



Annual Internationalisation Report 2015

Germany's international
collaboration in education and
research – Priorities for the
Federal Ministry of Education and
Research and selected science
organisations



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1. Summary

The German research and education system is becoming more international. This trend has intensified in recent years and – to different degrees – concerns all parties, all specialist areas and all strategic activity fields of German research organisations. Internationalisation, understood as a process of increasing interconnection and integration at the international level, is the subject of numerous publications and analyses.¹ Although we lack an overall view of current internationalisation activities for the German research and education system. This present report – the second of its kind following a first report in 2014 – should contribute to closing this gap. It has the objective of accompanying implementation of the federal government’s internationalisation strategy adopted in 2008 and of the “International Cooperation Action Plan” of the Federal Ministry of Education and Research (BMBF) from 2014. Therefore, it highlights current priorities for the BMBF and research and intermediary organisations. Both the conceptual and strategic level will be examined, as well as specific instruments for implementation of the internationalisation objectives.

¹ See, for example, the “International Collaboration” section of the annual monitoring reports of the Pact for Research and Innovation (relating to DFG, Fraunhofer, HGF, Leibniz and MPG), the “Stellungnahme zur Alexander von Humboldt-Stiftung (AvH), Bonn, und zur Förderung des internationalen wissenschaftlichen Personentransfers in Deutschland” by the German Council of Science and Humanities (Wissenschaftsrat) dated October 2013 and the annual German Academic Exchange Service (DAAD) and German Centre for Higher Education Research and Science Studies (DZHW) publication “Wissenschaft weltoffen” with data and facts on the internationality of study and research in Germany.

The paramount importance of European research to German science is borne out by a special section (Section 2.2 “Collaboration within the European Union”). Against the background of the recent strong rise in worldwide interest in the German dual system for vocational training, topics and structures of international vocational cooperation are also addressed in the individual sections. The international activities of the BMBF are described in detail in the Federal Report on Research and Innovation 2014, to which this report refers as appropriate.

The overall aim of the report is not to provide a complete representation of European and international collaboration by German researchers. On the contrary, it is intended to provide an overview of the high points and experience to date and offer a forward view of future developments. The analysis shows a high level of dynamism in three areas: The first is that the German science organisations have been very intensively involved with strategic issues of internationalisation in the past seven years. Important results of this process are the adoption of (organisation-specific) internationalisation strategies and – increasingly – the establishment of internal monitoring systems for indicator-based orientation of the respective internationalisation activities.

The second is that selected, existing funding and cooperation instruments were made available specifically for international collaboration. The third is above all that numerous internationalisation instruments were newly developed and

tested. These can be divided into five categories:

- a. "Analysis and advice",
- b. "Strategic instruments",
- c. "Institutional internationalisation and research infrastructures",
- d. „Project funding“ and
- e. „Mobility“

(cf. Section 3 "Strategies and instruments for internationalisation").

First of all, the relevant documentation and secondary literature on Germany's European and international collaboration in research and education were evaluated for the 2015 report. Secondly, background talks were conducted in autumn 2015 with selected German research and intermediary organisations.² They consistently showed great interest in cross-organisational information exchange on the topic of internationalisation and relevant indicators (e.g. "guest scientists"). However, currently there is no uniform reference system.

Since in part the organisation-specific definitions of individual indicators differ significantly from one another, internationalisation data collected in Germany are currently only comparable to a limited extent in the national and international

context.³ This report should ideally serve as a discussion platform for these questions – in particular with a view to implementation of the federal government's update of its internationalisation strategy planned for 2016 ("Federal Government Strategy for the Internationalisation of Education, Science and Research in 2016").

² In alphabetical order: Alexander von Humboldt Foundation (AvH), Federal Institute for Vocational Education and Training (BIBB) and iMOVE initiative, German Academy of Natural Scientists Leopoldina Association – National Academy of Sciences (Leopoldina), German Research Foundation (DFG), German Federal Enterprise for International Cooperation (GIZ), German Academic Exchange Service (DAAD), The Fraunhofer Society (Fraunhofer), Hermann von Helmholtz Association of German Research Centres (HGF), German Rectors' Conference (HRK), Max Planck Society (MPG), Gottfried Wilhelm Leibniz Research Association (Leibniz).

³ For an example of this see the discussion on current development of the "core research data set" under the leadership of the German Council of Science and Humanities. For further information see http://www.wissenschaftsrat.de/arbeitsbereiche-arbeitsprogramm/kerndatensatz_forschung.html.

2. The international dimension of the German research and education system – Particular achievements and progress

2.1 Trends in transnational research collaboration in Europe and globally

International exchange and cross-border collaborations are integral parts of the German research and education system. They are undoubtedly the basis for Germany's innovative strength and its worldwide attractiveness as a place for study and research. Admittedly there is no uniform assessment scheme for measuring internationalisation of the German – or any other nation's – research system.⁴ Selected key performance indicators and qualitative descriptions can however illustrate the status quo and its development over time. Particular achievements and progress in establishing the international dimension of the German re-

search and education system are assigned below into the categories "Input" and "Output".⁵

"Input" in this context describes the framework conditions for internationalisation processes. This includes both resources (personnel, funding, etc.) and the legal framework conditions for international collaborations (legal and financial conditions for foreign academics in Germany; regulations on international knowledge transfer, etc.). German research policy has significantly increased its input since adoption of the internationalisation strategy by the federal government in 2008. Between 2011 and 2015 the BMBF increased by two-thirds the number of **contributions** towards direct funding of projects that involved international collaboration (from 1,768 to 2,971 contributions).⁶ The funds associated with these

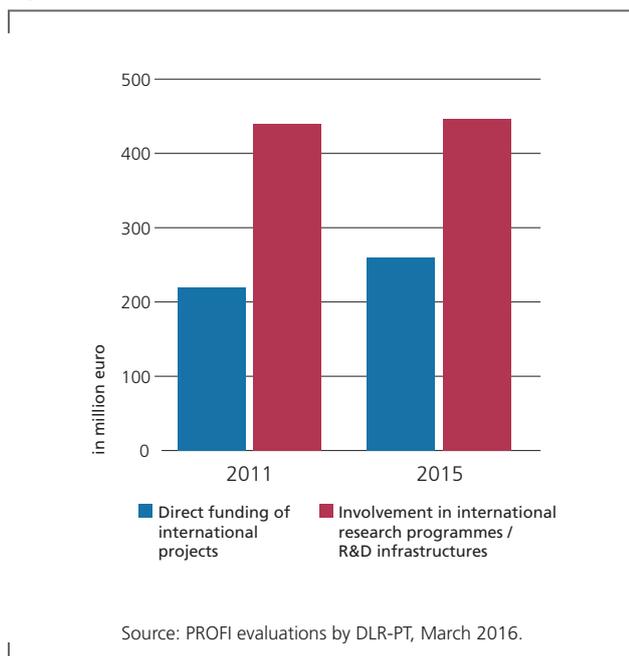
⁴ Compare this with the recommendations of the German Council of Science and Humanities to the Federal Statistical Office in Wissenschaftsrat (2013): Stellungnahme zur Alexander von Humboldt-Stiftung (AvH), Bonn, page 49 and Wissenschaftsrat (2016): Empfehlungen zur Spezifikation des Kernsatzensatz Forschung [Recommendations on the specification of the core research data set], Dahlem Research School (DRS) 5066- 16, Berlin, 22/01/2016. A study by the European Parliament also calls for the further development of national systems for collection of research-related data as well as for coordination of such systems at European and – in the longer term – at a global level: European Parliament (2014): Measuring scientific performance for improved policy making, Study IP/A/STOA/FWC/2008-096/Lot8//C1/SC13, Brussels, April 2014.

⁵ For a detailed analysis of the international dimension of Germany's research and education system, including consideration of current studies on the effects of the exchange between different internationalisation activities, see "International Cooperation Action Plan" 2014 (Section 2 "Data, Facts and Analysis") and Strategy of the federal government for the internationalisation of education, science and research of 2016 (in preparation).

⁶ The details in this section are based on PROFI evaluations by the Project Management Agency within the German Aerospace Centre (DLR-PT) from March 2016. About the selected time frame: the statistical evaluation refers from the point of view of the current year (2016) back over the five previous financial years (2011–2015). The PROFI database only includes budget expenditure beyond five years ago in cumulative form and not for the individual financial year – data beyond the 5-year period are, therefore, only comparable to a limited extent with more up-to-date data. In specifying the number of contributions it must be noted that

2.1 Trends in transnational research collaboration in Europe and globally

Figure 1: BMBF contributions 2011–2015



projects increased in this period from around 220 million euros to around 260 million euros. The BMBF invested a total of 1,236 billion euros over this period in projects involving international collaboration. In addition, the commitment of the BMBF to participate in international research programmes and R&D infrastructures has significantly increased. The annual contributions for this were always over 425 million euros between 2011 and 2015; total contributions in the last five years amount to 2,208 billion euros. The focus of international activities was on European collaboration – some 65% of all funding (project funding and contributions) was in cooperation with European partners. Asset out in more detail in Section 2.2 “Collaboration within the European Union” Germany is particularly strongly inte-

in 2011 the (DLR-PT) International Bureau projects were not yet recorded in the PROFI database – since 2012 these projects do form part of the PROFI data set. In principle these details must be considered to be approximate values, subject to data maintenance for international activities.

grated within the European Research Area – as a collaborative partner and shaper of political and institutional framework conditions.

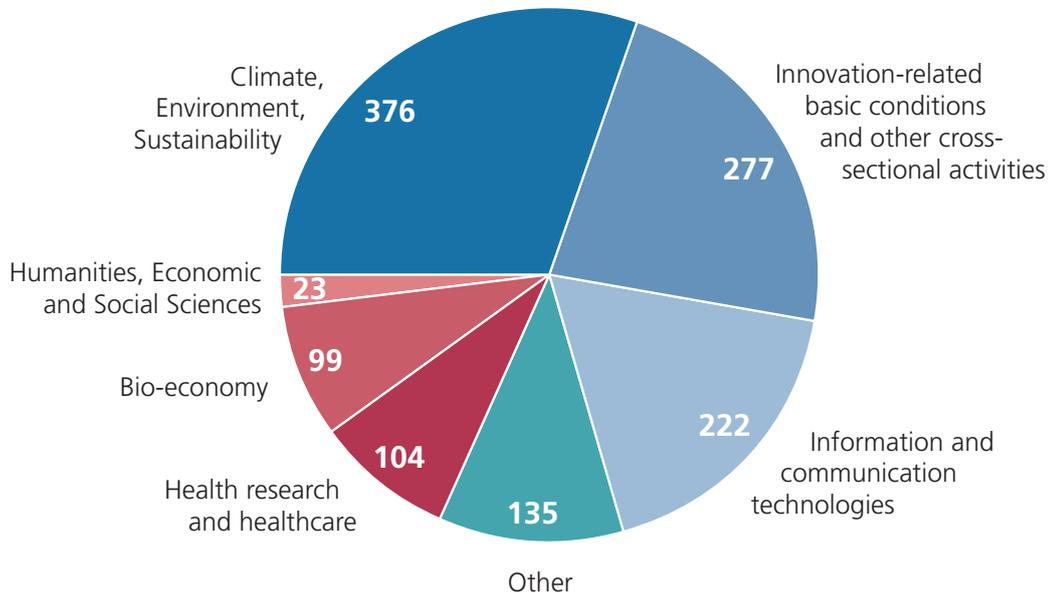
A review of BMBF funding in the period from 2011 to 2015 allows the following **main priorities** to be identified: far in front are the subject of climate, environment and sustainability (total project funding: around 376 million euros; total number of projects: 1,029), followed by “innovation-related framework conditions and other cross-sectional activities” (approximately 277 million euros; 2,350 projects), information and communication technologies (around 222 million euros, 717 projects), health research and health-care (around 104 million euros, 528 projects), the bio-economy (around 99 million euros, 446 projects) and humanities, economic and social sciences (around 23 million euro; 62 projects).

The **legal framework** for international co-operation was also improved, for example, by facilitations in the residence law for researchers and professionals in 2012.⁷ So it was that the “blue EU card” was introduced in Germany in August 2012, which grants highly-qualified, skilled workers from third-party countries access to the European labour market. Germany is the top performer in terms of distribution when compared with the rest of Europe: in 2014 alone, 93.6% of all “blue EU cards” granted across Europe were issued by Germany.⁸ In light of the current refugee crisis, since autumn 2015 the BMBF and the

⁷ See the act on implementation of the highly-qualified directive of the European Union of 1 June 2012 (valid from 1/8/2012), Federal Law Gazette, 2012 Part I No. 24, pp. 1224–1234, Bonn, 08/06/2012.

⁸ The total number of blue EU cards issued by Germany in 2014 amounted to 11,848. See <http://www.bamf.de/DE/Infotthek/Statistiken/BlaueKarteEU/blaue-karte-eu-node.html>.

Figure 2: Distribution of BMBF funding 2011–2015 by subject area (in million euros)



Source: PROFI evaluations by DLR-PT, March 2016.

German research organisations have also planned various measures to promote the integration of refugees. These measures are intended both to improve the educational opportunities especially for young refugees and to allow refugees with an academic background entry into research or research-related employment.⁹

The second indicator category covers the “output” of a research system. Bibliometric data as well as data on cross-border trade with patents demonstrate the close integration of German research into the world-wide research landscape: In the period 2003–2012 over 40% of all publica-

tions by German researchers were **international co-publications**¹⁰ – this is more than twice the EU average.¹¹ In 2014 even more than every second research publication was written with one or more foreign co-authors.¹² In an OECD-wide comparison for the period 2009–2013, German figures for receipts from the **international flows of knowledge assets** increased above average: at 9.1% the increase was above the growth of other industrial nations such as the United States and the United Kingdom (6.2% and 3.2%), although significantly below the growth in the

¹⁰ OECD (2015): OECD STI Scoreboard 2015, p. 70.

¹¹ European Commission (2015): Innovation Union Scoreboard 2015, p. 49.

¹² Fraunhofer Institute for Systems and Innovation Research ISI (2016): Performance and structures of the German science system, studies on the German innovation system No. 5-2016, published by the Commission of Experts for Research and Innovation (EFI), p. 11.

⁹ See, for example, <https://www.bmbf.de/de/fluechtlinge-durch-bildung-integrieren-1615.html>; <https://www.mpg.de/9400063/Fluechtlingen-in-Deutschland-Perspektive-geben>; <https://www.helmholtz.de/artikel/wir-bieten-fluechtlingen-eine-perspektive-in-der-wissenschaft-5061/>.

2.1 Trends in transnational research collaboration in Europe and globally

top performers Luxembourg, South Korea and Switzerland (24.6%, 23.2% and 12.8%).¹³ 9.2% of all registered German patents had one or more foreign co-inventors (international co-patents) in the period 2010–2013 – almost two percentage points more than the OECD average (7.4%).¹⁴

A core element of internationalisation in the German research system is promotion of the transfer of international researchers. **Mobility** as a result of appropriate promotional measures is not admittedly a research output in the narrower sense, but shows the openness and internationality of the German education, research and innovation system. This includes information both about guest residence of expatriate students and researchers in Germany (inward mobility) as well as information on residence abroad of German students and researchers (outward mobility).

Over 40,000 scientific and research staff with foreign citizenship were engaged at German universities in 2014. More than every tenth member of university research staff, therefore, held a foreign passport. The proportion of foreign staff increased by 56% compared to 2008.¹⁵ More than a third of them came from Western Europe, followed by Asia with almost a quarter. The five most important countries of origin in 2014 (shares of between 7% and 5%) were Italy, China, Austria, the United States and Russia.¹⁶

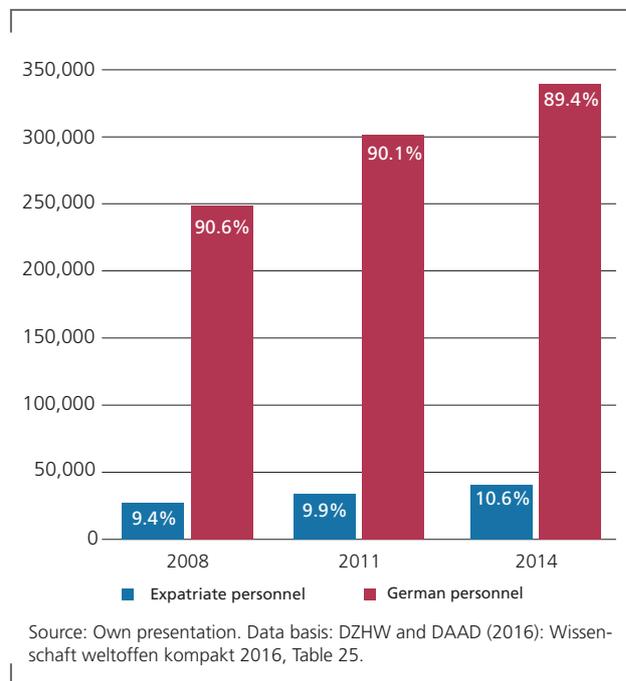
¹³ OECD (2015): OECD STI Scoreboard 2015, p. 141.

¹⁴ OECD (2015): OECD STI Scoreboard 2015, p. 138.

¹⁵ DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016. Data and facts about study and research in Germany is available at www.wissenschaft-weltoffen.de, Table 25.

¹⁶ DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016, Table 23.

Figure 3: Expatriate personnel at German universities in 2008, 2011 and 2014

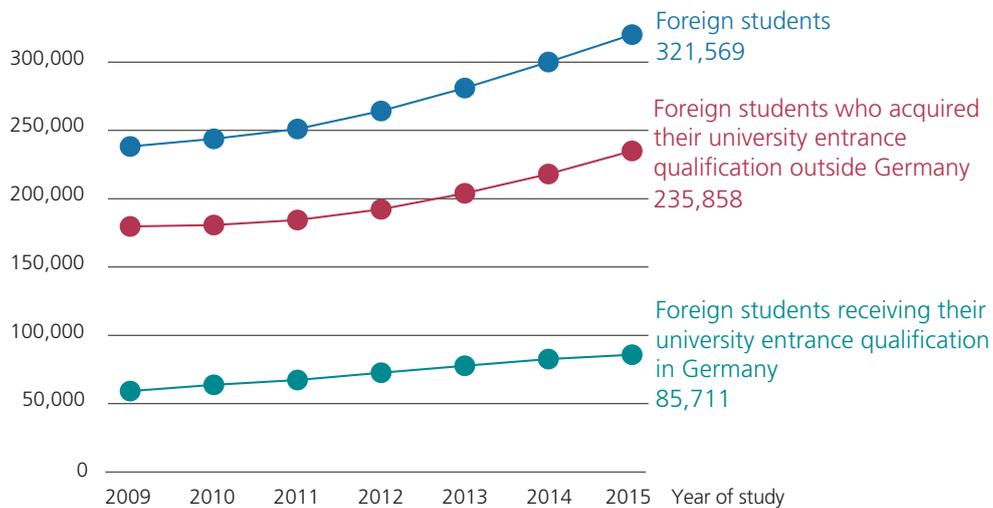


As in previous semesters, in the winter semester 2014/2015 the number of expatriate students has also grown continuously – to a total of around 320,000.¹⁷ Within this group the proportion of so-called “Bildungsausländer”, i.e. those students who are of foreign nationality, possess a foreign university entrance qualification and come to Germany specifically for study¹⁸ has risen especially strongly: from 2009 to 2015 the increase amounted to more than 30% (year of study 2009: 180,222 “Bildungsausländer”; year of study 2015: 235,858). This increase illustrates

¹⁷ Unless indicated otherwise, the data in this section comes from DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016, Tables 1 and 3.

¹⁸ In addition to “Bildungsausländer”, the statistics cover the so-called “Bildungsinländer”. These are of foreign nationality, but have generally lived a long time in Germany already and have obtained their university entrance qualification here.

Figure 4: Foreign students 2009–2015



Source: DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016, Table 1.

the growing attractiveness of Germany as location for study. By far the largest group of foreign students comes from China (2015: 12.8%) followed by India and Russia (both 4.9%) and Austria (4.2%).¹⁹ As in previous years, again in the winter semester 2014/2015 the large majority of “Bildungsausländer” (2015: 88.1%) sought to obtain a degree in Germany. The proportion of actual graduates is admittedly well below this objective, but has risen continuously in recent years (in 2008 some 25.7% of the graduates were “Bildungsausländer”, in 2013 it was 32.1%).²⁰

The number of German students pursuing a degree abroad in 2013 (“degree-related interna-

tional mobility”) was around 134,500.²¹ The five main host countries during the year in question were Austria (19.7%), the Netherlands (17.2%), the United Kingdom (11.7%), Switzerland (11.0%) and the USA (7.6%).²² International mobility also includes temporary study-related residence abroad, for instance as part of the EU Erasmus+ programme (see also Section 3.2.5 “Mobility”). The proportion of German students with Erasmus experience was constant in the last

¹⁹ DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016, Table 5.

²⁰ Stifterverband für die Deutsche Wissenschaft and McKinsey & Company (2015): University Education Report 2020, Annual Report 2015, Focus: International Education, p. 13.

²¹ DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016, Table 13. This is an extrapolation. Regarding the issue of partial overlap and the collection of data in the field of German students abroad, including recent changes by several states in the recording of mobile students from abroad, compare the detail in the section “German Students Abroad” in DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016.

²² DZHW and DAAD (2016): Wissenschaft weltoffen kompakt 2016, Table 14.

five years at just over 8%.²³ Germany had the second largest group of Erasmus students behind Spain in the 2013 and 2014 academic years.²⁴

2.2 Collaboration within the European Union

Research collaboration in the context of the European Union is of outstanding significance. A **European Research Area (ERA)** is being created under the umbrella of the EU treaties, which should enable the free movement of researchers and research findings comparable with the internal market.

Research in the European Union will not end at national borders, but develop transnationally. The aim is to increase competitiveness in Europe. Under this premise, the European Commission and the 28 member states determine the orientation of the EU framework programme for research and innovation – currently Horizon 2020 – started in 2014 with a budget of approximately 80 billion euros for seven years.²⁵ In addition to the 28 member states, 13 other European countries have associated themselves with the framework programme²⁶ and are, therefore, equal partners

²³ Stifterverband für die Deutsche Wissenschaft and McKinsey & Company (2015): University Education Report 2020, Annual Report 2015, Focus: International Education, p. 13.

²⁴ European Commission (2015): Erasmus. Facts, Figures and Trends, The European Union support for student and staff exchanges and university cooperation in 2013–2014, pp. 7–8.

²⁵ For further information on the budget for Horizon 2020, including details on allocation to different funding priorities, please see http://ec.europa.eu/research/horizon2020/pdf/press/fact_sheet_on_horizon2020_budget.pdf.

²⁶ Albania, Bosnia and Herzegovina, Faeroe Islands, Iceland, Israel, the Republic of Macedonia, Moldova, Montenegro, Norway, Switzerland (partially associated), Serbia, Turkey and Ukraine.

in the competition for funds. Although as the world's largest research funding programme, the framework programme is in principle open to partners from all over the world.

Coordination of national research policies is also progressing in the context of the European Research Area. In 2015 the member states agreed on the **European Research Area Roadmap (ERA Roadmap)** including focal points for implementation and introduction of the ERA by 2020. The EU Council ratified these focal points in May 2015.²⁷ The member states are now required to draw up national action plans for implementing the ERA (ERA action plans). As the first EU Member State, Germany submitted the **Strategy of the Federal Government for the European Research Area**²⁸ in 2014 as a national implementation plan aligned to the six ERA priorities. Two of these ERA priorities are particularly relevant to international research and education cooperation: Priority 2: "Optimum transnational collaboration and appropriate competition" and Priority 6: "The international dimension of the ERA". The following, therefore, presents three areas of collaboration in the EU context, which are directly linked to implementation of these two priorities: (a) the current EU framework programme for research and innovation, (b) coordination of programme planning at nation-state level and (c) European collaboration in research infrastructures.

²⁷ For the Council's conclusions on the ERA Roadmap 2015–2020 see Doc. 9351/15, 29/05/2015 available at <http://data.consilium.europa.eu/doc/document/ST-9351-2015-INIT/de/pdf>.

²⁸ Available at https://www.bmbf.de/pub/BMBF_Forschungsstrategie.pdf.

The “Horizon 2020” framework programme for research and innovation

Since they started in 1984, the EU research framework programmes have become established as an essential component in the funding of German research institutions. In the 21 months that the current “Horizon 2020” framework programme for research and innovation has been operating, German institutions have to date been able to attract European grants of around 1.83 billion euros.²⁹ Due to the tendering procedure and in particular to the progressive development of the budget funds available, it is to be expected that this proportion will increase in the coming years.³⁰ European research funding contributes significantly to the third-party income of German institutions and thereby also strengthens their position in international competition. As of October 2015 a total of 1,186 German institutions, including 68 publicly funded institutions, were involved in 1,629 projects as part of “Horizon 2020”. The German proportion of all participants in the EU member states is approximately 14.6%, the German funding share of the assigned contributions is 20.2%. In a comparison of the EU-28 by contributions and EU funding, Germany is in first place ahead of the United Kingdom, Spain, France and Italy.

Germany received the largest share of EU funds via the European Research Council (ERC); this equates to 15.8% of the grants received by Germany. ERC funding covers all disciplines, as does

mobility funding from the “Marie Skłodowska-Curie actions” (9.2% of the German EU grants). The German share in the case of joint research is highest in the areas of “information and communication technologies” (11.4%) and “transport” (7.8%). The proportion of German project coordination roles is an average of 13% across all programme areas.

Overall, Germany registered a **well-balanced involvement in the major groupings**: 31% of all German involvement is attributable to the higher education sector, 29% to non-university research institutions and 35% to industry. This distribution is, therefore, similar to the dimensions of the predecessor programme (the “7th EU research framework programme”: 34% higher education, 27% non-university research and 36% industry). The ten most successful participating institutions in Germany are together involved in 625 projects and have to date been awarded 0.74 billion euros from “Horizon 2020”. Altogether the German research organisations (Helmholtz Association, Fraunhofer Society, Max Planck Society and Leibniz Association) were able to obtain around 683 million euros of EU funding.

The **involvement of international partners** is an important indicator for the visibility and the value of the EU research framework programme above) “Horizon 2020” allows cooperation with institutions from nearly all countries in the world outside Europe, provided the minimum requirements for the respective partner within the project consortia are met. In this form “Horizon 2020” is the world’s largest coherent support programme in the field of research and innovation. The proportion of third country participa-

²⁹ The source for all data referred to in the following section on the EU research framework programme is the ECORDA database. Analysis by the DLR-PT EU Office in January 2016.

³⁰ By comparison with the “7th research framework programme” (2007–2013) the values increased from 300 million euros in 2007 to 1.75 billion euros in 2013.

tion in Horizon 2020 is so far 2% below the level of the precursor “7th research framework programme” (4%). However, it is important to take into account that the institutions in leading emerging countries (the so-called BRICS countries³¹ and Mexico) are no longer funded and that Switzerland is only partially associated.

Until now participants from Germany are collaborating in a total of 351 research projects with institutions from 99 countries out of a total of 120 participating countries. Among third-party countries the USA, Canada and Russia are the most common partner countries, followed by China, Australia and South Africa. The focus of German third-country cooperation is in the areas of “information and communication technologies” at 15.7% of all joint projects, “research infrastructures” at 12% and “health, demographic change and well-being” at 11.4%.

Coordination of programme planning at nation-state level

Implementation of the second ERA priority (“Optimal transnational cooperation and competition”) is firstly achieved by the coordination of national research activities. For instance, a concept such as the member state-driven “**Joint Programming**” takes into account that global challenges such as climate change, food security and demographic change can only be addressed by the interaction of several countries and by the pooling of financial and human resources.³² Ten Joint Programming Initiatives (JPIs) have been

³¹ Brazil, Russia, India, China and South Africa.

³² For further information on the 6 ERA priorities and corresponding measures for their implementation see the Federal Government Strategy for the European Research Area, 2014.

launched since 2008 and Germany is involved in nine of these initiatives.³³ The “Strategy of the Federal Government on the European Research Area” in this respect aims to strengthen in particular the structure-forming effect of JPIs. This includes the design and implementation of so-called bivalent programmes: a European component should be co-developed when planning BMBF funding programmes and be oriented towards the strategic research agendas of the JPIs.³⁴

“Horizon 2020” also calls for **further measures for coordinated programme planning**, including EU involvement in the funding programmes of several under § 185 of the Treaty on the Functioning of the European Union (TFEU)³⁵ and organising joint calls for proposals as part of the ERA-NET COFUND instrument (formerly ERA-NET and ERA-NET Plus). Moreover, “Horizon 2020” promotes collaboration with industry through participation in joint undertakings and Joint Technology Initiatives under § 187 of the TFEU³⁶. In

³³ Neurodegenerative Disease Research (JPND); Agriculture, Food Security and Climate Change (FACCE); A Healthy Diet for a Healthy Life (HDHL); Urban Europe; Connecting Climate Knowledge for Europe (Climate); More Years, Better Lives – The Potential and Challenges of Demographic Change; Antimicrobial Resistance (AMR); Water Challenges for a Changing World (Water); Healthy and Productive Seas and Oceans (OCEANS).

³⁴ The Federal Government Strategy for the European Research Area, 2014, p. 11.

³⁵ Examples of § 185 initiatives: Research and Development Programme aimed at supporting research performed by small and medium-sized enterprises (Eurostars-2), European and Developing Countries Clinical Trials Partnership Programme (EDCTP2), European Metrology Programme for Innovation and Research (EMPIR), Active and Assisted Living Research and Development Programme (AAL), Joint Baltic Sea Research Programme (BONUS).

³⁶ Examples of § 187 measures / Joint Technology Initiatives (JTIs): Shift2Rail – JTI Rail, BBI – JTI Bio-based Industries, Clean Sky 2 (CS 2) – JTI Aeronautics and Air Transport, IMI

addition, there are European Innovation Platforms (EIPs) focusing on agenda-setting in certain Horizon 2020 subject areas with the involvement of industry. All transnational initiatives run with variable geometry and are in principle open to the participation of institutions from third countries. Beyond the participation of individual researchers and institutes within the framework programme for research and innovation, third-party countries can in the context of joint calls for proposals participate strategically in invitations to apply in the framework programme or as a partner in ERA-NETs and JPIs (see above) that are oriented geographically beyond the Union. National funding programmes are coordinated, synchronized and as far as possible implemented jointly in transnational cooperation under ERA-NET initiatives. Since the introduction of ERA-NETs in 2006, Germany has become involved in 179 out of 208 of these initiatives (ERA-NET, ERA-NET Plus and ERA-NET COFUND).³⁷

European collaboration in research infrastructures

European and international level coordination measures for establishing research infrastructures also lead to implementation of ERA priority 2. Large research infrastructures (RIs) are increasingly only feasible whenever several countries become involved in their funding and operation. Participating EU Member States are bound by obligations regarding the establishment and operation of research infrastructure, in particular the

initiatives of the **ESFRI Roadmap (ESFRI: European Strategy Forum on Research Infrastructures)**³⁸, but also the underpinning of other global, national and regional RIs of pan-European interest and taking these into account in the establishment of national RI roadmaps and structural funding programmes. Legal and other barriers to cross-border access to RIs are to be removed. “Horizon 2020” promotes transnational access to research infrastructure as part of targeted calls for proposals. ESFRI has moreover in 2015 on behalf of the Commission produced a “Charter for access to research infrastructures” with common standards and harmonised access rules and conditions for the use of RIs, which have already been accepted by the largest European research infrastructure interest groups.³⁹

The project list for the **new ESFRI Roadmap 2016** was decided in the ESFRI Forum meeting in December 2015: it comprises 21 projects and 29 so-called “landmark” projects that have already successfully reached the implementation phase. Germany is involved until now in 22 of a total of 50 ESFRI projects through the signing of a legal form;⁴⁰ it is country of domicile of the four ESFRI projects European XFEL / Hamburg, FAIR / Darm-

³⁸ Further information and documents from the first ESFRI Roadmap 2006 up to the current “Roadmap 2016” process at http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri-roadmap.

³⁹ Further information on the charta at http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=access_ri.

⁴⁰ For the current list of ESFRI projects and German participations see ESFRI (2016): “Strategy Report on Research Infrastructures. Roadmap 2016”, available at http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri. Possible legal forms now include the new Community regulatory framework for a European Research Infrastructure Consortium (ERIC) created in 2009. Possible legal forms now include the new Community regulatory framework for a European Research Infrastructure Consortium (ERIC) created in 2009.

2 – JTI Innovative Medicines Initiative, FCH 2 – JTI Fuel Cells and Hydrogen, ECSEL – JTI Electronic Components and Systems for European Leadership, SESAR – JU Single European Sky ATM Research.

³⁷ Source: www.era-learn.eu, questionnaire on 28/01/2016.

stadt, SHARE-ERIC / Munich and INFRA FRONTIER / Munich. Already in **August 2015**, the BMBF launched the **second national roadmap process for research infrastructures**.⁴¹ By 2018 the “National Roadmap for Research Infrastructures” – first published in 2013 – will be updated by the assessment and prioritisation of selected projects.

⁴¹ For further information see <https://www.bmbf.de/foerderungen/bekanntmachung.php?B=1088>.

3. Strategies and instruments for internationalisation

3.1 Strategies for internationalisation

Those involved in the German research system have in the last few years made special efforts to promote collaboration with international partners and to design it in accordance with their interests and constitutional requirements. This concerns both the definition of specific objectives and priorities in the field of international cooperation and the development of new instruments and forms of cooperation. As an orientation framework this report uses the **“Strategy for Internationalisation of Science and Research” of the Federal Government from 2008** and the **BMBF “International Cooperation Action Plan” (“Aktionsplan Internationale Kooperation”) from 2014**.

The 2008 strategy identifies four target areas (“Zielfelder”):

1. Strengthening research cooperation with global leaders,
2. International exploitation of innovation potentials,
3. Intensifying the cooperation with developing countries in education, research and development on a long-term basis,
4. Assuming international responsibility and mastering global challenges.

The 2014 action plan picks up these four target areas and adds a further target area in order to accommodate the growing significance of international cooperation in the area of vocational training and the global interest in the dual system of vocational education and training in Germany:

5. Creating perspectives through education – for people and the economy

Both documents also stress the outstanding significance of the European Research Area (ERA) for the (joint) appearance of Germany and its European partners on the international stage: “The success of the ERA is the best protection for Europe’s innovative strength and its resulting global competitiveness.”⁴² In its **2014 “Strategy for the European Research Area”**, the **Federal Government** formulated guidelines for this and concrete steps toward implementation of the six ERA national priorities (the “National Roadmap”). The sixth ERA priority “International Dimension of the European Research Area” aims to strengthen cooperation between EU member states and third countries. This international cooperation and networking is intended to improve European access to world-wide knowledge production and, thus, also to increase Europe’s attractiveness as a location for research and innovation.⁴³

⁴² BMBF (2014): International Cooperation. Action Plan of the Federal Ministry of Education and Research (BMBF), p. 31.

⁴³ For further information on this cooperation in the framework of the EU, see Section 2.

3.1 Strategies for internationalisation

From an overarching perspective the 2008 internationalisation strategy also defines three generic measures: (a) presence abroad, (b) international monitoring and (c) promoting Germany as location for higher education, research and innovation.⁴⁴ The 2014 action plan formulated a number of accompanying measures in each of these three areas, which are intended both to bundle and further develop the existing activities of German researchers and to initiate new initiatives.⁴⁵

Furthermore, in the past five years many German science organisations, including the German Research Foundation (2012), the Fraunhofer Society (2013), the Helmholtz Association (2010 and 2012), the Max Planck Society (2012 and 2014), the Leibniz Association (2013) and the Federal Institute for Vocational Education and Training (2015) have adopted organisation-specific internationalisation strategies and measures for their implementation.⁴⁶ Common to all is the goal of strengthening research collaboration with the best researchers, experts and institutions worldwide (**target area 1**). Internationalisation is considered to be a key factor for excellent research. The Max Planck Society (MPG) is especially focused on basic research and sees its international orientation as a necessary prerequisite for competing successfully for the best minds.⁴⁷

⁴⁴ Cf. Federal Government (2008): Strengthening Germany's role in the global knowledge society. Strategy of the Federal Government for the Internationalization of Science and Research, pp. 27–28.

⁴⁵ Cf. BMBF (2014): Action Plan, pp. 102–111.

⁴⁶ The German Research Foundation (DFG) plans to update its existing internationalisation strategy in 2016. Interview with the DFG on 28/09/2015, Bonn.

⁴⁷ Cf. "The Max Planck Society. At home in Germany – present in the world", 2014, p. 2.

In its internationalisation strategy the Fraunhofer Society combines the focus on excellence with a focus on the global commitment of the German economy. Fraunhofer is, therefore, motivated to select international cooperation partners on the basis of their excellence and innovative strength in the relevant specialist area. Fraunhofer only assesses international cooperation as successful if it generates added research value for Fraunhofer and results in direct or indirect benefits for German companies in Germany or in the target country. Of the science organisations investigated for this report, Fraunhofer demonstrated the clearest alignment to **target area 2** of the Federal Government's internationalisation strategy: global development of innovation potential is part of its core business. Fraunhofer sees the future markets for German industry as being increasingly in the emerging markets and partly also in developing countries.⁴⁸

Collaboration with developing countries (see also **target area 3**) is explicitly defined by the Helmholtz Association and by the Leibniz Association as a strategic goal or as part of their "research policy mandate".⁴⁹ In its internationalisation strategy of 2013, the Leibniz Association refers to this focus of collaboration of Leibniz institutions with researchers from emerging and developing countries, for example, in the areas of biodiversity research, infection research and agricultural research.⁵⁰ Goals and concrete focal points of

⁴⁸ Cf. "Research in International Competition. Main Features of Fraunhofer's Internationalisation Strategy", Munich 2013.

⁴⁹ HGF (2012): The Helmholtz Association in the World. The Basis for an International Commitment, p. 4.

⁵⁰ Cf. Leibniz (2013): The Internationalisation of the Leibniz Association, p. 4.

international cooperation arise in this case from the coincidence of organisation-specific research interests and local circumstances and requirements. International cooperation with developing countries is a core task for the German Society for International Cooperation (GIZ) GmbH. The GIZ corporate objective is promotion of international cooperation for sustainable development and international education work.

German intermediary organizations also pursue organisation-specific objectives in cooperation with developing countries. Thus, the German Academic Exchange Service (DAAD), whose main task is the promotion of international exchange of students and researchers, is engaged in educational collaboration with developing countries. In 2014, for example, it adopted a strategy for academic cooperation with the countries of sub-Saharan Africa for the period 2015–2020. In addition to support of capacity building for graduate training and research at African universities, the DAAD strategy also provides for significantly increased scholarships to African scholars.⁵¹ The Alexander von Humboldt Foundation (AvH), has committed to fund top foreign researchers, who it supports to come to Germany for a research stay. Geographical or specialist specifications play no part in the selection of those supported. The AvH sponsorship offer is recognised and used worldwide, so that it results in AvH funding of top researchers from developing countries, even without a specific quota.⁵²

⁵¹ DAAD (2014): Academic Cooperation with the Countries of sub-Saharan Africa: a Strategy Paper. See also DAAD (2015): Annual Report 2014, p. 38 and DAAD (2013): The German Universities and the DAAD: Partners in Development Cooperation, DAAD Position, May 2013.

⁵² In 2014 AvH received applications from a total of 83 countries. Among them were 45 countries on the DAC list

Selective activities of all the research organisations examined here can be assigned to the broad **target area 4** (“Global challenges”). This aim is found at strategic programme level above all at the Helmholtz Association: in the context of six research areas, for example, Helmholtz researchers are investigating issues of energy supply, sustainable use of resources and health research.⁵³

The German Research Foundation (DFG) with its broad spectrum of funding generally targets support of international cooperation and jointly shaping international research standards.⁵⁴ Against this background, the DFG is involved inter alia in the “Global Research Council” founded in 2012, an informal worldwide association of presidents and heads of research and research funding organisations.⁵⁵ The shaping of the framework conditions for international research cooperation, particularly through the exchange of experience and the development of recommendations, is also a core task of the German Academy of Natural Scientists Leopoldina (Deutsche Akademie der Naturforscher Leopoldina) – National Academy of Sciences. It

of developing countries and territories of the OECD. Sources: Alexander von Humboldt Foundation, “Annual Report” 2014, p. 54–57; Federal Ministry for Economic Cooperation and Development: DAC list of developing countries and territories (valid for the reference years 2014–2016), obtained in January 2016.

⁵³ These six research areas are: 1. Energy; 2. Earth and environment; 3. Health; 4. Aviation, space travel and transport; 5. Matter; 6. Key technologies. Cf. Helmholtz (2015): „2015 Annual Report of the Helmholtz Association of German Research Centres”.

⁵⁴ Cf. DFG (2012): The internationalisation strategy of the German Research Foundation, p. 8–9.

⁵⁵ The DFG is currently leading a team set up in 2015 (the “Executive Support Group”), which supports the executive level of the Global Research Council and is tasked with ensuring continuity of the GRC. This team has a specific duty to support the five regional conferences organised globally each year.

officially represents German research in multi-national academic associations such as the global network of science academies (IAP)⁵⁶ and the European Academies Science Advisory Council (EASAC) which is the association of the national academies of science of the EU member states. The EASAC office has been located at the Leopoldina headquarters in Halle since 2010.

Target area 5 newly included in the “International Cooperation” action plan of 2014 (“Creating perspectives through education – for people and the economy”) covers a wide range of international activities based on the German vocational training system. The significant growth in demand in recent years for the German dual system of vocational training has, thus, led to an interdepartmental and cross-organisational extension of bilateral cooperation. Above all this is intended to combat high youth unemployment at European level. This rose substantially in some EU member states as a consequence of the global economic and financial crisis in the years after 2007. At international level, particularly with the BRICS countries China, Russia, India and South Africa, but increasingly also with countries such as South Korea, Thailand, the USA and Mexico, cooperation activities are focused on the development of practice-based, cooperative vocational training systems. Innovation focal points are, for example, the development of national standards, curricula and examination regulations, the training of in-firm trainers and the testing of dual vocational training courses within the context of pilot projects.⁵⁷

⁵⁶ The abbreviation “IAP” is derived from its former name “Inter-academy Panel on International Issues”, which was amended in the course of a statute change dated 27/02/2013.

⁵⁷ Cf. BMBF (2014): Action Plan, pp. 96–97.

An export-oriented German economy has a strong interest in meeting the growing demand for specialists (also) abroad. International vocational training collaboration, thus, contributes to improving the conditions for foreign involvement of German companies and to strengthening their innovation and competitive potential. A central aim of German policy is also increased internationalisation of the German vocational training system: in 2013 the Bundestag had recommended that by 2020 at least 10% of the trainees in a study year should spend part of their courses abroad (goal in the EU context until the year 2020: 6%).⁵⁸

The **“Strategy paper on international vocational education and training cooperation from a single source”**, which the Federal Government adopted in **July 2013**, serves as a strategic framework for the above activities.⁵⁹ A “round table” was established as a coordination and clearing centre for bilateral international vocational training cooperation, which is attended by representatives of the Federal Ministries concerned. The lead for international vocational training cooperation rests, depending on the context of the partner countries, with the BMBF (cooperation with OECD, BRICS and emerging countries) or with the Federal Ministry for Economic Cooperation and Development (BMZ) (co-operation within the framework of the coop-

⁵⁸ Cf. German Parliament Document No. 17/10986, 16/10/2012, p. 5 and “Immer mehr Azubis sammeln Auslandserfahrung” (“More and more trainees gain foreign experience”), BMBF press release 002/2015 09/01/2015. From 2009 to 2014, the number of those supported by the “ERASMUS+” mobility programme more than doubled (2009: 8,473; 2014: 17,808). The BIBB National Agency for Europe (2015): Annual Report 2014, p. 68.

⁵⁹ Document No. 17/14352, 05/07/2013.

eration and development policy).⁶⁰ The “round table” meets at regular intervals both at a working and department level and at state secretary level. In addition, the BMBF has established the Federal Institute for Vocational Training (BIBB) as the central point of the Federal Government for international vocational training cooperation – the German Office for International Cooperation in Vocational Education and Training (GOVET), which serves as a point of contact for all German institutions involved in vocational education and training cooperation as well as for interested parties from abroad.⁶¹ GOVET is intended to complement existing advisory services, such as the Society for International Cooperation (GIZ) and the Kreditanstalt für Wiederaufbau (KfW, Reconstruction Credit Institute).⁶²

In addition to the area of vocational training, Germany has also advanced the definition of objectives and guidelines in other selected areas of international cooperation in education and research. Thus, in **April 2013** the **“Strategy of Science Ministers of the Federation and the Federal States for the Internationalisation of University-level Institutions in Germany”** was adopted.⁶³ It defines nine areas of activity that should serve the overarching aim of making German universities attractive and competitive internationally and place them in a position to contribute to the solution of global problems. It is aimed at the development of internationalisation strategies within universities, which understand

“internationalisation” as a cross-sector task systematically applicable to all university departments – research, teaching, training and management. The Strategy of Science Ministers of the Federation and the Federal States, therefore, creates a direct connection to the internationalisation strategy of the German Rectors’ Conference (HRK), which was adopted in 2008.⁶⁴

German policy also extends to strategic considerations for internationalisation in education and research in **country or regional strategy papers**.⁶⁵ Examples of this are the strategy documents “Germany, Latin America and the Caribbean: Concept of the Federal Government” (2010)⁶⁶, the “Africa Policy Guidelines of the Federal Government” (2014)⁶⁷, which generally relate to cooperation between Germany and the African States (also on education and research) and – with a special focus on education and research – the “Strategy for Africa 2014–2018” (2014)⁶⁸. The BMBF Africa Strategy showcases a catalogue of measures on the seven focal topics of environment, health, bioeconomy, social development, resource management / raw materials, innovation and transformation. Most recently the “China strategy of the BMBF 2015–2020”⁶⁹ was

⁶⁰ Cf. Document No. 17/14352, 05/07/2013, p. 5.

⁶¹ Further information from the central agency website at <http://www.govet.international>.

⁶² Cf. 2014 Action Plan, p. 96.

⁶³ Decision at Meeting 18 of the Joint Science Conference (Gemeinsame Wissenschaftskonferenz), Berlin, 12/04/2013.

⁶⁴ Available at http://www.hrk.de/fileadmin/_migrated/content_uploads/Internationale_Strategie_der_HRK_01.pdf.

⁶⁵ Cf. also Section 6.2 “Country Strategies” in: Strategy of the Federal Government for the Internationalization of Science and Research, February 2008, p. 30.

⁶⁶ See http://www.auswaertiges-amt.de/DE/Aussenpolitik/RegionaleSchwerpunkte/Lateinamerika/Lateinamerikapolitik_node.html.

⁶⁷ See http://www.auswaertiges-amt.de/DE/Aussenpolitik/RegionaleSchwerpunkte/Afrika/AktuelleArtikel/140521_Afrika-Leitlinien.html.

⁶⁸ See http://www.bmbf.de/pub/Afrika-Strategie_2014-2018.pdf.

⁶⁹ See https://www.bmbf.de/pub/china_strategie_bmbf.pdf.

The three priority areas for the Max Planck Society

In an international comparison, the Max Planck Society (MPG) already has a high degree of internationalisation. Against the background of increasing international competition and the need for research cooperation worldwide the primarily promotes the internationalisation of their activities in three priority areas: (1) Strengthening of the European Research Area (relating in particular to strong research partners in Europe and Eastern / South-eastern Europe); (2) Institution-specific internationalisation outside Europe (relating to excellent research partners, e.g. in the USA, Canada, Japan and Israel); (3) Further development of programme-related internationalisation (relating in particular to emerging research countries).

published in October 2015. This broad “strategic framework for collaboration with China in research, science and education” is primarily dedicated to the possibilities for cooperation in the field of “collaboration in research and innovation” and “collaboration in higher education and vocational education and training”.⁷⁰

All of the German research organisations place **European collaboration** in a prominent position. The particular importance of the European Research Area to German research organisations is highlighted by the fact that some of them have adopted independent strategies for research collaboration within the EU and for the shaping of research and innovation funding in the EU.⁷¹ An example of the alignment of a basic internationalisation objective – the strengthening of the principle of excellence – for European conditions is the strategy paper “Teaming for excellence”, drawn up in 2012 by the Max Planck Society

⁷⁰ See China strategy, pp. 37–39.

⁷¹ See, for example, “Position of the Max Planck Society on Horizon 2020”, 25/05/2012; “Position of the Fraunhofer Society on the Commission’s Green Paper: “Challenge and Opportunities: Common strategy for EU funding of research and innovation”, Munich, 28/03/2011; “Future research and innovation funding by the European Union. Position paper of the German Research Foundation”, 2011.

jointly with eight other European research institutions and associations.⁷² This paper shows the course for developing Europe’s specific regional capacities for excellent research – in the context of strategic partnerships and by using the EU funding programme “Horizon 2020” and the EU Cohesion Fund.

3.2 Instruments for internationalisation

The German research organisations have a wide range of instruments that bolster international networking of individual organisations and of the German research system as a whole. A general distinction can be made between those instruments whose main objective is “internationalisation” and those that internationalise structures and processes in the German research and education landscape as a side effect. Both the development of instruments specifically designed for internationalisation and the availability of established funding instruments to international applicants are criteria by which internationalisa-

⁷² „Teaming for excellence. Building high quality research across Europe through partnership”, 2012.

International DAAD Academy

The international DAAD Academy (iDA) specialises in the transfer of knowledge and the acquisition of competence in the field of internationalisation. Its goal is to make the internationalisation of universities more professional and thus support German universities in their internationalisation process. It offers over 100 seminars every year and since its foundation in 2006 it has developed around 8,000 members of staff in German universities. The range of iDA events covers seminars, workshops where the individual elaboration of topics is at the forefront as well as interactive language and intercultural training.

tion trends in Germany can be determined. The following section presents selected BMBF sources of funding for non-university research and intermediary organisations and, to a lesser extent, for the field of university-level education, which can be viewed as particularly relevant to internationalisation due their innovative character and/or their volume of funding. Five categories serve as an analytical grid for assigning selected sources of funding to specific organisations:

1. Analysis and advice
2. Strategic instruments
3. Institutional internationalisation and research infrastructures
4. Project funding
5. Mobility

3.2.1 Analysis and advice

The high level of political attention paid to internationalisation of education and research in the past years has led to the expansion of appropriately tailored consulting services in the German research system. The specific advice and recommendations vary depending on the provider and target group. The Alexander von Humboldt Foundation, for example, is focused on interna-

tional cooperation and advises universities and non-university research facilities. Consultation takes place in the context of **general information events and individually at the request of research institutions**.⁷³ DAAD offers online country-specific information for scholarship programmes for studies, teaching and research stays. It founded the “International DAAD Academy” in 2006, which offers training courses in internationalisation to staff members in higher education (see info box above).⁷⁴

In 2009 the German Rectors’ Conference (Hochschulrektorenkonferenz – HRK) developed an individual **audit procedure** entitled “The internationalisation of universities” designed specifically for the target group it represents. This procedure offers universities the opportunity to jointly analyse their international profile with external experts on the basis of a detailed questionnaire and to develop it further. Important topics are for instance the internationalisation of teaching and the university’s institutional language policy, its international research collaboration, the internal management and its processes of internationali-

⁷³ Cf. Wissenschaftsrat (2013): Stellungnahme zur Alexander von Humboldt-Stiftung (AvH), Bonn, p. 144

⁷⁴ Further information can be obtained at <https://www.daad-akademie.de/de/>.

sation, the internationalisation of its administration as well as the setup of representative offices abroad.⁷⁵ The HRK audit involves both quantitative and qualitative data and assessments. By the beginning of 2016, 66 universities had completed the HRK audit and the audit procedure is running in ten others.⁷⁶ Universities already audited can since 2014 participate in a “re-audit” to support the concrete implementation of their internationalisation process. By the beginning of 2016, five universities have passed through the re-audit and 14 more are currently in the re-audit process.⁷⁷

Comprehensive analysis on the development and current status of internationalisation in the higher education sector is provided in the project initiated in 2006 by DAAD, HRK and AvH to raise the **profile** of “Internationality at German universities”. This evaluates data on international activities that the research organisations concerned or the Federal Statistical Office have already systematically captured.⁷⁸ The regularly published results help universities, much like the individual HRK audits, to compare and position themselves strategically at national and international level.⁷⁹

⁷⁵ Online survey by DLR-PT, August 2015 and interview with the HRK, Bonn, 25/09/2015.

⁷⁶ Current information on participating universities via <http://www.hrk.de/audit/audit/hochschulen/> (last accessed on 22/01/2016).

⁷⁷ Current information on participating universities via <http://www.hrk.de/audit/re-audit/hochschulen/> (last accessed on 22/01/2016).

⁷⁸ By the end of 2015, a total of six documents had been published as part of the profile data project. See <https://www.hrk.de/themen/internationales/strategische-internationalisierung/profildatenprojekt/>. See an example of the latest publication in this DAAD series (2015): “Internationality at German universities – Sixth survey of profile data 2015”, Doc&Mat Volume 80, Bonn.

⁷⁹ In January 2016 the Science Council had presented “Rec-

The advice on international co-operation possibilities also belongs by nature to the core business of the diverse **international representative offices** of German research and intermediary organisations. The presence of the German innovation landscape abroad includes the international representative offices of German universities and research facilities, the Chambers of Commerce abroad, branches of German companies and the German embassies. The GIZ has around 90 locations worldwide – either in joint country offices with Germany’s development cooperation or with its own offices.⁸⁰ In the case of the research organisations, DAAD takes a prominent position due to its traditionally strong presence abroad.⁸¹ In 2014 or 2015 the international representative offices of the Helmholtz Association in Brussels, Beijing and Moscow celebrated their tenth anniversary. Strongly visible internationally are also joint representations of several organisations, especially in the context of the current five German Houses for Research and Innovation (DWIH) (cf. Section 5). Their task, among other things, is to provide the institutions of the respective organisation – or German research in the case of the DWIH – with advice and networking to facilitate access to the local research community and markets.

ommendations on specification of the core research data set” (DRS 5066-16). The core data set recommends that universities and non-university research institutions collect a series of selected, comparable key performance indicators. Relevant to an internationalisation perspective is the recommendation to register the nationality of the respective person for the areas “members of staff” and “promotion of young researchers”. See *ibid*, pp. 37–39.

⁸⁰ For further information see https://www.giz.de/de/ueber_die_giz/99.html.

⁸¹ The DAAD network currently comprises among other things, 15 branch offices and 56 information centres in 60 countries as well as approximately 470 lecturers and around 150 language assistants abroad. Online survey by DLR-PT, September 2015 and February 2016.

Professional services and advice with respect to the content and structural development of the German science system and to international research cooperation in the broadest sense are also provided by institutions such as the German Science Council and the Leopoldina, mainly in the form of **recommendations and position statements**. After its nomination to the National Academy of Sciences in 2008 – and alongside its representative duties at international level (cf. Section 3.2.2 “Strategic Instruments”) – the Leopoldina has developed policy consultation as a new field at national and international level.⁸² The departments “Science – Politics – Society” and “International Relations” were newly created as part of this extension of its remit.

The German Society for International Cooperation (GIZ), including the merged former German Society for Technical Cooperation (GTZ), plays a special role in the area of “consultation”. After the fusion in 2011 the GIZ is still and increasingly involved in international education and university cooperation.⁸³ In addition to pure education and university projects, education and higher education are increasingly becoming cross-sectoral issues, in the sense of sustainable capacity development in projects for reform of key sectors. Frequently the GIZ cooperates here with the Federal Institute for Vocational Training (BIBB) and with DAAD (see Section 5). Its development policy expertise and international networking as well as its orientation towards national and regional development plans and the labour market demands of the private sector shape the educational activities

⁸² Telephone interviews with the Leopoldina, 26/09/2013 and 27/11/2015.

⁸³ The information contained in this paragraph is based on an interview with the GIZ on 11/12/2015 in Eschborn.

of the GIZ. A central instrument for this is firstly the secondment of experts, who implement education projects in situ together with local partners. Secondly the “Centre for International Migration and Development (CIM)”, a joint venture between GIZ and the Central Placement Office of the German Federal Employment Agency, provides specialists and executives to employers in developing and emerging countries.⁸⁴ Such “CIM experts” or integrated specialists are also permanently integrated into the legal staff and structures of the partner organisation abroad. The demand for both posted and integrated specialists has increased sharply in recent years.

In addition to these external-facing consultancy and analytical activities of German research organisations, some of those involved are turning their attention to the development of internal monitoring systems for targeted orientation of their international activities. An indicator-based internal monitoring system that systematically tracks current developments in the main research regions and countries and evaluates them from an organisation-specific perspective has, for instance, been under discussion or tested for some time at the Alexander von Humboldt Foundation, the DAAD and the German Research Foundation, whilst the Fraunhofer Society already applies it.⁸⁵

⁸⁴ For further information on CIM international personnel placement see <https://www.giz.de/de/jobs/24438.html>.

⁸⁵ Interviews with AvH (Bonn, 06/08/2013 and 22/09/2015), DAAD (by telephone on 19/02/2016), DFG (Bonn, 26/09/2013 and 28/09/2015) and Fraunhofer (Munich, 18/07/2013 and 05/10/2015). Fraunhofer, for example, has developed a “set of indicators for focus countries” in which a selection of the 20 highest-ranked countries in the indicator “Innovation pillar” of the global competitiveness index, in which Fraunhofer has generated foreign income of over 0.5 million euros, is correlated to the indicator “Import” of R&D-intensive products. A precursor of this graphic can be found on p. 3 of the Fraunhofer internationalisa-

The BMBF cooperates bilaterally in **vocational education and training** with those countries that express an interest in the dual system of vocational training. Bilateral working groups are established once or twice per year on the basis of political memoranda of understanding. These agree the areas of cooperation and the implementation of individual measures for system reform in the target countries. The BMBF is currently running five European and twelve non-European vocational training partnerships.⁸⁶ These bilateral BMBF working groups are supported by experts from the German Office for International Cooperation in Vocational Education and Training (GOVET) (see above) that was set up in 2013.

At the same time, the BMBF uses such partnerships to pursue Germany's vital interest in improving the conditions for foreign involvement by German companies, whilst at the same time meeting their need for well-trained local specialists. Building on the existing foreign involvement of German companies and the German chambers of commerce abroad (Auslandshandelskammern – AHK), business-related, demand-oriented approaches for dual vocational education and training are developed and tested in the partner countries. The "VETnet" strategy project (German Chambers worldwide network (AHK) for cooperative, work-based Vocational Education & Training) at the Association of German Chambers of Industry and Commerce (DIHK) supports structural adjustments in selected European and

non-European countries. These are based on the German system of vocational training and aim to meet the demand for skilled labour from both German and local companies. Together with interested companies, the AHKs develop and test dual vocational training programmes and in doing so they establish important dual elements, such as vocational education and training and boards of examiners, the training of trainers and occupational training and examination standards.⁸⁷ The activities from the VETnet projects are systematically integrated into the activities portfolio of the respective BMBF bilateral working group to ensure a coherent approach. VETnet began in 2013 and was extended in 2015 at nine of the original eleven locations by a further 3 years.⁸⁸ The reform of vocational education and training systems in the partner countries (mainly in Asia and Latin America), which is based on the German dual model style, is also part of the classical consultation offered by the Federal Institute for Vocational Education and Training (BIBB).⁸⁹

The BMBF "iMOVE" initiative – International Marketing of Vocational Education & Training – has advised and supported the education sector in the export of vocational education and training

tion strategy, "Forschung im internationalen Wettbewerb", available at <https://www.fraunhofer.de/de/ueber-fraunhofer/wissenschaftspolitik/internationalisierungsstrategie.html>. The DLR-PT has a further developed version of the graphic from autumn 2015.

⁸⁶ For further information see <https://www.bmbf.de/de/duales-ausbildungssystem-weltweit-gefragt-328.html>.

⁸⁷ Note: Activities in international vocational education partnerships often involve a mix of instruments. Since system support is such an important element of the VETnet project, it is also referred to in this "Analysis and advice" section. Further information on project initiatives in vocational education and training can be found in Section 3.2.4 "Project funding".

⁸⁸ These locations are China, Greece, India, Italy, Latvia, Portugal, Russia, Slovakia and Thailand. For further information see <http://www.dihk.de/themenfelder/aus-und-weiterbildung/bildung-international/berufsbildungsexport/vetnet>.

⁸⁹ See also: Modernisation of vocational education and training – the international consulting approach of the BIBB, Bonn 2016 (forthcoming).

services since 2011. To do this iMOVE produces market studies on important target markets, organises country seminars and promotes German competence in vocational training and further education worldwide under the brand “Training – Made in Germany”. A particular model of advice and support is currently being tested by iMOVE in India: on behalf of the Indian Government iMOVE conducted four invitations to apply in Germany in 2015 for a three-year cooperation with leading Indian vocational education institutions. iMOVE had been integrated as a new field of work within the Federal Institute for Vocational Education and Training (BIBB) in 2013.⁹⁰

3.2.2 Strategic instruments

In the following, “strategic instruments” are firstly designated as instruments that smooth the path to internationalisation of the German research system from a higher-level perspective. Secondly, (organisation-specific) instruments will be portrayed, which set targeted incentives for increased international cooperation that can be implemented as part of internationally oriented programme and project funding (cf. Section 3.2.3 “Institutional internationalisation” and 3.2.4 “Project funding”). The first set of strategic instruments, for example, includes representation of German research interests at international level, bi- and multilateral agreements to fund research, publicity for Germany as a location for research and innovation and development of the above-mentioned representative offices abroad.

⁹⁰ For further information see <http://www.imove-germany.de>.

Leopoldina currently **represents German science committees within international bodies**, such as the InterAcademy Council and in the context of policy consultation through the national science academies of the G7/G8 countries⁹¹. In the run-up to the annual summit of Heads of State and Government of the G7/G8, the academies formulate joint recommendations on science-related issues of global reach.⁹² In 2011 the German Research Foundation contributed as one of the seven original members to the formation of the new scientific organisation Science Europe, based in Brussels. HGF, MPG and Leibniz are further members of this European association of research-funding and research-based organisations.⁹³

The interests of the German universities are represented at European level in particular by the German Rectors’ Conference, which maintains its own office in Brussels and is a member of the European University Association (EUA).⁹⁴ A current example of the conceptual, strategic work of the HRK at international level is the inaugural meet-

⁹¹ *Nota bene*: In response to Russian policy during the Crimea crisis in spring 2014, the Heads of State and Government of the seven leading industrial nations decided in March 2014 to return to meeting in the original G7 format (Group of Seven) and to suspend the G8 format that includes Russia.

⁹² For example, in 2015, with Germany as the host nation, the subjects were antibiotic resistance, tropical diseases and the future of the oceans. For further information on the 2015 G7 Summit in Germany and on policy advice of the G7/8 academies see <http://www.leopoldina.org/de/internationales/politikberatung-der-g7-akademien>.

⁹³ See the website of Science Europe: <http://www.scienceeurope.org/about-us/member-organisations>. Both the European Science Foundation (ESF) and the European Heads of Research Councils (EUROHORCs) have been amalgamated into Science Europe.

⁹⁴ For further information on HRK activities in the European context see <http://www.hrk.de/themen/internationales/internationale-zusammenarbeit/europa>.

ing of the “Hamburg Transnational University Leaders Council” in June 2015. At this event, jointly organised by the HRK, the Körber Foundation and the University of Hamburg, around 60 heads of universities specifically invited from all regions of the world discussed the future development of universities within the globalisation process.⁹⁵

A concluding paper (the “Hamburg Protocol”) captures “common values as a guide for the global development of higher education”, inter alia on such topics as the freedom of research, access to higher education and the financing of research and teaching.⁹⁶ In the area of vocational education and training, the BIBB supports the Bonn-based UNESCO international vocational training centre (UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training). Even since 1994, BIBB has been a member of the worldwide UNEVOC network of vocational education and training institutions and organisations and the German UNEVOC centre. Since 1999 there has been a cooperation agreement between the two organisations under which the BIBB supports the technical work of UNESCO-UNEVOC until the end of 2015, including by providing research staff.⁹⁷

Bi- and multilateral agreements and memoranda of understanding between individual

⁹⁵ From the organiser’s point of view, the strategy of restricting the circle of participants to be comparatively small (taking geographical balance into account) proved its value by facilitating in-depth discussions. This format is due to be retained for the follow-up meeting in 2017. Interview with the HRK on 25/09/2015, Bonn.

⁹⁶ For further information on the “Hamburg Transnational University Leaders Council” and the „Hamburg Protocol” see <https://www.htulc.de>.

⁹⁷ For further information see <https://www.bibb.de/de/9687.php>. See also the BIBB Annual Report 2014, p. 71.

German research institutions and selected international partners are also a strategic instrument that can pave the way for in-depth research cooperation. Depending on the nature of the agreement, this includes the exchange of data and research results, alternate use of research facilities or the development of transnational processes for application and appraisal of researchers.

Illustrative examples are the eight current bilateral memoranda of understanding between the HGF and facilities in India, Canada, China, Russia and France⁹⁸ as well as eleven corresponding cooperation agreements between Leibniz and institutions in France, South Korea, Japan, Taiwan, Poland, India and Mongolia⁹⁹. Leopoldina has concluded eight bilateral agreements with partner academies in India, Poland, Russia, Africa (Network of African Science Academies, NASAC), Korea, France, South Africa and Israel.¹⁰⁰ The structured networking between German universities and partners abroad is aided by the DAAD programme “Strategic partnerships and thematic networks” started in 2012, which involves inter alia the establishment and development of joint study courses, doctoral programmes and research related to international networks. This support is fundamentally aimed at deepening existing collaborations in research and teaching. In two funding rounds so far (2013–2016 and 2015–2018) a total of 49 projects were selected for funding.¹⁰¹

⁹⁸ In order of their conclusion since 2011. Interview with the HGF on 24/09/2015, Berlin, and e-mail contact in January 2016.

⁹⁹ In conclusion sequence since 2004. E-mail contact with Leibniz on 01/02/2016.

¹⁰⁰ Leopoldina Year Book 2014, p. 257.

¹⁰¹ For further information see <https://www.daad.de/hochschulen/programme-weltweit/hochschulpartnerschaften/strategie/de/23489-strategische-partnerschaften-und-thema->

The **promotion of Germany as location for higher education, research and innovation**

represents one of the three generic measures of the federal government's internationalisation strategy.¹⁰² Since 2006, Germany has presented itself abroad as a location for innovation under the brand name "Research in Germany – Land of Ideas".¹⁰³ Within the framework of two-year topic or country campaigns, the BMBF promotes the internationalisation activities of German R&D networks that usually comprise research institutions, universities and research companies. To date four topic campaigns (most recently on medical technology, 2011–2013) and three country campaigns (most recently Russia, 2012–2014) have been conducted. The topic campaign "City of the Future" starts in 2016.¹⁰⁴ In addition there are bilateral Science Years, which raise the visibility of existing collaborations and encourage further cooperation by means of various event formats in Germany and in the partner country as well as by targeted press and public relations work. Since 2007 a total of six bilateral Science Years have taken place; most recently in 2014 the German-Turkish year of research, education and innovation.¹⁰⁵ The BMBF launched a new "Research Marketing Action Alliance" (Aktionsbündnis Forschungs-

tische-netzwerke/.

¹⁰² The other two measures relate to German presence abroad and to monitoring research policy developments at the international level (cf. Section 3.1).

¹⁰³ See the corresponding Internet portal <http://www.research-in-germany.org/de.html>. For further information on the transversal topics presence abroad, research marketing and international monitoring, see also the Federal Report on Research and Innovation 2014, p. 369 et seq.

¹⁰⁴ For further information see <http://www.internationales-buero.de/de/zukunftskampagnen.php>.

¹⁰⁵ For further information see http://www.internationales-buero.de/de/internationale_wissenschaftsjahre.php.

marketing") in 2015. The objective of this action alliance is to network those involved in German research, education and innovation more closely with one another at home and represent them abroad under the umbrella brand "Research in Germany".¹⁰⁶ The action alliance is sustained by the measures of the research marketing group (cf. Section 5), future campaigns of the BMBF and the services of the German Houses of Research and Innovation.

In the area of higher education marketing, the campaign led by DAAD and operating since 2008 under the brand name "Study in Germany" and the joint DAAD / HRK GATE-Germany consortium for international higher education marketing are important instruments for convincing highly qualified foreign students to undertake a stay at a German university.¹⁰⁷

The second set of strategic instruments – targeted incentives – includes research awards and support measure prizes for foreign researchers, alumni networks, the internationalisation of appraisals and research personnel and organisation-internal funding instruments for the strategic strengthening of international collaboration.

Among **research awards**, the Alexander von Humboldt Professorship¹⁰⁸ – assigned since 2008 – is outstanding: Its purpose is to enable scientific activity in all disciplines by the world's leading scientists from abroad at a German university over a period of five years and, thus,

¹⁰⁶ See BMBF (2014): Action Plan, p. 55.

¹⁰⁷ See the corresponding Internet portal www.study-in.de.

¹⁰⁸ ¹⁰⁹ For further information on the AvH Professorship and previous award winners, see <http://www.humboldt-professur.de>.

strengthen the international competitiveness of Germany as a research location. Given its award value of up to five million euros, the AvH Professorship is the most valuable international research award in Germany. Further internationally oriented awards are the AvH Sofja Kovačevskaja Award for young foreign scientists to build a research group in Germany (since 2002), the Helmholtz International Fellow Award for foreign researchers and science managers (since 2012) and the Leibniz Chairs. Leibniz Chairs have been awarded since 2005 by Leibniz institutions for several years or even for life; in the case of foreign and European guest researchers, the honour is intended to further strengthen cooperation between the respective Leibniz Institute and the home institution of the person receiving the award.¹⁰⁹

A current example for the **funding of support measures in the area of internationalisation** is the three competitions advertised in 2015, which the Stifterverband für die Deutsche Wissenschaft (Endowment Association for German Research) used to target improvement of the framework conditions for international students. The competition "Practice MINTernational" distinguished six universities for their practical training offers to international MINT students, the competition "MINTernational Digital" recognized eight innovative examples of digital learning and information services at German universities and the competition "Study&Work" featured ten regional networks that supported foreign students

¹⁰⁹ Of the six Leibniz Chairs awarded to date, three award winners are from institutes abroad (Universities of Lucerne, San Diego and Warsaw). Telephone interview with Leibniz, 09/05/2014. See also <http://www.leibniz-gemeinschaft.de/forschung/hochschulkooperationen/gemeinsame-berufungen>.

in their studies and facilitated the start of their subsequent careers.¹¹⁰

Various **research alumni networks** have been established and expanded in Germany in recent years. Firstly, these increase the visibility and, thus, the attractive power of the respective organisation, but international alumni also act as overall multipliers for Germany as a research location. Traditionally, for instance, the international alumni work of the AvH has carried a lot of weight; there are currently 122 Humboldt Alumni Associations in 75 countries.¹¹¹ Against the background of this experience, in the last five years the AvH has funded researcher alumni work by means of ideas competitions at universities and research institutions in Germany, with BMBF support as part of its international research marketing and, thus, placed on the agenda the extension of collaboration with the specific research segment among the alumni. Since 2014 there has also been an AvH social network ("Humboldt Life"), which aims to facilitate world-wide cooperation and the maintenance of contacts among Humboldtians.¹¹² Under the name "maxNet" the Max Planck Society also offers a worldwide, interdisciplinary network that is available to all research staff and guest researchers staying longer than six months, all diploma students, doctoral candidates, scholarship holders, post-doctoral students and non-research staff.¹¹³ Worthy of

¹¹⁰ Online survey by DLR-PT, December 2015. For further information see <https://www.stifterverband.org/>.

¹¹¹ For further information see <http://www.humboldt-foundation.de/web/alumnivereinigungen.html>.

¹¹² AvH (2015): Annual Report 2014, p. 5. Interview with the AvH on 22/09/2015, Bonn.

¹¹³ For further information see <http://www.mpg.de/alumni-betreuung>.

final emphasis is the DAAD “Alumni programme for support and commitment to alumni abroad”, which supports German universities in their international alumni work. The main objective of this programme is to prepare foreign alumni professionally, increase their loyalty to Germany in the long run and promote their networking among each other and with their German partners from research and industry.¹¹⁴

The German research organisations have striven increasingly for some years to achieve **internationalisation of its research personnel** at all career levels¹¹⁵ and **internationalisation of evaluation**. In principle, a variety of internationalisation instruments, especially in the area of internationally-oriented youth promotion, smooths the path to lasting employment in the German science system.¹¹⁶ An example of targeted recruitment of researchers from abroad is the HGF recruiting initiative “Winning over the best minds” (“Die Besten gewinnen”) adopted in 2012.¹¹⁷ This initiative, funded by the Pact for

Research and Innovation, provides various measures for winning top researchers from around the world to undertake research in Germany with a view towards selected subject areas such as the move towards sustainable energy. The integration of international expertise is also a declared goal in the appraisal of individual applications in the regular scientific advisory councils of the institutes as well as in the commissions for the institutional or programme evaluations. Whereas this overall trend towards a strategic opening-up of the selection procedures of the German research organisations is emerging,¹¹⁸ specific challenges are arising with regard to language barriers and the (time) availability of internationally renowned experts.

Finally, special **funding instruments** for research and intermediary organisations are required as internal strategic instruments for the start-up of internationalisation activities. One example of this is the Fraunhofer funding instrument “ICON – International cooperation and networking”, which supports strategic collaboration with excellent institutions abroad – usually universities – by means of projects lasting several years.¹¹⁹ The HGF “Impulse and networking fund (Impuls- und Vernetzungsfonds – IVF)” serves as a financial basis for various funding instruments, which are intended to support initiatives for the formation of networks between Helmholtz centres, universities and non-

¹¹⁴ For further information see <https://www.daad.de/hochschulen/betreuung/alumni/de>.

¹¹⁵ *Nota bene*: Corresponding data are not collected from all organisations; comparability is also partially limited due to different definitions of personnel categories. In 2012, 52.9% of the “trainees and guest researchers” at MPG were of foreign nationality, in 2014 the proportion was 55.5%. Noticeably high was the proportion of foreigners amongst post-doctoral students: 89% in 2012 and 75.4% in 2014. At Fraunhofer in 2013 and 2014 the proportion of staff members with foreign citizenship was in each case around 9%. E-mail contact with MPG on 22/10/2015 and Fraunhofer on 12/01/2016.

¹¹⁶ Cf. “Institutional internationalisation and research infrastructures”. An overview of the measures for internationalisation of research personnel especially of the organisations in the Pact for Research and Innovation is provided the appropriate subsection in the Pact’s annual monitoring reports (2015: Section 3.33)..

¹¹⁷ Helmholtz (2015): Annual Report 2015, p. 10.

¹¹⁸ See the data and references in the subsection “The internationalization of appraisals” in the annual monitoring report of the Pact for Research and Innovation (2015: Section 3.34).

¹¹⁹ The share of Fraunhofer headquarters finance for Fraunhofer Institute ICON projects was almost 2 million euros in 2014. Interview with Fraunhofer, Munich, 05/10/2015, and subsequent e-mail contact. See also “Research in International Competition. Features of Fraunhofer’s Internationalisation Strategy”, Munich 2013.

university partners and thereby cooperation with top international researchers.¹²⁰ Also the “Strategy Fund” of the Leibniz Association amounting to 2 million euros annually is used for start-up financing of European and international cooperation of importance for the whole association.¹²¹

The National Agency Education for Europe (NA at BIBB) founded in 2000 is domiciled at the BIBB. It has been responsible for implementation of the Erasmus+ EU funding programme for vocational training and adult education since 2014.¹²²

3.2.3 Institutional internationalisation and research infrastructures

The focus of this report is on current developments and trends in the area of internationalisation. Of particular importance to its analysis are, therefore, the instruments for institutional internationalisation, including the development of internationally used research infrastructures. Since these are essentially applied over time, they can also be used to indicate future developments in the internationalisation of the German research landscape.¹²³ First and fore-

¹²⁰ Helmholtz – Creating knowledge for the digital world. Annual Report 2014, p. 11. Annual Report 2015, p. 44.

¹²¹ The “Impulse and Strategy Fund” was renamed “Strategy Fund” as new concepts were introduced in 2015. It is now primarily applied to start-up promotion for strategic Leibniz projects that are effective in the longer term. Telephone interview with Leibniz, 16/09/2015. See also Leibniz (2014): “Pact for Research and Innovation 2016–2020: The basis for further development of the Leibniz Association as a successful research organisation”, p.2, available at <http://www.leibniz-gemeinschaft.de/medien/positionen>.

¹²² See also Section 3.2.5 “Mobility”. For further information on the activities of the national agency for education and training in Europe, see <http://www.na-bibb.de>.

¹²³ *Nota bene*: The definition for the following category “project funding” is not always clear-cut, depending on the weighting of the criteria for analysis (duration of funding; targeted development of cross-project structures; funding of

most is the permanent establishment of **institutes abroad** by German research organisations.¹²⁴

These are designed in such a way that they conduct research without time limit, in accordance with the principles of the relevant parent organisation and in close cooperation with local partners, particularly universities and companies. Examples of this strongest form of institutionalised cooperation are the five Max Planck Institutes abroad¹²⁵ and the 15 Fraunhofer Centres under the umbrella of Fraunhofer subsidiaries abroad. Under certain conditions a Fraunhofer Centre can become an independent institution – a Fraunhofer Institute abroad.¹²⁶ For these various formats, specific questions have to be clarified in advance concerning the autonomy rights of the relevant foreign institute as well as complex issues pertaining to grant law, for example, in relation to the origin of the basic funding and access to public funding in the country concerned.¹²⁷

major research groups). Despite sometimes only slight differences in categorisation of the instruments, the distinction between long-term institutional internationalisation on the one hand and short-term international project funding on the other is a decisive topic for this report.

¹²⁴ Note on source assessment: If not otherwise indicated, the information presented in this “Institutional internationalisation and research infrastructures” section comes from the already cited respective publications, such as the monitoring reports of the Pact for Research and Innovation and the Annual Reports of the research and intermediary organisations.

¹²⁵ These five institutes are located in Florence, Florida, Luxembourg, Nijmegen (NL) and Rome, whereby the Max Planck Florida Institute for Neuroscience founded in 2009 and the Max Planck Institute Luxembourg for International, European and Regulatory Procedural Law founded in 2012 feature a particularly high degree of independence. Interview with the MPG, Munich, 18/07/2013, and online survey by DLR-PT, September 2015. For further information see http://www.mpg.de/182559/Max-Planck-Institute_im_Ausland.

¹²⁶ So far there are not any Fraunhofer Institutes abroad. Information about the Fraunhofer Centres, Fraunhofer Institutes and Fraunhofer Project Centres came from: Online survey by DLR-PT, September 2015 and interview with Fraunhofer 05/10/2015, Munich.

¹²⁷ An illustrative example of such a regulation framework is provided by the decision of the Joint Science Conference

The second pillar of institutional internationalisation are cooperation instruments like the international Max Planck Centres (since 2010; currently 16 centres)¹²⁸ and the Fraunhofer Project Centres (since 2008; currently 9 Project Centres)¹²⁹.

These have no separate legal personality and are each limited to five years (each with unique extension option) but also contain structure-forming elements such as the joint working group, which in the ideal case extend beyond the funding phase to a **lasting network with the relevant partner abroad**. Cross-project cooperation designation also increases the visibility of the respective German research organisation abroad – in comparison to individual funding without such an institutional framework. Another example of this type are the Helmholtz Alliances, also restricted to a five-year period, in which selected Helmholtz Centres conduct research jointly with other national and international research institutions (universities and non-university partners) on a range of topics such as the environment, energy and health¹³⁰. Albeit the Helmholtz Alliances, in contrast to the above-mentioned MPG and Fraunhofer instruments, are not intrinsically geared towards international cooperation; in such a thematic cooperation framework, as in the case of the Helmholtz Virtual Institutes or the Leibniz Research Associations,¹³¹

on MPG: Management principles for institutions funded under the MPG implementation agreement (BewGr-MPG), as of: 1 May 2014.

¹²⁸ See <https://www.mpg.de/maxplanckcenter>. There is an ongoing evaluation of this first generation of Max Planck Centre. Interview with MPG on 05/10/2015, Munich..

¹²⁹ Online survey by DLR-PT, September 2015.

¹³⁰ These topics are, for example, at the heart of the “Helmholtz Alberta Initiative” that has existed since 2009. For further information see <http://www.helmholtz-alberta.org>.

¹³¹ International research groups can also take part in the 5- to 15-year Leibniz research collaborations. For further infor-

mation see <http://www.leibniz-gemeinschaft.de/forschung/leibniz-forschungsverbuende/>.

internationalisation only occurs as – an important – side effect. The HGF has further funding instruments targeted more explicitly towards international cooperation, such as the Helmholtz International Research Networks conceived in 2013, which support the establishment of joint research projects between the Helmholtz Centres and strategic cooperation partners abroad. The funding period is up to six years; two such networks have been established so far with partners in Israel and in China.¹³²

The bilateral Helmholtz Russia Joint Research Groups had already been set up in 2007 (final invitation to apply in 2012)¹³³ and the Helmholtz International Research Groups designed according to this model followed in 2012 (2013: 15 groups)¹³⁴. The single institutional framework of both these instruments is designed to increase the international visibility of the individual initiatives, although the funding period, as in the case of the funding programme established in 2012 between the HGF and the Chinese Academy of Sciences, is only three years. As a result of this

mation see <http://www.leibniz-gemeinschaft.de/forschung/leibniz-forschungsverbuende/>.

¹³² The “Helmholtz Israel Cooperation in Personalized Medicine” network was launched in 2013 and the German-Chinese competence centre for earth system monitoring and modelling (the Helmholtz-CAS Research Centre for Environmental Information Service – RCEIS) in 2014. Interview with HGF on 24/09/2015, Berlin.

¹³³ See http://www.helmholtz.de/karriere_talente/foerderprogramme.

¹³⁴ Helmholtz – Creating knowledge for the digital world. Annual Report 2014, p. 11. In 2015 there were no further invitations to apply in the “Helmholtz International Research Groups” area; the instrument is currently being evaluated. Interview with HGF on 24/09/2015, Berlin.

relatively short period of time, generally speaking fewer structural effects can be expected than, for example, in the case of the Max Planck Centres that endure for up to a maximum of ten years. According to initial MPG experiences, the collaboration between Max Planck Institutes and outstanding overseas partners in future-oriented research areas takes on a new quality due to the Max Planck Centres. This creates platforms within the framework of scientific cooperation programmes on which the participating Max Planck Institutes and their international partners can combine their respective expertise and achieve added research value through this combination of complementary methods and knowledge synergies.

Thirdly **research infrastructures** generate a special form of institutional, long-term structures that are very significant to the internationalisation of the German research landscape. The Helmholtz Association institutions in particular have world-renowned scientific infrastructures and large units that attract an increasing number of international guest scholars.¹³⁵ Many Leibniz institutions are also characterised by partially unique scientific infrastructures and data collections, especially research stations abroad. In order to network this research capital even more closely within Leibniz and make it even more visible externally, in May 2013 Leibniz established an

¹³⁵ Monitoring Report 2015, HGF Annex, p. 19. Illustrative examples of an internationally significant research infrastructure operated by an HGF Centre are the German Electron Synchrotron “DESY” in Hamburg and Zeuthen, one of the world’s leading centres for research with photons, particles, particle astrophysics and accelerator physics (www.desy.de) or also the research vessel “Polarstern” – Polar Star – operated by the Alfred Wegener Institute at the Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven (www.awi.de/expedition/schiffe/polarstern.html). For research infrastructures, see also Section 4.3.

internal research infrastructure group.¹³⁶ Regarding research infrastructures, the large German research organisations are involved at European level, for example, in the European Strategy Forum for Research Infrastructures (ESFRI) and they participate in corresponding calls for tenders.¹³⁷

The establishment of permanent structures is fourthly a feature of the internationally-oriented youth promotion area, notably through the establishment of **international graduate schools**. Examples of this are the International Research Training Groups (“Internationale Graduiertenkollegs”) established as early as 1999, the International Max Planck Research Schools (since 2000) and the International Graduate Schools of the Leibniz Association (since 2006). In the spring of 2016, the DFG supported 37 International Research Training Groups offering a group at a German university and a partner group abroad (February 2016: involving 19 countries) joint doctoral training.¹³⁸ The BMBF-funded international research collegia in the field of humanities, often with a special focus on youth promotion, also illustrates the current trend towards lasting institutional internationalisation.¹³⁹

¹³⁶ The “Standing Commission for Research Infrastructure Facilities and Research Museums” was set up in November 2015 under the statutes of the Leibniz Association (§11, Point 7). Available at <http://www.leibniz-gemeinschaft.de/ueber-uns/organisation/>.

¹³⁷ See Section 2.2 “Collaboration within the European Union”.

¹³⁸ For current statistics and information on the geographical distribution of DFG international graduate studies programmes, see http://www.dfg.de/foerderung/programme/koordinierte_programme/graduiertenkollegs/internationale_grakos/index.html.

¹³⁹ For information on the establishment of international humanities collegia in the context of the BMBF framework programme Humanities, Cultural Studies and Social Sciences (2013–2018), see <https://www.bmbf.de/de/geistes-und-sozialwissenschaften-weltweit-744.html>.

Fifthly, in the higher education sector there exists a dense network of **partnerships with foreign universities** and research institutions that are supported by a wide variety of funding measures from the BMBF and the research and intermediary organisations. According to the HRK Higher Education Compass, German universities currently cooperate in the framework of over 30,000 partnerships around the world.¹⁴⁰ In the past few years in particular, the demand for an institutionalised German-foreign collaboration in the higher education sector increased significantly – both with regard to the establishment of individual study programmes and in relation to the establishment of independent universities. In 2001 BMBF funds helped start the DAAD programme “Transnational education – Study opportunities offered by German universities abroad”,¹⁴¹ which assisted foundation of the German University in Cairo (GUC), for example. The German Jordanian University (GJU) commenced teaching activities in 2005 and the Turkish-German University (TDU) in Istanbul in 2013. In addition, Germany is engaged via GIZ in cooperation with DAAD, funded by the Federal Ministry for Economic Cooperation and Development and by a targeted BMBF contribution, in the establishment of a new pan-African University (PAU) by the African Union.¹⁴² Via AvH and DAAD the BMBF has supported an Endowed Chair at the African Institute of Mathematical Sciences in Senegal (AIMS Senegal) since 2012.

¹⁴⁰ See the HRK Higher Education Compass at <http://www.hochschulkompass.de/auslandskooperationen.html>.

¹⁴¹ For further information see <https://www.daad.de/hochschulen/hochschulprojekte-ausland/studienangebote/de>.

¹⁴² For further information see <https://www.bmz.de/de/themen/bildung/hochschulbildung/Zusammenarbeit-konkret/Aufbau-einer-Panafrikanischen-Universitaet/index.html>. The BMBF contribution supports the development of a research agenda for the pan-African University (PAU).

This pilot action is part of the AIMS Next Einstein Initiative (AIMS NEI), the aim of which is to build a network of 15 national mathematical centres of excellence in Africa by 2020.¹⁴³

3.2.4 Project funding

The German research organisations provide a variety of instruments for promoting internationally oriented projects for both individuals and large, interdisciplinary research groups. This includes in principle all of the promotion measures designed to involve international partners and the instruments focused on the establishment of (permanent) institutional cooperation structures already described in the previous section. Germany’s transnational research cooperation, with a focus on corresponding BMBF funding measures, are presented separately in Section 4. This section, therefore, concentrates on selected instruments of German organisations in the areas of research and vocational training.

The Leibniz Association funds so-called “Leibniz Groups” where German and international researchers come together to research a common topic. In addition to the funding instrument of the Helmholtz youth promotion groups, in 2012, the HGF advertised for the first time a global call for applications for a Helmholtz post-doctoral programme. The Max Planck partner groups, limited to a maximum period of five years, have already existed since 1999: after a research stay at a Max Planck Institute, guest researchers from abroad can receive support for the creation of a partner group in their homeland

¹⁴³ For further information see <http://www.nexteinstein.org/index.php>.

or at their home university to continue academic exchange with colleagues in Germany.¹⁴⁴

The Fraunhofer Institute's bilateral projects with businesses abroad are worth a brief mention at this point. In 2014 over a quarter (26.4%) of the income to all German Fraunhofer Institutes came from partners abroad.¹⁴⁵

Of paramount importance to all German research organisations is their **involvement in European funding measures**, especially in the European research framework programmes (cf. Section 2.2). In this context, a leading role in Germany and in Europe is played by the Max Planck and Fraunhofer Institutes: In a comparison of all research organisations participating in the seventh EU research framework programme compiled by the European Commission in 2015, the Fraunhofer Society occupied second place and the Max Planck Society fifth place.¹⁴⁶ The Helmholtz Association also plays an outstanding role in this: if you add the EU funding obtained by the respective Helmholtz Centres (due to their legal status the Centres are listed individually in the European Commission ranking), the Helmholtz Association is shown to be particularly successful in European and national comparison. Thus, the HGF received, in a national comparison for the period 2008 to 2014, the highest number of new grants (in terms of project participation) in the European research

¹⁴⁴ Since 1999, a total of 106 partner groups have been established. Monitoring Report 2015, MPG Annex, p. 25.

¹⁴⁵ Calculated without income from foreign subsidiaries and without foreign license income. E-mail from Fraunhofer, 29/01/2016.

¹⁴⁶ By number of contributions in terms of signed EU support contracts in the period 2007–2013. European Commission (2015): Seventh FP7 Monitoring Report. Monitoring Report 2013, Brussels, 11/03/2015, p. 16.

framework programme.¹⁴⁷ With a view to the total sum of EU funding received in the current research framework programme Horizon 2020 (as of: July 2015; Horizon 2020 term: 2014–2020) HGF is in second place in an EU comparison (see Figure 5).

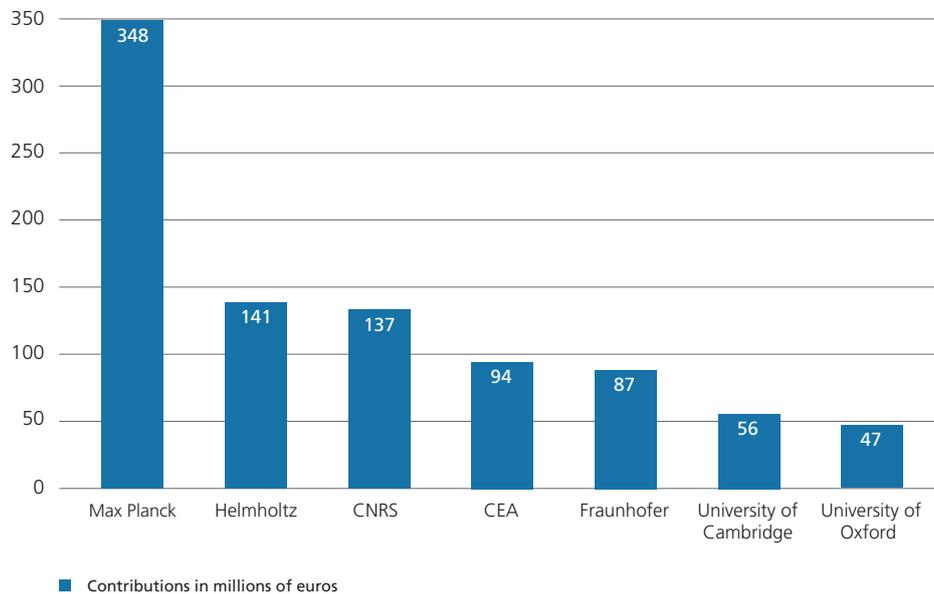
The instrument of project funding is also used in the field of **internationalisation of vocational education and training**: The “Vocational training export” (“Berufsbildungsexport – BEX”) funding initiative has existed since 2009 and is aimed at German providers of education and training services. The worldwide demand for qualified specialists has increased, and with it the market potential for German vocational education and training service providers. The BMBF uses the BEX funding initiative to support German training providers in accessing cooperation opportunities and developing sustainable international business models. The project consortia consist of partners from research and practice and are designed to provide innovative developments and trials of demand-oriented qualification measures.¹⁴⁸

In addition, the BMBF and BMZ fund selected projects with partner countries as part of vocational training partnerships. The BIBB and GIZ are active at this worldwide as a national centre of competence and as an implementation organisation. Current examples of comprehensive collaborations in the non-European countries are the modernization of the Indian vocational education and training system since 2007 and the introduction of a dual system of vocational education in

¹⁴⁷ See Monitoring Report 2015 of the Pact for Research and Innovation, Figure 6, p. 31.

¹⁴⁸ For further information see <https://www.bmbf.de/de/die-foerderinitiative-berufsbildungsexport-325.html>.

Figure 5: Research organisations: "Horizon 2020" contributions



Source: Helmholtz Association; data basis "Horizon 2020" Ecorda contract database (July 2015).

Mexico since 2013. German vocational trainers undertake the consulting and implementation tasks in both cases.¹⁴⁹

3.2.5 Mobility

Transnational transfer of research personnel is a prerequisite for international networking and access to world-class research – and, thus, a key building block for the internationalisation of the German research system. Measures to promote mobility among researchers are, therefore, integral parts of many internationally-aligned funding instruments. These measures range from support

for conference travel to the financing of longer guest stays, both in terms of **outward mobility** (researchers operating in Germany go abroad for a while) and of **inward mobility** (researchers from abroad come to Germany for a while). Funding programs within international graduate schools, therefore, regularly support presentations and visits to partner institutions abroad, for example.

Naturally, German intermediary organisations have the broadest range of transnational mobility measures at their disposal, above all the AvH and DAAD. Whilst AvH funding is focused on researchers at all stages of their careers after graduation, the DAAD – in addition to "re-

¹⁴⁹ Interviews with BIBB on 02/10/2015 in Bonn and with GIZ on 11/12/2015 in Eschborn. An overview of information on countries involved in vocational education and training is provided in the country portal of the Central Office for International Vocational Education and Training Cooperation (GOVET) at <http://www.govet.international/land>.

searchers and university lecturers”¹⁵⁰ – targets in particular both students and graduates. The three main programme lines of AvH funding are the Humboldt Research Fellowship (target group: researchers from abroad with a research project in Germany), the Feodor Lynen Research Fellowship (target group: German researchers who are planning a 6–18-month guest stay at a research institute abroad) and the Georg Forster Research Fellowship established in 1998 (target group: researchers from developing and emerging countries whose research project deals with development policy objectives in Germany).¹⁵¹

In addition to grants as part of cross-organisation cooperation programmes (see Section 5) the annual scholarships for research and study are the central DAAD funding instrument. Those who are funded come both from abroad as well as from Germany, whereby the proportion of those funded from abroad is significantly higher: a total of 4,252 people from abroad received a DAAD one-year scholarship in 2015, while 1,420 people from Germany were funded.¹⁵² Introduced in 2014 and in great demand, the DAAD mobility programme P.R.I.M.E. (Post-doctoral Researchers International Mobility Experience), co-financed by the European Union Marie Curie Programme, is aimed specifically at post-doctoral researchers. Rather than grants, it provides employments for

highly-skilled young researchers of all nationalities and specialities and includes a twelve-month phase abroad and a six-month integration phase at a German university, where those funded are employed over the entire promotional period.¹⁵³

DAAD also acts as an information and advisory agency on behalf of the BMBF for the EU university programmes (National Agency for EU Higher Education Cooperation), whose specific instruments in the area of mobility are of central importance for academic collaboration in Europe.¹⁵⁴ Ever since 1987, DAAD has managed the EU higher education programme “Erasmus”, which was extended in December 2013 into the comprehensive “Programme Erasmus+ for general and vocational education and training, youth and sport” (2014–2020).¹⁵⁵ Erasmus+ should among other things also increase the cross-border mobility of German trainees – this is one of Germany’s declared policy aims (see Section 3.1).

¹⁵⁰ The DAAD category “researchers and university lecturers” includes post-doctoral students and refers to “as a rule research or academic staff actively engaged full-time at a university or research institute”. Sources: DAAD Annual Report 2012, p. 94, DAAD-Annual Report 2014, p. 82 plus an interview with DAAD in Bonn, 28/08/2013 and subsequent e-mail exchange.

¹⁵¹ Cf. Wissenschaftsrat (2013): Stellungnahme zur Alexander von Humboldt-Stiftung (AvH), Bonn, pp 100–102.

¹⁵² DAAD Annual Report 2014, p. 96.

¹⁵³ Interview with DAAD on 02/10/2015. For further information see <https://www.daad.de/ausland/studieren/stipendium/de/22346-postdoctoral-researchers-international-mobility-experience>.

¹⁵⁴ For further information see <https://eu.daad.de/de>.

¹⁵⁵ Regulation (EU) No. 1288/2013 of the European Parliament and of the Council dated 11 December 2013 on the establishment of “Erasmus+”, the Union programme for education and training, youth and sport, and repealing Resolutions No. 1719/2006/EC, No. 1720/2006/EC and No. 1298/2008/EC, Official Journal of the EU, L 347/50-73, 20/12/2013.

4. Research collaboration outside the framework of the European Union

As explained earlier, cooperation with European partners and within the European Research Area (ERA) is of significant importance for the German research landscape (see Section 2.2). The following provides brief highlights of three further areas of cooperation outside the EU framework: bilateral and multilateral cooperation with European partners and as part of the European macro-area strategies (Section 4.1), bilateral and multilateral cooperation with partners outside Europe (Section 4.2) and collaboration in the context of international organisations and in the field of research infrastructures (Section 4.3). It is important to note that there is no sharp dividing line to collaboration in the framework of the EU, but on the contrary many bilateral and regional promotional activities in Germany are linked with targeted EU activities as, for example, in the case of the macro-regional EU strategies for the Danube and the Baltic Sea regions. In line with the guidelines of the National ERA Strategy, the federal government is striving to create an intelligent integration of national, bilateral and European research and innovation policy in order to create synergies between these areas.¹⁵⁶

4.1 Bilateral and multilateral cooperation with European partners and as part of the European macro-area strategies

France is Germany's most important partner at the **bilateral level** in Europe.¹⁵⁷ Intergovernmental councils of German and French ministers coordinate the collaboration. A wide range of new collaborations were decided in the years 2012, 2013 and 2014, for example, in the areas of health research, biotechnology, environmental research and social sciences. At the 17th German-French Council of Ministers in March 2015, among other things, the two research ministers signed the articles of association for the German-French Centre Marc Bloch (CMB) in Berlin. Founded in 1992, since January 2016 this interdisciplinary social science centre now has its own legal personality as a registered association.¹⁵⁸ Raw materials research is a further area of common strategic interest: Currently, for example, the German-French funding announcement "Sustainable technologies for the production, processing and substitution of strategic raw materials", supports the two collaborative projects "eco-metals"

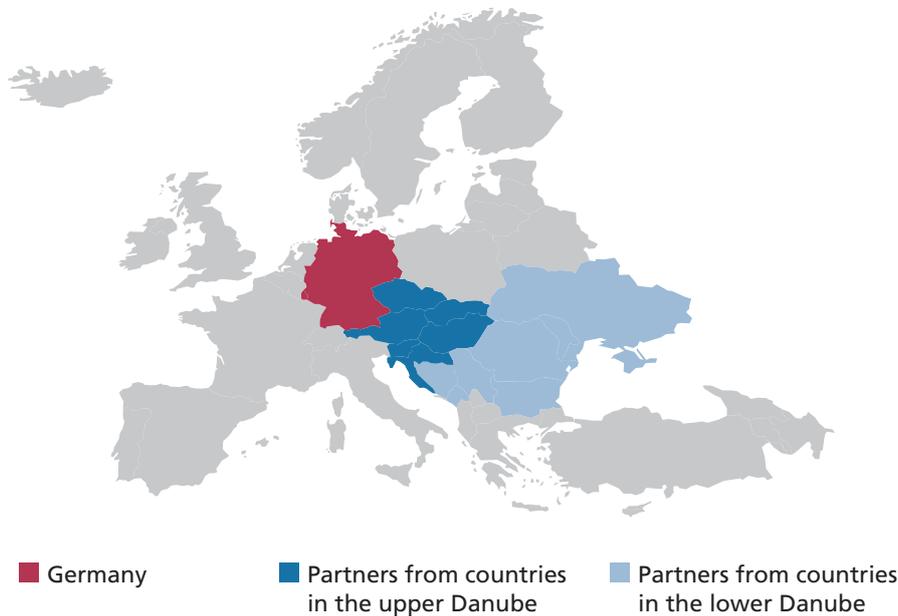
¹⁵⁷ For an overview of selected partner countries and regions in Europe and the current focal points of bilateral and multilateral cooperation, see also the Federal Report on Research and Innovation 2016 (<https://www.bmbf.de/de/bundesbericht-forschung-und-innovation-735.html>).

¹⁵⁸ For further information see <http://www.ambafrance-de.org/17-Deutsch-Franzosischer>.

¹⁵⁶ Federal Government (2014): Strategy on the European Research Area (ERA). Guidelines and National Roadmap, p. 4.

4.1 Bilateral and multilateral cooperation with European partners

Figure 6: Target countries: R&D networks with partners in the Danube countries



Source: DLR; own presentation.

and “RECVAl- HPM” from 2014 to 2017 with a total of 8 million euros.¹⁵⁹

Together with France and other important European partners, such as Poland and Switzerland, the BMBF also regularly hosts bilateral research and innovation forums to promote the networking of research landscapes. Strengthening of bilateral collaboration in particular was most recently achieved with the Czech Republic: in July 2015 the foreign ministers of the two countries agreed a comprehensive strategic dialogue including a package of measures in the field of research and development.¹⁶⁰

¹⁵⁹ For further information see the websites of both projects at <http://www.ecometals.org/> und <http://www.recval-hpm.de/>.

¹⁶⁰ For further information see http://www.internationales-buero.de/de/tschechische_republik.php.

For **multilateral cooperation with European partners** since 2010, three major BMBF funding initiatives were of significant importance due to their close connection to the objectives of the EU: Firstly, the initiative “Establishment and development of innovative R&D networks with partners in the Baltic Sea region”¹⁶¹ also served to implement the EU Baltic Sea strategy from 2009. Three funding rounds (2010, 2011 and 2013) supported a total of 55 projects dealing with Federal Government High-Tech Strategy topics (climate / energy, health / nutrition, security, mobility, production and communications technologies).¹⁶²

¹⁶¹ The formation of a network requires in addition to at least one German partner the involvement of at least one partner from the group of countries Denmark, Finland, Norway or Sweden and at least one partner from the group of countries Estonia, Latvia, Lithuania or Poland.

¹⁶² DLR-PT information, March 2016.

With the same thematic orientation followed secondly in 2013 the initiative “Establishment and development of innovative R&D networks with partners in the Danube States”¹⁶³. The macro-regional framework for this was created by the EU Strategy for the Danube Region in 2011. A total of 31 projects were funded in the course of the first call for proposals in 2013. The overall volume of funding for the second call for proposals from 2015 was 1.25 million euros; the three Danube countries Republic of Moldova, Republic of Serbia and Hungary have guaranteed to co-finance the projects.

Thirdly, the programme “Establishment and Expansion of Joint Research Structures in Europe” was advertised for the first time in 2015.¹⁶⁴ This funding announcement is aimed at supporting research institutions, universities and (research) companies from Germany to develop knowledge and innovation potential in less research-intensive regions in Europe and to institutionalise their collaboration with partners from the target regions. At the same time, the intention is to promote the partner’s connectivity to the European Research Area – in line with corresponding EU policies like for instance “Teaming for excellence” (see Section 3.1). Target countries of the announcement are the EU Member States Estonia, Latvia, Lithuania Poland, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania and Bulgaria as well as the EU candidate

¹⁶³ The formation of a network requires in addition to at least one German partner the involvement of at least one partner from the upper Danube region (Croatia, Austria, Slovakia, Slovenia, Czech Republic, Hungary) as well as at least one partner from the countries of the lower Danube region (Bosnia and Herzegovina, Bulgaria, Moldova, Montenegro, Romania, Serbia and Ukraine).

¹⁶⁴ For further information see <http://www.internationales-buero.de/de/227.php>.

Internationalisation of Leading-Edge Clusters

Stronger international networking of research and the economy in Germany is a central element of the “strategy for the internationalisation of science and research” from 2008 (target field 2; see Section 3.1) and of the new high-tech strategy of the Federal Government from 2014. The BMBF funding measure “Internationalisation of Leading-Edge Clusters, Forward-Looking Projects, and Comparable Networks” from 2015 is aimed at the internationalisation of successful consortia (“clusters”) and networks consisting of research institutions, universities, companies and others involved in the field of developing technology and innovation. This supports already established clusters in the development of their internationalisation strategies and then with implementation of the specific research and development projects with international partners. The funding in each case is up to 4 million euros for a project term of up to five years. Eleven projects were selected for funding in the first of three planned rounds of competition. These commenced at the beginning of 2016.

countries Albania, the former Yugoslav Republic of Macedonia, Montenegro and Serbia. The total funding value for the period from 2015 to 2018 amounts to 1.5 million euros; a total of 15 projects were selected for funding.¹⁶⁵

The strengthening of **multilateral collaboration with European partners and worldwide** is also the objective of the current BMBF funding

¹⁶⁵ DLR-PT information, March 2016.

measure “Internationalisation of Leading-Edge Clusters, Forward-Looking Projects, and Comparable Networks” (“Internationalisierung von Spitzenclustern, Zukunftsprojekten und vergleichbaren Netzwerken”¹⁶⁶. This initiative was started in 2015 and supports both the establishment of international network structures (category “institutional internationalisation”, see Section 3.2.3) as well as cross-border research projects.

4.2 Bi- and multilateral collaboration with partners beyond Europe

Traditionally there has been close research policy cooperation with **industrialised countries world-wide**. The current Federal Report on Research and Innovation 2016 highlights in particular the thematically wide-ranging cooperation with Israel, Australia, Canada and the USA. Successful bilateral collaborations designed for the longer term can, thus, also be opened up for multilateral collaboration.

A current example of this from the field of health research¹⁶⁷ is the funding instrument “German – US Collaboration in Computational Neuroscience” set up in 2009, which has also been open to applicants from Israel and France since 2015.

The so-called **BRICS countries** (Brazil, Russia, India, China and South Africa) have developed a their research and innovation systems in the last decade in a very dynamic way. As a consequence,

¹⁶⁶ For further information see <https://www.bmbf.de/de/cluster-netzwerke-international-547.html>.

¹⁶⁷ For current focus topics in international cooperation, see also Section 2.

Under the bilateral funding instrument “German – US Collaboration in Computational Neuroscience” BMBF cooperates with the US National Science Foundation (NSF) and the National Institutes of Health (NIH). This funding measure is part of the field of action 6 “International cooperation in health research” of the Federal Government’s Health Research Framework Programme from 2010. Research in the subject area “Computational Neuroscience” is to be coordinated by means of joint activities. So far 26 bilateral collaborations with German participation have been funded; the total volume of funding for the period 2010–2019 is 6.4 million euros.¹⁶⁸ The instrument was also opened to Israeli and French applicants in 2015.¹⁶⁹

both the German research policy as a whole and the respective German research organisations have increasingly had to focus their activities on these emerging research nations.¹⁷⁰ VAmongst the BRICS countries, the BMBF invested by far the most resources in cooperation with China in the period from 2011 to 2015 (around 91.4 million euros) followed by Russia with around 43.8 million euros.¹⁷¹ The largest growth in

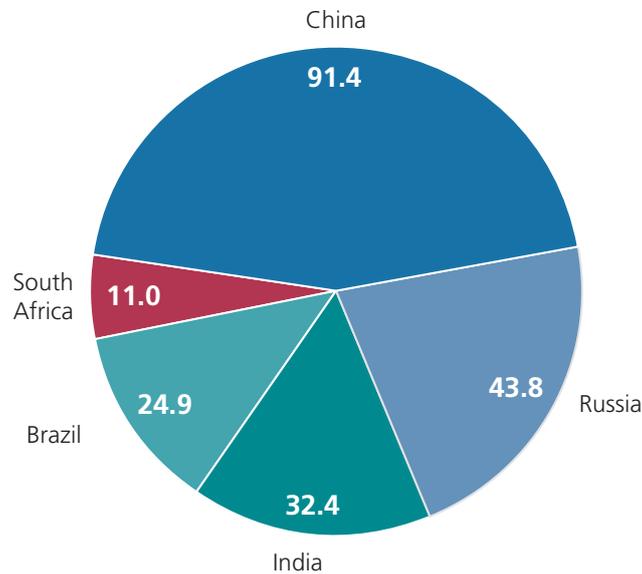
¹⁶⁸ DLR-PT figures as of: December 2015. For basic information on this funding instrument, see <http://www.gesundheitsforschung-bmbf.de/de/2550>.

¹⁶⁹ See Guidelines for funding “Multilateral Collaboration in Computational Neuroscience: Germany – USA – Israel – France” dated 10/08/2015, at <http://www.gesundheitsforschung-bmbf.de/de/5651.php>.

¹⁷⁰ BMBF (2016): Federal Government Report on Research and Innovation 2016, Part V “International Collaboration in Research and Innovation”; DAAD (2013); DAAD 2020 Strategy, Bonn, p. 8.

¹⁷¹ The information in this section is based on PROFI evaluations by the DLR-PT from March 2016. Nota bene: in each case these are data on bilateral cooperation with individual BRICS countries from which trends in such cooperation

Figure 7: Cooperation with the BRICS countries 2011–2015 (in millions of euros)



Source: PROFI evaluations by DLR-PT, March 2016.

resources is recorded by India: here the resources applied have quintupled since 2008 (from 1.4 million euros to 7.2 million euros in 2015). This is partly due to establishment of the “Indo-German Technology Centre (IGSTC)” in 2010, which promotes cooperation between German and Indian researchers and industry partners, but also to increased activities in the thematic programmes. Investments in German-Brazilian cooperation have also risen sharply in recent times: from around 2.3 million euros in 2011, the allocation of expenditure has almost tripled to around 6.8 million euros in 2015. There was a similar increase, if at a lower level, in investments for cooperation with South Africa (from around 1.1 million euros in 2011 to around 2.9 million euros in 2015).

can be extrapolated. In addition, the BMBF made investments in multilaterally oriented support measures in which (also) BRICS countries were involved; for the years 2011 to 2015, the expenditure for BRICS-related multilateral funding amounted to around 72.5 million euros.

By far the most important subject area in cooperation with the BRICS countries – as well as for BMBF activities overall (see Section 2.1) – are climate, environmental and sustainability issues (at around 140.4 million euros more than half the total expenditure for the years 2011– 2015). An increasingly important role is also played by cooperation in the field of vocational education and training.¹⁷² An illustrative example of the current strategic orientation towards the BRIC(S) countries is the further development of the Chancellor Fellowship funding instrument. It has funded young executives from abroad since 1990 and is managed by the AvH. Initially limited to the USA, it was extended in recent years to Russia (since

¹⁷² See also Section 3.1. For further information on current co-operation activities with individual BRICS countries in vocational education and training, see the Federal Report on Research and Innovation 2016, Section 3.2 “Collaboration with the BRICS countries”.

2002), China (since 2006) and more recently also to Brazil and India (since 2013).

As explained in Section 3 collaboration with “developing countries” is identified as a separate objective in the internationalisation strategy (target area 3). There is no uniform definition for the terms “**emerging and developing countries**”. The majority of these countries, however, display common characteristics, such as a low per capita income, poor healthcare and poor educational opportunities.¹⁷³ Whilst as a rule the development cooperation emanates from the requirements of the partner countries, science and research cooperation places the existing potential at the forefront and builds on this in terms of Germany’s interests. This furthers mutually beneficial cooperation; capacity building on the one side and access to resources on the other, for example. One current focus is on collaboration with **Africa**. In the years 2011 to 2015, in which also the “Federal Government’s Africa policy guidelines” and “The Africa Strategy 2014–2018” of the BMBF were adopted (both documents from 2014, see also Section 3.1), the annual expenditure on project funding in sub-Saharan Africa rose continuously from around 16 million euros to around 41 million euros.¹⁷⁴ A programme like “Welcome to Africa”, under which the DAAD has funded German-African research and university cooperation since 2012, deals comprehensively with this geographical focus.

Besides Africa, developing and emerging countries in **Asia and Latin America** are increasingly

¹⁷³ Cf., for example, the indicator selection in World Economic Forum (2015): The Global Competitiveness Report 2015–2016, Geneva, p. 6.

¹⁷⁴ PROFI evaluations by DLR-PT, March 2016.

becoming the focus of attention. In May 2013 for the first time a BMBF measure for “Funding research collaboration with developing countries in the Asia Pacific region and of the Latin American and Caribbean region” was launched to extend the internationalisation of German universities and to strengthen the innovation systems of the target countries.¹⁷⁵ A total of 35 target countries were defined for the Asia Pacific region (including 22 Pacific Island States) and Latin America includes all countries with the exception of the focus countries Argentina, Brazil, Chile, Colombia and Mexico, with which long-lasting partnerships are already in place as part of science & technology cooperation and regular bilateral funding measures. Up to 2016, this measure funded 14 projects in the Asia Pacific region and 15 projects with the countries of Latin America and the Caribbean. Whereas the first round of invitations was targeted mainly on mobility measures, the second round of invitations in April 2016 will be extended to include strategic project funding and, therefore, also involve joint research projects.¹⁷⁶

4.3 International organisations and research infrastructures

Those involved in the German research and education system shape the framework conditions

¹⁷⁵ Bekanntmachung des Bundesministeriums für Bildung und Forschung im Rahmen der Strategie der Bundesregierung zur Internationalisierung von Wissenschaft und Forschung von Richtlinien zur Förderung der Zusammenarbeit mit Entwicklungsländern des Asiatisch-Pazifischen Raums und der Region Lateinamerika und Karibik in der Forschung, 06/05/2013.

¹⁷⁶ Current data in this section are based on DLR-PT information (as at: March 2016).

and structures of international cooperation in many ways. This “input”, in particular in the form of resources and legal framework conditions for international cooperation, has already been outlined in Section 2.1 by way of introduction. Germany’s involvement in international organisations and forums is a key building block in this respect. In particular as a contracting country of the **United Nations** and, therefore, also the **United Nations Organisation for Education, Science and Culture (UNESCO)** and of the **Organisation for Economic Cooperation and Development (OECD)** as well as a member of the informal alliance **Group of 7 (G7)**, Germany together with its international partners can be involved in setting the research policy agenda and defining standards for an increasingly global network for research.¹⁸⁰ The activities of Leopoldina as the representative of German research at international level, particularly in the context of policy advice to the G7 Academies of Science, and the long-standing cooperation of BIBB with the UNESCO international vocational education and training centre (UNESCO-UNEVOC) serve as illustrative examples of the commitment of German research institutes within international organisations (see Section 3.2.2).

The analysis and consultancy activities of the OECD should be particularly emphasised in the context of the present report. In order to be able to measure, compare and improve the performance of various research and innovation systems, the first step that is necessary is to agree upon common standards for the collection and interpretation of data. This is achieved, for example, by the OECD Frascati Manual, which has stipulated rules for the collection of statisti-

cal data on research and development since the 1960s. The latest revision of this manual, with active BMBF participation, was undertaken between 2013 and 2015 in order to adapt international R&D statistics to changes in the international framework conditions.¹⁷⁷ One challenge here is to maintain the basic definitions to the extent that substantial time periods can continue without interruption, thus, allowing long-term trends to be identified. Regular OECD publications in the field of statistics within research to which this report also refers are the Science, Technology and Industry Outlook – STI Outlook (last published in 2014) and the STI Scoreboard (last published in 2015).¹⁷⁸

The growing need for transnational and long-term cooperation is also particularly clear in the area of large-scale research infrastructures. Depending on the research area, such infrastructures often only enable top-level research – and because of the necessary resources can only be established and operated together with a number of partner countries. The focus of international cooperation activities in the area of research infrastructures is on third countries with strategic importance for the development, exploitation and management of exceptional research infrastructures. Special focus is on the countries of the so-called “Group of 7+5”, consisting of the G7 (Germany, France, Italy, Japan, Canada, USA and the United Kingdom) and the five largest emerging countries (Brazil, China, India, Mexico and

¹⁷⁷ For further information see <http://www.kooperation-international.de/detail/info/frascati-manual-2015-oecd-fue-statistikhandbuch-aktualisiert.html>.

¹⁷⁸ For an overview of OECD activities and publications in the area of research, see <http://www.kooperation-international.de/buf/organisationen/oecd/forschung/ziele.html>.

South Africa) as well as Australia. Cooperation with these countries in the area of research infrastructures occurs inter alia through participation in the G7 “Group of Senior Officials” (GSO). In addition to the G7 countries, this group currently also includes Australia, Brazil, China, India, Mexico, Russia and South Africa. At the G7 meeting of Science Ministers in 2015, presided for the first time by Germany, the GSO submitted a progress report that also contains a list of national research infrastructures of potential global interest.¹⁷⁹ These proposals were submitted by individual GSO members. Other GSO countries voiced suggestions regarding the proposed research infrastructures on the list. This should result in a series of new international collaborations.

Three ESFRI projects listed on Germany’s “National Roadmap for Research Infrastructures” (see Section 2.2) also include the involvement of international partner countries: South Africa in the Cherenkov Telescope Array (CTA) from the particle astrophysics research area, Russia and India in the “FAIR” accelerator centre (Facility for Anti-proton and Ion Research in Europe) and again Russia in the “XFEL” X-ray laser facility (European X-ray free electron laser facility). Russia and Mexico have also expressed interest in cooperating with the PETRA III storage-ring-based X-ray radiation source (see info box).

The extension of PETRA III within DESY

The Deutsche Elektronen-Synchrotron (DESY – German Electron Synchrotron) is one of the world’s leading centres for research with photons, particles and particle astrophysics as well as accelerator physics. It was established as a foundation in Hamburg on 18 December 1959. On 1 January 1992, DESY was extended by a second location in Zeuthen. Besides the accelerator activities, the main focus of research in Zeuthen is in particle astrophysics. DESY employs more than 2,300 personnel with a current total budget of approximately 320 million euros. On its research campus in Hamburg, DESY operates the x-ray radiation source PETRA III and the x-ray laser FLASH, which as state-of-the-art research facilities are available to more than 2,000 groups of researchers from all over the world. The PETRA III Extension (in construction) will ensure its status as a globally leading synchrotron. DESY offers “special access groups” for international research groups to share PETRA III, via which organisations contribute to the construction and operation of the facility and receive testing time in return. Russia and Mexico have accordingly already expressed interest in cooperation with PETRA III.

¹⁷⁹ For further information and the “Group of Senior Officials Progress Report 2015” see <https://www.bmbf.de/de/die-deutsche-g7-praesidentschaft-273.html>.

5. Inter-organisational cooperation – Success stories

German research and intermediary organisations cooperate in a variety of ways with each other and with science and research organisations worldwide. Section 3 (“Strategies and instruments for internationalisation”) has already covered collaboration with research institutes, universities and companies from abroad. This overview will be supplemented below by means of selected examples of inter-organisational cooperation at national level, which have an explicitly international focus.

For instance, the Deutsche Wissenschafts- und Innovationshäuser (**DWIH – German Houses of Research and Innovation**) established in 2009 are designed to improve the coherent appearance of German research abroad. The five Houses currently in New York, Moscow, New Delhi, Sao Paulo and Tokyo showcase German science and research services and research-based companies. They also serve as platforms for international collaboration.¹⁸⁰ The DWIH initiative is run by the Foreign Office in agreement with the BMBF and in collaboration with the Alliance of German Science and Research Organisations¹⁸¹ as well as the German Chamber of Commerce and Industry in Japan and the Association of German Chambers of Industry and Commerce. The German Houses of Research and Innovation are in each case man-

aged in situ by one or two organisations (DAAD; DFG; HRK or the German Chamber of Commerce and Industry in Japan).¹⁸²

The AvH, DAAD, DFG and Fraunhofer also form the group **“International Research Marketing”** funded by BMBF since 2010. This group promotes Germany as a research location both within Germany and abroad¹⁸³ and is part of the new **“Research Marketing Action Alliance”** formed in 2015 (cf. Section 3.2.2 “Strategic Instruments”).

Other examples from the range of strategic internationalisation instruments are **joint research awards**, such as the Max Planck Research Award bestowed by AvH and MPG, which supports cooperation between foreign and German researchers in selected subject areas.¹⁸⁴ The strategic orientation towards international cooperation is also served by the project already portrayed in Section 3.2.1 **“Profile data on the internationality of German universities”** under which AvH, DAAD and HRK gather data on the state of international cooperation at German universities and regularly publish the results of their analy-

¹⁸⁰ For further information and links to the DWIH websites, see <http://www.bmbf.de/de/16877.php>.

¹⁸¹ Represented in the Alliance are AvH, DAAD, DFG, Fraunhofer, HGF, HRK, MPG, Leibniz, Leopoldina and German Science Council.

¹⁸² Consideration currently being given at the political level as to whether to transfer leadership in coordination of DWIHs to the DAAD. Interview with DAAD on 02/10/2015, Bonn.

¹⁸³ Further information at http://www.dfg.de/dfg_profil/internationale_zusammenarbeit/internationaler_kontext/forschungsmarketing/index.html.

¹⁸⁴ Further information at <http://www.humboldt-foundation.de/web/max-planck-preis.html>.

ses. The **“Alumniportal Deutschland”** is where AvH, DAAD, the Goethe Institute and GIZ conduct their inter-organisational work. Its website provides networking options, event information and job vacancies for international graduates of all German continuing education providers and universities.¹⁸⁵

Examples from the area of project funding are the one-year **Leibniz-DAAD Research Fellowships** first awarded in 2011. They are directed towards post-doctoral researchers from abroad who would like to conduct research at a Leibniz Institute in Germany; around 15 fellows are selected every year. In 2014 the Leibniz Association and DAAD concluded an unlimited cooperation agreement to continue their joint funding programme indefinitely.¹⁸⁶

The **GIZ** in turn seeks inter-organisational **cooperation in the education sector**, in particular with the **DAAD** and **BIBB**. In 2012 the GIZ concluded fundamental cooperation agreements both with DAAD¹⁸⁷ and with BIBB.¹⁸⁸ One example of a GIZ-DAAD cooperation is the GIZ project for the set-up of the German-Mongolian University for Raw Materials and Technology (2013–2016; an extension until 2019 is being sought) on behalf of the BMZ. The DAAD is involved here through the secondment of German lecturers and within the framework of cooperation with Ger-

man universities.¹⁸⁹ GIZ, BIBB/GOVET and others involved in German vocational education and training are currently cooperating increasingly in Mexico, to promote further development of the Mexican model of the dual vocational education and training system¹⁹⁰ (see also Section 3.2.4).

¹⁸⁵ Further information at <https://www.alumniportal-deutschland.org/startseite.html>.

¹⁸⁶ Monitoring Report 2015, Leibniz Annex, p. 47.

¹⁸⁷ DAAD Annual Report 2012, p. 38. A renewed GIZ-DAAD cooperation agreement is in preparation for the year 2016. Interview with GIZ on 11/12/2015, Eschborn.

¹⁸⁸ Cooperation agreement between BIBB and GIZ GmbH, 09/11/2012, available at https://www.bibb.de/dokumente/pdf/kooperationsabkommen_9_november_2012.pdf.

¹⁸⁹ For further information see <https://www.giz.de/de/weltweit/23147.html>.

¹⁹⁰ Interview with GIZ on 11/12/2015, Eschborn, plus subsequent e-mail contact.

6. Outlook

The present report aims – as did the first report from 2014 – to accompany the implementation of the Federal Government’s internationalisation strategy adopted in 2008 and of the of the BMBF “International Cooperation Action Plan” from 2014. Therefore, it highlights current priorities for the BMBF and the research and intermediary organisations. Both the conceptual and strategic level have been examined, as well as specific instruments for implementation of the internationalisation objectives. The report’s goal is to provide a summary of previous high points and experiences and offer an outlook with regard to future developments.

The analysis shows a dynamic development in three areas in particular: The first is that German research organisations have been very intensively involved with strategic issues of internationalisation in the past seven years. Important results of this process are the adoption of (organisation-specific) internationalisation strategies and – increasingly – the establishment of internal monitoring systems for indicator-based orientation of the respective internationalisation activities.

The second is that selected, existing funding and cooperation instruments were made available specifically for international collaboration. The third is above all that numerous internationalisation instruments were newly developed and tested. In 2016 many meaningful experiences gained in implementing this newly developed generation of internationalisation instruments will become available – in this context, evaluation

processes have been conducted within organisations, in particular since 2015. These practical experiences from the German research organisations together with the forthcoming update of the internationalisation strategy in 2016 (“Federal Government Strategy for the Internationalisation of Education, Science and Research 2016”) will dominate future debate.

List of abbreviations

AA	Auswärtiges Amt – Foreign Office
AAL	Active and Assisted Living Research and Development Programme
ACP	African countries, the Caribbean and the Pacific (ACP countries)
AIMS-NEI	AIMS-Next Einstein Initiative
AIMS-Senegal	African Institute of Mathematical Sciences in Senegal
AvH	Alexander von Humboldt Foundation
AWI	Alfred Wegener Institute at the Helmholtz Centre for Polar and Marine Research
BBI	Bio-based Industries
BewGr-MPG	Management principles for institutions funded under the MPG implementation agreement
BIBB	Bundesinstitut für Berufsbildung – Federal Institute for Vocational Education and Training
BMBF	Bundesministerium für Bildung und Forschung – Federal Ministry for Education and Research
BMU	Bundesministerium für Umwelt – Federal Ministry for the Environment
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung – Federal Ministry for Economic Cooperation and Development
BRICS	Brazil, Russia, India, China and South Africa (BRICS countries)
CERN	European Organisation for Nuclear Research (Conseil Européen pour la Recherche Nucléaire)
DAAD	Deutscher Akademischer Austauschdienst – German Academic Exchange Service
DAC	Development Assistance Committee (OECD)
DFG	Deutsche Forschungsgemeinschaft – German Research Foundation
DIHK	Deutscher Industrie- und Handelskammertag – German Association of Chambers of Industry and Commerce
DLR	Deutsches Zentrum für Luft- und Raumfahrt – German Aerospace Center
DLR-PT	DLR Projektträger – DLR Project Management Agency
DWIH	Deutsche Wissenschafts- und Innovationshäuser – German Houses of Research and Innovation
DZWH	Deutsches Zentrum für Hochschul- und Wissenschaftsforschung – German Centre for Higher Education and Scientific Research
EARTO	European Association of Research and Technology Organisations
EASAC	European Academies Science Advisory Council
ECORDA	External Common Research Data Warehouse (ECORDA database)
ECSEL	Electronic components and systems
EDCTP2	European and Developing Countries Clinical Trials Partnership Programme

EIP	European Innovation Partnerships
EIT	European Institute for Innovation and Technology
EMPIR	European Metrology Programme for Innovation and Research
ERA	European Research Area
ERC	European Research Council
ERIC	European Research Infrastructure Consortium
ESA	European Space Agency
ESFRI	European Strategy Forum for Research Infrastructures
EUA	European University Association
Eurostars-2	Research and development programme to support European cooperation amongst small and medium-sized enterprises
EUROSTAT	Statistical Office of the European Union
FCH 2	Fuel Cells and Hydrogen 2
Fraunhofer	Fraunhofer Society
FIS	Large research infrastructures
FNR	Fonds National de la Recherche
FRP	EU Research Framework Programmes
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit – German Corporation for International Cooperation
GJU	German-Jordanian University
GOVET	German Office for International Cooperation in Vocational Education and Training
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit – German Corporation for Technical Cooperation
GUC	German University in Cairo
HGF	Hermann von Helmholtz-Gemeinschaft Deutscher Forschungszentren – Hermann von Helmholtz Association of German Research Centres
HIS	Institut für Hochschulforschung – Institute for Research on Higher Education
HRK	Hochschulrektorenkonferenz – German Rectors’ Conference
IAP	InterAcademy Panel on International Issues
ICON	International Cooperation and Networking
ICPC	International Cooperation Partner Countries
IGSTC	Indo-German Technology Centre
IMI 2	Innovative Medicines Initiative 2
iMOVE	International Marketing of Vocational Education
IVF	Impuls- und Vernetzungsfonds – Initiative and Networking Fund
KIC	Knowledge and Innovation Communities
Leibniz	Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V. – Gottfried Wilhelm Leibniz Scientific Association

List of abbreviations

Leopoldina	Deutsche Akademie der Naturforscher Leopoldina e. V. – Nationale Akademie der Wissenschaften – National Academy of Sciences
LERU	League of European Research Universities
MPC	Mediterranean Partner Countries
MPG	Max Planck Society
NMP	Nanosciences, Nanotechnologies, Materials and new Production Technologies
OECD	Organisation for Economic Co-operation and Development
PAU	Pan-African University
R&D	Research and Development
SME	Small and medium-sized enterprises
TDU	Türkisch-Deutsche Universität – Turkish-German University Istanbul
VETnet	German Chambers worldwide network (AHK) for cooperative, work-based Vocational Education & Training

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