HIGHTECH FORUM

Paths to the 3.5 percent target

A discussion paper from the High-Tech Forum*

* **This discussion paper was reviewed at the second session of the High-Tech Forum, on June 5, 2019.** Editorial responsibility lies with the contributing committee members Dr. Martin Brudermüller, Prof. Andreas Barner and Johannes Oswald.

HIGH-TECH STRATEGY 2025
Talents. Skills. Innovations.

1 Research to create sustainable value

Research and innovation play an important part in safeguarding future growth, maintaining competitiveness and ensuring the advancement of society. There is broad social consensus that the state and industry should undertake long-term, substantial investment in research and development (R&D). A widely recognized quantitative indicator of the level of R&D investment – comprising 2/3 from industry and 1/3 from the public sector – is to express this as a proportion of gross domestic product (GDP). Social, economic, fiscal, technological and legal factors influence the funding of research and innovation. These also have an indirect impact on the target of 3.5 percent. The present publication examines these factors.

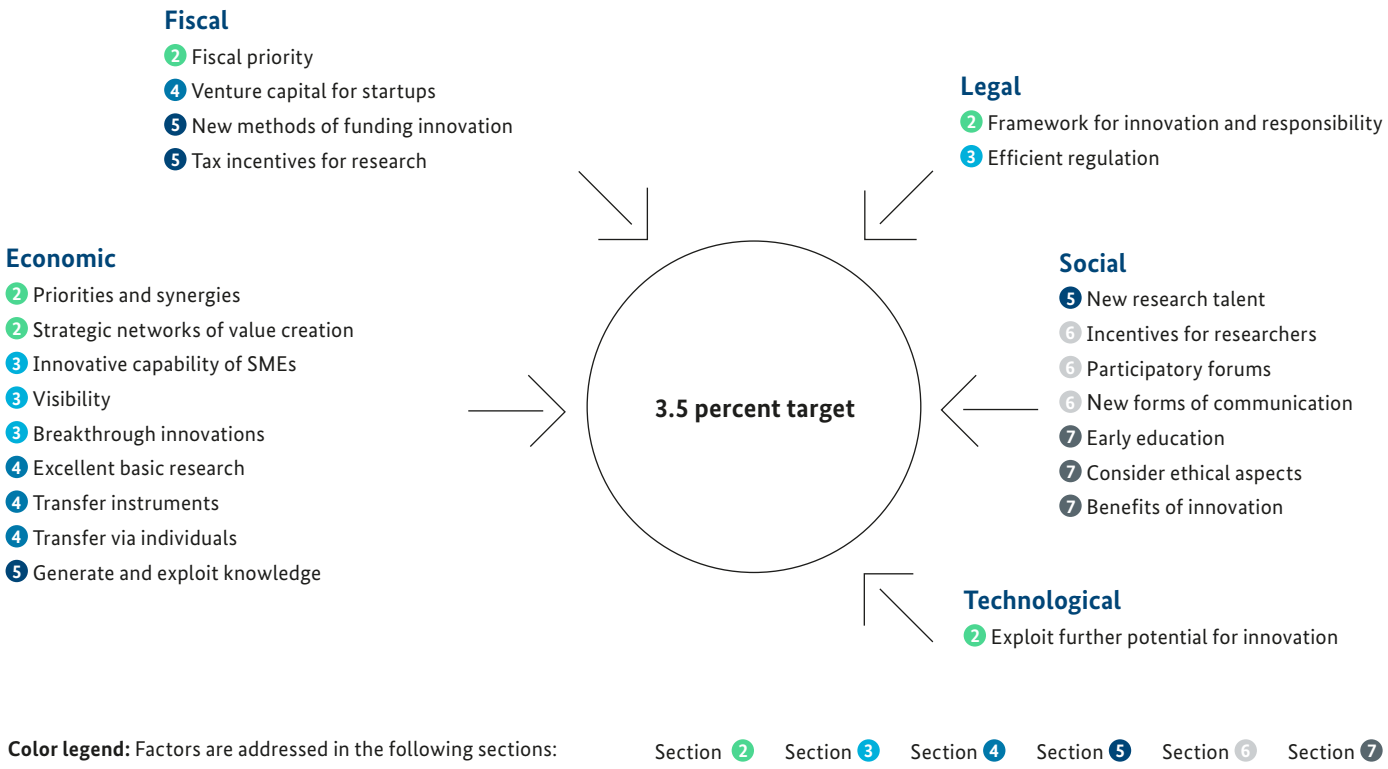

Fig. 1: Factors influencing the achievement of the 3.5 percent target, as examined in the present discussion paper.

2 Strategic focus of research policy

It is only by adopting a common and coordinated European policy for R&D that Germany will be able to hold its ground against rival economies. For this purpose, the measures of the High-Tech Strategy 2025 should be dovetailed with a long-term industrial strategy and the sustainability strategy of the German federal government. This should also include greater support for social innovation.

Building strategic networks of value creation: As evidenced in China and the USA, other research locations around the world are increasingly adopting a national focus. Germany, by contrast, should aim to increase multilateral cooperation. This will help maintain its attractiveness and competitiveness as an industrial location as well as benefit Germany and Europe as locations for R&D. In parallel, there needs to be a new, strategic dialog between government, industry, science and civil society. This will serve to identify common interests and R&D priorities, which can then be strategically developed in order to achieve a globally leading position. Germany and Europe should reinforce efforts to become a lead market for standardization, particularly in the field of digital applications. One should recognize that alignment with international goals and standards, including the United Nations Global Compact and the UN Sustainable Development Goals (SDGs), can help create a competitive advantage in the development of products and processes.

Establishing priorities and creating synergies: Research strategies at both national and European levels should concentrate on maintaining research capability in major areas of technology. In particular, research should focus on topics of key importance for the future, where there is the potential to play a globally leading role.[1] These include digital transformation, bioeconomy, health care, innovations for a circular economy, energy efficiency and future mobility. Furthermore, greater synergies with European R&D should be exploited to discover common ground between the objectives of the High-Tech Strategy 2025 and those of the Horizon Europe funding program for research and innovation.

Unleashing further innovation potential: There needs to be a discussion between government, industry, science and civil society about the potential for innovation in areas such as security and defense research – cybersecurity, resilience, aerospace, telecommunications, etc. – not least with regard to the civil use of such technology. This will help exploit synergies in order to meet the two percent target for defense spending and the 3.5 percent target for R&D investment. Individual institutions will retain the option of applying the so-called civil clause – a commitment by German scientific institutions, such as universities, to conduct research exclusively for civil purposes.[2] At the same time, research in the field of international peace and conflict studies should be strengthened.

Creating a framework for innovation and responsible research: One of the key public services that a state is expected to provide is to ensure that the country retains its innovative capability.[3] There are differing views on how draft legislation should attempt to balance the precautionary principle against the innovation principle. A discussion process should therefore take place with stakeholders from civil society, science and industry as to how the application of these two principles can be brought into harmony.

Establishing fiscal priorities: In the future, when drafting federal budgets, investment in research and innovation should remain a top priority. The aim here should be to reposition research and innovation policy as an aspect of social policy that contributes toward achieving social, ecological and economic goals.

Embedding a broad understanding for innovation: Social innovations may be triggered by technological progress, they may complement it or even arise independently of it.[3] In particular, social innovations often form a bridge between the solution to a challenge facing society and the emergence of new business models in the platform economy, which then offer the possibility of better and more sustainable forms of coexistence. The options for achieving stronger promotion of social innovation require examination.

3 New forms of innovation

Existing forms of collaboration between the research community and actors from other areas of society must be developed and encouraged. This will help generate new developments across disciplinary boundaries and in ever shorter periods of time. For this purpose, new and agile forms of innovation will be required.

Reducing regulation and making it more efficient: Living labs provide an opportunity for science, industry and the public sector to trial intelligent regulatory approaches for a new technology in a limited area and for a fixed period of time. This requires a willingness on the part of politicians to exploit the full flexibility of the legal framework, to make responsible use of experimentation clauses and to use impact assessments in order to pave the way for the introduction of future technology. Overall, regulation should be made more efficient and the "one in, one out" principle universally applied.

Ensuring visibility: In order to attract young talent into academia and to stimulate investment, one should therefore seek to establish (regional) centers of international repute, where research addressing the challenges facing society can be strategically combined with key areas of technology. In other words, one should have the courage to concentrate resources rather than spreading them evenly. This is why the process of branding German R&D locations should take into account not only offers of funding and investment but also the availability of trained staff.

Helping SMEs to become more innovative: Many companies get tied up in the red tape of the innovation process (e.g., the time and expense required to meet licensing and authorization procedures, product regulations and other regulatory requirements). Streamlining bureaucratic procedures can help companies increase innovation. Government should therefore remove the barriers to innovation erected by existing company law. At the same time, government should also seek to devise less-bureaucratic methods of research funding (e.g., simplified application procedures and faster processing times).

Improving the conditions for disruptive innovations: In order to ensure that ideas with disruptive potential make their way into concrete applications, it is crucial that funding programs are open to all technologies rather than just a select group. This facilitates rapid market penetration and the creation of new standards. Program managers should therefore be given considerable latitude in their choice of research topics.

4 Knowledge and technology transfer

A key challenge here is to organize research in such a way that basic research can be quickly and successfully brought to market and thereby generate value in Germany and Europe. This presupposes the existence of an innovation ecosystem that enables the widespread diffusion of ideas and research and expedites their development into market-ready products.

Promoting excellent basic research and efficient transfer: A political desire for increased transfer of technology should not lead to restricting scientific freedom in the realm of basic research. Excellent basic research lays the foundation for future innovation. The various actors within the scientific system must continue to act in line with their specific roles and cooperate with one another according to their strengths. This includes universities, nonuniversity research establishments and also, and expressly, universities of applied science. The goal here is to organize basic and applied research and the transfer of that knowledge in accordance with the institutional strengths of these scientific establishments and to develop formats that enable efficient collaboration between them.

Promoting transfer via individuals: To make it easier for people to move between industry, science, government and public administration, career development paths should be made more open and less rigid. In particular, universities and other higher-education establishments should step up their teaching of skills relevant to innovation (e.g., entrepreneurship and data literacy).

Strengthening transfer instruments: By providing solid support for the validation of new ideas (e.g., VIP+), it is possible to discover at an early stage whether the results of basic research show potential for successful commercial exploitation. Additional capital should be made available for proven instruments such as the Collective Industrial Research (IGF) program and the Central Innovation Program for SMEs (ZIM). Such measures expedite the transfer of new scientific innovations to companies that themselves pursue little or no R&D. In turn, universities and other establishments of higher education should step up their efforts to meet the R&D needs of these companies. As with technology transfer, the transfer of knowledge can substantially boost innovation and create important instruments for the purpose of participation and dialog.

Mobilizing venture capital for start-ups: High-tech start-ups are frequently a fertile ground for R&D and should therefore be targeted more specifically (e.g., through the use of start-up scouts at universities and universities of applied science). In order to increase the involvement of start-ups in joint R&D projects, the creditworthiness criteria for start-ups should be modified accordingly. If not, the readier availability of venture capital in other countries may well lead to a migration of R&D expertise in the medium term. To counteract this trend, Germany and Europe need a greater number of technology-oriented investment funds with substantially increased financial provision. In particular, this will help provide effective support for high-tech start-ups in their growth phase. At the same time, targeted recruitment of foreign investors should be undertaken in order to raise additional venture capital, and initiatives should be strengthened to attract private investment capital for high-tech start-ups and R&D.

5 Stimulating investment in research

The public sector must significantly increase its share of research expenditure and implement measures that will enable Germany to achieve, with the assistance of the corporate sector, the 3.5 percent target by 2025. Innovation, and a recognition of its importance for our future, must become a key element of government policy.

Introducing effective tax credits for research: Germany's new legislation on tax credits to encourage research and development should now be swiftly adopted so that it can enter into force on January 1, 2020. Given the fact that many SMEs do not have their own R&D departments, tax credits for external contract research should be awarded to the contracting company. Imposition of a cap on the maximum amount would result in potential remaining untapped.

Creating new formats to attract young research talent: At present, demand for trained junior personnel outstrips supply. In Germany, this is exacerbated by demographic factors. Universities and other establishments of higher education should be given scope to devote more resources to education and training, alongside research. At the same time, better use should be made of the potential offered by immigration for a targeted recruitment of R&D personnel. Similarly, efforts should be made to further reduce the obstacles hindering the recognition of qualifications obtained abroad.

Generating and exploiting knowledge: German companies already source a lot of their knowledge abroad as well as help generate it there. Measures should be taken to actively support these activities abroad. Appropriate mechanisms here include German representative offices and national platforms for the diffusion of knowledge. These will boost the value of this inflow of knowledge to Germany and Europe and increase its exploitation.

Exploring new means of promoting innovation: Successful methods employed by other countries to leverage private capital for R&D should be systematically evaluated and examined as to their suitability for use in Germany. There should also be a greater focus on the role of privately funded prizes for mission-oriented innovation (e.g., the X-Prize) and the use of matching funds from the public sector in order to leverage R&D funding provided by the private sector or by foundations and trusts.

6 Innovation and participation

The development of new technologies and innovations should be accompanied by full public participation and dialog formats from the very outset. This includes an ongoing discourse on the social benefits of the research in question as well as a consideration of the opportunities and risks associated with the use of that research.

Creating opportunities for greater participation: Accompanying interdisciplinary research should also focus on improving our understanding of the socioeconomic and ecological impact of new technological innovations. Innovation should be accompanied by entirely new forms of public participation, thereby ensuring that research is geared toward the values, objectives and needs of society (e.g., by the application of responsible research and innovation (RRI) methods).[4] This should also mean greater involvement by representatives from all social groups – bottom-up and top-down – thereby facilitating broad-based policy consultation. There must also be a discussion of whether a fixed percentage of public funding for R&D should be invested in measures to promote public participation and dialog.

Using new forms of communication: In order to reach a broad section of the general public, it is important that information about new research is presented in a form that corresponds to the media habits of the specific target group (e.g., the use of social media to address younger target groups). The best way to generate authentic communication is to hold a direct dialog with those involved in the innovation process and to present concrete, hands-on exhibits. Senior managers and employees can also play a role here by providing a human face to the company, research institute or university behind the research.

Creating incentives for researchers: Science must be able to argue the positions it takes and represent them in the public sphere. Science communication plays a key role here – and, by this means, the transfer of knowledge. Researchers should therefore be rewarded not only for their output (publications, patents, transfer) but also for their broader contribution to society. Incentives here may extend to appointment procedures.

7 Culture and society

Innovation is not an end in itself. Rather, it is a means to an end: safeguarding future prosperity, promoting the advancement of society and ensuring the environmental compatibility of human activity.

Focusing on the utility of new innovation: Science communication should focus not only on individual technologies themselves but also present the systemic benefits it brings to society, right down to the individual citizen, or to nature and the environment. The use of clear and simple language can help stimulate a dialog on the benefits of innovation.

Considering ethical aspects: The primary purpose of the innovation process should be to bring about economic, ecological and social progress through the concrete application of new research. It also important to ensure that this process is firmly anchored within society. At the very beginning of the R&D process, there should be an active discussion as to whether a commercial exploitation of the research in question complies with ethical and sustainability principles.

Starting early with education: Educational measures to instill a degree of technological competence should begin in early childhood and continue through school. If young people are encouraged to develop an interest in, and understanding of, technology and innovation at an early age, they will then be able to participate meaningfully as adults in the public debate surrounding the introduction of a new technology. This should also include a look at the role of the dual education system. In particular, there should be a focus on STEM subjects and the teaching of reflective skills, neither of which has thus far received adequate attention in education policy.

8 Annex

Current situation

R&D investment measured as a proportion of GDP provides a key indicator of a country's attractiveness and competitiveness as an industrial location. Germany has pledged to maintain the proportion of R&D expenditure at over three percent of GDP until 2020. This target was reached for the first time in 2015, with industry contributing 60.51 billion euros (66 percent) and the state 25.11 billion euros (27 percent).[5] On the strength of this achievement, the governing parties resolved in the coalition agreement of early 2018 to increase R&D investment to at least 3.5 percent of GDP by 2025. This ambitious target has been welcomed by various commissions and advisory bodies.[3, 6, 7] The initial target was exceeded in Germany for the first time in 2017, when R&D expenditure rose to 3.03 percent of GDP, due not least to a significant increase in research on the part of the automotive industry.[8] Within the EU-28, where R&D investment as a proportion of GDP was on average two percent, only Denmark, Sweden and Austria invested more than Germany.[9] Globally, R&D investment in 2017 was highest in countries such as Israel, South Korea (both approx. 4.5 percent) and Switzerland (3.3 percent).

References

1 These key topics are cybersecurity, digital platforms along with Industrie 4.0, the bioeconomy, interaction with cognitive systems, personalized medicine and synthetic biology, and electric, connected and automated mobility; cf. High-Tech Forum (ed.) 2017: Gemeinsam besser: Nachhaltige Wertschöpfung, Wohlstand und Lebensqualität im digitalen Zeitalter – Innovationspolitische Leitlinien des Higtech-Forums. Berlin, p. 46 ff. Available for download at: www.hightech-forum.de.

2 Cf. https://de.wikipedia.org/wiki/Zivilklausel | Accessed: 6.14.2019.

3 High-Tech Forum (ed.) 2017: Gemeinsam besser: Nachhaltige Wertschöpfung, Wohlstand und Lebensqualität im digitalen Zeitalter – Innovationspolitische Leitlinien des Hightech-Forums. Berlin, pp. 20, 38.

4 https://publications.europa.eu/en/publication-detail/-/publication/bb29bbce-34b9-4da3-b67d-c9f717ce7c58 | Accessed: 6.14.2019.

5 Rainer Frietsch, Christian Rammer, Michael Astor, Marius Berger, Stephanie Daimer, Martin Hud, Cordula Klaus, Christian Lerch, Jan Limbers, Peter Neuhäusler, 2017: Schrittweise Erhöhung der FuE-Quote auf bis zu 3,5 % des BIP – Instrumente und Auswirkungen auf volkswirtschaftliche Kennzahlen. Abschlussbericht. Updated in January 2019, p. 4 ff.

6 EFI – Expertenkommission Forschung und Innovation 2013 und 2017: Gutachten zu Forschung, Innovation und technologischer Leistungsfähigkeit Deutschlands, Berlin.

7 Forschungsunion Wissenschaft – Wirtschaft (2013): Perspektivenpapier der Forschungsunion: Wohlstand durch Forschung – Vor welchen Aufgaben steht Deutschland? p. 77.

8 Stifterverband für die Deutsche Wissenschaft, May 2019.

9 https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm | Accessed: 6.14.2019.

About this discussion paper

The committee examined and commented on this discussion paper at a meeting of the High-Tech Forum on June 5, 2019. Its content is not based on a unanimous authorization of the committee members.

This discussion paper was produced by the High-Tech Forum team appointed to work on the topic "Paths to the 3.5 percent target." Its purpose is to advise the German federal government on the implementation of the High-Tech Strategy 2025. The team comprises the following members: Dr. Martin Brudermüller, Prof. Andreas Barner and Johannes Oswald.

The paper is based on contributions to a workshop – "Paths to the 3.5 percent target" – with 40 experts from science, industry and civil society, which was held in Berlin on April 10, 2019; and on consultation provided by members of the High-Tech Forum. It builds on the work of the High-Tech Forum from 2015 to 2017.

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About the High-Tech Forum

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