

# A0 R&I Policy at a Turning Point in History

In its 2021 and 2022 reports, the Commission of Experts emphatically emphasized the crucial importance of research and innovation (R&I) for mastering the major transformations. Be it the energy transition, the mobility transition, the digitalization of the economy and society, the transition to organic farming or others, they are all intended to help achieve the major objectives of climate neutrality and sustainability. The fact that Germany as an R&I location, with its internationally top-ranking performance, is well positioned for these tasks was highlighted in the reports, as were the obvious difficulties in aligning R&I activities with the new transformation-oriented challenges. Therefore, it was urged that the style and structure of R&I policy be tailored to the requirements of wide-ranging transformations and radical technological as well as social innovations. To this end, the Commission of Experts considers a new R&I policy approach necessary - a market-oriented version of the New Mission Orientation.<sup>1</sup>

As if this R&I policy task were not complex and challenging enough, it is currently further complicated by two major crises: the Covid-19 crisis since 2020 and the war in Ukraine since 2022. Disrupted supply chains and lockdowns, energy crisis, high energy prices and inflation are weighing on the economy and society. Acute economic distress in private households as well as in many companies, especially in energy-intensive industries, were and are to be compensated for in the short term. The immediate support of the economy, the avoidance of a recession, the fight against inflation and measures to alleviate the energy crisis dominate the day-to-day business of economic policy. Long-term issues such as climate change in particular are in danger of slipping to the back of the agenda. Government-funded compensation and support measures for companies and private households are putting further pressure on public budgets, progressively limiting their

financial leeway – today and, because of the accumulated high debts, also in the future. Accordingly, the scope for action to support and orchestrate the upcoming major transformations in R&I policy and to actively tackle them with the help of innovative solutions is becoming increasingly limited.

## Strengthening Technological Sovereignty in Times of De-Globalization

For Germany to successfully pursue its transformation objectives, it needs to be in a position of economic strength. However, Germany's successful model of an open, export-oriented economy is coming under increasing pressure. The trend towards de-globalization is being driven by geopolitical polarization, especially between China and the Western industrialized countries. Increasing demarcation and nationalization tendencies are not limited to China, however, but are also present in the USA and within the European Union (EU). This puts existing supply chains, access to raw materials as well as free trade and the open exchange of knowledge and technology at risk.<sup>2</sup> Dependencies regarding important raw materials and key enabling technologies such as semiconductors are having an increasingly noticeable impact. This threatens Germany with a loss of technological sovereignty.<sup>3</sup> To prevent this and to safeguard the technological competitiveness of companies for the future, considerable private-sector efforts are required, supported by strategically smart public investment, especially in R&I activities in key enabling technologies.<sup>4</sup>

## Ensuring Economic and Structural Capacity for Transformations

Strong economic performance is a prerequisite for the success of the major transformations. The fun-

damental reform of existing structures also requires a high degree of commitment to renewal and agility on the part of society, the economy and politics. The key objectives of climate neutrality and sustainability are just as important as improving the ability of social and economic systems to adapt to changing conditions and to show resilience in the face of adverse developments. The current crises not only reduce the amount of available financial resources, that are urgently needed for this transformation. They also threaten the social acceptance of the transformation objectives, especially if these objectives are perceived as less urgent than the current emergencies due to their long-term character. As a result, necessary transformation measures are threatened with further and further postponement, which, however, cannot be justified in view of impending tipping points and irreversibility, especially regarding climate and the environment.

### Balancing Conflicting Goals Between Crisis Interventions and Transformations

Managing the overlapping crises, facing the demands of the new geopolitical situation and meeting the transformation requirements poses immense challenges for policy making. This is because the complexity of this situation leads to numerous conflicting objectives. Measures to support production and employment in the short term often focus on established technologies and business models to directly maintain economic power. As a result, the transformations required in the medium and long term, including the necessary innovations, are in danger of falling behind in these fields. Compensatory measures such as an energy price cap also trigger similar conflicts of objectives. While certainly desirable from a social point of view, caps of this kind can stand in the way of incentives to innovate and develop alternative energy sources.

To balance such conflicting objectives, a clever combination of short-term support measures and transformation-oriented investments in the future is needed. The Federal Government must resist the temptation to fully compensate for the consequences of the current crises and the expected negative impacts of the transformations. The Commission of Experts calls attention to the fact that a lasting solution to the crisis cannot be achieved through consumption, but only through investment. Therefore, compensation payments must be limited to

particularly needy persons and hardship cases in companies.

As a rule, it is important to ensure that investment measures to overcome the crisis not only solve acute problems, but also promote future viability. For instance, the Bundeswehr's special assets of €100 billion offer the opportunity to increase not only the alliance and defence capabilities in the long term, but also Germany's technological competitiveness by promoting R&D activities in the field of digital technologies or in aerospace.

### Acting More Strategically Due to Limited Resources

The coordinated and efficient use of public budgets requires a strategically acting state. Whether the Federal Government will succeed in mastering the current crises and transformation challenges also depends on whether agile policy action is enabled by means of adequate decision-making processes and governance structures.<sup>5</sup> Without agility, the tightening financial margins cannot be used effectively. Agility, however, requires the willingness of politics and society to actively reform deficient or outdated structures and not to sit it out by creating parallel structures or compensation payments. In addition to the ability to react agilely to current events and changing requirements, German R&I policy needs a long-term orientation as well as strategic planning and the formulation of clear priorities. A turning point is also needed in R&I policy.

# A 1 Creating Agile Governance Structures

**A** new, agile policy style and a governance structure to match are needed to advance the major transformations (e.g. towards climate neutrality and the digital transformation) swiftly and in a socially acceptable manner, while at the same time safeguarding the competitiveness of the German economy and its companies. These transformations affect large parts of the economy and society and require numerous technological and social innovations. To initiate these, diverse and coordinated interventions from different policy fields are required. Accordingly, transformations do not fall within the remit of a single ministry, but of several. At the heart of the new policy approach, which can be described as a market-based mission and transformation policy, is the fact that the ministries concerned coordinate their strategies and measures in line with the transformation objectives and cooperate in an agile manner. The Commission of Experts is of the opinion that several structural and procedural adjustments are needed to successfully implement this policy approach.

Agile policy action is not only characterized by a quick and flexible reaction to changes.<sup>6</sup> It is also proactive, involves relevant actors, continuously reviews the measures introduced and adapts them to changing conditions if necessary. The main requirement here is to continuously coordinate long-term planning and short-term adjustments. The silo mentality within the Federal Government still constitutes a major obstacle to agile policy action. The Commission of Experts emphatically points out that cooperation between and within the ministries urgently requires improvement in view of the tasks ahead. Germany cannot afford a 'business as usual' approach to policy coordination, neither in terms of time nor financially.

## Establish a Government Committee for Innovation and Transformation

In order to more closely dovetail the content of the innovation- and transformation-related policies

of the various ministries at the strategic level, the Commission of Experts recommends establishing a permanent government committee for innovation and transformation. This committee is intended to provide, at the highest level, alignment and coordination of content, as well as the regular review of strategies related to R&I policy. This will create the greatest possible commitment and joint strategic responsibility for missions and transformations.

Although the Federal Government has already adopted or will soon adopt several strategies related to R&I policy (cf. box A 1-1) in the current legislative period, the Commission of Experts considers these strategies to be still insufficiently interlinked. In view of the transformations, better coordination of content would be important to ensure greater effectiveness and efficiency of policy action. Funding instruments that overlap or work in different directions must be avoided, complementary policy measures must be coordinated and complex processes must be managed jointly and in a smartly timed manner.

The Commission of Experts is of the opinion that the currently established mechanisms of inter-ministerial coordination are not suitable for formulating an overarching set of objectives for the Federal Government regarding innovation and transformation-related topics and for clarifying which strategies should be (further) developed to pursue which objectives. These government tasks can neither be adequately performed within the context of cabinet meetings nor in the course of interministerial coordination of individual strategies.<sup>7</sup> Instead, these tasks should be assumed by the government committee for innovation and transformation recommended by the Commission of Experts in order to prepare and be responsible for a planned and coordinated approach of the Federal Government at the strategic level.

The government committee for innovation and transformation should be established within the Federal Chancellery.<sup>8</sup> In other countries, commit-

tees with a similarly comprehensive range of tasks are also established at the highest political level.<sup>9</sup> In addition to the head of the Federal Chancellery, the government committee for innovation and transformation should include as permanent members those ministers whose departments are most closely involved with innovation- and transformation-related issues. Other ministers should be consulted on an ad hoc basis.

To ensure that the strategic level and the implementation level are interlinked and to increase commitment, the government committee for innovation and transformation should regularly report to the Federal Cabinet and the German Bundestag. In turn, the government committee for innovation and transformation should receive reports from the individual ministries represented there.

### Assign Clear Responsibilities to Interdepartmental Mission Teams

The claim formulated in the Federal Government's Future Strategy for Research and Innovation to actively shape transformation processes also gives rise to the need for comprehensive inter-ministerial coordination at the implementation level. The draft version of the Future Strategy published by the BMBF in autumn 2022 proposed 'six mission teams as agile, interdepartmental and topic-specific steering units'<sup>10</sup> that would specify objectives, derive milestones as well as review and, if necessary, readjust progress.<sup>11</sup> The Commission of Experts considers the establishment of such units to be urgently necessary and crucial to the success of the missions. As the tasks of the mission teams are demanding and require sufficient scope for agile policy action (cf. chapter A 2), the Commission of Experts sees the need to provide the mission teams with clear areas of responsibility and sufficient decision-making powers. To create the greatest possible commitment in the coordination and implementation of mission-oriented policy, the Commission of Experts recommends that the ministries involved be integrated into the mission teams at state secretary level. It is equally important that the mission teams report regularly to the proposed government committee for innovation and transformation.

### Finally Expanding SPRIND's Scope for Action

With its focus on leap innovations,<sup>12</sup> SPRIND GmbH,<sup>13</sup> founded in 2019, promotes a segment of the German R&I system that was previously covered neither by government support programmes and research institutions nor by the involvement of private actors.<sup>14</sup> To cope with its specific task, SPRIND GmbH was given an institutional structure that differs significantly from the structures of ministries and project executing agencies. It has become apparent, however, that the agency's scope for decision-making is not yet sufficient to enable it to act agilely enough. The governing parties have announced in the coalition agreement that they will substantially improve the legal framework of SPRIND GmbH without delay.<sup>15</sup> The Commission of Experts urges that this plan finally be implemented.

### Dovetail DATI Funding with Mission Orientation

Knowledge and technology transfer in Germany must be made more effective, efficient and rapid.<sup>16</sup> To this end, suitable instruments must be developed and transfer must be holistically and systematically embedded in the science and innovation system. The Federal Government is therefore planning to establish the German Agency for Transfer and Innovation (Deutsche Agentur für Transfer und Innovation, DATI). In a policy brief, the Commission of Experts critically examined the key issues paper on the configuration of DATI published in April last year.<sup>17</sup> The Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF) is currently developing the DATI concept further, taking into account the results of stakeholder consultations.<sup>18</sup>

Functioning transfer processes are crucial for the success of the Future Strategy. The Commission of Experts therefore considers it sensible for DATI to be used to develop and implement a nationwide concept for the promotion of transfer processes. To achieve this, all transfer-relevant actors should be integrated into this concept through interfaces and a central service point for transfer should be established. In terms of content, the DATI concept should be dovetailed with the missions (cf. chapter A 2) of the Future Strategy. The DATI should be open with regard to the supported actors and

technologies and not restrict the support of actor groups in regional terms.

### Reform Structure of Project Executing Agencies

The Commission of Experts feels that the development, adaptation and administration of traditional R&I support programmes should be more agile than has been the case to date. In as far as possible, R&I funding procedures should be designed uniformly and in a consistent digital format for the recipients across the various support programmes. In addition, funding should be made available as a lump-sum budget and linked to results-oriented monitoring. Barriers to the participation of small and medium-sized enterprises (SMEs) and start-ups in funding procedures should be reduced as far as possible and approval procedures kept short.

In Germany, the individual R&I support programmes are usually administered by so-called project executing agencies (German: Projektträger). These support the funding departments in the ministries, also in terms of content, in the design and adaptation of measures as well as in monitoring. The structure of project executing agencies has developed in such a way that thematically related R&I support programmes are managed by different project executing agencies.<sup>19</sup> To achieve more coherence here and to leverage synergies, a mission-related bundling of R&I programmes at individual project executing agencies would make sense. The commissioning of missions, as well as the commissioning of project executing agencies outside of missions, should be carried out on a competitive basis.

The project executing agencies are often very actively supported by the responsible departments in the ministries and have few opportunities to

#### Box A 1-1 Select Federal Government Strategies with R&I Policy Relevance

##### Future Strategy

The Future Strategy for Research and Innovation (short: Future Strategy),<sup>20</sup> which replaces the previous government's High-Tech Strategy 2025, identifies two top priorities of R&I policy, namely 'Science, Research and Transfer' and 'Actively Shaping Transformation Processes'.

The priority 'Science, Research and Transfer' comprises six R&I policy goals aimed at boosting the level of R&I activities to meet the 3.5 percent target and achieving a more purposeful use of funds. These goals are to prepare the ground for tomorrow's progress, to turn new knowledge into innovations, to reinforce European and international cooperation, to increase participation in research and innovation, to promote talent across the board and at the top, and to establish an agile research and innovation policy.

In the priority 'Actively Shaping Transformation Processes', the aim is to steer R&I activities in socially desired directions. Six so-called missions are specified for this purpose. These include enabling resource-efficient industry and sustainable mobility, protecting the climate and biodi-

versity, improving health for all, safeguarding Germany's and Europe's technological sovereignty and harnessing the potential of digitalization, exploring and sustainably using space and the oceans, and strengthening societal resilience, diversity and cohesion. For each of these missions, the Federal Government formulates objectives against which the missions are to be fulfilled.

In its Future Strategy, the Federal Government also sets out how it intends to promote communication, exchange and participation in the R&I sector.

##### Start-up Strategy

The Federal Government's Start-up Strategy was developed under the leadership of the Federal Ministry for Economic Affairs and Climate Action (Bundesministerium für Wirtschaft und Klimaschutz, BMWK) and adopted by the Cabinet in July 2022.<sup>21</sup> With its strategy, the Federal Government highlights the importance of start-ups for the transformation of the economy and society as well as for safeguarding technological sovereignty. The aim is to improve the conditions for start-ups and the growth phase of start-ups. The strategy is structured into ten fields of action:

1. Strengthen funding for start-ups,
2. Make it easier for start-ups to attract talent – make employee ownership schemes more attractive,
3. Ignite the startup spirit – make startups easier and more digital,
4. Strengthen female start-up founders and diversity in start-ups,
5. Make it easier to create startup spin-offs from science,
6. Improve the general environment for non-profit start-ups,
7. Mobilise start-up skills for public contracts,
8. Make it easier for start-ups to access data,
9. Strengthen regulatory sandboxes – make access easier for start-ups,
10. Put the focus on start-ups.<sup>22</sup>

Numerous measures, e.g. regarding the participation of institutional investors, employee participation and the recruitment of foreign experts, demonstrate a discrepancy between the key issues paper published by the BMWK in advance and the final strategy. Some of the start-up-friendly regulations proposed by the BMWK are now only included in the Start-up Strategy as review requests.

### Digital Strategy

The 'Digitalstrategie – Gemeinsam digitale Werte schöpfen' (Digital Strategy – Creating Digital Value Together) presented in August 2022 is intended to achieve a breakthrough in digitalization projects<sup>23</sup> that have been planned for a long time and had already been identified as important projects in the precursor strategies.<sup>24</sup> Examples include the electronic patient record, digital identity and stable internet connections throughout Germany. With the voluntary commitment to expand infrastructures such as fibre-optic and mobile networks on a large scale, the Digital Strategy also adopts the key objectives of the Gigabit Strategy published in July 2022.<sup>25</sup> The Digital Strategy is structured into three fields of action: 'Connected and Digitally Sovereign Society', 'Innovative Economy, Work, Science and Research' and 'Learning, Digital Government'. The fields of action in turn comprise numerous projects, 18 of which have been designated as lighthouse projects. Each ministry is represented with at least one lighthouse project, which it implements under its own responsibility.<sup>26</sup> One

example of this is the establishment of a National Education Platform by the BMBF.

The three projects 'High-capacity and sustainable networks and availability of data and data tools', 'International uniform technical norms and standards' and 'Secure and user-friendly digital identities and modern registers'<sup>27</sup> are highlighted in the Digital Strategy as projects with a leverage effect. They are given absolute priority as they set the stage for all other projects.

### Skilled Labour Strategy

The Federal Government's Skilled Labour Strategy was published in October.<sup>28</sup> In it, the Federal Government analyses the opportunities and challenges facing Germany as a business location and presents the skilled labour requirements up to 2026. In the objective of securing the supply of skilled workers, the following five priority fields of action are identified: 'Up-to-date Training', 'Targeted Continuing Education and Training', 'Exploiting the Labour Force Potential, Increasing Labour Market Participation', 'Improving the Quality of Work and Changing the Culture of Work' and 'Modern Immigration Policy and Reducing Emigration'. These five priority fields of action are backed up with measures in the Skilled Labour Strategy. The Federal Government sees the Skilled Labour Strategy as an overarching strategy for the various activities of the Federal Government and as a basis for exchange with all actors in the education and labour market.

### Continuing Education Strategy

To continue and further develop the National Continuing Education Strategy (Nationale Weiterbildungsstrategie)<sup>29</sup> adopted in 2019, the 'National Continuing Education Strategy. Continuation and Further Development. Together for a Decade of Continuing Education – Moving Towards a Continuing Education Republic' (Nationale Weiterbildung. Fortführung und Weiterentwicklung. Gemeinsam für ein Jahrzehnt der Weiterbildung – Aufbruch in die Weiterbildungsrepublik) was agreed in September 2022.<sup>30</sup> The following cross-cutting issues form the core of the strategy: 'Facilitating Access to Counselling, Support and Continuing Education', 'Intensifying Cooperation in Regions and Sectors', 'Further Developing Concepts' and 'Strengthening Digital Continuing Education'.

shape processes themselves. As a result, it is not possible to respond adequately to potential adaptation needs in R&I projects and policy learning is made more difficult. The project executing agencies should therefore be granted more leeway, includ-

ing experimental leeway, in the implementation of support measures. This should be combined with a more results-oriented management of the use of funding by the project executing agencies and regular, state-of-the-art evaluations of the measures.

## A 2 Tackling the Grand Societal Challenges

**R**&I policy is called upon to make a significant contribution to solving the grand societal challenges. These include first and foremost human-made climate change, digitalization and the demographic ageing of society. The New Mission Orientation in R&I policy is designed to address these grand societal challenges.<sup>31</sup> The Commission of Experts is of the opinion that the Federal Government should pursue it resolutely.

### Refining the Mission-oriented Approach of the Future Strategy

The Commission of Experts welcomes the Federal Government's commitment to a mission-oriented R&I policy in its Future Strategy,<sup>32</sup> but sees the need to refine the transformation goals set out in the missions and to specify them in an operable manner.<sup>33</sup> The Commission of Experts considers the six objectives named as missions in the Future Strategy (cf. box A 1-1)<sup>34</sup> to be too wide-ranging to be manageable in strategic and operational terms. For this reason, it recommends naming several action-guiding missions within each of these overarching objectives and formulating measurable and ambitious, but realistic, transformation goals with a precise time frame. To increase commitment on the part of policy-makers, it should also be specified which transformation goals are to be achieved by the end of the already advanced legislative period.

An action-guiding mission could be, for example, 'Climate-neutral Motorized Private Transport'. As part of such a mission, it would be necessary to specify which savings targets are to be realized and by when. By involving potentially affected groups of actors and federal levels from the outset in the conception of action-guiding missions, the acceptance of mission-oriented policies can be increased and the mobilization of agents of innovation can be facilitated. The Commission of Experts expects that the naming of the action-guiding missions and the specification of the transformation goals will in themselves contribute to the success of the missions, as they provide orientation for the development of a policy mix and the adjustment of measures.<sup>35</sup>

For the six overarching missions or objectives defined in the Future Strategy, a large number of individual goals are listed, some of which have the character of measures but are not put in relation to each other.<sup>36</sup> The Commission of Experts calls on the Federal Government to draw up roadmaps for specific transformation goals that coordinate and structure the measures of the various ministries in terms of content and timing. Coordination processes with the Länder and municipalities as well as the EU<sup>37</sup> may also be required. In addition, actors in business and society who can contribute to achieving the mission goals should be involved in the preparation of the roadmaps. There must be no simple juxtaposition of relevant measures.

Rather, an effective and efficient interaction of R&I projects, support measures and legal frameworks is needed for mission success. For example, in an action-guiding mission of ‘Climate-neutral Motorized Private Transport’, R&I policy instruments must be linked with measures concerning CO<sub>2</sub> pricing, a complementary reform of taxes and levies, the development of charging infrastructure and the expansion of renewable sources of electricity, as well as regulations on the data exchange of autonomously driving cars.<sup>39</sup>

The implementation of missions takes place in a dynamic environment and not all processes can be perfectly controlled. This results in the requirement to conduct continuous monitoring as well as to evaluate the measures taken and adjust them if necessary. The Commission of Experts recommends that monitoring and evaluation processes be taken into account from the outset when designing missions.<sup>39</sup> In this way, measures and packages of measures can be continuously improved and aligned with the transformation goals to be achieved. In this respect, the final report of the supporting scientific research on the High-Tech Strategy 2025 already provides a large number of practical tips on how mission-oriented R&I policy can be designed to be more effective and efficient than before.<sup>40</sup>

### Not Pitting Energy Security and Climate Protection Against Each Other

In light of the energy crisis brought about by the war in Ukraine, there is a risk that the goals of energy security and climate protection will be pitted against each other. The Commission of Experts maintains that the expansion of renewable energy and the increase in energy efficiency contribute to both energy security and climate protection in the long term. Price signals, which provide important incentives for the transformation of the economy and consumption behaviour, should therefore not be undermined by ever new ‘price brakes’. Although socio-political compensation is necessary, especially for low income groups, the Commission of Experts considers the current design of the energy price brakes<sup>41</sup> with a price cap for a basic quota of consumption (usually 80 percent) and a market price compensation for consumption above the discounted quota to be socially unbalanced. Moreover, the energy price brakes only create savings incentives for consumption above the discounted quota and

tempt consumers to make full use of this quota. Should compensation for energy price increases still be necessary in the future, simple flat-rate payments for lower income groups should be used instead of quota solutions for all. Compensation for the industry, which should be limited in time, should be based on benchmarks rather than historical consumption and should be made more dependent on how exposed the respective industry is to international competition.

### Implement CO<sub>2</sub> Boundary Adjustment As Soon as Possible

The Commission of Experts welcomes that the European Parliament and the European Council reached a preliminary agreement in December 2022 on the establishment of a CO<sub>2</sub> border adjustment mechanism.<sup>42</sup> Such a mechanism helps to limit carbon leakage to non-EU countries. It incentivizes industry to accelerate decarbonization through the deployment of innovative technologies, while protecting it from companies from countries with less ambitious climate targets. This will also create incentives for other countries to operate more sustainably and emit fewer emissions. It will now be important to clarify the technical details to implement the border adjustment mechanism as quickly as possible and to coordinate it with the measures of the Climate Club<sup>43</sup> established by the G7 in December 2022.

### Compensating Negative Emissions in Pilot Projects

At the United Nations Climate Change Conference COP 27 in Sharm-el-Sheikh,<sup>44</sup> the international community was once again unable to agree on any concrete steps to reduce greenhouse gases. It is therefore becoming increasingly unlikely that CO<sub>2</sub> emissions worldwide can be reduced fast enough to reach the two degree target, let alone the 1.5 degree target. Therefore, it will also be important to develop technologies that remove CO<sub>2</sub> from the Earth’s atmosphere. The ongoing discussion about the conditions and requirements for the final storage or further use of stored CO<sub>2</sub> from direct air capture and carbon capture and storage technologies inhibits R&D activities of companies in this field. In addition to further R&D funding, the Commission of Experts proposes that a limited quota of reliably

stored CO<sub>2</sub> withdrawn from the Earth's atmosphere be remunerated within a pilot project in order to create incentives for the development of these technologies. This should be considered especially if a European consensus on key issues concerning the use of these technologies is not achievable in the short term.

### Make Network Charges Structure Compatible with Incentives

Germany has committed itself to ambitious climate targets. To achieve these, a significant expansion of capacities for CO<sub>2</sub>-neutral electricity generation is needed, as well as an interregional and intertemporal balancing of supply and demand. In Germany, electricity transmission through the grids is

still priced based on a uniform tariff that does not adequately reflect local, regional and temporary grid shortages. Relatively high network charges make the use of surplus green electricity unattractive, e.g. for the production of hydrogen.<sup>45</sup> Proposals to create different prices for different regional zones do not address the root of the problem. Rather, what is needed is flexible network pricing, so-called nodal pricing, which reflects the scarcity of the respective transmission capacities. This can create considerable incentives to use green power more efficiently and to store it. In particular, innovative concepts for long-term storage are required to compensate for the scarce supply of green electricity in the winter months (dark period) on the way to climate neutrality. Existing technologies such as smart meters must be increasingly used in a transformation of the electricity market design.<sup>46</sup>

## A 3 Catching Up and Avoiding Technological Gaps

**T**he ongoing transformations will not be mastered without innovative technologies. Key enabling technologies such as digital technologies, materials technologies, production technologies, bioeconomy and life sciences are of particular importance. Germany, and to some extent Europe, are not at the forefront of these technologies in an international comparison. More dynamic developments can be observed in Asia in particular.<sup>47</sup> To avoid losing touch in the key enabling technologies, Germany and its European partners must accelerate the development and advancement of knowledge and skills as well as the regulatory framework and infrastructure to be able to independently develop and apply technologies of this kind. This is all the more important as access to technologies via the global market is no longer assured due to increasing de-globalization and intensified geopolitical antagonisms.

### Intensify the Establishment of Production Facilities for Key Enabling Technologies

In recent years, foreign companies in Germany have invested in the establishment of infrastructure facilities and production sites for the manufacture and further development of key enabling technologies. In doing so, they are contributing to maintaining Germany's technological sovereignty. In some cases, these investments are linked to substantial government funding commitments.<sup>48</sup> The Commission of Experts is generally in favour of funding research and production facilities if they serve to maintain Germany's technological sovereignty. It advises the Federal Government and the Länder governments to ensure in their funding commitments that self-sustaining structures are created which can continue to operate even if the investor withdraws from Germany. To this end, public funding should be invested primarily in infrastructures and in the

development of competencies on site, for example in the establishment of R&D capacities, start-up centres and networking activities.

Regardless of whether it is a domestic or foreign investor, the Commission of Experts urges that the promotion of key enabling technologies should have a catalytic character and must not amount to permanent subsidization.

The Commission of Experts points out that the locations for the research, development and production of key enabling technologies do not necessarily have to be in Germany but can also be located in other EU Member States. Since Germany's technological sovereignty can only be secured in cooperation with its European partners, the establishment of key enabling technologies in a European partner country is also in Germany's interest. A business location policy coordinated at the European level is also a key prerequisite for avoiding an intra-European subsidy race. Moreover, the Federal Government must lobby at EU level for a much faster pace in the promotion of key enabling technologies. Considering the massive state support measures, such as those seen for the chip industry in China, Japan, South Korea, Taiwan and the USA, the European countries are in danger of falling further behind.<sup>49</sup>

## Reduce Dependence on China

Germany is highly dependent on Chinese sales markets as well as on technology and commodity imports from China. The increasing tendency of the Chinese government to distance itself from the Western community of states and to politically control international economic relations makes these dependencies a growing risk for Germany. Ultimately, in the event of a crisis, Germany could come under increasing pressure by being excluded from Chinese sales markets and from technology and commodity imports from China. The risk of such a crisis occurring has risen sharply in recent years. With this in mind, the Federal Government has begun to formulate a new China strategy. Even though no official preliminary version is yet available, the media have already reported extensively and quoted from the strategy document.<sup>50</sup>

The Commission of Experts advocates that the Federal Government, with its new China strategy, develop an interdepartmental concept that can help

to systematically reduce Germany's pronounced economic dependence on China.<sup>51</sup> This should in no way involve severing the extensive economic and cooperation ties with China. Instead of unilaterally distancing Germany from existing international cooperation partners, the diversification of trade relations, especially with Asia, Latin America and Africa, must be promoted.

To ensure that German companies diversify more regionally, the Commission of Experts recommends that economic activities in China no longer be supported to the same extent as before. Companies are free to decide whether and with what intensity they want to be active in China. However, the associated entrepreneurial risks should not be borne by the state and consequently by the public. Accordingly, a cap and a tightening of the conditions for granting investment and export credit guarantees are a logical step.<sup>52</sup>

Another important aspect of Germany's China policy must be its integration into joint European action.<sup>53</sup> It is equally important to develop and expand technological competencies, e.g. in key enabling technologies, together with European partner countries. In this way, the necessary critical mass can be achieved to keep up with China as well as other dynamic economic and innovation locations in Asia and North America.<sup>54</sup>

To this end, standardization activities must also be pursued more strategically together with the EU partner countries. Political support for the standardization efforts of German actors is necessary to counter China's increased involvement in the international standardization organizations.<sup>55</sup>

## Establish a China Competence Centre

In the field of scientific cooperation with China, care must continue to be taken to avoid an unintended outflow of knowledge – while maintaining freedom of research. The Commission of Experts considers it sensible not to fund R&I projects in which Chinese actors are involved and a knowledge drain is likely, or to fund such projects only under strict conditions.

Moreover, cooperation must have limits where it can lead to results that run counter to our liberal democratic values. These limits are tightening more

and more, because as a result of the Chinese objective of geopolitical dominance, the risks of disclosing research results have increased in many areas of research.<sup>56</sup> The Federal Government and the EU have already reacted to this problem with educational measures and adjustments to dual-use regulations.<sup>57</sup> The actors in the science system are also called upon to act responsibly in this sense.

In view of the increasingly difficult environment, the Commission of Experts welcomes the BMBF's initiatives to expand China competence in Germany.<sup>58</sup> However, in contrast to a devolved and regional network approach as pursued by the BMBF, the Commission of Experts refers to its recommendation in the 2020 Report to establish a central competence centre to advise German scientists. This competence centre should provide expertise on legal issues relevant to cooperation and research, for example regarding the protection of intellectual property and data protection. In addition, the competence centre should systematically collect and evaluate information on experiences and problems in German-Chinese cooperation and provide it to scientists and research institutions.<sup>59</sup>

### Restructure Governance for Digitalization of Public Administration

The implementation of the Online Access Act (Onlinezugangsgesetz, OZG) has failed. Of the 575 administrative services defined in the Act, only a fraction were available nationwide after the implementation deadline of 31 December 2022.<sup>60</sup> There is broad consensus on the reasons for the continued failure of the digitalization of the German administration: Responsibilities are fragmented, there is no clear distribution of competences and no unequivocal responsibilities, in other words, there is a lack of suitable digitalization governance.<sup>61</sup> This makes it difficult to define and implement uniform technical standards and interfaces down to the municipal level.

By delaying the digitalization of the administration, Germany not only risks falling further and further behind as a location for business and innovation in international comparison. The state's ability to act and its ability to withstand crises are also increasingly in doubt.<sup>62</sup> Repeated administrative problems, whether in the registration of refugees, the recording of Covid-19 infections or the payment of flat-rate energy allowances, clearly show that political

crisis management by the public administration can only be implemented inadequately and with considerable delay. In its Digital Strategy (cf. box A 1-1), the Federal Government has once again announced that it will eliminate the long-standing main deficits in e-government. This is to be achieved by the end of 2025.

Foremost importance is attached to the so-called OZG 2.0. A draft bill on the subject aims to achieve greater harmonization of important digital services. For citizens and businesses, there is to be a single federal account in connection with a federal ID instead of various user accounts of the Länder. Also, so-called electronic application assistants are to be introduced for the simplified online processing of one or more administrative services of the Federal Government and the Länder. The Commission of Experts supports these harmonizations. However, it considers it critical that the draft bill, unlike the previous version, refrains from making the one-for-all principle<sup>63</sup> and end-to-end digitalization mandatory.<sup>64</sup> The Commission of Experts therefore remains sceptical that a breakthrough in the digitalization of public administration will succeed without a fundamental reform of digitalization governance, including Federal-Länder cooperation.<sup>65</sup>

### Create Synergies Between Military and Civilian Research

The Russian attack on Ukraine has brought the issue of military security and military research back into focus in Germany. This is also reflected in the special assets for modernizing and upgrading the Bundeswehr, a small part of which is to be invested in research, development and artificial intelligence (AI),<sup>66</sup> as well as in the additional measures planned for military cyber security.<sup>67</sup>

The Commission of Experts draws attention to the fact that there are synergies between military and civilian research in the field of AI and cyber security. Studies show that research activities in the military sector provide important impulses for innovations in the civilian sector and vice versa.<sup>68</sup> The strict separation of military and civilian research in Germany leads to parallel structures and prevents synergies between the two sectors. As a result, R&I resources are currently not being used efficiently to solve socially important problems, such as safeguarding data networks and critical infrastructure.

In light of the changing times, the Commission of Experts recommends that the Federal Government consider potential synergies between military and civilian research in its own R&I funding. In addition, the actors in the R&I system should review their voluntary commitments and regulations, which aim at a strict separation between military and civilian research.

### Empower the Cyber Agency With More Freedom

The Cyber Agency (Agentur für Innovation in der Cybersicherheit – Agency for Innovation in Cybersecurity) is an organization that overcomes the separation of military and civilian research. With the projects it invites to tender, it initiates innovation

activities in the civilian sector that are intended to contribute to improving Germany's internal and external security against cyberattacks. However, the Cyber Agency is struggling with structural problems that limit the effectiveness of its work. For instance, IP rights to research results that arise in the tendered projects usually fall to the Cyber Agency. Exceptions to this rule can only be applied for with significant effort. This renders cooperation unattractive for researchers and companies and makes it difficult for the agency to find suitable cooperation partners for its projects. In addition, restrictive framework conditions of public procurement law hamper the tendering of research projects with high uncertainty of results. The Cyber Agency needs more freedom to fulfil its core task of advancing research and pioneering innovations in the field of cyber security.

## A 4 Removing Barriers to Innovation

The current situation of overlapping crises is putting considerable financial strain on many companies and exposing them to elevated levels of uncertainty. This raises the risk of research-based companies cutting back on longer-term investments in R&I or even withdrawing from the market altogether. The main objective of R&I policy must therefore be to provide effective incentives for the continuation of R&I activities and for the establishment of new innovative companies. It is equally important to identify and remove barriers to the development and dissemination of innovations. In the current times of crisis, the financial resources for an expansion of support structures are increasingly limited. R&I policy is therefore particularly challenged to initiate structural reforms and use regulatory levers to raise innovation potentials and eliminate existing inefficiencies in the R&I system.

### Develop Innovation-friendly Framework Conditions With Real-world Laboratories

Existing laws and regulations as well as lengthy administrative procedures are increasingly preventing or slowing down innovation processes.<sup>69</sup> The Federal Government should therefore not only promote R&I activities through financial support, but also create new incentives for innovation and remove barriers to innovation by adapting legal framework conditions. Moreover, it should work to ensure that this also happens in the EU.

Real-world laboratories as regulatory sandboxes are an effective means of developing innovation-friendly framework conditions. The Commission of Experts advocates the increased use of this means as well as the plan to create a real-world laboratory law.<sup>70</sup> Evaluations will be necessary to gain insights into the effectiveness of the real-world laboratories. This is quite methodologically demanding in

real-world laboratories. Therefore, when setting up a real-world laboratory, impact-oriented evaluation should be included in the concept right from the start.

### Boost Innovation-oriented Procurement

Public procurement can provide important impulses for innovation activities. However, the formal requirements of public procurement with a detailed description of the goods and services to be procured stand in the way of innovation-oriented procurement. With the establishment of the intermediary platform KOINNOvationsplatz at the Competence Centre for Innovative Procurement (Kompetenzzentrum Innovative Beschaffung, KOINNO), the Federal Government enables exploration of the range of potential innovative solutions before awarding contracts. On the one hand, this renders the procurement-relevant challenges of public administration visible, and on the other hand, companies are given the opportunity to present innovative solutions. The platform offers support in market research and matchmaking. Public contracting authorities can invite the companies active on the platform to submit a bid for current or planned tenders.<sup>71</sup>

The Commission of Experts welcomes the establishment of the KOINNOvationsplatz. It considers this to be an important step towards giving greater consideration to start-ups and SMEs in the awarding of public contracts. This is in line with the goal formulated in the Federal Government's Start-up Strategy to make greater use of the innovative offerings of start-ups for public contracts and at the same time to promote them by awarding contracts.<sup>72</sup>

### Set Clear Rules for Data Economy

Clear rules on data use are a prerequisite for the development of a data economy that includes a digitalized public administration, networked companies and research institutions, platforms and private users. The Federal Government had announced a national data strategy for this purpose, but its development has been delayed.<sup>73</sup>

The existing data protection regulations are not conducive to the development of a data economy, as they create a high degree of uncertainty due to

varying scope for reading and interpretation. The conditions for using data need urgent clarification. The Federal Government should use its planned national data strategy to end the state of uncertainty through clear and simple regulations. According to the Commission of Experts, this also includes a harmonized interpretation of data protection regulations across all Länder. The Commission of Experts moreover recommends not losing sight of the implementation of the old Data Strategy, which was not adopted until 2021, over efforts to formulate a new national data strategy. The funding of research projects on the anonymization of personal data announced by the BMBF can additionally help to better reconcile data use and data protection.<sup>74</sup> Waiting for these results should not, however, lead to a further delay in the urgently needed improvement of data access, especially for research purposes.

The Commission of Experts sees the data institute planned by the Federal Ministry of the Interior and Community (Bundesministerium des Innern und für Heimat, BMI) and the Federal Ministry for Economic Affairs and Climate Action (BMWK) as a key step that can help to make rapid progress on the issue of data use. It is intended to promote data sharing and data evaluation, especially across different sectors, and to develop the necessary governance models. Pilot projects are to be launched as early as the start-up phase,<sup>75</sup> to quickly gather practical experience that will be useful for the further institutional design. It should also be noted that the data institute plans to establish data trustee models<sup>76</sup> and to use the already existing competences, for example in research data centres.<sup>77</sup>

### Promote Manufacturing-X

The large-scale project Manufacturing-X, initiated by companies and trade associations, is intended to create a decentralized network for the manufacturing sector, including the automotive industry, which will enable the actors involved to securely share data with each other.<sup>78</sup> This will enable the digitalization of value-added networks in a way that allows them to react quickly to disruptions and make them more resilient. In addition, it can facilitate new business models and digital innovations.<sup>79</sup> The model is Catena-X, the association of the automotive industry for the networking of value chains. More intensively than Catena-X, which is geared towards large companies, Manufacturing-X aims to involve SMEs.

The Commission of Experts sees Manufacturing-X as an important initiative to advance the digitalization of SMEs and to force their integration into the data economy. Seed funding from the Federal Government can make an important contribution to quickly establishing a reliable and trustworthy data space that is used by many companies for data exchange and data analysis. However, the Commission of Experts points out that the goal must be to further develop Manufacturing-X as a private-sector initiative that is supported by the member companies in the medium term. Existing solutions should be used and expanded as needed.

Regardless of the financial support, the initiators must quickly agree on a data trustee model. The teething problems of the Gaia-X project associated with Manufacturing-X reveal that the design of the data trusteeship is critical to success. Here, the planned data institute could take on a supporting role in the future.<sup>80</sup>

### Make Employee Equity Participation More Attractive

In July 2022 and thus at the beginning of the legislative period, the Federal Government presented a Start-up Strategy (cf. box A 1-1), in which it emphasizes the importance of start-ups for the transformation of the economy and society.<sup>81</sup> The strategy contains a comprehensive package of measures, including improving financing opportunities, recruiting employees, spin-offs from academia and giving greater consideration to start-ups in public contracts.<sup>82</sup> All measures are to be implemented during this legislative period.<sup>83</sup>

To further support the development of start-ups, the modular Future Fund established by the previous Federal Government in 2021 is to raise up to €30 billion in venture capital for critical areas of innovation and transformation by 2030 in cooperation with private investors. Specifically mentioned are AI, quantum technology, hydrogen, medicine, sustainable mobility, bioeconomy and circular economy as well as climate, energy and environmental technology. Climate technologies are also to be supported by the DeepTech & Climate Fund, financed from resources of the Future Fund and the ERP Special Fund, to help deep-tech companies with a validated business model achieve sustainable growth while maintaining their independence.<sup>84</sup>

The Commission of Experts welcomes the Start-up Strategy as a sign that the Federal Government is aware of the importance of start-ups as drivers of innovation and structural change. However, the Commission of Experts criticizes the failure to open up venture capital financing to institutional investor groups from the field of statutory and private pension provision. The Start-up Strategy does not contain any specific measures in this regard, but only a review request.<sup>85</sup>

So far, the Federal Government has not been able to decide to revise the comparatively unattractive conditions for employee equity participation in Germany. It has, however, announced that it will adjust income tax law with the planned Future Financing Act.<sup>86</sup> Until now, non-cash benefits from shares have to be taxed in the event of a change of employer or after twelve years at the latest, even if no real inflow of liquidity has taken place (so-called dry income taxation). A liquidity inflow usually only occurs when the company is sold or goes public. The Federal Ministry of Finance (Bundesfinanzministerium, BMF) is now considering extending the twelve-year period to 20 years. As with capital gains tax, a flat tax rate of 25 percent is to be applied for the taxation of these assets.<sup>87</sup> The Commission of Experts regards these considerations as a step in the right direction.

# A 5 Securing the Skilled Labour Base

The pressure to maintain Germany’s skilled labour base, which is already noticeable today, will continue to increase in the coming years.<sup>88</sup> The demographic ageing of society will cause the working-age population to shrink significantly, so that growth and innovation inhibiting shortages of skilled labour are likely to intensify and become more entrenched. It is therefore necessary to make better use of the domestic skilled labour base and at the same time to attract more foreign skilled labour. As a result of the structural change taking place parallel to demographic change, increased efforts in education and training are also required.<sup>89</sup>

## Improve Utilisation of Existing Skilled Labour Base

The skilled labour base available in Germany is currently not being sufficiently leveraged. The Commission of Experts therefore welcomes the fact that the Federal Government’s Skilled Labour Strategy contains a range of measures to increase women’s participation in gainful employment and to achieve more full-time employment for women. This urgently requires a further improvement in the compatibility of family and work. Among other things, this would involve sufficient care infrastructure for children and others in need of care, which, however, is itself challenged by the lack of skilled workers in these fields.

In the Skilled Workers Strategy, the Federal Government also announced that it will enter into a social dialogue with management and union representatives on how to make it easier for older workers to remain in the labour force for longer.<sup>90</sup> However, the Skilled Workers Strategy does not mention any definite policy measures that could contribute to an extension of working life. More specific measures should consider the interests of employees and employers. For example, there is little evidence of a need to protect retirees against repeated fixed-term employment by the same previous employer (cf. chapter B 1). The Commission of Experts is there-

fore of the opinion that employing retirees on fixed-term contracts should always be permitted without having to specify an objective reason.

## Reduce Bureaucracy in the Immigration of Skilled Workers

In light of the demographic ageing of society, Germany must position itself better in the international competition for skilled labour. In particular, it needs to become more attractive for skilled workers from third countries, i.e. from countries outside the EU. In November 2022, the Federal Government presented its ‘Key Issues Regarding the Immigration of Skilled Workers from Third Countries’ (Eckpunkte zur Fachkräfteeinwanderung aus Drittstaaten) and addressed major obstacles.<sup>91</sup> The key issues paper provides for employers with collective bargaining agreements to be given more responsibility in deciding on the immigration of skilled workers from third countries. The Commission of Experts thinks that this approach is very well suited to achieving higher quality, better matching and quicker recruitment of skilled workers from third countries.

## Modernising the Dual System of Vocational Training

In Germany, the dual system of vocational education and training makes a significant contribution to implementing innovations and managing transformative changes.<sup>92</sup> However, the dual system is coming under increasing pressure, both from the supply and the demand side. The Federal Government has recognized this and identified ‘Modern Training’ as one of five priority fields of action in its Skilled Labour Strategy.<sup>93</sup> The Commission of Experts considers the planned expansion of collaborative training<sup>94</sup> to be sensible, as it enables smaller companies without technical-infrastructure capabilities to train junior staff. It also supports the ‘Excellence Initiative for Vocational Education and Training’ (Exzellenzinitiative Berufliche Bildung),<sup>95</sup>

by means of which the Federal Government aims, among other things, to provide more vocational orientation for young people at grammar schools and to develop and test innovative vocational education and training programmes.<sup>96</sup> However, the Commission of Experts points to the additional need of making a larger share of young people fit for vocational training than has been the case so far.

### Strengthening Professional Adaptability Through Continued Training

Transformative change increases the demands on professional adaptability.<sup>97</sup> Members of the labour force need to develop digital as well as personal and social-communicative core skills in order to maintain professional competence. It is therefore necessary to intensify job-related continuing education and training. Against this background, the Commission of Experts welcomes the fact that ‘Targeted Continuing Education and Training’ is also one of the priority fields of action of the Federal Government’s Skilled Labour Strategy and that the National Continuing Education Strategy will be continued and further developed (cf. box A 1-1). However, the focus of the support instruments should not be solely on continued employment with the previous employer, because this will not always be possible. The Commission of Experts therefore reiterates its call for the development and regional testing of instruments for anticipatory adaptation training that make it easier for employees to switch to a new employer. These instruments should involve both the transferring and the receiving employer appropriately in the financing and ensure a balance of interests.

### Increase Transparency of Academic Career Paths

The shortage of skilled workers affects almost all segments of the labour market. According to the Skilled Labour Monitoring of the Federal Ministry of Labour and Social Affairs (Bundesministerium für Arbeit und Soziales, BMAS), only six out of 140 occupational groups are expected to have an excess supply of potential applicants in the future compared to the vacant positions. These six occupational groups include the occupational group ‘Teaching and Research at Tertiary Education Institutions’, which is highly relevant for the German innovation

system. In its Skilled Labour Strategy, the Federal Government refers to the high professional mobility of members of this occupational group, for whom good labour market opportunities are anticipated due to expected bottlenecks, for example in research (‘Technical Research and Development’) and continuing education (‘Teaching at Extracurricular Educational Institutions’).

However, the current discussion on career opportunities for young researchers shows that working outside the academic system is often not perceived as an attractive option by those concerned. The Commission of Experts therefore recommends that researchers in the doctoral and postdoctoral phase be better prepared for careers outside the academic system than has been the case to date. Public research funding, which finances a significant part of the qualification positions at universities, should pay more attention to alternative career paths for young researchers in its support programmes.

The Federal Government is currently preparing a reform of the Act on Temporary Contracts in Science Research (Wissenschaftszeitvertragsgesetz, WissZeitVG),<sup>98</sup> last amended in 2016, based on the evaluation commissioned by the BMBF and published in May 2022.<sup>99 100</sup> The Commission of Experts is of the opinion that contract periods, especially for PhD candidates, should be adapted even more closely to the duration of the qualification phase. The Commission of Experts moreover advocates that the decision for or against an academic career should be made earlier than before and also institutionalized, for example, in the context of a career interview after two to three years of postdoctoral experience.<sup>101</sup> This would ensure transparent career paths and prevents a surprise end to an academic career after the potential junior staff member has already worked in the academic sector for many years. The Commission of Experts rejects considerations to further reduce the permissible fixed-term employment period of twelve years set out in the WissZeitVG.

Equally, the Commission of Experts takes a critical view of the regular extension of employment contracts for an indefinite period of time after completion of a doctorate or in the early postdoctoral phase, and thus the automatic creation of permanent positions. This would shift the moment of decision for or against an academic career too far forward. Instead, the widely established tenure track prin-

principle should be further consolidated, as it makes the path to a professorship more predictable than was previously the case. The tenure track principle could also be introduced for the path to permanent non-professorial faculty positions.

The number and proliferation of permanent positions must be handled prudently. An increase in permanent positions must not be allowed to reduce

the necessary flexibility in academia and the universities' continuous ability to renew themselves in terms of personnel and intellect, and thus the quality of research and teaching.<sup>102</sup> For this reason, too, a balance must be found between fixed-term and permanent positions in the non-professorial faculty. It is therefore necessary to define permanent tasks in a comparatively narrow manner.<sup>103</sup>

## A 6 Key Recommendations for Action

In its 2021 and 2022 reports, the Commission of Experts emphatically emphasized the crucial importance of R&I for mastering the major transformations, such as the energy transition, the mobility transition and the digitalization of the economy and society. As if the related R&I policy task were not complex and challenging enough, it is further complicated by the Covid-19 crisis and the war in Ukraine. Publicly funded compensation and support measures for companies and private households are increasing the pressure on public budgets. Germany's scope for action to support and orchestrate the forthcoming major transformations with R&I policy and to actively tackle them with the help of innovative solutions is being massively restricted as a result.

The coordinated and efficient use of public budgets requires a strategically acting state. Whether the Federal Government will succeed in mastering the current crises and transformation challenges also depends on enabling agile policy action by means of adequate decision-making processes and governance structures. Equally, German R&I policy requires long-term orientation, strategic planning and clear priorities. A new era is also needed in R&I policy.

The Commission of Experts' key recommendations for action are as follows:

### Establish a Government Committee for Innovation and Transformation

To intensify inter-ministerial coordination at the strategic level of innovation and transformation policy, it is necessary to establish a government committee for innovation and transformation based in the Federal Chancellery (cf. chapter A 1). The task of such a committee should be to formulate an overarching set of objectives for the Federal Government on innovation and transformation-related topics and to coordinate the political strategies derived from these. The government committee should regularly report to the Federal Cabinet and the German Bundestag. In turn, the individual ministries represented there should report to the government committee.

### Integrate State Secretaries in Mission Teams

The interdepartmental mission teams planned in the draft version of the Future Strategy published by the BMBF in autumn 2022 must be established quickly and coordinate the mission-oriented policy at the implementation level (cf. chapter A 1). To ensure the greatest possible commitment to coordination and implementation, the Commission of Experts recommends that the ministries involved

be integrated into the mission teams via the level of state secretaries.

### **Reform the Project Executing Agency System**

The project executing agency system should be reformed (cf. chapter A 1). For example, a mission-related bundling of R&I programmes at the project executing agencies and a more results-oriented monitoring of the use of funding is advisable. The project executing agencies should moreover be granted more leeway in the implementation of measures.

### **Create Mission-related Roadmaps**

Within each of the six missions of the Future Strategy for Research and Innovation, which are very broadly conceived, several action-guiding missions should be agreed upon and underpinned by measurable transformation goals (cf. chapter A 2). With a view to the specific transformation goals, roadmaps should be developed for each of these action-guiding missions that coordinate and structure the measures of the various ministries in terms of content and timing.

### **Avoid Unintended Knowledge Outflow to China**

R&I projects involving Chinese actors and where an unintended outflow of knowledge is likely should not be funded, or only under strict conditions (cf. chapter A 3).

### **Restructure Governance for the Digitalization of Public Administration**

To finally achieve a breakthrough in the digitalization of public administration after the failed implementation of the Online Access Act (OZG), the Commission of Experts calls for a fundamental reform of digitalization governance, including Federal-Länder cooperation (cf. chapter A 3).

### **Create Synergies Between Military and Civilian Research**

In light of the changing times, the Commission of Experts recommends that the Federal Government consider potential synergies between military and civilian research in its own R&I funding (cf. chapter A 3). In addition, the actors in the R&I system should review their voluntary commitments and regulations, which aim at a strict separation between military and civilian research.

### **Make Greater Use of Real-world Laboratories and Evaluate Them Systematically**

Real-world laboratories as regulatory sandboxes are an effective means of developing innovation-friendly framework conditions and therefore should be used to a greater extent. Impact-oriented evaluation should be included in the concept right from the start when setting up a real-world laboratory (cf. chapter A 4).

### **Set Clear Rules for Data Economy**

The Federal Government should use its planned national data strategy to end the state of uncertainty through clear and simple regulations (cf. chapter A 4). According to the Commission of Experts, this also includes a harmonized interpretation of data protection regulations across all Länder.

### **Improve Planning of Academic Careers**

Researchers in the doctoral and postdoctoral phase should be better prepared for careers outside the academic system than has been the case to date. Contract periods for PhDs should be adapted even more closely to the duration of the qualification (cf. chapter A 5). Suitable formal regulations should contribute to deciding for or against an academic career earlier than in the past. The maximum permissible fixed-term employment period under the WissZeitVG of twelve years should be retained.

