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## IMPACT OF STATE INVESTMENT ON THE DEVELOPMENT OF PROJECTS AND PROGRAMS IN HIGHER EDUCATION

### IMPACTO DE LA INVERSIÓN ESTATAL EN EL DESARROLLO DE PROYECTOS Y PROGRAMAS DE EDUCACIÓN SUPERIOR

Tatyana Rodenkova<sup>1</sup>

E-mail: [Rodenkova\\_t@mail.ru](mailto:Rodenkova_t@mail.ru)

ORCID: <https://orcid.org/0000-0002-5185-3076>

Zhanneta Gerzelieva<sup>1</sup>

E-mail: [gerzelgi@yandex.ru](mailto:gerzelgi@yandex.ru)

ORCID: <https://orcid.org/0000-0003-1387-0593>

Vladimir Slepov<sup>1</sup>

E-mail: [slepov.va@rea.ru](mailto:slepov.va@rea.ru)

ORCID: <https://orcid.org/0000-0003-0373-7190>

Tatyana Verezubova<sup>2</sup>

Email: [verezubova\\_t@bseu.by](mailto:verezubova_t@bseu.by)

ORCID: <https://orcid.org/0000-0001-7507-9487>

Anastasia Krasikova<sup>1</sup>

E-mail: [anastasiagkrasikova@yandex.ru](mailto:anastasiagkrasikova@yandex.ru)

ORCID: <https://orcid.org/0000-0001-5443-4988>

<sup>1</sup> Plekhanov Russian University of Economics. Russian Federation.

<sup>2</sup> Belarusian State Economic University. Republic of Belarus.

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#### ABSTRACT

In European countries, the predominant government investment in education calls for constant upscaling of the funds allocated for not only the functioning but also the development of national higher education systems. In this context, updating the investment toolkit, including through projects such as academic excellence strategies, contributes to the development of the university system, making it more dynamic and internationally competitive, aimed at strategic institutional profiling. Exploration of the various aspects of higher education funding helps determine the effectiveness of national policy in investment in education, as well as its possible impact on the prospective development of the country as a whole. The conducted analysis of the current trends in investment in higher education in European countries allows determining the key instruments for attracting public investment in OECD universities and revealing the features of state investment in universities in Germany as a leading country in terms of public investment and university-enterprise collaboration.

#### Keywords:

State investment, funding for OECD universities, investment in academic excellence programs, university-enterprise collaboration.

#### RESUMEN

En los países europeos, la inversión gubernamental predominante en educación exige una constante ampliación de los fondos asignados no solo para el funcionamiento sino también para el desarrollo de los sistemas nacionales de educación superior. En este contexto, la actualización de la caja de herramientas de inversión, incluso a través de proyectos como las estrategias de excelencia académica, contribuye al desarrollo del sistema universitario, haciéndolo más dinámico y competitivo internacionalmente, orientado al perfil institucional estratégico. La exploración de los diversos aspectos de la financiación de la educación superior ayuda a determinar la eficacia de la política nacional de inversión en educación, así como su posible impacto en el desarrollo prospectivo del país en su conjunto. El análisis realizado de las tendencias actuales de inversión en educación superior en los países europeos permite determinar los instrumentos clave para atraer inversión pública en universidades de la OCDE y revelar las características de la inversión estatal en universidades en Alemania como país líder en términos de inversión pública y desarrollo universitario. colaboración empresarial.

#### Palabras clave:

Inversión estatal, financiación de universidades de la OCDE, inversión en programas de excelencia académica, colaboración universidad-empresa.

## INTRODUCTION

European Union's development strategy for the period until 2030, embodying the ideology of sustainable development, stipulates a new technological upswing based on scientific research and innovation as the key direction of economic development. In pursuit of this goal, European countries in the course of the next decade will strive to fund projects with "high 'social payoff' and the creation of open ecosystems for research, innovation, and education" (Ibragimova, 2018). It is also considered advisable to ensure not just the quality, but also the efficiency of higher education through sustained investment both directly in education and in university research and development. On average, OECD member countries spend 4.9% of GDP on education-related purposes, of which public spending constitutes 4.1% of GDP.

The need for predominantly public funding of European universities stems from the socio-economic benefits that higher education brings to society. On average in OECD countries the state spends 1.4% of GDP on higher education, given that every dollar invested in this sphere brings \$2-3 to society. State protectionism in the policy of financial support for European higher education is driven by the fact that investment in this sphere, forming the quality of human capital, increases labor productivity, contributing to the economic growth and social development of the state.

The level of state support for universities varies greatly in European countries. For example, in England, direct financial support for universities is less than half of their total income, while in Denmark and Norway it goes beyond 90% (Claeys-Kulik, Estermann, 2015). Most EU countries, but four, are more and more often considering the appropriateness of performance-based funding for institutions of higher education (8). Only Germany, Estonia, Malta, and Spain are allocating funds based on a substantiated application agreed upon with the funding body. In these countries, public expenditures on educational institutions from primary to higher education are typically higher than the OECD average (4.1% of GDP) (De Martino, et al., 2020). In addition, they are characterized by the fact that "the sums allocated by the state to the maintenance and development of higher education account for about 80% of all funds spent for this purpose". (De Martino, et al., 2020)

The COVID-19 pandemic has had a far-reaching impact on the higher education sector in OECD countries, forcing institutions to urgently switch to distance learning. This has substantially raised the financial burden on the state budget, limiting the availability of public funding for higher

education in OECD countries. For example, the German economy was teetering on the brink of recession in 2019 with only 2.1% GDP growth in 2021 in contrast to 2018, when the German economy's contribution to global GDP was 4.65%. Developed countries have spent about 17% of their GDP on fighting the pandemic. In Germany, the additional costs and lost revenues due to the COVID-19 pandemic were 11%. Despite this, in 2020, expenditure on research and development in this country amounted to \$109.8 billion (4th place in the world). Furthermore, the state support for leading universities, by the number of which Germany ranks 3rd in the world in the 2021 QS ranking, not only is not reducing but is supported by long-term financial guarantees.

In this light, the purpose of this study is to analyze the mechanisms of university funding and trends in their changes based on the example of Germany as one of the leading European countries. Achievement of this research goal provides for formulating scientifically valid conclusions about the expediency of expanding the tools of public investment in national projects and programs for the development of universities in Europe.

Reports of the European University Association and expert releases of the League of European Research Universities present information characterizing the level of international competitiveness of European universities. This information confirms Salmi's (2016), assertion that *"none of these high-quality private institutions subsists on private sources of funding alone"* and that the problems of reaching the level of a "world-class university" are usually brought about by a number of factors. The most significant of these are not only limited financial and intellectual resources but also socio-economic and political factors.

The particular interest of Russian scientists Lukichev & Filippov (2008), in studying the influence of these factors on the volumes and sources of funding of universities arises from the need to understand the processes of globalization and internationalization in the global educational space. Senashenko (2017), further investigates the problems of financing higher education in developed countries owing to specific socio-economic situations. Scientific papers by Gherghina & Cretan (2012), stress the importance of differentiating the sources of funding for higher education, and studies by Claeys-Kulik & Estermann (2015), focus on effective funding strategies for European universities. In the last two decades, the theoretical basis for scientific research in the field of higher education financing has been the Concept of Knowledge Economy, first proposed by the American sociologist Drucker (1995), at the meeting of the Committee on Science and Technology Policy of OECD countries. Later, it was also

used for the development of the Europe 2020 Strategy for Education. Within the framework of this Concept, the so-called “knowledge production models” were proposed. For our study, of particular interest are three of them:

- Gibbons, et al. (1994), Mode 2 model, which explores “state-university”, “university-enterprise”, “state-market”, “science-business” interaction, etc. The essence of the model is the institutional unification of various spheres of knowledge production, innovation, and technology;
- Etzkowitz & Leydesdorff’s (1998), “triple helix” model, which includes three institutions – “university, government, and business”, as well as a system of incentives for the development and use of innovation in the new economy with the prevailing role of universities as organizers of basic research;
- the “pentaspiral” model combining science with education, as well as with business, power, and civil society institutions, which was developed based on Ackoff’s & Emery (1972); and Urmantsev’s (2014), theories of system stability and Etzkowitz’s knowledge space theory” (1998) and assumes comprehensive management of the creation of innovative technologies based on new knowledge.

We believe that world-class universities are becoming one of the tools for implementing the “pentaspiral” model, while other classes of modern universities (e.g., leading and research universities) should at least conform to the “triple helix” model with significant resource support from the state.

Altbach (2003), argues that *“the cost of creating a world-class university is directly related to the amount of government investment in the industry”*. His view is echoed by Salmi (2016), who argues that “today one can hardly expect a world-class university to be subsisted without public assistance and direct financial support from the state”. Drawing on international experience, Salmi (2016), identifies the key strategies of governments in this process: *“state support for major leading universities; encouraging the state to transform several universities into a new university; creating a new world-class university from scratch”*. To this end, the DEFINE project of the European Association of Universities investigated the public funding mechanisms of European universities in order to support their international competitiveness and efficiency. This included *“large-scale initiatives aimed at developing broader institutional strategies, such as the so-called ‘excellence initiatives’ in Germany and France”*.

Most researchers note that the mechanisms of university financing vary in different European countries and have their own specifics due to the level of social and economic

development of the country, on the one hand, and the national characteristics of educational systems, on the other. However, the issues of state guarantees for long-term investment in world-class national universities in order to maintain their financial sustainability and investment attractiveness remain outside the scope of research.

## MATERIALS AND METHODS

The conducted research is based on the theoretical and methodological provisions of the international Concept of the Knowledge Economy dedicated to the transformation and modernization of national education systems in the context of globalization and internationalization of the global educational space. Of fundamental importance for the study are the principles of systems management theory, system-structural and statistical data analysis, as well as methods of functional analysis in determining the dominant models that establish the relationship between national public policy in education and the level of funding of the leading universities of the OECD countries. As additional methods, the study employs graphical methods of information interpretation, as well as comparison, formalization, and specification of two groups of materials: official data on the state of education in the world provided by UNESCO and the OECD, statistical data of the Association of European Universities and analytical reviews (expert releases) of the League of European Research Universities and the “High-Tech Strategy 2020 Action Plan of Germany until 2020”.

## RESULTS AND DISCUSSION

A consequence of the processes of globalization and competition in the global market of educational services is the increased support of national education systems by governments of European countries, including through the implementation of special investment programs to promote the development of universities. Specifically, during the period from 2005 to 2015, 37 programs of academic excellence were implemented around the world, 19 of them – in European countries. This allowed many countries to improve the positions of national universities in international academic rankings. However, countries such as the US and UK, as well as Germany, which previously held “most of the top positions in the world rankings, showed a negative result over the same period” (Prikhodko & Kameneva, 2020). Meanwhile, compared to other European countries, Germany has seen a significant increase in public funding for higher education over the last decade (in the pre-crisis period) (Figure 1).

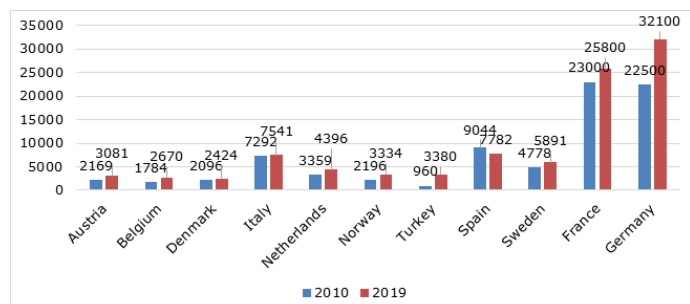


Figure 1. The volume of state investment in European universities.

The demonstrated data suggest that in 2019, the largest volume of state investment was made in Germany, France, Spain, and Italy. At the same time, a significant (3.5 times) rise in the value of funding is observed in Turkey, which is associated with a significant increase in the number of students (by 239%) during this period. In most of the remaining countries, the increase in investment ranges between 20% and 50%. Italy and Spain show a slight decrease, yet the level of funding remains quite high. Thus, until 2020, Germany remained the leader in terms of public investment in universities. The federal structure of Germany implies three levels of financing for universities: federal (state), regional (Länder), and local (municipalities).

In 2019, the public sector spent 32.1 billion euros on higher education institutions in Germany. Regional budgets (land budgets) accounted for 26.8 billion euros, or 83.3% of spending, and the federal budget accounted for 5.4 billion euros, or 16.7% of spending. One result of the strong state support for higher education has been stable economic growth (about 5% of global GDP), and the fact that today Germany stands among the countries that invest in research and development the most, both “in absolute terms and as a percentage of GDP”.

The funding received by universities from the state budgets funded by the Ministry of Education and Culture or the Ministry of Science and Research is used to cover salaries and other operating costs, as well as to allow investments in equipment and the necessary educational and research infrastructure. The funding procedure usually involves several steps:

- each individual university prepares a cost estimate to be included in the budget of the state ministry in charge of higher education;
- the responsible ministry prepares an overall budget and submits it to parliament for approval;
- the budget is discussed and approved by the parliament;
- the funding is allocated;

– the finance is distributed within the university under the observation of regional authorities.

Germany’s High-Tech Strategy 2020, adopted in 2010, aimed at implementing promising research projects within the Triple Helix model, received government support in the amount of 6 billion euros. Maintaining this strategic direction in the current decade, the German government has set a goal of spending at least 3.5% of GDP on research and development by 2025, which is one of the highest amounts worldwide.

At the same time, there also operate framework agreements on the development and financing of universities, which are concluded between the Länder and the universities for a period of several years in order to improve the process of planning their activities. The framework agreements can set objectives such as the structural development of universities and the expansion and improvement of management, define strategic performance indicators and goals, and establish the types and amounts of public funding.

Higher education institutions can also receive support from federal sources through individual programs, such as the “Academic Excellence Strategy” project (timeline 2019-2025, aiming to strengthen Germany’s position in the international research arena through cooperation between universities) (Grishina et al., 2021). The project assumes an annual allocation of up to 533 million euros to promote high-quality research by German universities in two areas: “clusters of excellence” and “universities of excellence”. The distribution of investments between the federal budget and the state budget is 75:25. “Excellence clusters” assume project funding in internationally competitive areas of research at universities or groups of cooperating universities, and “universities of excellence” imply investment in the development of universities or groups of cooperating universities, as well as their positions in research at the global level.

The “excellence clusters” line of financing provides that 385 million euros will be allocated and 45-50 “clusters” will be created. The financing period is assumed to be 14 years, 7 years for each phase. Under the “Universities of Excellence” funding line, 148 million euros are planned to be allocated to 11 universities. The funding is continuous. A precondition for receiving funding as a university of excellence is that at least two clusters of excellence (at least three for groups of cooperating universities) have received funding. The selected universities are to undergo an independent external evaluation every seven years, based on the results of which a decision will be made on the continuation of funding.



In the process of selection of “excellence clusters,” the total funding requested in the 195 applications originally received amounted to about 1.5 billion euros per year (Figure 2). 88 applications were approved for further consideration with an investment volume of 712 million euros per year. This amount increased in the process by 4%, reaching 743 million euros per year, in particular, due to increased personnel costs. In the end, 57 “clusters of excellence” at 34 universities were selected for funding in 2018, with a funding volume of 385 million euros per year (Statistische Übersichten zu den Förderentscheidungen zu Exzellenzclustern, 2018).

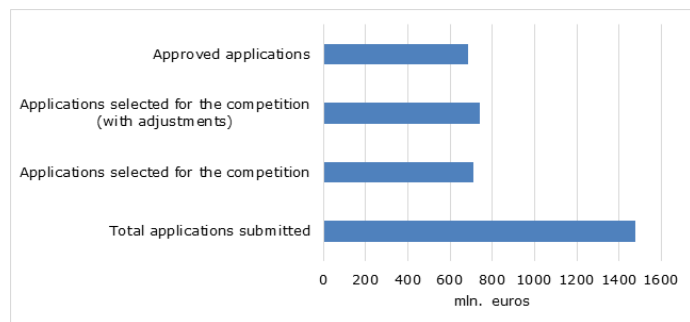


Figure 2. Distribution of funding at different stages of application selection in “excellence clusters”.

In 2019, the committee selected 10 “universities of excellence” and 1 “consortium of excellence” out of 19 applications. The second stage of selection will take place in 2022 for “clusters of excellence” and in 2024 for “universities of excellence”.

The first results of the Academic Excellence Strategy project show positive effects despite the COVID-19 pandemic:

- a higher number of employees involved in the operation of clusters;
- growth in the size of clusters;
- career advancement of employees (Figure 3). In January 2019, professors leading research in clusters formed the largest group of employees (2,150), followed by doctoral students (2,036). From January 2019 to August 2020, the number of doctoral students increased by 70%, making them the largest category of cluster employees. Postdoctoral fellows also entered the clusters in large numbers (54% increase), and the participation of early-career researchers increased. The number of professors has remained stable, with an increase of 11%; the involvement of female researchers is high (from 14.6% to 57.5%, depending on the field of research);

- an influx of foreign specialists on a medium- and long-term basis (30% of the total number of researchers in 2020), mainly from Italy, China, and India;
- attraction of guest researchers from other countries (US, UK, and China);
- further development and illumination of the current research of German universities in a globally competitive environment;
- assured fulfillment of the increased demands for interaction between science, politics, and society as a whole in the COVID-19 pandemic.

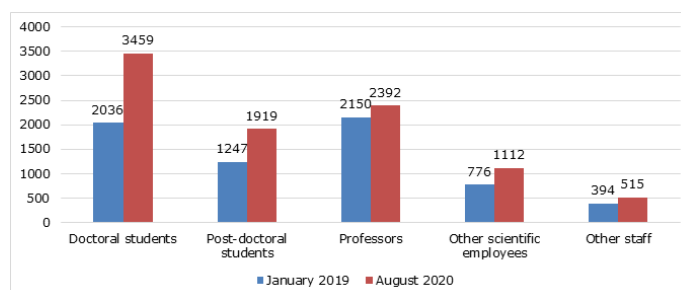


Figure 3. Dynamics of the structure of employees in “Excellence Clusters”.

It should be noted that after the successful launch of the program in 2020, the growth has continued at a slower pace. The COVID-19 pandemic exacerbated the problem of financial support and internationalization of universities. Thus, the recruitment of international students and researchers was hampered by the pandemic. In higher education, the year 2020 was the time of the project of digitalization of learning on a global scale. On the one hand, digitalization contributed to the awareness of the importance of new technologies in education (Educational Technology), but on the other hand, it brought about the risk of a decline in public funding due to the introduction of the compulsory digital format of education.

To give an example, Germany’s GDP growth at the end of 2021 was 2.8%, and the country’s leadership estimated that “a level consistent with what was seen before the pandemic will be reached in the 2nd quarter of 2022”. In addition, although the existing clusters are tasked with finding and carrying out new promising research in the field they worked on during the first won period, in seven years, they will once again have to convince experts of the potential, which is no less important than the results achieved.

In accordance with the “triple helix” model, German universities of excellence have managed to show the highest level of university-enterprise collaboration (Inshakov, 2013) among more than 80 university-enterprise collaboration

support programs implemented in European countries. Continuing the strategic focus on building an innovative economy, in 2021, the German government authorized an ambitious funding program for universities until 2030 to be implemented based on both federal and local budgets. The planned volume of investment in equipment is 4 billion euros; 120 billion euros are to be allocated for research centers and educational innovations.

On the whole, higher education institutions in Germany, receiving guaranteed long-term state support necessary to achieve the strategic objectives of economic and social development, in the presence of financial autonomy established by the legislation of the country, have significant budgetary responsibility. This mechanism of public investment in education in Germany requires a steady increase in the funds allocated in order to meet the needs of not only the higher education system but also the country's economy, as well as to ensure a reduction in the differentiation of regional investments. At the same time, the implemented public investment projects, such as the "Academic Excellence Strategy" contribute to the development of the higher education system as a more dynamic, internationally competitive, and aiming at strategic institutional profiling.

Attraction of state investments for European higher education institutions is performed by means of the following instruments: individual specific budget lines (direct financing); one-time subsidies, target contracts, project-based financing, co-financing. Investment in certain specific items of expenditure or activities implies strict restrictions (or prohibition) on the reallocation of funds to other budget lines. This leads to high levels of financial control and transparency but limits the ability of universities to independently manage resources and make strategic decisions on their priorities.

A one-time grant provides funding for broad categories of expenses, which can include tuition, operating expenses, and research activities. Most universities are allowed to allocate investments to individual items within a single category, but not between categories. Thus, they are able to independently determine the narrow areas to be financed with the allocated funds.

The allocation of a certain amount of one-time subsidy takes into account the previous results of university activities, both internal – the number of students, teachers, and facilities, and external – international ranking, publication activity, and the number of research contracts. The authorities control the actions of universities by establishing varying levels of significance of criteria when calculating the amount of one-time subsidies. This allows investment

funds to be directed to the most effective projects and programs in case of significant budget constraints and reduced investment opportunities.

In addition, it is possible to use previous funding experience with adjustments for current conditions, as well as negotiations leading to a funding agreement (negotiation model).

Targeted contracts assume the linkage of funding to the achievement of specific goals according to the universities' goals or state priorities. In such contracts, goals are set as results to be achieved (the results-based funding model). The results may be represented by both qualitative indicators (e.g., an increase in the international ranking of the university) and quantitative indicators (e.g., an increase in the number of publications in international journals). The shortcomings of this type of funding include the need for strictly targeted use of funds, as well as a certain degree of restrictions on the autonomy of universities in making financial decisions.

Project-based funding presupposes the allocation of funds on a competitive basis. Most often they are directed to scientific research, but can also be spent on the purchase of specialized equipment, innovations, and the development of educational technologies. With the reduction in the size of one-time grants, this type of investment becomes a significant source of income for universities. It allows universities to expand opportunities for research work, raise the caliber of faculty members, and develop infrastructure both in terms of purchasing research equipment and creating or amplifying the importance of units responsible for finding, supporting, and preparing applications. Performance indicators for receiving such funding are included in the criteria for calculating the size of a one-time subsidy.

Bozeman & Gaughan (2007), report on a correlation between the efficiency of university-enterprise collaboration and the number of state contracts and grants, noting that "funding of joint research projects by enterprises is more effective than state funding". However, this form of funding implies a deviation from educational goals toward scientific research. In addition, there may be a decrease in financial sustainability due to an increase in the likelihood of funding gaps.

Co-financing is used as an additional source of fundraising for the university budget and assumes a sponsor. However, in this case, it is necessary to find an additional proportional amount to finance the necessary costs or the cost of the funded project at the expense of its own budget or other sources. This type of investment encourages improvement in the quality and efficiency of

educational technology, as well as the conditions of learning. Nevertheless, this option bears an increased risk of reduced financial sustainability and investment opportunities for development.

The diversity of funding systems for European universities, including the level of state support, the structure of revenues, and the methods of their distribution, make it impossible to form a universal model of the financial mechanism. According to Italian researcher De Martino et al. (2020), “most EU countries use the so-called ‘funding formula’ as the main mechanism”, which takes into account the national specifics of university funding (legislation, traditions, resources). Empirical research on the experience of 27 European countries and Russian practice shows that of the two groups of universities, leaders and outsiders in global academic rankings, the former use a “negotiated funding model”, while the latter are funded “by formula” or by results. At the same time, almost all researchers confirm that the dominant source of funding for most universities, regardless of their place in the rankings, is state financial resources.

Researchers conclude that the volatile financial situation in the world prompts OECD countries not only to diversify the sources of funding for universities but also to look for effective models of state support for them. Analysis of the effectiveness of public expenditure on higher education in OECD countries reveals that there is no direct correlation between the level of this expenditure and the results ( et al., 2013). This view is also confirmed by the practice of public financing of universities in Germany presented in this study. The FRG model of public support for higher education demonstrates that “an important component of success in increasing the level of global competitiveness of universities is not only the availability of external financial support program at the expense of public resources, but also effective financial management” in accordance with the chosen strategy and priorities of university development. According to leading Russian (Prikhodko & Kameneva, 2020) and foreign researchers “world leader” universities provided with financial resources to implement global priorities should take into account national traditions, interests, and needs in their development strategies.

Sharing this standpoint, we argue that the models most promising for the successful solution of the strategic tasks of sustainable development of European higher education remain the targeted and project financing, and, above all, the programs of academic excellence implemented within the “triple helix” and “pentaspiral” models. Our position is supported by the experience of German universities as the most successful in university-enterprise collaboration.

This interaction is stimulated by state investments in German university centers as “clusters of excellence”, helping to minimize risks and increase the profits of companies participating in the collaboration.

## CONCLUSIONS

State support programs for higher education systems implemented in almost every OECD country employ a variety of funding models aimed at implementing strategic priorities in education, science, and innovation. Globalization and internationalization of the European educational space increase the desire of governments to form world-class scientific and educational clusters. Among the indicators of efficiency of public expenditures in higher education is not only the number of leading universities but their positions in the world academic rankings. However, despite all the models of financing (“negotiated”, “formula-based”, and results-based) currently in place in most European countries, there is no stable correlation between the amount of state investment and the position of universities in the world rankings. In response, the governments of such countries as Germany, France, and Spain support more flexible funding mechanisms as part of special national programs stimulating the sustainable development of the best universities.

The strategic goal of such support is not only to raise the international competitiveness of such universities but also to modernize the research environment by concentrating resources on long-term social and economic objectives. The EU’s current priorities are programs to support networking between universities and enterprises (e.g., the EU Framework Program for Research and Innovation), which stimulate applied research. This trend is evidenced by the practice of state investment in German universities as “clusters of excellence” with targeted funding of 6.5 million euros per year for each research project.

Initially, the German government’s Excellence Initiative programs focused on a strategy to increase the contribution of higher education to the German economy. The aim of state investment in the second wave programs was to strengthen the position of national universities in international rankings. We believe that in the post-pandemic period, state support for university-enterprise collaboration in the framework of the “triple helix” and “pentaspiral” models becomes more promising for developed European countries.

While addressing the social and economic consequences of COVID-19, the German government maintains the pace of transformation in higher education, keeping the trajectory towards developing world-class universities, and

continues to invest extensively in academic excellence initiatives, forging government guarantees for long-term financial support. In our judgment, such an investment policy can form the basis for a more effective funding model aimed at addressing strategy not only in the development of German universities at the institutional level but also in the sustainable development of the country's economy as a whole. This study was financed by a grant from the Plekhanov Russian University of Economics.

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