Germany's Digital Future **Is at Stake**

The German economy is booming, with research and development seeing welcome growth in recent years. However, our author, Chair of the German government's Commission of Experts for Research and Innovation (EFI), warns that we shouldn't content ourselves with our achievements to date. Germany still has some catching up to do, particularly when it comes to digital infrastructure and the internet offerings of German public authorities and ministries. But higher education institutions and young, innovative businesses need support from the new federal government, as well.

TEXT **DIETMAR HARHOFF**

Germany has already achieved considerable successes in its research and innovation (R&I) policy. For example, there have been significant increases in public and private research and development spending since 2005. There have been improvements in the positioning of German universities and research institutions in terms of attractiveness and excellence, and in the modernization of the German economy. Germany has moved significantly closer to its aim of playing a leading role as a location for innovation. At the same time, the challenges the country faces have continued to grow over the past few years.

> We should be targeting a pioneering role in research and innovation

These challenges include, for instance, combating climate change and shaping the future of mobility and our energy supply, as well as dealing with demographic change and ensuring equitable participation in the fruits of innovation. On top of this, the digital transformation poses major problems for German politics.

Germany won't be able to respond to these problems adequately unless its science, research and innovation sectors are further strengthened. In addition to implementing specific measures, the Commission of Experts for Research and Innovation (EFI) has recommended that German research and innovation policy formulate clear objectives that can be used to measure and evaluate future progress.

According to the EFI, Germany should invest 3.5 percent of its gross domestic product (GDP) in research and development by 2025, and should aim

A decisive role: Expanding the digital infrastructure, especially high-speed broadband networks in both the countryside and in cities, is crucial to the future success of the German economy.

Photo: Stihl024/fotolia

WILLEN

to establish three of the country's universities among the top 30 in the world. Furthermore, venture capital as a share of gross domestic product should double within the same period. The federal government should strive to ensure that Germany

For years, Germany has suffered from a lack of venture capital for young companies

becomes one of the five leading nations in terms of digital infrastructure in the coming years, and that it takes a pioneering role in e-government. In addition, the government should double its funding in the field of digitalization.

Germany has achieved notable successes with its research and development spending in recent years. In 2002, the European Union set member states the goal of increasing research and development expenditure to 3 percent of gross domestic product by 2010; in 2005, Germany was a long way from reaching that goal, with a share of 2.5 percent. In 2015, the share spent on domestic research and development finally reached 3 percent.

As one of the world's leading economic powers, though, Germany should be setting its sights much higher. Investing 3.5 percent of gross domestic product in research and development by 2025 would demonstrate the country's willingness to develop its technological competitiveness on a long-term basis and to catch up with other innovation nations.

Introducing tax incentives for research and development would represent a key step on the road to the 3.5 percent target, and would effectively complement existing, proven project funding measures. It would make sense to initially limit such support to small and medium-sized enterprises, whose willingness to innovate has receded in recent years. Tax incentives with modest subsidy costs would have significant effects for this group of businesses, making this a relatively efficient use of funds.

For years now, the Commission of Experts has recommended raising the prominence and international profile of the German science system. Despite their methodological shortcomings, international university rankings are an important point of reference for internationally mobile researchers and students. Positioning German universities at the top of international rankings would visibly document successful science policy – but this requires further substantial improvements in the higher education sector.

Over the last ten years, the federal government has already introduced a package of measures that have strengthened Germany as a location for science. One of those measures was the Excellence Initiative. The agreement on an open-ended follow-up program to the Excellence Initiative – the Excellence Strategy – is a welcome development. This program comprises two funding lines: institutional funding for the highest-performing universities and support for exceptional research structures.

A central challenge in the coming years will be to substantially improve the basic funding German universities receive and further reinforce their ability to compete internationally. The majority of German higher education institutions remain structurally underfinanced, and it is primarily the federal states that are under obligation. However, the Commission of Experts recommends that the German government and the federal states together initiate a follow-up program to the Higher Education Pact. The German government should continue to support the federal states in funding teaching and overhead costs, but this must not result in the federal states reducing their university funding contributions in other ways. The German government must therefore attach verifiable conditions to its support.

It is also important to increase the number of permanent professorships while at the same time improving student-faculty ratios and reducing teaching commitments for professors. This would enhance the German science system's attractiveness

in the international arena – both for outstanding researchers and for particularly talented students – as well as improve the quality of teaching for all students. More permanent professorships would also benefit junior scientists, as such a change would improve the career opportunities of the rapidly growing number of young researchers. Against this backdrop, universities could then rely more heavily on the tenure-track process, which provides junior scientists greater clarity regarding their career path and professional requirements.

Besides improving basic staffing and physical facilities, universities' organization and leadership also need to be modernized. Higher education institutions require greater scope to set themselves apart and to experiment with new administration and management structures.

But research and innovation policy doesn't end at the universities' gates. The German government can also lay important foundations for businesses – particularly young, innovative companies – to build on. For years, Germany has suffered from a shortage of venture capital. Young, innovative enterprises simply can't create and market their innovative products and business models without venture capital.

An international comparison shows that the German venture capital market is considerably less developed than those in the US and other European countries. While Germany invested some 0.027 percent of gross domestic product in young, growing companies in 2015, the proportion of GDP invested in such businesses in the US was more than ten times higher. Even in a European comparison, Germany comes in, at best, in the middle of the pack.

To overcome the weakness of the German venture capital market and make the country an internationally competitive location for investment, the German government introduced an array of improvements for venture capital investments and government-financed funds in recent years. However, the Commission of Experts advises against providing additional public funds for this purpose, recommending instead that the government remove barriers and create incentives to make investment in venture capital funds and startups more attractive for private investors.

The Act on the Further Development of Tax Loss Carryforwards for Corporations, passed in late 2016, was an important step in facilitating venture capital investments. Previously, loss carryforwards were eliminated when an investor purchased a certain number of shares in a company. But innovative companies in particular incur considerable research and development expenses in their first years that are then adjusted into loss carryforwards. If these unused losses for research and development work can no longer be used following a takeover, such companies become less attractive to potential investors.

The new regulation introduced by the German government aims to ensure that loss carryforwards can still be used despite a change in shareholders. This is conditioned on the entity's business operations being

> The expansion of the digital infrastructure shouldn't be aimed at achieving average targets

maintained after the change of shareholders, and on the losses not being used in any other way. However, it is now important that this condition be applied flexibly, as startups often amend and adjust their business model, target customer groups and technology. These changes are determined by commercial factors and mustn't lead to a situation where these loss carryforwards can't be used.

There is still one considerable handicap to Germany as a location for investment, namely the fact that – in contrast to many other European countries – fund managers' administrative services are subject to value-added tax, which makes Germany a relatively unattractive location to build and maintain venture capital funds. >

Photo: Stihl024/fotolia

A further important component of support for innovation is the development of digital infrastructure, which is now a major determinant of growth for modern economies. Digitalization is placing ever-increasing demands on the availability and capacity of internet connections. In an international comparison, Germany lags behind in almost all indicators relating to broadband expansion with high-speed networks above 50 megabits per second. At the same time, it can be assumed that an internet infrastructure with bandwidths of 50 megabits per second will no longer be sufficient in the not too distant future.

Network operators are currently predicting that, by 2025, average private internet speed demands will reach 400 megabits per second for downloads and 200 megabits per second for uploads. The Commission of Experts thus considers the German government's existing plans to expand the country's broadband infrastructure to be far from adequate. Germany needs an ambitious expansion of its infrastructure – not one that is in line with the average values for OECD member states, but one that leads the way in terms of output and capacity for further expansion. The expansion targets must be dynamically adapted to the respective technical standards.

Germany also needs to catch up in terms of digital governmental and administrative processes – so-called e-government. The range of digital public-sector services remains limited and isn't very user friendly. What's more, government-managed datasets still haven't been made freely accessible as Open Government Data, and well-structured access modalities are lacking, too.

These deficits are due mainly to Germany's federal structures, as administrative organization is largely the responsibility of the federal states. The lack of higher-level, legally binding specifications and the various federal actors' divergent interests in expanding e-government have led to disjointed and technologically heterogeneous provision in this area.

An important step toward overcoming this unsatisfactory situation was taken in late 2016, when the reform of federal and state financing relations was passed. As part of this reform, an amendment to the Basic Law gives the German government legislative power to structure access to the administrative services of the federal and state governments, including at the municipal level.

The complementary law passed by the Cabinet – known as the Online Access Improvement Act – requires the federal government, states and municipalities to provide their administrative services online and make them accessible via a network of federal and state administration portals within five years. This should make it possible for citizens and businesses to access all online-capable services easily and with no media discontinuity through an administration portal, and to use a single user account for all services.

> The government neglected to direct sufficient funding to information technologies

Fortunately, these changes have led to significant improvements in the basic conditions over the past few months. As a result, there is now an opportunity to create and develop effective digital portals for government and administration and thus raise the quality of e-government in Germany to international standards in the next few years. To achieve this objective, the German government must actively use its newly gained authority in the new legislative period and present workable solutions to expand e-government in Germany.

The digital transformation is progressing at an impressive pace and currently represents a major challenge for the German economy. The technologies and business models being used aren't among the core strengths of the German research and innovation system. Especially for Germany, the digital transformation represents a radical change in almost all areas and challenges the competitive and specialization advantages the country has earned over the years.

Research and innovation policy to date has paid far too little attention to the technological and eco-

Photo: Stihlo24/fotolia

nomic dynamics underlying this transformation. Government support for research and development in information and communication technologies remains underdeveloped, despite the welcome fact that the federal government significantly increased total spending for research and development – from 12.0 billion euros in 2009 to 15.8 billion euros in 2016. However, the distribution of these funds to individual funding areas has remained largely constant.

Between 2009 and 2015, the German government simply neglected to direct sufficient funding to information and communication technologies, which are crucial to managing the digital transformation. It wasn't until 2016 that the target funding amount suggested that this area was being assigned higher priority. In view of digitalization, Germany must develop new technological and economic strengths in the coming years, so this field of action should be a high priority in the new legislative period.

It is also important to more effectively focus the currently fragmented and sometimes even opposing activities of departments tasked with establishing digital policy. Above all, the new federal government must ensure that it quickly implements further measures to strengthen digital infrastructure and that it effectively supports research and innovation, particularly in small and medium-sized enterprises. Potential solutions include an innovation agency, which has already been discussed in the Bundestag; a coordination office in the Federal Chancellery; and the formation of a ministry for digital affairs with broad competence in such areas as infrastructure, promoting innovation and e-government. These organizational structures each entail various benefits and drawbacks – it is the Commission of Experts' opinion that no one of these options is clearly superior to the others.

In any case, political leaders must focus the competencies available to them more effectively than has been done to date, thus sustainably reducing complexity. Considering the challenges it faces, Germany can't afford long-winded decision-making and implementation processes – its politics, too, must become much more agile. ◀

Photo: David Ausserhofer/MPG

THE AUTHOR

Dietmar Harhoff, born in 1958, is a Director at the Max Planck Institute for Innovation and Competition and Chair of the German government's Commission of Experts for Research and Innovation (EFI). After completing a degree in mechanical engineering, he began his professional career as a research engineer in the United Kingdom and Germany. He then obtained a master's degree from Harvard University and earned his doctorate at Massachusetts Institute of Technology (MIT). In 1996, he qualified as an economics professor at the University of Mannheim and, two years later, was appointed to a position at Ludwig-Maximilians-Universität in Munich, where he headed the Institute for Innovation Research, Technology Management and Entrepreneurship from 1998 to 2013.