THE HIGHER EDUCATION INSTITUTIONS AS PART OF THE INNOVATION INFRASTRUCTURE IN BULGARIA

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Abstract
The outbreak of the COVID-19 pandemic has forced changes in people's thinking of finding new job opportunities, directly related to innovation in organizations. A prerequisite for their implementation is the performance of R&D, which implies the engagement of researchers, as well as the provision of financial resources for conducting their research. An important place in these processes is taken by the Higher Education sector, which provides the necessary specialists, as well accommodates favorable conditions for research and development activities. In this regard, the purpose of this article is to characterize the state of personnel engaged in R&D in higher education institutions in Bulgaria, as well as the funds they invested in research for the period 2018-2020.

Keywords: Innovation, R&D, Higher Education, Staff, Expenses

1. INTRODUCTION
Innovations are a prerequisite for discovering new competitive advantages, strengthening market positions, and satisfying consumer preferences more fully. This presupposes the formation of a favorable environment in which the conditions allow testing of ideas, their development and transformation into real values that find a place in the market. Both the internal and external environments of organizations are important, as a synchronicity must be achieved between them that predisposes to innovation. Innovations find application in all spheres of human activity, which explains the long-standing interest in them.

2. INNOVATIONS, INNOVATION INFRASTRUCTURE AND INNOVATION SYSTEM
Innovation has been the subject of research for centuries. However, there is still no consensus on their definition. A common element, commented on in some way by all, is the need for novelty, the scope of which includes various aspects, as well as mandatory practical applicability. Today, innovation is seen as the main engine of growth and competitiveness of any economy, region, and company. As a result, Asenov and team of authors (2017, p. 346), for example, write about three levels of enforcement of innovation policy, namely: European, national and company, each of which is characterized by its own particularities. The framework in the form of directives, regulations, strategies and key areas of innovation are defined at European level. State policy finds expression in the innovation strategy of the specific country and represents the national level. This strategy, in turn, is the basis for the development of private strategies and innovation plans at the company level. As a result, the company's innovation strategy is a part of the organization's corporate strategy, oriented towards achieving the company's innovation goals.

The formation of a favorable environment is a prerequisite for effective innovation activity, as a result of
which there is a thesis in the specialized literature that this implies the formation of an innovation infrastructure. Numerous researchers, among whom are D. Schuurman, L. Marez, P. Ballon (2013), A. Stahlbrot and B. Bergvall-Kareborn (2013), N. Vitanov (2013), H. Chesbrough and S. Brunswicker (2014), W Janssen et al. (2014), M. Abuzyarova (2015), A. Alexander, K. Miller, S. Fielding (2015), reduce its main components to the following: innovation intermediaries; specialized centers for the development of new products and technologies; source of financial support for innovation activity; coordinator of the innovation process; consulting and educational centers. At the same time, we must point out that in order to generate innovations - a scientific research infrastructure is also needed, provided with the necessary equipment and people to conduct scientific research. In practice, the modern innovation and scientific infrastructure is a prerequisite for the formation of new knowledge, for its practical implementation, for building effective partnership relationships between the elements of the scientific and innovation system, such as higher schools, research organizations and businesses. In turn, the innovation system is presented as an open network of organizations that simultaneously interact with each other and function under certain framework conditions regulating their activities and interactions (Panteleeva 2013:266). The innovation system is characterized by three elements that represent its components and these are: networks; innovation activities; framework conditions. Taken together, they jointly perform the function of creating and disseminating innovations that accumulate economic, social and environmental value as a whole. As some researchers point out, innovation systems have different scopes, which is why in literature and practice they are classified as follows (Kerchev 2011:108; Panteleeva 2013:267): by company, by sector (technological), regional, national, and international innovation system.

At the same time, from the point of view of organizations, the innovation system has an internal and external circle, each of which is characterized by its own characteristics and participants. The inner circle is associated with the formation of three main functional blocks related to research and development (R&D), production and sale of products (services). The outer circle, in turn, creates the environment in which companies can develop innovative activities. The main participants in it are: state structures and public institutions; higher schools and similar institutions; innovation formations. From the point of view of the goal set in this article, the higher schools are of particular interest to us. They are closely related to the implementation of theoretical and risk research, but in general they have little appeal for private business, which is why they are characterized by low commercial potential. We should also point out the fact that universities have a double role – on the one hand, they stimulate the general and specialized educational level of the workforce to provide prepared personnel for business and society, and on the other hand, they develop two-way links for the applied and fundamental innovative activity of companies and technology centers. The implementation of innovation activity also requires building an innovation culture in the organization, on the one hand, and on the other hand, it is directly dependent on the availability of knowledge and creativity, which are the basis for development. Scientific, technological and organizational innovations are generated through them. They, in turn, are a prerequisite for change, for which experience shows that we should consider it as a natural process related to transformations and oriented towards increasing the strengths and competitive advantages of companies. The success of organizations depends on the degree of flexibility in the decisions made and the strategies developed to respond to the constantly occurring changes in the environment. The acquisition of new knowledge itself is of leading importance, as it lies at the heart of R&D, which is also directly related to innovation. The formation of new knowledge, as we have already indicated, takes place in specialized institutions. The real implementation of effective R&D presupposes the availability of appropriate conditions and resources, among which the central place is occupied by people and the financial means invested in research. According to the Strategy for the Development of Scientific Research 2017-2030 in Bulgaria, the strengths of these studies are indicated precisely by the people involved in them, i.e. scientific workers and researchers.

### 3. R&D IN THE HIGHER EDUCATION SECTOR IN BULGARIA

There are currently 52 higher education institutions in Bulgaria, of which 14 are private (https://rvu.nacib.bg/institutions). Higher education institutions are places where, on the one hand, researchers work, and on the other, potential researchers are trained. The quantity and quality of scientific workers and researchers are important for carrying out research and development activities, on the basis of which innovations are carried out. In this regard, we can point out that for the period 2018-2020, the workforce engaged in R&D in the field of higher education in Bulgaria remains relatively stable. The analysis of the data shows that there is a slight decrease in the number of researchers in higher education institutions in Bulgaria in the amount of 4% for 2019 and below 3% for 2020 compared to 2018. Despite the outbreak at the beginning of 2020 pandemic, there is an increase in people engaged in research and development in 2020 compared to 2019 by just over 1%. Regarding gender, an important characteristic for Bulgaria is the
approximately equal distribution with a slight preponderance of female researchers in higher education institutions, whose share varies between 54% and 55% for the reviewed period (see Fig. 1).

![Fig. 1. Personnel engaged in R&D in the Higher Education sector in Bulgaria by gender (2018-2020)](image1)

A more detailed analysis of the field of higher education in relation to individual scientific fields shows that the largest share is distinguished by personnel engaged in R&D in technical sciences (41%), followed by medical and health sciences (21%). The number of researchers in the field of humanities and arts is characterized by the smallest share. The only area in which an increase was observed during the entire considered period (2018-2020) was medical and health sciences, where in 2020 the largest number of female researchers worked - 28% of all female researchers in Bulgaria. (see Fig. 2).

![Fig. 2. Personnel engaged in R&D in the Higher Education sector in Bulgaria by fields of science (2018-2020)](image2)
A reason for this growing trend in the field of medical and health sciences can be found in the need for more research related to the outbreak of the COVID-19 pandemic.

The positive trend, of increasing the share of people with higher education and a doctorate degree carrying out R&D in Bulgaria, while maintaining their relative share over the years is impressive - 84% and 27% respectively. For researchers with other education, a drop of just over 1% is observed (see Fig. 3).

![Fig. 3. Personnel engaged in R&D with the Higher Education sector in Bulgaria by level of education (2018-2020)](image)

The analysis of data on the citizenship of researchers in the sphere of higher education in Bulgaria shows that almost 99% of all have Bulgarian citizenship (see Fig. 4).

![Fig. 4. Distribution of researchers by citizenship in the Higher Education sector in Bulgaria (2018-2020)](image)

From the point of view of the age structure, the extremely low relative share of researchers in the age groups up to 25 years between 2% and 3% (for 2020 and 2018, respectively) is striking. We can look for a reason
for this in the fact that in Bulgaria, high school graduates are aged 18-19, after which they study for 4 or 5 years at universities. In this way, people aged 23-24 and older are attracted as researchers in higher schools. 18-19% of the total number of personnel that are engaged in research in the field of higher education are between the ages of 25-34. People between the ages of 35 and 54 are the most, forming a total of 50-52%. The share of personnel aged 65 and over increased by less than 1% and represents slightly more than 5% of all scientific workers in the country (see Fig. 5).

Fig. 5. Distribution of researchers by age groups in the Higher Education sector in Bulgaria (2018-2020)

An important resource necessary for the implementation of R&D is the financial means invested in it. In this regard, we should point out that for research and development expenses in the field of higher education, their increase was observed during the considered period, and more precisely - by 1.6 times in 2019 compared to 2018 and by 1.4 times in 2020 compared to 2018. The data shows a decrease of 15% in 2020 compared to the previous year 2019 (see Fig. 6).

Fig. 6. Expenditures for R&D in general and in the Higher Education sector in Bulgaria (2018-2020)

A more detailed analysis by scientific field shows that the highest research spending was reported in medical and health sciences, where the increase was the largest, at 2.3 times in 2020 compared to 2018, which exceeded the increase of the total amount of expenses in the amount of 1.4 times in 2020 compared to 2018 (see Fig. 7).
In a territorial aspect, due to the uneven distribution of higher education institutions in Bulgaria, as well as the peculiarities of the scientific areas of competence, there are large differences between the expenses incurred for R&D in higher education, with 78% of the total expenses being concentrated within the South-West and South-Central Bulgaria. The capital is also located there - the city of Sofia, where most of the country's universities are concentrated. On the other hand, a one-way dynamics of costs is observed – an increase compared to the beginning of the period and a decrease in 2020 compared to 2019 (see Fig. 8).

Fig. 7. Expenditures for R&D in the Higher Education sector in the scientific fields in Bulgaria (2018-2020)

Fig. 8. Expenditures for R&D in the Higher Education sector by statistical regions in Bulgaria (2018-2020)
Given the importance of R&D as a basis for innovation, Bulgaria should work towards increasing the funds invested in this activity. On the other hand, better research funding is also a prerequisite for the development of higher education centers in the country. It is necessary to work in the direction of finding a way to overcome the decline in the amount of funds allocated to R&D in higher education, in order to secure the financial prerequisites for scientific research, as well as to maintain the favorable trend reported above of a growing number of researchers in the country.

4. ACKNOWLEDGEMENT

One of the main tools stimulating the conduct of modern research and increasing the activity of entrepreneurs in the field of innovation is the construction of a modern scientific and innovation infrastructure. It should provide favorable conditions for implementing new ideas in organizations and accelerating their growth. Higher schools are an invariable part of it. An important feature is the fact that the creation of an opportunity to increase the practical activity of universities and, accordingly, the diffusion of theoretical results to the concrete practical activity of companies implies working in the direction of stimulating the connections between universities and business. State policy regarding R&D and innovation in general is also important. During the last two program periods, the EU’s attention has been concentrated in this direction as well, since innovation is a driver of economic growth in general. Bulgaria is no exception in this regard, but has not yet reached the expected level and should continue to work in this direction.

REFERENCE LIST


