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Country Note Germany

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General Information on EFFORTI

EFFORTI (Evaluation Framework for Promoting Gender Equality in R&I) seeks to analyse and model the influence of measures to promote gender equality on research and innovation outputs and on establishing more responsible and responsive RTDI (research, technology, development, innovation) systems. For this purpose, EFFORTI will

- develop an evaluation framework which enables evaluators, science managers, policy-makers and programme owners to conduct a sound analysis of the research and innovation outputs, outcomes and impacts of gender equality measures across Europe, with a focus on the national level;
- design a differentiated concept to analyse a variety of policy measures and assess their performance, taking into account the diversity in the national policies as well as organisational contexts;
- derive general lessons for evidence-based and thus "good" policy-making in the field of gender equality within RTDI systems. This means that not only has progress towards more gender equality in RTDI been achieved, but also that RTDI has been able to benefit from this progress through enhanced scientific and innovation outputs and productivity, as well as through a higher responsiveness to societal needs and challenges.

Terms of use

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0 Introduction

This German Country Note is one of seven country notes that were written as part of the H2020 project EFFORTI (Evaluation Framework for Promoting Gender Equality in R&I, No 710470) to analyse the context in which gender equality measures in RTDI take place. EFFORTI seeks to analyse and model the influence of measures to promote gender equality on research and innovation outputs and on establishing more responsible and responsive RTDI (research, technology, development, innovation) systems.

The main objective of this report is to understand the influence of wider contextual framework conditions in Germany on structuring the situation of women in RTDI, their career opportunities and, subsequently, on the effects of gender equality measures in RTDI. Based on the objectives of the EFFORTI project we have considered following contextual framework conditions as relevant:

- the structure and performance of the research and innovation system,
- gender equality policies in the labour market and welfare policies related to reproductive work and child-care,
- the governance and existing policies of gender equality in RTDI and
- the evaluation culture and policy especially in the field of gender equality in RTDI.

In a concluding chapter the findings of each country note are summarised. This provides a better understanding of how gender equality policies in RTDI are related to the innovation system on the one hand and to broader policies of gender equality and welfare regimes on the other.

With this report we acknowledge the need to analyse the structure and governance of innovation systems and the societal environments in terms of the opportunities and constraints offered by various gender, welfare and innovation regimes for women's employment. This task is particularly important as programmes and initiatives to promote gender equality in RTDI are located at the interface of different policy environments of the innovation system and gender equality as well as welfare policies. For each EFFORTI country (Austria, Denmark, France, Germany, Hungary, Spain, Sweden) such a report was compiled because the selected programmes and initiatives that will be analysed as case studies, are embedded in different contexts and interact differently with their environment. The national country notes will provide a better understanding of these contexts.

Subsequently, the seven national country notes will be compared with each other in a comparative report. The comparative report will focus on the interfaces between the three domains innovation system, welfare and gender equality policy initiatives as well as of evaluation cultures and how they are reflected in gender equality programmes in RTDI. A special emphasis will be put on how gender equality policies are embedded in and aligned with national innovation policies.

Methodology

Most of the research carried out in preparation of the national country notes is desk-based (secondary data collection and analysis of international and national literature). Additional local and sector-level information have been obtained through expert interviews with key informants and through national workshops with stakeholders and evaluators in cases where the information was not available in the collected data or literature.

1 Innovation System

1.1 Structure of the research and innovation system

1.1.1 Ranking in the European Innovation Scoreboard (Rank and Class)

According to the European Innovation Scoreboard (EIS) – previously Innovation Union Scoreboard (IUS) – Germany has had an innovation performance well above that of the EU average for over a decade and is part of the group of **innovation leaders** with an innovation index that has grown at an average annual growth rate for 2008-2015 of 0.2% (EIS 2016, 13[1]). Therefore, Germany belongs to the Top 5 of innovative countries in the EU as Table 2 indicates.

Table 1: Summary Innovation Index of EIS for 2008 to 2015

	Summary Innovation Index							
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
EU	0.495	0.502	0.511	0.514	0.519	0.521	0.523	0.521
Germany	0.624	0.636	0.654	0.655	0.667	0.661	0.655	0.632

Source: EIS 2016 database[2]

Table 2: Ranking in the EIS between 2008 and 2015

	EIS Ranking							
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
EU	15	15	15	15	15	15	15	15
Germany	5	5	4	4	4	4	5	5

Source: EIS 2016 database

Up until 2012, Germany's innovation performance increased but then started to decline. "Relative to EU, performance was highest at 28% above the average in 2012, but has dropped to 21% above the EU in 2015. Germany's strongest dimensions are **firm investments and innovators**. In all other dimensions except open, excellent and attractive research systems, the country is also performing above the EU average. Relative weaknesses are the **integration of Non-EU doctorate students** and **license and patent revenues from abroad**. Performance has improved most strongly in license and patent revenues from abroad (32%), Non-R&D innovation expenditures (6.3%), and International scientific co-publications (6.3%). Strong performance declines are observed for Non-EU doctorate students (-5.8%) and Sales share of new product innovations (-5.5%). Provisional CIS 2014 data show worsened performance for four and improved performance for two indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.632 to 0.629 assuming that for the other indicators performance would not change." (EIS 2016, 51)

With regard to the dimension of performance in human resources, Germany only manages to perform at the EU average but does perform very well in doctoral education (EIS 2016, 19). However, Germany's performance providing an **open, excellent and attractive research systems** is below the EU average due to a low share of non-EU doctorate students at only 42% of the EU average (EIS 2016, 20) and a

[1] http://ec.europa.eu/DocsRoom/documents/17822

[2] http://ec.europa.eu/DocsRoom/documents/17823/attachments/1/translations/en/renditions/native

strong performance decline in that respect as already mentioned. In terms of **firm investments** Germany and Sweden are the overall leaders. This means that companies invest more in innovation activities, both for science-based R&D activities and non-R&D innovation activities, including investments in advanced equipment and machinery than in other EU countries. Still it can be observed that the group of small and medium-sized enterprises (SMEs), which is particularly relevant for the German economy, shows signs of weaker investments in recent years (EFI 2015). However, "the overall performance improvement of the EU is higher than that for 24 Member States which is a direct result of the fact that Germany contributes more than one-third to the EU's overall business R&D expenditures and non-R&D innovation expenditures." (EIS 2016, 22) Concerning the **performance in innovators** Germany has recently lost its top position and follows Ireland on rank 2. In contrast to these positive indicators, the **performance in intellectual assets** has decreased for Germany, as well as for two other Innovation Leaders namely Denmark and Sweden (EIS 2016, 24).

The identified challenges for Germany's R&I system are:

1. Counteracting the trend of declining innovation activities in German SMEs - German economy relies more than most other countries on a strong base of SMEs. Hence, the slowdown of innovation investment from this particular group of firms requires further insights and subsequent policy responses.
2. Improve framework conditions for and supply of venture capital – in EU comparison the venture capital market in Germany is underdeveloped and stagnant.
3. Counteracting adverse trends in human capital availability - The human capital underlying the German R&I system is challenged by a disproportionally large share of soon to retire scientists and engineers and by a shift in the career choices of secondary school students. (Sofka and Sprutacz 2016, 7)[3]

On the meta-level of R&D policy making Germany also faces challenges when it comes to establishing formats for the participation of civil society. Additionally, it can be observed that the pace of incorporating new technologies or addressing new service innovations is sometimes quite slow in Germany – a fact that also holds true for the relevant policy institutions.

1.1.2 Development of the R&D sector and its subsectors

1.1.2.1 Development of GERD (share of gross domestic expenditure on R&D) between 2009 and 2015

The status of R&D in Germany is of major importance and there is an enormous and increasing political will as well as engagement within the business sector to support R&D expenditures (see Table 3).

Table 3: Development of GERD (gross domestic expenditure on R&D) as a percentage of GDP for 2005, 2009 and 2014

	2005	2009	2014
EU-28	1.76	1.94	2.03
Germany	2.42	2.72	2.87

[3] https://rio.jrc.ec.europa.eu/en/country-analysis/Germany/country-report

Source: Eurostat 2017c

Table 4: Development of GERD (gross domestic expenditure on R&D) as a percentage of GDP between 2005 and 2014 by sector of performance

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EU 28	**All sectors**	1.76	1.78	1.78	1.85	1.94	1.93	1.97	2.01	2.03	2.03
	BES	1.1	1.13	1.13	1.17	1.2	1.19	1.25	1.28	1.29	1.3
	GOV	0.24	0.23	0.23	0.24	0.26	0.25	0.25	0.25	0.25	0.25
	HES	0.4	0.4	0.4	0.42	0.46	0.47	0.46	0.47	0.48	0.47
	PNP	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Germany	**All sectors**	2.42	2.46	2.45	2.6	2.72	2.71	2.79	2.87	2.83	2.87
	BES	1.68	1.72	1.71	1.8	1.84	1.82	1.89	1.95	1.9	1.95
	GOV	0.34	0.34	0.34	0.36	0.4	0.4	0.41	0.41	0.42	0.42
	HES	0.4	0.4	0.39	0.43	0.48	0.49	0.5	0.51	0.51	0.49
	PNP	:	:	:	:	:	:	:	:	:	:

Source: EUROSTAT: Total intramural R&D expenditure (GERD) by sectors of performance[4]

"Gross R&D expenditures (GERD) in Germany have reached €83.9b in 2014 or 2.88% of GDP.3 GERD in Germany amounts to almost 30% of all R&D expenditures in EU-28. GERD has grown by 20% between 2010 and 2014. Government budget appropriations or outlays for research and development (GBAORD) amount to €25.4b in 2014, which is 5.4% higher than in 2012. Business expenditures on R&D (BERD) account for 1.95% of GDP in 2014 which is slightly higher than in 2013 (1.9%). The relationship between government and private R&D investment in Germany is very stable over the years with two-thirds (68% in 2014) being performed by the private sector. Investments in R&D by both government and private sector in Germany have consistently increased even in times of severe economic stress from financial and economic crises." (Sofka and Sprutacz 2016, 13)

As a committed member to the European Union Germany follows a target of 3% of GDP being invested in R&D according to the Lisbon Strategy with two thirds stemming from the business sector. This goal is well within reach with 2.88% in 2014.

Concerning EU R&D budgets, "Germany has received a total €4.02b for projects related to Research, Technology and Development (RTD) as part of the EU Structural Funds between 2007 and 2012 (RIO elaboration on DG Regio data). This is a strong increase compared to the total receipts of €2.2b for RTD in Germany between 2000 and 2006. It should be noted that data refer to allocated funds and not to the real execution.

Focusing on the participation in EU framework programs, Germany received 4,388 projects from the FP6 programme with €3.02b in funding. That equals 19.2% of all EU funds allocated in FP6. By comparison, Germany received only 17.6% of EU funds from FP7, with 8,897 projects and €7.2b in funding. Success rates of applications from Germany are above average (24%) compared to the EU average of 20.4% (European Commission, 2014b). In absolute terms, Germany is the largest recipient of FP7 but as a percentage of GDP, its share is below EU average. Characteristic for FP7 projects from Germany is that a high share of projects involves the private sector (33%) (BMBF, 2014a). Within

[4] http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Horizon 2020 Germany seems well positioned to increase its share of funding with a current funding level of 20.3% of total EU funds." (Sofka and Sprutacz 2016, 29)

1.1.2.2 Development of number of researchers between 2009 and 2015 in the whole R&D sector and its subsectors

The German government has provided increasing budgets over the past decade to secure and increase the number of R&D personnel within the public but also private sector. Even during the financial crisis, which started around 2008, there was no decline in public R&D budgeting but an increase since successful activities in this policy field are seen a cure to overcome economic hardship.

The following tables illustrate this development in more detail.

Table 5: Number of researchers in all R&D sectors by years (in full time equivalents)

	EU 28	Germany
2005	1,374,760	272,148
2006	1,422,499	279,822
2007	1,458,115	290,853
2008	1,523,245	302,641
2009	1,555,606	317,307
2010	1,602,765	327,996
2011	1,626,802	338,689
2012	1,680,987	352,419
2013	1,731,241	354,463

Source: Eurostat 2016f

Table 6: Number of researchers in the BES by years (in full time equivalents)

	EU 28	Germany
2005	626,081	166,874
2006	654,004	171,063
2007	667,464	174,307
2008	695,179	180,295
2009	695,602	183,214
2010	719,935	185,815
2011	747,215	190,693
2012	792,692	199,623
2013	830,713	198,585

Source: Eurostat 2016f

Table 7: Number of researchers in the HES by years (in full time equivalents)

	EU 28	Germany
2005	551,459	65,363
2006	566,464	67,273
2007	585,624	72,985
2008	618,351	77,004
2009	642,780	84,852
2010	663,331	90,398
2011	656,965	93,811
2012	661,902	97,199
2013	675,973	99,123

Source: Eurostat 2016f

Table 8: Number of researchers in the GOV by years (in full time equivalents)

	EU 28	Germany
2005	181,758	39,911
2006	185,036	41,486
2007	188,306	43,561
2008	192,370	45,342
2009	199,210	49,241
2010	201,547	51,783
2011	203,821	54,185
2012	207,428	55,597
2013	210,635	56,755

Source: Eurostat 2016f

Generally speaking, one of the major challenges for Germany is “counteracting adverse trends in human capital availability“ which was already pointed out. The RIO country report provides a solid description of the related circumstances: “A lack of skilled personnel has been identified as one of the main emerging constraint facing the German R&I system (OECD 2012; EFI 2014; Voigt 2014). Two trends influence the human capital underlying the German R&I system. The first is rooted in an overall aging society and a large share of soon to retire scientists and engineers. Until 2030, more than half of today's highly skilled professionals without a university education will have left the workforce. Depending on the labour force participation rate, net immigration of between 346.000 and 533.000 people per year until 2050 will be needed to keep the working population stable (Bertelsmann Foundation 2015). The decline in new business start-ups in the last few years may also be linked to the onset of first effects of demographic change (EFI 2015). The second trend stems from a shift in the career choices of secondary school students. The German R&I system has traditionally benefitted from a labour force in which innovation is not exclusively the task of university trained scientists and engineers but is based on a specific combination of highly qualified university graduates and highly skilled workers from the dual vocational education system. While in the mid-1960s, 92% of school leavers entered into vocational training and only 8% enrolled in university education, in 2011 the share of newly enrolled university students (50.1%) and the share of newly enrolled participants in dual training (49.9%) were almost equal. Among professions for which apprenticeship supply does not meet demand are several with relevance for R&I in Germany:

Technicians (-10%), electrical technician (-10%) and IT (-11%). Today, also fewer dual educated workers advance to an engineering level through further education and training. Numbers of students in STEM subjects have been increasing over the past years but dropout rates in STEM study programmes are seen as reducing the pool of qualified scientists, with 39% of university students in maths and natural sciences not finishing their studies." (Sofka and Sprutacz 2016, 11)

Furthermore, the case of university employment and the situation for junior researchers can be described as follows: "Universities employed 662,076 employees in 2013, 56% of those employees are research or artistic personnel, 44% fulfil administrative, technical or similar jobs. […] University employment has increased consistently: Total employment has increased by 7% between 2011 and 2013, research/artistic personnel by 10% during the same time period. Overall, the growth of university employment in Germany is consistent and was not interrupted by the economic crisis of 2009. However, the increase in students has been stronger than the increase in university personnel. The ratio of students per full-time research/artistic personnel had its lowest level since 1995 in 2010 with 10.5 and has since increased to 11.2 in 2013. The Federal Government has agreed in September 2015 to reform the Fixed-term Employment in Higher Education and Research Act (*Wissenschafts-zeitvertragsgesetz*). The previous version of the law was criticised for example by the union for education and science (*Gewerkschaft Erziehung und Wissenschaft*) for inflating the number of short-term employment contracts for junior researchers and reducing their opportunities for career planning. The revised law ties the duration of the employment contact directly to the desired level of qualification, e.g. a PhD project, or third party grant (*Drittmittel*). Permanent tasks and related employment contracts are supposed to be separated from scientific or artistic training. Finally, the Federal Government is in the process of negotiating a broader initiative for predictable careers in science with States governments. The latter are primarily in charge of financing and regulating university education. (Sofka and Sprutacz 2016, 61-62)

1.2 Knowledge intensity of economies

1.2.1 Share of ISCED 6 STEM graduates in the whole population

This subsection shows the share of ISCED 6 STEM graduates in the whole population and will be estimated per million to create a clearer overview. ISCED and STEM can be defined as follows: ISCED is an International Standard Classification of Education developed by the UNESCO to facilitate comparisons of education statistics and level 6 includes secondary stage of tertiary education, e.g. Ph.D. programmes. Furthermore, STEM refers to the academic disciplines of science, technology, engineering and mathematics.

From Table 9 we find that the share of ISCED 6 STEM graduates in the whole population increased steadily, particularly from 2010 onwards.

Table 9*:* **Share of ISCED 6 STEM graduates in the whole population**

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Germany	0.00010 957	0.00010 369	0.00010 658	0.00011 564	0.00011 428	0.00012 434	0.00013 224	0.00013 78	0.00014 798

Source: Innovationsindikator 2015[5]

1.2.2 Proportion of scientists and engineers in total labour force

Classic manufacturing sectors are of major importance for the German economy: "They accounted for 34.4% of total gross value added in 2013. In comparison, manufacturing sectors have a higher importance for the German economy than for the average of EU-28 with gross value added shares of 26.2% from manufacturing in 2012 (latest available year). Moreover, compared with the average economic structure of EU-28, Germany has a high percentage of employment in high- and medium-high tech manufacturing sectors. 9.8% of employees in Germany worked in such sectors in 2014 (EU-28 average: 5.7%). In terms of employment in knowledge intensive sectors, Germany (2014: 39.7% of employment) is fairly aligned with the average of EU-28 (2014: 39.8%)." (Sofka and Sprutacz 2016, 13)

Observably there is an increase of the proportion of scientist and engineers in the active population between 15 and 74 years by year but a stagnation when it comes to employment in knowledge-intensive activities as the following tables indicate.

Table 10: Proportion of scientists and engineers in the active population between 15 and 74 years by year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	:	:	:	4.9	4.9	5.0	6.4	6.5	6.6	6.6	6.8
Germany	5.3	5.4	5.4	5.3	5.5	5.8	7.2	6.9	7.0	7.1	7.2

Source: Eurostat 2016e

1.2.3 Employment in knowledge intensive activities (KIA)

Regarding the employment in KIA, the figures for Germany are by and large slightly higher than the EU20 average and show the largest share during the years 2009-2012.

Table 11: Annual data on employment in knowledge-intensive activities as a percentage of total employment at the national level (from 2008 onwards, NACE Rev. 2)

	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	34.2	35.0	35.4	35.6	35.7	35.8	35.9	36.0
Germany	36.6	37.2	37.6	37.4	37.5	36.9	36.9	36.9

Source: Eurostat 2016a

[5] http://www.innovationsindikator.de/2015/home/#!/Innovation-messbar-machen English version: http://www.innovationsindikator.de/fileadmin/2015/PDF/Innovationsindikator_2015_Web_en.pdf

1.2.4 Employment in knowledge intensive activities – business activities (KIABI)

Also, the data on shares of employment in KIABI shows that Germany is below the average, with the largest shares during the years 2009-2012.

Table 12: Employment in knowledge intensive activities – business activities (KIABI)

	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	13.2	13.4	13.5	13.7	13.8	13.8	13.9	14.0
Germany	14.9	15.2	15.4	15.4	15.3	14.7	14.6	14.6

Source: Eurostat 2016a

1.2.5 Number of scientific papers in relation to the population size

Due to a number of initiatives particularly on the Federal level, namely the Pact for Research and Innovation (*Pakt für Forschung und Innovation*), the University Pact (*Hochschulpakt*) and the Excellence Initiative (*Exzellenzinitiative*) (please see 1.3.1 for more details) it was possible to realise a significant increase in the number of scientific papers see Table 13).

Table 13: Number of scientific papers in relation to the population size (million)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Germany	916	938	960	997	1,037	1,077	1,118	1,185	1,202	1,225

Source: Innovationsindikator 2015

1.2.6 Number of patents developed by publicly financed research per one million inhabitant/citizen

From Table 14 we can observe a relative stagnation in the number of patents between 2005 and 2013. This result ranks currently high on the agenda for political debate, despite the fact that the overall patent output is rather strong.

Table 14: Number of patents developed by publicly financed research per inhabitant/citizen

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Germany	16.2	17.9	18.3	19.2	19.4	19.9	20.1	18.7	17.3

Source: Innovationsindikator 2015

1.2.7 Share of tertiary educated population among the group of 25 to 34 years old

Since Germany is a federal country with different responsibilities for R&I between the Federal and Länder level and education system that is largely controlled by regional authorities there are significant regional variations between the Länder: the proportion of 25-34 year-olds with tertiary education ranged from 20% in Sachsen-Anhalt to 38% in Berlin. (OECD 2014, 34)[6]

Furthermore, the OECD points out, that "based on current patterns, in 2012 an estimated 53% of young people in Germany are expected to enter academically oriented tertiary programmes (tertiary-type A) in their lifetime, up from 30% in 2000 and closer to the OECD average of 58% (compared with

[6] https://www.oecd.org/edu/Education-at-a-Glance-2014.pdf

48% in 2000). In addition, some 22% of young people are expected to enter shorter, more vocationally-oriented tertiary programmes (tertiary-type B) during their lifetime, up from 15% in 2000 and exceeding the OECD average of 18% (up from 16% in 2000). Despite these increases in entry rates, tertiary graduation rates are still below the OECD average. An estimated 31% of young people in Germany are expected to graduate from academically oriented tertiary programmes in their lifetime, up from 18% in 2000 (a 13 percentage-point increase compared to the 10 percentage-point increase of the OECD average, from 28% in 2000 to 38% in 2012). (OECD – Country Note Germany 2014, 4)

Table 15: Share of tertiary educated population among the group of 25 to 34 years old*

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	28.3	29.2	29.9	30.9	32.3	33.3	34.4	35.5	36.5	37.2	37.9
Germany	22.5	22.0	22.6	23.9	25.7	26.0	27.6	28.9	29.9	28.4	29.6

* Introduction of the ISCED 2011 classification: data up to 2013 are based on ISCED 1997, as from 2014, ISCED 2011 is applied.
Source: Eurostat 2017b, Population by educational attainment level, sex and age (%)

It is important to note tough, that "many 25-34 year-olds in Germany have not yet completed their studies, as tertiary programmes are longer than the average" (OECD – Country Note Germany 2014, 5)[7].

1.3 Governance

1.3.1 Main actors in research and innovation governance – Ministries at the Federal and State level

Table 16: Main responsibilities on the federal level

	Main responsibility on the Federal level
2. Germany	Federal Ministry of Education and Research (BMBF)
	Federal Ministry for Economic Affairs and Energy (BMWi)

Even though the central policy initiative for fostering R&D in Germany, The High-Tech Strategy (first launched in 2006), states that supporting innovation is an equally shared responsibility of all ministries within the Federal Government, the Federal Ministry of Education and Research (BMBF) accounts for the biggest share of the budget and therefore opportunity to formulate and implement R&D related policies. Focussing on support for R&D intensive SMEs and knowledge and technology transfer, the

Federal Ministry for Economic Affairs and Energy (BMWi) is the second biggest ministerial player. In addition, other Federal Ministries provide funding for research in their respective spheres of competence, particularly the Federal Ministry of Food and Agriculture (BMEL), the Federal Ministry of Health (BMG), the Federal Ministry of Transport and Digital Infrastructure (BMVI) and the Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB). Figure 1 shows the distribution of the federal R&D money for the year 2016 by departments.

[7] http://www.oecd.org/edu/education-at-a-glance-2014-country-notes.htm

Figure 1: Expenditure of the Federal Government for R & D in Germany by departments 2016 (debit side in Mio. Euro)

Source: BMBF (2016a, 12)

However, just recently different commissions (among others EFI 2017) and research and evaluation bodies (unpublished expertise for the BMBF by Daimer et al. 2017) concluded that the ambitious plan to formulate and implement the High-Tech Strategy in a cross-departmental, strategic and forward looking manner mainly failed due to the existing rivalry between the different ministries on the Federal Level. It seems that the pattern of "politics of the lowest common denominator" is still prevailing. Against the background of the expressed will to tackle "big challenges of our time" like climate change, demographic change or epidemic diseases through ambitious mission-oriented policy initiatives in the field of research, innovation and technology policy, the coordination between the different entities as well as opportunities for participation of civil society must be improved.

Additionally, to the Federal Government, the 16 Länder (States) also provide funding for research and innovation (R&I) under their own programmes particularly to facilitate knowledge transfers between science and industry. To some extend these regional policies are based on the Federal Government's research funding priorities but also follow more local and regional agendas. The main responsibility for legislation and for financing related institutions is held by the States. However, there have been recent changes to harmonise policy making between the Federal and State level concerning the funding of as well as schooling. The former cooperation forabe ("Kooperationsverbot"), a rule that strictly separated the responsibilities between Federal and States level, has been abolished. The federal parliament (*Bundestag*) as well as the representation of the States ('Bundesrat') have approved a change to the constitution (Art. 91b Constitutional Law (GG 'Grundgesetz')) in December 2014 with significant consequences for the German R&I system. The Federal Government is now able to make agreements with individual States and fund R&I in permanently. States can still object agreements since the new law requires unanimous approval of all States (German Bundestag 2014). Another goal of the revised law to find agreements between Federal and States governments is to develop distinctive profiles in R&I. The "Kooperationsverbot" has been criticised for quite some time and the change in constitution had been called for and welcomed by institutions such as the Expert Commission on Research and Innovation (EFI 2015).

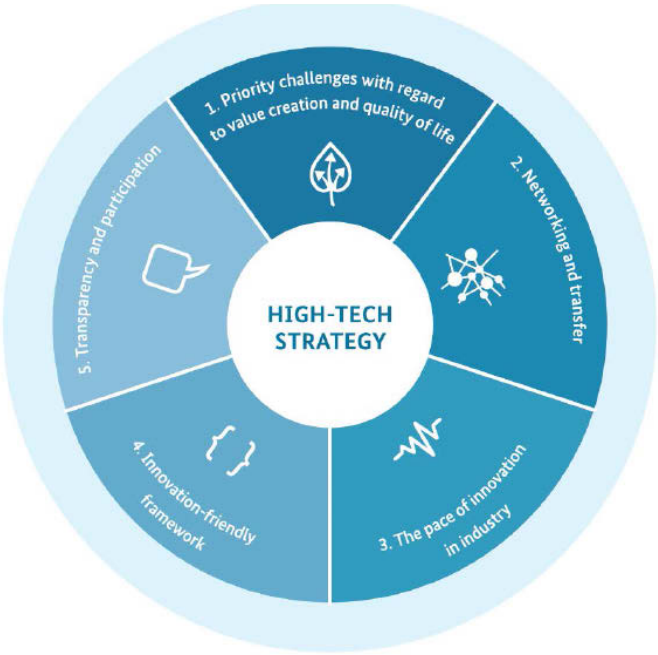
Furthermore, the States fund the universities in their state and co-fund Max Planck Society, Fraunhofer Society, Helmholtz Association, and Leibniz Association.

At the institutional level, the Joint Science Conference (GWK) is the main body that coordinates research policies between the Federal Government and Länder governments. The GWK has agreed in October 2014 to continue ambitious policy programmes, which were about, to expire such as:

- the Pact for Research and Innovation (*Pakt für Forschung und Innovation*), which provides additionally funding for not university related research according to certain success criteria such as the increase of publications and patents,
- the Pact (*Hochschulpakt*), which provides more financial resources for institutions to cope with the growing number of students,
- the Initiative for Excellence (*Exzellenzinitiative*, now called *Exzellenzstrategie*), which is a competitive programme supporting successful universities with significant resources for cutting-edge research in tailored graduate schools and clusters.

As already mentioned the "High-Tech Strategy" is Germany's central agenda for R&I policy and subsumes every Federal policy instrument except for institutional funding. First launched in 2006 the German Bundestag adopted its third edition in 2014 and a new innovation strategy is expected for late 2017/early 2018 after the upcoming elections. The overarching aims of the strategy are to intensify cooperation between science and industry, to further improve the framework conditions for innovation and tackle the "grand challenges of our time" through specific R&D programmes.

Figure 2: Core elements of the current High-Tech Strategy (2014-2018)



Source: BMBF (2014, 4)

Besides the High-Tech Strategy, however, there are several other topical strategies and agendas to foster specific key areas like the "Digital Agenda", the "Internationalisation Strategy" or the "National Research Strategy Bioeconomy 2030".

A unique feature of the German R&I system with a worldwide reputation are the research organisations Max Planck Society, Fraunhofer Society, Helmholtz Association, and Leibniz Association are. Their institutes cover a broad spectrum from basic to applied research with different disciplinary backgrounds and foci and act as providers of research services.

To inform policymaking and provide a solid knowledge base in certain areas a number of ministries have own research institutes (*Ressortforschungseinrichtungen*). These institutes provide ministries with specifically relevant scientific knowledge or assess quality or safety standards.

There is also a long-standing tradition of advisory boards, expert commissions and regular formats that provide expertise in the field of R&I with distinct different agendas and mandates (just to name a few):

- The German Science Council (sometimes called the German Council of Science and Humanities – WR) advises the Federal Government and the Länder on questions related to universities, science and research both content-wise and from the structural development point of view.
- "The Commission of Experts for Research and Innovation (*Expertenkommission Forschung und Innovation - EFI*) advises the German Federal Government and presents an annual report on research, innovation and technological performance in Germany. A key task is to provide a comprehensive analysis of the strengths and weaknesses of the German innovation system in an international comparison. Furthermore, Germany's perspectives as a location for research and innovation are evaluated on the basis of the latest research findings. The EFI presents proposals for national research and innovation policy."[8]
- The "Stifterverband focuses its efforts primarily on the fields of education, science and innovation. To date, it is the only organisation in Germany to engage in holistic work in all three areas, with projects that build on one another with synergistic effect. Stifterverband actively promotes equal opportunities in education, excellent universities and internationally competitive research institutions. Its instruments range from extracurricular talent promotion and structural programmes to detailed analyses of the scientific and innovation system that serves as a basis for recommended policy courses of action."[9]
- The National Academy of Science and Engineering – Acatech "provides expertise for political decision-making processes on the basis of a double mandate from the federal as well as the regional governments in Germany. The Academy has established efficient structures for the science-based dialogue on technology-related future challenges. Experts from science, business and society develop sound concepts as input for the public and political debate. The topics range from raw material and resources to questions pertaining to the energy supply system, including technological developments and technology communication and the challenge of securing highly qualified specialists."[10] Acatech also organizes the so-called "Innovationsdialog", a regular meeting concerning R&D related topics between representatives of the government (including chancellor and ministers), the scientific community, civil society and businesses.

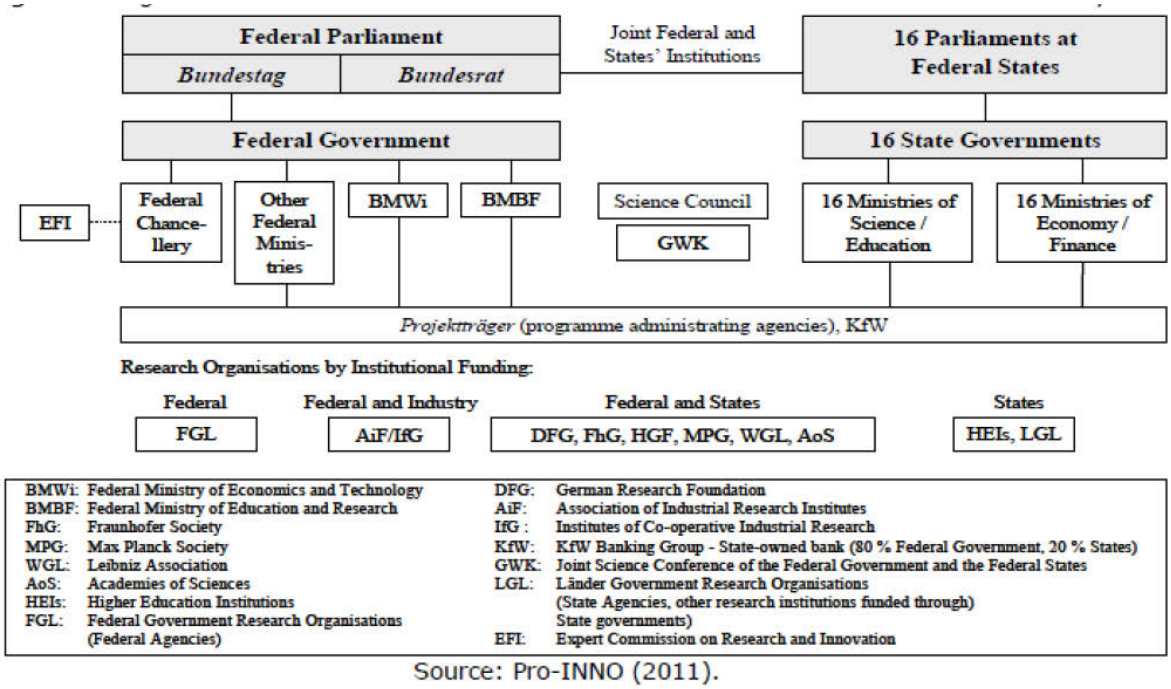
The following illustration offers a comprehensive overview on the relevant levels and actors on R&D policy making in Germany.

[8] http://www.e-fi.de/die_expertenkommission.html?&L=1

[9] https://www.stifterverband.org/english

[10] http://www.acatech.de/uk/home-uk/mission-statement.html

Figure 3: Organisational chart of institutions in the field of research and innovation in Germany



Source: Sofka and Sprutacz 2016, 18

1.3.2 Major Funding Agencies (national & regional)

	Major Funding Agencies
3. Germany	German Research Foundation, DFG funding management agencies (*Projektträger*, PRO)

All R&D programmes by Federal ministries and most of the programmes set up by the Länder are administered and managed by a range of implementation agencies (*Projektträger*, currently seven). These agencies can either work on direct command of the ministry or administer their programmes on a fairly independent basis. The latter are so called "beliehene Projektträger" which are empowered to even choose the beneficiaries of the R&D programmes on behalf of the ministries.

When it comes to fostering excellent cutting-edge research on a competitive basis, the DFG is the most important player: "The central task of the DFG is to award funding for basic research to universities as well as research organisations' cooperating with them in projects via a competitive procedure. DFG provides one of the main sources of competitive funding through its funding programmes collaborative research centres, research training groups, priority programmes and research units, both in quantitative as well as in qualitative terms." (European Commission 2015a, 5)

Additionally, there are several foundations that foster innovation activities in Germany, which are connected either to a political party (like a.o. the Friedrich Ebert Foundation, Heinrich Böll Foundation or Rosa Luxemburg Foundation) or a business (like a.o. the Volkswagen Foundation, Robert Bosch Stiftung or Bertelsmann Foundation).

1.3.3 Relevance of national and regional levels in R&I policy and financing

As already mentioned above (please see 1.3.1) for further information on the former "Kooperationsverbot") there have been significant changes concerning the mutual financing for R&I between the Federal and States Level. Accordingly, the agreements between Federal and States governments have significant potential to strengthen the German R&I system, but "the realisation of these potentials will depend on the implementation". (Sofka and Sprutacz 2016, 20)

One example of the complex "burden sharing", that often follows specific negotiated agreements between the different levels is provided by the Pact for Research and Innovation (also already mentioned above), which was concluded by "the Federal Government and the Länder […] with the science and research organisations (DFG, FhG, HGF, WGL and MPG) in 2005. The Pact was renewed in 2009 to cover the period up to 2015. One of the objectives of this joint initiative is to launch suitable measures to ensure and optimise the quality, efficiency and performance of science and research institutions that receive institutional funding. Large non-university research institutions (HGF, FhG, MPG and WGL) allocate a share of their institutional funds on competitive basis, based on processes that include peer review. According to the Pact for Research and Innovation, these instruments should be developed further on a continuous basis. 90% of the funding for universities is provided by public sources, 80% by the Länder and 10% by the Federal Government. 10% are private funds. The governments of the Länder are responsible for financing research and teaching at public universities in their respective state. Co-funding of universities by the Federal Government is restricted to financing the construction of research infrastructure and some specific programmes (for example 'Excellence Initiative', Pact, Programme for Women Professors)." (European Commission 2015a, 5-6)

Germany also launched "several policy initiatives to leverage geographical clusters such as the Leading-Edge Cluster Competition (*Spitzencluster-Wettbewerb*) of BMBF with a budget of €200m for up to five leading edge Clusters in each round of funding (BMBF, 2015d). However, there is currently no policy document, which explicitly outlines a smart specialisation strategy at the federal level. This is largely due to the federal structure of Germany in which the States have important authority over R&I. There is some indication that the Federal Government prioritises strengthening the international connectedness of the Leading-Edge Clusters. Examples include the successful application for two Knowledge and Innovation Communities (KIC) ("Raw materials" and "Healthy living and active aging") in a European-wide competition of the European Institute of Technology which will be coordinated in Germany (BMBF 2014a). Support for the internationalisation of Leading-Edge Clusters, Future Projects and comparable networks (*Internationalisierung von Spitzenclustern, Zukunftsprojekten und vergleichbaren Netzwerken*) is now a BMBF programme with three yearly funding rounds between 2015 and 2017. In each round cluster or network managements can apply for funding for the development of internationalisation concepts (up to two years) and implementation (up to three years)." (Sofka and Sprutacz 2016, 25)

2 Gender Equality Policies

2.1 Employment and labour market policies

2.1.1 Description of equal opportunity/anti-discrimination legislation

Anti-discrimination legislation

On a constitutional level, GE legislation is anchored in Article 3, para. 2 and 3 of the German constitution, amended in 1994. Hence, effective gender equality has the status of a national objective (like keeping a general economic balance, or realizing a conjunct Europe). While para. 3 prohibits any disadvantageous or privileging treatment because of sex, a disability, descent, race, language of origin, religion and religious or political opinion; paragraph 2 explicitly states the equality of men and women as well as the state's responsibility to actively promote it (German Bundestag 2011).

The most important measures in anti-discrimination legislation of the recent decades are the Act on the Equality between Women and Men in the Federal Administration and the Federal Courts (Federal Equality Act) of 2001, the General Equal Treatment Act of 2006, as well as the Law on Equal Treatment of Soldiers, the Federal Equality Statute and several equality statutes of the states.

The Federal Equality Act and para. 2 of the Joint Rules of Procedure of the Federal Ministries oblige every member of the public administration to consider and realise gender equality in its work (European Commission 2016a). The General Equal Treatment Act further concretises the general principle of equal treatment of the German constitution, the responsibility of businesses and established a federal complaints office that conducts studies on discriminations, and proposes measures to prevent discrimination (European Commission 2016a; Lenz 2013).

At state level, with the exception of Baden-Wuerttemberg and North Rhine-Westphalia, all Länder have explicitly anchored gender equality in their constitutions and enacted corresponding laws (GenderCompetenceCenter 2010; EIGE 2016a).

Laws that support equal opportunities

The Maternity Protection Act protects women against dismissal due to pregnancy; the Law on Parental Leave similarly protects parents and grants the right to return to an equivalent job (European Commission 2016a, 22-23; BMFSFJ 2016a, 103). However, it has been criticised that this right should be stated more explicit in the law on parental leave (djb 2014).

Parents are entitled to parental leave according to parental leave legislation regardless of their gender (BMFSFJ 2016a). This supports the opportunity for fathers to participate in childcare (see 2.2.2).

The Law for the Support of Children of 2008 grants a legal right for a day care place for children between one and three years. After a first period in which new day care places were created, the right became fully effective on august 1st 2013. The law is accompanied by an extensive investment programme (see 2.1.3, 2.2.1 and 2.2.3) for the creation of ten thousands places at day-care mothers, other day-care facilities or company kindergartens. (BMFSFJ 2014)

In 2015, the Law for the Equal Participation of Women and Men in Leading Positions was implemented. It obliges large businesses that have a stock exchange listing and underlie all matters of employee participation to maintain a fixed gender quota of 30% among the members of their

supervisory boards. This comprises 101 German companies. Businesses that are listed or underlie the regulations of employee participation have to set themselves "binding" target figures for their management boards, supervisory boards and highest management level. This relates to about 3.500 German companies. At the same time, the Law on the Appointment and Deputation of Women and Men in Bodies under the Control of the Federal Government was modernised, so that the 30% quota (from 2018 on a 50% quota) is also binding for all boards in which the federal government holds at least three seats. A further amendment of the Federal Equality Law obliges the federal administration to set target figures for the share of women and men on every management level, including concrete measures to reach this targets. (BMFSFJ 2016e)

There is a Law for Wage Transparency about to be established which addresses income inequality between men and women. In Germany, women earn 21% less than men because they work in different sectors and have lower qualifications. However, even in the same field and the same position, women earn 7% less than men (see 3.7.1 for more information on the gender pay gap in Germany). Unequal pay is connected to the opacity of the wage-structures in many German companies. At current legislation, employers must not discriminate against women, but there is no chance to check for discrimination if the differences in wages of men and women are not transparent. The Federal Government agreed on implementing a new law to foster the transparency of wages resulting from a discussion on a Law for Wage Justice, which had been demanded by the federal minister of family affairs. This law is planned to introduce a duty for large businesses to report about the promotion of women and equal pay, to grant employees an individual right of information, and to prompt businesses to resolve current unequal pay. The draft is likely going to be implemented into the legislative process by the federal government. (BMFSFJ 2017a)

2.1.2 Description of structures for Gender Equality

Federal

Equality policy is an autonomous policy field of the German government and located at the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (BMFSFJ). As a result of the above-mentioned legislative measures, equality policy is a cross responsibility of all government bodies. The BMFSFJ is especially responsible for the strategic design and coordination of GE policy, the realisation of political goals, main foci, or programs, international cooperation and the participation at legislation procedures (cf. German Bundestag 2011, 34). GE is incorporated as one of five main departments of the ministry. Other ministries (e.g. Federal Ministry of Finance) have units dealing with specific GE issues. All federal ministries have an equal opportunity commission, which works independent from instructions and exchanges with its colleagues in other ministries via an interministerial working group (EIGE 2016b).

State

As a federal state, Germany is characterised through a high diversity in the realised administrative GE measures. According to the European Institute for Gender Equality (EIGE) (2016b), all states have established a GE department under the roof of their ministries for social affairs. Hamburg and Saxony-Anhalt have integrated GE at their minisitries of justice. The degree of relevance of GE and Gender Mainstreaming higly varies between the state governments: for example, Brandenburg and Saxony-Anhalt own specific units for Gender Mainstreaming within its ministerial departments. Lower Saxony and Saxony-Anhalt have established interministerial working groups on the topic. (EIGE 2016b)

Relevant impulses on the federal GE policy are set by the Conference of Ministers for Gender Equality and Women's Affairs (GFMK), established in 1991 (German Bundestag 2011). Members of the conference are the responsible ministers for GE matters and the BMFSFJ. Aim is the harmonisation and coordination of the federal GE policy through joint legislative initiatives and implementation efforts. The federal government only has an observing role and is not capable to monitor or control GE measures under state responsibility (EIGE 2016b).

Municipalities

Due to the subsidiarity principle in the German constitution, the municipalities are responsible for GE policies and measures within their scope of competence. This predominantly concerns the municipal administration itself and its public services. Typically, municipal GE policy comprises the office of an equal opportunity officer (German Bundestag 2011). The Federal Working Committee of local women's offices (BAG) is a network of 1.900 local equal opportunity officers (German Bundestag 2011; BAG 2016).

Civil Society

The German Women's Council connects other institutional actors of the women's movement, e.g., the GE groups of the large German social welfare associations, professional associations, parties or unions. Its member organisations represent more than 10 million members. The German Women's Council represents Germany at the roof association of European Women's Lobby (Lenz 2013).

2.1.3 Description of relevant policy initiatives to foster equality

Equal economic independence

Under the topical umbrella of equal economic independence, the BMFSFJ comprises primarily five nation-wide initiatives, among which the extension of childcare facilities is the most resource-intensive. The federal investment programme for the creation of childcare facilities has been introduced along with the Law for the Support of Children of 2008 (BMFSFJ 2014) (see 2.1.1).

Since 2008, BMFSFJ and Federal Employment Agency support women and men who had reduced their working time or stopped working for several years to take care for their family with an action programme in their re-entry into the working world. The action programme combines diverse measures to support women in their job re-entry; to sensitise businesses for the potential of returnees; to improve the conditions for re-entries on a local level; and to sensitise men to relieve their partners through the use of household-related services. (BMFSFJ 2015a)

To foster female entrepreneurship, the federal government, the European Commission and the state of Baden-Wuerttemberg finance the Female Entrepreneur Agency, established in 2004 by BMFSFJ and the federal ministry for economy. This, in Europe unique, institution engages in networking, consulting and research of female entrepreneurship in Germany (bga 2016).

Equal pay for equal work and work of equal value

To support a change in the gender structure of occupation, there is an annual day of non-traditional vocational orientation for teenagers. The annual Girl's Day takes place in April. Girls from the fifth to the tenth grade get the chance to experience different occupational fields where they are normally underrepresented, like the MINT professions. The pendant to the Girl's Day is the Boy's Day, which is parallel conducted since 2011. (BMFSFJ 2015e)

Equality in decision-making

Accompanying to the federal efforts for more women in leading positions, the “Targeted” programme" (*Zielsicher*) was implemented. Goal of the measure is to support those companies affected by the quota with a practical guide on how to raise the share of women in top management and a workshop series for peer exchange. (BMFSFJ 2016f)

Horizontal issues

The Atlas for the Equality between Women and Men in Germany results from a cooperation of the federal government with the states at the GFMK. The second edition of this tool collects indicators that allow the assessment of the implementation of GE objectives on the local and regional level. (BMFSFJ 2013)

There has been an equality body on federal level since 2006. The Federal Anti-Discrimination Agency was established after the introduction of the General Equal Treatment Act as an authority that promotes anti-discrimination by public and political work as well as research. There are differences across states and municipalities regarding anti-discrimination agencies on more local levels. (European Commission 2016a, 41)

Current Discourse

Significant progress is made concerning the reform of the joint taxation of married couples into a family taxation.[11] The CDU is one of the three ruling parties and party of the chancellor. It was, the most important long-year veto player, blocking any substantial changes on the joint taxation of married couples. During its most recent party convention the CDU passed a resolution that paves the way to a fiscal reform that gives an advantage to couples with children – being married or not (Emmrich 2016).

A broad debate also accompanied the implementation of the Law for the Equal Participation of Women and Men in Leading Positions in the beginning of 2016. The employer side often understands the measure as a symbol of state interventionism; what can be proven by the incrementalism of the progress that is made since the introduction of the quota, as described below. In many cases, the quota still appears to collide with an androcentric business culture. An important driver behind the quota for large and/or listed businesses was the German Women Lawyers' Association whose members bought shares of listed companies – and with this a right to speak at the annual shareholder meetings, in which they held the companies accountable for their GE practices. In four years, 300 shareholder meetings had been visited (djb 2013). In the same way like the quota for leading positions in business, also the planned Law for Wage Justice is controversially discussed.

Generally spoken, gender stereotypes in Germany are shifting. In a study of young men and women in Bavaria, Allmendinger et al. (2016, 62) show that both sexes have become more similar in their life goals, striving for a balanced relation between work and family. In return, young people struggle with and distance themselves from the perceived norms of their own sex. However, external pressures – espescially the expectations of employers – build a serious obstacle to more equality between the sexes in family life. (Allmendinger, Krug von Nidda and Wintermantel 2016)

[11] (The problem of joint taxation is explained below at 2.2.1)

2.1.4 General assessment of the effectiveness of existing equal opportunity / anti-discrimination legislation measures

Germany is characterised by a well-developed legal framework for Gender Equality (GE). In the field of employment and labour market policies, the General Equal Treatment Act marks a substantial advance. However, GE policies are criticised for being focused too much on professional equality of women, and not tackling the causes of disparities between men and women that start in the private sphere. Therefore, GE legislation especially favours well-educated working women. In contrast, social and fiscal policies strengthen classic role distributions between the sexes. (Boekhorst 2015; Auth, Buchholz, and Janczyk 2010; see 2.2.1)

The extension of childcare (2.2.3.6) has been going along with an increase in the enrolment rate from 15.5% in 2007 to 32.7% in 2016 according to official statistics (Destatis 2016d, table ZR8). Quality has improved, but is still being criticised for a leak of educators per child (Bertelsmann Foundation 2016). Enrolment rates have risen, but the demand, which has increased too, cannot be satisfied yet. Against some negative apprehensions, there was no wave of suits after 2013. (BMFSFJ 2015d)

The key measure concerning re-entry to the labour market after parental leave is protection against dismissal. However, in the current discourse return to work is perceived a problem. There might be problems of acceptance by employers (Kaiser et al. 2012). Besides, people who have lost attachment to their former job during parental leave may face problems of reintegration into the labour market (Dahlkamp et al. 2017).

Table 17: Current nation-wide policy initiatives to foster equality between women and men

Equal economic independence	• Labour market participation	X
	• Work-life-balance	X
	• Childcare facilities	X
Equal pay for equal work and work of equal value	• Wage transparency	X
	• Awareness raising for consequences of part-time-work and fixed term contracts	
	• Equal pay	X
	• Vocational orientation for non-traditional occupations	X
Equality in decision-making	• Initiatives to improve the gender balance in decision making	X
	• Monitoring the 25% target for women in top level decision-making positions in research	X
	• 40% of members of one sex in committees and expert groups	
	• Support greater participation by women in European Parliament elections including as candidates	
Horizontal issues	• Promoting non-discriminatory gender roles in all areas of life such as education, career choices, employment and sport	
	• Equality bodies who monitor, enforce, evaluate and update the legal framework	X
	• Annual Report on progress on gender equality	X
Additional activities	• Gender budgeting in legislation	(not on the federal level)

Source: own depiction

Assessments of the German GE policy of the present or recent past are very ambivalent. Lembke summarises that the German legislation for GE surpasses the requirements of EU directives, e.g., she mentions the scope of application, maternity protection or parental allowances. However, concerning a few points, she states 'disturbing gaps'[12] in implementation (European Commission 2016a, 43).

Following the BMFSFJ, one year after implementation, the efforts of the federal government regarding the equality in decision making (Law for the Equal Participation of Women and Men in Leading Positions) are showing results. Between January 2015 and March 2017 the share of women among the members of supervisory boards increased by 5.9% points to 27.9%. However, one may argue that a quota of 30% which is affecting only 101 companies is very limitied in its impact on gender equality. The possibility to formulate obligatory target figures on women in management is used by hardly 1% of the 3.500 relevant companies. (BMFSFJ 2016d)

Lepperhoff (2010) criticises, with an eye on the GE policy of the federal legislature from 2005 to 2009, that there is no strategic approach to equal opportunity/anti-discrimination policy. GE policy rather is managed indirectly and "arises" as an indirect result of family or women's promotion policy. According to Lepperhoff, GE has no value in itself; women are strengthened in the roles of entrepreneurs or managers. GE policy in Germany is highly market-related, in the sense that the responsibility for female empowerment is transferred to the discretion of businesses. Measures like the quota appear to provide only a minor contribution to breaking up structural inequalities. (Lepperhoff 2010, 40) The trend of a market-related GE policy is also reflected by extensive investments in the childcare infrastructure, marking a significant paradigm change to the family policy of former decades due to German reunification (Lenz 2013). Simultaneously, the enrolment rate of children under the age of three in childcare facilities has steadily been increasing from 14.0 in 2005 to 32.7 percentage in 2015 (see 2.2.3.6).

It can be summarised that GE policy is characterised by significant progress, but still often is only understood as part of family policy and shaped by the path dependencies of an emancipating, former bread-earner society. The case of Gender Budgeting in Germany is an example how pretended restrictions of the legislator are more determined by a cultural perspective than by structure. While the federal government officially argues, that Gender Budgeting is not compatible with the principles of cameralistic accountancy that are anchored in the German constitution; a report for the BMFSFJ comes to the conclusion that due to acceptance problems of Gender Budgeting in the public administration an explicit legal norm is needed. Indeed, Gender Budgeting is not applied at the federal level, but in some states like Berlin or Bremen; and already well spread among German municipalities. (WD 2016)

[12] Examples for those are that the General Equal Treatment Act is not applied to dismissals; Germany's non-compliance with the standards set in Directive 2010/41/EU on the application of the principle of equal treatment of self-employed women and men (see also Barnard and Blackham 2015); or the lack of a right of return to the same job after parental leave (what is only partially right, as explained below). As problematic is also seen, that in some states a claim related to a discrimination in access to goods and services demands a failed mediation before it can be brought to court. The prohibition of sexual harassment to the area of employment is considered to be not defended strong enough . Further, the extensive use of intransparent collective agreements is criticized (e.g. concerning also the conclusion of employment contracts) between the social partners to regulate their affairs. Basically, courts and legal practitioners take EU law into account; but national law is not sufficiently interpreted in the light of EU regulations on GE. (in detail: European Commission 2016a, 41-43)

2.2 Welfare and Gender Regimes

There are various theories of Welfare and Gender regimes in the social sciences. This report does not limit itself to a certain theoretical approach of understanding welfare and gender, but draws on key dimensions shared by several concepts, in particular the financial independence of women, childcare and fertility, which was pointed to in Schleutkers (2014) discussion of theories on welfare and gender regimes. Most concepts assume that there is a rather high degree of dependence on the family, which goes along with a low rate of financial independence of women and few public childcare facilities in Germany and Austria, while the opposite is the case for Denmark and Sweden. (Schleutker 2014)

With regard to the interpretation of welfare institutions, Esping-Andersen's theory of welfare regimes suggests that Germany is a "conservative welfare state" with a relatively high degree of individual independence from labour market income, but at the same time a high dependence of women on the income of family members (Gerlach 2009). Even though criticism has pointed to weaknesses in Esping-Anderson's theory[13], the authors of this report assume that his conceptualizing Germany as a conservative welfare regime is accurate with regard to the past. From this reference point, the report aims at identifying changes in the present welfare regime.

Part 2.2.1 describes the welfare regime in Germany with regard to fiscal policies. Its main finding is that there are substantial welfare institutions in Germany, which remain from the traditional single breadwinner family-model. However, recent reforms discontinue this tradition and aim at supporting women's labour market participation.

Part 2.2.2 focuses on parental leave policies in Germany. Former parental leave legislation (*Erziehungsgeld*) had been introduced with the intention to keep women from working outside home (Baronsky, Gerlach, and Schneider 2012), but there were substantial reforms in 2007. The current parental leave legislation allows for flexibility to combine parental leave with part-time work and tries to encourage fathers' participation in childcare.

Part 2.2.3 gives empirical evidence for the use of parental leave, fertility, family formation and childcare enrolment. It reveals that there is still a traditional role division in most families. The data provides evidence that parental leave benefits are increasingly used by fathers, but women still use it far more. Reconciliation between paid work and family is a problem for parents. Childcare facilities have been extended, but there are still leaks in the provision of childcare due to the high demand.

In conclusion, the gender welfare regime has undergone some changes in the direction of supporting compatibility between work and life. The preferences of mothers to work instead of staying at home have also changed. However, compared to Sweden and Denmark, there are still less women working and fewer public childcare facilities in Germany. Even though some of the conservative welfare traditions have been overcome, this path is still visible.

[13] Reviewers have argued that welfare regimes according to Esping-Anderson do not always automatically match the real situation of gender equality in the respective countries. For instance, France is assumed to be a conservative welfare state with similar institutional arrangements as Germany, but the employment situation and fertility of women in France is significantly different from Germany. (Gerlach 2009)

2.2.1 Fiscal Policies

In summary, certain fiscal policies, namely the joint taxation system of married couples and non-contributory co-insurance in the statutory health insurance have a negative effect on the labour market participation of women in Germany. Parental allowances may also contribute to keeping women from the labour market. However, the reformed parental allowance scheme since 2007 is more flexible and supportive to labour market participation of mothers and in particular encouraging fathers to take parental leave. Subventions of childcare facilities are an important support for labour market participation of women in Germany, however there are still leaks in provision of adequate and affordable childcare. Two federal states pay contributes for not working full-time, which discourages labour market participation of women. With regard to unemployment benefits, it is criticised that eligibility depends on the partner's income and that this is limiting women's financial independence.

Joint taxation of married couples

Taxation in Germany increases progressively, which means that the tax rate increases with the income. Joint taxation of married couples (*Ehegattensplitting*) allows married couples and homosexual civil unions to calculate each partner's tax rate based on the combined income of both partners. As a result, the partner with the lower income pays more taxes, while the partner with the higher income pays less compared to individualised taxation. Tax savings are particularly high if the income differences are high, if one of the partners has a high income or if one of the partners doesn't have any income at all because in this case a second tax-free allowance is deducted from the income before taxation (Buslei and Wrohlich 2014). This way of taxation for married couples supports a traditional role distribution of married couples. It provides disincentives for the person with the lower income, mostly women, to work because they would pay high taxes, which reduces their net income significantly. Furthermore, it reinforces incentives for the partner with the higher income, mostly men, to spend more time working on their paid job. As a result, the partner with the higher income may have less time available to participate in the unpaid work at home, e.g. childcare. Thus, there are economic incentives for the partner with the lower income to work at home and for the high-earning partner to work outside. (ZEW and Research Center for Family-Conscious Personnel Policy 2013, xi)

Several studies point out that joint taxation discourages female labour market participation in Germany (Auth, Buchholz, and Janczyk 2010; Bonin et al. 2013; OECD 2014; Plantenga 2014; Prognos AG 2014). The effect of joint taxation on the labour market participation of women is strong in comparison to other family-related fiscal policies (Prognos AG 2014). Joint taxation is giving incentives for married women, and mothers in particular, to withdraw from the labour market. In the long run, joint taxation does not promote labour market participation and financial independence of women (Prognos AG 2014; Auth, Buchholz, and Janczyk 2010).

There are several ideas in the political discourse on reforming the joint taxation law in Germany, which include different degrees of individual taxation and tax advantages for couples and families (Buslei and Wrohlich 2014).

Non-contributory co-insurance in the statutory health insurance

Furthermore, there is a non-contributory co-insurance in the statutory health insurance for a partner who is married or in a homosexual civil union and whose work is not subject to social insurance contributions. If this second earner enters the labour market, additional fees for insurance may

unfold the effect of an implicit taxation because they lower the rewards of work for the second earner. This affects the labour market participation of women, particularly married mothers of small children. On the other side, for those women who are in a job, increased social insurance contributions may give incentives to work longer hours so that the additional insurance costs pay off. (Prognos AG 2014) The long-term effects of non-contributory co-insurance are similar to the effects of the joint taxation: a low participation rate in the labour market over the life course (ZEW 2013).

Costs of childcare

Costs of childcare may have a similar effect as taxes for families with both partners working (Plantenga 2014, 13-14). http://www.foreurope.eu/fileadmin/documents/pdf/Workingpapers/WWWforEurope_WPS_no059_MS206.pdfAs a consequence, subventions for childcare are an important support to labour market participation of mothers (Prognos AG 2014). Yet, there are less childcare facilities in Germany than demanded and the costs of childcare facilities may discourage women's labour market participation. It is estimated that making childcare facilities available to all parents would increase the labour market participation of mothers of children between the age of two and three years by 2% (DIW 2013). If there were no fees for childcare facilities, the labour market participation of mothers with children between the ages two and three would rise additionally by 1.5% (DIW 2013, 115). Furthermore, external childcare could be improved with regard to the flexibility of opening and closing times, particularly during holidays (Prognos AG 2014, 241).

Parental leave policies

Parental leave policies are intended to make it possible for parents to withdraw from the labour market for a limited time. Consequently, they promote a reduction in the labour market participation of mothers during the first year after childbirth. However, it is assumed that the new parental leave legislation introduced in 2007 gives incentives to return to the labour market afterwards (Prognos AG 2014, 249-52; please see 2.2.2 for more information on the parental leave legislation in Germany).

Cash for care *(Landeserziehungsgeld)*

In Germany, there was a cash for care programme at federal level from 2013 until July 2015. Parents with children between 15 and 36 months, who did not plan to use public childcare facilities, could apply for childcare subsidy (*Betreuungsgeld*). On July 21st 2015, the Federal Constitutional Court declared it was not a matter of federal jurisdiction and therefore unconstitutional (Federal Constitutional Court, 2015).

There is a federal state child-raising allowance (*Landeserziehungsgeld*) in two federal states, Saxony and Bavaria. The income-related and time-limited payments are at maximum 150€ for the first, 200€ for the second and 300€ for every further child. Payments are only available to parents who do not work full-time after the end of the parental leave benefit (Blum, Erler, and Reimer 2016)[14].

[14] Some preconditions differ between the two states. In Bavaria, the income ceiling is 25000€ for couples and 22000€ for single parents and rises with the number of children. Besides, a proof of participating in early detection screenings for children is required. In Saxony, the amount of payments is reduced successively if the parents have an income higher than 17100€ for couples or 14100€ for singles. A statement not to plan using childcare facilities is required by the applying parents. (Blum, Erler, and Reimer 2016)

It can be assumed that cash for care programmes negatively affect the labour market participation of women by giving incentives to stay at home.[15]

"Needs Unit" for unemployment benefits

Certain policies for unemployed people are criticised for having a limiting effect on women's financial independence. According to the concept of the "needs unit" (*Bedarfsgemeinschaft*) unemployed people are only eligible for basic security benefits for job seekers if their partner's income is not sufficient. It is assumed that women are more often unemployed and dependent on their partner's income than men. If both partners are eligible, the common amount of basic security benefits is only transferred to one of the partners, following the traditional model of the "head of the household" who is responsible for the finances of the family. (Rudolph 2006)

Tax abatements

Tax abatements for dependent children and child allowances have heterogeneous effects on the labour market participation of women. On one side, having more net income available may be a reason for parents to work less, but on the other side tax abatements increase the benefits parents can get from working (ZEW 2013, 133). Tax abatements and child allowances support families with low income who would otherwise depend on public benefits to achieve the subsistence level. For incomes that are a little below the subsistence level, tax abatements and child allowances support families to exceed the subsistence level. Thereby it provides an incentive to work (ZEW and Research Center for Family-Conscious Personnel Policy 2013, 65-66). It is estimated that the total effect of tax abatements and child allowances on the labour market participation is only weak (ZEW 2013; Prognos AG 2014).

The tax relief for single parents (*Steuerlicher Entlastungsbetrag für Alleinerziehende*) is estimated to have a positive impact on the labour market participation of single parents, most of whom are women. It helps to prevent the welfare-dependence of single parents and supports the wellbeing of children. (Prognos AG 2014)

Comparison of the Average Effective Tax Rate across European countries

Several fiscal policies in Germany provide disincentives for women to participate in the labour market. Concerning the fact that there is a combination of direct and indirect effects and the interdependencies of various policies, it is difficult to measure and compare the disincentives of fiscal policies across countries. Plantenga (2014) offers a model for the direct fiscal disincentives of a secondary earner entering the labour market by counting the change in the Average Effective Tax Rate (AETR). She includes differences in taxes as well as received benefits in relation to the gross earnings for a secondary earner in a household composed of two children and two adults, of whom one earns 100% and the second one 67% of the local average (Plantenga 2014, 12). In this model, the situation in Germany seems average in comparison to other European countries, however, this might be because only parts of the effect of joint taxation have been taken into account.

[15] The negative impact of cash for care on the labour market participation and economic equality of woman has already been observed in the experiences of Nordic countries (Boll and Reich 2012).

Table 18: Fiscal incentive for secondary earners, 2011 – sorted by Average Effective Tax Rate (in %)

	secondary earner (AETR) Primary earner at 100% of average wage (AW) and 2 children	Single (Net Personal Average Tax)	Ratio (Secondary earner/Single)
Austria	30	27.3	1.1
Denmark	48.5	36.8	1.3
France	29.3	26.1	1.1
Germany	46.2	34.9	1.3
Hungary	29.6	29.5	1.0
Spain	23.4	17.7	1.3
Sweden	22.1	22.1	1.0
Unweighted Average	31.3	23.7	1.4
Unweighted Average without joint taxation countries	30.0	23.1	1.3
Unweighted Average for joint taxation countries (FR, DE, IE, LU, PT)	37.3	26.9	1.4

Source: Own depiction according to Plantenga 2014, 41

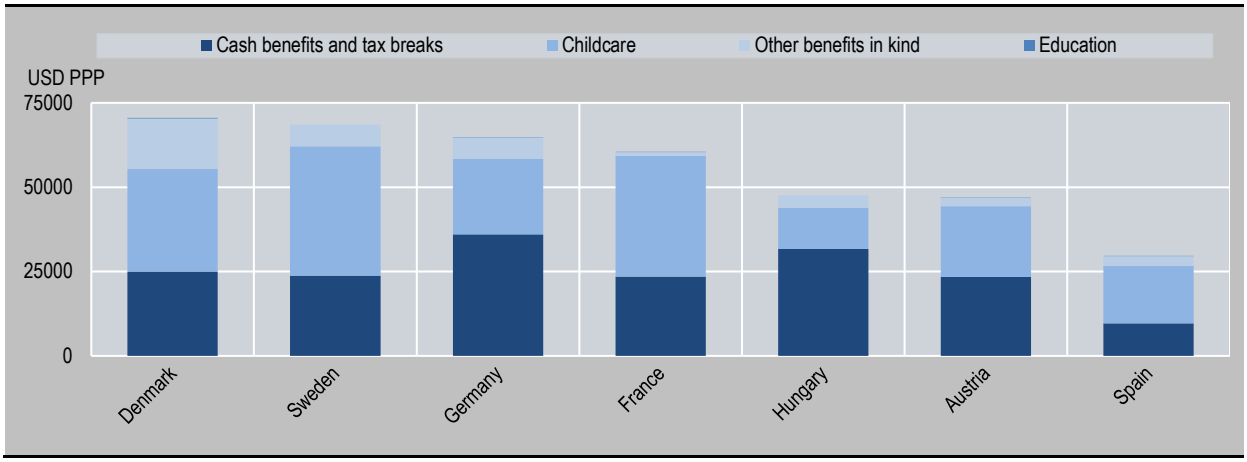
Table 18 shows the results of the estimation for Germany, the unweighted average in EU member states in total, the unweighted average in EU member states without joint taxation and the unweighted average in EU member states with joint taxation. In Germany, the AETR of 46.2% is notably higher after a second earner entered the labour market than for a person under individual taxation (34.9%). The AETR for a second earner in Germany is 14.9 percentage points higher than among EU-countries on average, which seems a lot in the first place. However, comparing the ratio of the tax burden between a secondary earner and individual taxation, Germany scores better than the unweighted average across EU countries. Germany's ratio of 1.3 equals to countries without joint taxation and is lower than the unweighted average of countries with joint taxation as well as the unweighted average of EU member states overall. Germany scores slightly better than the average in Plantenga's assessment of economic disincentives for a secondary earner to enter the labour market.

The authors of this report suppose that this model underestimates the gender-bias of taxation in Germany. First, the results should be interpreted cautiously because the model is only calculated for a specific income situation and may differ for people with higher income (Plantenga, 2014). For Germany, this is very likely the case because the effects of joint taxation become explicit in particular for couples with high incomes and high-income differences. Second, Plantenga's model only takes into account the direct negative incentives for a secondary earner, but does not look at the indirect negative effects of joint taxation. In other words, it does not include the fact that married couples may have other unpaid work to do and not enough time for both partners to participate in the labour market. By providing incentives for primary earners to work more outside, it also provides disincentives for their participation in care-work. In consequence, it provides reasons for the secondary earner to do more of the care-work at home (ZEW and Research Center for Family-Conscious Personnel Policy 2013).

Figure 4: Cash benefits and tax breaks and childcare are important in per capita social expenditure on children in early childhood (0-5 years).

Comparison government spending across European countries

Spending in USD PPP on children aged 0-5, 2011



Source: Retrieved from OECD 2016b, Chart PF1.6.C.

Figure 4 illustrates the investment structure in family policies by the German government according to data from the OECD family database. Cash benefits and tax breaks make up the biggest share of government spendings for families with children up to five years. According to the OECD-data, the German governments spends an equivalent of 64,815 USD purchasing power parity (PPP) per child in the first stage of childhood (0-5 years), of which 35,972 USD PPP are cash benefits and tax breaks. More than one third (22,465 USD PPP) is spent on childcare. Parents in Germany receive more money via cash benefits and tax breaks than in any other EFFORTI-country according to OECD-statistics and counted in USD PPP. With regard to share of such direct financial support among all public spendings in the first stage of childhood, Germany ranks second after Hungary. The structure of public spendings may indicate a comparatively high level of familiarism: puplic support addresses the financial situation of the parents by tax reductions and money transfers more than by public institutions, such as public childcare facilities. This fits in with a conservative welfare tradition.

2.2.2 Parental leave policies

The parental leave scheme was reformed in recent years to support both parents to better participate in the labour market and in childcare.

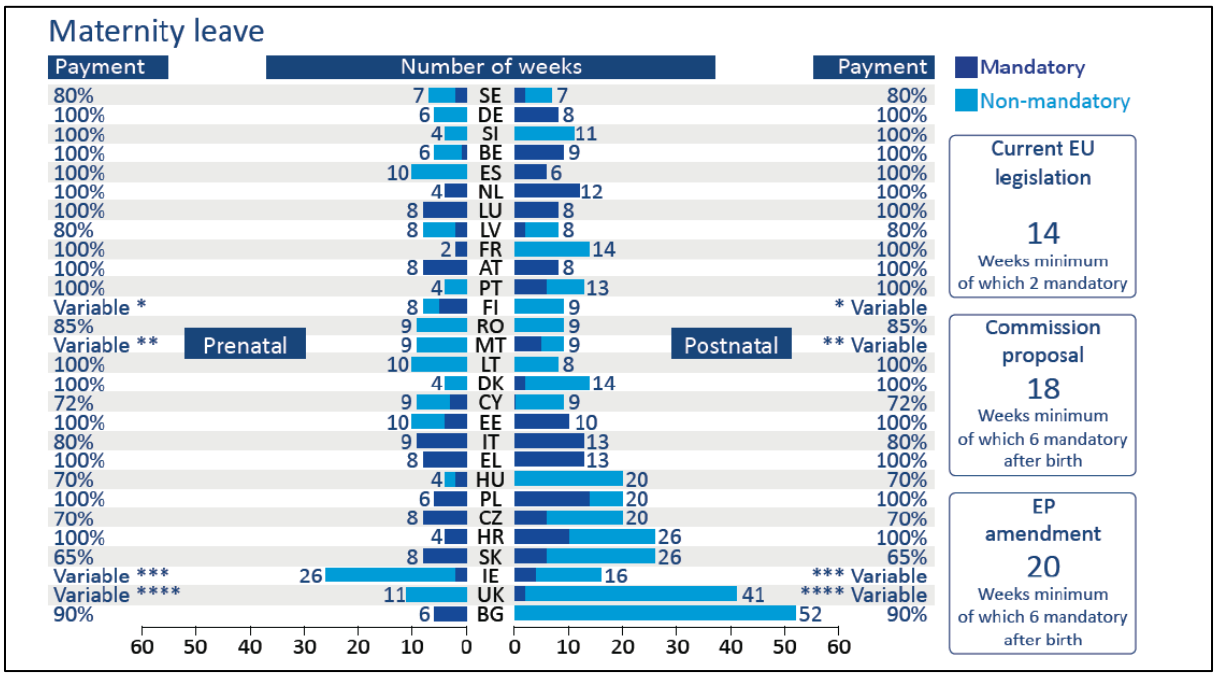
Next to parental leave, there are federal state child-raising allowances (*Landeserziehungsgeld*) in the federal states of Saxony and Bavaria which support parents who do not work full-time after the end of the parental leave benefit (Blum et al. 2016; please see 2.2.1 for more information about this program).

2.2.2.1 Maternity leave

Maternity leave *(Mutterschutz)* is the prohibition of work for employees who give birth to a child (European Commission 2016a, 20-21). Pregnant employees are not allowed to work six weeks before estimated childbirth, except they voluntarily consent to (Sections 3(2) of the Maternity Protection

Act). In addition, employment is prohibited eight weeks after childbirth (Section 6 of the Maternity Protection Act)[16]. The relevant decision-making bodies in Germany have decided to extend the current maternity leave law with regard to several aspects. The changes will be effective on 1st January 2018. (BMFSFJ 2017b)

Figure 5: Comparison of regulations on maternity leave between EU-countries



Source: European Parliament 2015

The duration of maternity leave in Germany is among the lowest in comparison with other EU states. There is only one other state (Sweden) which also only has 14 weeks of paid maternity leave. 14 weeks matches exactly the current EU legislation. However, the time of eight weeks for postnatal mandatory parental leave in Germany is more than the mandatory two weeks of maternity leave at current EU legislation and the six-week proposed by the Commission and the EP amendment. Even though these two documents propose more than 14 weeks for voluntary maternity leave, it should be emphasised that mothers in Germany can take a voluntary unpaid parental leave of two weeks in addition to the mandatory maternity leave.

2.2.2.2 Possibility of paternity Leave

There is no parental leave particularly for fathers in Germany (European Commission 2016a, 25). However, fathers can take parental leave.

2.2.2.3 Possible duration of parental leave

Parents are entitled to reduce employment for up to three years per child up to the child's 8th birthday according to Section 8 of the Part-Time and Fixed-Term Employment Act. In addition, they

[16] The duration of maternity leave is extended under certain circumstances, for instance, if the employee gives premature birth or gives birth to multiple children. If the mother dies or has a chronic illness, the maternity benefit may be transferred to another person. (Blum, Erler, and Reimer 2016)

can apply for parental leave and receive parental leave benefits according to the federal law on parental leave.

There are two tracks for compensation of parental leave: *Elterngeld* and *ElterngeldPlus*. The first track was introduced in 2007. The second track was introduced in July 2015 to allow for more flexibility for part-time-work up to 30 hours per week. Both options can be combined.

For couples, Elterngeld is paid for 12 months and two additional months if both parents use at least two months (*Partnerschaftsmonate).* Single parents can receive 14 months. Elterngeld can be split into two phases (Blum et al. 2016, 3).

Parents can receive 24 months of ElterngeldPlus plus four additional months if both partners work between 25 and 30 hours per week for at least four consecutive months at the same time (*PartnerschaftsBonus*). Single parents are equally entitled to 28 months. ElterngeldPlus can be divided up to three periods (BMFSFJ 2016a).

2.2.2.4 Who is entitled to take parental leave?

Eligibility for parental leave includes the official parents, adoptive parents, foster parents and the parents' partners who live with the child (European Commission 2016a, 23). Parents in Germany are entitled to take parental leave, regardless whether they work part-time and which category of work contract they have (European Commission 2016a, 22). Parents who used to have income from employment before the birth of their child are eligible for parental benefits, but long-term unemployed are not. Grandparents can take unpaid parental leave if the parent is underage or has not completed their professional education.

2.2.2.5 Flexibility of Parental Leave arrangements

In Germany, parents are entitled to reduce their working hours since the introduction of the *Part-Time and Fixed-Term Employment Act* in 2001 if they are employed in organisations with more than 15 persons and not civil servants. If the company has less than 15 employees, the employer has to agree to the reduction of working hours. Employers are also encouraged to offer options for part-time work (Section 6 of the Part-Time and Fixed-Term Employment Act). The employer may oppose the request for part-time work only if they can argue for very strong opposing reasons, such as safety reasons (European Commission 2016a, 26-28).[17]

The new programme *ElterngeldPlus* makes it possible for parents who work up to 30 hours a week to receive benefits more suitable for part-time work. With ElterngeldPlus the parent receives half the amount of benefits they would get if they used Elterngeld. This is made up for by doubling the time of eligibility: each month of Elterngeld becomes two months ElterngeldPlus.

2.2.2.6 Policies in place for supporting paternity leave or usage of entitlements by fathers

The reform of the parental leave legislation, which became effective in 2007 intended to support the use of parental leave entitlements by fathers. This was communicated partly in the discourse of the

[17] For civil servants, part-time work during parental leave is regulated under the Federal Civil Service Act or the states' civil service legislation and the rules may differ from other employees. Civil servants can work part-time to care for children under the age of 18, except for urgent opposing operational reasons. (European Commission 2016a, 26-27)

reform and broke with the intention of earlier parental leave legislation (Erziehungsgeld) to decrease the labour market participation of women (Baronsky, Gerlach, and Schneider 2012). The intention to support fathers' parental leave is also mirrored by the design of the program. Unlike earlier parental leave policies, Elterngeld is dependent on the wage of the parent, which makes use of parental leave easier for the primary earner of the family. Subsequently, the partnership months were introduced, which means that the overall time of parental leave will increase by two months if both partners make use of it. (Baronsky, Gerlach, and Schneider 2012) A causal effect of the new legislation on the rising share of fathers who take parental leave is assumed. Most of the fathers on parental leave (79.8%) take up to two months, which is the duration of the two partnership months. (BMFSFJ 2015b, 28)

In 2015, there was a second change in the legislation to introduce ElterngeldPlus and allow for more flexibility in combining parental leave and part-time work. With ElterngeldPlus, the two partnership-months, become four months of entitlement for a partnership-bonus. This way, the new policy supports fathers who would like to reduce their working hours in order to have more time for their family.

2.2.2.7 Regulations and initiatives supporting parents returning to work

Protection against dismissal is perceived a key measure to support parents returning to work. Due to the General Equal Treatment Act, employees have the right to return to an equal job after maternity leave. (European Commission 2016a, 22) Parents on parental leave are also protected against dismissal and have a right to return to an equivalent job with regard to pay and working hours after the end of the parental leave (BMFSFJ 2016a, 103). However, it has been criticised that this right should be stated more explicit in the law on parental leave (djb 2014).

2.2.2.8 Compensation rate for wages[18] for maternity leave

Maternity leave in Germany is fully paid for dependent employees under the statutory health insurance scheme. The health insurance bears parts of the costs for maternity leave benefits (*Mutterschaftsgeld*) (€13 per day). If the mother is employed, the employer pays the difference between the payments of the insurance and the employee's salary (Blum u.a. 2016). There is a mandatory pay-as-you-go-system for the reimbursement of employers' costs on maternity leave (Jansing 2006).

Unemployment benefits are matched by the maternity leave benefits from their insurer (Jansing 2006). Unemployed mothers, who do not receive unemployment benefits, do not receive maternity leave benefits. Self-employed mothers receive 70% of their former income, which is the same amount as would be calculated as sickness benefits. This rule, which used to be valid for self-employed women voluntary insured under the statutory health insurance (European Commission 2016a, 21) has been extended to self-employed women with private insurance in 2017 (BMFSFJ 2017b). In 2016, the European network of legal experts in gender equality and non-discrimination had criticised the situation of self-employed workers who are quasi-subordinated[19] to a contract

[18] *Percent of wages covered by leave benefits during leave period*

[19] Quasi-subordinated workers are self-employed, but still dependent on a certain contractee (*arbeitnehmerähnliche Personen*), which means they will be included with regard to the protection from work, but not eligible for allowances from their contractee (BMFSFJ 2017b).

partner (European Commission 2016a, 21). This situation is going to be improved to some extent in the new maternity leave legislation from 2018 on.

2.2.2.9 Compensation rate for wages[20] for parental leave

Compensation for parental leave is tax-funded and depends on the parents' income. Parents who opted for Basiselterngeld receive 65% of their former income as "parental benefit" (Elterngeld) if their net income is higher than 1.240€ per month. The minimum monthly payment for one child is 300€, the maximum €1,800 for one child. The benefit rate is higher for parents on a low income and there is a bonus for parents with multiple children. The "parental benefit" is paid for 12 months if one parent uses parental leave and for 14 months if both parents do so. The additional months are called partner months (*Partnermonate*). (BMFSFJ 2016a)

For ElterngeldPlus, parents receive half of the monthly benefits for the double amount of time which is to say 24 (+4) months. The minimum benefit is €150 and the ceiling €900. The bonus months if both partners use parental leave are called "partnership bonus" (*Partnerschaftsbonus*). The allowances for self-employed people are calculated based on the income of the previous year. (European Commission 2016a, 21)

2.2.2.10 Additional paid leave for working parents?

According to the emergency childcare leave (Section 45 of Social Code No. 5) employees can leave their job up to 10 working days a year (or 20 working days in case of single parents) to care for their sick or disabled child under the age of twelve. In total, the maximum workings days for emergency childcare (for employees with several children) are 25 and 50 days for single parents, except for terminally ill children. Emergency childcare is usually compensated by the health insurer by 70% of the employee's income or by the employer, if this was agreed on in the contract of employment. (European Commission 2016a, 26)

2.2.2.11 Legal right to reduce working time on request (Elternteilzeit)

Please see 2.2.2.5 for this topic.

2.2.2.12 Protection against dismissal

Pregnant workers are protected against dismissal during pregnancy and four months after childbirth. Parents who are using parental leave are also protected from dismissal from eight, respectively 14 weeks before the leave starts until the end of the leave under Section 18 of the Federal Statute on Parental Leave and Parental Allowances. There are certain exceptions from the protection of dismissal in the cases of maternity leave and parental leave. Exceptions have to be approved by the concerned authority and must not be related to the employee's parenthood. However, if the parent is employed under a fixed-term contract, the contract may expire and not be renewed during parental leave. People who are on their vocational training or junior researchers at universities are excepted from this rule. (European Commission 2016a, 20-23)

[20] Proportion of wages covered by leave benefits during leave period.

2.2.2.13 Additional information

Regardless of parental leave, one of the parents (usually the mother) can get recognised child rearing as a contribution to the public contribution-based pension system. The recognised time is three years for one child (Blum, Erler, and Reimer 2016, 2-3) and can be longer than three years if the parent rears multiple children.

2.2.3 Empirical Evidence for Gender Regime

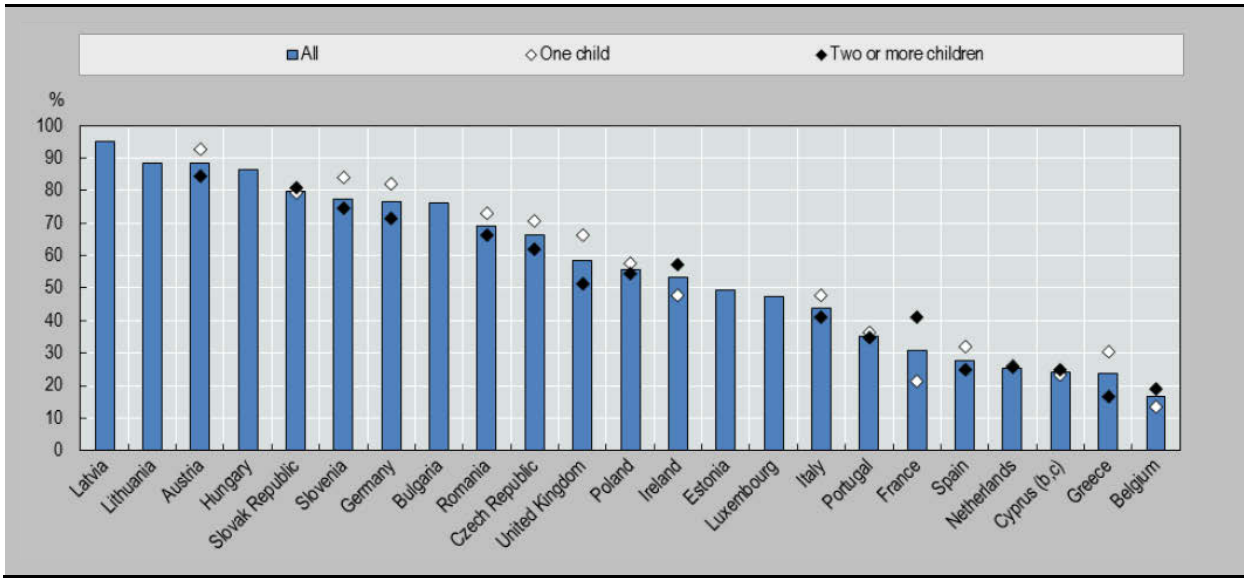
For Germany, the indicators provide evidence that reconciliation between paid work and family is a prevailing problem for parents. It is pointed out that men are less participating in child caring than they wish, even though the participation rate has been rising since 2007. In comparison to the OECD-average, men in Germany, are participating more in unpaid work and both sexes have less total hours of work. Women in Germany are concerned with most of the care-work, in particular, for very young children. In comparison to other EU-countries, a leak of adequate childcare facilities for children under three is noticeable as enrolment rates are comparatively low in Germany and 29% of mothers say they do not work because adequate childcare is not available or affordable. However, childcare facilities have been extended in the last decade.

2.2.3.1 Usage of parental leave

In Germany, usage of parental leave is very common. Basiselterngeld is more popular than ElterngeldPlus or partner months. In the third quarter of 2015 around 86.2% of all parents, applying for parental leave benefits opted for *Elterngeld and* 13.8% for *ElterngeldPlus*. In addition, 3.4% applied for the *Partnerschaftsbonus.* (Blum, Erler, and Reimer 2016)

Women make more often and longer use of parental leave than men. This holds true at the current moment, when the participation of men in childcare is rising and companies are noticing the demand for more flexibility to support reconciliation between work and family for fathers. Mothers use parental leave the more the younger their children are. Among mothers with children under one year, 77% are on maternity or parental leave. Around 42% of mothers with children under three years are currently on parental leave and around 25% of mothers with children under the age of six years. (Blum, Erler, and Reimer 2016)

Figure 6: Proportion (in %) of employed mothers with a child under age 1 on maternity or parental leave in 2013, by number of children



Source: Retrieved from OECD 2016b, Chart PF2.2.A.

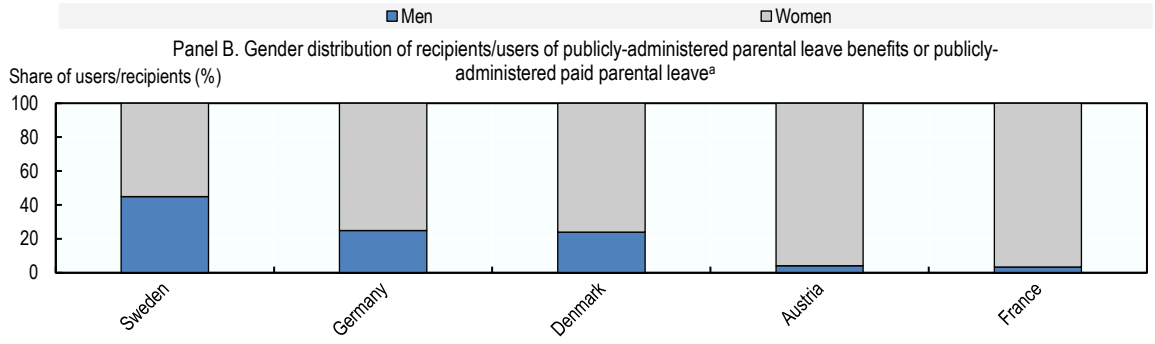
There is strong variation in the proportion of mothers of young children who use parental leave across countries. Compared to EFFORTI-countries, Germany is ranked in the middle. Figure 6 shows the proportion of employed mothers in countries participating in the European Labour Force Survey (EU-LFS) whose child has not reached its first birthday yet and who use maternity or parental leave. The share reaches from 16.53% in Belgium to 95.01% in Latvia. Among the EFFORTI-countries, Austria, Germany, and Hungary all have a share higher than 75% of employed mothers of children under one year on leave. In Germany, a comparatively high share of 76.79% of women with children under one year take maternity or parental leave, especially those who only have one child (81.65%). Among the mothers of two or more children (with one being younger than one year), about 10 percentage points less (71.02%) use maternity or parental leave.[21]

Contrasting the strong participation of mothers in parental leave, only 2% of fathers with children under three years and only 1.2% of fathers with children under the age of six years are on parental leave (Blum, Erler, and Reimer 2016). The participation of fathers in parental leave has increased since the introduction of the new parental leave scheme (*Elterngeld*) from about 3% in 2006 (Destatis 2008) to 34.5% for parents of children born in in the first quarter of 2015. However, there are strong differences between the federal states: In Saxony 44% of the fathers of children born in the first quarter of 2015 have used parental leave, but only 22.2% did so in Saarland. (Destatis 2016c)

[21] It is common among OECD countries that mothers with two or more children are less likely to be on maternity leave than mothers with one child under one year, but there are also exceptions. The exception in France may be explained due to the increase in the eligibility for paid leave. In general, the lower rate of mothers of multiple children on parental leave may be due to the fact that these mothers are more likely to have lost attachment to their job and are not counted as being on leave by the OECD statistics. (OECD 2016b)

Next to regular parental leave, there is also an increasing number of fathers who take short-time parental leave to care for a sick child. One of the biggest statutory health insurers noticed an increase in the participation of fathers between 2009 and 2014 from 10% to almost 20% in short-time parental leave days (DAK-Gesundheit 2015).

Figure 7: Gender distribution of recipients/users of publicly administered parental leave benefits or publicly administered paid parental leave in 2013[22]



Source: Retrieved from OECD 2016b, Chart PF2.2.C.

Comparing the gender distribution among recipients of parental leave benefits across EFFORTI-countries, Germany has a share of 24.9% men which is the second highest rate after Sweden (45%). This difference is much higher (about 20 percentage points) than the difference between Germany and Denmark (24.1%). Male participation is much lower in Austria (4.3%) and France (3.5%). There is no data available for Hungary.

[22] "Data refer to recipients/users of publicly-administered parental leave benefits or publicly-administered paid parental leave, and do not include users of maternity or paternity leave unless the country in question does not make a distinction between the different leaves (e.g. Iceland, Portugal). […] Data for Australia, Austria, Canada, the Czech Republic, Denmark, Estonia, Finland, Germany, Iceland, Italy, Luxembourg, Norway, Poland and Sweden refer to recipients of statutory parental leave benefits (or equivalent). […] For Austria, data refer to recipients of 'Kinderbetreuungsgeld' (childcare allowance). For Denmark, data refer to recipients of benefits for the 32 week 'common leave' period only. […] For France, data refer to recipients of CLCA (Complément de libre choix d'activité). For Germany, data refer to recipients of 'Elterngeld' (parental allowance) for those with children born in the given year. […] In all cases data refer only to those using statutory schemes and do not include individual's using only employer-provided parental leave or parental leave pay […]b) Data for Australia refer to 2012-13, for Belgium to 2012, for France to 2011, and for Korea and Poland to 2014", (OECD 2016b, Chart PF2.2.C.).

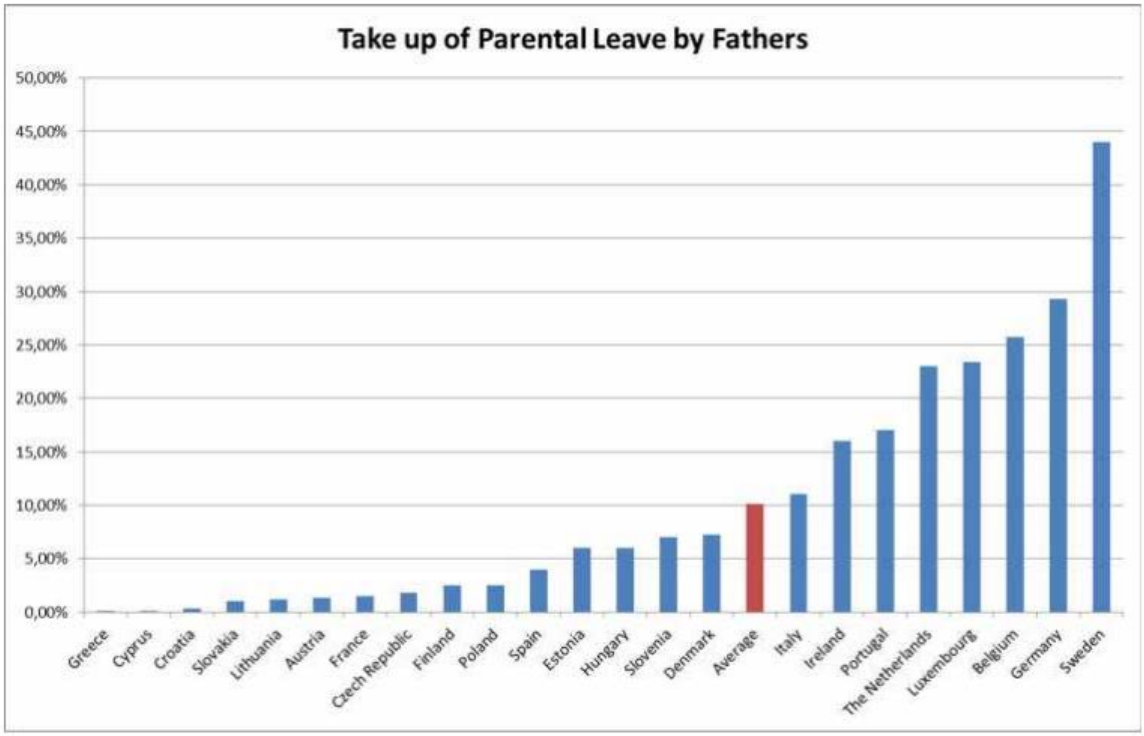
Table 19: Recipients/users of publicly administered paternity leave benefits or publicly administered paid paternity leave per 100 live births, 2006 and 2013

	2006	2013
Austria	-	-
Denmark	65.8	68.9
France	-	-
Germany	-	-
Hungary	21.9	25.1
Spain	58.1	56.3
Sweden	73.6	72.3

Source: Retrieved from OECD 2016b, Chart PF2.2.B.

In contrast to other EFFORTI-countries, there is no parental leave benefit explicitly for fathers in Germany. Both parents are eligible for parental leave benefits. Therefore, the data in Table 19 is not comparable regarding Germany.

Figure 8: Take-up of parental leave by fathers in 23 Member States in percentages of the available leave[23]



Source: European Parliament 2015, 73

[23] "Because of incomparable statistics, United Kingdom could not be included. Additionally, in the case of three countries, the statistics were not specific, which resulted in calculating the average for those three countries. The take up for Austria is between 0.6% ams 2%, for France between 1% and 2%, and for Finland between 2% and 3%." (European Parliament 2015, 73)

It is difficult to compare the take-up rate of parental leave across countries because of the incomparability of the legislation in different countries and because parents may have the option to use more than one programme for parental leave benefits. Figure 9 shows the attempt of such a comparison, which suggests misleading conclusions. According to statistic visualized in Figure 9 (European Parliament 2015, 73) fathers in Germany take up around 30% of the available parental leave for fathers in Germany.[24]

2.2.3.2 Average duration of parental leave periods by sex (measured in days);

Fathers use parental leave benefits for a much shorter time than mothers do. For children born in the first quarter of 2015, fathers used parental leave benefits for 3.1 months and mothers for 11.6 months on average (Destatis 2016c). Hence, fathers take shorter leave periods overall. 79.8% of fathers used two month of parental leave benefits and only 7.1% of fathers used 10-12 months. For mothers the numbers look the other way around: Only 0.9% of those who used parental leave did so for up to two months and 92.4% used 10-12 months (Destatis 2016c).

The regional differences in the number of fathers who have used parental leave benefits may be connected to the duration of fathers' parental leave, which is shorter in Saxony (2.8 months on average) than in Saarland (3.3 months on average). It is also noticeable, that fathers use parental leave for a longer time if they had no income from employment before (5.3 months compared to 2.8 months on average) (Destatis 2016c). For mothers, the difference is much smaller (11.7 months for those with income from employment and 11.4 months for those without income from employment).

2.2.3.3 What are the main barriers for increasing the participation of men in parental leave?

Barriers for fathers' participation in parental leave become explicit in the results of the fathers-barometer (*Väter-Barometer*), a representative survey among 1000 employed fathers and 300 company representatives, which was conducted for the first time in 2015 (BMFSFJ 2015c, 2016b). In 2016, 51% of the fathers and 69% of the young fathers (between 18 and 29 years) wished to reduce their working hours to have more time for the family. This indicates that fathers face barriers that keep them from realizing their wish to spend more time caring for their children, including the participation in parental leave.

It can be assumed that financial reasons are important for the decision of fathers to use parental leave. A higher income would be a valuable support to use parental leave for 51% of the fathers interviewed in 2016 and a higher income of the partner for 25% (BMFSFJ 2016a, 2016b). Besides, other studies found a negative impact on the fathers' parental leave if the mother does not participate in the labour market (Trappe 2013 according to BMFSFJ 2015b, 20), and a positive effect of a high household income (Allensbach Institute according to BMFSFJ 2015b, 42).

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[24] This contrasts the official statistics, according to which around 34.5% of fathers take parental leave with an average duration of 3.1 months (Destatis 2016c). However, fathers could possibly take as much parental leave as mothers, which equals 12 months if they are parenting in a partnership and 14 months if they are lone parents (see section 2.2.2.3 for more information). If the calculaton was put like this, fathers in Germany take far less than 305 of the available leave benefits and the statistics in Figure 8 is wrong. Figure 8 may also estimate the parental leave available to fathers only two month because in the German benefit. In contrast, Figure 7 had revealed that the rate of fathers among the users of parental leave (without regard to the length of the leave) is similar in Germany and Denmark. This reality is not adequately represented in Figure 8, according to which the take-up rate in Denmark is below average and according to which the German rate seems three times higher.

Uncertainty about or lacking of the employers' support is a second barrier for the participation of fathers in parental leave. Several publications emphasise that anticipated career-disadvantages are a key reason for fathers not to use parental leave or to use it for a short period of time only (BMFSFJ 2015b, 41). The fathers-barometer found that fathers believe a reduction of work to care for the family is only partly accepted by employers (2.8/4 points), while employers claim to accept a reduction of work due to fatherhood (3.2/4 points). Young fathers feel a higher acceptance of reduction in working hours (3.1/4 points). This may indicate a recent change towards more acceptance, which has not reached all, fathers yet (BMFSFJ 2016b). This could also be due to the fact that companies recently introduced new means of flexibility, which had not existed when older fathers would have made of them. Besides, young fathers may be better informed about work arrangements that support flexibility for fathers than older fathers. Young fathers have a stronger impression (3.2/4) that employers contact them explicit about support for work-life-balance than fathers in general (2.5/4) (BMFSFJ 2016b).

Negative effects of parental leave on the father's career is not only apprehended, but also found true by research studies. Kaiser et al. (2012, 41) emphasised that employers assume that those who take parental leave had a leak of aspiration for their career. This barrier to parental leave is even stronger for men than for women. Besides, part-time work was not perceived accepted for employees who would like to be promoted to higher leading positions. Taking parental leave would be seen as a potential risk for the future career by employees (Kaiser et al. 2012). Similarly, Pfahl, Reuyß, Hobler, & Weeber (2014) analysed that 10-25% of the interviewed fathers who have taken parental leave for three months or longer may be confronted with a "career setback" (Karriereknick) which is expressed by less chances to be promoted to a higher position in the short run (Pfahl et al. 2014).

With regard to the decision whether to use parental leave or not, the attitude of the immediate superior has a high influence, especially on fathers who are unsure. Many companies do not have a common policy on supporting parental leave yet and immediate superiors may not have the means to find an adequate substitute for the father who plans using parental leave. (Pfahl et al. 2014)

Companies in Germany believe that supporting flexible working models for fathers (part-time work, home office, etc.) is beneficial to them. A survey of 1737 people concerned with HR-matters in various companies revealed that employers notice increasing expectations by fathers' for flexibility at work and demand to use such supportive opportunities. At the same time, they assume that flexible working hours go along with higher productivity of fathers. However, this is contrasted by taking a look at the current personnel management in the companies. Most companies do not know which male employees are fathers, only 40% of the companies could offer part-time jobs to fathers (Erfolgsfaktor Familie and BMP 2014).

2.2.3.4 Fertility indicators

In Germany, the fertility of women in terms of total births in a woman's life and the mean age of women at the time of giving birth has been decreasing for decades. At the same time, an increasing proportion of women does not have children at all. Low fertility and a late age at birth may indicate problems to realise work-life-balance (Gerlach 2009), as well as the choice to live without children may be influenced by the availability of other work-life-choices and further reasons (Schleutker 2014). Consequently, it may be argued that there are problems of work-life-balance for women in Germany.

Demographers connect decreased fertility to the phenomenon of advanced maternal age. Women postpone the birth of their children to a later time in life, but only a part of the postponed births is being realised then (Pötzsch and Sommer 2009). In Germany, an interesting phenomenon has been noticeable in recent years: Both the Total Fertility Rate (TFR)[25] and the mean age of women at birth of their first child have been rising. Possible reasons for the increasing birth rates may be that the effect of increasing births is stronger than the effect of later age at birth, immigration, fetching up births that had been postponed before and improved options to balance work and family life.

Table 20: Total Fertility Rate (TFR) for the years 2006 – 2015 (in %)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU28	1.54	1.56	1.61	1.61	1.62(b)	1.59(b)	1.59(b)	1.55(eb)	1.58(bep)	:
Germany	1.33	1.37	1.38	1.36	1.39	1.39(b)	1.41	1.42	1.47	1.5

: = not available b = break in time series e = estimated p = provisional

Source: Eurostat 2016c; Data for 2015 retrieved from Destatis 2016e

The total fertility rate (TFR) in Germany has been lower than the average among EU-28 countries for at least one decade. However, the TFR has increased from 1.33 in 2006 to 1.5 children per women in 2015. This increase by 0.14 children per woman until 2014 is higher than in the average of EU states, where the number has risen by 0.04 from 1.54 to 1.58 children per woman.

The rising TFR in the last decade, which is interpreted as an increase in the fertility of women in Germany, may partly explained by the renewed parental leave legislation in 2007 and improved chances for reconciliation between work and life (Gerlach 2009). Migration may be a second reason because the TFR of women with foreign nationality is higher than the TFR of women with German nationality (Destatis 2016b). However, an increase of the TFR in recent years in Germany does not represent the number of children a woman will give birth to in her lifetime (Destatis 2017c), so the results should be interpreted cautiously.

Table 21: Mean age of women at birth of first child for the years 2005 – 2015

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Germany[26]	29.6	29.7	29.8	30	28.7	28.8	28.9	29	29.2	29.4	..

Source: UNECE 2017d. There are minor differences between the data used here and the data provided by Eurostat (2016d)

[25] Fertility is often being measured using the Total Fertility Rate (TFR), which describes the sum of the age-specific fertility rates at a certain point in time. The TFR is not a perfect measure of fertility because it is based on the hypothetical assumption that future generation will have a similar timing of birthgiving as current generations. At times of postponed births, this assumption does not hold true. Alternatively, Pötzsch and Sommer (2009) propose that the Cohort Total Fertility Rate in Germany (CTFR) is a more precise measure than the TFR to predict fertility of women in Germany. However, the results will finally only be known when the current generation of women in the age of capability to give birth will have achieved their 50th year of life. The CTFR in Germany has constantly been lowering since the cohort of 1933, which gave birth to 2.224 children on average compared to 1.53 children per woman born in 1966 (Destatis 2017b). Using the CTFR it can be assumed that the mean number of children women in Germany will give birth to in their lifetime will be between 1.5 and 1.6 on the long run (Pötzsch and Sommer 2009).

[26] "Break in methodlogy 2009: From 2009 data refer to biological birth order. Change in definition (1980 - 2008): Data refer to children born in marriages. Data are based on events" (UNECE 2017d)

Table 21 illustrates the trend of later births in Germany, even though the development is slightly blurred by a break in methodology and the leak of available data.[27] Considering this, Table 21 reveals that the mean age of women at first birth has increased in Germany from 28.7 in 2009 to 29.4 in 2014. There was also an increase between 2005 and 2008, but a sudden drop from 30 to 28.7 between 2008 and 2009 that goes along with the change in methodology. Keeping in mind that the age before 2009 may have been estimated higher than it actually was due to the statistical errors, it is likely that the mean age of women at birth of their first child has constantly been increasing. With regard to the CTFR, it also becomes evident that there is a trend of later age at first birth for women in Germany (Pötzsch and Sommer 2009).

Table 22: Share of women in Germany without children among all women of the respective age group according to their highest professional or general educational qualification (ISCED 97) (in %). Results of the microcensuses from 2012 and 2008 - population at primary residence.

age at time of report (2008/2012)	women in total		according to the level of educational achievement					
			low		medium		high	
	2012	2008	2012	2008	2012	2008	2012	2008
16-19	99.0	98.0	86.0	84.0	98.0	98.0	/	/
20-24	90.0	89.0	57.0	57.0	89.0	88.0	92.0	94.0
25-29	68.0	67.0	35.0	30.0	63.0	62.0	82.0	83.0
30-34	42.0	40.0	20.0	20.0	37.0	37.0	56.0	57.0
35-39	26.0	26.0	14.0	16.0	25.0	25.0	33.0	33.0
40-44	22.0	20.0	16.0	15.0	21.0	19.0	26.0	26.0
45-49	20.0	17.0	18.0	16.0	18.0	15.0	24.0	22.0
50-54	17.0	16.0	15.0	12.0	16.0	15.0	22.0	20.0
55-59	16.0	14.0	14.0	11.0	15.0	14.0	20.0	18.0
60-64	14.0	12.0	12.0	10.0	13.0	12.0	18.0	17.0
65-69	12.0	11.0	10.0	8.0	12.0	11.0	17.0	18.0
70-75	11.0	11.0	9.0	9.0	12.0	11.0	17.0	21.0
The achieved level of education is combined by the highest educational and professional degree according to the International Standard Classification of Education 1997 (ISCED97).								

Source: Table retrieved from Destatis 2015a, own translation

The higher the degree of education is the higher is the rate of women who do not have children (yet). Table 22 shows that 26% of the women between 40 and 44 years were childless in 2012, compared to 21% of women with medium education and 16% of women with low education. High-educated women give birth later in their life. 56% of women with in the age group 30 to 34 were childless in 2012 but only 20% of women with low education. There was a slight decrease of childlessness in the cohorts between 20 and 34 of women with between 2008 and 2012. In 2008, 94% of women with between 20 and 24 had no children, but only 92% in 2012. For women between 25 and 29 the rate of

[27] Reliable data for the mean age of women in Germany at the birth of their first child has been available since 2009. Before, there was a similar statistic that counted information on the mean age of women at the time of the first birth in her current marriage. However, substituting the missing data on the biological birth order with this information may lead to estimating a higher age because many women will have given birth to their first child before the current marriage. (Der Spiegel 2010)

childlessness has decreased by one percentage point from 83% to 82% and 57% to 56%. This may indicate that the perceived options for combining work and life choices are slightly increasing for young women with higher education.

2.2.3.5 Household and family composition

It is difficult to compare families across EFFORTI-countries as the number of families living with minor children varies. Germany has a high share of families who do not live with minor children (Eurostat 2015). In Germany, marriage is the prevailing family form for parents who live with minor children. In 69% of the families, parents are married couples. 10.5% are cohabiting couples. Around 20.5% of all parents living with minor children, around 1.64mn in total, are lone parents. 90% of the lone parents are women. If it is not included whether children are of minor age or adults, it can be estimated that there are around 2.74mn lone parents in Germany (Destatis 2017a). In comparison to the family composition across EFFORTI-countries, the number of one-parent-families seems to be very low in Germany at first view.

Table 23: Key figures on households and families in Germany, 2015

Households		40.8 mn
	One-person households	41.4%
Families with minor children		8.0 mn
	Married couples	69.0%
	Lone parents	20.5%
	Cohabiting couples	10.5%
Couples		20.4 mn
	Married couples	85.7%
	Opposite-sex cohabiting couples	13.9%
	Same-sex cohabiting couples	0.5%

Source: Destatis 2017d

Table 23 shows the number of families with minor children. 20% of households in Germany, which is to say 8.1mn of the 41mn households, are families with minor children. Regarding this, the share of lone parents can be estimated 20.5% of all parents living with minor children.

Table 24: Lone parents with minor children by sex and share of all families with minor children in Germany, 1996 to 2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Fathers (in 1000)	154	164	158	156	154	151	156	165	167	180
Mothers (in 1000)	1409	1454	1411	1428	1406	1425	1466	1478	1448	1459
Share among all families with minor children (in %)	17.6	18.5	18.3	18.8	19.0	19.4	20.0	20.3	20.0	20.0

Source: Data from the Microcensus. Table retrieved from BiB 2016. Own translation

Both the absolute number of lone parent mothers and fathers and their share among all families with minor children in Germany has risen between 2005 and 2012 according to microcensus data. Women

are single parents more often than men are. The number of single mothers has increased from 1.4096mn to 1.478mn between 2005 and 2012 but varied little in 2013 and 2014 (see Table 24). The number of single fathers has constantly been rising from 154000 in 2005 to 180000 in 2014. In total, there were around 1.6mn single parents in Germany in 2014, of whom around 90% were women. The share of lone parent families has risen from 17.6% in 2005 to 20.3% in 2012. In 2013 and 2014, it stagnated at 20%.

Further statistics in Germany reveal that divorce is the most common reason for becoming a lone parent family. Lone mothers are more often singles (43%) than lone fathers (27%) are and less often widowed (4% of mothers, 10% of single fathers). On average, the children who live with lone fathers are older than those who live with lone mothers. (Destatis 2016a)

Table 25: Analysis of different types of family nuclei, national averages (in % of all families) in 2015

	Married couples[28]	Registered partnerships	Consensual unions	Lone father families	Lone mother families
EU-28	71.2	0.2	12.6	2.6	13.4
Denmark	67.9	0.3	19.6	2.2	10.0
Germany	75.1	0.1	12.1	2.0	10.7
Spain	71.6	-	12.2	3.4	12.8
France	64.7	-	20.8	2.3	12.1
Hungary	65.3	0.0	14.9	2.6	17.1
Sweden	60.0	0.1	26.8	3.1	10.0

Source: Retrieved from Eurostat 2015

The family composition of parents with minor children in Germany varies from the life forms of adults in families overall. Table 25 compares the types of family nuclei in the EFFORTI-countries regardless of whether these families live with minor children or not. It reveals that marriage is far more common in Germany and that cohabitations are less common in Germany. With 75.1%, Germany is the country with the highest share of married couples. Complementary, it is the country with the lowest share of cohabitations (12.1%). Hence, it can be concluded that couples in Germany are more likely to get married. This may be connected to financial incentives (see 2.2.1). The share of single parents is also comparatively low in Germany, only 2.0% of the families in Germany (compared to 2.6% on the EU average) have a single-father and 10.7% a single-mother (compared to 13.4% on the EU average). However, composition of family formation should be cautiously interpreted with regards to the family formation for people with children, as most households in Germany do not live with minor children.

[28] Same-sex registered partnerships are included under married couples.

2.2.3.6 Enrolment rate of children aged in childcare facilities

Table 26: Child Care by Indicator, Country and Year (Enrolment Rate of Children aged under 3, per 100 children), 2005 – 2016 (in %)

	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Germany[29]	14.0	16.0	18.0	20.0	23.0	25.0	28.0	33.3	36.6	36.2	..

Source: Retrieved from UNECE 2017a

In Germany, enrolment in childcare facilities became gradually more common within the last decade. In 2005-2006, only 14% of children under the age of three years had been enrolled in childcare facilities, in 2014-2015 the enrolment rate was already 36.2%. The data retrieved from UNECE (2017a) differs from the official statistics on children in childcare and day care that are public or supported by the public (see Table 26).

Table 27: Rate of children in childcare and day care who are not enrolled in additional childcare or school, 2007 – 2016 (in %)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0-3 years	15.5	17.6	20.2	23.0	25.2	27.6	29.3	32.3	32.9	32.7
3-6 years	89.0	90.7	91.6	92.2	93.0	93.4	93.6	93.5	94.9	93.6

Source: Retrieved from Destatis 2016d, table ZR8, own translation

Table 27 shows the enrolment rate for children younger than three years according to the annual count by official statistics in March. It illustrates that the enrolment rate for children under the age of three has doubled between 2007 and 2014 from 15.5% to 32.3%. However, it has varied little between 2014 and 2016. In 2015 it increased a little to 32.9%, but then decreased again to 32.7% in 2016. A decrease in the enrolment rate does not mean a decrease in absolute numbers because the number of children under the age of three has also increased.

The official statistics of childcare enrolment also reveal that enrolment is particularly low for children under one year and increases with age. 2.8% of the children under one year, 34.6% of the children between the age of one and two and 59.7% of the children between the age of two and three were enrolled in childcare or day care in 2014 (BMFSFJ 2015d).

Table 28: Percentage of children in formal childcare, 2012

	below age 3			**between age 3 and compulsory schooling age**		
	1-29 hours	30 hours +	total	1-29 hours	30 hours +	total
EU28	15	15	30	37	46	83
Germany	9	15	24	46	44	90

Source: Eurostat: EU-SILC; table retrieved from Plantenga 2014, 44

Table 28 illustrates that Germany has a low enrolment rate in formal childcare for children under three compared to the EU-average in 2012. 30% of the children under three years were enrolled in

[29] "Children in day care are included starting with reference year 2012/2013 according to definition of ISCED Level 010 in ISCED 2011" (UNECE 2017a).

formal childcare on average in the EU in 2014, but only 24% in Germany. However, Table 26 and Table 27 reveal that childcare has become more common for children under three in recent years, so the difference measured in 2012 may not exist anymore. While the use of formal childcare below and above 30 hours per week is equal in the EU-average, the share of children enrolled in formal childcare for 30hours/week or more (15%) is higher than the share of children enrolled in childcare below 30 hours/week (9%).

For children between three years and the mandatory schooling age, the enrolment rate is a bit higher in Germany than in the EU-average, but at the same time, children are enrolled for less hours than in other EU-countries. Most children between three and six years are enrolled in formal childcare in Germany, however, less than half of them is enrolled in a childcare facility that provides for more than 30 hours a week. 90% of the children between age of three and the mandatory schooling age are enrolled in childcare in Germany compared to 83% on EU-average. 46% of children in Germany are enrolled for less than 30 hours/week compared to 44% who are enrolled in childcare that lasts 30 hours or longer. In the EU-average, 46% of children are enrolled in childcare facilities for 30 hours or longer and only 37% of children are enrolled for childcare that lasts less than 30 hours.

The conclusion that there is a leak of childcare in Germany is also supported by other studies in Germany. A comparison between a survey by the German Youth Institute (*Deutsches Jugendinstitut*) and enrolment rates revealed that 41.5% of the parents of children under three years wanted a place in childcare, but only 32.3% of the children had one in 2014 (BMFSFJ 2015d). Similarly, in a survey conducted by infratest dimap, 83% of parents agreed on the idea that more childcare places for children under three should be created (infratest dimap and Bertelsmann Foundation 2016).

2.2.3.7 Women not working or working part time because of inadequacy of childcare services

Empirical data from the European Labour Force Survey of 2010 provides evidence for a lack of adequate childcare provision being a key reason for the low participation of mothers in the labour market in Germany in comparison to fathers.

Table 29: Impact of the inadequacy of childcare services as a reason for women (aged 15 - 64 and with children up to the mandatory school age) not working or working part time

	Children younger than 3		**Children between 3 and the mandatory school age (MSA)**	
	Absolute value: adequate childcare services are not available or affordable	Relative value: percent of mothers who do not work or work part time	Absolute value: adequate childcare services are not available or affordable	Relative value: percent of mothers who do not work or work part time
EU27	1,982,543	23	1,441,445	18
Germany	249,572	29	247,479	16

Source: EU-LFS data 2010, table retrieved from European Commission 2013a, 34)

Even though the enrolment rate in childcare facilities in Germany has strongly increased during the last decade, it still does not satisfy the demand. Table 29 shows evidence for this finding from the analysis of the European Labour Market Survey (EU-LFS) in 2010. Availability of childcare is a critical subject for mothers of children younger than three years. Around 29% of mothers of children under

age of three are not working or are only working part-time due to non-affordability or non-availability of adequate childcare facilities. This is by six percentage points higher than the European average. For children between three years and the mandatory school age, problems of finding adequate childcare are less, but still keeping 16% of mothers from participating in the labour market to the degree, they wish to. This is slightly less than the average among EU member-states (18%).

Table 30: Main reasons for women (aged 15-64 and with children up to mandatory school age) not working or working part time by perceived shortcomings of childcare (in %)

	Not available	Too expensive	Insufficient quality
EU 27	25	53	4
Germany	25	31	…

Source: Retrieved from European Commission 2013a, 35

It is not evident from the EU-LFS-results, whether the leak of childcare in Germany is due to problems of availability, affordability, insufficient quality or further reasons, for instance expectations shaped by the cultural context. Data is only available for questions of availability and affordability. Availability is a problem for 25% of the mothers who do not work (as much as they wanted) due to a leak of childcare provision both in Germany and among the EU average. Affordability is only an issue for 31% of the mothers concerned in Germany, while this is a key point for 53% on the EU-average. This indicates that affordability is less important for mothers in Germany than across EU-countries and it can be assumed that there are other reasons more relevant for them.

From the literature on childcare, problems of quality cannot be excluded as a reason. There is an ongoing debate about problems of quality in Germany. According to official statistics, childcare has not been extended at the expense of quality (BMFSFJ 2015d), however it also has not improved much. The average number of teachers per child under three has improved from 4.5 per child in 2012 to 4.1 in 2014 (BMFSFJ 2015d, 28). The ratio between educators and children stayed 1:10 in the same time period. However, it is criticised that this ratio is not satisfying. The Bertelsmann-Stiftung estimates that the ratio of educator and children should be 1:3 for children below three years and 1:7.5 for children between the ages three and six (Bertelsmann Foundation 2016).

Furthermore, the provision of childcare is not federal domain; therefore, the quality differs across states and municipalities (Bertelsmann Foundation 2016, 9). While the ratio of educators and children under the age of three is 1:3 in Baden-Württemberg, it is 1:6.4 in Saxony. The major part of parents would agree with the idea of stronger federal regulations with regard to the ratio of educators and children, the training of educators and the food standards (infratest dimap and Bertelsmann Foundation 2016).

2.2.3.8 Time spent in unpaid work

Table 31: Time spent in unpaid, paid and total work in the year of 2001/2002, by sex in minutes per day

Time spent in unpaid[30], paid and total work, by sex.

	Paid work		Unpaid work	
	Women	Men	Women	Men
OECD Average	215.3	328.5	271.7	137.6
Germany	180.9	281.6	268.8	163.8

Source: OECD 2017

On the OECD-average, women spend more time working than men in total with 487 minutes compared to 466.1 minutes. While men spend more time with paid work (328.5 minutes/day) than with unpaid work (137.6 minutes/day), women spend more time with unpaid work (271.7 minutes/day) than with paid work (215.3 minutes/day).

People in Germany work less hours than the average inhabitant of an OECD-country and the work is distributed more equally between the sexes. Total working time is similar for men and women in Germany, both work between 445 and 450 minutes per day. Women in Germany use less time than the OECD-average for both paid and unpaid work. Men in Germany use less time than the OECD average for paid work and 26.2 minutes/day more for unpaid work.

2.2.4 General Assessment of the Gender Regime

In Germany, employment and care work is mainly traditionally distributed between women and men. Welfare institutions have been supporting this. In recent years, policies have been trying to support flexible parental allowances that can be combined with part-time work. The share of fathers who use parental leave has been increasing, childcare facilities have been extended and companies have tried to introduce more flexibility at work for parents. However, these improvements could not change the gendered work distribution in general.

Overall, it is difficult to compare the impact of welfare rules on gender equality across countries because there are many influences and interdependences. Regarding fiscal disincentives for women to participate in the labour market, Germany scores among the European average according to Plantengas (2014) model, but it can be assumed that the results would have been different if the hypothetical parameters were changed or if indirect effects were included. Even though childcare facilities have been extended in the last decade, the leak of adequate childcare provision seems still more critical in Germany than in other European countries.

In conclusion, even though the preferences of people in Germany have changed towards a less conservative breadwinning model and more gender-balanced policies were introduced, Germany maintains characteristic fiscal policies of a conservative welfare regime.

[30] There is no precise definition of the indicators of unpaid work in the database. The OECD has provided a definition at another place in 2011. According to this definition, unpaid work is work without payment that, however, could potentially be sold on the market or done by a third person. (OECD 2011, 10)

2.3 Gender Equality policies in RTDI (current developments)

Concerning GE in the research and technical development infrastructure, only small progress is made. It is not possible to say whether this progress is the result of the recent policy initiatives as described in this section, or whether it is due to general trends in society. The junior professorship (*Juniorprofessur*) is criticised because of uncertain future prospects, but also seen as a chance to support women's representation at academic top positions.

2.3.1 Description of overall strategic gender equality policies in RTDI in place

Federal government and states formulate strategic guidelines and set financial impulses that are taken up by universities, research organisations, and the DFG. Therefore, the main strategic decisions on GE in research are expressed in the coalition agreement of the governing parties on the federal level, the resolutions of the GFMK on the state level, and the funding principles of DFG.

Federal

GE is explicitly mentioned with a prominent position in the German coalition agreement between CDU/CSU and SPD. It is stated that women are still disadvantaged in the German research system. The government aims to raise the proportion of women on all levels of the research system, especially in leading positions. To reach this goal, funding instruments shall be designed more according to GE principles, and more concrete target quotas shall be introduced for women in leading positions. Quotas are mentioned as "essential". Furthermore, the Programme for Women Professors (*Professorinnenprogramm*) is called a success and its continuation is confirmed. Research institutions shall be supported to implement more family-friendly structures. (Federal Government 2013)

State

In its resolution from August 25th 2014, the GFMK addresses GE in the German research system (GFMK 2014). This document can be seen as a confirming response to the coalition agreement. The GFMK aims to tackle GE on a programme, institutional, and network level. On the programme level, the GFMK strives for a systematic anchoring of GE targets and control instruments in all agreements between the federal and state governments that are relevant for research policy. GE criteria shall be considered in funding and contracting, the assessment of research proposals, and evaluated in their impact on the institutional level. Regarding research institutions, the GFMK pleads for a reform of the legal framework to tie research grants to the successful fulfilment of GE targets, and to set incentives for GE measures through the inclusion of the concept into competitive grant distribution. Finally, the GFMK suggests the federal government to establish a federal/state working group with the participation of research institutions and the German Rector's Conference (HRK) that promotes the exchange of experiences and goals to improve GE in the establishment of research networks, develop a gender-oriented framework for network structures, and test as well as evaluate this framework in at least two different cooperation projects.

DFG

The German Research Foundation (DFG), which is financed by German federal government and states, mentions the promotion of GE in science and academia as one of its goals in article 1 of its statute. Its Research-Oriented Standards on Gender Equality are seen as one of the "most comprehensive measures" for the promotion of GE in research (Sofka and Sprutacz 2016, 66-67). In 2008, the member assembly of DFG agreed on four principles that structural and personal GE

standards of research institutions should fulfil on a non-mandatory basis.[31] Its main target is to raise the share of women on all career levels according to the cascade principle (DFG 2016a)[32] The main contribution of the DFG principles is to be seen in the establishment of a comprehensive annual reporting system on GE in research institutions, substantiating the development of the relevant indicators. In its evaluations in 2009, 2011, and 2013, the DFG shows itself satisfied with the spread of GE measures among research institutions in Germany and its anchoring as a responsibility of top management. However, it is stated that although the GE measures are well spread, they hardly appear to have significant effects on the effective share of women on all career levels (DFG 2016a). Accompanying the standards on GE, the DFG also applies Gender Mainstreaming to its own funding measures. For instance, personnel shortfalls due to family reasons (maternity or parental leave) are compensated through project extensions or financial support for the maintaining of project management functions. Scholars with children can apply for additional supplements (Sofka and Sprutacz 2016).

2.3.2 Main challenges concerning GE in RTDI

The Joint Science Conference (GWK) summarises the fundamental trends concerning equal opportunities for men and women in research (GWK 2016a):

- The share of women at all qualification and career levels increases constantly, but slowly. With every step on the career ladder, the share of women decreases (see Table 32). This holds also true for leadership positions at both, universities and non-university research institutions.
- Female professors have disproportionately often-temporal contracts and work part-time. The largest amount of the current share of women among professorships traces back to junior professorships.

- In STEM and engineering sciences, the underrepresentation of women is structurally hardened and remains around 30% among matriculations. Progress can be seen in the engineering sciences. Here, the share of women increased from 19.6% in 1995 to 24.9% in 2014. Traditionally, women are overrepresented in medicine (2014: 68.9%), linguistics and cultural studies (2014: 73.9%).

Table 32: Share of Women at different scientific qualification levels, 2005 and 2014 (in %)

Qualification level	2005	2014
Matriculations	48.8	50.1
Graduates	50.5	50.8
Promotions	39.6	45.5
Habilitations	23.0	27.8
Professors with Junior Professors	14.3	22.0
Junior Professors	29.0	40.0

Source: GWK, 2016a

[31] Those principles are comprehensiveness, transparency, competitiveness and future-orientation, and competence according to the (DFG 2008).

[32] This means, the pursued share of women on the higher career level is determined by the current share of women on the lower career level.

Since the proportion of women in academia is particularly high among junior professors, the junior professorship appears to have become the new bottleneck for female researchers. However, it is not fully assessed, to what extent the junior professorship can contribute to increasing the share of women at academic top positions. Junior professors often face uncertain futures and problems of reconciliation between work and family (Burkhardt et al. 2016). The junior professorship was mainly assessed as an improvement by the experts at the national workshop (see section 3.6.3.2) and also surveys found that most junior professorships will result in a full professorship afterwards (Nickel, Püttmann, and Duong).

In consideration of those facts, the main challenges for GE in research remain to encourage more young women to study "unconventional" disciplines, and to overcome the culturally rooted brain drain of female graduates and PhDs. The data proof an irrational research system in which professional development is depending on values and stereotypes that favour the promotion of men and lead to a loss of (female) innovation potential (GWK 2016a, 13).

2.3.3 Policy measures promoting gender equality in RTDI

Summarizing the efforts of federal government, states and research organisations, the typical mix of GE measures in Germany comprises faculty-specific, self-defined target quotas, individual grants, and equal opportunity officers as the key drivers of GE at the university level.

2.3.3.1 Measures addressing GE in scientific careers

Federal

The most significant policy initiatives regarding GE in scientific careers are the "Programme for Women Professors" and the "Pact for Research and Innovation", both implemented in mutual coordination of the federal government and the states. Nearly all other nation-wide projects and programmes with respect to GE in scientific careers can be subsumed under the "Pact for Research and Innovation", and a relevant share of Gender Mainstreaming measures at universities can be traced back to the "Programme for Women Professors".

The "Programme for Women Professors" finances up to three positions for female professors with an initial funding limited to five years. The measure was introduced in 2008 and is meanwhile extended to 2017 due to its high demand. In its first period, universities qualified for participation by the submission of external reviewed Gender Mainstreaming concepts. In the second period, already accepted universities could qualify again by the implementation of their concepts. 198 universities submitted concepts of whom 85% got accepted (BMBF 2016b)

The "Pact for Research and Innovation" started in 2006 and meanwhile is extended to 2020. The overall goal of the concerted action of federal government and states is to strengthen the competitiveness of the German research system. It is addressed to the DFG as the most important source for third-party funds in Germany and the partly publicly funded non-university research institutions Fraunhofer-Society, Max-Plank-Society, and Leibniz-Society. The Pact obliges the research organisations to several negotiated targets. The progress on those targets lays in the responsibility of the organisations themselves and has to be documented by an annual monitoring report. In return, the organisations receive an annual growth of their budget of currently 3%. In the context of the "Pact for Research and Innovation", the research organisations also set target quotes for the share of women at their different hierarchy levels, applying the logic of the cascade-principle (BMBF 2016d; GWK 2016b).

Lastly, with the programme “Women to the Top”, the German Ministry for Education and Research (BMBF) from 2007 to 2015 funded 116 research projects on career orientation and career paths of women in business and research organisations with a sum of 37.2 million Euros (BMBF 2013).

State

On the state level, a high diversity of GE measures regarding career opportunities of women can be found. Design and extent of the programmes differs highly, depending on versatile factors such as the governing parties, or institutional and cultural path dependencies. The state of Baden-Wuerttemberg annually invests 4.1 million Euro for GE measures in research institutions. Those funds are mainly allocated to individual scholarships like the “Margarete-von-Wrangell-Habilitation Programme”, the “Brigitte Schlieben-Lange-Programme” for mothers with children, or the “Mathilde-Planck-Teaching Programme” to foster teaching experience among female graduates (MfWFK Baden-Württemberg 2016). Similar programmes also can be found in North Rhine-Westphalia. The state supports junior researchers with 1.5 million Euros on an annual basis, with a focus on the promotion of female researchers, and grants institutional support of one million euros annually to chairs of Gender Studies (MfIWF 2016). Additionally, a quota regulation was included into the Law of NRW, following the role model of the “Programme for Women Professors”. Hence, North Rhine-Westphalian universities are obliged to set specific arbitrary quotas for each faculty and are encouraged to implement measures for the realisation of their targets (para. 37a Law NRW). Remarkable also is the integration of GE into the performance-related resource allocation: as in a few states, the senate of Berlin sets financial incentives for the appointment of female professors that are higher as lower the current share of women in a discipline and qualification level is (Senate of Berlin 2016).

University

Not all GE measures in every German university can be mentioned here. Instead, a quick glance is given on the GE concepts of the Top-3 German universities in the Institution Ranking of the Center of Excellence Women in Science at GESIS. Following the annual ranking, the distribution of the sexes is balanced best at (1) RWTH Aachen University, (2) Free University Berlin, and (3) Hildesheim University (Löther 2016).

The GE concept of RWTH Aachen is outlined in the equal opportunity plan for women that consists of a framework plan, the specific plans of the faculties, the plans of the central university administration, of the scientific institutions, and of the central operational units (RWTH Aachen University 2014). Structural drivers of the university’s GE concept are:

- a staff position with the task of consulting the rectorate and developing concepts in the field of Gender and diversity,
- an equal opportunities officer, integrated in all boards and commissions of the university,
- representatives of the equal opportunities officer in each faculty,
- three chairs with a focus on Gender Studies that offer scientific expertise,
- and a GE commission as a permanent commission at the academic senate that consults and supports the university with respect to all GE matters and that monitors the implementation of the equal opportunity plan and the distribution of funds as the Equal Opportunities Law of the state requires it.

The university undertakes actions in six activity fields. It tries to reduce the underrepresentation of women on all career levels, carries out specific qualification measures for women, fosters the

compatibility of job, studies and family, tries to improve working conditions, implements measures to guarantee safety and health, and applies a gendered speech.

In a similar way as in Aachen, the FU Berlin also uses an integrated equal opportunity plan that is based on the contributions of the central administration units and the faculties. In comparison, the FU additionally shows a higher diversity of actors pushing GE. Next to those actors that also can be found in Aachen, there is, among others, a Central Women's Council, elected by the female university members and electing the equal opportunity officer; a Dual Career & Family Service as a consulting service for all questions about the compatibility of work and family and as coordinator of the university's compatibility concept; and an intramural expert advisory board that consults the presidium in GE-related matters. The FU set itself five GE goals: like Aachen, it wants to tackle underrepresentation of women on all career and qualification levels, foster compatibility of work and family, and strengthen the gender and diversity awareness at the university. Unlike Aachen, the FU strategy additionally is more focused on Gender Research. The FU wants to build up an internationally competitive Gender Research, and wants to integrate it into its curricula and the organisation of the study conditions in an "appropriate way". (FU Berlin 2015)

Very similar to the already mentioned universities, the Hildesheim University structurally anchored GE in its quality management, which means that GE aspects are integrated into accreditation processes of courses of study, and target quotas are set and regularly monitored. Furthermore, an equal opportunity officer, who is working in full-time, is appointed, and is assisted by a commission for GE, consisting of members of different faculties and status groups. The ten targets of Hildesheim fully comprise those of FU Berlin and RWTH Aachen. Hildesheim emphasises a double strategy, combining the promotion of women – especially by quotas – as a top-down approach with the Gender Mainstreaming of its quality management and other internal procedures as a bottom-up approach. (University of Hildesheim Foundation 2008)

2.3.3.2 Measures addressing Gender balance in decision making

As explained above, Germany has not introduced a statutory quota, but, e.g., North Rhine-Westphalia has implemented a regulation that all faculties have to define their own quotas, and Berlin gives financial incentives for an improvement of the share of female researchers at all qualification levels. In most cases, universities and non-university research organisations set faculty-specific quotas by themselves. All approaches to quotas follow the cascade principle: they do not aim at an equal proportion of men and women on all career levels; they aim at a convergence of the women's share of the higher hierarchy level to the lower one.

2.3.3.3 Measures addressing the integration of gender dimension in research

Another focus of the above mentioned (2.3.3.1) programme "Women to the Top" of the German Ministry for Education and Research were gender-related research questions in current research fields, such as gender effects in drug approvement (BMBF 2013).

Most measures for the integration of a gender dimension into studies and research are initiated by the universities themselves as part of their GE strategy (as described above).

2.3.4 Actors responsible for GE in RTDI

The governance structure of the German innovation system and of GE in the general working world, as well as the main GE measures in RTDI, are already described above. In this section, we shortly list

those actors with the most direct impact on the career development of female academics. Besides the more general GE measures of the BMFSFJ, the Ministry for Education and Research (BMBF), in concerted action with the state ministries of science, addresses GE in RTDI through measures like the "Programme for Women Professors" and the "Pact for Research and Innovation" more directly. Furthermore, the states have significant influence on GE in RTDI by the design of their laws and the funding of institutions. As the most important source for third-party funds, the DFG has a high potential for impact on GE among funded institutions and projects.

In Germany, universities have the privilege of academic autonomy, which means that they administer most of their processes by themselves. Due to academic autonomy, each university has the right to choose the scope and intensity of its GE policy within the broad framework of the respective state's law and the federal German Framework Act on its own behalf. In so far, GE is a responsibility of all academic decision boards. Structural anchors of GE in the universities are the equal opportunity officers that are statutory in all German states.

An influential actor that was not already introduced above, is the Centre of Excellence Women and Science (CEWS) of Leibniz Society. Next to the grantee evaluations of DFG and the evaluations of research institutions in the context of the "Pact for Research and Innovation", the CEWS has the most comprehensive perspective on GE in science and research. It is a publicly financed department of GESIS institute and conducts research on GE policies and GE proportions in research, and fosters a knowledge transfer in the role of a policy advocate and as a provider of scientific services. The CEWS offers statistics on GE in RTDI and, most importantly, publishes an annual ranking of the realisation of GE among German universities.

2.3.5 Assessment of Gender Equality Policies in RTDI

In conclusion, the state of GE policy in the German research system is described best by the expression "legally binding, but not sanctionable" (Kamphans 2014, 47). All relevant actors for RTDI policy, from the federal to the university level, have committed themselves explicitly to GE goals. However, all discussed measures, like the "Pact for Research and Innovation", the" Programme for Women Professors", the GE standards of the DFG, or the CEWS ranking have in common that they prefer positive incentives over direct sanctions. GE measures are often blurry; there is no concrete and binding checklist, but a variety of possible strategies and activities (Kamphans 2014, 50).

As it was demonstrated by the discussions of GE measures at university level, GE is well-institutionalised and well-monitored. However, the numbers show that GE still is not effectively implemented. As it will be shown in detail below, the share of female professors at the highest two hierarchy levels (W3, C4) stagnates. Instead, the instrument of junior professorships has become the rallying point for promising female junior researchers with limited contracts and unclear future prospects.

Due to the fact that effective GE measures still mainly build on the voluntary commitment of elites in research and research policy, in our opinion, a relevant factor for the stagnation of the women's share at permanent professorships, is the conservative culture of the research system. In 2008, prominent heads of German research institutions, like the DFG, Max-Plank-Society, German Rector's Conference, the Science Council, and the German Association of Colleges and Universities, still publicly argued against a quota for academic top positions (Forschung & Lehre 2008). Also, in her qualitative PhD-study of discoursive strategies related to Gender Mainstreaming of 2014, Kamphans (2014, 254) comes to the conclusion that scepticism towards Gender Mainstreaming increases with

the status and position of academic decision-makers. So Germany has a high commitment to GE on paper, but a lack of consciousness among the elites of the RTDI system that GE measures make an contribution to equal opportunities, rather than giving unreasonable advantages to women.

3 Gender equality in RTDI

3.1 Gender Equality in RTDI on the organisational level

3.1.1 Proportion of RPOs that have adopted gender equality plans

Gender equality plans are more common in Research Performing Organisations (RPOs) in Germany than in the EU average (Table 33).

Table 33: Proportion of RPOs that have adopted gender equality plans, 2013 (in %)

	2013
EU 28	36
Germany	81

Source: European Commission 2015b

According to data from the ERA survey, 81% of RPOs in Germany had adopted gender equality plans by 2013. This is more than the EU average – across the EU only 36% of RPO had adopted Gender Equality Plans in 2013.

Research organisations in Germany are supposed to use GE measures according to the General Equal Treatment Act. Gender equality plans are a common way to fulfil this task (GWK 2016a, 138).

3.1.2 Proportion of R&D personnel working in RPOs that have adopted gender equality plans

Table 34 shows that most researchers and developers (96%) working in RPOs in Germany work in organisations that have adopted gender equality plans. This is more than the EU-average that accounts for 70% of R&D personnel working in RPOs with gender equality plans.

Table 34: Proportion of research & development personnel working in RPOs who adopted gender equality plans, 2013 (in %)

	2013
EU 28	70
Germany	96

Source: European Commission 2015b, 117

Both in Germany and the EU, the share of research and development personnel working in RPOs that have adopted gender equality plans is higher than the share of RPOs with gender equality plans. This indicates that RPOs with many employees have a stronger trend to adopt gender equality plans than those with few employees. Thus, the structure and size of RPOs is a variable that should be considered when assessing the rate of RPOs that have adopted gender equality plans in a certain region.

3.2 Participation of women in tertiary education

3.2.1 Share of tertiary educated population among the group of 25 to 34 years old by sex

Table 35 illustrates the development of the rate of tertiary education in the total population, the male population and the female population between 25 and 34 years in the EU and Germany from 2005 to 2015.

In the EU, women have continuously had a higher rate of tertiary education than men have in the last decade. The rate has been increasing for both sexes. In 2005 25.4% of men and 31.1% of women between 25 and 34 had tertiary education, in 2015 32.9% of men and 42.9% of women did so. Thus, in absolute numbers, women's lead in educational attainment has even been increasing.

Table 35: Share of tertiary educated population among the group of 25 to 34 years old by sex (in %)[33]

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	Total	28.3	29.2	29.9	30.9	32.3	33.3	34.4	35.5	36.5	37.2	37.9
	Males	25.4	25.9	26.4	27.2	28.2	29.1	30.0	30.8	31.7	32.5	32.9
	Females	31.1	32.5	33.6	34.8	36.4	37.6	38.8	40.2	41.3	42.0	42.9
Germany	Total	22.5	22.0	22.6	23.9	25.7	26.0	27.6	28.9	29.9	28.4	29.6
	Males	22.8	21.6	21.9	23.0	24.4	24.8	25.6	26.8	27.9	28.0	28.6
	Females	22.1	22.3	23.4	24.8	26.9	27.2	29.5	31.0	31.9	28.9	30.6

Source: Eurostat 2017b

In Germany, the share of adults between 25 and 34 with tertiary education is around eight percentage points lower than the EU average. Only 29.6% have tertiary education in Germany compared to 37.9% across the EU. The dual vocational training system in Germany is one possible explanation. It offers a qualification without tertiary education and Germany has a comparatively high proportion of middle-ranked qualified people (Leszczensky et al. 2010, 33). The dual vocational training in Germany is praised for its attention towards business demands, contributing to a comparatively low youth unemployment rate. On the other side, the low rate of tertiary education in Germany is also seen as a disadvantage compared to other countries (Leszczensky et al. 2010, 33).

A comparatively low rate of tertiary education in Germany is in particular visible for women. Only 30% of women between 25 and 34 years had tertiary education in Germany in 2015, 12.3 percentage points less than the EU average. In contrast to the EU, in 2005 men had a higher rate of tertiary education (22.8%) than women (22.1%) did. The rate of women in 2006 overtook the rate of men in tertiary education. Since then, the share of tertiary educated people has been rising for both men and women, but the rate of women has been increasing faster.

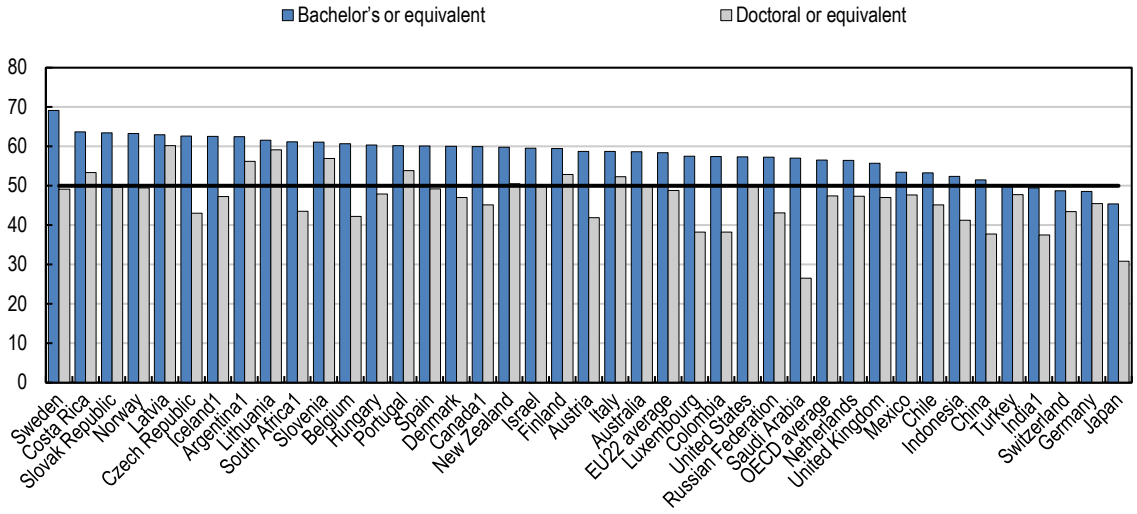
Leszczensky et al. (2010, 3) assume that the trend of the "feminisation" of education is currently starting in Germany, which means that women are having tertiary education to a higher degree than men, but Germany is still behind other European countries.

Below, Figure 9 compares the share of women among graduates in tertiary education. Germany is among the OECD-countries with the lowest rate of female graduates at the level of a Bachelors' or

[33] The data uses the classification of tertiary education by ISCED 1997 until 2013 and by ISCED 2011 from 2014 on.

equivalent degree. 49% of Bachelor graduates are women in Germany, this is significantly lower than in the OCED and EU average, where most Bachelor graduates are women. However, the data for PhD graduates in Germany (45%) is comparable to other OECD countries.

Figure 9: Percentage of female graduates in tertiary levels of education (2014)



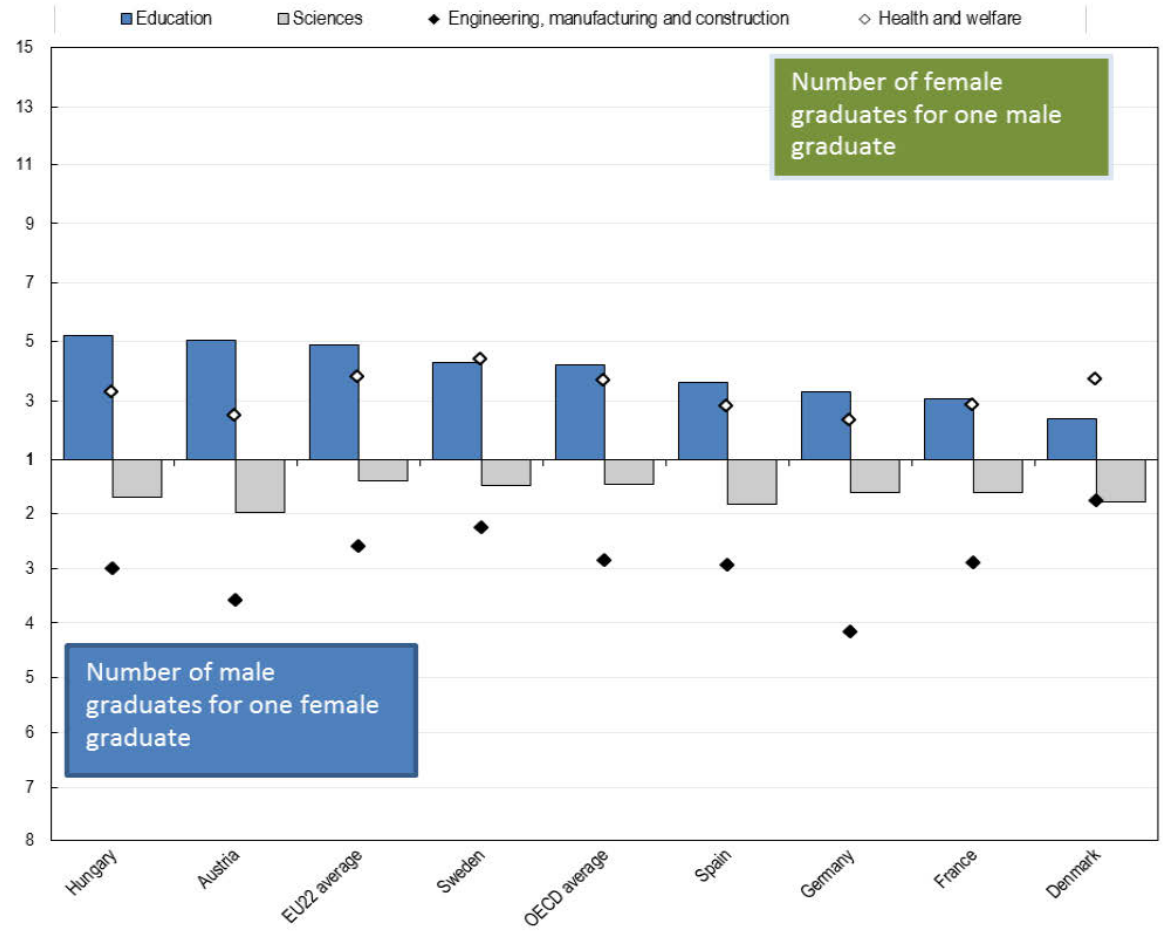
Source: OECD 2016a, Figure A3.3.

Even though women have higher educational attainments than men in Germany and across the EU do, their labour market outcomes are not as high as those of men are. Men with tertiary education have higher average salaries than women with tertiary education (cf. OECD 2016a, 64).

3.2.2 Gender ratio for all tertiary graduates by field of education

Figure 10 illustrates the gender segregation of graduates of tertiary education programmes in subject areas by showing the ratio of men and women in separate fields of education.

Figure 10: Gender ratio for all tertiary graduates by field of education (2014)



Source: OECD 2016a, Figure A3.4.

Gender segregation in fields of education is visible in both the German, the EU22 and the OECD average. While more women graduate in the areas of education and health and welfare, more men than women graduate in the areas of science as well as engineering, manufacturing and construction. The latter are particularly unbalanced fields of education in Germany with more than four male graduates for one female graduate. The gender differences in the areas of education, health and welfare and sciences are comparatively low in Germany, which is to say: comparatively many men graduate in subjects related to health and welfare, and somewhat less, but more than in the EU22 and the OECD average, graduate in education-related subjects. The number of women in sciences is higher than in other EFFORTI-countries (apart from Sweden), but lower than the EU and OECD-average.

One reason for the gender imbalance in subject-choice are gendered ideas about professions, which start long before university entrance (OECD 2016a, 66).

3.2.3 Development of the number of women ISCED 6 graduates

Table 36 illustrates the number of men and women who graduated from an educational programme that can be categorised Level 6 of the International Standard Classification of Education (ISCED) of 1997. In Germany ISCED 6 describes the attainment of a PhD programme or a habilitation (VDSt and KOSIS-Verbund 2003). The data on the European level used in the Table 36 to Table 39 do not specify if both degrees are included or PhD programmes only. The numbers in Table 39 differ slightly from those provided by the German federal office of statistics (Destatis n.d.)

Table 36: Development of the number of women ISCED 6 graduates

		EU 27	Germany
2006	Men	55,163	14,662
	Women	43,519	10,284
2007	Men	57,196	14,060
	Women	46,754	10,379
2008	Men	59,784	14,815
	Women	50,743	10,789
2009	Men	54,876	14,220
	Women	46,586	11,307
2010	Men	56,162	14,506
	Women	47,185	11,533
2011	Men	62,626	15,051
	Women	54,628	12,303
2012	Men	63,472	14,628
	Women	56,916	12,179

Sources: European Commission 2013b, 78; European Commission 2015b, 36

According to data from the European Commission, the number of men who are ISCED 6 graduates is higher than the number of women. However, the difference between men and women has been decreasing since 2006. This holds true for both the European Union and Germany. In the EU 27, there were counted 55,163 male and 43,519 female ISCED 6 graduates in 2006, this is to say, there were about 11,000 more male than female ISCED 6 graduates were were. In 2012, there were counted 63,472 male and 56,916 female ISCED 6 graduates. The difference decreased to less than 7,000. In Germany, women are also catching up with men when it comes to ISCED graduations, but unlike in the EU, the number of male ISCED 6 graduates in Germany stagnates. In 2006, 14,662 men and 10,284 women were ISCED 6 graduates, in 2012, the number of men was even a bit lower than it had been in 2006, 14,628 men and 12,179 attained an ISCED 6 degree in that year.

3.2.4 Development of the proportion of women ISCED 6 graduates differentiated by field of study

Table 37 illustrates how the share of women in ISCED 6 graduates has developed in broad fields of study in the EU and Germany between 2006 and 2012.

Table 37: Development of the proportion of women ISCED 6 graduates differentiated by field of study (in %)

		Education	Humanities & arts	Social sciences, business and law	Science, mathematics and computing	Engineering, manufacturing and construction	Agriculture and veterinary	Health and welfare	Services
EU 27	2006	64	52	47	41	25	51	54	:
	2010	64	54	49	40	26	52	56	:
	2012	64	54	51	42	28	57	59	45
Germany	2006	53	51	37	35	14	60	51	:
	2010	54	52	42	38	15	62	56	:
	2012	:	:	:	:	:	:	:	:

Source: European Commission 2015b, 26; European Commission 2013b, 79 (data for 2010, calculations JOANNEUM RESEARCH); European Commission 2009, 51 (data for 2006)

The share of women among ISCED 6 graduates has increased in all subject areas apart from science, mathematics and computing between 2006 and 2010, in both the EU and Germany. In the EU, the share of women has increased in all subject areas. There is no data available for the year of 2012 in Germany.

The proportion of women in Germany is below the EU average in most subjects, as the share of women among PhD students in Germany is comparatively low in general. Education is the field with the highest proportion of female ISCED 6 graduates in EU 27 states, but agriculture and veterinary is the subject area with the highest proportion of women in Germany. In education, the proportion of women between 2006 and 2012 was constantly 64% on average across EU 27 countries, but in Germany it was only 53% in 2006 and 54% in 2010. Agriculture and veterinary is the subject area with the highest proportion of female ISCED 6 graduates in Germany, 60% of ISCED 6 graduates were women in 2006 and 62% in 2010. However, Table 37

Table 39 in 3.2.6 reveals that comparatively few doctoral degrees are awarded in teaching and education science as well as agriculture and veterinary.

Engineering, manufacturing and construction are the subject areas with the lowest proportion of female ISCED 6 graduates both in the EU and in Germany. However, the share of women in this field is much lower in Germany (15% in 2010) than in the EU (28% in 2012). This indicates that there is much unused female potential in Germany.

3.2.5 Development of the proportion of women ISCED 6 graduates differentiated by narrow fields of study in the natural sciences and engineering

Table 38 provides information on the share of women among ISCED 6 graduates in specific fields of study in STEM. In sciences and engineering, the number of female ISCED 6 graduates is particularly high in the field of life Sciences and has been increasing between 2004 and 2012, in both the EU and Germany. In the EU, the share of women in life sciences was 58% in 2012, in Germany it was 59%. The share of women is below 50% in all other fields of study in the natural sciences and engineering both in the EU and Germany. However, it has been increasing between 2004 and 2012 in the fields of physical science, mathematics and statistics, computing, engineering and engineering trades, and architecture and building.

Table 38: Development of the proportion of women ISCED 6 graduates differentiated by narrow fields of study in the natural sciences and engineering (in %)

		Life Science	Physical Science	Mathematics and Statistics	Computing	Engineering and Engineering Trades	Manufacturing and Processing	Architecture and Building
EU 27	2004	53	34	31	18	19	30	36
	2010	57	34	32	19	23	42	34
	2012	58	37	36	21	25	35	38
Germany	2004	47	22	28	10	9	19	21
	2010	57	30	26	14	12	32	24
	2012	59	33	25	18	15	29	26

Source: European Commission 2015b, 31 (data for 2004 and 2012); European Commission 2013b, 80 (data for 2010, calculations JOANNEUM RESEARCH)

The share of women ISCED 6 graduates has been increasing by more than 10% between 2004 and 2010, both in the EU and Germany, but then decreased between 2010 and 2012. Across the EU it is 35%, in Germany, the share of women is 29% in this narrow field of study. The fields of study with the lowest share of women ISCED 6 graduates are computing (21% across the EU and 18% in Germany in 2012) as well as engineering and engineering trades (25% across the EU and 15% in Germany in 2012).

3.2.6 Distribution of ISCED 6 graduates across fields of study by sex

Table 39 shows the allocation of subjects to male and female ISCED 6 graduates, or in other words, it illustrates which subjects women and men choose more often in the EU and Germany in 2012. In fact, the most common subject for women ISCED 6 graduates is science, mathematics and computing. 26% of women ISCED 6 graduates in the EU and 27% of women ISCED graduates in Germany had graduated in this field of study. A reason for the high share of women ISCED 6 graduates may be that attaining ISCED 6 qualifications are very common in these fields of study.

Table 39: Distribution of ISCED 6 graduates across broad fields of study by sex, 2012 (in %)

		Teaching and education science	Humanities and arts	Social sciences, business and law	Science, mathematics and computing	Engineering, manufacturing and construction	Agriculture and veterinary	Health and welfare
EU-28	Women	4	14	20	26	9	4	23
	Men	2	10	17	32	21	3	14
Germany	Women	4	9	14	27	4	5	37
	Men	2	7	17	34	16	2	22

Source: European Commission 2015b, 29 (data only for 2012)

The share of science, math and computing among male ISCED 6 graduates is even higher than among female ISCED 6 graduates (32% in the EU and 34% in Germany). In contrast, there are only few doctoral degrees awarded in teaching and education science and agriculture and veterinary. As Table 37 in 3.2.4 reveals, the proportion of women is particularly high in these subject areas in which few people obtain a doctoral degree.

3.3 Labour Market Participation of women and men in the RTDI (whole sector)

3.3.1 General Labour market participation

3.3.1.1 Employment rate by sex

Table 40 shows the proportion of employed people among men and women between 20 and 64 years of age in the EU and Germany between 2005 and 2015. Furthermore, it shows the gender gap in employment in the EU and Germany in this period of time.

Table 40: Employment rates in the total population aged 20-64 by sex and gender gap[34] (in %)

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	Males	75.9	76.8	77.6	77.8	75.7	75.1	75.0	74.6	74.3	75.0	75.9
	Females	60.0	61.1	62.1	62.8	62.3	62.1	62.2	62.4	62.6	63.5	64.3
	Gender Gap	15.9	15.7	15.5	15.0	13.4	13.0	12.8	12.2	11.7	11.5	11.6
Germany	Males	75.6	77.2	79.1	80.1	79.6	80.4	81.7	82.1	82.1	82.2	82.3
	Females	63.1	65.0	66.7	67.8	68.7	69.7	71.3	71.6	72.5	73.1	73.6
	Gender Gap	12.5	12.2	12.4	12.3	10.9	10.7	10.4	10.5	9.6	9.1	8.7

Source: Eurostat 2017a

Germany has higher total employment rates than the EU average, both for men and women. In the EU, 75.0% of men and 64.3% of women between the ages 20 and 64 were employed in 2015, in Germany, 82.3% of men and 73.6% of women were so. The gender gap in the employment rate is with 8.7% in Germany slightly lower than in the EU (11.6%). The lower gender gap does not represent full-time

[34] The gender gap is a measure of the difference between the employment rates of women and men. It is calculated by subtracting women's employment rate from men's employment rate.

employment and goes along with a high rate of part-time employment of women in Germany (see 3.3.1.3).

3.3.1.2 Employment rate by age of children and sex

Table 41 illustrates how a leak in the reconciliation of providing care for small children and employment causes the withdrawal of mothers from the labour market.

Table 41: Employment rate of persons aged 25-49 by age of youngest child, sex, country and year (in %)

			2005	2006	2007	2008	2009	2010	2011	2012
Germany	Female	Child aged under 3	40	46	46	44	47	48	54	54
		Child aged 3-5	58	61	63	65	67	67	69	70
		Child aged 6-16	72	73	74	75	76	77	78	79
	Male	Child aged under 3	88	88	90	90	90	91	92	92
		Child aged 3-5	89	90	91	92	91	91	92	93
		Child aged 6-16	90	91	92	93	92	93	94	94

Source: UNECE 2017c

Mothers in Germany are the more likely to participate in the labour market the older their children are. 54% of mothers with children aged three or younger were employed in 2012, 70% of mothers with children between the age of three and five and 79% of mothers with children between six and 16. In comparison, 86% of childless women were employed in Germany in 2012 (see Table 42).

The employment rates of mothers have increased between 2005 and 2013, which indicates that the options to combine employment and childcare have improved.

Parenthood has a different effect on the labour market participation of men and women. While mothers are employed less often than childless women, fathers in Germany even have a higher employment rate than childless men. The employment rate of fathers increases by 1-2 percentage points when the child is older.

A negative effect of parenthood on the labour market participation of mothers and a positive effect of parenthood on the labour market participation of fathers is observable in most European countries and can be interpreted as an indicator of a traditional labour distribution of couples (Plantenga 2014, 7).

In Germany, work-distribution within couples is often re-traditionalised after the birth of the first child because then the mother spends more time with the child, while the father works more to make up for the lost income and the greater expenses. Thus, the father will advance faster on the labour market, which increases the opportunity costs of changing work-distribution in the future (Bujard and Schwebel 2015).

Below, Table 42 illustrates comparative data on the labour market participation of childless women and men. It shows the employment rate of women and men without children.

Table 42: Employment rate of persons aged 25-49 without children by sex, country and year (in %)

		2005	2006	2007	2008	2009	2010	2011	2012
Germany	Female	82	83	84	85	85	85	86	86
	Male	81	83	84	85	84	84	86	86

Sources: UNECE 2017c

A comparison of Table 42 and Table 43 illustrates the effect children have on labour market participation in Germany. Women and men without children were employed at equal numbers in 2012. 86% of non-parents were employed in 2012, but only 54% of mothers with children between 0 and three were employed in 2012. In contrast, 92% of fathers with children between one and three were employed. Overall, the comparison reveals that having children often results in a more traditional labour distribution between women and men.

Table 43 illustrates the employment impact of parenthood on men and women respectively. The employment impact of parenthood is calculated by subtracting the employment rates of fathers and mothers of young children (0-6 years old) from childless men and women (Plantenga 2014, 7).

Table 43: Employment impact of parenthood, age 20-49

	Males	Females
EU 28	-11.3	10
Germany	-7.9	17.8

Source: Plantenga 2014, 40; Data retrieved from Eurostat

On average across EU-countries, the employment rate for fathers is 11.3% higher than the employment rate of childless men and the employment rate of mothers is 10% lower than the employment rate of childless women. In Germany, the employment advantage of fathers is a little weaker than across the EU (3.4 percentage points), but the employment disadvantage of mothers is much (7.8 percentage points) higher. The employment rate of fathers is 7.9% higher than the employment rate of childless men and the employment rate of mothers 17.8% lower than the employment rate of childless women.

3.3.1.3 Employment by full-time and part-time status, sex

Table 44 shows the labour market participation of men and women measured in full-time equivalents (FTEs). As a consequence, part-time employment appears in the statistics as a share of FTEs.

Table 44: Full-time equivalent (FTE) employment rates among women and men aged 20-64 (in %) and gender gap (in percentage points), 2010-2014

		2010	2014
EU 28	Males	73.1	72.7
	Females	53.5	54.5
	Gender Gap	19.6	18.2
Germany	Males	77.0	78.7
	Females	53.6	56.6
	Gender Gap	23.4	22.1

Source: European Commission 2016b, 49

The EU 28 gender gap was 18.2% in full-time equivalents in 2014, in comparison, the gender gap was only 11.6% when employment was counted only (see Table 40 in 3.3.1.1). The comparison reveals that there are big differences concerning full- and part-time employment between men and women in Germany. The gender gap in FTE employment rates is even higher than across the EU. Besides, the difference between the gender gap in employment and the gender gap in FTE employment is even

higher. A gap of 22.1% age points in FTE is contrasted by a gap of only 8.7 in employment in general (see Table 44). This indicates that women in Germany are more likely to work part-time and that the presumably high employment rate is not due to full-time employment.

3.3.2 Participation of women and men in RTDI

3.3.2.1 Proportion of scientists and engineers in total labour force by sex

Table 45 shows how many percent of the total active population, the male active population and the female active population between 15 and 74 years in the EU and Germany are scientists and engineers.

Table 45: Proportion of scientists and engineers in the active population between 15 and 74 years by sex and year (in %)

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU 28	Total	:	:	:	4.9	4.9	5.0	6.4	6.5	6.6	6.6	6.8
	Males	:	:	:	6.0	6.1	6.2	7.3	7.2	7.3	7.4	7.5
	Females	:	:	:	3.5	3.5	3.6	5.5	5.5	5.7	5.8	6.0
Germany	Total	5.3	5.4	5.4	5.3	5.5	5.8	7.2	6.9	7.0	7.1	7.2
	Males	7.5	7.7	7.8	7.6	7.8	8.2	9.3	8.7	8.8	8.8	9.1
	Females	2.6	2.7	2.6	2.7	2.8	3.0	4.8	4.8	4.8	5.0	5.1

Source: Eurostat 2016e

The proportion of scientists and engineers in the total labour force has increased in the time between 2005 both in the EU and in Germany and both for men and women. In comparison to the EU average, Germany has a higher proportion of scientists and engineers in the overall population, a higher share of scientists and engineers in the male population and a lower proportion of female scientists in the female population. In 2015, the share of scientists and engineers in the total population of EU countries was 6.8%, but in Germany 7.2% of the population were scientists or engineers. Among men, the share of scientists and engineers was 7.5% in the EU, but 9.1% in Germany. Six percent of the women in the EU were scientists and engineers in 2015, but only 5.1% in Germany.

3.3.2.2 Employment in knowledge intensive activities (KIA) by sex

Table 46 illustrates the proportion of employees in the EU and Germany who work in knowledge intensive activities (KIA).

Table 46: Annual data on employment in knowledge-intensive activities as a percentage of total employment at the national level by sex (in %)[35]

		2008	2009	2010	2011	2012	2013	2014	2015
EU 28	Total	34.2	35.0	35.4	35,6	35.7	35.8	35.9	36.0
	Males	27.2	28.0	28.5	28,7	28.8	28.9	29.1	29.1
	Females	42.7	43.5	43.8	43,8	43.9	43.9	44.0	44.2

[35] From 2008 onwards, statistical classification of economic activities in the European Community (NACE) Rev. 2.

Germany	Total	36.6	37.2	37.6	37,4	37.5	36.9	36.9	36.9
	Males	29.7	30.2	30.6	30,3	30.3	29.5	29.3	29.2
	Females	44.8	45.3	45.6	45,6	45.8	45.4	45.6	45.5

Source: Eurostat 2016a

Employment in KIA is higher in Germany (36.9 %) than in the EU average (36%). However, other EU countries have been catching up with employment in KIA. Across the EU, employment in KIA has increased by 1.8% between 2008 and 2015 and there was a steady increase, but this trend is not that clear in Germany. The share of employment in KIA is higher in the population of employed women than in employed men, both in the EU and Germany. In the EU, 29.1% of men and 44.2% of women were employed in KIA in 2015. In Germany, 29.2% of men and 45.5% of women were employed in KIA in 2015.

3.3.2.3 Employment in knowledge intensive activities – business activities (KIABI) by sex

Table 47 shows the proportion of employed men and women who are employed in knowledge intensive activities – business activities (KIABI) in the EU and Germany between 2008 and 2015.

Table 47: Employment in knowledge intensive activities – business activities (KIABI) by sex (in %)

		2008	2009	2010	2011	2012	2013	2014	2015
EU 28	Total	13.2	13.4	13.5	13.7	13.8	13.8	13.9	14.0
	Males	13.3	13.6	13.9	14.1	14.2	14.4	14.5	14.6
	Females	13.1	13.2	13.1	13.2	13.3	13.2	13.3	13.4
Germany	Total	14.9	15.2	15.4	15.4	15.3	14.7	14.6	14.6
	Males	15.1	15.6	15.8	15.9	15.9	15.0	14.9	15.1
	Females	14.7	14.8	14.8	14.8	14.7	14.2	14.2	14.1

Source: Eurostat 2016a

The share of employees in KIABI among the total workforce is slightly higher in Germany (14.6%) than in the EU average (14%). The proportion of employed men in KIABI is slightly higher than the proportion of employed women in KIABI both in the EU and in Germany.

3.3.2.4 Researchers in all R&D sectors

Table 48 and Table 49 show that both the number of female researchers and the proportion of female researchers have increased between 2005 and 2013 in Germany and the EU.

Table 48: Number of researchers in all R&D sectors by sex and years (in full-time equivalents)

		EU 28	Germany
2005	Total	1,374,760	272,148
	Females	:	47,666
	Males	:	224,482
2006	Total	1,422,499	279,822
	Females	:	:
	Males	:	:
2007	Total	1,458,115	290,853
	Females	:	54,241
	Males	:	236,612
2008	Total	1,523,245	302,641
	Females	:	:
	Males	:	:
2009	Total	1,555,606	317,307
	Females	:	65,258
	Males	:	252,049
2010	Total	1,602,765	327,996
	Females	:	:
	Males	:	:
2011	Total	1,626,802	338,689
	Females	:	74,766
	Males	:	263,923
2012	Total	1,680,987	352,419
	Females	:	:
	Males	:	:
2013	Total	1,731,241	354,463
	Females	:	80,353
	Males	:	274,110

Source: Eurostat 2016f

The total number of researchers has grown from 1,374,760 in 2005 to 1,731,241 in 2013 in the EU. In Germany, it has increased from 272,148 to 354,463 in the same time period. The number of female researchers has increased stronger in relation to their low proportion among researchers. 224,482 men worked as researchers in 2005 in Germany and 274,110 in 2013, which is an increase of almost 50,000. 47,666 women worked as researchers in 2005 and 80,353 in 2013. The increase of more than 30,000 female researchers is still not as high as the increase in male researchers, but it is high compared to how few female researchers there used to be.

Table 49: Share of women in R&D by country (in %)

	2005	2007	2009	2011	2013
Germany	18	19	21	22	23

Source: Eurostat 2016f (calculations JOANNEUM RESEARCH)

The increase in the number of female researchers brought about an increase in the share of female researchers in Germany from 18% in 2005 to 23% in 2013.

3.3.2.5 Researchers differentiated by R&D sectors

Table 50 and Table 51 show the representation of women in different sectors of R&D. The higher education sector (HES) is the one with the strongest proportion of women in Germany. In 2013, there were 35,064 women and 64,059 men working as researchers in the sector (see Table 51).

Table 50: Number of researchers in the business enterprise sector (BES) by sex and years (in full-time equivalents)

		EU 28	Germany
2005	Total	626,081	166,874
	Females	:	19,013
	Males	:	147,861
2006	Total	654,004	171,063
	Females	:	:
	Males	:	:
2007	Total	667,464	174,307
	Females	:	19,682
	Males	:	154,625
2008	Total	695,179	180,295
	Females	:	:
	Males	:	:
2009	Total	695,602	183,214
	Females	:	22,961
	Males	:	160,253
2010	Total	719,935	185,815
	Females	:	:
	Males	:	:
2011	Total	747,215	190,693
	Females	:	26,485
	Males	:	164,208
2012	Total	792,692	199,623
	Females	:	:
	Males	:	:
2013	Total	830,713	198,585
	Females	:	27,136
	Males	:	171,449

Source: Eurostat 2016f

The number of researchers working in the business enterprise sector has been increasing since 2005, both in the EU and in Germany. In absolute numbers, there were 626,081 researchers working in the

business enterprise sector in the EU in 2005, 166,874 of them in Germany. This has increased to 830,713 in 2013, 198,585 of whom were based in Germany.

Women are clearly underrepresented as researchers in the business enterprise sector (BES). The number of women has risen from 19,013 in 2005 to 27,136 in 2013. Similarly, the number of men has also increased from 147,861 in 2005 to 171,449 in 2013.

Table 51: Number of researchers in the higher education sector (HES) by sex and years (in full-time equivalents)

		EU 28	Germany
2005	Total	551,459	65,363
	Females	:	18,273
	Males	:	47,090
2006	Total	566,464	67,273
	Females	:	19,990
	Males	:	47,283
2007	Total	585,624	72,985
	Females	:	22,458
	Males	:	50,527
2008	Total	618,351	77,004
	Females	:	24,588
	Males	:	52,416
2009	Total	642,780	84,852
	Females	:	27,548
	Males	:	57,304
2010	Total	663,331	90,398
	Females	:	29,871
	Males	:	60,527
2011	Total	656,965	93,811
	Females	:	31,585
	Males	:	62,226
2012	Total	661,902	97,199
	Females	:	33,181
	Males	:	64,018
2013	Total	675,973	99,123
	Females	:	35,064
	Males	:	64,059

Source: Eurostat 2016f

The total number of researchers in the HES has risen between 2005 and 2013, both in the EU and in Germany. At the same time, the number of female researchers has grown faster than the number of male researchers. The numbers of male and female researchers in the HES have both increased by around 17,000 between 2005 and 2013; as a result, the gender imbalance in the HES has been decreasing.

Table 52: Number of researchers in the government sector (GOV) by sex and years (in full-time equivalents)

		EU 28	Germany
2005	Total	181,758	39,911
	Females	:	10,380
	Males	:	29,531
2006	Total	185,036	41,486
	Females	:	11,191
	Males	:	30,295
2007	Total	188,306	43,561
	Females	:	12,101
	Males	:	31,460
2008	Total	192,370	45,342
	Females	:	13,001
	Males	:	32,341
2009	Total	199,210	49,241
	Females	:	14,749
	Males	:	34,492
2010	Total	201,547	51,783
	Females	:	15,779
	Males	:	36,004
2011	Total	203,821	54,185
	Females	:	16,696
	Males	:	37,489
2012	Total	207,428	55,597
	Females	:	17,571
	Males	:	38,026
2013	Total	210,635	56,755
	Females	:	18,153
	Males	:	38,602

Source: Eurostat 2016f

According to Table 52, the number of female researchers in the government sector (GOV) has increased between 2005 and 2013 from 181,758 in the EU and from 39,911 to 56,755 in Germany. The increase of female researchers in the GOV is higher than the increase of male. As a consequence, the proportion of female researchers in the GOV has increased.

There is no data available for the number of researchers in the private non-profit sector in Germany between 2005 and 2013.

3.4 Horizontal segregation

3.4.1 General horizontal Segregation

3.4.1.1 Gender segregation in occupations and in economic sectors, 2004 vs 2014

Considering both occupations and at sectors, Table 53 and Table 54 illustrate that gender segregation of employees is slightly stronger in Germany than in the EU average. Among legislators, senior officials and managers the gender imbalance is one of the strongest: 71% of this occupation were men in Germany in 2014.

Table 53: Gender segregation in occupations and in economic sectors, 2004 and 2014 (in %)

	Gender segregation in occupations		Gender segregation in sectors	
	2004	2014	2004	2014
EU 28	24.7	24.4	17.7	18.9
Germany	26.7	25.4	18.1	19.4

Source: European Commission 2016b, 52

The index of gender segregation in occupations and in economic sectors describes how many percent of employees would have to change work if an equal proportion of men and women across occupations and sectors was to be achieved (cf. European Commission 2016b, 52).

Around one quarter of the employed people in the EU and Germany had to change their occupation to equalise the number of men and women in all occupations. In Germany, the number is even a bit higher than on the EU average (25.4% vs. 24.4%).

Gender segregation in sectors is lower than gender segregation in occupations, in 2014, it was 18.9% in the EU and 19.4% in Germany.

Segregation in occupations has decreased a little (by 1.3 percentage points) between 2004 and 2014, but gender segregation in sectors has increased (also by 1.3 percentage points) at the same time.

Table 54: Employment in Germany by occupation, sex, measurement and year (in %)

		2004	2014
Legislators, senior officials and managers	Female	27.7	29
	Male	72.3	71
Professionals	Female	38.6	44.4
	Male	61.4	55.6
Technicians and associate professionals	Female	58.9	56.4
	Male	41.1	43.6
Clerks	Female	67.6	65.9
	Male	32.4	34.1
Service workers and shop and market sales workers	Female	74.8	63.3
	Male	25.2	36.7
Skilled agricultural and fishery workers	Female	30.1	19.1
	Male	69.9	80.9
Craft and related trade workers	Female	9.7	10.9
	Male	90.3	89.1
Plant and machine operators and assemblers	Female	16.1	14.4
	Male	83.9	85.6
Elementary occupations	Female	55.5	61.3
	Male	44.5	38.7
Armed forces	Female	2.8	9.8
	Male	97.2	90.2

Source: UNECE 2017b

Clerks was the occupational field with the highest share of women in Germany in 2014 (65% women), followed by service workers and shop and market sales workers (63.3%). The share of women has decreased in these occupational fields between 2004 and 2014, especially for service workers and shop and market sales workers. Besides, the proportion of women is above 50% in the fields of elementary occupations (61.3%) as well as technicians and associate professionals.

The share of men is particularly high in the armed forces (90.2% in 2014), craft and related trade works (89.1% in 2014), plant and machine operators and assemblers (85.6%), skilled agricultural and fishery workers (80.9% in 2014) and legislators, senior officials and managers (71%). The gender ratio has hardly changed in most of these fields over the preceding decade. A backlash can be found in the area of skilled agricultural and fishery workers, where the proportion of men has increased from 69.9 to 80.9% in between 2004 and 2014. In the armed forces, the proportion of men has decreased from 97.2 to 90.2%.

3.4.2 Proportion of female researchers by economic activities (NACE Rev. 2) in the business enterprise sector by sex

Table 55 reveals information about gender segregation of researchers in the BES by showing the share of women among researchers by economic activity.

Table 55: Proportion of female researchers in the business enterprise sector by economic activity (NACE Rev. 2) 2012 (in %)

		Manufacturing	Manufacture of chemicals and chemical products	Manufacture of basic pharmaceutical products and preparations	Services of the business economy	other NACE category
EU 27	2009	15	27	45	19	83
	2012					
Germany	2009	12	26	40	15	28
	2012	13	23	41	18	23

Source: European Commission 2015b, 60 (data only for 2012); calculations: JOANNEUM RESEARCH

In the German BES, the research field of manufacture of basic pharmaceutical products and preparations had the highest share of women (41%) in 2012. This proportion is still lower than the EU-average of 2009 (45%). 83% of the researchers working in other NACE categories were women in the EU, compared to 28% in Germany. The share of women in the fields of manufacturing, manufacture of basic pharmaceutical products and preparations and in services of the business economy has risen a bit in Germany between 2009 and 2012. The share of women in manufacture of chemicals and chemical products as well as the share of women working in other NACE categories has decreased in Germany between 2009 and 2012.

3.4.3 Distribution of researchers in HES, across fields of science, 2012

Table 56 reveals which fields of science are most common among female and male researchers in the HES. It shows the proportion of female researchers working in each field of science among all female researchers in the HES and the proportion of male researchers working in each field of science among all male researchers working in the HES.

Table 56: Distribution of researchers in the HES, across fields of science, 2012 (in %)

		Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities
Germany	Women	19	9	30	4	14	24
	Men	28	22	19	2	15	14

Source: European Commission 2015b, 56 (data only for 2012)

Among female researchers working in the HES, the medical sciences are the most common field of study. 30% of the female researchers in the HES work in the medical sciences, but only 19% of the male researchers in the HES. For male researchers in the HES, the natural sciences are the most popular field of study, 28% are working in this area, but only 19% of the women. The humanities are also popular for female researchers, 24% work in this field, compared to 14% of the male researchers. The strongest gender-difference is visible in the field of engineering and technology. 22% of the male researchers in the HES are working in this field, but only 9% of the female researchers in the HES.

3.4.4 Horizontal segregation by scientific field in the sector

Gender segregation can be assessed using the gender dissimilarity index. This indicator measures how many researchers would have to change their scientific field for an equal distribution of male and female researchers across scientific fields (cf. European Commission 2015b, 79). Table 57 shows the gender dissimilarity index for researchers in the HES and GOV.

Table 57: Dissimilarity index for researchers in the sector and government sector

	Dissimilarity Index 2006		Dissimilarity Index 2009		Dissimilarity Index 2012	
	HES	GOV	HES	GOV	HES	GOV
EU 27	0.14	0.18	-	-	-	-
Germany	0.21	0.16	0.22	0.17	0.23	0.20

Sources: European Commission 2015b, 80; European Commission 2013b, 77; European Commission 2009, 64

Table 58 reveals that Gender segregation is higher in the HES than in the GOV. Segregation has increased between 2006 and 2012. The Dissimilarity Index has grown by 0.01 in both the HES and the GOV between 2006 and 2009. Between 2009 and 2012 it has grown by 0.01 in the HES and by 0.03 in the GOV.

3.5 Vertical Segregation

3.5.1 General vertical segregation

3.5.1.1 Share of male and female members of boards in largest quoted companies, supervisory board or board of directors

Table 58 shows the share of women in various domains of power in the EU average and in Germany. The numbers were evaluated within the framework of the Gender Equality Index 2015 (EIGE 2015).

Table 58: Share of male and female members of boards in largest quoted companies, supervisory board or board of directors (in %)

	share of female ministers	share of female members of parliament	share of female members of regional assemblies	share of female members of boards, in largest quoted companies, supervisory boards or board of directors	share of female members of central bank
EU	22	25	31	16	17
Germany	28	32	32	18	17

Source: EIGE 2015, 173

Over all fields, for the European average as well as for Germany, the share of women in powerful positions is not higher than one third. The category, which is interesting here, is "boards, largest quoted companies, supervisory boards and boards of directors". The share of women in the mentioned committees in Germany is slightly above EU level. But though women do not even make up for one fifth of the members (EIGE 2015).

3.5.2 Vertical segregation in RTDI

3.5.2.1 Proportion of women academic staff by grade

Table 59 shows the share of women in academic staff in Europe and in Germany for the years 2007, 2010 and 2013, split by grade.

Table 59: Proportion of women academic staff by grade and total (in %)

		Grade A	Grade B	Grade C	Grade D	Total
EU 27	2007	19	36	44	44	38
	2010	20	37	44	46	40
EU 28	2013	21	37	45	47	41
Germany	2007	12	18	33	38	33
	2010	15	21	27	41	36
	2013	17	23	29	43	38

Source: European Commission 2015b, 129 (data only for 2013); European Commission 2013b, 90 (data for 2010); European Commission 2009, 75 (data for 2007)

The higher the grade the lower is the proportion of women – this applies to both Europe and Germany. On nearly all levels there has been a slight gain in Germany, with the exception of grade C,

the assistants. In the European average, the numbers have hardly changed since 2007. (European Commission 2015b, 2013b, 2009).

3.6 Employment conditions/status/contracts

3.6.1 General working time culture

As Table 60 shows, the total working hours of full-time workers in Germany are above the EU average. In Germany, the average weekly working hours of male full-time workers (42.0 hours) are a bit higher than the average weekly working hours of female full-time workers (39.8 hours). The total amount of working hours has slightly been decreasing from 2005 to 2015 as well as the gender difference. (Eurostat 2016b)

Table 60: Actual weekly working hours of full-time workers by gender and country

	EU 28			Germany		
	women	men	total	women	men	total
2005	39.4	42.5	41.4	40.7	43.7	42.7
2006	39.2	42.3	41.2	40.3	43.1	42.2
2007	39.2	42.3	41.2	40.4	43.2	42.3
2008	39.1	42.1	41.0	40.4	43.0	42.1
2009	38.9	41.7	40.7	39.8	42.2	41.4
2010	39.1	41.9	40.8	40.0	42.5	41.7
2011	39.1	41.9	40.8	40.1	42.7	41.8
2012	39.0	41.7	40.7	40.0	42.5	41.6
2013	38.9	41.6	40.6	39.9	42.2	41.4
2014	38.9	41.5	40.5	39.9	42.1	41.4
2015	38.9	41.5	40.5	39.8	42.0	41.2

Source: Eurostat 2016b

According to calculations of the Institute for Employment Research, there were nearly one billion unpaid as well as about 800 million paid long hours in Germany in 2015 (IAB 2016).

In addition, holiday entitlements are not fully used up. A study of the German Institute for Economic research comes to the result that 37% of fully employed people in Germany in 2010 did not make full use of their vacation days. This is a decay of 12% of the total capacity of holidays (Schnitzlein, 2011).

In Germany few hours (8.3 hours) are spent in second jobs compared to the EU average (12.2 hours). The proportion of employed people aged 15 to 74 who usually work at night is higher in Germany (9 %) than the EU average (6.5 %) (Eurostat 2013).

Although a progress towards flexible working hour models can be recorded, a culture of attendance is still dominant in Germany. The rambling opinion is that commitment is shown by working overtime (BMFSFJ 2016c).

3.6.2 Working time in RTDI

Table 61 shows that weekly working hours of full-time employed persons in academic professions in Germany are 2.5 hours above EU average. The number of women's working hours (41 hours) is on average lower than those of men (43 hours). For both genders, the average number of working hours in RTDI has been decreasing since 2005.

Table 61: Actual weekly working hours of full-time employed persons in academic professions by gender and country

	EU 28			Germany		
	women	men	total	women	men	total
2005	38.0	42.3	40.4	42.4	45.6	44.7
2006	38.0	42.0	40.3	42.2	45.1	44.2
2007	38.2	42.0	40.4	42.5	45.1	44.3
2008	38.2	41.8	40.2	42.2	44.9	44.0
2009	38.1	41.6	40.1	41.7	44.0	43.2
2010	38.3	41.6	40.2	41.6	44.1	43.3
2011	38.1	41.7	40.1	41.5	44.0	43.2
2012	38.2	41.7	40.1	41.5	43.9	43.0
2013	38.2	41.4	40.0	41.2	43.5	42.7
2014	38.3	41.2	39.9	41.0	43.2	42.5
2015	38.3	41.2	39.8	41.0	43.0	42.3

Source: Eurostat 2016b

Especially postgraduates invest unpaid additional work to their stipulated work time. In addition, other highly qualified academics work overtime, but it is unclear if they get financial compensation (BuWiN 2017).

Scientific careers, especially in STEM, are shaped by a high workload and an attendance culture. This results in more challenging compatibility of family and career (Solga and L. Pfahl 2009; Cech and Blair-Loy 2014; Niessen et al. 2010). Simultaneously, the attempt for more work-life balance has often negative consequences for career paths. For example, the use of flexible work-models is often interpreted as missing willingness (Turco 2010; Correll, Benard, and Paik 2007). Female postdocs voice criticism about lacking support from role models with family obligations more often (Trübswetter et al. 2015). These circumstances make (academic) careers in RTDI less attractive for women and contribute to their underrepresentation on higher career levels (Niessen et al. 2010).

Working contracts in RTDI are more often full-time than in humanities or social sciences (BuWiN 2017). The share of part-time working female researchers (32.2 %) in Germany is nearly twice as high as the share of male researchers (18.7 %). Both genders are significantly above EU average (women 13.5 %; men 8.5 %) (European Commission 2015b). Female professors are also less likely holders of permanent contracts (Sofka and Sprutacz 2016).

3.6.3 Working contracts in RTDI

3.6.3.1 Fixed-term contracts vs. permanent positions/contracts

In 2012, 15% of the male and 19.3% of the female researchers in the sector were in precarious contracts. This is twice as high as the European average (European Commission 2015b).

Table 62: "Precarious" working contracts of researchers in the sector out of total researcher population by sex, 2012 (in %)

	Men	Women
EU 28	7.3	10.8
Germany	15	19.3

Sources: European Commission 2015b, 104, Figure 5.2

Table 63 shows that the type of working contract depends on the career stage. In Germany, stable employment conditions for researchers start from R3. Researchers with a master's degree, PhD degree, postdocs and assistant professors have temporary contracts, which are often financed through external funding. Only associate professors and full professors have permanent contracts.

Table 63: Career stage with stable employment conditions

Career stage with stable working conditions	Number of countries	Countries
R1	2	Romania, Brazil
R2	4	Belgium, Ireland, Netherlands, Slovenia
R3	17	Austria, Bulgaria, Cyprus (no tenure-track option in R4), Czech Republic, Denmark (no tenure-track option in R4), Finland, France, **Germany**, Hungary, Iceland, Italy, Luxembourg, Poland, Portugal (no tenure-track option in R4), Spain, Turkey, Singapore
R4	11	Croatia, Serbia, USA, Australia, Japan, South Korea, Bosnia and Herzegovina (no tenure-track option), Lithuania (no tenure-track option), Montenegro (no tenure-track option), Norway (no tenure-track option), Sweden (no tenure-track option)
No career stage provides stable working conditions	5	Estonia (tenure-track option in R1+2), Macedonia, Latvia, Russia, China
Miscellaneous	1	Israel
Missing information	6	Liechtenstein, Switzerland, Canada, Albania, Greece, Faroe Islands

Source: MORE2 Draft Report WP3 and WP4 2012, 68

3.6.3.2 Career opportunities

Normally, after PhD junior faculty have to complete a perennial habilitation stage in Germany. This system is increasingly changing due to the fact that scientific journal publications become more and more important in researchers' careers. Universities increasingly accept collections of scientific

journal publications instead of a single research outcome for habilitation. Therefore, the number of habilitations in Germany declined from 2,128 in 2000 to 1,567 in 2013. (Sofka and Sprutacz 2016)

In the beginning of the last decade, there also was a legislative change when the German states introduced a tenure track system. Since then, junior faculty can get the position of a "Junior Professor" (*Juniorprofessur*), which means a temporary contract with the option of being transferred into a permanent professor position. The purpose of this model is to make academic careers faster and more transparent. The junior professorship is comparable to the assistant professor tenure track system in other countries (Sofka and Sprutacz 2016). Nearly all junior professors (97%) work full-time. (Sofka and Sprutacz 2016)

A discussion at the first national workshop of EFFORTI in Germany showed a positive perception of junior professorships. According to the participants' information, most of the junior professorships result in a full professorship.

In 2013, 17% of all professors in Germany (7,659 in total) were at least 60 years, which is to say that a relevant number of open positions will be available in the medium or short term (Destatis 2015b). This is a positive structural development for young researchers. Simultaneously the number of junior professors has increased by 361 positions (29%) from 2010 to 2013 (Destatis 2011). There were government budget constraints in Germany, but there is no indication that recruitment of young researchers was restricted (Sofka and Sprutacz 2016).

In Germany, it is possible to exchange knowledge in industrial PhD Programmes. In this case, the PhD student is not employed by a university but by a non-university research institute or by a company. One quarter of all PhD students in Germany chose this model in winter semester of 2010/2011 (BuWiN 2013). External PhD projects (not as part of a PhD programme) normally emerge on a case-by-case basis when potential PhD students contact university supervisors. Companies often support PhD projects of employees, e. g., by reducing working hours, but there is no standard model (Sofka and Sprutacz 2016).

In 2016 a reform of the Fixed-term Employment in Higher Education and Research Act inured. The previous version had been criticised for promoting an inordinate quantity of short-term employment contracts for junior researchers and, thus, being an obstacle for career planning. The revised law relates the duration of the employment contract directly to the desired level of qualification, like a PhD project, or to the contractual period of a third party grant. Enduring tasks and related employment contracts are supposed to be separated from scientific or artistic training. (BMBF 2016e).

Additionally, the Federal Government supports the establishment of 1000 new tenure track professorships nationwide until 2032 with a tenure track program (*Tenure-Track-Programm*). The program aims at introducing tenure track professorships comprehensively at universities across the country (BMBF 2016c).

A survey on the job satisfaction of young researchers shows challenges especially in the predictability of career opportunities. They want permanent contracts and better future opportunities. This insecurity is a special restraint for scientists with care responsibility (Jaksztat, Schindler, and Briedis 2010; Trübswetter et al. 2015). The European Commission outlines this under the term "maternal wall", because especially women with children or family wish are affected due to lasting traditional role models (European Commission 2013b).

There are several alternative career paths instead of staying in academia. Most of graduated researchers work in non-university research institutions (16%), in the corporate sector (65%) or on a

self-employed basis (21%). In 2015 just 19% of the postdocs under 45 years were employed by a university (BuWiN 2017).

3.7 Gender Pay Gap

3.7.1 General Gender Pay gap

The Gender pay gap measures the difference between the average gross hourly compensation of male and female paid employees, expressed as a percentage of the former (

Table 64).

Table 64: Gender Pay Gap by country (difference between the male and female gross hourly compensation in percentage points)

	2007	2008	2009	2010	2011	2012	2013	2014
EU 28	:	:	:	16.1	16.5	16.6	16.4	16.1
Germany	22.8	22.8	22.6	22.3	22.2	22.4	21.6	21.6

Source: Eurostat 2016d, European Commission 2016b, 51

In Germany, the gender pay gap is 5.5 percentage points higher than the European average is. From 2007 (22.8 %) to 2014 (21.6 %) a slight fall can be reported.

3.7.2 Gender Pay Gap in RTDI

In the economic activity “scientific research and development” the gender pay gap is with 19.3% higher than the EU percentage of 17.9, but lower than the gap in the total economy (22.3 %) in Germany. This means, in 2010, women’s average gross hourly earnings in scientific research and development services were 19.3% lower than the earnings of their male colleagues in Germany (European Commission 2015b).

Table 65: Gender pay gap in the economic activity "Scientific research & development" and in the total economy, 2010 (in %)

	Scientific research and development services	Total economy
EU 28	17.9	16.6
Germany	19.3	22.3

Source: European Commission 2015b, 109 (for 2010 only)

The inferior pay gap in RTDI can be explained by the high number of employment contracts in this field, which follow wage agreements. Collective agreements have a bating influence on the gender pay gap (Klenner 2016).

3.7.3 Gender Gap in Scientific Outputs

3.7.3.1 Gender Gap in Scientific publications

As can be seen in Table 66, the number of scientific publications in Germany has constantly been rising from 48,431 in 2005 to 66,007 in 2014. Table 67shows the development of the proportion of

publications written by women as main author in the same timeframe. It has increased by six percentage points

Table 66: Numbers of scientific publications by country

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Germany	48431	52258	53757	55009	57631	59463	63161	65838	67463	66007

Source: Scopus Database, own calculations by Fraunhofer ISI

Table 67: Proportion of publications written by women as main author (in %)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Germany	20	20	21	22	22	23	24	24	25	26

Source: Scopus Database, own calculations by Fraunhofer ISI

As Table 68 shows, the German gender ratio of authorships from 2011 to 2013 is below the EU average. With a percentage of 30, it is also very far from parity between men and women (which would be 100%). (European Commission 2015b)

Table 68: Women to men ratio of authorships (when acting as corresponding author) in all fields of science (2011-2013)

	Ratio
EU 28	0.5
Germany	0.3

* Parity between women and men = 1

Source: European Commission 2015b, 153

The next table gives more detailed information about the women-to-men-relation of scientific authorships by field of science.

Table 69: Women to men ratio of scientific authorship (when acting as corresponding author) by field of science, 2007-2009 and 2011-2013

		Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities
EU 28	2007-09	0.3	0.2	0.5	0.6	0.5	0.6
	2011-13	0.3	0.3	0.5	0.7	0.6	0.6
Germany	2007-09	0.2	0.2	0.3	0.5	0.4	0.4
	2011-13	0.2	0.2	0.3	0.5	0.5	0.4

Source: European Commission 2015b, 155

There is no gender parity in any field of science in the EU average. Even compared to this, Germany scores low in both evaluation periods. There has been no progress between 2007 to 2009 and 2011 to 2013, except a slight one of ten percentage points in social sciences. The ratio is lowest in male

dominated fields as natural sciences and engineering and technology. The highest gender ratio of 0.5 can be found in agricultural sciences and social sciences where one publication of a woman comes on two publications of a man. (European Commission 2015b)

3.7.3.2 Gender Gap in Scientific patents

The number of patents in Germany that developed unstable from 2005 to 2014 (Table 70).

Table 70: Number of patents by country

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Germany	27189	28334	29628	27255	27195	27760	27689	26110	25220

Source: Patstat Database, own calculations by Fraunhofer ISI

The percentage share of patents filed by women increased by one percentage point in 2007 and has been stable but very low since then.

Table 71: Proportion of patents filed by women amounted to 5% in 2005 to 2007 (in %)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Germany	5	5	5	6	6	6	6	6	6	6

Source: Patstat Database, own calculations by Fraunhofer ISI

3.7.3.3 Gender Gap in Academic Spin-Offs

There is no consistent data – or even a unified definition – for academic spin-offs in Germany (Nörr 2010; Roski 2011). For business creations general data exist which say that 37% of all founders are women (Sternberg, Vorderwülbecke and Brixy 2013).

3.8 Sex differences in international mobility of researchers

3.8.1 During their PHD

The following chart shows the international mobility rates of researchers from the higher education sector during their PhD. The percentages express the share of PhD students who moved for at least three months to a country other than where they will attain their PhD. The sex difference is calculated by subtracting the share of internationally mobile women researchers from the share of internationally mobile men researchers. Both, the EU and the German outcomes, are positive what means that male PhD students are more mobile than female PhD students are. Especially the female German PhD students are less mobile than the average European PhD student is. (European Commission 2015b)

Table 72: International mobility rates of HES researchers during their PhD by sex and sex difference 2012 (in %, sex difference in percentage points)

	Women	Men	sex difference
EU 27	17.6	18.9	1.3
Germany	9.7	13.5	3.8

Source: European Commission 2015b, 106 (based on More2)

3.8.2 In their post-PhD careers

The structure of the next chart is equal to the last one, but in Table 73, the international mobility after the achievement of PhD is shown. International mobility rates in post-PhD careers are higher, the German rate as well as the average EU rate. Both genders are more mobile in Germany than in the EU. The sex difference is very high with 20% points. (European Commission 2015b)

Table 73: International mobility rates of HES researchers in post-PhD careers by sex and sex difference 2012 (in %)

	Women	Men	sex difference
EU 28	25.1	34.2	9
Germany	30.3	50.5	20.2

Source: European Commission 2015b, 107 (based on More2)

A reason for the higher mobility rate in German post-PhD careers is the so-called *"Hausberufungsverbot"*. This regulation makes it very difficult for former PhD students to get a professorship at the university they earned their degree (Forschung & Lehre 2009).

3.9 Women in decision making positions in RTDI

3.9.1 Proportion of women grade A staff by main field of science

Table 74 shows the proportion of women as top-level researchers by main field of science for the years 2007, 2010 and 2013 in Germany and the equivalent numbers for 2010 and 2013 for Europe.

Table 74: Proportion of women grade A staff by main field of science, 2013 (in %)

		Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities
	2007	-	-	-	-	-	-
EU 27	2010	13.7	7.9	17.8	15.5	19.4	28.4
EU 28	2013	15.8	9.8	23.3	22.7	23.5	30
Germany	2007	7.4	5	7	11.1	9.8	21.5
	2010	9.8	5.9	9.2	13.5	12.6	25.2
	2013	11.6	7.6	11.5	18.4	16	28.6

Source: European Commission 2015b, 133 (data only for 2013); European Commission 2013b, 93 (data for 2010); European Commission 2009, 116, calculations by JR (data for 2007)

First of all, there is not one scientific field, where women cast more than 30% of grade A positions, neither in Germany nor in Europe. In all years, the German share is lower in every field of science than the European share. Especially in engineering and technology, medical sciences and natural sciences the number of female top-level researchers is very low. In social sciences, agricultural sciences and humanities, the share is higher, but not balanced at all. Even though the numbers are constantly rising

since 2007, women are still underrepresented in grade A positions over all fields of science. (European Commission 2015b)

3.9.2 Glass Ceiling Index

The Glass Ceiling Index (GCI) relates the proportion of women in top-level positions to the proportion of women in academia. At a GCI of 1, parity in the promotion of women and men would be reached. A GCI score of more than 1, which can be seen in Table 75, indicates that women are underrepresented in top-level positions. (European Commission 2015b)

Table 75: Glass Ceiling Index

	2004	2007	2010	2013
EU 27	2	1.8	1.8*	1.8*
Germany	1.9	1.5	1.5	1.3

* Data for EU 28

Source: European Commission 2015b, 136; European Commission 2013b, 96, European Commission 2009, 78

Both Europe and Germany report a declining GCI from 2004 to 2013. The German GCI is lower than the European one, but there are still more men on top-level positions in academia than men.

3.9.3 Proportion of women heads of institutions in the HES

Only one fifth of the heads of institutions in the HES are women in Europe (Table 76). In comparison, the German proportion is three percentage points lower. Both rates were rising in the last years.

Table 76: Proportion of women heads of institution in the HES (in %)

	2007	2010	2014
EU 27	13	16	20*
Germany	8	12	17

* Data for EU 28

Source: European Commission 2015b, 141; European Commission 2013b, 115; European Commission 2009, 97

3.9.4 Proportion of women on boards, members and leaders

Boards like scientific or R&D commissions, boards, councils, committees, foundations, academy assemblies and councils hold a high level of decision-making power. Although the proportion of women in these bodies is slowly but constantly rising in Germany since 2007, women are still a minority there (Table 77). In 2014 one quarter of the board members were female, but just 8% of the women are also board leaders. Compared to Europe (22 %), this number is very low.

Table 77: Proportion of women on boards, members and leaders (in %)

	2007	2010	2014	
			Members[36]	Leaders
EU 27	22	36	28*	22*
Germany	20	21	25	8

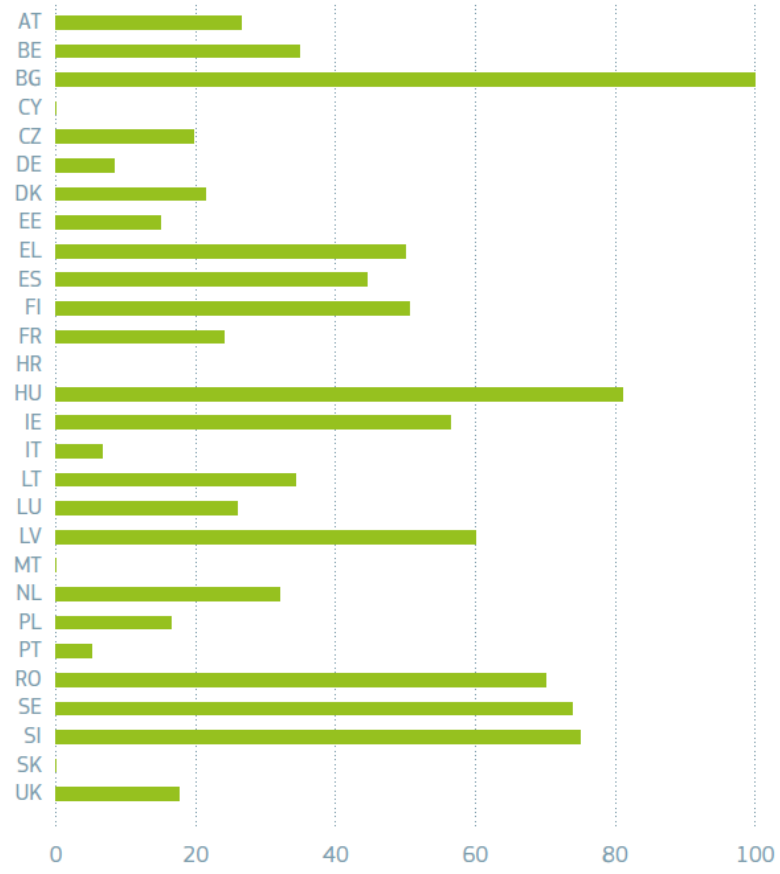
* Data for EU 28

Source: European Commission 2015b, 143 (data only for 2014); European Commission 2013b, 117; European Commission 2009, 98

3.9.5 Percentage of research evaluation panels in RFOs that included at least 40% of target of under-represented sex in boards.

One of the targets of the European Commission's Horizon 2020 programme is to ensure gender balance in decision-making. This goal shall be reached by a target of 40% of the under-represented sex in panels and groups (50% for advisory groups). (European Commission n.d.)

Figure 11: Share of gender-balanced research evaluation panels in funders, 2013 (in %)



Source: European Commission 2015a, 32

Figure 10 above shows the share of gender-balanced research evaluation panels in funders. In Germany, only about 10% of these panels are gender-balanced (European Commission 2015a).

[36] Members include leaders already ((European Commission 2015b)).

One participant of the national EFFORTI workshop in Germany noted that there is no obvious association between the gender-balance or -imbalance of the funding panels and the preference for men's or women's applications. The participant hypothesised that women are more critical at assessing other women because they have to justify their decision for a woman's proposal eminently.

3.10 Inclusion of gender in research and teaching

3.10.1 Support to the inclusion of gender contents in research agendas by funders

In Germany, the frequent support of the inclusion of the gender dimension in research content is below EU average. However, applicable measures for increasing the inclusion of gender dimension are identified (Table 78) (European Commission 2015a).

Table 78: Support to the inclusion of gender contents in research agendas by funders (in %)

	frequently	occasionally	none	not applicable	no answer
Germany	24.6	74.6	0	0.7	0

Source: European Commission 2015a, 85

One quarter of the funders in Germany, state that they consider the gender dimension in research agendas frequently, the other three quarters occasionally (European Commission 2015a).

3.10.2 Inclusion of the gender dimension in research contents

Regarding the inclusion of the gender dimension in research contents, Table 79 shows that Germany is also below EU level but has already identified measures to strengthen the gender dimension (European Commission 2015a).

Table 79: Inclusion of the gender dimension in research content in RPOs (in %)

	yes	no	not known	not applicable
Germany	62.9	9.5	14.3	13.2

Source: European Commission 2015a, 85

About 60% of German RPOs state that they include the gender dimension in research contents, nearly 10% don't, 15% don't know if they consider the gender dimension and 13% think, it is not applicable for their field (European Commission 2015a).

3.10.3 Inclusion of the gender dimension in teaching/curricula

There are two main aspects of diversity – or in particular of gender – in teaching: first of all, readers have to grapple with the diversity of their students. Secondly, comprehensive and subject-specific gender competence has to be imparted. (Seng and Landherr 2015)

The influence of gender research in Germany in teaching began in fields like cultural sciences, humanities, social sciences and pedagogy. Meanwhile the inclusion has been expanded to STEM fields and medicine as well. (Technical University of Munich 2011)

Examples are Gender in academic teaching at Thuringian tertiary institutions (*GeniaL – Gender in der akademischen Lehre*), "Gender in teaching" at Leuphana University Lüneburg and "Gender Curricula

for Bachelor and Master" by Women's and Gender Research Network NRW. The latter offers proposals of integrating the contents of women's and gender studies into degree courses and gender-sensitive evaluations of study programmes. Leuphana University developed the approach of the "integrative gendering" which means that in every research approach, every lecture and every tutorial, gender aspects have to be considered when contenct and didactics are developed. (IMA/ZLW - RWTH Aachen University n.d.)

4 Evaluation Culture and Policy

4.1 Description of Evaluation Culture

When describing the evaluation culture in Germany we can historically distinguish between the following pillars: (1) research performance of individuals and /or groups which are evaluated by peers, often based on bibliometric indicators like number of publication in peer reviewed journals or number of citations; (2) programme evaluations which emerged during the 1970ies in the context of a more strategic orientation of Science and Technology Policy and became rather common during the late 1980ies and early 1990ies, promoted inter alia by the European Commission; typical examples are "problem/mission-oriented" programmes (e.g. environment; energy; health; bio-economy.); "new technology" programmes (like biotech; micro-systems; new materials); SME innovation support programmes (e.g. R&D co-operation; venture capital; technology centres and technology transfer, but also "New Länder" programmes); competition based programmes aiming at structural innovation and networking effects (e.g. competence centres and networks, clusters); (3) evaluation of research institutions which occurred in the course of a policy shift towards New Public Management where the principals govern primarily through target agreement and a subsequent performance measurement, primarily since end of the 1990ies; concrete examples here are thematic evaluations, covering different institutions horizontally (e.g. Wissenschaftsrat 2012), performance evaluations of single institutes (e.g. industrially oriented institutes in Baden-Württemberg ("An-Institute"), Kuhlmann and Holland 1995, Koschatzky et al. 2008; evaluation of institutes for departmental research ("Ressortforschung", functional ("systems") evaluations of institutional models (e.g. Fraunhofer; MPG; DFG; Leibniz; HGF, see Wissenschaftsrat 2000, 2001) and a variety of new evaluation approaches in universities (e.g. faculties or entire universities; research and/or teaching; third mission)); (4) system evaluation, looking not only at individual performance but on the interplay between different actors of a societal sub-system like research and innovation systems as rather recent activities.

In the following, we will focus on research as well as programme evaluations as they shape the German evaluation culture within RTDI to the largest extent.

4.1.1 Explicit legislation and adoption of evaluation standards:

Policy framework for evaluations

Regarding the research and innovation system, there are two main actors at the federal level in Germany: The federal ministry of Education and Research (BMBF) and the federal ministry for Economic Affairs and Energy (BMWi). Other federal ministries do also commission programme evaluations with a reference to research and innovation, i.e. the Federal Ministry for Health, for Environment, for Labour and Social Affairs etc. but do not play the same crucial role as the aforementioned ministries. Furthermore, Germany has a variety of research performing organisations which are jointly funded by the Federal State and the "Länder", for example the Max-Planck-Society, the Fraunhofer-Society, the Leibniz Society and the Helmholtz Association. Within the the "Pact for Research and Innovation" (*Pakt für Forschung und Innovation*), the BMBF as the main sponsors of these organisations defines performance criteria against which the organisations are assessed (see below). As the federal states are in charge of educational issues in Germany, the policy framework for the University sector is characterised by a variety of 16 different Laws, which describe the arrangement between the policy level and the single Institutions. One important part of many

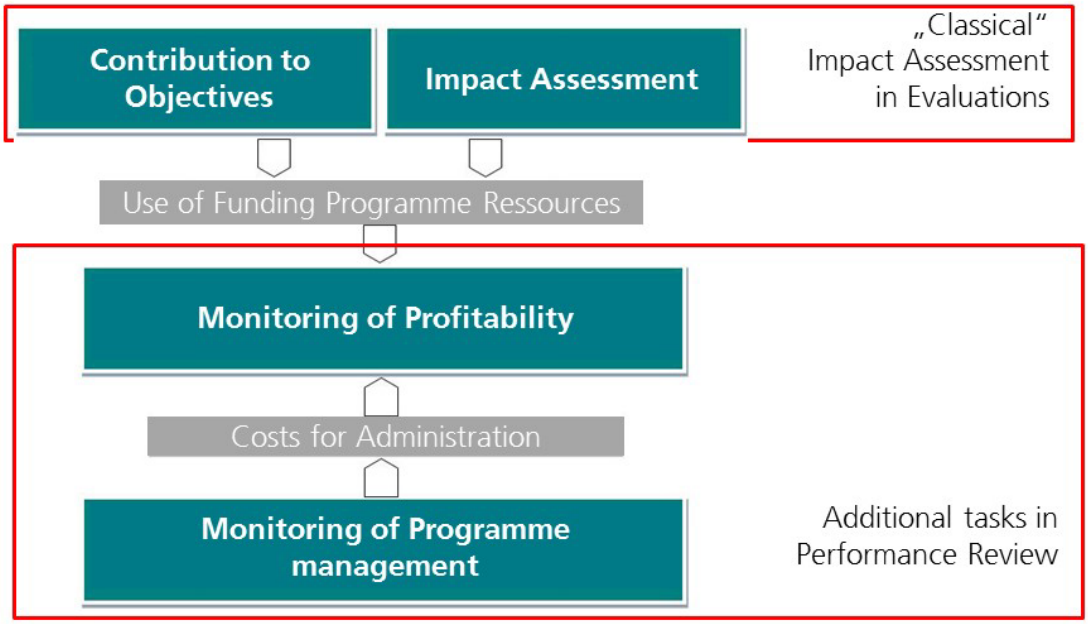
Laws consists in different procedures of a performance-oriented resource allocation (*LOM – leistungsorientierte Mittelvergabe*). These "LOMs" define a certain set of performance indicators like publications and amount of grants against which the performance of single faculties is measured.

Formalisation of evaluation procedures /legislation

Regarding programme evaluation, we find "soft" recommendations as well as legal requirements whereas during the past years the pressure of the Federal Court of Audit to monitor profitability of public spending significantly increased.

Particularly the German Federal Ministry for Economic Affairs and Energy (BMWi) emphasises the Administrative Rule No 11a to §44 of the Federal Budget Code (*BHO - Bundeshaushaltsordnung*) in combination with Administrative Rule No 2 to §7 BHO as basis for their Performance Reviews for which programme evaluations are part of. The subject here is the monitoring of targets, impacts and programme completion as a basis for monitoring profitability and suggestions for further development, as shown in Figure 12.

Figure 12: Demands for a Performance Review according to §7 BHO for R&I programmes, source: own compilation



Evaluation Standards and Guidelines

Several codes of conduct are in use in Germany, e.g. the standards of the DeGEval – Gesellschaft für Evaluation (see http://www.degeval.de/degeval-standards/standards/) but also the standards of the Austrian Evaluation Platform (see http://fteval.at/en/standards/) give orientation. Whereas the DeGEval standards are rather broad in their nature and refer primarily to general ethical and scientific standards for empirical research in the Social Sciences, the Platform-Standards are focused on RTDI initiatives. The compliance to standards is not mandatory but can establish a competitive advantage in selection procedures for the commission of external evaluation studies. In some calls for tender from German ministries it is even explicitly required that the suppliers are familiar with the DeGEval-standards. Thus, programme evaluations in Germany often refer to common standards or guidelines of the programme owners.

Furthermore, the German Ministry for Economic Affairs (BMWi, formerly BMWA – Ministry für Economic Affairs and Labour) published an internal evaluation guideline already in 2004 (BMWA 2004) which became part of the DeGEval official documents.

The German Ministry for Economic Affairs and Energy refers not only to the §7 BHO but also to an expert report according to which evaluation of economic policy measures is an element of an evidence-based Economic Policy (BMWi 2013). Overall, the BMWi seems to be more process-oriented and standard-oriented when it commissions programme evaluations, e.g. it regularly foresees evaluations when planning new programmes and the evaluation results are typically publicly available.

The orientation towards scholarly defined common standards or guidelines defined by the programme owners lead to some sort of convergence regarding the design and conduction of evaluation studies e. g. coverage of topics or impacts, methods of data collection or analysis etc. (Edler et al. 2010). As the INNO APPRAISAL report points out: "Actually, there is some sort of standardisation of approaches visible, but more important, this convergent development takes place at a high quality level and includes the openness of evaluators (and commissioners of evaluations) towards new methods." (Edler et al. 2010, pxvi). Not only the INNO APPRAISAL report, but also internal investigations done by Fraunhofer ISI shows that there is a certain standard evaluation design using rather similar methods. Basically, the following approaches are used: document analysis, survey among the beneficiaries and expert interviews. This core set of methods is sometimes enriched by focus groups, social network analysis and control group approaches. More sophisticated approaches like bibliometric and patent analysis are rather seldom, depending on the concrete R&I programme.

Besides the programme level, the German Science Council published a guideline for the evaluation of institutions, called "Tasks, Criteria and Processes of the evaluation committee of the Wissenschaftsrat" (Wissenschaftsrat 2013a), which forms the basis for their own evaluation activities. This guideline refers to the "Recommendations for the assessment and management of research performance" (Empfehlungen zur Bewertung und Steuerung von Forschungsleistung" (Wissenschaftsrat 2011). Further guidelines exist at the federal state level (see below) and for the internal evaluation of large research performing organisations like the Leibniz Society (Leibniz-Gesellschaft 2014). Additionally, the German Science Council published recommendations for a basic set of indicators to measure research performance (Wissenschaftsrat 2013b, 2016).

Development of RTDI policy evaluations

The basic characteristics of programme evaluations in Germany can be summarised as follows: At the federal level, evaluations are regularly foreseen, primarily the BMWi programmes undergo interim and/or ex-post evaluations whereas the BMBF approach is or has been less systematic. Generally spoken, the BMBF puts a greater emphasis on formative evaluations, the BMWi on accountability and profitability.

Usually, the programme owners dedicate a certain budget to the evaluation, which is typically below 1% of the programme budget. Tender procedures for programme evaluations in Germany are mostly open and evaluators are in most cases external. According to the InnoAppraisal project, the application of open tender procedures is linked to high quality scores (Edler et al. 2010, pxvi). However, the ministries do also use internal evaluations as well. In the field of programme evaluation, we find a certain division of labour between external evaluators and the project agencies ("Projektträger"): the latter focus on the programme and project monitoring, the external evaluators

add the external view on goal attainment, outputs, outcomes and impacts. However, there is still room left for an improvement of the interface between these two actors as monitoring data not always meet the programme evaluation requirements and the division of labour is not always fully clear.

Evaluation reports are often but not always publicly available, in many cases the programme evaluations are treated as a pure internal service to the ministry and the results are kept confidential. This is a certain contradiction to recommendations formulated by professional organisations like the DeGEval. A further challenge for the improvement of the evaluation culture in Germany is that most evaluation reports, if published at all, are only available in German, which hinders an international exchange about good practices.

Programme evaluations may serve different purposes whereas the below mentioned functions are the most important ones:

- the legitimization for the allocation of public money to R&I,
- the enhancement of an adequate and effective use of funding by measuring the scientific/technological quality or the (potential) socio-economic impact,
- improvement of the management and “fine tuning” of R&I policy programs,
- the provision of new ideas about changes in R&I performing organisations and funding agencies, thus enhancing the fulfilling of their missions.

The two first mentioned aspects are reflected in summative evaluation approaches, the last two in formative approaches. Until recently, Germany has a long tradition in formative approaches, looking on not only simple input-output-relations but also taking into account framework conditions and aiming at mutual learning of the involved stakeholders.

During the past years, however, we can observe a certain shift towards a stronger emphasis on impact analysis. This particular type of programme evaluation is typically conducted ex post and commissioned as part of broader evaluation exercises. Often, impact assessments are very specific programme-related questions, but some common characteristics are:

- Impact assessment is **linked to the analysis of the logic of the programme:** Was it appropriate? Has the design been internally coherent? Is it externally coherent, i.e. does it match the funding landscape in place?
- Impacts should be **contextualised:** procedural, structural or cultural characteristics of the research and innovation system might act as barriers or levers for a funding programme in the generation of impacts.
- Usually, **different types of impact** play a role (e.g. Timing: short-term, mid-term, long-term; Range/Coverage: beneficiaries, further actors; Dimensions: scientific, technological, economic, social, systemic, environmental impacts etc.
- **Multi-Method** approaches work best; mix of qualitative and quantitative methods; increasing use of **counterfactual** approaches.
- Impact Assessment includes perspectives from all stakeholders as programmes are typically situated in **multi-actor settings**.

4.1.2 Budget, number, frequency and public access to of evaluations

Budget

The evaluation community recommends a share of 0.5%-1% of the programme budget to be foreseen for a sound programme evaluation. In practice, however, the ministries handle programme evaluations still relatively diverse, deciding case by case whether they carry out no evaluation, an internal evaluation or an external evaluation and, if the latter is the case, how large the budget is.

Number and frequency

According to the large diversity how ministries and programme owners in Germany handle their evaluation activities, it is rather difficult to indicate a precise number of programme evaluations. The fact that it is not mandatory to publish evaluation reports, even if publicly financed, doesn't ease the compilation of a comprehensive overview on evaluation activities in Germany. Especially one of the major research and innovation programme funders, the BMBF, is rather reluctant in this regard, but also the "Länder". National research funders like the German Research Foundation (DFG, Deutsche Forschungsgemeinschaft), but also the German Academic Exchange Service (DAAD, Deutscher Akademischer Austauschdienst) and the Alexander von Humboldt Foundation (AvH, Alexander-von-Humboldt-Stiftung) publish their evaluation reports regularly, also including at least an English summary.

To sum up: There is no national repository of evaluation studies in Germany like it exists in Austria. Also the SIPER database (Science and Innovation Policy Evaluation Repository (SIPER), set up by the University of Manchester, does not yet deliver a comprehensive overview: only some few evaluation studies for Germany (N=13) are mentioned there at the moment. However, the working group "Research, Technology and Innovation Policy" within the DeGEval started to inform its members about ongoing and finished programme evaluations in emails regularly sent to its members.

4.1.3 Actors and Institutions:

The most important actors in fields of research and innovation evaluation in Germany are, in terms of initiators or sponsors:

- State Funding agencies like national or regional research ministries,
- legal bodies like the Federal Court of Audit,
- oversight agencies like the German Wissenschaftsrat,
- foundations like the DFG (Deutsche Forschungsgemeinschaft), the Volkswagen Foundation, the Robert-Bosch Foundation etc.,
- research performing organisations like university management or major research institutions like Helmholtz Association.

The German Council of Science and Humanities (**Wissenschaftsrat**) conducts itself evaluations and provides counselling for Federal and "Länder" governments. The organisational units in charge of the evaluation are the Evaluation Committee and appointed working groups on a respective topic. The main focus of work are institutional evaluations, but the council is also engaged in cross-sectional reviews of research areas, for example Chemistry and Law. Besides evaluation studies, the Wissenschaftsrat also addresses different topics with relevance for science policy making like the examination of the role of universities of applied science, structural challenges for University research (Wissenschaftsrat 2002, 2010, 2013c) and the role of women in science (Wissenschaftsrat 1998, 2007).

Evaluation of the German R&I system as a whole is done by the **Expert Commission on Research and Innovation (EFI),** an expert body which was established in 2006 and consists of six Professors from economic research (national economy as well as management science). The EFI commission publishes annual reports. The annual report 2014 explicitly dealt with evaluation in terms of "Promoting innovation more efficiently through the evaluation of policy measures" (EFI 2014). Besides the annual reports, the EFI Commission launches studies on particular challenges of the German research and innovation system The role of women was one of the studies in 2014 (see below, EFI study 12-2014). The prominent role of the EFI-Commission reflects a general trend in German innovation policy making to rely rather on expert opinion than on evidence stemming from programme evaluations. In this regard also the Imboden Commission that evaluated the German Excellence Initiative has to be mentioned (IEKE 2016). These experts act as "human exclamation marks".

Since 2007, the ministers and senators of the Federal Government and the States responsible for science and research as well as for finance form the **Joint Science Conference (GWK**) (http://www.gwk-bonn.de/index.php?id=126). This expert body publishes annual monitoring reports for the "Pact for Research and Innovation" (*Pakt für Forschung und Innovation*), a policy initiative which relates an increase in the basic funds of the large German research organisations like Fraunhofer Society, Max Planck Society, Helmholtz Association and the Leibniz Association to certain performance areas. A better representation of women in science and innovation is part of the performance monitoring (GWK 2016b, see also below).

A further important player at the federal level is the **German Research Society (DFG)**, which has high, international standards of programme evaluations, encompassing all programmes, independent evaluators, quantitative assessments and considerations of both effectiveness and efficiency of resources. Some examples for such kind of programme evaluation are the Evaluation of International Research Training Groups (Geyer et al. 2015), the Evaluation of Transfer Projects in Collaborative Research Centres (Berger et al. 2012) and the evaluation of the Emmy Noether programme (Böhmer et al. 2008) (http://www.dfg.de/dfg_profil/zahlen_fakten/evaluation_studien_monitoring/studien/index.html).

At the state level, organisations like the Scientific Commission of Lower Saxony (Wissenschaftliche Kommission Niedersachsen) or the Evaluation Agency Baden-Württemberg (Evaluationsagentur Baden-Württemberg) play an important role for the evaluation of Universities (http://www.wk.niedersachsen.de/startseite/; https://www.evalag.de/). They typically focus on an assessment of teaching, research and services but also entire organisational units. For these purposes both agencies have guidelines at their disposal which define basic principles, processes but also evaluation criteria.

Finally, external programme evaluations are typically conducted by:

- independent researchers in universities and research institutes specialized in R&D evaluation and related areas like Technology Assessment and Foresight, and science and technology policy analysis more generally (e.g. Fraunhofer ISI, ZEW, HOF),
- consultants ranging from specialized research firms (e.g. Technopolis, prognos) to business administration-oriented consulting firms participating in R&D evaluation jobs from time to time (Rambøll, Ernst and Young, PwC),
- professionals in other jobs (in particular academics) knowledgeable about R&D evaluation, who from time to time participate in an R&D evaluation study.

4.1.4 What kind of evaluations are commissioned and conducted?

Evaluations can serve **summative** or **formative** functions; they can take place **ex ante**, **interim, ex post** or as an **accompanying** exercise; be conducted **internally** (by agencies like the German "Projektträger") or by **external** experts (consultants, universities, research institutes etc.); and address different **levels** and "objects" (single researchers, projects, **programmes,** institutions or whole innovations systems). As there is no general evaluation repository in Germany it can hardly be assessed which type is dominant.

At the programme level, the whole spectrum of evaluations studies is commissioned and conducted in Germany, i.e. ex ante, ex post, interim evaluations. At least all large funding programmes are evaluated by external experts, for example the leading-edge-cluster competition (Rothgang et al. 2015) and ZIM – the central innovation programme for SMEs (Kulicke et al. 2010; Becker et al. 2014). Large programmes are also evaluated at federal state level like the evaluation of the Bavarian cluster initiative (Bührer et al. 2008, Koschatzky et al. 2011). These large-scale programme evaluations are based on a competition and an open tender procedure, which assures a certain amount of quality. Evaluations are also foreseen when new policy measures are designed.

A particularity in Germany is the frequent use of accompanying evaluations which are often labelled "accompanying research" to express that not a summative judgement is the focus but the generation of insights and knowledge about supportive and hindering factors when implementing a policy measure. One of the most long-lasting accompanying exercises is the accompanying evaluation of EXIST, conducted since 1998 when this instrument has been launched (Kulicke 2014).

About seven years ago, the INNO-APPRAISAL-report summarised the German situation as being characterised by three different types of programme evaluations: (1) ex-post evaluations which follow mainly a summative purpose; (2) accompanying evaluations where the ministries often intend a formative approach in order to be able to redesign certain aspects of ongoing policy measures. (3) Interim evaluations of long-term measures with a primarily formative character (Edler et al. 2010, 270).

4.1.5 Relevance of gender equality in RTDI evaluations & evaluation of gender equality initiatives in RTDI

Neither the consideration of gender aspects in RTDI evaluations nor the evaluation of gender equality initiatives in RTDI is widespread in Germany. Standard programme evaluations do typically not foresee any considerations of gender issues, at least as long as the promotion of Gender Equality is not the focus of an initiative. Exceptions are programme evaluations which focus on the promotion of individuals like mobility or doctorate programmes which usually take gender issues into account. There are some few conventional R&I programme evaluations like the evaluation of the Bavarian cluster initiative (Koschatzky et al. 2011) where the representation of women in the cluster management was one of the numerous evaluation criteria. Explicit gender promoting programmes are sometimes evaluated, for example the "Evaluation des Nationalen Pakts für Frauen in MINT-Berufen (2008 bis 2011)", but the evaluation results are not publicly available. The main exception is the evaluation of the German Professorship Initiative (Zimmermann 2012).

However, there are several datasets which describe the role of women within the German Science and Innovation system, for example the **studies compiled by the GWK** since 2005 and which are regularly updated. The most recent publication stems from 2014/2015 but is only available in German (GWK 2016a), except from the GWK Book 24 about Equal Opportunity in Science and

Research which refers to the data 2009/2010 (GWK 2011). The annual monitoring reports of the GWK on the results of the "Pact for Research and Innovation" (*Pakt für Forschung und Innovation*) contain detailed information on gender-related strategies, instruments and progress of the respective research performing organisations, again only available in German (e.g. GWK 2015, GWK 2016ahttp://www.gwk-bonn.de/themen/wissenschaftspakte/pakt-fuer-forschung-und-innovation/).

As mentioned above, the Wissenschaftsrat also publishes statements about the role of women in the German research system (WR 2007, 1998) at regular intervals.

The DFG publishes data on Gender Equality too: (1) in form of monitoring reports about the application success of female researchers (last monitoring report from 2016 (DFG 2016b), first one from 2012, http://www.dfg.de/dfg_profil/gesamtliste_publikationen/statistische_doku/index.html), but also (2) particular studies on gender effects in research funding (Ranga et al. 2012), success rates of applications (Auspurg et al. 2010), career developments of junior researchers, graduate students and awardees (2009, 2004), (4) but particularly the gender equality standards (Gleichstellungstandards) (DFG 2008).

Finally, the CEWS (Center of Excellence Women and Science), an institution of the Leibniz Society that sees itself as "national hub for realisation of equal opportunities for both women and men in science and research in Germany" regularly publishes a University ranking based on Gender Equality indicators (http://www.gesis.org/cews/cews-home/zielgruppen/gleichstellungsakteurinnen/).

4.1.6 Recent trends/developments in RTDI policy evaluation

During the past years, we can observe different trends in research and innovation policy making which effect the evaluation activities too. These developments can be summarised as follows:

1. More pressure to demonstrate **legitimacy and profitability of public spending**
   - As mentioned above, the Federal Court of Audit and the national legislation emphasise much stronger than in the past an effective and efficient use of public spending. This leads to an increase in the number of programme evaluations and a growing acceptance of this kind of strategic intelligence among policy-makers and administrators.
   - Due to the stronger need for legitimacy and profitability instead of learning, impact analysis becomes more important.
   - Corresponding to the tendency that funding for research and innovation is more and more based on competition, also programme evaluations become more comprehensive and widespread.
2. More **complexity** of programmes and the corresponding evaluations
   - Complex, systemic programmes aim at generating impacts in form of agenda setting, awareness raising, behavioural additionalities and changes in organisational structures and cultures. Evaluation research and practice has to find answers how to address these challenges.
3. Strong trend towards **professionalization** and **standardisation** of evaluations
   - Research and innovation founders increased their in-house knowledge on evaluation significantly, fostered by professional organisations like the DeGEval, guidelines and

standards to be considered and through the establishment of dedicated organisational units within their institutions.

- As a consequence, commissioners of evaluations frequently formulate clear demands as regards the use of certain approaches and methods in the empirical analysis. Also, own evaluation criteria are sometimes suggested. However, there is a certain openness towards new methods, e.g. evaluation econometrics, and evaluation suppliers are sometimes explicitly encouraged to use new approaches.

4. New **evaluation topics**

   - The scope of the topics increases too: not only RTDI impacts, but also the monitoring of the profitability, the programme administration, impacts of single projects and the analysis of the programme theory etc. gain importance.
   - Effects which are linked to the launch of the programme, i.e. through the proposal writing and building of partner consortia, attract attention too.
   - There is growing discussion about new respectively additional impact dimensions and types of indicators which go beyond the traditional impact dimensions and indicators like publications, patents, trademarks, spin-offs etc. which refer to economic, technological and scientific impacts; instead, new impact dimensions like societal, systemic, ecological and political impacts gain importance.

5. New **approaches** and **methods**

   - Control and comparison groups become more important and are used respectively demanded wherever it is meaningful, e.g. for person-related measures like doctorate programmes, innovation vouchers or labour market initiatives.
   - Control groups approaches are often part of quantitative impact assessments.
   - We also find an enrichment of new **quantitative methods** like Text Mining and Altmetrics.
   - There are new avenues also for **qualitative impact assessment**, particularly e.g. process tracing and contribution analysis which refer to “Theory Based Impact Assessment TBIE” (Weiss 1997a, 1997b, White 2010)

4.2 Evaluation utilisation and policy learning:

Programme evaluations address different target groups and the amount of policy-learning and evaluation use differs according to them:

- policymakers in ministries and funding agencies: they can use programme evaluations to justify their overall strategy and related expenses;
- programme managers within funding agencies and/or ministries might learn about the programme’s efficiency and effectiveness and receive input for a further improvement or adoption of their policy instruments;
- heads and Departments for strategic development within research organisations and universities may receive input for their strategy development; the definition of funding priorities and the assessment of the appropriateness of funding instruments:
- elected politicians (parliament) might use evaluations as source of strategic intelligence to further elaborate their research and innovation policies;

- R&D communities can use programme evaluation for benchmarking purposes, for example persons in charge of cluster management;
- academic researchers (science and innovation studies; ...): Evaluation studies can, if properly conducted, contribute to a better understanding of the processes and outcomes of policy-making as well as on the design of measures which promise the most effective and efficient way to implement change within a system.

As mentioned above, Germany has a strong tradition of using evaluations as learning instrument. This is reflected by numerous formative and interim evaluations, but also the use of methods like focus groups or workshops which serve the validation and adoption of evaluation results. As the INNO-APPRAISAL study found out, "the learning applies in fewer cases to the evaluated measures themselves but takes place on a more general level namely the overall policy learning for future policy making and programme design. One of the reasons for this is that the aspect of "policy/strategy development" is an integral part of formative evaluations in Germany." (Edler et al. 2010, pxvi). Furthermore, "German evaluations are discussed on average more within government and slightly more with stakeholders compared to other countries. The level of discussion within government is to a statistically significant extent higher than in other countries. This again confirms the finding of the learning aspect. When it comes to measurable consequences, we find that the expansion and prolongation of a measure follows in Germany quite often from evaluations (Edler et al. 2010, p276).

In selected cases, system evaluations can lead to substantial changes within the research and innovation system even if this occurs rather seldom. However, as several expert groups addressed the negative impacts of the last constitutional change regarding the cooperation between the Federal State and the "Länder" (Art. 91b GG 'Grundgesetz') which impeded an active role of the "Bund" for the Sector, this has meanwhile changed into a permanent partnership of federal and states governments in funding universities (Sofka and Sprutacz 2016, 96).

However, (programme) evaluations are only one piece of the puzzle among several others to inform policy-makers and administrators about current and future challenges. Beside evaluation, also **technology assessment** and **foresight activities** have to be mentioned. The main promoter of foresight activities in Germany is the BMBF. Foresight functions here as a supplier of ideas about future needs for the German research and innovation system and as early warning system for challenges (Sofka and Sprutacz 2016, 23).

5 Conclusions

5.1 Comparison between gender equality in the labour market and in RTDI

Some characteristics of the German labour market can be assumed to be equally valid in RTDI. Fiscal incentives for a traditional role distribution within couples and the leak of childcare facilities for small children are obstacles to the labour market participation of women in general as well as for women working in RTDI.

Parental leave policies are valid for the labour market in general as well as for the RTDI sector and comparatively generous in Germany. Junior researchers can extent their fixed-term contracts more easily than other employees do with precarious contracts in the German labour market (European Commission 2016a, 23). However, the experts at the first national workshop estimated that the take-up rate of parental leave is lower in academia than in the general labour market because of the performance pressure.

Women work part-time more often than men do both in general as well as in RTDI. In the general labour market in Germany, the extent of part-time work becomes obvious when comparing the gender gap in total employment. Also in RTDI, women work more often part-time than men do. The share of part-time working female researchers in Germany is nearly twice as high as the share of male researchers (European Commission 2015b).

There are particular programmes to promote gender equality in RTDI, which do not exist in the general labour market. For instance, the Female Professor Programme and the programme Women to the Top by the federal government, the Research-Oriented Standards on Gender Equality of the German Research Organisation or the encouraging of self-defined target quotas by state governments, to name some examples. Most RPOs in Germany have adopted gender equality plans (European Commission 2015b) and a number of RPOs has committed to work on including gender content in research.

5.2 Main strengths and weaknesses of the innovation system and their impact on gender equality in RTDI

Germany is a federal republic and Universities have comparatively high autonomy. Going along with this structure, actors in the RTDI system have committed to gender equality goals and there are positive incentives, but no legally binding measures. This can be assumed to be one of the reasons why gender equality is improving in RTDI, but slowly.

The academic, as well as parts of the RTDI system in Germany are characterised by uncertainty in career planning, precarious working conditions, and a high workload. These characteristics favour employees without (anticipated) responsibility for a family, in short: they are more attractive to men.

In academia in Germany, researchers often work under precarious working conditions until they achieve a full professorship position. As women have lower positions on average than men do in the sector, they are more often working in precarious working conditions than men are. Compared to the European average, around twice as many female researchers in Germany have precarious working contracts (European Commission 2015b, 104). Even after attaining a professorship, women in Germany are also less likely to have permanent working contracts (Sofka and Sprutacz 2016). The high workload and attendance culture, which characterises scientific careers, is less attractive for women than for men (Niessen et al. 2010) and thus a potential barrier to gender equality in RTDI.

A new career stage, the junior professorship was introduced in Germany in 2002. Some of the junior professors have tenure track options and therefore better chances to get promoted to full professorships afterwards. At the moment, there is a comparatively high proportion of women among junior professors and this change in academic careers may bring about a higher proportion of women. However, there are also reasons against this assumption, such as the fact that many junior professors didn't see good options to reconcile professional and family life (Burkhardt et al. 2016).

Gender inequality in RTDI in Germany is connected to the working time and attendance culture. In the German RTDI-system, more people work part-time than on the EU average (European Commission 2015b). Female researchers in particular are more likely to work part-time than male researchers (European Commission 2015b) are. The authors of this country note assume that a part of these part-time contracts may in reality be a full-time workload and connected to overtime work. Besides, part-time work may be a problem to future career chances considering the widespread attendance culture in academia. The working time culture in academia in Germany implies that even researchers in full-time positions regularly work overtime (Eurostat 2016b). Male researchers work more overtime than female researchers do (Eurostat 2016b), which may lead to further career advantages for men.

As illustrated, the gender pay gap in RTDI (19.3%) is smaller than the gender pay gap in the total economy (22.3%). This may be due to a relatively high proportion of collective labour agreements in RTDI, most particular in the sector, which is the sector with the highest number of women in total as well as the highest proportion of women among all researchers.

High mobility at the post-PhD stage is a specific characteristic of the German RTDI-system. It relates to the "Hausberufungsverbot" at German universities, a regulation to prevent that RPOs award professorship positions to PhD graduates from their own institutions (Forschung & Lehre 2009). The high difference between the mobility of men and women suggest that the lower mobility of women may be one of the reasons why they cannot take the best offers to further their career in RTDI. It can be hypothesised that the lower mobility of women is connected to family-related responsibilities.

Regarding the number of women in leading positions in RTDI, there is no clear direction to answer whether women face more barriers in Germany than in the EU average. In Germany, the Glass Ceiling Index, which compares the number of women in top level positions in academia to the number of women in academia, is lower than the EU average, which indicates that women's underrepresentation at top positions in Germany is below the EU average. However, the number of women in the position of board leaders is substantially lower in Germany than in the EU average.

5.3 Main issues of evaluation culture and policy in RTDI

The German evaluation system is characterised by a large variety of actors and evaluation approaches. In the field of RTDI evaluation, Germany can be seen as a pioneer among European countries, contributing to scientific debates through the implementation of advanced evaluation methods and practices. In this regards, Germany has a strong tradition in using programme evaluations as learning tool, emphasising the formative aspects, reflected in numerous long-lasting accompanying evaluation studies. However, we also found numerous quantitative evaluation studies based on econometric approaches too.

Meanwhile, all major RTDI programmes are evaluated, primarily by external experts who are selected on the basis of public call for tenders. The main effect of programme evaluation for policy-making is, by and large, the fine-tuning of existing programmes and the design of futures measures.

During the past years, we can also observe a growing trend towards standardisation, promoted by mutual exchange between the supply and demand side of evaluations, i.e. programme owners and evaluators, but also through the foundation of the Society of evaluation DeGeval where evaluations practitioners and scholars regularly meet.

In our view, a “good” programme evaluation is sharpened by (1) Context-sensitivity, (2) Stakeholder Involvement (multi-perspective approach) respectively participation (involvement also in the interpretation of findings and in learning from the findings) and an (3) Acknowledgement of methodological limitations. These requirements are best met if the available resources are reasonable, in terms of time as well as money and if not only accountability but also learning is in the focus.

6 Glossary

AETR	Average Effective Tax Rate
AvH	Alexander von Humboldt Foundation [Alexander-von-Humboldt-Stiftung]
BAG	Federal Working Committee of local women's offices [Bundesarbeitsgemeinschaft kommunaler Frauen- und Gleichstellungsbeauftragter]
bga	Female Entrepreneur Agency [bundesweite gründerinnenagentur)
BES	Business enterprise sector
BHO	Federal Budget Code [Bundeshaushaltsordnung]
BMBF	Federal Ministry of Education and Science [Bundesministerium für Bildung und Forschung]
BMFSFJ	Federal Ministry for Family Affairs, Senior Citizens, Women and Youth [Bundesministerium für Familie, Frauen, Senioren und Jugend]
BMWi	Federal Ministry for Economic Affairs and Energy [Bundesministerium für Wirtschaft und Energie]
CDU	Christian Democratic Union of Germany [Christlich Demokratische Union Deutschlands]
CDU/CSU	Parliamentary faction of the Christian Democratic Union of Germany [Christlich Demokratische Union Deutschlands] and the Christian Social Union in Bavaria [Christlich-Soziale Union in Bayern] in the German Bundestag
CTFR	Cohort Total Fertility Rate
DAAD	German Academic Exchange Service [Deutscher Akademischer Austauschdienst]
DeGEval	Evaluation Society [Gesellschaft für Evaluation]
DFG	German Research Foundation [Deutsche Forschungsgemeinschaft]
EIGE	European Institute for Gender Equality
EU-LFS	European Labour Market Survey
FTE	Full-time equivalent
GE	Gender equality
GFMK	Conference of Ministers for Gender Equality and Women's Affairs [Konferenz der Gleichstellungs- und Frauenministerinnen und -minister, -sena-torinnen und -senatoren der Länder]

GCI	Glass Ceiling Index
GOV	Government sector
GWK	Joint Science Conference [Gemeinsame Wissenschaftskonferenz]
HEI	Higher education institution
HES	Higher education sector
HRK	German Rector's Conference [Hochschulrektorenkonferenz]
ISCED	International Standard Classification of Education
KIA	Knowledge intensive activities
KIABI	Knowledge intensive activities – business activities
LOM	Performance-oriented resource allocation [Leistungsorientierte Mittelvergabe]
MSA	Mandatory school age
NACE	Statistical classification of economic activities in the European Community [Nomenclature statistique des activités économiques dans la Communauté européenne]
PPP	Purchasing power parity
PNP	Private non-profit sector
R&D	Research and Development
R&I	Research and Innovation
RFO	Research Funding Organisation
RPO	Research Performing Organisation
RTDI	Research, Technology, Development, Innovation
SPD	Social Democratic Party of Germany [Sozialdemokratische Partei Deutschlands]
TFR	Total Fertility Rate

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