growth rates, %	-	162.5	144.8	101.6	96.7	99.4	128.5
Commercial organisations, BYN	140,191.6	302,096.8	374,691.5	308,977.7	355,186.2	410,438.0	486,630.0
growth rates, %	-	215.5	124.0	82.5	115.0	115.6	118.6
Higher educational organisations, BYN	24,788.6	41,184.2	54,957.7	52,840.8	56,117.1	53,931.0	69,325.0
growth rates, %	-	166.1	133.4	96.1	106.2	96.1	128.5

Source: own study based on the National Statistical Committee of the Republic of Belarus (2018)

Table 2 shows that the scientific and technical activities more than doubled between 2011 and 2017. Growth trends were observed in all R&D sectors. On average, 89.8% of the total volume was performed in-house. Activities of commercial organisations were dominant. Their share increased by 4.0% from 63.0% in 2011 to 67.0% in 2017 and amounted to BYN 486,630.0 thousand (92.9% of which was performed in-house). The share of activities of public organisations decreased by 2.4% from 25.8% in 2011 to 23.4% in 2017 and amounted to BYN 169,738.0 thousand (83.3% of which was performed in-house). The share of higher education organisations also decreased by 1.5% from 11.1% in 2011 to 9.6% in 2017 and amounted to BYN 69,325.0 thousand (91.0% of which was performed in-house).

It is envisaged that the Hi-Tech Park, the State Committee on Science and Technology (SCST), the NAS of Belarus, Great Stone Industrial Park, a regional network of science and technology parks, and higher education organisations will be the locomotives of the future knowledge economy. The future development of the NAS of Belarus is planned according to the model of an innovation and production corporation (*Ministry of Economy of the Republic of Belarus, 2017a*).

Innovative organisations are prominent in the innovative development of the country, since they finance, create and establish up-to-date products and technologies (product and process innovations).

Analysis of the innovatively active organisations shows that their total number has been small in the Republic of Belarus (see Table 3). This number decreased by 18.4% (86 units) by the end of 2017 compared to 2011. A significant reduction of 21.7% (96 units) occurred among industrial organisations. At the same time, the number of service organisations increased by 41.7% (10 units).

Table 3. Dynamics of organisations engaged in innovations in Belarus

Indicators	2011	2012	2013	2014	2015	2016	2017
Organisations engaged in innovations, total, units	467	482	454	415	375	378	381
growth rates, %	-	103.2	94.2	91.4	90.4	100.8	100.8
Including							
Industrial organisations, units	443	437	411	383	342	345	347
growth rates, %	-	98.6	94.1	93.2	89.3	100.9	100.6
Service organisations, units	24	45	43	32	33	33	34
growth rates, %	-	187.5	95.6	74.4	103.1	100.0	103.0

Source: own study based on the National Statistical Committee of the Republic of Belarus (2018)

These changes led to changes in the structure of innovatively active organisations (see Figure 3). The share of service organisations increased from 5.1% to 8.9% due to the increase in their number, while the share of industrial organisations decreased from 94.9% to 91.1% between 2011 and 2017.

Figure 3. Structure of innovatively active organisations in Belarus

Source: own study based on the National Statistical Committee of the Republic of Belarus (2018)

Let us now consider how the innovative course of action of the industrial organisations has changed since they accounted for a significant share in the structure of all innovatively active organisations (see Table 4).

Table 4. Measurement of dynamics of organisations which carry out innovations by type of the innovative activity in the industry

Indicators	2011	2012	2013	2014	2015	2016	2017
Organisations which carry out innovations in the industry, total, units	443	437	411	383	342	345	347
of which carried out:							
R&D of novel products, services, manufacturing methods and processes, units	249	115	113	110	122	124	136

Table 4 continued on next page

Table 4 continued

Indicators	2011	2012	2013	2014	2015	2016	2017
growth rates, %	-	46.2	98.3	97.3	110.9	101.6	109.7
Acquiring of machinery related to technological innovations, units	242	241	240	203	151	135	139
growth rates, %	-	99.6	99.6	84.6	74.4	89.4	103.0
Acquiring new and high technologies, units	11	13	16	12	10	6	7
growth rates, %	-	118.2	123.1	75.0	83.3	60.0	116.7
Acquiring of computer programs and databases related to technological innovations, units	29	30	34	23	16	18	15
growth rates, %	-	103.4	113.3	67.6	69.6	112.5	83.3
Production design, other types of pre-production for release of new products, and introduction of novel services or their manufacturing methods, units	169	229	195	206	184	196	179
growth rates, %	-	135.5	85.2	105.6	89.3	106.5	91.3
Training, retraining and staff development related to technological innovations, units	58	60	51	40	33	28	32
growth rates, %	-	103.4	85.0	78.4	82.5	84.8	114.3
Marketing research related to technological innovations, units	39	41	43	38	29	27	25
growth rates, %	-	105.1	104.9	88.4	76.3	93.1	92.6
Other costs of technological innovations, units	21	13	24	34	33	33	35
growth rates, %	-	61.9	184.6	141.7	97.1	100.0	106.1

Source: own study based on the National Statistical Committee of the Republic of Belarus (2018)

Table 4 shows the reduction in the number of industrial organisations in almost all types of innovative activities. Compared to 2011, the number of such organisations which carried out R&D of novel products, services, manufacturing methods and processes decreased by 45.4%, in purchasing machinery for improvement of technologies – by 42.6%, new and high technologies – by 36.4%, computer programs and databases related to technological innovations – by 48.3%, carrying out training, retraining and staff development – by 44.8%, and marketing research – by 35.9% in 2017.

The composition of Belarusian organisations which carried out innovations in the industry has also changed during the analysed period. Organisations engaged in production design, other types of pre-production for release of new products, and introduction of novel services or their manufacturing methods had the largest share of 51.6%. The number of these organisations increased by 5.9%. Organisations acquiring new and high technologies had the lowest share of 2% in 2017.

The largest number of organisations, which carried out cost innovations, were concentrated in the manufacturing industry. During the analysed period 2011-2017, their share almost did not change and amounted to 97.3% in 2017, including 16.2% of organisations which carried out production of food, beverages and tobacco, 15.3% production in optical and electronic, electrical and computational equipment. The lowest number of such organisations were engaged in the production of coke and petroleum goods (2.3%), wood and paper goods, and data medium (2.5%). Manufacturing organisations carried out 76.9% of technological innovations, 7.5% of organisational innovations and 12.8% of

marketing innovations. The total share of organisations of other types of industrial activity that incurred costs for innovations was very low and amounted to 2.7% in 2017.

In 2017, the share of employees engaged in high-tech activities was 0.8% of the labour force, 5.2% in medium-high-tech, and 4.4% in medium-low-tech. In knowledge-intensive activities, the largest shares of employees were in the education (11.7%), health care and social services (8.5%).

At the time of preparing this study, the authors also discovered that Belarus is still not present in the Global Competitiveness Index (GCI) ranking. However, the potential place of Belarus in GCI ranking could have been between 55th and 61st place according to the last CASE Belarus analytical papers (*Akulich, Valetko, Navrodskii & Sushkevich, 2015*). In general, therefore, the analysis shows a relatively low innovative activity of organisations in Belarus, and their technological backwardness, which is the reason for the poor competitiveness of Belarusian products in foreign markets.

Explanation of the EU Concept Towards Innovations Driving a Knowledge-driven Economy

The discussion on innovation management has become very dynamic and has intensified in recent years due to the increased complexity of national innovation policies which foster the development of a multi-actor innovative environment. Innovation policies have become more and more concerned with handling not only the elements of the innovative environment but also the relationships and collaboration between them that leads to integrated national innovation policy.

One of the significant problems is that the relevant policies in the field of innovations, science, training, SMEs and entrepreneurship, regional development of different business entities are usually managed by government ministries and their departments handling separate portfolios, objectives and components of an innovation support infrastructure. This fragmented institutional approach is inappropriate to manage major innovation issues within the NIS. Hence, it can be concluded from this finding of the authors that interrelated and cross-departmental innovation issues demand cross-departmental concepts and solutions.

Originally, the European Commission produced a communication on a data-driven economy (*European Parliament, 2001*) followed by a second communication titled “Innovation in a knowledge-driven economy” (*European Commission, 2004*). Noticed EU approach was based on five main objectives focused on enhancing member countries’ potentiality to resolve barriers hampering a more innovation-fostering environment. Improved the EU objectives were finally adopted (*European Parliament, 2019*), and they are classified as follows:

- To transform Europe into a world-class performer in the scientific field.
- To eliminate obstacles to innovators such as high cost of patenting, market fragmentation, slow process of adopting standards and high skills deficiency – which hamper and decelerate faster dissemination ideas towards markets.
- To offer radically new ways to communicate and collaborate for State and business, especially in the development of Innovation Partnerships among the EU institutions, national and regional authorities and the business sector.

The main EU institutional and infrastructure achievements were also stipulated explicitly (*European Parliament, 2019*): Innovation Union, Horizon 2020, Cohesion Policy, Financial Instruments, and European Innovation Council.

At present these are the most significant coordination mechanisms which can be distinguished in the EU:

- High-level advisory committees for managing a strategic framework (i.e. Finland, Ireland, Portugal). The efficient and trouble-free functioning deciding or consultative mechanisms at higher hierarchical levels than government ministries have been developed in these countries.

- Responsibility for coordination assigned to one Minister or Department, which results in the enhancing coordination mechanisms at interdepartmental level (i.e. UK, Sweden).
- Formation of one Ministry with managing the entire knowledge production and implementation chain (i.e. Denmark).

The “innovation council” management model which is implemented in the EU countries (i.e. Ireland, the Netherlands, Portugal, and Finland) seems to the authors to represent an optimal approach to improve the Belarusian innovation management, for the following main identified reasons:

- The character of innovations (e.g. fast developing, dynamic and cross-functional) currently demand the participation of a broad group of stakeholders, both from the public and the private sector. There are a growing number of different actors involved in innovation management. Therefore, it seems logical that a coordination mechanism at a high enough level could prove to be successful.
- Trends and statistics from recent years reveal that there is a growing portfolio of innovation measures and instruments at the disposal of innovation mechanisms. This development imposes the need for systematic approach, transparency, and high level of public responsibility.
- With the availability of several unequal support models for the innovative development using State budget or government financial resources, there seems to be a growing necessity for recording that spending of funds is performed rationally and effectively.
- The increasing autonomy of development regions imposes growing necessity of coordination with these entities to achieve optimum innovation effects. Without this approach, nations risk lack of developmental synergy, and poor performance with implementation of national priorities.
- The current development of national innovation policies is characterised by the fact that it interplays either directly or indirectly with practically all other economic and development policies.

Therefore, there isn't one single department able to manage and coordinate the whole set of measures with which innovation policy should be consistent with. Several EU member countries established their innovation and/or research councils which interact with the Enhanced European Innovation Council (EIC) (*European Commission, 2019*), whose mission is to support scientists, innovators, entrepreneurs, and SMEs with fresh ideas and the ambition to grow competitively and internationally.

Suggested New Innovation Coordination Mechanisms in Belarus

From a government point of view an effective science and technology policy logically demands coordination mechanisms. Similarly, there is the need for coordination between the ministries responsible for economic-regional economic development, education, and science sectors as well. An effective coordination and accomplishment of national innovation policy call for efficient measures.

Countries are increasingly evolving towards innovations, effective technology and science seeking a competitive approach globally. In fact, all countries are trying to improve coordination and integration. Overall the innovation models in the benchmarked EU countries (i.e. Ireland, the Netherlands, Portugal, Finland) can be characterised as a constant national learning process in adapting organisations and practices in order to meet both external and internal challenges.

However, it should be noted that good practices cannot be simply copied from one country to another as the circumstances are different. Belarus would also need to adapt the innovation proposals from the author's concept. Nevertheless, the mentioned benchmark countries of the authors do provide initial information which can serve initially to improve the efficiency and the effectiveness of the innovation management system in Belarus.

One of the main objectives of Belarusian innovative development for the future (*National Legal Internet Portal of the Republic of Belarus, 2017*) is “Development and improvement of the NIS”. Before presenting proposals the authors herewith discuss and analyse some aspects of Belarusian NIS and point out observed priority questions:

1. The most important State bodies in Belarus introducing and implementing innovation policy are the State Committee on Science and Technology, the NAS, the Ministry of Education, the Ministry of Economy, and the Ministry of Industry. Innovation policy is a horizontal policy by definition. The current level of collaboration between the three ministries can be optimised and made more efficient in order to achieve and manage an effective innovation policy. Therefore, it is necessary to develop an enhanced and evolving mechanism of coordination (horizontal level) and links among the key actors of Belarus NIS.
2. It is recommended to intensify the transfer of technologies between State and business for both innovations and research. Industry involvement ought to be generated in advance for long-term public sector research programmes. Financing is clearly seen as one of the main obstacles to the provision of business and research services to enterprises and more intensive science-industry co-operation.
3. It is further recommended to restructure the fragmented weakly supportive innovation infrastructure. In this regard, some developments from basic vocational training and information dissemination to promote the high-tech progress and specialised infrastructure are required.
4. There is room for improvement in co-operation in the various innovation support sub-systems.
5. The significant aspect of innovation policy should be optimised with horizontal support of business innovations and developing targeted support of risk capital and specific technology areas.
6. It is recommended to increase the amount of research of commercial organisations and finance the share of total R&D and innovations. There are two aspects of this question: increase the knowledge capability in view of industry’s added value capacity as well as its potentiality to borrowing knowledge from outside offered by the elaborated model of open innovation.
7. Create an effective coordination mechanism between innovation policies at the nationwide and regional levels. In order to benefit from regional advantages, the differences and similarities between various regions may show a need for a strengthened regional aspect of the NIS although the differences between the regions are not so significantly expressed for Belarus as a country.

Three alternative aspects towards an effective innovation management system in Belarus can be identified and will be discussed below, each of them with certain threats and opportunities. These three main concepts observed by the authors are the following:

1. Effective continuation of the present structure to achieve policy coordination.
2. Appointment of one of the present ministries to perform the role of coordination.
3. Establishment of Coordination by a high-level Innovation Council.

The authors propose a re-engineered *model of Belarus NIS*, which is represented organisationally and diagrammatically as follows (see Figure 4).

Figure 4. Proposed re-engineered model of Belarus NIS allowing dissemination of open innovation

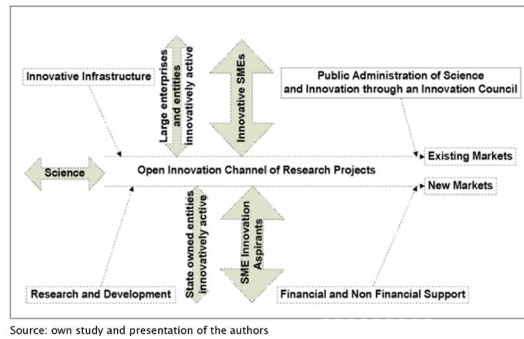


Figure 4 suggests that external and internal innovations are integrated. In the concept, enterprises share the innovation road map, align their business model with those of stakeholders and incorporate the support of the policymakers which already exist in Belarus, while focusing on new business opportunities as well as current business operations. Enterprise business models and approaches of the stakeholders are interconnected in the suggested open model and, therefore, innovations become a much more significant criterion in their development. Furthermore, innovations management does become the responsibility of every unit in an enterprise while intellectual property is considered as a “strategic business asset”. The authors are led to think that re-engineered model is able to give substantial advantages for a wide variety of Belarus stakeholders. On the basis of Figure 4 and statistical research, the authors identified the main advantages which are stipulated for the main stakeholders in Belarus (see Table 5).

Table 5. Summary of perceived advantages of open innovative development for Belarus

For Financial and Non-Financial Support Institutions and other Intermediaries	For SMEs
<ul style="list-style-type: none"> • Enabled practical and effective means for assessing performance and risk for SMEs/high-tech start-ups’ • Benchmarks spreading across countries and main industry sectors on finance sources are effectively used. • Availability of a full set of non-financial innovation management consulting tools enabled. • Opportunity to leverage input on innovation best practices & channel financial sources becomes a reality • Opportunity for competitive positioning as a “leading intermediary”. • Possible increase in borrowed funds for Research & Development & Innovation Networks developed in NIS. 	<ul style="list-style-type: none"> • Opportunity to cooperate with large enterprises, value chains and major innovators • Insight into best practice in Research & Development & Innovation Management. • Benchmarking own performance in innovation management with relevant qualitative tools. • Business interventions are identified to fill innovation gaps as compared to the best industry benchmarks. • Opportunity to establish links with R&D institutions • Testing Belarus own innovation management performance with relevant quantitative tools.
For Policy and Public Administration of Science and Innovations	For Large Enterprises and Business Entities or Organisations/ Innovatively Active
<ul style="list-style-type: none"> • Applying advantages and opportunities of existing public innovation and science policies which work well. • Opportunity to establish links with R&D institutions and SMEs which are innovation aspirants. • Availability of direct insight on focus innovation performance indexes for innovation management. • Understanding and management of existing threats and weaknesses to innovation management. • Opportunity to strengthen cooperation with large enterprises which are existing innovators. 	<ul style="list-style-type: none"> • Opportunity to co-operate with SMEs aspiring to develop and disseminate innovation. • Opportunity to develop partnerships with state-owned organisations and the private sector. • Competitive positioning in domestic and foreign markets by co-operating with other large enterprises and business entities or organisations/innovatively active. • Relevant benchmarks spreading across countries and the main industry sectors.

Source: own study of the authors

Functions and coordination activities of the proposed Innovation Council should include (but should not be limited to) awareness creation, shaping an innovation agenda, establishment and adjustment of innovation priorities in the national system. In principle, based on best practices from the EU it is proposed the Prime Minister should chair the Innovation Council while Cabinet members in charge of the economy, science and education should be functional members. In addition, a number of chief executive officers from Belarusian innovatively active organisations should be members as well as a number of top scientists active in research and development. A small number of members should be invited from other circles such as business associations, major universities and academia. Finally, a small select committee from the Government of the Republic of Belarus should conceive and propose to Parliament the Charter of the Innovation Council including membership and responsibilities.

CONCLUSION

It derives from the author's findings that it is necessary to develop an innovative environment for a knowledge-driven economy in Belarus. The new NIS would have to consist of traditional elements for all countries and those which are improved specifically for Belarus. The promising direction in advancement of the NIS lies in the improvement cooperation in development and dissemination of innovations, i.e. strengthening of interaction between science and innovations.

It should be noted that the development level of science and innovations in Belarus doesn't facilitate monitoring active innovations. In 2011-2017 the total number of R&D organisations in Belarus decreased by 9.4%, the total number of employees engaged in R&D – by 15.1%, the total number of organisations engaged in innovations – by 18.4%. In the structure of the scientific complex, 63% were commercial organisations and 67% of the total volume of scientific and technical work in 2017 was performed in-house.

In the structure of innovatively active organisations in Belarus, the dominant share (more than 90%) belongs to industrial organisations (more than 90% of them are manufacturing enterprises). Their innovative activities are concentrated in the production design, other types of pre-production for release of new products, and transfer; acquisition of machinery, and equipment related to technological innovations and R&D transfer, and new production processes.

Although the reduction in the number of participants in science and innovations was observed, there was simultaneously an increase in the number of scientific and technical activities of R&D organisations.

Finally, the authors outlined the EU concept towards innovations driving a knowledge-driven economy and EU's innovation management system. The key reasons for establishing such systems are discussed and recommendations for the most appropriate coordination model in Belarus innovative environment are offered. The authors also highlight the prospects of the NIS in Belarus such as strengthened horizontal coordination mechanism, strengthened transfer of technologies between public institutions and the private sector, restructuring the fragmented and weakly supportive innovation infrastructure, improving the innovation support sub-system including financing. In conclusion, the authors hope that the analyses, models and recommendations can serve to promote the innovative environment for stimulating innovations. This would provide qualitative conditions for growth and economic competitiveness of the Republic of Belarus in the long-term vision.

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