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THE SUPPORT OF RESEARCH OF TECHNICAL UNIVERSITIES IN GERMANY

The system of German higher technical education is characterized by a close link between instruction and research. Nowadays with first-rate research facilities and a high degree of innovation, Germany is one of the top research destinations in the world. Its science infrastructure consists of a unique network of university and non-university research institutions that work closely with industry and commerce providing the introduction and development of innovative education.

The study of peculiarities of students' education and research in German technical universities is provided by H. Albrecht, J. Arp, B. Bender, P. Brandt, H. Duddeck, H. Friedrich, H. Griesbach, K. Habetha, G. Heitman, K. Henning, W. Jorden, G. Lehmann, J. Longmuss, B. Vogel and others.

The article is devoted to the review of funding, internationalization and innovation providing in research organization in German technical universities.

Germany has a long tradition of outstanding research and development. German universities do not see themselves as "schools" for undergraduates and doctoral candidates, but as centres where "research and teaching are united". This principle was coined in XVIII century by Wilhelm von Humboldt [1].

Nowadays among the German government's highest priorities are research and innovation. The German research and innovation system has a broad, differentiated structure, and research is conducted in a variety of public and private institutions. At the public level, there are universities, colleges and universities of applied sciences. Technical university research is characterized by a broad subject matter and methodologies, whereas at universities of applied sciences, there is more of a focus on applied research. There is a wide range of non-university research conducted at private, non-profit institutions. Besides the various academies, foundations, and centers of innovation, four research organizations with different profiles make a significant contribution to Germany's research and innovation landscape: the Max-Plank-Gesellschaft, the Fraunhofer-Gesellschaft, the Helmholz Association, and the Leibniz Association.

Industry is also an important player in the German research landscape, it makes the largest contribution to research and development funding. More than two-thirds of annual funding invested in research in Germany comes from private sector. These funds are spent on the companies' own research as well as on joint projects with partners from science. The research conducted in this sector is application-oriented in nature and is aimed directly at utilizable results [2].

Industry runs its own research institutes in specific fields and cooperates with public institutions through various interfaces. In addition, many of the approximately 19.000 foundations in Germany promote research.

The interconnection of science and industry is facilitated, to a great extent, by the organizations, which are designated partners of the German Center for Research

and Innovation. Based on their functions, these institutions have been divided into three categories: advising and advocacy, funding, and research.

The technical universities in Germany work closely together with regional industry and independent research institutions. Applied research and cooperation agreements with multinational corporations or research instructions are part of daily life at the technical universities, and strengthen the competitiveness of their graduates.

The funding of research in Germany is as diverse and differentiated as the German research landscape itself. The Federal Government and the federal states act independently with regard to the funding and organization of research, although they coordinate their efforts in joint bodies and sometimes in joint initiatives. They are also joined by private donors and companies that provide a high degree of funding for research and development. Additionally, the European Union provides extensive funding for research through a wide variety of measures.

The Federal Government places a clear emphasis on science, research and development through numerous strategies and initiatives. The government initiatives – the Higher Education Pact, the Excellence Initiative, the Joint Initiative for Research and Innovation, the High-Tech Strategy, the Internationalisation Strategy, Research and Academic Relations Initiative as well as the numerous funding opportunities for German and international researchers – have also contributed substantially to Germany's vitality as a key location for science, research and innovation. Government provides roughly one third of all spending on research and development in Germany [3].

The Higher Education Pact, for example, is thus fostering university research, while the Excellence Initiative is intensifying competition between universities to achieve outstanding results in all higher education disciplines. Although they have different emphases, both the Joint Initiative for Research and Innovation and the High-Tech Strategy are focusing on networking and interchange. They also encourage cooperation between science and industry. Furthermore, the Federal Government is devoting greater attention to the important subjects of international exchange and cross-border networking in its Internationalisation Strategy and Research and Academic Relations Initiative.

On 4 June 2009, the heads of the Federal Government and the States agreed to update the Joint Initiative for Research and Innovation. The Initiative is designed to enable science organizations to continue and improve strategic measures, enhance the quality and quantity of existing instruments, and develop, test and establish new instruments.

The financial planning certainty provided by the Initiative is important for the strategic planning of science and research organizations:

- Hermann von Helmholtz Association of National Research Centres (HGF);
- Max Planck Society (MPG);

Fraunhofer Society (FhG);

Leibniz Science Association (Gottfried Wilhelm Leibniz Science Association, WGL);

- the German Research Association (DFG) as research funding organization.

As early as autumn 2008, the Joint Science Conference agreed on research policy goals for the period between 2011 and 2015. This was an important basis for the continuation of the Joint Initiative for Research and Innovation. Now, the heads of the Federal Government and the States have also reached an agreement on the financial framework of the Initiative: The Federal Government and the States will increase the funding of science organizations by

5 percent every year. In addition, special circumstances, such as new additions or changes in the form of funding, can result in additional funding [4].

By continuing the Pact for research and innovation, the Federal Government and the States want to achieve the following research policy goals:

1. Trigger dynamic developments in the science system;
2. Create dynamic and performance-enhancing networks in the science system;
3. Develop and implement new international cooperation strategies;
4. Establish sustainable partnerships between science and industry;
5. Recruit the best and persuading them to stay in Germany long-term.

Based on these research policy goals, the science and research organizations, as partners in the Joint Initiative, have issued their own declarations stating what measures they plan to take to achieve the goals and contribute to increasing the competitiveness of the German science system.

The declaration of the Joint Science Conference regarding the research policy goals, the decision of the heads of the Federal and the States governments regarding the financial framework, and the declarations of the science and research organizations together make up the Joint Initiative for Research and Innovation.

The German States and the Federal Government have set up the Excellence Initiative which supports research activities in various disciplines at German universities. From 2006-2017 a total of 4,6 billion euros will be invested to promote top-level research and to improve the international competitiveness of German higher education and research.

The Excellence Initiative provides funding for institutional strategies that are aimed at developing top-level university research in Germany and increasing its competitiveness at an international level. The funding covers all measures that allow universities to develop and expand their areas of international excellence over the long term and to establish themselves as leading institutions in international competition. This will make a significant contribution to strengthening science and research in Germany in the long term and increasing the visibility of current research excellence.

Clusters of excellence will enable German university locations to establish internationally visible, competitive research and training facilities, thereby enhancing scientific networking and cooperation among the participating institutions. Clusters of excellence should form an important part of a university's strategic and thematic planning, significantly raise its profile and reflect its considered long-term priorities.

They should also create excellent training and career conditions for young researchers. In conjunction with the other two funding lines, i.e. graduate schools and institutional strategies to promote top-level research, clusters of excellence will help to increase Germany's attraction as a research location in the long term and improve its international competitiveness.

As research universities technical universities have always been highly international. Close strategic cooperation with partner universities worldwide makes an intensive exchange of experts and research possible. With the internationalization of teaching over the last 20 years, opportunities to study abroad and courses for international students have been systematically set up. Many European countries, including Germany, are changing the structure of their higher education system. A trans-European credit system is being

introduced, bringing European degrees into line with each other and enabling students to change universities more easily.

A joint effort will be required to overcome the global challenges of the present and the future. These include climate change, questions of nutrition and food production, securing our future energy supply, combating poverty and infectious diseases as well as questions of security and migration. This prompted the Federal Government to adopt the Strategy for the Internationalisation of Science and Research in 2008.

There are four high-priority goals highlighted in the Strategy for the Internationalisation of Science and Research:

1. Strengthening cooperation between the best researchers. The Internationalisation Strategy aims to bring together the world's best minds. Accordingly, the Federal Ministry of Education and Research (BMBF) has initiated various measures, including the Alexander von Humboldt Professorship that enables outstanding researchers to undertake long-term research stays at German universities. The successful Sofia Kovalevskaya Prize for up-and-coming young researchers is being continued. Furthermore, existing and new scholarship programmes are increasing German students' mobility and Germany's attractiveness for foreign undergraduate and postgraduate students. Cooperation with the world's best teams is also being fostered by the increasing international orientation of funding programmes as well as numerous bilateral and multilateral agreements.
2. Gaining access to international innovation potentials. If German businesses wish to remain competitive, they have to collaborate with the best partners worldwide. That enables them to benefit from the latest discoveries and developments and at the same time strengthen Germany as a centre of innovation.
3. Sustainably strengthening cooperation with developing countries in the fields of education, research and development. The Internationalisation Strategy regards the developing and newly industrialised countries as important partners for international cooperation. German researchers will cooperate with their colleagues as equals and thereby establish partnerships with future centres of research and industry. This initiative also involves improved training for specialists and managers in developing countries. Specially adapted and coordinated instruments of development cooperation and scientific-technological cooperation form important prerequisites for collaboration between researchers.
4. Assuming international responsibility to overcome global challenges. The pressing problems of our age can only be solved through joint effort and Germany is contributing its research and innovation potential to finding appropriate solutions. Germany's research policy goals are therefore closely linked with its foreign and development policy goals. Dialogue with the G8 and OECD countries has been established on an international research agenda and Germany has assumed a leading role. Its subjects are climate change, securing energy supplies and combating poverty and infectious diseases [5].

Goals defined in the Internationalisation Strategy are being realised, for example, in the initiative to "Promote Innovation and Research in Germany", which the Federal Government initiated in 2006. Under the heading "Research in Germany" it is encouraging increased cooperation with specific countries and in selected subject- and country-related fields where Germany is traditionally strong.

Besides the European Research Area (ERA) is one of Germany's key areas of international cooperation and Germany is a major contributor to its development. The European Higher Education Area that is being created within the framework of the Bologna Process is also intended to increase academic mobility in Europe. It is based on the conviction, formulated in the Lisbon Strategy, that Europe can only successfully grow together if education and research play a key role.

The European Research Council (ERC), which Germany co-founded, acts on the principle that outstanding research is the sole precondition for European research funding. The European Institute for Innovation and Technology (EIT) was largely established during the German European Council Presidency. Additionally, the European Strategy Forum on Research Infrastructures (ESFRI), in which the Federal Government participates, is creating modern research infrastructures such as the European x-ray free-electron laser (XFEL) and various accelerator facilities for European researchers.

So we can affirm that the "unity of research and teaching" in Germany is the cornerstone of pioneering research and enjoys an outstanding international reputation. Research partnerships and technological transfer enable students to gain practical experience in industry during their studies and to make contacts for their later careers. The technical universities thus create excellent conditions for embarking on a career after graduation. The development of national and international funding and support and he possibility of providing the common system in Ukraine are the items of our future study in the field.

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