ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 30 (2), 2021

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ACADEMIA-BUSINESS COOPERATION IN BULGARIA: PROBLEMS AND PROGRESS POSSIBILITIES

The study presents general results of the research project "Academic sphere and business in Bulgaria: status and possibilities for expanding cooperation" carried out at the Economic Research Institute at BAS. An assessment of the status of the cooperation between the universities, research organisations and enterprises in Bulgaria is made. Main problem areas are identified and on this basis – possibilities for its expansion are derived.
JEL: I23; I28; O3

Introduction

In the conditions of globalisation and building a knowledge economy, the academic sphere – universities and research organisations, directly related to the process of creating new knowledge and forming an innovative culture of the population, is crucial for both social and economic development and achievement of intelligent growth, as well as for increasing the competitiveness of the economy. The created new knowledge requires the active participation of the business sector for its implementation in practice and the development of the process of intelligent specialisation of the economy. The need to solve the problems arising in this area is the motive to choose the subject of the project "Academic sphere and business in Bulgaria: status and possibilities for expansion of cooperation" carried out within the framework of the scientific and research programme of the Economic Research Institute at the Bulgarian Academy of Sciences, and finalised in 2020. This publication presents systematised general results of the project.

The study is based on the thesis that the weak and inefficient interaction between academic sphere and business has a negative impact on the innovation and competitiveness of the companies and enterprises, and the entire economy, on the possibilities for knowledge and technology transfer and commercialisation of the products of higher education and research, and on the development of each of the two spheres. Improving the cooperation between

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higher education, science and business in Bulgaria is one of the possibilities for increasing the innovation potential of the country through a technological renewal of production and stimulation of research and innovation.

The purpose of the project is to assess the state of the cooperation between the academic sphere (universities and research organisations) and business (enterprises) in Bulgaria, to identify problem areas and on this basis – possibilities for its improvement.

A set of methods was used in the research process, including empirical analysis of information from official statistical databases in Bulgaria and the European Union (EU), and from reports of international institutions; comparative analysis; qualitative analysis; expert assessments. The study applies authors' own approach to determine a set of indicators characterising the cooperation between academic sphere and business in the creation and implementation of new knowledge, products and services, adopting the definitions of concepts and indicators from the used national and international sources of information.

Literature Review

In the specialised literature, there are studies on the importance of and success factors for cooperation between business, universities and research institutions. A number of publications present good practices for its implementation, as well as attempts to assess its impact on the development of the academic and business spheres, the quality of their product and on the economy as a whole (Davey, Baaken, Galán-Muros, Meerman, 2011; Galán-Muros, 2016; Lam, 2010; OECD, 2014; Wilson, 2012).

The issue of the studied interaction has its own specifics in the particular countries, which presupposes the conduct of relevant national surveys in accordance with the ongoing changes related to the construction of the knowledge economy. In this regard, the topic "academic sphere – business" is a subject of a number of studies carried out in recent years in Bulgaria, devoted to certain aspects and problems of the relationship between the two spheres, dominated by publications on the relation between universities and business, as well as financial mechanisms and development of specific forms of public-private partnerships (Chobanova, 2012, 2014; Chobanova, Tassev, Milanova, Naydenova, 2013; Bakardjieva, 2013; Todorova, Slavcheva, 2016, 2017; Anguelieva, Kabakchieva, Gourova, 2011; Kirova, 2017; Georgieva, 1999; Atanassova, 2010, 2017, 2020; and others).

The study of the literature on the topic of that research reveals the existence of a number of problems related to the joint activities of the academic sphere and business in Bulgaria:

- low innovation of enterprises and low need for research products of the academic sphere;
- limited realisation and commercialisation of the created research production;
- unsatisfactory provision of the business sector with the necessary staff, with the required professional competencies and quality of knowledge and skills;
- insufficient practical applicability of the higher education in Bulgaria.

In this context, overcoming the problems of the higher education and science sphere itself, as well as the insufficient degree of innovation of enterprises, would be greatly supported by finding solutions to expand and deepen the interaction and cooperation between the two spheres.

General Assessments

The multifaceted study of the directions, state, conditions for and types and forms of cooperation between the academic sphere and the business in Bulgaria carried out within the framework of the presented project shows low degree, low efficiency and effectiveness, existence of various problems both in terms of implementation of the relationship between the two spheres, and in each of them. The results of the study allow us to highlight some general assessments.

The construction of the infrastructure necessary for the development of cooperation between the academic sphere and the business begins after the country's accession to the EU and the implementation of the goals and objectives of the first programming period 2007-2013. The practical realisation of the set goals, however, does not lead to more active interaction between the state and the components of the knowledge triangle, with little progress in terms of deepening the dialogue between academia and business. After the change of the European priorities and the adoption of the Europe 2020 Strategy, Bulgaria moves to the second stage of building an effective institutional innovation framework, related to the next programming period 2014-2020. Despite the achieved results, the Bulgarian innovation system is still characterised by separation of the areas of "research" and "innovation", low efficiency of the transformation process of the investments in research and development (R&D) into applied results, respectively low degree of commercialisation.

The interaction between academic sphere and business continues to be limited due to:

- lack of a critical mass of companies engaged in research and development;
- weak capacity for innovation and technology absorption by the business sector;
- low level of public R&D funding;
- demand mainly for external sources of funding, which leads to a distance of research from local business and to its focus on areas of international rather than national importance.

The measures and actions in the updated national strategic and regulatory documents envisaged to promote cooperation between the research institutions, higher education institutions and enterprises are still poorly implemented in practice:

- the national innovation system, in particular, public R&D and private sector innovations, remains fragmented;
- examples of successful public-private partnerships for technology commercialisation are rare;

- the role of the higher education institutions in facilitating knowledge transfer is still insignificant;
- human capital in the R&D system is insufficient;
- the slow pace of change hinders the creation of incentives for innovation in the research system;
- the mechanisms in the strategic documents provided for the involvement of local governments, companies and academic institutions do not fulfil their functions and are rather formal, failing to influence the practical establishment and implementation of the "science-business" relationship.

In recent years, there has been an improvement in Bulgaria's position in international rankings by the degree of cooperation between academia and business. For example, according to the Global Innovation Index indicator "innovation linkages" Bulgaria has increased its rank from 97 to 37 for the period 2011-2019. An improvement is observed in terms of the indicator "university/industry research collaboration" (raise of the country's rank from 100 to 69), as well as of "state of cluster development" (from 89 to 61). A progress is also reported by the Global Competitiveness Index. According to the indicator "university – industry collaboration in R&D" Bulgaria increases its rank from 68 in 2018 to 62 in 2019. These positive changes indicate the correct orientation of the national strategic goals, recognition of the existing weaknesses and obstacles and undertaking of the appropriate measures and actions, which contribute to the gradual development of the analysed relationship. However, the process remains very slow, Bulgaria is still in the bottom half of the respective rankings, and the practical results are not yet encouraging in terms of improving the country's position.

Identified Problem Areas

The problems identified in the research process in the field of and obstacles to the establishment and development of the cooperation between academic sphere and business can be summarised to the following main areas:

Strategic and regulatory framework

The process of developing, updating and approving by the European partners of the strategic and regulatory framework for the development of research and innovation after Bulgaria's accession to the EU, as well as of the relevant action plans, is slow and too lengthy: the final version of the Innovation Strategy for Smart Specialisation of the Republic of Bulgaria 2014-2020 was adopted only in 2018; of the National strategy for development of scientific research in the Republic of Bulgaria 2017-2030 (Better science for better Bulgaria) – in 2017; of the Strategy for Development of Higher Education in the Republic of Bulgaria for the 2014-2020 – in 2015, and the amendments to the Higher Education Act creating a legal basis for the implementation of various forms of cooperation in order to commercialise the results of research and training practices are from 2016. A significant part of the planned procedures

are characterised by a postponed start after their announcement, some have been interrupted due to the epidemiological situation in early 2020.

As a result, the implementation in practice of the established regulatory and institutional framework to support research and innovation in the country, which can be assessed positively in formal (substantive) terms, is still unsatisfactory in view of the achieved results and in particular – of its real impact on the formation and strengthening of the cooperation between the academic sphere and the business sector. Among the main reasons are:

- lack of consensus in society, business and government on the crucial importance of science and research for social and economic development of the country;
- continuing low R&D funding;
- lack of coordination and interaction between the line ministries responsible for the implementation of the respective strategic documents and of the related operational programmes;
- ineffective implementation of the developed measures and mechanisms to promote targeting of the research, conducted in the public academic institutions, to the needs of the business sector;
- weak government coordination of the relationship between academia and business at a national and regional level;
- search for partners both by the academia and the business mainly outside the country;
- visible separation of public and private sector activities in the field of innovation and knowledge and technology transfer;
- lack of systematic mutual dialogue and still limited implementation of incentives for more active cooperation between academia and business;
- inefficiency of the conducted information campaigns, which leads to poor knowledge of the respective programmes and procedures by both spheres.

Public and private funding

For the period 2010-2018, an almost double increase in the total R&D expenditures in the country is registered – from BGN 421.6 mln to BGN 828.9 mln. The highest level was reached in 2015 (BGN 850.5 mln). After a significant decline in 2016 (BGN 734.3 mln), they began to increase again, but still remain below the 2015 level. In 2018, the growth rate of R&D expenditures significantly exceeded that of 2017 – 2.4 times. Despite the registered growth, they represented 0.75% of the gross domestic product in 2018, and it is not realistic to expect:

- the achievement of the set national target of 1.5% of the gross domestic product for 2020;
- the overcoming the significant lag behind the EU average – overall and by sectors;

- the components of the innovation index related to research to reach the values corresponding to a "modest innovator" – the goal set in the National Strategy for Development of Scientific Research 2017-2030 to be achieved at the end of the first stage – 2022.

It can be concluded that the problems identified in the research process related to the low funding of R&D, which do not create favourable conditions for modernisation of the material base, for providing incentives and opportunities to remove barriers to knowledge transfer and commercialisation of the products of the academic sphere, and for the innovative development of the enterprises, have not been overcome and still require practical solutions.

An important problem in the field of the state funding of R&D is the fact that the measures and activities for the development of research and innovations outlined in the strategic documents are not sufficiently provided with the necessary public funds. At the same time, government policies regarding R&D funding are characterised by instability and constantly changing targets set in the several times updated National strategy for development of scientific research.

A new point is that in recent years the increase in total R&D expenditures is mainly due to the "Business enterprises" sector, where they have the largest size, share and growth rate compared to the "Government" and "Higher Education" sectors. In the structure of the total R&D expenditures, largest is the share of the sector "Business enterprises" funds (43.1% in 2018), while those of the "Government" (23.4%) and especially of the "Higher Education" (0.1%) sectors are significantly smaller. Initially, the main source of funds for R&D was the "Government" sector (43.2% in 2010), followed by the "Abroad" source (39.6%) and in third place – the "Business enterprises" sector (16.7%) with expenditures about two and a half times lower than those of the "Government" sector. In 2018, the share of the expenditures of the "Business enterprises" sector in the total expenditures for R&D is almost twice as large as that of the "Government" sector, which in turn already ranks third.

Moreover, there is mainly intra-sector funding of R&D by the business (95.8% of the expenditures in 2018), and expenditures with source "Abroad" are also directed mostly to the "Business enterprises" sector (88.2% of the expenses). All this limits the resources for the "Government" and "Higher Education" sectors to develop R&D, as well as the interest of the "Business enterprises" sector in cooperating with them. At the same time, in terms of the share of the budget expenditures for R&D from the total state budget expenditures, Bulgaria is on the penultimate place in the EU (0.56% in Bulgaria in 2018 compared to 1.4% in the EU-28), which confronts the academic sphere with serious financial problems hindering its R&D.

Another form of funding, such as the state Fund of funds, which combines funds provided under four operational programmes for financial instruments – "Human Resources Development ", "Innovation and Competitiveness ", "Environment ", "Regions in Growth ", is aimed at supporting the growth of existing new technology companies, while the financing of startups and microcredit with shared risk is still in the final phase before starting its activity at the end of 2019.

The European Commission framework programme for research and innovation "Horizon 2020" does not sufficiently fulfil its role in Bulgaria as an important source of funding for research and innovation. Researchers and businesses still face serious difficulties thwarting their effective participation. Despite the progress observed since 2016, it is insignificant, and the country remains in 24th place in the EU-28 in terms of absorbed financial contribution under this programme. One of the main barriers to funding, even for some of the projects approved in 2018, remains the lack of a budget.

Human capital

In the period 2010-2018, there is an increase in R&D personnel, especially in the "Business enterprises" sector (from 3316 to 15949 persons), where at present it is largest in number. Its significant growth in this sector leads to sizable changes in the structure of researchers by sectors and to the limitation of the human resource of the academic sphere and its potential to perform the necessary R&D, as well as narrows the possibilities for interaction between sectors.

Moreover, it is observed a much higher total number of personnel, than that in full-time equivalent in the sectors "Higher Education" (9765 and 4404 persons respectively in 2018) and "Business enterprises" (15949 and 13110 persons respectively in 2018). That could be explained to a certain extent by an informal "borrowing" of personnel between sectors, respectively a low degree of institutional cooperation. In this regard, the rapid increase in the number of self-employed persons (enterprises with zero employees) as R&D personnel (from 88 to 354) and researchers (from 71 to 321) for the period 2010-2018 is also indicative.

Another problem is the outlined negative trends in the training of potential new R&D personnel for all sectors – decrease in the number of higher schools students (from 281170 to 220168 for the period 2010/2011 – 2019/2020) and of PhD students, especially after 2016 (from 6750 to 6440 for the period 2015/2016-2019/2020).

Business capacity

A characteristic feature of the Bulgarian economy is that the predominant share of the companies perform economic activities that do not require the use of high technology (low and medium-tech industries continue to dominate[3]), and for which the needs for R&D and

[3] In 2018 the largest number and share, although slightly declining compared to 2010, have enterprises in the field of "Wholesale and retail trade; repair of motor vehicles and motorcycles". In second place are those of "Professional, scientific and technical activities". The other areas of economic activity in which there are companies from the group of hifgh-tech industries and knowledge-intensive services are "Manufacturing", in which the number of enterprises is growing slightly, but their share is declining (from 8.5% to 7.7% for the period 2010-2018), and "Information and communication" in which the number and share of companies increase significantly (from 2.3% to 3.5% for the same period). It should be taken into account, however, that in the sector "Manufacturing" only two of the industries are from the group of high-tech, in the sector "Professional, scientific and technical activities" only

innovations are limited/minimal. Small and medium-sized enterprises, which represent a significant part of the enterprises in Bulgaria, have limited resources and possibilities for R&D, and there is a decrease in the relative share of those with their own innovation activity. Innovative among them are much less than those among the medium-sized and especially among the large enterprises (according to NSI data for 2016, the share of the innovative small enterprises amounts to 20.5%, among medium-sized enterprises this share is 44.3%, while for large companies it increases to 81.9%). The number of companies that have an R&D budget, i.e. own funding for innovation is insignificant (the results of a survey within the framework of a project "Science and Business" of the Ministry of education and science, of 2013, show that only 3.8% of the companies have a budget for R&D). Overall, the share of innovative companies is growing, but is still far below the EU average (for example, the share of SMEs with their own innovation activity, of the total number of SMEs, represents 26.9% of the EU-28 average in 2019). The capacity of a large number of enterprises is not sufficient for the implementation of innovations and for the assimilation of R&D technologies and products, as well as there is a lack of skills for production and administration of innovations. In parallel with this, the number of foreign-controlled enterprises using mainly external to the country research products and services is high in percentage terms (according to the results of the above-mentioned project, foreign-controlled companies do not have targeted fund for R&D in their annual budgets and in most cases they have short-term relationships with academia, on specific projects). All this limits the needs of the business for sustainable development of cooperation with the academic sphere in Bulgaria.

At the same time, the business sector concentrates more and more human and financial resources for R&D, but lags behind in terms of development and introduction of innovative practices. There is an increase in the number of companies in the group of high-tech industries and services, and of companies that have new or improved products, but it still remains insignificant (the share of enterprises that have new or improved products new to the market is significantly lower than that of innovative ones; NSI data show that it has risen in recent years to reach 8.3% in 2016). As a result, however, the relative shares of the employed in high-tech industries and services and of sales of new product innovations, exports of high-tech products and services and patent activity are significantly below the EU average.[4] Therefore, the business in Bulgaria is still characterised by limited, although increasing needs for research products, and by insufficient, although growing potential to innovate.

It should be concluded that with the established lagging technological development, the interest of the business in cooperation is weak, the contacts with the academic sphere, where they exist, are mostly sporadic, short-term, for solving specific problems. There are many cases of cooperation which is based on personal contacts and is not institutionalised. Firms

"Research and development" is from this group, and the shares of enterprises dealing with such activitites is small.

[4] According to the European Innovation Scoreboard, the shares of the employed in knowledge-intensive activities in Bulgaria reaches 56% of the EU-28 average in 2019, of the exports of medium and high-tech products is barely 43.2%, and of the sales of new innovations for the market/company (% of turnover) is only 30.3%.

prefer R&D partnerships mainly with other companies and to a much lesser extent with academia.

The interaction between the two spheres is hampered by differences in the goals and time horizon for the performance of a certain activity, low level of information assurance, as well as by legal difficulties and problems with intellectual property and related rights. Simultaneously, the intermediation is not well developed, including by central or local level institutions, the aim of which should be the increase of the competitiveness of the economy and not the "private" interest of a particular company or academic unit.

Capacity of the academic sphere

One of the main difficulties for the functioning of the academic sphere is the insufficiency of personnel and financial resources. The R&D personnel in "Government" sector had decreased for the period 2010-2018 both in absolute number (from 9667 to 8719 persons) and in full-time equivalent (from 9346 to 8177 persons). In the "Higher education" sector the personnel in full-time equivalent had barely changed (from 4362 to 4404 persons for the same period), although as an absolute number had increased (from 7710 to 9765 persons). As a relative share, R&D personnel had declined in both sectors, much more in the "Government" sector (from 56.4% to 31.7% in "Government "sector and from 26.3% to 17.1% in "Higher education" sector), at the expense of a significant increase in the "Business enterprises" sector (from 16.8% to 50.8%). At the end of the period, the number of R&D personnel in the both sectors ("Government" and "Higher education") together was lower than that in "Business enterprises" sector, while at the beginning of the period each individually had a higher number of personnel. Although the R&D expenditures in the "Government" sector had increased for the period 2010-2018, their relative share in total expenditures had decreased (from 37.3% to 22.1%). This sector ranked second in size of these expenditures after the "Business enterprises" sector, albeit three times smaller. The "Higher education" sector's expenditures had decreased over the period as well as their share (from 11.8% to 5.4%).

There are institutional imbalances and fragmentation of higher education and research systems. Another problem concerning the development of R&D in the country is that the share of higher education institutions engaged in research is not large (around a quarter of the total number of the universities carry out research[5]), and the research element is not yet represented as an integral part of education. As a result, the academic product lags behind the EU average in terms of patents, joint projects, scientific publications, international co-publications, cited publications and others.[6] At the same time, it does not meet the needs of the business and is largely unrecognisable to the enterprises.

In addition, it is found that the academic sphere prepares a decreasing number of personnel for the needs of the business and for its own needs. The number of students studying in

[5] National Development Programme: Bulgaria 2030. Analysis of the social and economic development of the country after its accession to the EU.

[6] For example, according to the European Innovation Scoreboard 2020 the performance of Bulgaria relative to that of the EU in 2019 is as follows: PCT patent applications – 38.5%, international scientific co-publications – 24.4%, most cited publications – 20.8%, public-private co-publications – 15.4%.

Bulgarian higher education institutions has decreased steadily over the last ten years, and the number of PhD students, especially those with Bulgarian citizenship, has started to decrease since 2016. Simultaneously, a large share of the higher education graduates do not work in their speciality (according to data of "The European Higher Education Area in 2018: Bologna Process Implementation Report", in 2016 30% of the Bulgarian population aged 25-34 with higher education works in places for which higher education is not required). The quality and the fields of education do not correspond to the necessary degree to the needs of the business, to which the low degree of interaction with this sector also contributes.

All this leads to the following conclusion: although the higher education system is being modernised, the quality, the compliance of the labour market needs with the growing shortage of staff with the necessary skills, and the degree of involvement of the population in lifelong learning remain problem areas.

Market-oriented forms of cooperation and commercialisation of technologies and innovations

It is established that the use of market-oriented forms of cooperation is very limited in the country. Among the practices for realisation of this type of activities in the academic sphere, joint public-private educational, training and scholarship programmes, and analytical, expert and research activities and R&D services, assigned by the business under contract with the academic institutions, prevail. At the same time, joint research projects are rare. The latter leads to the poor performance of Bulgaria in the field of public-private publications: despite a slight increase in their relative share over the last decade compared to the EU average, it is only 17.5% of it in 2018 (10% in 2011); as a share of the total number of scientific publications, public-private ones are almost 5 times less than their average number in the EU (EU, 2019). This indicates the limited scientific cooperation between the two spheres in joint public-private research projects.

The problems of limited internal capacity and of the low level of commercialisation of technologies and innovations are essential. The normative framework for the commercialisation of the intellectual product created in the public research and educational institutions does not offer sufficient incentives for its realisation. The Commercialisation strategies developed and adopted by the higher schools in the country treat most of the existing forms of cooperation with the business as guidelines for future development, without indicating real results. The study of good practices in Bulgaria shows that the achievements of public research organisations in the field of commercial transactions related to knowledge and technology transfer are also limited.

According to the assessments of international experts, the national regulatory framework aimed at implementing innovations (legislation in the field of intellectual property protection and patent protection and registration of utility models) is well developed and largely complies with EU directives. It does not impose any restrictions on the use of intellectual property for the purpose of securing loans by enterprises and gives the research organisations and the higher education institutions freedom to manage the rights of the intellectual property they develop. A significant problem in this area is that the system of intellectual property

rights is not sufficiently used by enterprises and academia due to a number of obstacles, including the lack of experience and skills to manage innovations – Bulgaria ranks penultimate in the EU in terms of general patent applications. Some other weaknesses should be mentioned, such as:

- the application of regulations is uneven;
- the perception by the private sector is limited mainly to patents obtained through international partnerships, which does not stimulate local innovation activity;
- the patent activity in the field of higher education is relatively low;
- the system for the protection of intellectual property rights remains unpopular and the level of awareness of its benefits among business and academics is still limited;
- practices of patent application/possession by individuals, as well as non-institutionalised (informal) contacts between the representatives of the academic sphere and the business community are widespread, which leads to problems in the management and protection of the intellectual property of the academic institutions and the research centres and complexes.

Despite the obstacle to the commercialisation of innovations was overcome through the amendments to the Higher Education Act from 2016 by creating normative opportunities for the development of academic entrepreneurship, this activity is not yet developed in the country. As the performed analysis shoes, this refers mainly to the lack of practices for establishing academic spin-off companies, i.e. the activity of creating new innovative enterprises in the academic institutions is not intensified. Among the reasons is the lack of "entrepreneurial" character and skills of most public higher education and research institutions, as well as of incentives and attitudes for research mobility in the enterprises, necessary for the development of cooperation with the business sector.

Unlike the spin-offs, the Bulgarian startup ecosystem has undergone significant development in recent years: nearly 2000 startups were created in the period 2013-2018 (predominantly in the ICT sector), with 650 active; 15% of startups are high-tech, one third of the product companies and one fifth of the service companies create global innovations.[7] However, the available information on startups operating in the country does not allow to understand and evaluate either the participation of the academics in them or the presence of academic ones.

Non-commercial forms of cooperation

The study shows that informal and non-commercial forms of cooperation prevail in the country, both at institutional level and in most cases at individual level, which do not bring economic benefits to the academic sphere. Sometimes they lead to cooperation agreements or, much less frequently, to the commercialisation of the product, which is more typical for the fields of higher education and vocational training. Another more common form of

[7] The information is based on data from: https://investsofia.com/start-up/.

cooperation is barter in formal non-commercial agreements – organised by the companies internship and scholarship programmes, workshops, master-classes and the like.

Intermediary scientific and technological infrastructure to facilitate the transfer of knowledge and technology

The construction of an intermediary scientific and technological infrastructure to facilitate the transfer of knowledge and technology in the country is one of the main ongoing activities to promote the development of the relationship "academic sphere – business". Due to the initial stage of most of the existing projects, the effectiveness of the cooperation between the academic sphere and the business cannot be assessed. What has been achieved in this field is mainly expressed in the construction of research infrastructures and the equipment of laboratories.

The information about the currently registered by the Ministry of Education and Science 4 Centers of Excellence and 9 Centers of Competence is reduced to a description of the expected effects and impacts of their activity, and there is no data on the achieved results. Several national innovation complexes (infrastructures) have been built or are under construction.

The Procedure "Establishment and development of Regional Innovation Centres (RIC) "was unsuccessful during the first programming period and is characterised by a serious delay in the current one. It was officially announced that opportunities for its implementation will be sought within the funds of the new programming period 2021-2027.

Within the scope of the functions of the technology transfer offices and centres established in the country, predominate activities related to:

- dissemination of information, including research results;
- provision of consulting services;
- training activities;
- research on the needs of companies in the relevant scientific fields or in a regional context;
- performance of scientific, technical and economic assessments and expertise of the presented developments and projects;
- organisation and participation in workshops and various events and happenings in order to establish contacts.

At the same time, activities related to the legal provision and other types of support for the protection of the intellectual property, as well as for assistance in launching and implementing innovative developments, products and solutions, do not receive the necessary attention. The study conducted on the existing websites of the technology transfer centres, especially those set up under the PHARE programme and the previous operational programme, shows that most of them indicate only the objectives, tasks and services set out at the beginning of the project and not the results of the activity, which calls into question their actual functioning.

The general conclusion is that the system of established centres for technology transfer in most academic institutions is inefficient and is characterised by inadequate knowledge of the business needs and of the commercialisation tools, mainly those for the assessment and protection of intellectual property.

Such new forms of cooperation in the field of innovations as innovative clusters are in initial phase of development in Bulgaria, but, according to a specialised study (Kirova, 2017), their performance in the field of economy, as well as in the regional context is still unsatisfactory, and a large part of the existing cluster structures are outside industries with innovative potential for development.

Sofia Tech Park is an initiative of great importance for the development of the research and innovation processes in Bulgaria and for the establishment of real interaction between the spheres of academia and business. However, in order its goals and mission to be achieved, it is necessary to overcome a number of serious shortcomings related to the limited use of its scientific infrastructure, management and long-term financial sustainability, registered by an independent panel of experts in the design and management of science parks whose secretariat has been provided by the Joint Research Centre, the European Commission's science and knowledge service.

Accelerated development is observed with regard to the intermediary network of non-profit organisations and associations to facilitate and support the transfer of knowledge and technology, including by supporting the process of building partnerships between the academia and the business. The fact is, however, that there are no examples of real commercialisation of intellectual product as a result of their activities. The undertaken initiatives lead mainly to the establishment of informal contacts between the representatives of both spheres, and not to the formation of market relations between the stakeholders.

The general conclusion about the development of the intermediary infrastructure for knowledge and technology transfer at a national and regional level is that its characteristic feature is instability over time, its separate forms are in initial stage or under construction, good practices are limited and unsystematic. It still has no significant impact on establishing fruitful cooperation between academia and business.

Opportunities to Improve and Expand "Research – Higher Education – Business" Cooperation

Based on the identified and systematised groups of problems in the development of the cooperation between academia and business, the areas that provide opportunities for its improvement and expansion are outlined.

In the field of normative and institutional regulations, where there is a lack of policy coherence, therefore education, research and technology are not considered as interconnected components of a system. With a view to comprehensive regulation and coordination of relations between stakeholders in the fields of research and innovations and increase the

innovation and competitiveness of the Bulgarian economy, it is necessary to improve the sustainability of the government policy and the coherence of its separate components, aimed at the development of research, education and innovations, as well as the coordination of the actions of the line bodies and institutions responsible for its implementation. In this regard, it is appropriate to adopt the long-delayed draft of the Innovation Act, developed in 2016, which aims are: predictability of the innovation policy; increasing public and private funding for innovations; improving the business environment by supporting the creation and growth of economic activity and reducing regional imbalances; supporting the application of innovative approaches in the enterprises and others. Such a law is necessary, but the drafted project must be revised and improved, eliminating the existing gaps identified in the process of its public discussion, and reflecting the current problems of the management of the national innovation system, which have arisen in recent years in the process of the implementation of the relevant strategic and regulatory documents and the implementation of the operational programmes.

To overcome the lack of coordination between the current state structures in the development and implementation of policies for smart growth, it would be useful to establish a single state regulatory body/agency for the promotion of innovations. Such an agency was proposed in the treated draft law, but has not yet been established. The current Council for Smart Growth at the Council of Ministers and the National Council for Science and Innovation at the Ministry of Education and Science are advisory bodies without operational powers, and at the same time, as practice shows, do not contribute to the synchronisation of policies and actions in the field of research and innovations. The establishment of such a structure would help to overcome the pointed problem and to establish a coordination link with the intermediary organisations assisting in the creation and transfer of knowledge, as well as to support the coordination of the activities of local technology transfer centres, which will facilitate the commercialisation of the research results.

In the field of funding, which is characterised by insufficient and unsustainable public funds for the development of R&D in the country and reliance mainly on external sources. The inadequate amount of government funding leads to the non-fulfillment of its main function to sustain and support the effective functioning of public academic institutions. Its increase is necessary to enhance productivity and support with financial resources, the process of commercialisation of the product of the academic sphere. In addition, the research evaluation criteria for budget allocation need to be improved. They should take into account the specifics of separate institutions and research areas, as well as the quality of research in view of their applicability in the business sector and public life.

The low level of public funding of R&D is accompanied by a rise in price and duplication of some of the measures. One of the ways to overcome them is the implementation of the new European initiative “Open Science – Open Innovation”. The first step in the process of development of the open science is the establishment by the Ministry of Education and Science in 2020 of a Bulgarian portal for open access to scientific information, which is maintained by the National Centre for information and documentation in pursuance of the Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information.

An important specific financial instrument for the development of the research-business relationship is the Technology Transfer Fund, which is intended to support projects in the thematic areas of the national Innovation Strategy for Smart Specialisation aimed at strengthening the interaction between academia and business, as well as to create a favourable environment for the development of innovations worked out in academic institutions, technology parks and laboratories. In 2020, the Fund of Funds completed the procedure for selection of a financial intermediary for the management of the Technology Transfer Fund, the call for project proposals began, but its real activity is still in its infancy, which does not allow an assessment of its contribution to the development of either operating or newly created innovative companies.

The resources of the Technology Transfer Fund are expected to trigger the financial instruments for startups. The mechanisms functioning so far under the Operational Programme "Innovation and Competitiveness" mainly benefit the already operating companies, because the financing scheme provides for the recovery of the initially spent funds. The latter makes it difficult for small startups, so the introduction of tax reliefs in the first months would allow them to overcome the problem of risk capital shortages. It should be emphasised that there are generally no tax reliefs for R&D in Bulgaria. This limits the motivation of the business to finance it and to seek cooperation with academia. Such a practice is typical for many countries, where different forms of tax preferences are applied for both enterprises and academic institutions. Given the current state of the academic and business spheres in the country and the low level of cooperation between them, it would be useful to introduce such preferences in order to create favourable tax conditions for funding research and innovations, especially for companies investing in Bulgarian research. It should be noted that the introduction of tax incentives and their possible forms in the field of R&D is a subject of ongoing discussions in Bulgaria (Damyanova, 2020).

With regard to the funding from the European funds and programmes, it should be emphasised that it is carried out on a project basis, which raises the question of the sustainability of the achieved results after the completion of the project, i.e. to what extent the effects of this form of funding will last over time. A practical example in this regard is the already established separate structural units for intermediary scientific and technological infrastructure to facilitate the transfer of knowledge and technology, many of which do not operate or do not work effectively after the suspension of funding. This depends, to a large extent, on increasing their capacity, especially in management, on their interest and on their management, which requires improving the activities of intermediary structures, including of the state, to meet the interests and time horizons of business and academic sphere.

In general, it should be underlined that it is necessary to raise the criteria for allocating funds under national and European programmes and to increase the control over their spending.

In the field of human capital, in which it is observed a shortage of personnel in public research organisations, as well as its transfer to work in the private R&D sector and in higher education or foreign academic institutions. Among the important ways to overcome these trends is the increase of the attractiveness of scientific careers and of the payment for research work, which is inadequate both to the EU average and to a number of other economic sectors

in the country. The increase in wages and the academic professional growth must be accompanied by more adequate criteria for evaluating research work, as well as by incentives for more active participation in knowledge and technology transfer activities.

Another possibility to expand and deepen the cooperation between academia and business, to learn about the mutual opportunities and needs for partnership, to acquire the necessary skills and exchange experience is the stimulation of the development of intersectoral mobility of researchers and practitioners. This requires the creation of appropriate pathways for its implementation at institutional level in both spheres (internships, business trips, etc.).

In the field of the potential for cooperation between business and academic sphere, which is still insufficient and does not lead to real partnerships, especially in the field of R&D and to a lesser extent in education and training. Its development requires better matching between demand and supply of scientific and technological products. One of the solutions to the problem with the found weak demand from the business is to provide it with accessible and up-to-date information about the achievements in the scientific field. At the same time it will help to increase its trust in the quality of the offered products, on the one hand, and on the other, to increase domestic demand at the expense of external transfers. With regard to supply, it is appropriate to constantly monitor the current needs and niches of the market by the academic sphere in order to produce the desired product. There is also a need of change in the style and way of working in this sphere in order to achieve greater flexibility and faster reactions to the emerging needs of the business. Improving mutual awareness of the needs and capabilities of both parties and the communication between them is a condition for deepening cooperation in the field of R&D.

In order to improve the cooperation between both spheres, the efficiency of the activities of the intermediary structures for transfer of knowledge and technologies related to information provision, consulting and training activities should be increased, with emphasis on the provision of legal and other services to support protection and management of intellectual property rights, for launching and implementing innovative developments and products, etc. This would also help to:

- overcome the lack of skills for creating and managing innovations in enterprises and of human potential for their implementation;
- raise the entrepreneurial culture of the academic staff;
- improve the skills of academics to assess the market orientation of their research projects and the ability to participate in research consortia;
- overcome the differences in the professional culture/the way of work of the academic institutions and the business.

In the field of R&D commercialisation, which is characterised by an adequate legal framework, but the main problems are the low level of its knowledge, the insufficient institutional culture, interest and initiative to carry out relevant activities related to

commercialisation, as well as to the exploitation and transfer of knowledge and technology. A proactive behavior in both spheres is necessary, which would be facilitated by awareness and knowledge of the benefits of commercial forms of cooperation between them. In turn, the latter can be achieved through wider involvement in the information platforms created by the intermediary organisations, in their training initiatives and those of the Bulgarian Patent Office.

The development of effective Commercialisation strategies by all structures in the academic sphere is important for overcoming these problems. Such strategies have already been adopted by some institutions, but the practice related to commercialisation shows a low degree of their effectiveness. In this regard, the academic Commercialisation strategies must set out appropriate policies and mechanisms (procedures, rules, instructions, etc.) for their implementation and financial provision, including the provision of funds for the acquisition of intellectual property rights over their respective objects and for the commercialisation of the created research products. Covering patent costs at institutional level would help to overcome the observed trend of claiming inventions mainly by individuals.

The achievement of the institutional strategic goals requires raising awareness and knowledge and skills through relevant, initiated by research organisations and universities information campaigns and training courses for the administration and academic staff on the needs, benefits and ways of implementing the commercialisation process.

Another possibility in this direction is the improvement of the personnel capacity of the technology transfer units (offices, centres) for providing qualified services for primary consultations, regulation of the intellectual property rights, assistance for preparation of documentation and for application activity for obtaining patents and licenses, preparation of market expertise/assessments of the intellectual property objects and others. More effective activity of these units can be achieved by creating their own information platforms for presentation of the produced, including patented, scientific products and through marketing research of the business needs.

Conclusions

In conclusion, we would like to emphasise that Bulgaria should faster get out of the bottom of the rankings for competitiveness and innovation. For that purpose, it is necessary to encourage, stimulate and support the development of high-tech industries and services, on the one hand. On the other hand, it is imperative that public and political consensus make research and development a real priority for the social and economic development of the country. To a large extent, it is the lack of consensus that leads to the conclusions on the state of research and innovations found in the study, and more specifically: in the presence of favorable conditions – a good strategic and regulatory framework and provided programme funding, the desired results have not been achieved and Bulgaria is still far from meeting national targets in this area. An important reason for that is the inefficient use of the allocated funds in view of the practical realisation of the envisaged goals and carrying out activities, which often do not lead to actual implementation of the set indicators.

All this implies still limited opportunities for expanding and deepening cooperation between business and academia. In turn, the weak interaction between higher education, research sphere and enterprises has a negative impact on the innovation and competitiveness of the business sector, on the opportunities for commercialisation of R&D products, as well as on the improvement of the conditions for development and increasing efficiency, quality and effectiveness of the Bulgarian higher education and research systems.

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