

RESEARCH, INNOVATION  
AND TECHNOLOGICAL  
PERFORMANCE IN GERMANY

COMMISSION OF EXPERTS  
FOR RESEARCH  
AND INNOVATION

EFI

# REPORT

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The Commission of Experts wishes to emphasize that the positions expressed in the report do not necessarily represent the opinions of the aforementioned persons.

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# Executive Summary

## A Current developments and challenges

### A 1 Commentary on current research and innovation policy

The High-Tech Strategy 2025 (HTS 2025) was adopted by the German Federal Cabinet in September 2018. This Strategy sets a target of expending the equivalent of 3.5 percent of gross domestic product on R&D by 2025. The Commission of Experts calls upon the Federal Government to make adequate funds available in this legislative period as a contribution towards the step-by-step achievement of the 3.5 percent target.

The Commission of Experts expressly welcomes the prominent consideration afforded in HTS 2025 to digital transformation, but urges that the measures announced should be swiftly implemented.

The Commission of Experts also once again calls for the prompt introduction, as already previously recommended by the Commission, of tax incentives for R&D activities with particular attention being paid to SMEs.

In August 2018 the Federal Cabinet resolved to establish an Agency for Disruptive Innovations. In order to achieve the desired objectives, this agency must have considerable freedom and be able to conduct its day-to-day business with the maximum independence from political control. The current restricted budget is to be increased over the medium term.

The Joint Science Conference is currently consulting on agreements to succeed the Pact for Research and Innovation (PFI) and the Higher Education Pact. In carrying forward the PFI, greater attention should be paid to the transfer of knowledge and technology. With regard to the distribution of funds for tertiary education, the agreement which succeeds the Higher Education Pact should in addition to considerations of capacity also take note of quality indicators.

### A 2 Artificial Intelligence – The AI strategy of the German Federal Government

The Federal Government's Artificial Intelligence strategy was adopted by the Government on 15 November 2018. The Commission of Experts welcomes the Federal Government's intention to provide substantial funding for this important technology at the amount of €3 billion (by 2025). However, in the opinion of the Commission of Experts the current version of the AI strategy is still vague on many points and requires substantial further development. Above all there is a need for an implementation plan with clearly defined goals.

The Commission of Experts is sceptical of the Government's intention to establish at least 12 AI competence centres. The Federal Government should use the budgeted funds primarily to strengthen the already existing AI centres in order to create high-performance, internationally visible AI ecosystems.

In view of the overheated employment market for AI specialists, it also appears questionable as to whether there will be sufficient high-quality candidates to meet the Government's target of 100 professorships. These funds should instead be staggered over a longer period and used to fill both permanent as well as tenure-track professorships. European cooperation in research and transfer must urgently be strengthened. Here too, there is currently an absence of details regarding the measures announced.

The machine learning methods currently in use require large datasets for training purposes. This favours AI research in countries such as the USA and China. The Federal Government should therefore take steps to improve the availability of data. On the other hand, support should be more strongly focused on Germany's specific locational advantages. These include the high availability of machine-oriented data, and relatively high quality datasets.

### A 3 Basic research funding structures and publications in international comparison

In terms of competitive financing for basic research, the central research funding organization in Germany is the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG). The funding structures of the DFG and publications deriving from DFG-funded projects are compared with those of the most important research funding organizations in Great Britain, the Netherlands, Switzerland and the USA. International comparison indicates that the DFG attaches more weight to funding programmes intended to foster cooperation and structural development. At the same time, in terms of single project funding, the average funding amounts involved in new applications to the DFG are comparatively low and the funding durations relatively short. The heavy weighting of funding programmes intended to foster cooperation and structural development should be critically reviewed. In addition, it could be useful to increase the average funding amount and the maximum funding duration of single project funding.

Also striking is the below-average rate of international cooperation measured by the co-authorship of publications referencing the DFG. This raises the question as to whether international cooperation should not be more strongly promoted by the DFG.

If one considers the quality of publications deriving from DFG-funded projects, based on publications with funding-provider references, it is apparent that this is lower than in the comparison countries. The Commission of Experts suggests that the reasons for this pattern should be investigated. The Commission therefore recommends that greater use should be made of causal analyses according to latest scientific standards.

## B Core topics 2019

### B 1 The role of start-ups in the innovation system

The term start-ups refers to young enterprises with innovative business ideas and high growth potential. A vibrant start-up scene has developed in Germany, where it is highly regionally concentrated.

Start-ups pursue new business models, and through their innovations, they expand and modernize the range of available products and services. New companies spun off from the scientific institutions play an important role in the transfer of knowledge and technology in practice. Start-ups are also trend scouts and provide momentum for established companies. As partners in cooperation with established businesses, start-ups contribute to the joint development and marketing of innovations.

Start-ups in Germany – particularly in the growth phase – still have problems in accessing venture capital. In addition, in view of their size and their business models, they face specific challenges which are to some extent posed or influenced by the legal environment. With this in mind, the Commission of Experts makes the following recommendations:

- In order to promote start-ups from the world of science, the start-up culture at tertiary education institutions must be strengthened still further. Start-up training should be a constituent part of all courses. To enable founders to obtain licenses quickly, tertiary education institutions and non-university research institutions should develop standard license agreements for the purpose of transferring rights to spin-off companies.
- Start-ups, particularly in the high-tech sector, profit from geographically concentrated ecosystems in which they are able to locate in the immediate vicinity of research institutions, investors, established businesses and other start-ups. In order to promote globally visible start-up ecosystems, it is essential not to counteract their geographical concentration, but instead broaden already existing or developing start-up ecosystems.
- The conditions for private investments in start-ups must be further improved. Given the shortage of anchor investors in Germany, the Commission of Experts advocates the creation of incentives for institutional investors to invest more heavily in venture capital. In addition, the mandatory imposition of VAT on the management services provided by fund managers should be repealed.
- Employee share schemes are an important instrument with which to recruit skilled workers and ensure their longer-term loyalty to a start-up company. However, the legal and particularly tax-law requirements to be considered in formulating the necessary contracts are frequently a source of considerable uncertainty for start-ups and their investors. In order to increase the legal certainty for start-ups in the introduction of employee share schemes, trade associations with close links to start-ups should in coordination with the federal authorities jointly develop standard contracts for such schemes that offer a maximum of legal security.
- In dynamic fields of technology – such as Blockchain or AI – the Federal Government should be proactive in establishing a reliable legal framework in order to reduce the uncertainties experienced by start-ups. In the interests of developing an innovation-friendly environment, increasing use should be made of regulatory test beds.

## B 2 Innovations for the Energy Transition

Germany shares the climate policy goal set by the international community of limiting global warming to below 2 degrees centigrade. To this end, the energy system in Germany must become largely greenhouse gas-neutral by 2050. As a consequence, an Energy Transition will be required from fossil fuels to greenhouse gas-neutral renewable energy sources.

Innovative technologies and business models can make a decisive contribution to a cost-effective Energy Transition. It is not primarily a question of inventing new technologies. Many important technologies and business models are already market-ready. However, their diffusion is hindered by low CO<sub>2</sub> prices and regulatory constraints.

Higher CO<sub>2</sub> prices which are central to the decarbonisation of the energy system will lead to higher prices for diesel, petrol, heating oil and natural gas. To attenuate undesired distributional effects, a CO<sub>2</sub>-oriented tax reform must compensate low-income households, e. g. by means of income transfers.

The Commission of Experts recommends that the Federal Government should take the following measures:

- In order to make innovative and climate-friendly technologies and business models more competitive, taxes and levies on energy across all sectors of the economy should be based on the CO<sub>2</sub> content of energy carriers. The government should use additional tax revenues from a CO<sub>2</sub>-oriented tax reform to compensate low-income households who will be particularly burdened by higher energy prices.
- The incentive regulation (ARegV) for electricity grid operators must be modified so as to ensure the profitability of innovative technologies and business models that stabilize the grid.
- To make flexibility options in the supply and demand for electricity profitable, grid charges must be reformed in order to reflect the actual costs of grid usage over time and space.
- Given the outstanding importance of sector coupling for the Energy Transition, R&D (support) should be better oriented towards the organizational principle of sector coupling.

## B 3 Blockchain

Blockchain is a technology which enables the immutable, tamper-proof digital storage and transfer of data. Data are stored not by any one individual institution, but by numerous participants simultaneously. There is therefore no central instance which has control over the stored data.

Blockchain technologies are currently being developed, tested and transitioned into marketable products by various participants. It is hoped that the decentralized data storage that can be achieved with Blockchain will reduce the level of market concentration in data-driven industries and lower the barriers to market entry. In this way, Blockchain technologies can lead to radical changes in existing industries.

Germany is in a promising position to help shape the development of Blockchain technologies and realize both economic and social potential. This current locational advantage should be used by the political community as a lever to promote the on-going development and application of Blockchain technologies.

The Commission of Experts regards Blockchain technologies as holding considerable potential benefits for businesses, the population and administration. In order to realize this potential, the Commission of Experts recommends that the Federal Government should take the following measures:

- The Federal Government’s planned Blockchain strategy should include an analysis of the strengths and weaknesses of Germany as a Blockchain centre. This should incorporate analyses of current legal and regulatory conditions which inhibit innovation.
- The strategy should include proposals for regulatory test beds in which solutions to the identified obstructions can be tested in order to prepare necessary amendments to the legal situation.
- The strategy should designate interfaces with other digital policy strategies of the Federal Government such as the AI strategy or the implementation strategy. Likewise the combined effects of the various strategies should be identified and utilized.
- Legal uncertainties for businesses should also be reduced by promoting the development of competencies on the part of contacts at ministries and authorities. This increase in competencies should also be utilized to analyse concepts for the use of Blockchain technologies in government administration and, where meaningful, launch pilot projects.
- Finally, members of the public as well as businesses should be made aware of the advantages and disadvantages of Blockchain technologies to enable them to deal confidently with Blockchain applications.

## B 4 Digitalization of tertiary education institutions

German tertiary education institutions according to their own statements attach great importance to digitalization. However, this is not reflected equally well in the levels of digitalization achieved in research, teaching and administration. Significant development potential therefore exists for the continuing digitalization of German tertiary education institutions, above all in teaching and in administration.

In the digitalization of the tertiary education institutions, a technically complex task is compounded by inadequately developed governance structures. For digitalization to succeed, the tertiary education institutions must continue to modernize their administration.

- The Commission of Experts recommends that the tertiary education institutions should develop a digitalization strategy with clearly defined goals and a suitably coordinated implementation plan. This digitalization strategy should go hand in hand with the profile-building of tertiary education institutions repeatedly called for by the Commission of Experts. The need for extra-occupational training should be taken into account in particular.
- Tertiary education institutions should increase their negotiating power by aggregating the purchase of licenses on an inter-university basis. The Ministries of Science and Culture of the Länder can provide support for this process.
- The digitalization of Germany’s structurally under-financed tertiary education system is an on-going task which requires sustainable financing. The Commission of Experts recommends that the tertiary education institutions should be supported through the introduction of a lump-sum digitalization payment. The tertiary education institutions should receive a specific amount per student with which to develop and maintain their digital infrastructure and applications and expand their digital teaching and learning offer.
- The support for tertiary education institutions digitalization via competitively awarded project funding should continue.

- In order to make it easier for tertiary education institutions to recruit IT specialists, the Commission of Experts recommends that the Länder in their capacity as public service employers should introduce some flexibility into the existing pay regulations with an orientation towards the Collective Agreement for the Public Service (Tarifvertrag für den öffentlichen Dienst, TVöD).
- The Commission of Experts suggests that smaller tertiary education institutions in particular should be supported through the creation of IT service centres and by strengthening existing advisory and support institutions.

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