Structural Reform in Germany, 2013-2017

Final Report

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Authors

Name (Institute)	Contribution
Marius Berger (ZEW)	Chapter 6.2
Irene Bertschek (ZEW)	Chapter 2.2
Wolfgang Briglauer (ZEW)	Chapter 2.3
Verena Dutt (ZEW)	Chapter 4.1
Birgit Gehrke (CWS)	Chapters 5.1, 5.2
Friedrich Heinemann (ZEW)	Quality Control
Reinhold Kesler (ZEW)	Chapter 5.1
Bastian Krieger (ZEW)	Chapter 2.1
Moritz Lubczyk (ZEW)	Chapter 4.2, 6.1, 6.2
Christian Rammer (ZEW)	Chapters 2.1, 4.2, Co-ordination
Markus Trunschke (ZEW)	Chapter 5.2
Simona Wagner (ZEW)	Chapter 6.1
Insa Weilage (CWS)	Chapters 3.1, 3.2, 3.3

CWS Centre for Economic Policy Studies, University Hanover, Germany

ZEW Centre for European Economic Research, Mannheim, Germany

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Contact: Tomas Brännström

E-mail: GROW-A2@ec.europa.eu

European Commission
B-1049 Brussels

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1. INTRODUCTION

This study discusses structural reforms in Germany in the period 2013 to 2017, including their origins, intended impact, and experiences made with the reforms to date, as well as remaining reform needs. Structural reforms include all government policies and initiatives that aim at creating the right conditions for economic actors to increase the level of productivity of an economy in order to pave the way for higher growth, higher competitiveness and higher income in the future. The structural reforms to be analysed include national reforms aiming at improving the functioning of markets and the conditions for doing business. Reforms the sole purpose of which is to implement EU legislation fall outside the scope of this study.

The study investigates five areas of structural reform in Germany:

- Policies and initiatives to strengthen private investment in **research, development and innovation** (R&D&I) as well as **digitalisation** efforts of businesses and the **digital infrastructure** - digitalisation represents one of the leading current technological and economic trends and is becoming an increasingly important determinant for productivity growth.
- Policies and initiatives to stimulate private investment in infrastructure, including **energy infrastructure** (e.g. new high-voltage grids), **road infrastructure** (including PPP models for financing motorways) and **railway infrastructure**.
- Policies and initiatives to improve the general business environment, particularly with respect to **taxation** and general **bureaucratic burden** of running a business.
- Policies and initiatives to promote **E-government** services and **innovative public procurement**.
- Policies and initiatives to support **entrepreneurship** and **innovative start-ups**.

The purpose of this study is to serve as a background document for the European Commission publications, notably in the context of the European Semester. For each sub-area of reform (i.e. the areas highlighted in bold), three topics are discussed:

- **Current challenges:** Based on statistics, reviews and reports, an overview is given of the main challenges in each sub-area. Special attention is paid to the identification of problems hindering the performance of the German economy and in particular to the role of private investment.
- **Reforms implemented during 2013-2017:** This part summarises main reform activities by the Federal government which have been implemented during the five years 2013 to 2017. This includes the analysis on a conceptual level of the ways and mechanisms through which the reforms tried to tackle the identified challenges. Based on existing data, indicators and studies, the experiences made with these reforms are summarised. Reforms implemented at the regional (i.e. by state governments) or local policy levels (i.e. by municipalities) are only captured if they represent significant activities for Germany as a whole or act as models for other regional or local policy making.
- **Need for further reforms:** Based on the experiences made with reforms and the existing challenges, priorities for future policy intervention are identified and discussed. This includes issues of timing, complementarities and modalities for the implementation of future reforms.

The reform period covered in the report, 2013 to 2017, mainly represents the 18th legislative period of the German Parliament (*Bundestag*), starting in October 2013 and ending in October 2017, and the activities of the third Merkel cabinet which started in December 2013 and remained in office until early 2018. As a consequence of this policy cycle, policy activity at the Federal level started in 2014 with a number of new initiatives and programmes and was somewhat confined in 2017 by the end of the legislation period since much policy attention from summer 2017 onwards was given to the general elections in September 2017 and the following coalition negotiations. Since no new government was formed in 2017, there were few new reform activities in the second half of 2017, although a number of measures initiated earlier the year came into force at the end of 2017 or at the beginning of 2018.

The report includes an **Appendix table** that contains a short description of main characteristics of relevant reform initiatives introduced during 2013 and 2017 for each area of reform covered.

2. INVESTMENT IN R&D&I AND DIGITALISATION

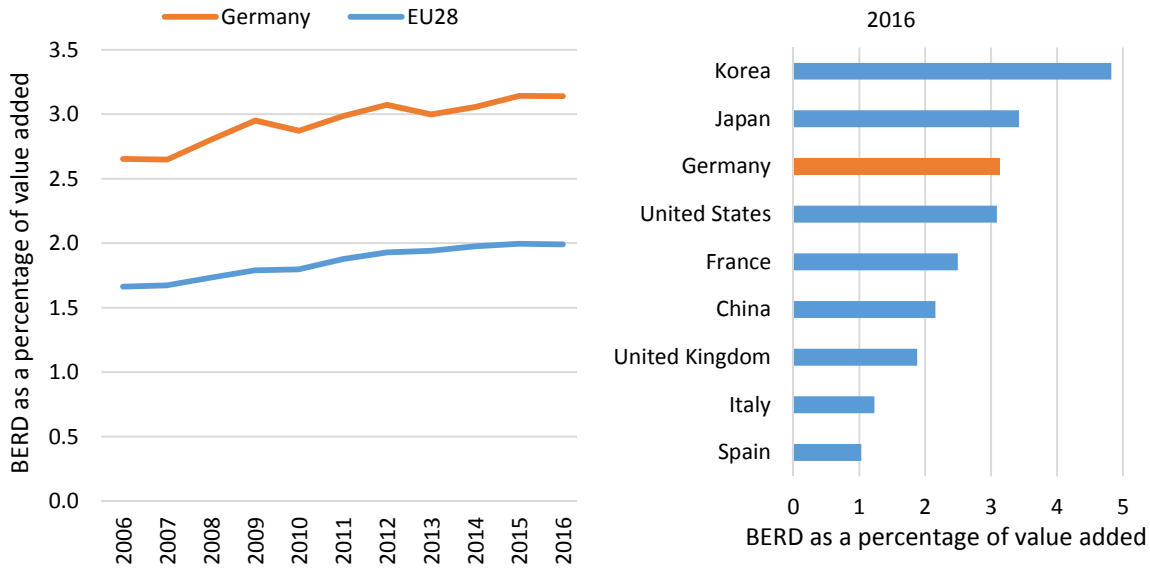
This area of reform covers private investment in two areas of particular importance for the German economy: research, experimental development and innovation (R&D&I) expenditures by firms, and business investment in digitalisation. In addition, the chapter discusses reforms and reform needs in the area of digital infrastructures as these infrastructures are most critical for digitalisation efforts of firms, and become even more important for business innovation.

2.1. R&D&I

2.1.1. Current Situation and Main Challenges

Private investment in R&D&I represents rather a strength of the German economy. The share of business enterprise R&D expenditure in total industry value added went up from 2.65% in 2006 to 3.14% in 2016 (Figure 1). The increase by 0.49 percentage points was higher than the one for EU28 (+0.33). From a global perspective, R&D expenditures of the German enterprise sector per value added are higher than in other large EU economies and slightly above the US value, but fall behind the levels of Japan and Korea.

Figure 1: Business R&D expenditure as a percentage of industry value added in Germany and the EU, 2006 to 2016, and in selected countries, 2016



Source: OECD MSTI 2017/2

A main concern of German innovation policy is the progressive divide between large corporations and SMEs when it comes to investment in R&D&I. Over the past decade, growth in R&D&I expenditure of the German business enterprise sector took place almost entirely in large enterprises, particularly in very large, globally active MNEs. The 12 largest R&D performers in the German business enterprise sector doubled their global R&D budgets between 2005 and 2016 from €28.2 billion to €56.6 billion (Table 1).[1] In 2016, 12 out of the 24 largest R&D performing MNEs in Europe were headquartered in Germany, including the top-3. Each of these global R&D players was at least among the global top-20 within their sector in terms of R&D expenditure, and four companies were in the group of the global top3- performers within their sector. Note that the top R&D performer headquartered in Germany - Volkswagen - spends more than twice the amount on R&D (2016: €13.7 billion) as the entire German SME sector (2015: €6.1 billion for internal and extramural R&D in firms with less than 250 employees). The total intra- and extramural R&D

[1] See the EU Industrial R&D Investment Scoreboard.

expenditure of firms in Germany with less than 1,000 employees (2015: €13.4 billion) equals the amount of Volkswagen's R&D expenditure.

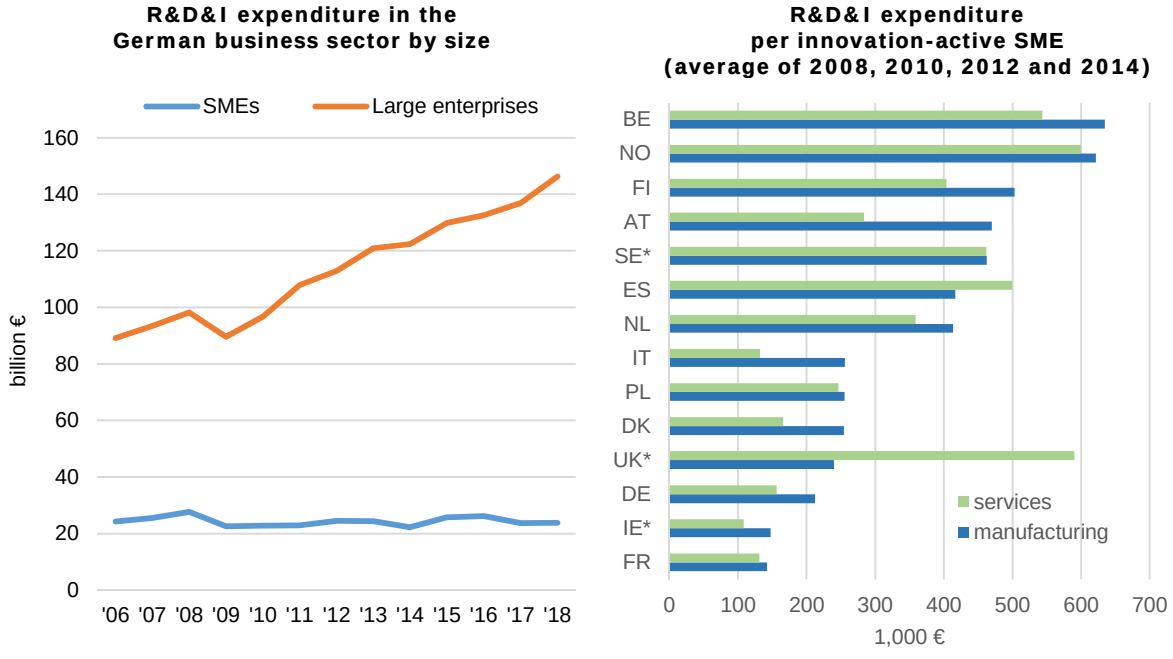
Table 1: Top-12 business R&D performers headquartered in Germany, 2016

Company	Sector	R&D in 2016 (bn€)	R&D in 2005 (bn€)	Global rank 2016	Rank in EU-28 2016	Rank in sector 2016
VOLKSWAGEN	Automobiles & Parts	13,672	4,075	1	1	1
DAIMLER	Automobiles & Parts	7,536	5,649	12	2	3
BOSCH	Automobiles & Parts	5,587	2,931	20	3	6
BMW	Automobiles & Parts	5,164	3,115	23	5	8
SIEMENS	Electronic & Electrical Equipm.	5,056	5,155	25	7	2
BAYER	Pharmaceuticals & Biotechn.	4,774	1,886	29	9	8
BOEHRINGER	Pharmaceuticals & Biotechn.	3,112	1,360	46	14	16
SAP	Software & Computer Serv.	3,037	1,089	47	15	6
CONTINENTAL	Automobiles & Parts	2,917	590	48	16	12
MERCK	Pharmaceuticals & Biotechn.	1,972	713	68	21	20
ZF	Automobiles & Parts	1,893	559	69	22	15
BASF	Chemicals	1,834	1,086	75	24	1

Source: Industrial R&D Scoreboard, ZEW calculation

The group of SMEs, in contrast, has not increased their expenditure over the past decade (Figure 2). As a consequence, R&D&I resources in the business sector have become more and more concentrated among the group of large enterprises (see Hünermund and Rammer 2017; Rammer and Schubert 2018). The gap between R&D&I expenditure of large enterprises and SMEs is widening more and more. This development has raised concerns among the government and expert groups (such as the Commission of Experts on Research and Innovation - EFI). A limited innovation capacity among SMEs may jeopardise their competitiveness and could result in lower productivity increase, taking into account that 55% of total employment in the German business sector is in SMEs.

Figure 2: Expenditure for R&D&I in SMEs. Germany 2006 to 2018, and expenditure per SME in selected EU countries, 2008 to 2014

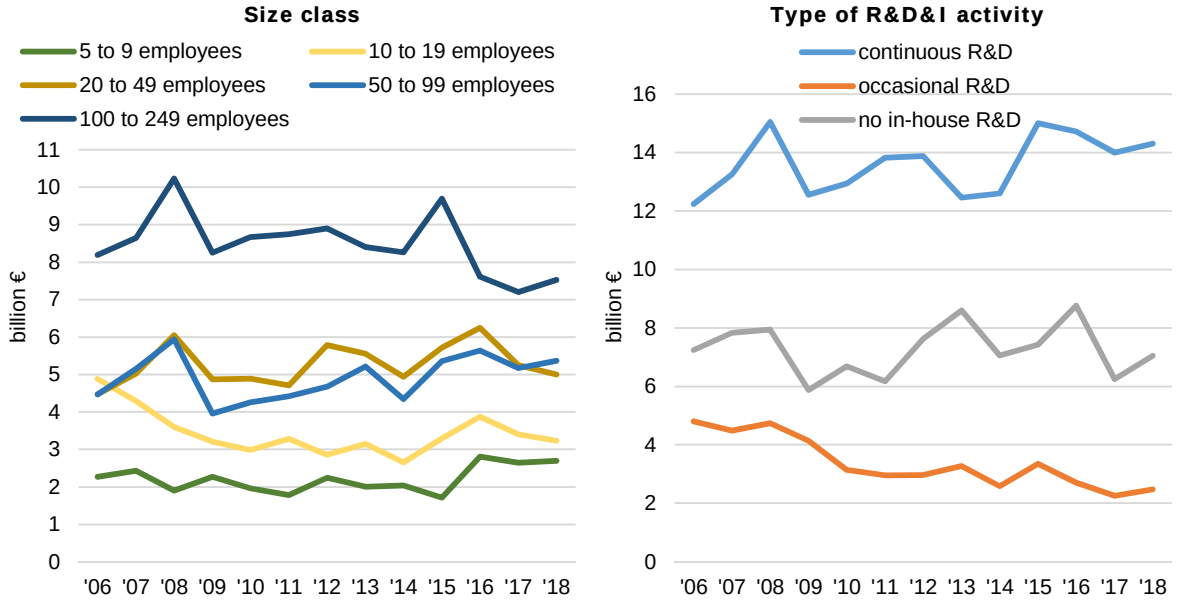


* IE and UK: 2012 and 2014, SE: 2008, 2010 and 2012.
**2017 and 2018 figures based on planned data.
Source: ZEW, German Innovation Survey; Eurostat, CIS

A distinct feature of innovation-active[2] SMEs in Germany is their low expenditure on R&D&I. Compared to other European countries, innovation-active SMEs spend very little on R&D&I. In manufacturing, a SME from Germany with expenditure in research, development or other innovation activities spends €212,000 per year (average of the years 2008, 2010, 2012 and 2014, see Figure 2). In services, this amount was even smaller (€156,000). Innovation-active SMEs in other European countries spend up to three times that number per year on R&D&I.

Over the past twelve years, R&D&I expenditure of SMEs in Germany has not shown a clear trend when broken down by size class (Figure 3). Differentiated by type of R&D&I activity, however, SMEs conducting in-house R&D only on an occasional basis report falling R&D&I expenditure from 2006 to 2018 (by about €2.5 billion) while for SMEs with continuous in-house R&D, R&D&I expenditure increased by about €2 billion. For innovation-active SMEs without in-house R&D activity, no clear trend emerges. The decline in R&D&I expenditure of SMEs with occasional R&D is mainly driven by a falling number of such SMEs. From 2006 to 2016, the number of SMEs with occasional R&D fell by 34% whereas the number of SMEs with continuous R&D grew by 12%. Part of this development may be linked to differencesw in the access to public funding of R&D&I (see below for more detail).

Figure 3: Expenditure for R&D&I in German SMEs by size class and type of R&D&I activity, 2006 to 2018

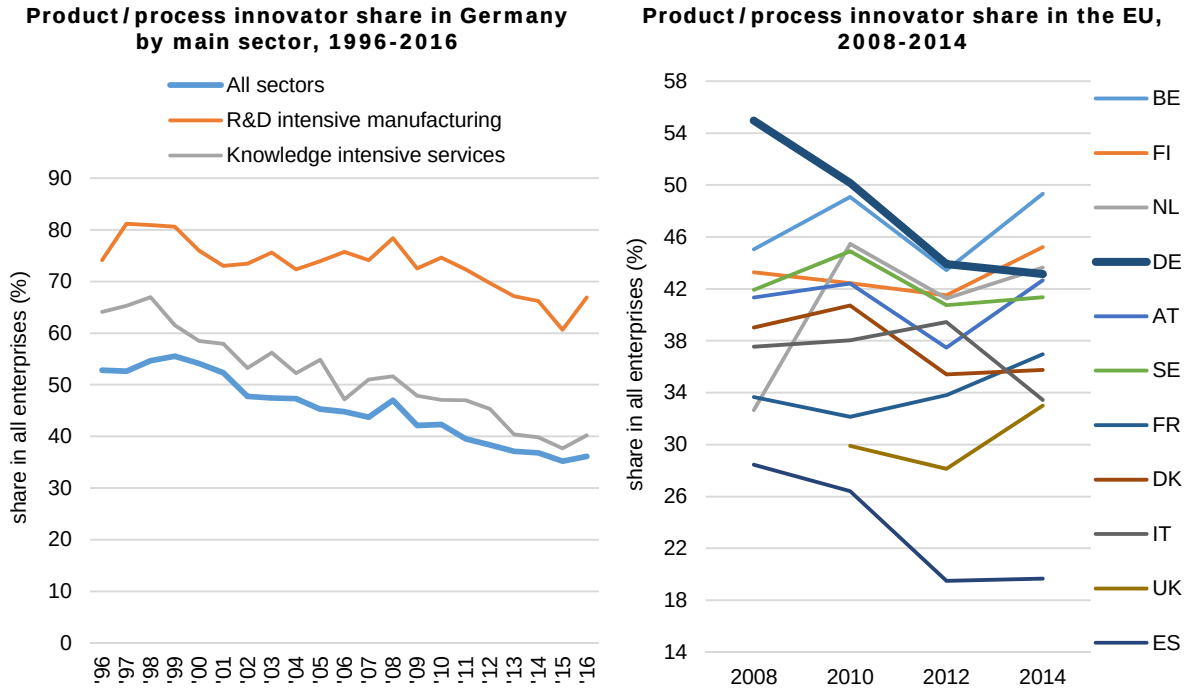


2017 and 2018 figures based on planned data.
Source: ZEW, German Innovation Survey

The reasons for the low R&D&I investment dynamics in the German SME sector are manifold (see Rammer et al. 2016). First, an **increasing share of SMEs refrains from any innovation activity**. The share of firms having introduced product or process innovation went down from 56% in 1999 to 36% in 2016 (Figure 4). The decline in innovation activity also applies to sectors where innovation is particularly important for competitiveness (the so-called R&D and knowledge intensive sectors). While Germany ranked first among a group of comparator countries in 2008, it fell behind Belgium, Finland and the Netherlands in 2014. No other country reported such a strong fall in the indicator value.

[2] In this section, innovation-active firms is equivalent to the term 'product and process innovation active firms' used by Eurostat in the context of European innovation statistics based on the CIS. Innovation-active firms include all firms with R&D activities or activities to develop or introduce product or process innovation, including ongoing and abandoned activities.

Figure 4: Share of firms with product / process innovation: Germany 1996 to 2016, and selected EU countries, 2008 to 2014



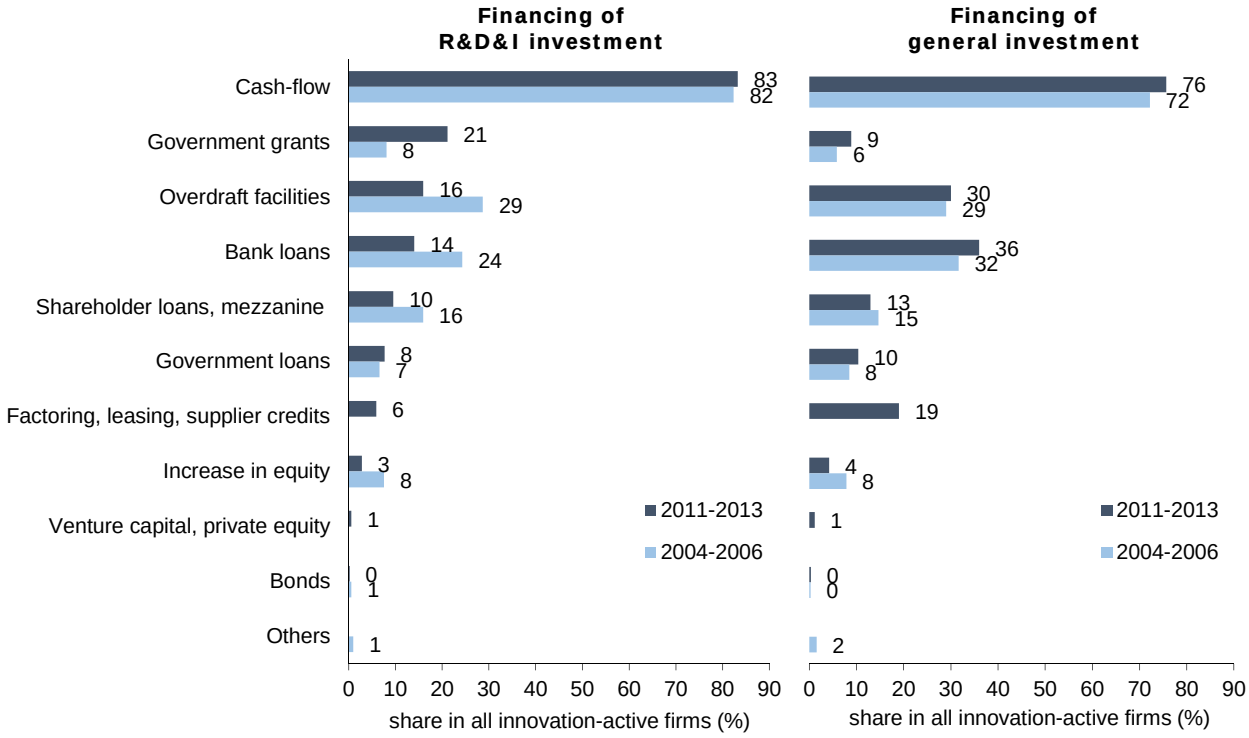
Note: Data on Germany for 1996-2016 (left-hand chart) refer to enterprises with 5+ employees and include firms from NACE sections M and N whereas data for EU member states (right-hand chart) refer to enterprises with 10+ employees and exclude firms from NACE sections M and N (except for division 71 to 73).
Source: ZEW, German Innovation Survey; Eurostat, CIS

A second potential reason for the low dynamics in R&D&I investment of SMEs is related to **financing of R&D&I**. More and more firms rely on own funds and government subsidies to finance their R&D&I activities whereas the use of bank loans for R&D&I is decreasing (see Behrens et al. 2017: 61ff). In the period 2004-2006, i.e. prior to the financial and economic crisis of 2008/09, 24% of innovation-active firms used bank loans for financing R&D&I investment (Figure 5). After the crisis (2011-2013), this share went down to only 14%. For general investment (e.g. replacement or expansion of capital stock), only a slight decline (from 36 to 32%) can be observed. A similar development can be seen for using overdraft facilities (which is a preferred short-term financing instrument for many SMEs, particularly family enterprises, see Peters and Westerheide 2011). The share of firms using this source of financing for R&D&I went down from 29 to 16%, while it remained stable as a source for financing general investment.

The shift away from bank financing of R&D&I seems to be a process driven by both sides and does not necessarily reflect a failure of financial markets in providing funds for innovation. While banks may try to avoid too high risks from lending money to innovative firms, innovative firms on the other hand may avoid loan financing because in case the innovation project fails, repaying the loan could jeopardise other business activities and potentially the entire firm. A result of the diminishing role of bank credit for R&D&I financing is that SMEs focus on a more limited set of financing sources, i.e. own funds and government subsidies.

Government grants seem to be a relevant substitute in this situation. The share of innovation-active firms that used public grants for financing R&D&I went up from 8% in 2004/06 to 21% in 2011/13. This increase was made possible through the expansion of Federal government R&D grant programmes for SMEs from 2008 onwards (Central Innovation Programme for SMEs - ZIM, 'SME innovative' initiative as part of BMBF's technology programmes). The share of firms using government loans did not change much before and after the crisis, reflecting that this instrument is not a priority of government funding for R&D&I. Venture capital is used by a very tiny share of merely 1% of firms.

Figure 5: Sources of financing for R&D&I and general investment in German firms, 2004/06 and 2011/13



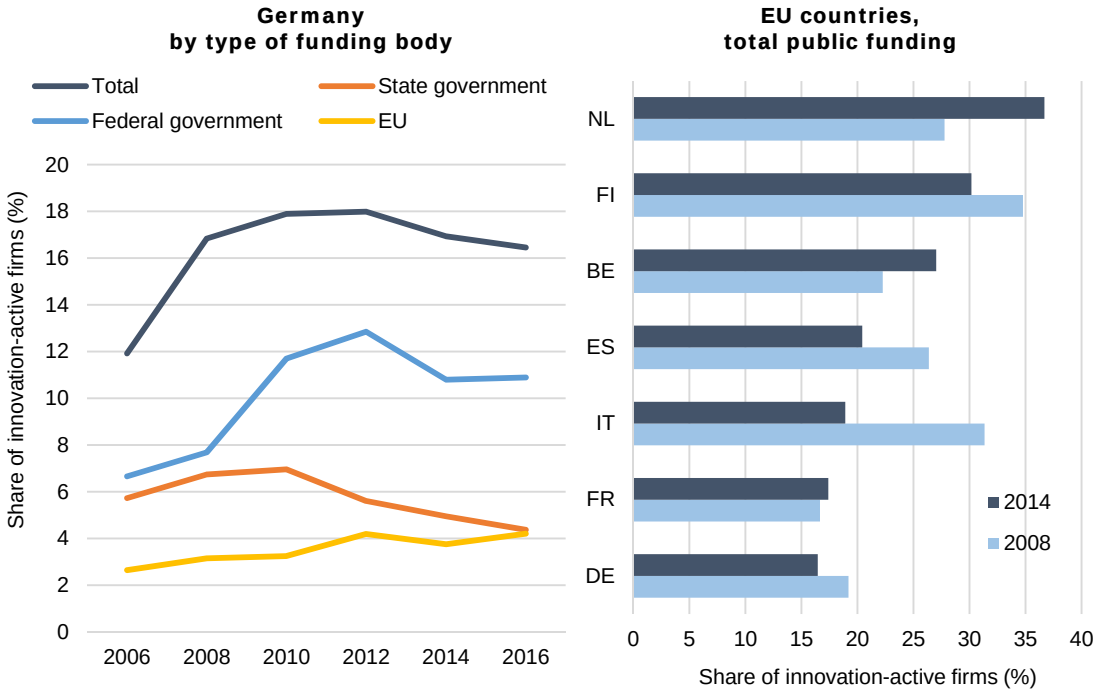
"Innovation-active": firms with R&D, product or process innovation activity.
Source: ZEW, German Innovation Survey

The share of innovation-active firms in Germany using government grants peaked around 2012 and has slightly decreased since then. Based on a more narrow definition of government support used in the CIS, 18% of innovation-active firms used financial means provided by the government for R&D&I in 2012, compared to 16% in 2016 (Figure 6, left graph). Federal government grants are the most widespread source for this type of funding (2016: 11%) whereas the share of innovation-active firms using grants from State ministries fell to about 4% in 2016. The share of EU funding is at about the same level.

Compared to other EU countries (Figure 6, right graph), the share of R&D&I active firms receiving financial support from government for R&D&I is rather low. In the Netherlands, 37% of all innovation-active firms received such funding in 2014. In Finland, this share amounted to 30% and in Belgium it was 27%.

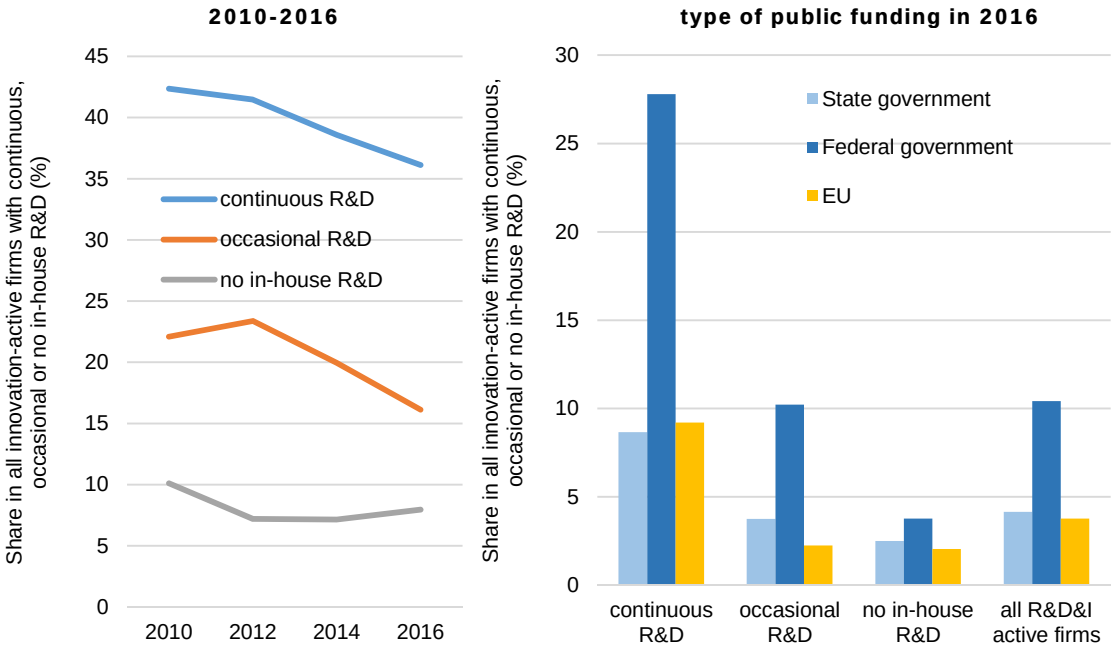
The decline in the share of R&D&I active SMEs receiving public funding after 2012 concerned both firms with continuous in-house R&D and SMEs that conducted R&D only occasionally. In 2012, 41% of SMEs with continuous R&D received public funding for R&D&I, compared to only 36% in 2016 (Figure 7). For SMEs with occasional R&D activity, this share went down from 23 to 16%. In absolute numbers, the decline was even stronger since the number of SMEs with occasional R&D dropped significantly during this period. Innovation-active SMEs without in-house R&D activity rarely receive public financial support for R&D&I in Germany (2016: 8%) since most R&D&I funding programmes require own R&D activity of beneficiaries. In addition, the much lower share of occasional R&D performers receiving public funding compared to SMEs with continuous R&D shows that R&D&I programmes primarily target the group of continuous R&D performers, i.e. firms with permanent R&D staff and dedicated R&D facilities.

Figure 6: Public funding of R&D&I, 2006 to 2016



"Innovation-active": firms with R&D, product or process innovation activity.
Data not fully comparable to data shown in Figure 5 due to deviations in definitions and questionnaire design.
Source: ZEW, German Innovation Survey; Eurostat, CIS

Figure 7: Public funding of R&D&I in German SMEs, 2010 to 2016, by type of R&D&I activity



"Innovation-active": firms with R&D, product or process innovation activity.
Source: ZEW, German Innovation Survey

A third reason for the stagnation of R&D&I investment of SMEs is related to the **dynamics of the groups of SMEs and large firms**. Some growing SMEs become large firms whereas some large firms shrink and become SMEs. The balanced effect of these dynamics on the amount of R&D&I expenditure in the SME sector is negative (see Table 2). During 2006 and 2016, the German SME

sector lost about €3.2 billion of R&D&I expenditure through these dynamics. Per year, this equals a loss of about 1.2% of R&D&I expenditure. The reason is that SMEs growing out of the SME sector (i.e. passing the 250 employee threshold) invest more in R&D&I than large firms that pass this threshold downwards do.

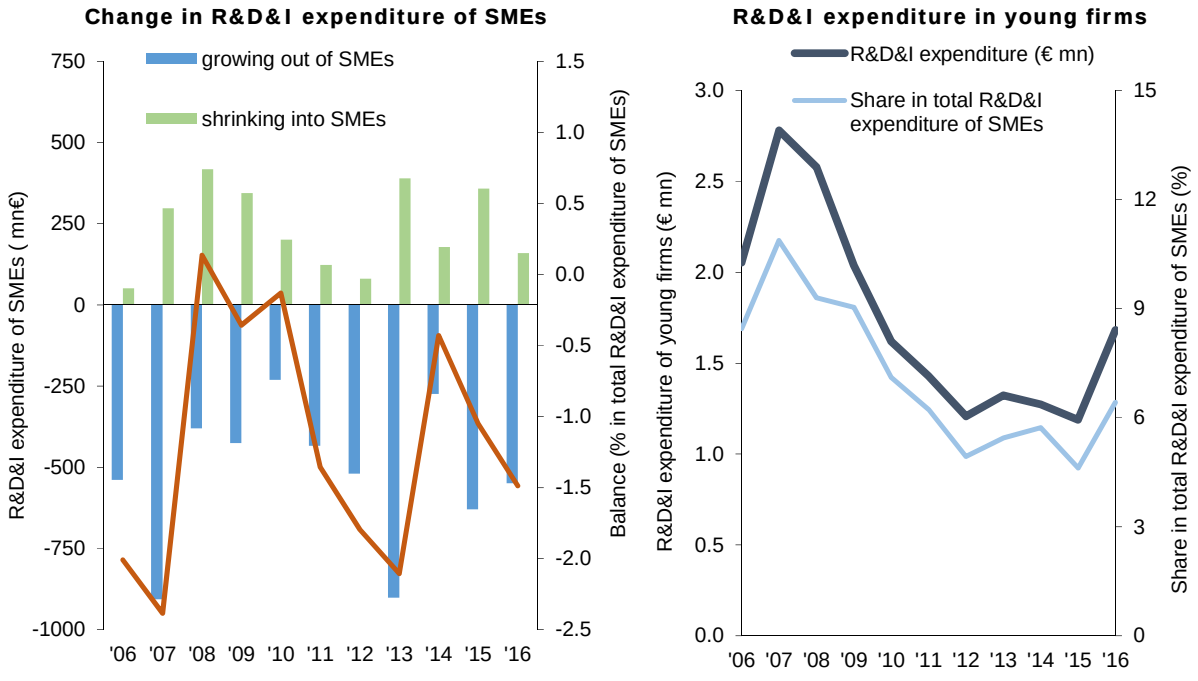
Table 2: Dynamics of R&D&I expenditure in the German SME sector due to change in the status of SMEs (annual average for 2006 to 2016)

	R&D&I expenditure (million €)	% of total R&D&I expenditure of SMEs
Loss due to closure of SMEs (5-249 employees)	-108	-0.4
Gain due to newly founded SMEs (5-249 employees)	137	0.6
Loss due to shrinking below the lower threshold (5 employees)	-150	-0.6
Gain due to growth beyond the lower threshold (5 employees)	169	0.7
Loss due to growth beyond the upper threshold (250 empl.)	-526	-2.2
Gain due to shrinking below the upper threshold (250 empl.)	236	1.0
Total	**-242**	**-0.9**
Balanced change in stable SMEs[1)]	*180*	*0.7*

1) SMEs that belong to the SME sector in two consecutive years.
Source: ZEW, German Innovation Survey

This loss is not compensated for by newly founded firms or micro firms that pass over the lower size threshold of the innovation survey (which is 5 employees in case of the German CIS) since the additional R&D&I expenditure contributed by these firms are balanced by a loss in R&D&I expenditure by SMEs that cease business or that shrink below the lower size threshold. The balanced effect on R&D&I expenditure of the firm dynamics in the SME sector in Germany is negative with an average annual loss in R&D&I expenditure of 0.9% (see Figure 8). This is higher than the average annual increase of R&D&I expenditure in firms that belong to the SME sector in two consecutive years. These 'stable SMEs' expanded their R&D&I expenditure by 0.7% per year.

Figure 8: Change in R&D&I expenditure of SMEs in Germany resulting from firm dynamics, and R&D&I expenditure of young firms, 2006 to 2016

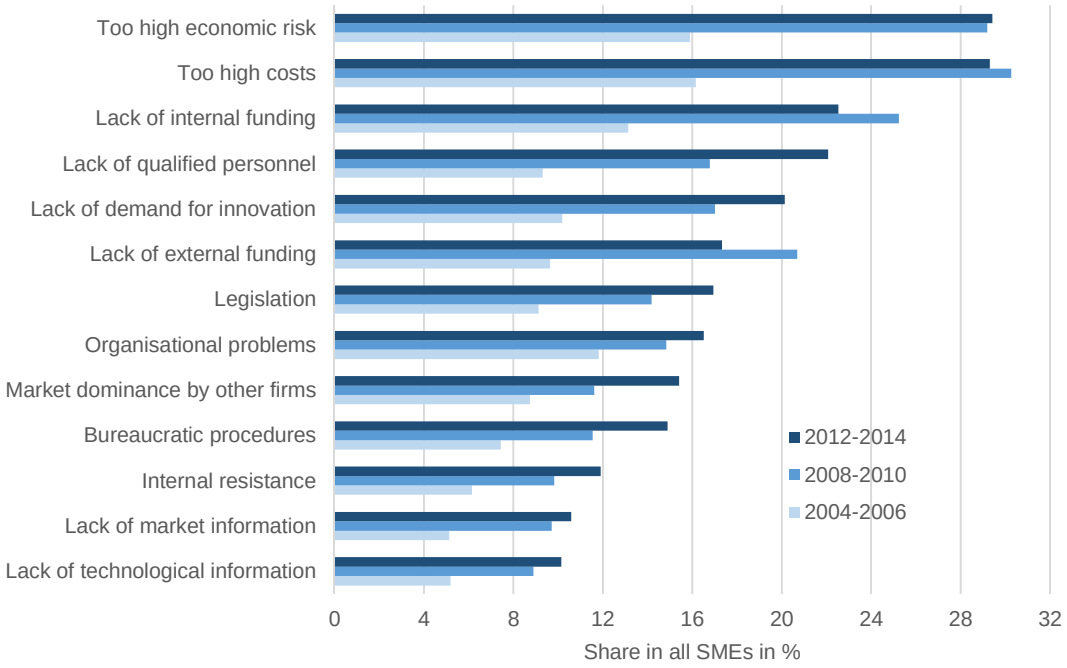


Young firms: up to five years of business operations.
Source: ZEW, German Innovation Survey

The negative balance of R&D&I expenditure due to firm dynamics in the SME sector is accompanied by low dynamics in new firm foundation (see section 6.1 of this report). As a consequence of the decreasing inflow of new firms, R&D&I expenditure of young firms (up to five years of business operation) has been falling for many years in Germany. In 2006 to 2008, young firms in Germany spent about €2.5 billion per year on R&D&I. This figure went down to about €1.25 billion per year in 2013 to 2015 (Figure 8). In 2016, R&D&I expenditure by young firms significantly increased to €1.5 billion.

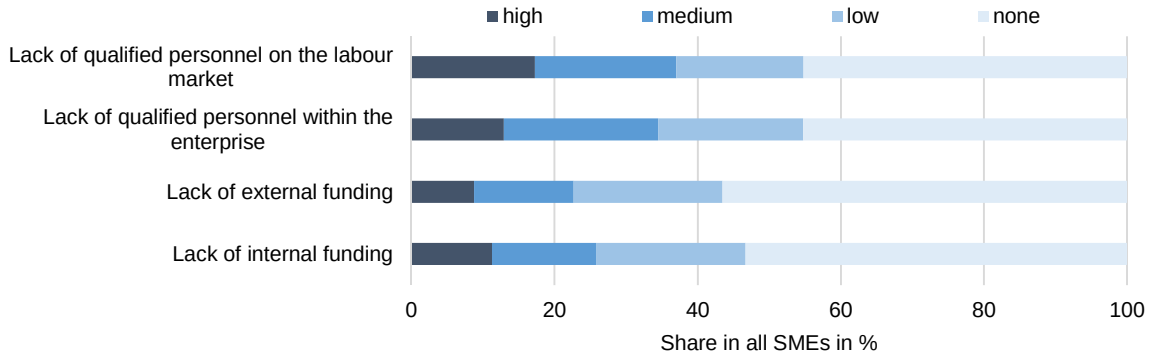
Finally, and perhaps most importantly, the **lack of qualified labour** is increasingly hampering innovation activities of SMEs. The share of SMEs reporting skill shortage as a hampering factor for innovation rose from 9% in the period 2004/06 to 22% in the period 2012/14 (Figure 9). Other constraining factors also increased in importance, though not at the same pace. In general, many more SMEs report barriers to innovation in the period after the financial and economic crises of 2007/08 than did before.

Figure 9: Hampering factors for innovation in German SMEs, 2006 to 2014



Hampering factors: factors that led to delaying, stopping or impeding R&D&I activities.
Source: ZEW, German Innovation Survey

Figure 10: Significance of hampering factors for innovation related to labour supply and funding in German SMEs, 2016



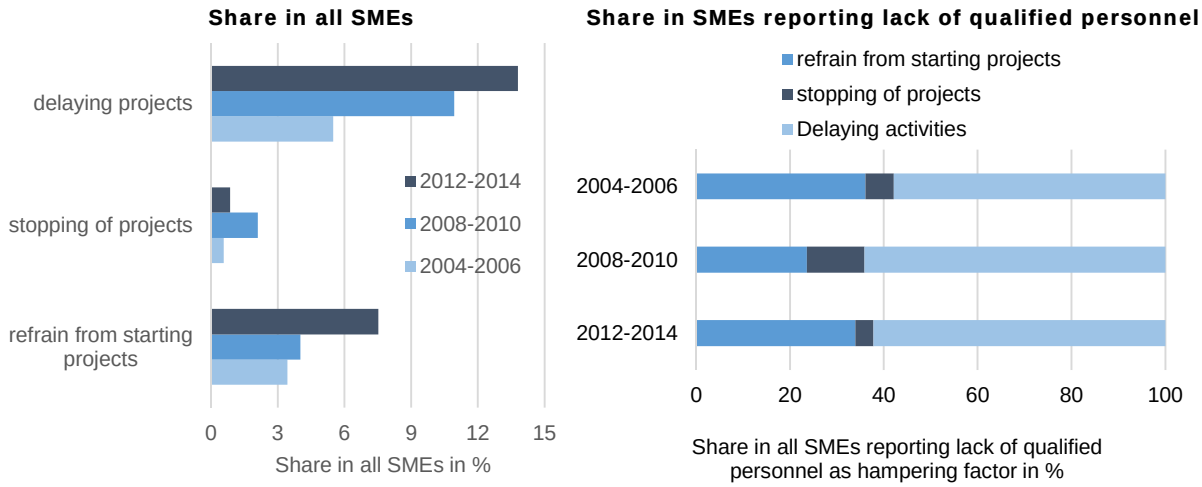
Source: ZEW, German Innovation Survey

Data from the most recent innovation survey (conducted in 2017) show that the lack of qualified personnel remained a more important impeding factor for innovation in 2016 as compared to lack

of funding (Figure 10). Skills shortage applies both to the supply of qualified personnel on the labour market and to the skill levels of existing personnel in SMEs. In 2016, more than 50% of German SMEs reported skill shortages as hampering factors for innovation to be at least of some importance.

Skill shortage affects SMEs' innovation activities primarily by delaying innovation projects. About 60% of SMEs that experience a lack of qualified personnel report that as a consequence, at least some innovation activities could not be completed according to the initial schedule. About a third of the SMEs report that they refrained from starting innovation projects while only a small share stopped innovation activities due to lack of qualified personnel. This share was high during 2008 and 2010 (12%) but went down to 4% in 2012 to 2014 (Figure 11). In 2012-2014, more than 7% of all SMEs in Germany refrained from starting innovation projects due to a lack of qualified personnel. This share went up by 4 percentage points since the pre-crisis period.

Figure 11: Impact of lack of qualified personnel on innovation activities of German SMEs, 2006 to 2014



Source: ZEW, German Innovation Survey

The skill shortage also affects productivity of SMEs negatively. Productivity models at the firm level based on German innovation survey data for the years 2000 to 2016 show a statistically weakly significant negative impact of a lack of qualified personnel on labour productivity. On average, SMEs experiencing a skill shortage lose 1.6% in labour productivity. The negative effect was strong in the period 2000-2008 (-2.9%) but insignificant in the period 2010-2016 (Table 3).

When differentiating the productivity effects of skill shortage in the 2010-2016 period by type of R&D&I activity (Table 4), we find a significant, strong negative impact for firms with process innovation that do not conduct R&D in-house (-9%). Their lack of in-house technological capabilities make them particularly dependent upon specialised external knowledge. In case they try to acquire this knowledge by employing skilled labour but fail due to skill shortage, they cannot fully exploit the productivity potentials of process innovation. Skill shortage does not exert a significant effect on labour productivity in firms with in-house R&D or in product innovators who do not conduct R&D in-house. There is also no significant effect for firms that neither perform R&D nor have introduced product or process innovations.

Table 3: Productivity effects of skill shortage in German SMEs, 2000 to 2016

Dependent variable: Sales per employee at FTE (log)	2000-2016	2000-2008	2010-2016
Lack of qualified personnel (d)	-0.016*	-0.029**	-0.011
	(0.009)	(0.014)	(0.011)
Capital intensity (log)	0.048***	0.049***	0.046***
	(0.003)	(0.004)	(0.004)
Material cost intensity (log)	0.311***	0.31***	0.312***
	(0.004)	(0.006)	(0.006)
Share of graduated employees (s)	0.248***	0.27***	0.22***
	(0.019)	(0.025)	(0.024)
Export share (s)	0.339***	0.335***	0.344***
	(0.022)	(0.028)	(0.029)
Employees (log)	0.026	0.034	0.019
	(0.004)	(0.005)	(0.005)
Located in East Germany (d)	-0.242***	-0.28***	-0.201***
	(0.009)	(0.011)	(0.011)
Constant	-1.044***	-1.063***	-0.87***
	(0.036)	(0.044)	(0.043)
# obs.	66,880	35,495	31,385
R^2	0.49	0.49	0.49

Estimated coefficients of pooled OLS models; standard errors clustered at firm level are shown in parentheses.
Time and industry dummies are included. ***: p < 0.01.
(d): dummy variable; (s): share; (log): logarithm.
Source: ZEW, German Innovation Survey

Table 4: Productivity effects of skill shortage in German SMEs, 2010 to 2016, by type of R&D&I activity

Dependent variable: Sales per employee at FTE (log)	Continuous R&D	Occasional R&D	No R&D, product innovation	No R&D, process innovation[1)]	No R&D, no innovation
Lack of qualified personnel (d)	0.03	0.00	-0.01	-0.09**	-0.02
	(0.02)	(0.03)	(0.03)	(0.04)	(0.02)
Capital intensity (log)	0.03***	0.04***	0.04***	0.03**	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material cost intensity (log)	0.31***	0.32***	0.31***	0.32***	0.30***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Share of graduated employees (s)	0.11**	0.20***	0.27***	0.32***	0.30***
	(0.04)	(0.05)	(0.06)	(0.09)	(0.04)
Export share (s)	0.21***	0.30***	0.42***	0.47***	0.47***
	(0.04)	(0.05)	(0.08)	(0.11)	(0.06)
Employees (log)	0.07***	0.04***	0.03**	0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Located in East Germany (d)	-0.22***	-0.23***	-0.17***	-0.16***	-0.20***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)
Constant	-0.77***	-0.58***	-0.81***	-0.82***	-0.77***
	(0.12)	(0.13)	(0.12)	(0.1)	(0.07)
# obs.	5,799	3,144	3,288	1,667	12,540
R^2	0.51	0.47	0.46	0.54	0.51

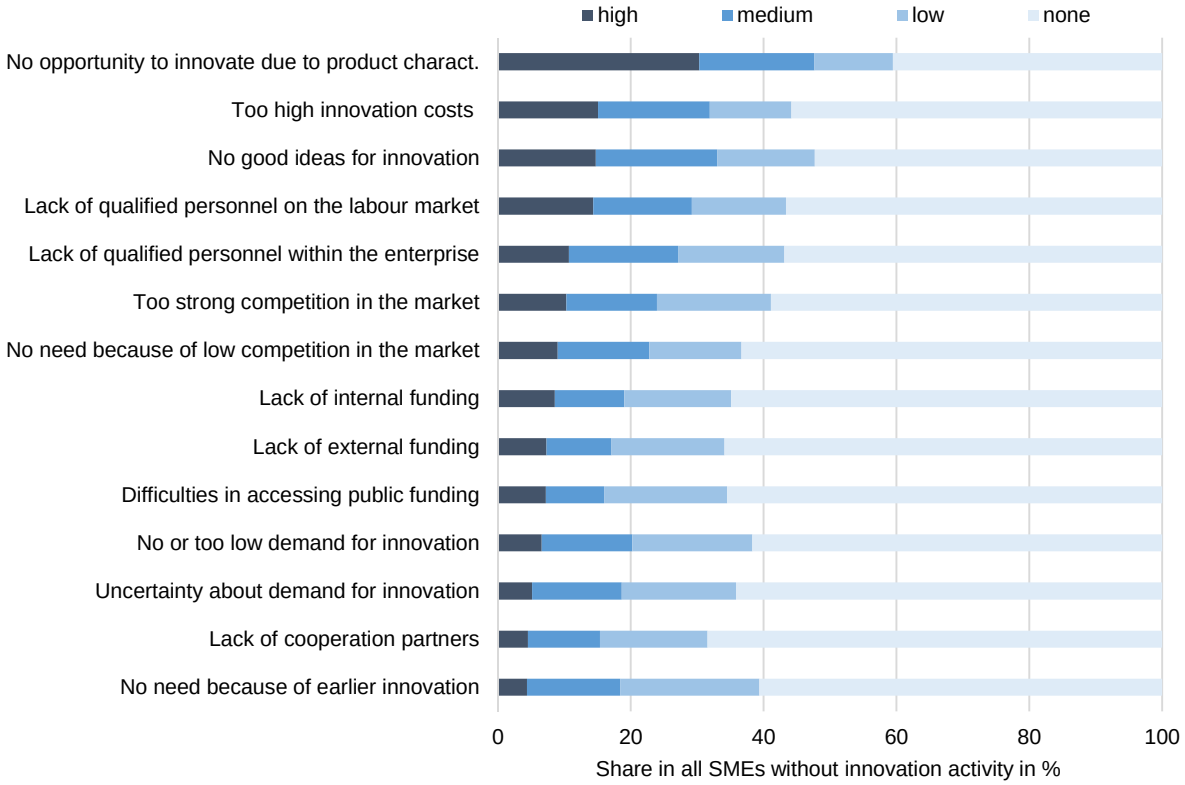
Estimated coefficients of pooled OLS models; standard errors clustered at firm level are shown in parentheses.
Time and industry dummies are included. ***: p < 0.01.
1) but no product innovation.
(d): dummy variable; (s): share; (log): logarithm.
Source: ZEW, German Innovation Survey

The available data does not allow to differentiate effects of skill shortage by the type of occupation that firms are looking for, by the composition of a firm's workforce, or by human resource management practices such as flexible working contracts. As a general observation, the current

situation in the German labour market is characterised by seller power, i.e. highly skilled workers usually can choose among many job offerings. Firms hence tend to offer more attractive working conditions (incl. permanent contracts) to hire highly qualified workers.

SMEs that did not conduct any R&D&I activity during 2014 and 2016 report a variety of reasons for refraining from innovation. The most important factor is the lack of opportunity to innovate due to product characteristics. SMEs in the utility sector and some service sectors report this factor most often (Figure 12). Too high innovation costs and no good ideas are the second and third most important reason for not innovating. Lack of qualified personnel is also a major factor for many not innovation active SMEs to refrain from entering into R&D&I activity. The least important reason for not innovating is no need because of earlier innovation. This result implies that the falling share of innovating SMEs cannot be attributed to prior innovations that would lift the SMEs from further innovation activity. In addition, lack of demand plays a minor role. It hence seems that supply-side factors such as labour market supply, access to financing and costs are the more important drivers for the low innovation incidence rate in the German SME sector.

Figure 12: Factors impeding innovation in non-innovation active SMEs in Germany, 2016



Source: ZEW, German Innovation Survey

2.1.2. Main Reforms 2013-2017

The German Federal Government took notice of the above described trends in SMEs' R&D&I activity very early, thanks to a continuous innovation monitoring system, including the annual reports by the Commission of Experts on Research and Innovation (EFI) and the annual German innovation survey which publishes new results timely. In order to stimulate R&D&I investment by SMEs, a first series of measures have been implemented during and after the financial and economic crisis by the Federal Ministry of Education and Research (specifically the new funding initiative *'KMU innovativ'* in 2007/08) and the extension of the R&D support programme ZIM (*'Zentrales Innovationsprogramm Mittelstand'*) in 2009/10. During the period 2013-2017, further measures have been taken:

- The new high-tech strategy adopted in September 2014
- Changes to the ZIM programme

- SME Action Plan of the BMBF
- Changes to loan-based the ERP Innovation Programme of the KfW
- Changes in the technology programmes (*'Fachprogramme'*) of the Federal government, including dedicated measures for SMEs (*'KMU innovativ'*) and for clusters and technology transfer (internationalisation initiative, 'VIP+')
- Merging measures for IP promotion into a new programme *Wipano*
- Extending the programme INNO-KOM to West Germany

The new **high-tech strategy** adopted in September 2014 continues the Federal Government's high-tech strategies of the periods 2006-2009 and 2010-2013. The high-tech strategy summarises the main goals and approaches of the Federal Government to strengthen innovation performance in Germany. It is a joint initiative of several Federal Ministries (with the BMBF taking the lead) and involves a large number of stakeholder groups. The high-tech strategy basically summarises ongoing policy activities and lays down new actions of the government during the election period. In the new strategy, more emphasis was laid on linking R&D, innovation and technology support to grand challenges and fostering cooperation between industry and science. Another priority of the high-tech strategy is to improve the framework conditions for innovation, including access to high-skilled labour.

The change to the **ZIM programme** in 2015 (new directive) directly addresses R&D&I investment of firms. In the new directive, support was extended to firms with 250 to 500 employees. These enterprises can receive subsidies of up to 25% of their eligible R&D costs for single R&D projects and up to 30% (35% in the new states in East Germany) for cooperative R&D projects. In addition, incentives for entering into international R&D cooperation have been increased by doubling the premium to the subsidy rate from 5% to 10%. Furthermore, the definition of eligible costs has been broadened. With January 1st, 2018, the promotion of cooperative networks within ZIM has been opened for international partners. The budget of ZIM increased from €510 million (2013) to €548 million (2017). Surveys of funded firms show that funded firms increase the number of employees (mainly R&D employees) by 1.1 as a result of receiving the subsidy. The share of funded firms that switch from occasional to continuous R&D activities increased by about 20 percentage points (Depner et al. 2017).

The BMBF published a new **SME Action Plan** (*'Vorfahrt für den Mittelstand. Das 10-Punkte-Programm des BMBF für mehr Innovation in KMU'*) in 2016 in order to strengthen innovation in SMEs. The main measure with respect to increasing SMEs' investment into R&D&I was the planned increase in BMBF's R&D grants to SMEs by 30% until 2017 (from about €250 million to about €320 million per year). To reach this goal, project calls within the thematic programmes (*'Fachprogramme'*) will be better aligned to the needs and potentials of SMEs (e.g. in R&D on new materials or photonics). Other measures relate to demonstration plants and model projects for industry 4.0, incentivising public research to engage more intensively with SMEs, establishing innovation fora for technology transfer to SMEs, involving SMEs in cluster and networks, promoting the Eurostars programme, organising recruitment support for STEM personnel, and a new module within the SME innovative initiative.

This **new module of the SME innovative initiative** (*'KMU-innovativ: Einstiegsmodul'*) aims at supporting SMEs in the pre-project stage of industrial R&D projects in order to transfer innovative ideas into projects that are ready to receive grant-funding by the BMBF's thematic programmes, particularly the main SME innovative scheme. SMEs may receive up to €50,000 for developing a R&D project and find appropriate partners. The measure should contribute to increase the range of SMEs that are able to submit high-quality R&D projects to the scheme and hence broaden the reach of the scheme.

A new measure within the thematic programmes aims at **internationalising leading-edge** clusters and networks (*'Spitzencluster'*) and large projects targeting upcoming societal challenges (*'Zukunftsprojekte'*). Internationalisation should contribute to link excellent research in Germany with partners abroad and help commercialise new technology from Germany globally. The measure provides funding of up to €4 million for a 5-year period to about 10 clusters/projects per year.

Another new measure within the thematic programmes is **VIP+** (*'Validierung des technologischen und gesellschaftlichen Innovationspotenzials wissenschaftlicher Forschung'*) introduced in 2015 and continuing an earlier similar measure. VIP+ provides support to universities and public research institutes for evaluating the innovation potential of new research results.

In 2017, the state-owned bank **KfW** changed its **loan-based financing of innovation** by setting up a new ERP Digitalisation and Innovation Loan ('*ERP-Digitalisierungs- und Innovationskredit*'). The policy aim of the programme is to increase the use of new digitalisation applications in SMEs and medium-large firms and to increase the share of innovating firms. The programme grants a 70% release from liability for loans used to finance digitalisation or innovation projects in firms with less than €500 million annual sales. Another new KfW programme, ERP-Mezzanine for Innovation, offers long-term oriented financing through loans and subordinate capital for close-to-market R&D.

Other reforms in the area of innovation policy include the merging of measures for IP promotion into a new programme ***Wipano*** and the regional extension of the ***INNO-KOM*** programme to all parts of Germany. Both measures are run by BMWi. Since both measures continue preceding programmes in a similar way and size, the impact on the initiation of additional R&D&I investment by firms is rather low, though both programmes are important elements of innovation support for the specific groups of beneficiaries addressed by the programmes.

2.1.3. Need for Further Reforms

The main policy concern in Germany in the field of R&D&I investment by firms is the low dynamics of R&D&I expenditure in SMEs, accompanied by a falling share of SMEs that engage in R&D&I activity. While the government took notice of this development and shared the concerns (see for example BMBF's Report on Research and Innovation as well as the SME Action Plan), little additional policy action to tackle this challenge has been undertaken in recent years. The policy changes described above were all rather minor in scope and focussed on improving existing measures and policy interventions. Policy continuity is certainly important in R&D&I policies as innovation actors often make decisions with a long-term scope, and a certain stability in the framework for R&D&I is needed as R&D&I often take place over a longer period of time.

In order to tackle the challenge of weak R&D&I investment in the SME sector, fresh policy approaches would be needed. Over the past four years, a main focus in the debate on an extension of the existing R&D&I policy portfolio at the Federal level was put on **R&D tax incentives**.[3] R&D tax incentives are expected to contribute to higher R&D&I investment by SMEs in the following ways:

- First, R&D tax incentives, if properly designed, reach out to all SMEs with R&D expenditure and provide financial support to all R&D performing SMEs. The current government support programmes for R&D fund less than 40% of all SMEs with continuous R&D activities, and much less of those conducting R&D only occasionally. An effective R&D tax incentive can hence stimulate additional R&D in a large number of SMEs not participating in the current R&D schemes.
- Secondly, R&D tax incentives can stimulate firms to engage more substantially in R&D. Particularly firms with occasional R&D activity may choose to 'upgrade' their R&D activity onto a continuous base. But also firms that stopped R&D activities recently but still have the technological and workforce capabilities required for R&D may re-enter into R&D activity if a financial stimulus is available. R&D tax incentives may also stimulate start-ups to focus on an R&D-based strategy and contribute to a larger number of R&D performing young firms.
- Thirdly, R&D tax incentives may shift some R&D activities in SMEs with R&D activity abroad towards Germany. In 2010, there were about 3,500 SMEs from Germany conducting R&D activities in subsidiaries abroad, primarily in other European countries.[4] As most of these countries offer R&D tax incentives, conducting R&D in Germany may have been subject to higher user cost than the same R&D conducted abroad (depending on the cost structure of R&D inputs).

[3] See for example the statement of the '*Bündnis Zukunft der Industrie*' (Alliance Future of Industry) from September 2016 on the need for an R&D tax incentive to tackle weaknesses in SMEs innovative potential (www.bmwi.de/Redaktion/DE/Pressemitteilungen/2016/20160919-buendnis-zukunft-der-industrie-steuerliche-foerderung-von-kleinen-und-mittleren-unternehmen.html)

[4] Results from the German Innovation Survey 2011, see Aschhoff et al. 2013, chapter10.

Germany had an R&D tax allowance scheme until the 1980s which was abolished with the German reunification. Since then, policy debates on re-introducing this type of instrument came up from time to time. During 2013 and 2017, stakeholder groups (such as BDI, VCI), expert groups (such as the EFI), government initiatives (such as the Alliance for the Future of Industry) and political parties campaigned in favour of an R&D tax incentive. In March 2016, the party *Bündnis 90/Die Grünen* introduced a motion to the German Federal Parliament for implementing an R&D tax credit for SMEs.[5] In June 2016, the Federal Council ('*Bundesrat*') demanded the introduction of an R&D tax incentive based on an initiative of the four largest Federal States (North-Rhine Westfalia, Bavaria, Baden-Wuerttemberg, Lower Saxony). At the ministerial level, BMBF and BMWi discussed various options of how R&D tax incentives in favour of SMEs could be designed. In addition, researchers have put forward concepts for R&D tax incentives (e.g. Spengel and Wiegard 2011) though the German Council of Economic Experts expressed a sceptical view on R&D tax incentives which could go along with new tax avoidance strategies and which bear the risk of supporting innovative activities that would be carried out anyway (see SVR 2017, 26). Assessing the exact impact of an R&D tax incentive on innovation, investment and tax revenue is not an easy task because this may depend not only on the type of the incentive, but also on its specific design, the interplay with the corporate income tax system and the company's profitability relative to the level of R&D expenditures (see Elschner and Ernst 2008).

While none of these initiatives resulted in the actual introduction of such an instrument, the coalition agreement of the new Federal Government signed in February 2018 contains the announcement to introduce an R&D tax incentive that focuses on SMEs and targets both in-house and extramural R&D expenditure. No further details have been made public since then.

In order to significantly increase R&D&I investment by SMEs, an SME-oriented R&D tax incentive should consider the following design features (see Spengel et al. 2017a, EFI 2017 and the proposals made by the *'Bündnis Zukunft der Industrie*' and the Federal Council in 2016):

- **Focus on SMEs**: SMEs should be the main target group as they most urgently need additional support for strengthening R&D&I investment. At the same time, international evidence shows that additionality of R&D tax incentive is higher with SMEs. In addition, government costs of the measure can be substantially confined by excluding large enterprises. The SME threshold does not necessarily have to rely on the EU definition but may include medium-sized firms up to 1,000 employees (see Peters et al. 2018). A too low threshold risks to exclude a crucial group of firms which represent a higher R&D&I potential than the entire SME sector (based on the 250 employee threshold). For large corporations, an incremental tax incentive or a lower tax rate combined with a ceiling seems to be more cost-effective.
- **Sufficiently high tax rate**: In order to stimulate SMEs to conduct more R&D&I, the tax rate needs to be high enough to provide the majority of R&D performing SMEs with financial sources that allow for additional R&D&I projects. Based on data on typical R&D project size and average R&D expenditure of SMEs, a tax rate of 15 to 20% seems to be reasonable.
- **Eligible costs and tax base**: While most countries apply R&D tax incentives on corporate taxation, the recent discussion in Germany focusses on relating R&D tax incentives to wage taxes for R&D workers.[6] As wage taxes have to be paid monthly, SMEs would experience a cash effect of the tax incentive much sooner than in case of corporate taxes. In addition, there may be a positive effect on demand for R&D workers. This model would also avoid carry forward and carry backward rules as well as cash payment in case the tax credit is higher than the taxes payable. It is also believed that it is less subject to possible misclaims. EFI (2017) also proposed an alternative model based on corporate taxation similar to the one proposed by *Bündnis 90/Die Grünen*. The advantage of this model is to include extramural R&D costs, though a regulation is required to avoid double-funding of extramural R&D.
- **Balance with grant-based funding**: An R&D tax incentive should be designed as an additional funding instrument that complements existing grant funding, e.g. through the ZIM programme or the technology programmes. The main goal of an R&D tax incentive is

[5] See http://dipbt.bundestag.de/dip21/btd/18/078/1807872.pdf

[6] See for example the proposal by *'Bündnis Zukunft der Industrie*'.

to increase R&D expenditure in all SMEs so that R&D performing firms can better leverage their technological capabilities.

Model simulations (see Spengel et al. 2017a) suggest that an R&D tax incentive will provide rather limited incentives for non-R&D performers to enter into R&D because of high fix cost of R&D. In order to stimulate SMEs to (re-)enter into R&D&I activities, other policy measures will be needed. These may include loan programmes for R&D&I activities with a larger capital expenditure share (including expenditure for intangibles) with a broader scope in terms of the number of SMEs to be reached as is currently the case with federal (ERP loan programmes) or state programmes (run by government-owned state banks). KfW has currently been moving towards this direction with its new ERP Digitalisation and Innovation Loan, though the enlargement focus seems to be more on addressing large firms than increasing the number of loans to SMEs.

While R&D tax incentives have proofed to be an effective instrument for increasing R&D expenditure (see Laredo et al. 2016; Gaillard-Ladinska et al. 2015; Castellaci and Lie 2015), this measure is unlikely to be sufficient for significantly and sustainably increasing R&D&I expenditure of SMEs. In addition to financial incentives, tackling the **skill shortage** will be of similar or even greater importance. In the coalition agreement, planned measures in this respect include training for unemployed and low-skilled workers, increasing the labour participation rate of women. While all these measures are useful in their own right, they are unlikely to fully address the expected increase in the lack of qualified labour which results from demographic change, sectoral change towards human capital intensive activities, and macroeconomic growth. In the short run, only increased immigration of skilled workers may provide the supply of human capital needed. A new law on immigration of skilled workers is planned in this context, though no details on this law have yet been decided. The Coalition Agreement states that demand, skill levels and an employment contract will be key features for regulating immigration of workers. For realising a strong immigration of high-skilled people, significant changes in a number of areas would be needed, including the use of English in all areas related to the immigrants work and life, affordable housing, reforms in the education system with a view on migrants, and tax incentives for immigrants.

Further issues that are often mentioned by stakeholders for increasing private R&D&I investment in Germany include

- the simplification (speeding up, more flexibility) of R&D funding procedures and administrative requirements;
- attracting more venture capital supply for high-tech start-ups;
- further improving knowledge transfer with public research and universities;
- providing more effective funding for break-through innovations and a social and political environment that is conducive to radical innovations.

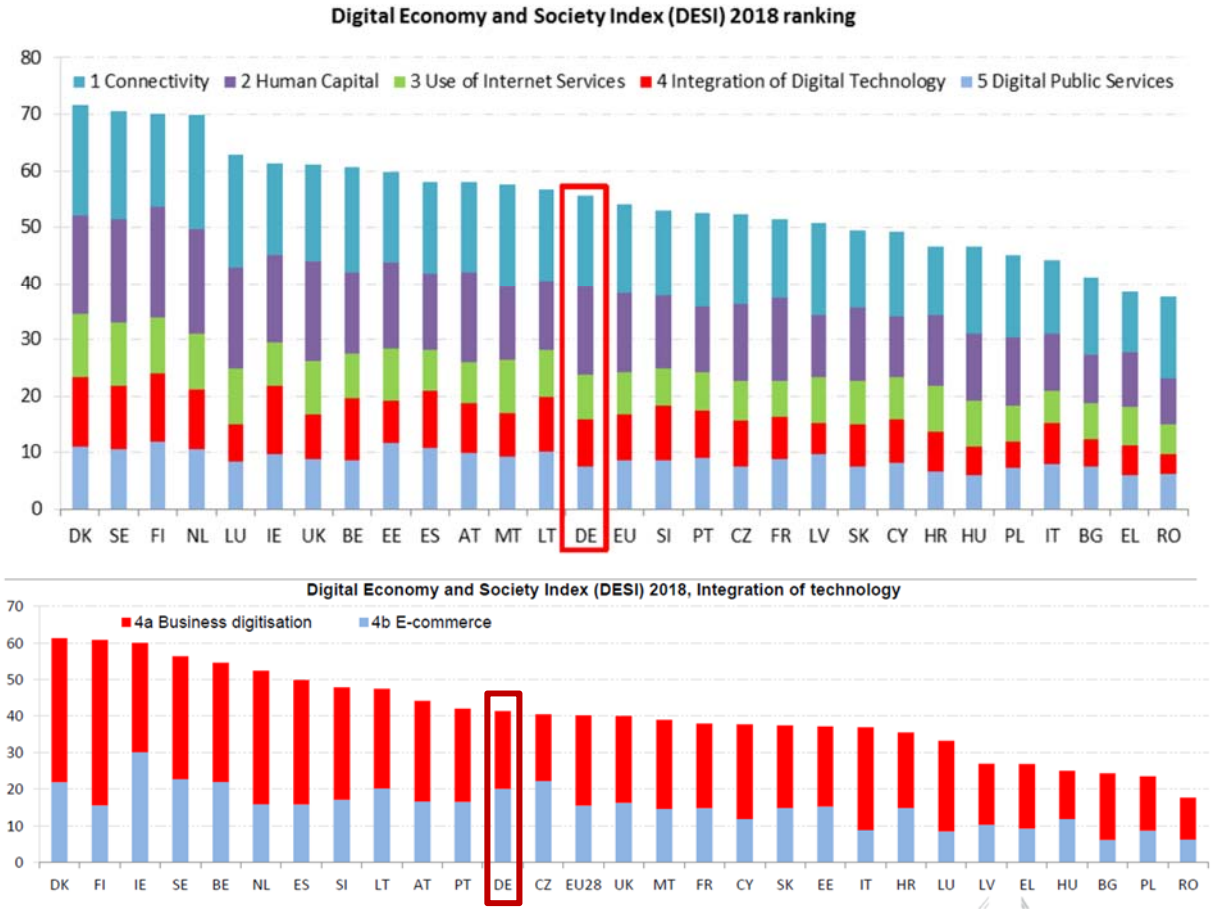
In addition, a large number of proposals for policy improvement related to private R&D&I investment refer to the area of **digitalisation** which is dealt with in detail in the following section.

2.2. Digitalisation

2.2.1. Current Situation and Main Challenges

According to the Digital Economy and Society Index (DESI) provided by the European Commission, in 2018, Germany ranks 14th in total (Figure 13) and 12th with respect to the dimension 'integration of digital technology' which refers to the digitalisation of the business sector (Figure 13, lower part). Germany performs well with respect to SMEs' online selling activities but less good with respect to the use of digital technologies (see DESI Country Report 2018).

Figure 13: Digital Economy and Society Index (DESI) 2018: total index, and sub-index 'integration of technology'

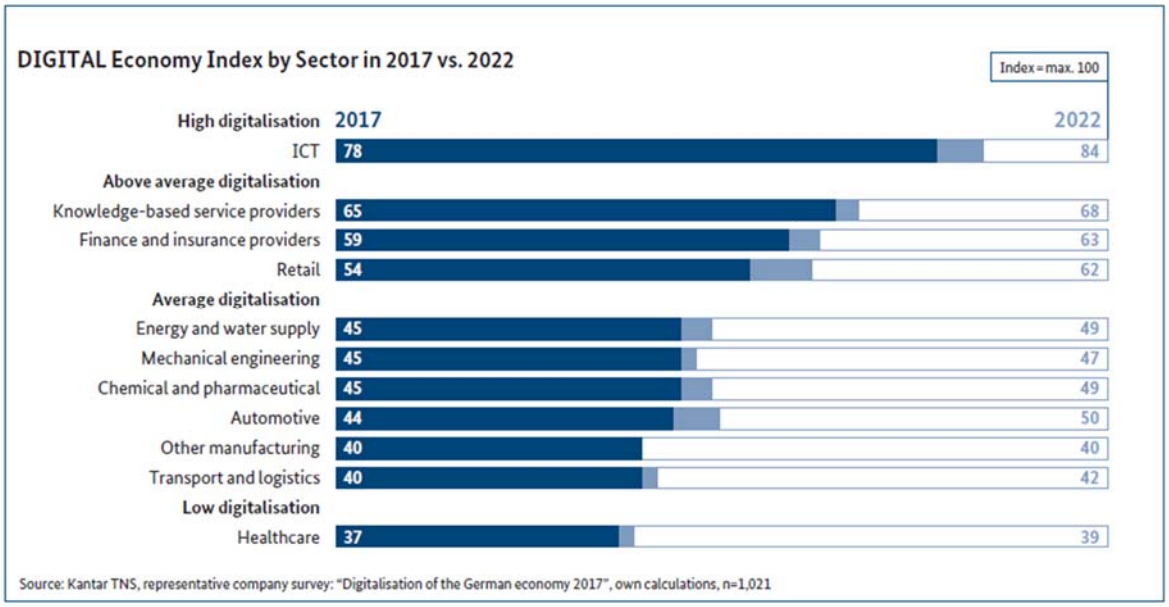


Source: European Commission (2018b), Digital Scoreboard, 2018.

As shown by the Digital Economy Index 2017[7], which is based on a survey among German manufacturing and services firms (see Graumann et al. 2017a), industries within Germany differ a lot in terms of the degree of digitalisation and the expected speed of digitalisation. The ICT sector is the most digitised sector, followed by knowledge-based service providers, finance and insurance and retail (Figure 14). Manufacturing industries reach an average level of digitalisation, the healthcare sector is the least digitised industry in this comparison. According to the Monitoring-Report 2018, the degree of digitalisation remains stable at the average. While services sectors reach a level of saturation, manufacturing sectors are now catching up (Weber et al. 2018, 6).

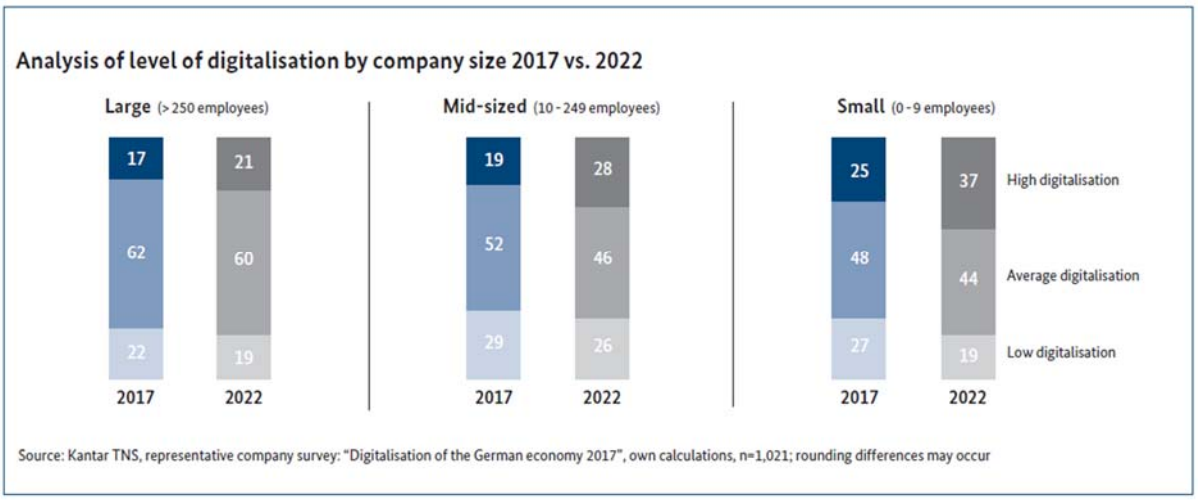
[7] The Digital Economy Index comprises 13 indicators referring to (i) business success on digital markets, (ii) restructuring of processes and organisation, (iii) intensity of the use of digital technologies and services (see Graumann et al. 2017a, 9).

Figure 14: Digital Economy Index for Germany by sector, 2017 and 2022



Source: Graumann et al. (2017b)

Figure 15: Digitalisation in firms in Germany by company size, 2017 and 2022



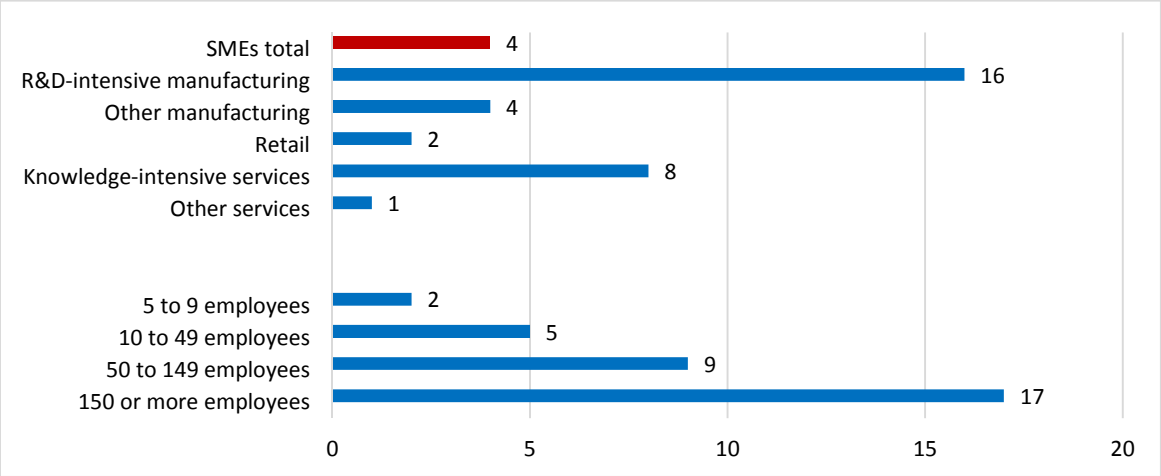
Source: Graumann et al. (2017b)

The degree of digitalisation also differs across firm size classes (Figure 15). In 2017, medium-sized companies (10 to 249 employees) reach a lower degree of digitalisation (Digital Economy Index: 52) than small firms (0-9 employees) and large companies (250 and more employees), reaching an index of 54, respectively. The relatively high degree of digitalisation of small companies is due to the fact that these firms quickly reach high intensities with respect to the use of digital technologies and services, i.e. in small firms it is much more often the case that all employees use a specific technology such as mobile devices or specific services than in larger firms. On average, 25% of small firms have a high degree of digitalisation, but only 19% of medium-sized firms and 17% of large firms. However, the share of firms with an average level of digitalisation is higher in large firms (62%) than in medium-sized (52%) and small firms (48%). This pattern is expected to be maintained within the next five years. One interesting issue is that in the group of large firms, a much higher share (45%) has digitalisation very strongly embedded into the overall strategy of the firm, whereas this is the case only in 30% of both the medium-sized and the small firms.

The term 'industry 4.0' was framed in Germany, and Germany puts a lot of effort in combining information and communication technologies with the traditionally strong industries of machinery

and automobiles. German manufacturing is leading in the development of new applications for industry 4.0. However, SMEs have not only shown a low dynamic in R&D&I investment over the past one and a half decades. SMEs are also lagging behind when it comes to adopting new digitalisation concepts and industry 4.0. (see Saam et al. 2016, 23, and Figure 16)

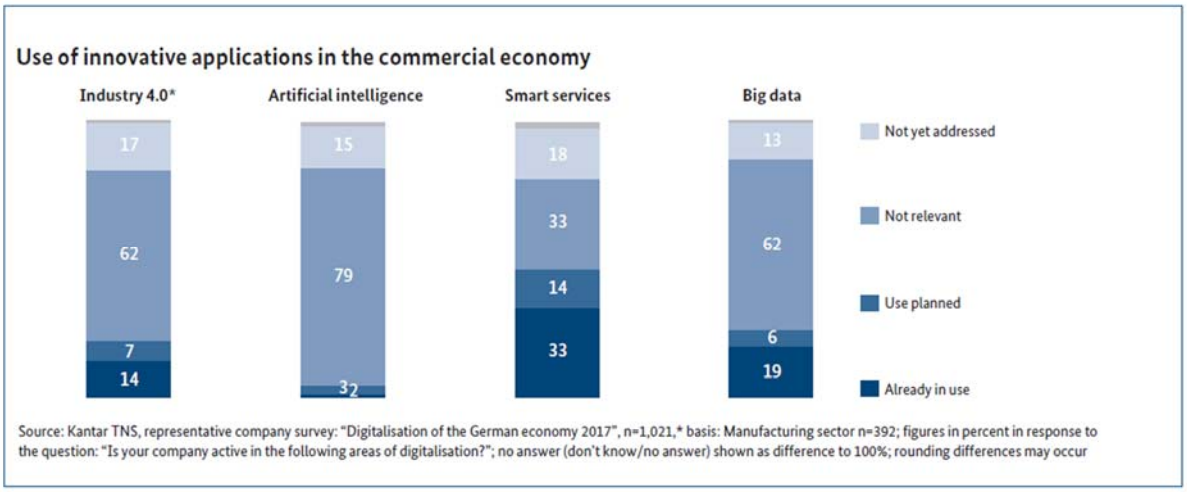
Figure 16: Share of firms in Germany with on-going and planned Industry 4.0 projects, 2015 (percentage)



Source: Saam et al. (2016, 23), ZEW ICT survey 2015 and 2015/2016.

Some new digitalisation concepts such as big data and artificial intelligence are still at the beginning of their diffusion process. A breakdown with respect to size classes shows that SMEs have lower user rates than large firms and high shares of firms say that these concepts even are not relevant for them (Figure 17). One exception are smart services for which medium-sized firms have higher user rates than small and large firms (see Graumann et al. 2017b, 60).

Figure 17: Share of firms in Germany using innovative applications, 2017 (percentage)

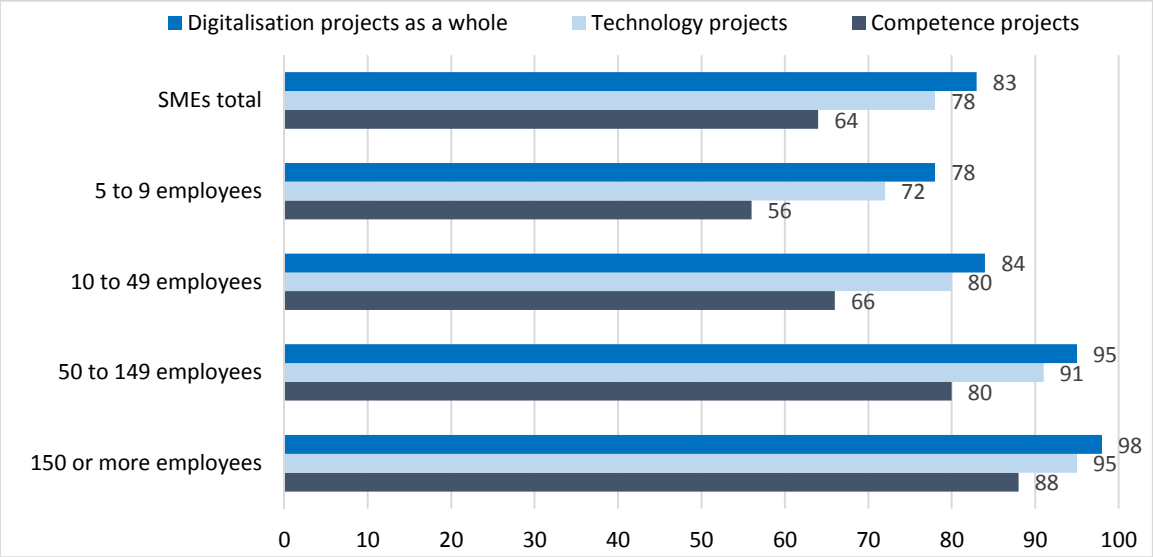


Source: Graumann et al. (2017b)

One fourth of the firms think that digitalisation is less important or not at all important for them (Graumann et al. 2017b, 30), one third of the firms do not see the need for digitalisation (Graumann et al. 2017b, 25). These shares decrease with firm size and with the existing degree of digitalisation. Almost every second firm considers that digitalisation projects demand a lot of time and organisational effort and 37% of the firms think that the costs related with digitalisation are too high (Graumann et al. 2017b, 76). By costs they do not necessarily mean financial costs but also costs w.r.t. adapting organisational structures, investing in knowledge and training measures etc. Digitalisation projects are mostly technological projects, in the period 2013 to 2015, 83% of

the firms of the German *Mittelstand* invested in technological projects whereas only 64% invested in projects that improve competencies related to digitalisation (Figure 18, Saam et al. 2016, 30). The gap between smaller and larger firms is larger w.r.t. projects improving competencies (78% of firms with 5 to 9 employees versus 98% of firms with at least 150 employees) than for technological projects (56 versus 88% of firms). A recent survey of medium-sized companies by KfW supports this result (Zimmermann 2018, 3).

Figure 18: Share of Firms with Digitalisation Projects, 2013 to 2015 (percentage)



Source: Saam et al. (2016, 30); ZEW ICT survey 2015 and 2015/2016.

As qualitative interviews about the implementation of Industry 4.0 projects show, firms often see digitalisation projects as innovation projects, and sometimes 'other' innovation projects have higher priority than digitalisation projects (Saam et al. 2016, 60-62). This might specifically be true for firms' chief executive directors who are basically interested in digitalisation as means for saving cost or improving product quality. Most of the 17 interviewed persons consider the digital transformation to be an evolutionary process. The recent KfW-survey shows that firms in the R&D-intensive manufacturing and knowledge-intensive sectors have completed more digitalisation projects during the period 2014 to 2016 than other sectors and considerably more than the construction sector.

As impediments to successful digitalisation, German SMEs mention the lack of digital skills of their employees, uncertainties about data security and data protection as well as high cost of investment and maintenance. Moreover, the lack of fast broadband internet is considered a strong impediment by many SMEs (see Saam et al. 2016; Graumann et al. 2017b). This is also shown by the recent Monitoring-Report 2018 (Weber et al. 2018), see Table 5. In particular, the German *Mittelstand* considers the lack of fast broadband an impediment to successful digitalisation. Almost every second medium-sized German company rather or totally agrees that the lack of powerful broadband internet is an impediment for them to successful digitalisation. By contrast, the lack of employees' digital know-how, the lack of IT specialists and the lack of reliable standards are impediments whose importance increases with firm size. The same holds for data protection rules that are considered to be too strict rather for larger than for smaller firms. Larger firms are less prone to insufficient IT security than SMEs.

According to a study by EY and Bitkom Research (2017, 28), in the sectors for automobiles, electrical engineering and machinery, the three most important impediments to introducing industry 4.0 solutions in firms with 100 up to 499 employees are: too much investment needed (59% of the firms), skill shortage (57%), and security concerns (49%). A report by the German Chamber of Commerce and Industry revealed that by November 2017, the vast majority of firms ranked investment in fast broadband internet as the top priority for the new government in the field of digitalisation. Other areas of action demanded by industry include legal security for using data and ensuring that all workers are equipped with basic digital skills (DIHK 2017).

Table 5: Impediments to successful digitalisation, 2018

Percentage of firms that totally or rather agree that the factor impeded successful digitalisation	all firms	micro firms (0 to 9 employees)	small or medium-sized firms (10 to 249 employees)	large firms (250+ employees)
Lack of powerful broadband internet	43.0	42.2	49.7	41.5
Lack of employees' digital know-how	36.1	34.3	49.3	50.0
Insufficient IT security	32.8	32.9	32.4	26.7
Lack of reliable standards	30.3	30.0	31.6	44.1
Lack of IT specialists	30.2	29.0	38.3	51.8

Source: Survey by Kantar TNS for the German Monitoring-Report 'Digital Economy' 2018

The impact of digitalisation on employment is a widely discussed issue. The study by Frey and Osborne (2017) very pessimistically predicts that 47% of jobs in the United States will be lost in the near future through automation. However, their analysis is based on the hypothesis that specific occupations will be totally completed and replaced by computer technologies. Assuming, more realistically, that only specific tasks within occupations will be replaced by digital technologies (task-based approach), predictions are much less pessimistic. For instance, the studies by Bonin et al. (2015) and Arntz et al. (2016) show that for Germany, according to the task-based approach, only 12% of jobs are likely to be lost through digitalisation whereas according to the occupation-based approach, 59% will be lost (Brzeski and Burk 2015). These studies exclusively look at the direct effects of automation or digitalisation on employment but do not take into account that digitalisation has further indirect effects such as increased demand if prices of digital technologies decrease, since they can be produced at lower cost, or that newly developed products and services create new demand resulting in higher demand for labour. Based on a firm-level survey, the study by Arntz et al. (2018) takes a macroeconomic perspective and takes into account these further adjustment processes. The results show that in the period from 2011 to 2016, total employment has increased by one percent, i.e. more jobs have been created than destroyed by digitalisation. A closer look at specific jobs reveals that primarily jobs involving routine tasks are getting less important, while analytical jobs such as software development or programming and interactive jobs such as medicine and dentistry are gaining importance. A prediction for the period 2016 to 2021 suggests an increase in total employment by 1.8% corresponding to an annual increase in employment of under 0.4%. Moreover, the study shows that investment in digital technologies contributes to rising wage inequality. While high-wage professions and sectors profit most from new technologies in terms of higher employment and wage increases, low-paid jobs and sectors, on average, are losing out. The positive employment effects are linked with changing job profiles implying the need for appropriate adjustments in educational and training programs and for mobility across occupations and sectors.

2.2.2. Main Reforms 2013-2017

The German government has launched several initiatives during the legislative period 2013-2017 to foster digitalisation of SMEs. According to the new coalition contract, the government plans to continue or reinforce existing initiatives, although without being very precise. Main reforms in the area of digitalisation during the 2013-2017 period include

- Government initiatives to promote industry 4.0, including the 'Industrie 4.0' platform and the 10 Action Points Plan for Industry 4.0
- Industrie 4.0 Map with best practices[8]
- SME 'Mittelstand 4.0' competence centres
- 'go-digital' programme
- Digital Agenda 2014-2017
- Smart Service World Initiative

[8] For further information see www.plattform-i40.de/I40/Navigation/Karte/SiteGlobals/Forms/Formulare/karte-anwendungsbeispiele-formular.html/

- Digital Hubs Initiative

Under the patronage of the German Minister for Economic Affairs and Energy and the German Minister for Education and Research, the **'*Industrie 4.0*' platform** aims at bringing together different stakeholders of industry 4.0. Members of the platform are suppliers of industry 4.0 products and services, i.e. firms from the industries and the industry associations of machinery, electronics and ICT, actual and potential users of industry 4.0, unions and research institutions. They work on the development of technical standards, on the cooperation comparable initiatives in other countries and on concepts for organising appropriate working environments. With the ***Industrie 4.0 Map*,** best practices of industry 4.0 projects are identified and presented in different Federal States. This helps to increase firms' awareness of the opportunities and challenges related to Industry 4.0 projects.

The programme **Smart Service World** was initiated by the Federal Ministry for Economic Affairs and Energy, the first round started in November 2014 and has been focussed on funding cooperation projects of science and industry in the fields of production, mobility, good life and general purpose technologies. It runs until 2019. A second round of funding started in November 2016 and will run until 2021, with a focus on projects in rural areas and small municipalities. It covers the fields of employment, mobility, living and basic supply (e.g. smart services for energy supply or medical care).[9] Both lines of the programme have a budget of up to 50 million Euros.

In 2014, the German government launched its **Digital Agenda 2014-2017** defining the goals and milestones for realising a digital society. It addressed seven fields of action: 1. digital infrastructure, 2. digital economy and digital workplace, 3. innovative government, 4. digital life, 5. education, research, science, culture and media, 6. Security, protection and trust for the society and the economy, 7. European and international dimensions of the Digital Agenda. In 2017, the federal government 'evaluated' its Digital Agenda reporting which of the goals set have been reached and which measures have been implemented (Die Bundesregierung 2017a). In addition and to some extent based on the Digital Agenda, the Federal Ministry for Economic Affairs and Energy developed an own **Digital Strategy 2025** defining the goals and measures that are specific for this Ministry.[10]

The following initiatives refer to the Digital Agenda and/or the Digital Strategy in particular with respect to the digitalisation of SMEs and the '*Mittelstand*'.

The purpose of the **'*Mittelstand 4.0*' competence centres** (launched by the Federal Ministry for Economic Affairs and Energy) is to help in particular SMEs to foster digitalisation by informing them about best practices for instance via interactive workshops or live presentations or by consulting activities. Currently, there are competence centres distributed across Germany, some of them work together with multipliers such as chambers of industry and commerce, some have a specific focus for example on the efficiency of processes, on logistics, on E-commerce or on the use of cloud services. The initiative is still very young and it seems that it is already well known by more digitalised firms, but less known by firms with a low degree of digitalisation.[11]

The **'go-digital' programme** of the Federal Ministry for Economic Affairs and Energy (BMWi) started in July 2017. It addresses SMEs with a maximum size of 100 employees or a maximum of €20 million turnover. Its purpose is to develop concrete concepts for SMEs for the realisation of digitalisation projects and to implement a concept or project. In order to be authorised for consulting, potential providers should have technological know-how and should be experienced in consulting small enterprises. Grants may cover up to 30 days of consulting within half a year and a maximum of €1,100 for the daily rate of the consultant.[12]

The state-owned bank KfW has established a loan programme for digitalisation and innovation projects (***'ERP-Digitalisierungs- und Innovationskredit'***). It addresses SMEs with less than 250 employees and up to €50 million annual sales and larger firms according to the EU's small mid-

[9] For further information see www.bmwi.de/Redaktion/DE/Artikel/Digitale-Welt/smart-service-welt.html.

[10] For further information see www.bmwi.de/Redaktion/DE/Publikationen/Digitale-Welt/digitale-strategie-2025.html.

[11] For further information see www.mittelstand-digital.de/DE/Foerderinitiativen/mittelstand-4-0.html.

[12] For further information see www.bmwi.de/Redaktion/DE/Artikel/Digitale-Welt/foerderprogramm-go-digital.html.

caps definition with a maximum of €500 million annual sales of the firm group. It grants a 70% release from liability for loans used to finance digitalisation or innovation projects in firms and covers investment cost and operating cost.

The '**Digital Hub initiative'** was launched by the BMWi in 2017. Digital hubs are physical locations, they promote cooperation between start-ups, SMEs, industry, science and administration. Twelve hubs, located in different German cities, were selected by a committee. They have different focusses, for example on Digital Chemistry and Health (Digital Hub in Mannheim and Ludwigshafen) or on Logistics (Digital Hub in Hamburg). The BMWi finances an agency as well as the international marketing of the initiative for a period of three years. The hubs themselves are financed by private partners and by developing their own innovation programmes.[13]

The initiatives that were set up during the last years go in the right direction. They could be communicated more actively in order to reach the low digitalised SMEs. Moreover, a consequent monitoring of the initiatives and their outcomes is still missing.

2.2.3. Need for Further Reforms

Given the results from surveys and interviews, measures should raise the **awareness for the opportunities of the digital transformation** of those firms who still do not see the need for (further) digitalisation or do not have or take the time to think about it. This does not necessarily mean that each firm should end up with a completely digitalised and connected value chain. However, each firm should think about its specific potentials of digitalisation. While larger firms usually have a higher awareness and also more financial and personnel resources, initiatives for raising awareness should be targeted at small and medium-sized firms. They should be focussed on providing easy access to information and to best practices as well as to possibilities to find cooperation partners for implementing digitalisation projects. Industry 4.0 projects, for instance, are usually implemented with partners or in larger networks (Saam et al. 2016, 64). Initiatives like the *Industrie 4.0* Map, the *Mittelstand 4.0* competence centres and the Digital Hubs are focussed on increasing awareness. Actors at the level of the *Bundesländer* might help accelerating the information flow since SMEs are often regionally connected.

Initiatives with the aim of **financially supporting investment** should also mainly be targeted to SMEs. The application procedure for financial support should be simple and non-bureaucratic. The go-digital programme has these features. It provides a list of companies authorised for consulting in the fields of IT security, digital access to markets and digitalised business processes. The application is prepared and submitted by the authorised consultants in order to keep the administrative burden for SMEs small.

Since financial restrictions are not necessarily the most important impediment, financial support should not be focussed only on technological projects but also on **building-up knowledge and skills** that are needed to implement and run a new technology. As previous phases of digitalisation have shown and as recent survey results reveal investment in technologies should be accompanied by investment in human capital. According to the Monitoring-Report 2016 (Graumann et al. 2016, 90-92), 35% of the German firms think that training in the field of digitalisation is 'very important', further 32% think it is 'important'. The awareness is much higher in highly digitalised firms (50 and 37%) than in firms with a low degree of digitalisation (10 and 15%). Firms need training primarily with respect to data security (82% of the firms in total, 57% with high need) reflecting the increasing importance of data. This is followed by the need for training w.r.t. using digital devices (76%), searching information (74%), cross-disciplinary knowledge (72%). Every second firm needs training in programming skills. Improving and intensifying education in digital skills at school, in apprenticeship and higher education is suggested also by associations such as Bitkom (2018, 23) and the association for IT SMEs in Germany, BITMi (2017, 2), as well as by the Commission of Experts for Research and Innovation (EFI 2018, 20).

Technological change should be accompanied by organisational change in order to fully exploit its productivity potential. This involves more autonomy and self-responsibility for employees (e.g. BMWi 2017, 11). **Legal adjustments with respect to the Working Hours Act** could allow more

[13] See www.de-hub.de/faqs/ for further details.

flexible working arrangements such as trust-based working time or agile working as suggested by BITMi (2017) in particular for IT SMEs.

Standards are a prerequisite for interoperability and are important for supporting the diffusion of Industry 4.0 solutions. **International standard setting processes** should be reinforced. For SMEs particularly open standards are favourable (e.g. Plattform Industrie 4.0 2017, 8).

While the General Data Protection Regulation that comes into force in May 2018 regulates the handling of personal data, **rules for using non-personal data** produced for instance by machines might need to be improved or adapted. These data could support digitalisation and the development of new data-driven business models but might give undesirable insights about the used technology or the order situation to competitors or external service providers (see Bitkom 2017, 27-28; Hornung and Hofmann 2017 for further details on the legal framework for Industry 4.0).

Next to initiatives directly focusing on the digitalisation in firms, investment in digital infrastructure, i.e. ultrafast internet, will help to foster the digital transformation of the economy since it is a prerequisite for many digital applications (see section 2.3 on Digital Infrastructure) and many firms consider the internet infrastructure as insufficient. Moreover, measures that are targeted at increasing the innovation activity of firms in general, might help to spur digitalisation since digitalisation projects often have the features of innovation projects (see section 2.1 on R&D&I).

2.3. Digital Infrastructure

2.3.1. Current Situation and Main Challenges

Before presenting the market situation and major challenges related to roll-out of digital infrastructure, we briefly outline the main digital broadband access technologies involved. Depending on the fibre reach, different '**next generation access**' (NGA) broadband network architectures are distinguished: One refers to FTTC (fibre to the cabinet or curb) when the modern VDSL technologies, such as VDSL2 and VDSL2 vectoring, are run on a hybrid fibre-based network, which extends to street cabinets, and copper lines, which typically cover around several hundred meters from street cabinet to the customers´ premises. NGA networks might also be realised by upgrading cable-TV (CATV) networks with high-speed access enabled by the DOCSIS 3.0 technology on hybrid fibre-coaxial cable (HFC). Fibre to the building (FTTB) requires the fibre-optic cables be located close to or inside a building. In this architecture, the only copper-based connections remain between the customers´ premises and the building's switch. Finally, fibre to the home (FTTH) refers to a scenario where each subscriber can be connected by a dedicated fibre access line. FTTH and FTTB scenarios are referred to as Fibre to the Premises (FTTP) which is sometimes equated with gigabit networks.[14]

In this section, next generation access (NGA) is used as a generic term that comprises all above mentioned wireline fibre scenarios including hybrid 'second-life copper/coax' technologies which contribute to delivering to some extent the bandwidth levels formulated in most national and EU level targets. We jointly refer to NGA and wireless (mobile) broadband – which we discuss below – as digital infrastructures.

Deviating from the principle of **technological neutrality** by explicitly favouring particular broadband access technologies ('winner picking') can only be justified in light of sound empirical evidence on differing welfare effects of distinct access technologies – evidence which is currently not available, neither at the EU level nor for Germany. Bertschek et al. (2016) provide a comprehensive review of the economic impact of broadband infrastructure deployment and adoption on various economic outcome variables. The authors conclude that '[r]eliable and broad evidence on economic impacts of high-speed wireline or wireless broadband infrastructure and adoption is still largely missing so far' (p. 24) and that there are essentially no empirical studies that assess the differential and causal impact of various NGA infrastructures.[15] Similarly, one of the main differences between FTTP proponents and FTTC/HFC proponents is the differential expectation of how private and public demand (and therefore willingness to pay) is going to develop and whether future demand patterns can be reasonably predicted or not. Consequently, the value of real options derived from a wait and-see strategy with regard to the future development of the market might be quite substantial.

Acknowledging demand and technological uncertainties, FTTP proponents refer to the fact that the deployment of optical fibre cables requires considerable construction capacities. In view of current capacity shortages in the construction industry in Germany it would thus be sensible to start (subsidised) construction early so that FTTP infrastructures are deployed steadily in order to prevent productivity losses (Eschweiler 2016, 9). Also, FTTP networks would be more efficient in terms of operating and maintenance costs (FTTH Council Europe 2012).

Depending on country-specific demand and cost characteristics network operators employ different NGA technologies in individual EU member states. With respect to fibre-based NGA broadband connections, which allow at least a speed of 30 Mbit/s, Germany has a penetration rate (as a percentage of all households) of more than 80% compared to only 70% in the EU-28 average

[14] In its recent telecoms review (European Commission 2016c) the Commission legally defines 'very high capacity networks' in Art. 2 (2) as follows: '[V]ery high capacity network means an electronic communications network which either consists wholly of optical fibre elements at least up to the distribution point at the serving location or which is capable of delivering under usual peak-time conditions similar network performance in terms of available down- and uplink bandwidth, resilience, error-related parameters, and latency and its variation.' It appears that the German government largely adopted this definition in its Digital Strategy 2025 and this understanding also underlies the coalition agreement (Section 2.2).

[15] We admit that there are quite a few industry studies providing anecdotal evidence based on qualitative case studies. Apart from methodological concerns, these studies are typically conducted for particular interest groups and not subjected to an external academic review process.

(Figure 19). However, regarding future-proof, optical-fibre FTTP connections, guaranteeing symmetrical gigabit transmission speed, Germany is significantly lagging behind on a nationwide level and particularly regarding rural regions. It is important to note that incentives to invest in high-end FTTP networks are heavily influenced by the quality of the existing first-generation broadband infrastructure, which is based primarily on the copper-wire infrastructure of incumbent firms and the coaxial-cable infrastructure of CATV operators. NGA investment would 'cannibalise' economic benefits from the first-generation broadband infrastructure, which represents corresponding opportunity costs associated with investment in new infrastructures. This 'replacement effect' (Arrow effect) is of relevance to the 27 EU member states – such as Germany in particular – that have a very well established first-generation infrastructure.[16] This effect has been further strengthened over recent years through substantial technological advances (second-life copper/coax technologies) explaining the NGA roll-out strategy of *Deutsche Telekom* and major German CATV operators.[17]

From a dynamic perspective the core challenge is thus to assess the extent of welfare that is lost by slower rather than faster migration to gigabit networks and whether market interventions in terms of favouring FTTP broadband technologies in public policies instead of market driven technology choices (technological neutrality) is justified in view of considerably higher deployment costs. The answer depends on the extent of incremental economic benefits related to FTTP broadband technologies and on the further evolution of the progress of hybrid NGA technologies and their scalability (Vogelsang 2014, 16).

Notwithstanding such trade-offs, it is generally acknowledged that a high-speed digital infrastructure is required to satisfy the significantly increasing data traffic and quality requirements. According to WIK (2016a, 9-10), the main drivers of commercial demand are related to the following applications: Big data, cloud computing, M2M, E-Commerce, CRM, Enterprise resource planning, VPN, video communication, industry 4.0, smart farming and E-learning. Whereas these applications are likely to be relevant demand drivers for the business sector in most developed countries, Germany exhibits a rather large heterogeneity as regards firm size which also suggests heterogeneous demand for broadband quality parameters. There is some consensus among FTTP and FTTC proponents in Germany that the current focus is too much on universal private household coverage. Instead, it would be advisable to concentrate more on the needs of private enterprises and public institutions such as companies in car manufacturing, engineering, in the health and educational sectors as well as public authorities offering E-government services (e.g. Knauth 2016 or Dresselhaus 2016).

Installing or updating transmission networks is traditionally a task for private market forces. This, however, has not led to a satisfying expansion of investments, especially in rural areas (Figure 19), where profitability is lacking ('white areas'). In order to ensure the broadest possible social participation in digitalisation and support structurally weaker regions, governmental support in rural areas is necessary. So far, the investment situation is only slowly improving in spite of the additional support of extensive public resources (section 2.3.2). According to the Federal Ministry for Economic Affairs and Energy (BMWi), 84% of internet connections in rural areas are still not future-proof because they have not yet been upgraded into the gigabit range (BMWi 2017e). Overall investment in digital infrastructure is low, as indicated by the fact that the proportion of GDP spent on ICT has remained unchanged since the mid-2000s (SVR 2017, chapter 1).

Broadband funding programmes from the federal government as well as in several states ('*Länder*') take on broadly two forms of subsidisation: The subsidy model ('*Zuschussmodell*') and the operator model ('*Betreibermodell*'). In the subsidy model, a municipality offers a one-time subsidy to a private telecommunications company to close the profitability gap and induce the company to expand the existing network. Depending on the specifics, offers can be made either for the whole area or for pre-defined sections of the development area ('*Erschließungsgebiet*') and contracts can

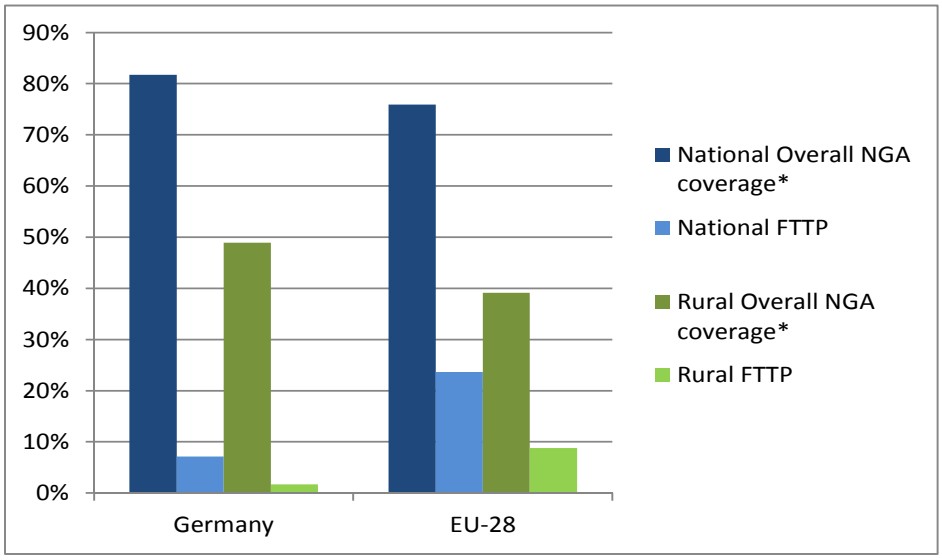
[16] In contrast, this effect is greatly reduced in most of the Eastern European countries that are characterized by a lack of a well-developed first-generation wireline ('legacy') infrastructure (for recent empirical evidence the reader is referred to Briglauer and Cambini 2018).

[17] Note that even FTTP proponents acknowledge that current HFC/DOCSIS 3.0 networks are gigabit-ready for households and that HFC infrastructure based on future DOCSIS 3.1 technology with symmetrical bandwidth up to 10 Gbit/s might become an attractive substitute for the business sector in the mid-term; there is, however, more controversy as regards the market potential of FTTC network deployments (for the whole range of different views the reader is referred to contributions of German market participants and stakeholders presented in ifo Schnelldienst 69 (20), 2016, and ifo Schnelldienst 71 (07), 2018).

be made with one or several providers accordingly. In the operator model, the municipalities themselves become active, either directly or indirectly by founding a limited liability company (GmbH). They then function as owners of the to-be-built infrastructure, whose construction they commission. By public tendering they look for a broadband network operator, which will rent the planned broadband network, install and operate its own active infrastructure and manage marketing and sales of the broadband service. After the contract with the operator is signed, there are three different possibilities to proceed: First, network expansion without any marketing beforehand is possible. Secondly, the area as a whole will only be developed if a sufficient number of households has agreed to buy a new broadband connection. Third, in a step-wise expansion a sub-area is developed if enough households in this sub-area have agreed on subscribing to a new connection.

In Germany, more than 80% of approved funding projects are based on the subsidy model to close the profitability gap in a certain area which typically favours FTTC network deployments as these exhibit lower profitability gaps especially in case of 50 Mbit/s bandwidth targets. In contrast, the operator model is largely based on FTTP deployments (WIK-Consult 2017, 24-25). In both models potential funding areas are defined at the local administrative level which suggests that spill-over effects might not be adequately internalised in the decision making process. Furthermore, there are substantial differences in terms of approved subsidies across states which on average do not correspond with the number of households per state eligible for subsidies. Whereas the subsidy model guarantees a faster network deployment at lower costs, the operator model is more likely to internalise spill-over effects, in particular in cases of region-wide municipal cooperation, and strengthen competition by attracting new entrants (WIK-Consult 2017, 26-27). Further distinguishing features refer to possibility of financing and amortisation periods which give a comparative advantage to the operator model. Another source of inefficiency refers to the case with limited upfront competition, particular in case of the subsidy model based on FTTC with only one (incumbent) operator. In this case, Briglauer et al. (2016) suggest a more efficient funding model arguing that the current contract practice of fixing ex ante targets for network expansion is inefficient given the uncertainty about future returns on fibre-based communications services and the local authorities' incomplete information about the costs of the network. The authors suggest an optimal linear contract sharing mechanism taking into account the trade-off between incentives for network expansion and the limitation of the NGA provider's profit. In cases where upfront competition exists, public tendering is meaningful. However, there is no evaluation as regards the efficiency properties of previous and current tender regimes nor it is foreseen.

Figure 19: Broadband Coverage in Europe and Germany, 2016



Broadband coverage data at the end of June 2016; the 2012-2014 editions of the BCE study depict end-of-year data (Source: OECD Broadband Portal 2017)
* NGA coverage includes VDSL, FTTP, DOCSIS 3.0

Another challenge related to NGA deployment is related to still rather low NGA **take-up rates**. As in most other EU countries, also in Germany there is a substantial gap between investment activities (coverage) on the supply side and demand side adoption implying low take-up rates

around 20% (Table 6). Low take-up indicates that overcapacities exist on the supply side and low willingness to pay on the demand side which is likely rooted in the fact that services and applications requiring extremely high download speeds of 100 Mbit/s or more are not yet widespread or the benefits are not transparent enough to consumers. A low take-up rate by consumers' does not necessarily constrain the corporate sector, however. In order to increase take-up the German Monopolies Commission (2017c) suggests to implement complementary demand side stimuli. In a related context, Briglauer and Cambini (2018) examine the role of the unbundling price on fibre adoption. The authors find that although a higher unbundling price has a positive impact on fibre adoption, an increase in unbundling prices could also generate extra-capacity implying that additional demand side policies, such as tax deductions or vouchers, are needed to sustain NGA take-up.

As indicated in Table 7, HFC and copper-based NGA connections represent by far the dominant access technologies in Germany, which are mainly employed by the incumbent *Deutsche Telekom* and CATV operators (*Vodafone/KDG*, *Unitymedia*). According to Monopolies Commission (2017c, 20), the market share of the incumbent operator *Deutsche Telekom* is still above 40% with respect to all broadband subscriptions. Substantially lower NGA market shares (30%) for *Deutsche Telekom* are the result of market entry by new types of operators, in particular municipalities and public utilities (e.g. *Net Cologne*, *Wilhelm Tel*, *M-Net*) and housing companies. This is also reflected by the fact that nearly half of all investments in 2016 applied to new competitors (Bundesnetzagentur 2017). The large share of CATV operators – despite its limited geographical footprint – is due to comparative cost advantages in upgrading hybrid-fibre coaxial cable networks.[18]

Table 6: NGA technologies employed in Germany, 2016

	FTTH/B	VDSL	DOCSIS 3.0	Total
Number of subscribers	610.000	4.700.000	6.426.000	11.736.000
Number of homes passed	2.461.200	30.000.000	28.000.000	60.461.200
Take-up rates*)	24,78%	15,67%	22,95%	19,41%
Adoption rates**)	1,49%	11,47%	15,69%	28,65%
Coverage rates**)	6,01%	73,24%	68,36%	147,61%

*) Rates are calculated as homes connected (subscribers) divided by homes passed.
**) Rates are based on total number of private households in Germany in 2016 (about €40.96 million).
Source: FTTH Council Europe/IDATE.

Table 7: Main NGA operators in Germany, 2016

Network operator	NGA market share	Main NGA technology
Vodafone/KDG	31%	HFC/DOCSIS 3.0
Deutsche Telekom	30%	FTTC/VDSL/Vectoring
Unitymedia	27%	HFC/DOCSIS 3.0
Telefónica O2	6%	FTTC/VDSL/Vectoring
NetCologne	3%	FTTB
M-Net	1%	FTTH/B
Wilhelm Tel	1%	FTTB
Deutsche Glasfaser	1%	FTTH

Source: FTTH Council Europe/IDATE

While the analysis so far has been limited to fixed (or wireline) broadband networks, mobile (or wireless) networks and mobile broadband services are playing an increasingly important competitive role. In particular, the 4th generation (4G) mobile communications technology already

[18] In contrast, upgrading copper-based networks to FTTC is more costly as it typically involves a physical migration of access infrastructure elements towards the direction of the customers' premises. Consequently, almost all cable connections have been upgraded to DOCSIS 3.0 in Germany (63.5% DOCSIS 3.0 HFC household coverage vs. 63.7% cable household coverage), whereas the share of FTTC/VDLS to DSL is much lower (58.8% vs. 97.1%) (European Commission 2017c, p. 94).

offers bandwidths that are increasingly comparable with hybrid NGA network architectures and the importance of mobile broadband will increase substantially in view of the upcoming next generation of wireless communication systems (5G) where wired and wireless communications will use the same infrastructure. Note that 5G evolution is not only about wireless: With new mobile networks requiring a strong fibre backhaul, 5G is emerging as the first example of a truly converged environment, where wireless infrastructure becomes 'wire-more'. This major disruptive change in the broadband ecosystem also brings about further technological uncertainties as regards the **optimal NGA network migration process**. Currently, it is unclear whether wireless, 5G, in particular, will serve as a cost-efficient substitute for rural areas and/or whether 5G (with a high concentration of 'small cells') will substitute NGA access technologies in urban areas. Experience with previous mobile broadband access technologies ranging from UMTS to current LTE standards (4G+) suggests that expectations were excessive in the past in Germany (and elsewhere). In fact, although basic mobile broadband coverage is above 90% it is very low for higher bandwidth levels and is only just above 6% for bandwidth levels ≥ 16Mbit/s as of mid-2017 (TÜVRheinland 2017). **Technological uncertainty and further regulatory challenges** arise in view of the optimal market integration and regulation of wireline NGA and wireless 5G access infrastructures as regards the provision of wireless broadband access (access-area) and connecting base stations with optical fibre lines to core networks (backhauling-area). These infrastructure deployments are inherently complex as they are complementary but realised at different times with 5G deployment lagging behind presumably many years.[19]

2.3.2. Main Reforms 2013-2017

On 20 August 2014, the Cabinet decided on implementing Germany's **Digital Agenda 2014-2017** (Federal Government 2014) as the framework for planning its activities concerning digitalisation. One of its three central goals states that, inter alia, '[a]ccess and participation for all citizens is to be improved via the expansion of high speed networks.' (BMWi 2016a, Table II, No. 34, p.62), and the first of seven 'action areas' covers 'Digital infrastructure'. Specifically, the Digital Agenda 2014-2017 aims at having a nationwide broadband infrastructure in place in Germany with a download speed of at least 50 Mbit/s by 2018. A complete evaluation is not intended but different aspects of the Digital Agenda 2014-2017 should in principle be open to indicator-based monitoring and evaluation.[20] In April 2016, BMWi (2016b) supplemented the Federal Government's Digital Agenda 2014-2017 with its **Digital Strategy 2025**. Among other things, it underlines the importance of the plan laid out in the strategy 'Future-oriented Gigabit-Germany' of establishing a converged gigabit-ready infrastructure by the end of 2025 and suggests concrete additional steps necessary to reach this goal.[21]

The recent **coalition agreement** contains an unequivocal commitment to optical fibre as the only subsidised technology (CDU/CSU and SPD 2018, 38). In line with the Digital Strategy 2025 the focus will be on providing certain institutions such as business parks or public institutions such as schools and hospitals with preferred access until 2022. This accounts for the fact that not all places can be supplied simultaneously while focusing on areas, which stand to profit the most from digitalisation and can in turn generate higher private demand by supplying new attractive applications requiring a high speed internet connection. This is also in line with the expectation that productivity increases of the business sector and positive externalities related to public institutions represent the main channels for broadband induced GDP growth (WIK 2016a, 5-7). Broadband coverage appears to be of particular importance for the SME sector in Germany where SMEs represent a strong driver of innovation and a large share of the overall economic value (WIK

[19] Whereas 5G will be deployed in Germany no earlier than 2020, first NGA projects have already been initiated in Germany in 2006 (Source: FTTH Council Europe).

[20] *TÜVRheinland*, a German testing services provider, conducts periodic monitoring reports on the status of basic and high-speed broadband coverage on behalf of the Federal Ministry for Transport and Digital Infrastructure (BMVI); for the latest report see TÜVRheinland (2017).

[21] Both goals are closely aligned with the respective goals of the European Commission: In particular, the Digital Agenda for Europe (DAE) 'seeks to ensure that, by 2020, (i) all Europeans will have access to internet speeds of above 30 Mbit/s and (ii) 50% or more of European households will subscribe to internet connections above 100 Mbit/s' (European Commission 2010, 19). Building upon these objectives, the EC expresses longer-term objectives for 2025 emphasizing the promotion of very-high capacity fibre-based networks, which enable gigabit-connectivity via wireline and/or wireless communications infrastructures. The Commission proposed three strategic objectives for 2025: i) Gigabit connectivity for the main socio-economic drivers, ii) 5G mobile data connectivity for all urban areas and transport paths, iii) access to internet connections offering at least 100 Mbit/s for all European households (European Commission 2010 2016c).

2016b). Until 2025 all regions and municipalities should be covered with fibre access lines which should be ideally directly deployed to buildings.

As regards future mobile broadband diffusion, the coalition agreement (p. 38-39) aims to foster 5G deployment by implementing timely and adequate spectrum policy (including national roaming and rural coverage obligations) as well as research (BMVI 2016) and trials in five selected regions ("5*5G"). In addition, the German regulatory authority (BNetzA) is requested to identify remaining mobile broadband dead zones and to publish results in a monitoring report. Despite such policy measures, 5G deployment will not start before 2020 in Germany (WIK 2016a, 30). WLAN solutions are also explicitly mentioned in the coalition agreement as a vital part of future wireless digital infrastructures and WLAN hot spots should be made freely available in all public institutions, in trains as well in train stations of *Deutsche Bahn* (2018a, 39).

In order to close the coverage gaps in unprofitable (white) areas, the Federal Government initiated a **broadband funding programme** for the expansion of NGA broadband networks in 16 November 2015. It started out with about €2.7 billion, to which €1.3 billion were added in 2016 (BMVI 2016). The focus of the programme is on the development of rural areas where market-based expansion is currently not profitable. The funds have been offered to applying municipalities from November 2015 onwards. Up to 70% of the costs of a specific project and a maximum amount of €15 million can be requested. The subsidy can be combined with programmes from the *federal states*, which have also taken action themselves to support broadband roll-out.[22] The Network Alliance for a Digital Germany (2017) estimates that approximately €10 billion are generated by the programme in areas that would not have been served by private operators. An evaluation of the effectiveness or efficiency of the existing funding models is currently not scheduled and also not foreseen in the coalition agreement.

Next to public subsidies, **sector-specific regulatory schemes** exist to incentivise NGA infrastructure investment including co-investment models as well as asymmetric and symmetric access regulations.

In monopolistic ('grey' or otherwise white) areas, **co-operation (or: co-investment)** models appear as an effective measure, in principle, for sharing risks related to future demand and market exposure as well as capital formation in case of capital market imperfections (Briglauer et al. 2017). An example from Germany is the '*Kontingentmodell*' launched by *Deutsche Telekom*, which was authorised in 2012 by both the sector-specific regulatory authority BNetzA and the EC. This volume-discount based co-operation model requests that competitors must book and pay for a specific quota in advance, whereby they can secure lower monthly payments compared to basic bitstream access for a fixed fee. This model ensures that risks are shared, since access seekers are also effectively assuming some of the demand risk. All things being equal, this model can generate higher investment incentives due to this risk sharing mechanism. What is crucial about this co-operation model is that it is neither an access obligation imposed asymmetrically as part of sector-specific ex ante regulation nor is it imposed at costs directly set by BNetzA. It is instead a 'quasi-market' solution albeit one that requires ex ante authorisation from BNetzA and has to be offered on the market on a non-discriminatory basis. Several commercial agreements have already been made under the '*Kontingentmodell*' between *Deutsche Telekom* and alternative competitors (*Vodafone*, *Telefonica*, *1&1*) which is broadly considered as a successful mode of voluntary NGA/VDSL access in the German wholesale market (WIK 2016a, 88).

In non-competitive areas regulators might also employ obligatory **asymmetric access regulations** imposed on the dominant operators to enhance retail competition. Whereas these access obligations have been successfully implemented in EU member states since the very beginning of market liberalisation in the end of the 1990s, NGA specific access regulations have been shown to be detrimental in view of ex ante investment incentives (Briglauer et al. 2018).[23]

[22] The discussion of state reforms is beyond the scope of this report. See the National Reform Programme 2016 (BMWi 2016a) for more details.

[23] Note that the effects identified in Briglauer et al. (2018) might underestimate the negative total effect of regulation on investment, if firms correctly expected (and responded to) future regulation. The main argument here is that the investment in NGA is more likely to suffer from the hold-up problem, because a large part of the legacy networks existed prior to the implementation of access regulation, whereas the fibre-optic elements of the access network need to be built anew and new investments might be thus subject to ex-post expropriation by regulators in the form of strict access regulations. Anticipating this, infrastructure operators would then invest less.

Consequently, any remaining asymmetric access regulations serve as a mechanism for safeguarding competition as an ultima ratio in otherwise non-competitive (white or grey) areas but not for inducing self-sustainable infrastructure-based competition.

In terms of retail market shares access seeking entrants play a rather limited role in Germany, in particular for business customers (*Versatel/1&1* is the strongest access seeking operator with 3% market share, WIK 2016a, 44). The decreasing role of asymmetric access regulations has apparently also been acknowledged – at least to a certain extent – from the European Commission in its recent telecom´s review (European Commission, 2016d) and is also reflected in the coalition agreement (p. 38); the latter foresees to subject NGA infrastructure to non-discriminatory open access within an ex post regime, instead of traditional ex ante cost-based access regulations. In a similar vein, Monopolies Commission (2017c, 50-60) suggests alternative forms of access regulations that provide more pricing flexibility to the regulated operator to ultimately foster investment incentives.

Besides voluntary forms of co-investment, the joint usage of infrastructures can also take shape based on mandatory **symmetrical access obligations**. In contrast to asymmetric regulation, symmetric forms of regulation concern measures that must be imposed on all providers, irrespective of the presence of market power. Insofar as symmetrical obligations are suitable for delivering synergy potentials and lowering total investment costs – such as the comparatively high installation costs in Europe where underground deployment is the norm – they will increase the profitability of NGA projects and, ceteris paribus, overall investment activity (Briglauer et al., 2017). An important milestone in this respect is the Act to Facilitate the Expansion of Digital High-speed Networks or **Digital Networks Act** *('Gesetz zur Erleichterung des Ausbaus digitaler Hochgeschwindigkeitsnetze'*, DigiNetzG*)*, which has been in force in Germany since 5 November 2016. It aims to reduce the cost of the broadband rollout by up to €20 billion by using synergies in construction. In doing so, the Federal Government also implements the Directive 2014/61/EU (Cost Reduction Directive). The reduction in costs is achieved by ensuring that all future public transport infrastructure projects will include the laying of optical fibre cables where needed. The DigiNetzG also includes provisions to ensure that new residential and commercial areas are connected with FTTP access lines. BMVI announced to continuously monitor the implementation of the Digital Networks Act to be able to apply corrective measures if necessary although specific evaluation measures have not been proposed.

In general, broadband roll-out is primarily a task of private actors, in this case telecommunications firms. To facilitate **coordination** in network roll-outs, the BMVI initiated the **Network Alliance for a Digital Germany** ('*Netzallianz Digitales Deutschland*') in March 2014. The Network Alliance's aim is to speed up the delivery of the Federal Government's broadband goal. To this end, the telecommunications firms in the Network Alliance invested €8 billion in the networks in 2015 and 2016, respectively (Network Alliance for a Digital Germany 2017, 12). In March 2017 the Network Alliance adopted the **strategy Future-oriented Gigabit-Germany**. It defines how the Federal Government and the industry want to advance the deployment of gigabit-ready networks in Germany in a targeted manner. This strategy also presents the aforementioned 2018 50 Mbit/s goal as the first step of a four-step plan ranging up to 2025 (Network Alliance for a Digital Germany 2017, 9). The second step of this roadmap consists of re-fitting business parks with fibre cables by the end of 2019, building on the **Special Programme for Business Parks** by the Federal Government. This programme supplies up to €350 billion to existing business parks which want to upgrade their telecommunication infrastructure featuring simplified procedures to speed up implementation. In addition, the Digital Networks Act (*'DigiNetzG'*) ensures that new business parks will be equipped with optical fibres from the beginning. In the third phase, up to the end of 2020, the telecommunication providers plan to lay the foundations for nationwide 5G rollout, while the regulatory authority is tasked with keeping the required frequency ranges available in the future as well. In the fourth and last phase, the Network Alliance for a Digital Germany wants to establish a converged gigabit-ready infrastructure[24] in Germany by the end of 2025.

[24] *Converged* in this context indicates that the telecommunication infrastructure satisfies a differentiated combination of intelligent networks, bandwidth, real-time availability, security, energy efficiency and other performance parameters.

2.3.3. Need for Further Reforms

From the discussion above the following policy evaluations and adjustments appear to be necessary:

- In order to assess the optimal migration path towards high-end FTTP infrastructures, ministries providing funds at national or state level need further reliable evidence on costs and benefits of different NGA architectures depending on the respective extent of actual externalities and demand. In particular, empirical research on the actual incremental benefits of FTTP broadband vs. basic or hybrid-fibre based broadband deployments is very scant both at the EU level but also for Germany. This need is reinforced in case of Germany in view of the high relevance of future second-life technologies in conjunction with a well-established first-generation broadband infrastructure. Reliable empirical evidence on differing welfare effects of distinct access technologies should also guide public authorities in the design of public subsidies, e.g. to identify areas where economic effects of subsidies are highest and most promising and should thus get preferred access. As the German business sector exhibits a rather large heterogeneity as regards firm size, there might also be heterogeneous demand for relevant broadband quality parameters which also needs to be addressed on empirical grounds.
- Funding ministries should evaluate multi-layer broadband funding models that have been applied in Germany at national and state level in terms of their effectivity and efficiency properties. Defining broadband targets and thus the demarcation of white, grey and black areas should ideally depend on evidence on differing welfare effects of distinct broadband access scenarios. Furthermore, policy makers, i.e. formally responsible ministries and BNetzA in particular, should consider including mobile broadband and 5G in particular in future funding programmes, as the latter might be the more cost-efficient alternative for specific digital services and applications in rural areas (e.g. smart farming).
- In order to incentivise efficient investment in digital infrastructures, the sector-specific regulator (BNetzA) has to design appropriate remedial measures. As regards asymmetric access regulations, the coalition agreement foresees a regulatory move from traditional ex ante access regulation towards an access regime based on ex post elements. This should incentivise investment as long as the latter actually involves a less regulatory intensity overall. Moving away from sector-specific ex-ante regulation towards an ex-post regime results, on the one hand, in more flexibility for the regulated firm with regard to its pricing strategy. On the other hand, in terms of procedural requirements, too, the regulated firm can gain additional flexibility (such as "time-to-market") depending on the specific formal design of disclosure and authorisation obligations. However, the actual degrees of freedoms for regulated operators will ultimately depend on the implementation of BNetzA.
- A similar reasoning applies to symmetric access regulations enacted by the Federal government. While clearly lowering deployment costs due to synergies, symmetric regulations must not ultimately result in extending asymmetric access regulations to a variety of infrastructure elements and all infrastructure operators regardless of actual market power. This would run contrary to, first, deregulation steps that have already been put in place in asymmetric access regulations, second, the central goal of promoting investment. In case that symmetric regulatory measures are optimally implemented by BNetzA these measures should be suitable for boosting the deployment of optical fibre networks both in terms of geographical spread and investment-intensive FTTH/B deployments (Briglauer et al. 2017, 955). In view of the trade-offs involved, policy makers should evaluate ex ante costs and benefits of mandatory symmetrical access remedies.
- Especially in areas with limited scope for infrastructure competition co-investment seems a promising concept to foster network investment next to symmetric access regulations. Economic analysis suggests co-investments perform better providing high-speed broadband coverage than the conventional mandated wholesale access regime. Mandating open access leads to lower investment and lower coverage because the access option constitutes an opportunity cost that makes co-investment less attractive. However, co-investment models will only induce additional infrastructure investment if the regulatory conditions, which are foreseen ex ante by co-investing parties, are not too restrictive in terms of accruing future investment rewards and in view of the actual extent of risk-sharing and cost reduction. Whereas this has been largely achieved in the German market within the so-called '*Kontingentmodell*', this quasi-market driven solution might be challenged in view of the regulations foreseen by the new EU regulatory framework (European Commission 2016d).

The latter contain a quite considerable regulatory component, with the result that such co-investment models differ substantially from pure voluntary market solutions and their associated ex-ante investment incentives. In general, the stricter ex-ante conditions for co-investment approvals are applied, the smaller the investment promoting effect will be (Briglauer et al. 2017, 952).

- Finally, there appears to be a need to coordinate policy measures in all of the above mentioned fields. Although there are numerous public institutions and private organisations active in Germany, it remains unclear whether joint coordination efforts are efficient and effective; this holds, in particular, with respect to public funding provided simultaneously at state and national level and with responsibilities divided between several ministries. A first attempt to integrate interdisciplinary research is the foundation of the German Internet Institute by BMVI in 2017 with funds of €50 million over 5 years. However, it is unclear whether this institution will improve market coordination timely and in the above mentioned fields or whether a similar form of competence bundling would be necessary at the policy level. Whereas most political parties have initially spoken in favour of establishing a special ministry on digitalisation ('*Digitalministerium*'), the coalition agreement now aims to establish a digital agency ('*Digitalagentur*') which should interact with all ministries on digitalisation related fields. In addition, a '*Staatsministerium für Digitalisierung*' has been appointed within the Chancellery. Indeed, optimal policy integration and coordination involves various trade-offs and still seems to be unresolved.

3. INFRASTRUCTURE

3.1. Electricity Grids

3.1.1. Current Situation and Main Challenges

Low energy costs and a reliable electricity supply are important competitive factors for private businesses. To ensure energy security and lower costs in the medium- and long-term by successfully implementing the energy transition ('*Energiewende*') well-developed electricity grids are crucial:[25]

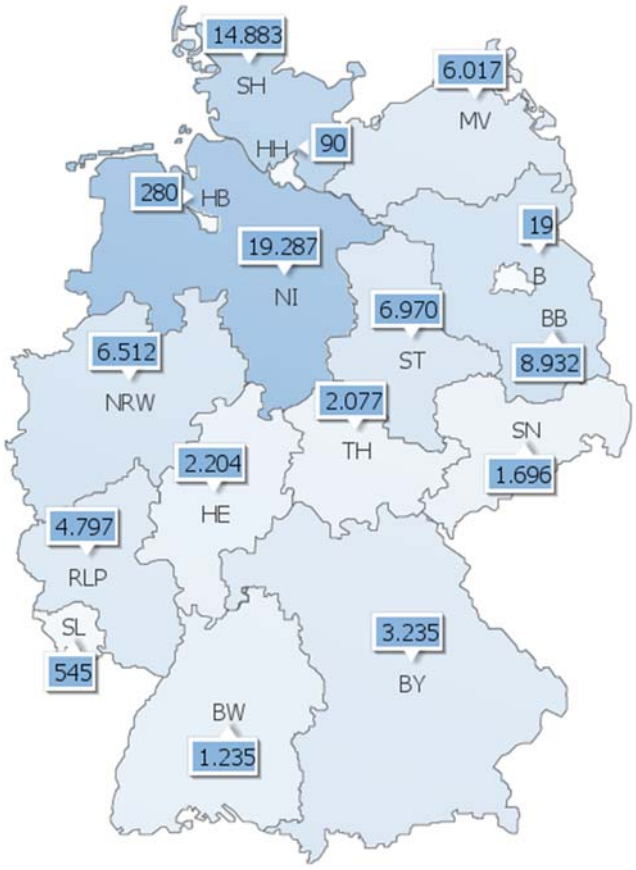
- The share of power generated from fluctuating energy sources is increasing.[26] Due to the decentralized nature of a lot of renewable energy generation, electricity sometimes needs to bridge large distances from the producer to the consumer. This is mainly the case because due to geographic advantages most large (wind energy) producers are located in the north and the east, whereas the largest industrial consumers are historically located in the south (BMWI n.d.a; Figure 20). To accommodate the growing amount of electricity from renewable sources while ensuring grid stability, a considerable expansion of the transmission grids is necessary.[27]
- Although transmission grids are key for a successful energy transition. The expansion requirements affect the distribution network operators ('*Verteilnetzbetreiber*', VNB) much more strongly than the transmission system operators ('*Übertragungsnetzbetreiber*', ÜNB) (BNetzA 2015, 54). If the local distribution networks are not capable of absorbing fluctuating power inputs from the plants in their region, this newly created electricity cannot be transferred to the transmission grid and will be irretrievable. The loads of the renewable energy feed-in are distributed unevenly among the distribution network operators: 60% of the feed-in power is concentrated on ten grid operators and 80% on twenty (out of a total of 878) grid operators, which are mostly located in northern and eastern Germany (BNetzA 2015, 57; Schröder 2017).
- A large number of power generation installations from small operators (e.g. rooftop photovoltaic installations from individual households, small onshore wind farms) become connected with the grid. Consequently, the grid now must be able to transmit energy in both ways: Not only to the end user but also from the end user back into the system (BMWI n.d.a).
- Electricity trading in the EU is increasing. Because of location of Germany in the heart of Europe, the country is expected to experience significantly more cross-border electricity trading than other countries, which requires a resilient and finely meshed transmission network (BMWI n.d.a).

[25] To this end, roughly €59 billion were invested in the construction, expansion, maintenance and repair of the power grids between 2008 and 2015 (BMWi 2017a, 21). However, the Federal Government admits that further investments are urgently needed.

[26] Diekmann et al. (2017; only available in German) provide an indicator-based analysis of how the federal states differ in their generation of different types of renewable energy, as well as renewable energy-related policies. They do not, however, look at grids due to a lack of up-to-date data.

[27] While investing in digitalisation to improve the synchronisation of supply and demand can certainly contribute to grid stability and efficiency of supply (see below), we are not aware of any claims that digitalisation and/or better management alone can make a substantial part of the grid expansion investments obsolete.

Figure 20: Electricity generated by wind power in Germany, 2016 (million kWh)



Source: *Agentur für Erneuerbare Energien* (2018)

Few expansion projects realised so far

Figure 21 shows the planned grid and power line expansion projects envisioned under the **Federal Requirement Plan Act** ('*Bundesbedarfsplangesetz*', BBPIG) for projects across federal states and the **Energy Line Expansion Act / Power Grid Expansion Act** ('*Energieleitungsausbaugesetz*', EnLAG) for intra-state projects.

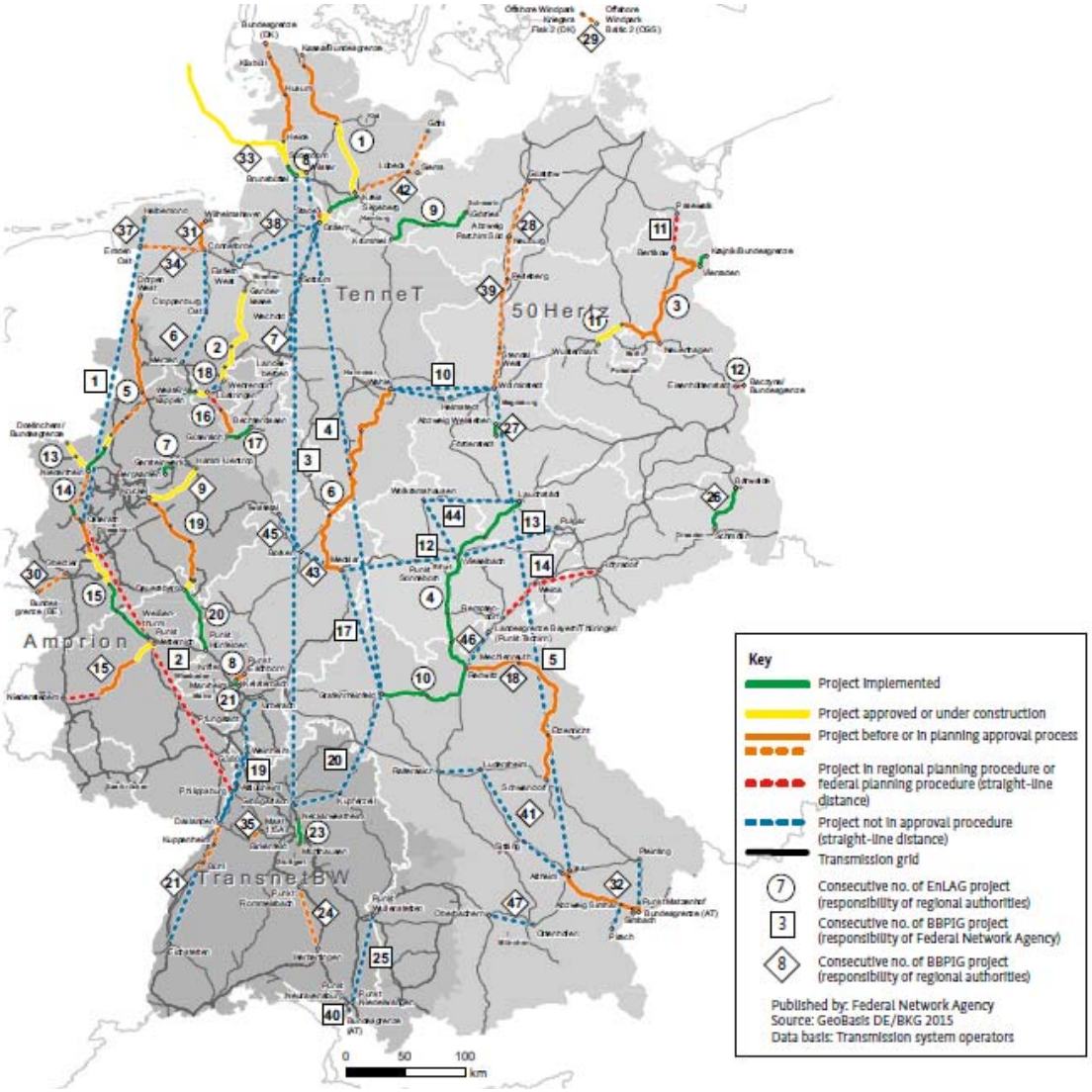
Under the **Federal Requirement Plan Act**, in the third quarter of 2017 about 450 km were granted approval, about 150 km of which were completed, while 2400 km are still in the planning procedure (Federal Network Agency 2017). The Council of the European Union (2017, 8) criticises that of a current total of 6,100 km of power lines planned to be built in the period up to 2024/2025 in accordance with the Federal Requirement Plan Act, only around 6% have been approved and only 1% have been constructed.

Under the **Energy Line Expansion Act** around 1,000 kilometres had been granted approval by the end of the third quarter of 2017, out of a total of 1,800 kilometres. Around 750 kilometres have been completed to date (Federal Network Agency 2017). Eleven of these projects are singled out as testing grounds for underground cabling (BMWi 2016c, also see section *Lowering public resistance to new energy lines).* Calculations of the Council of the European Union (2017, 8) come to a less favourable conclusions: It criticises that only around 35% of the highest voltage grid projects identified in the 2009 Energy Line Expansion Act had been implemented by the end of 2016.

Similar to the criticism voiced by the Council of the European Union, the Federal Network Agency (*Bundesnetzagentur*, BNetzA) concluded in its annual report 2016 that the current grid expansion process cannot keep up with the rapid changes of the energy landscape (Federal Network Agency 2017, 14). Figure 21 illustrates that, e.g. in the fourth quarter of 2016 several of the envisioned north-south power lines had not even entered the planning approval procedure. An insufficiently developed electricity grid leads to bottlenecks in the grid and, as a consequence, to increasing emergency cut-outs and respective costs. For example: the largest of the four transmission grid

operators, Tennet, alone paid almost €1 billion for grid stabilisation interventions in 2017 compared to €660 million in 2016 (Solarify 2018). After the nuclear power plants will be turned off in 2022, this amount is estimated to rise up to €4 billion according to the Federal Network Agency (strom magazin 2017).

Figure 21: Grid Expansion under EnLAG and BBPlG in Germany, Q4 2016



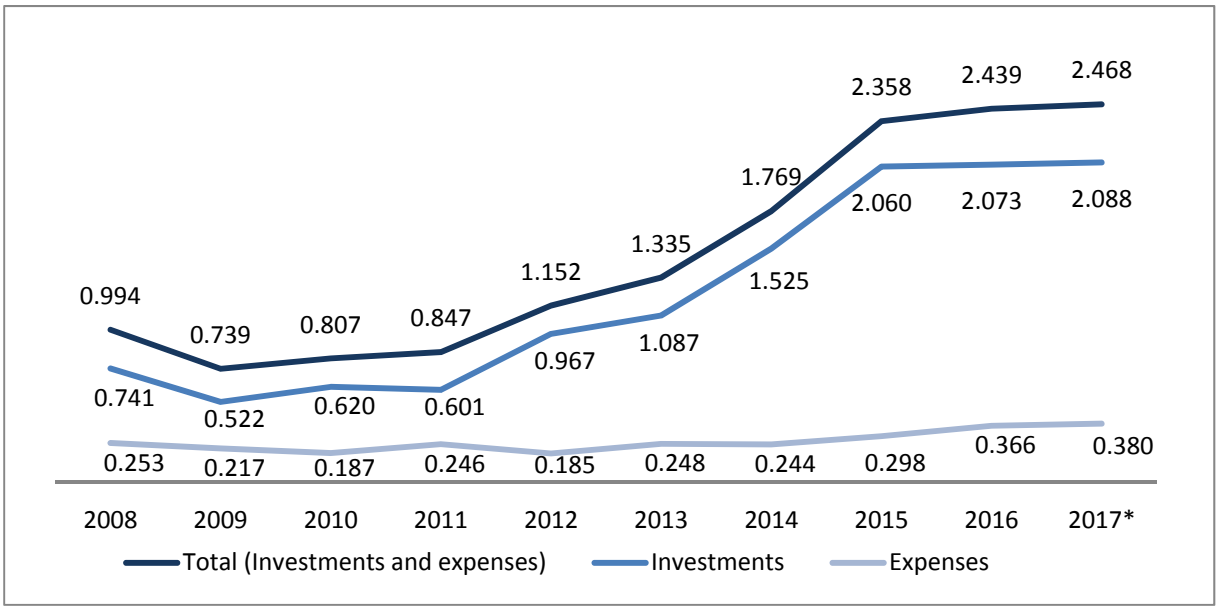
Source: BMWi (2017b, 40).

Projected investment needs higher than current investment trends

Although the distribution grid operators are much more strongly affected than the transmission grid operators, this is currently not reflected in respective amounts invested. Figure 22 and Figure 23 show the development over time. In 2016 the four large transmission grid operators spent about €2.44 billion for investments in and maintenance of the grid network. This is 3% more than it was in 2015 (BNetzA 2017b, 99). This number has been rising for almost a decade, and it has done so steadily since the low point of €739 million in 2009, which corresponds to an increase of €1.7 billion and 230% over seven years. For 2017, €2.47 billion were planned (BNetzA 2017b, 99).

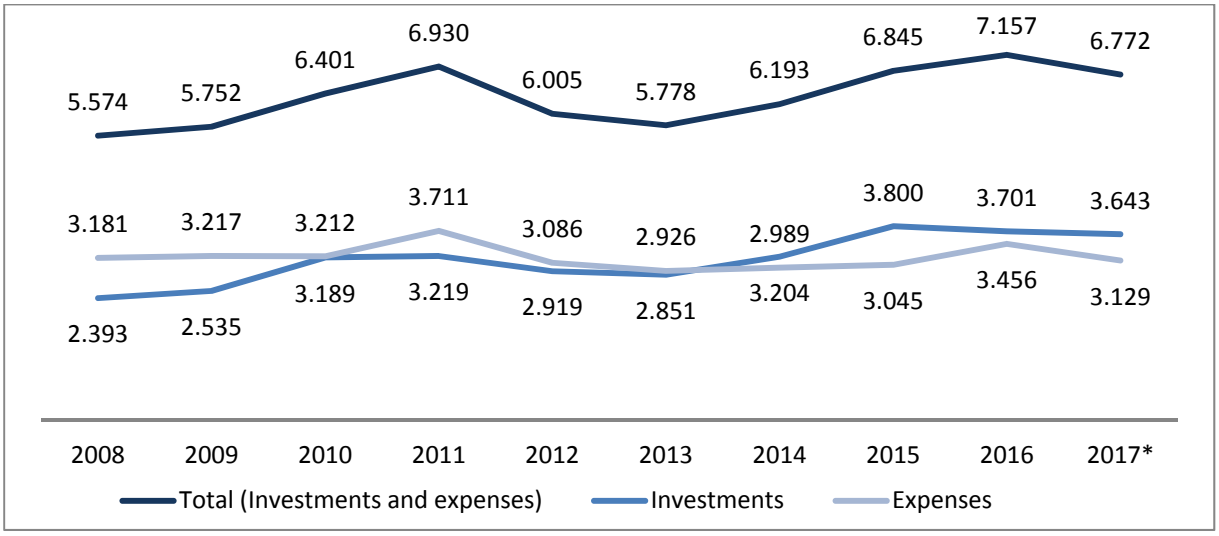
For the distribution grid operators the respective number for 2016 was €7.16 billion with a growth of about five% from 2015, and €6.77 billion scheduled for 2017 (BNetzA 2017b, 100). This number, however, has changed comparatively little since 2009 when it stood at €5.75 billion, which corresponds to an increase of less than 25% over seven years.

Figure 22: Investments and expenses for the network infrastructure of the transmission grid operators in Germany, 2008 to 2017 (billion €)



* planned.
Source: BNetzA (2017b, 99).

Figure 23: Investments and expenses for the network infrastructure of the distribution grid operators in Germany, 2008 to 2017 (billion €)



* planned.
Source: BNetzA (2017b, 100).

At the same time, even more investments are needed to successfully implement the energy transition. For example, the next transmission grid expansion projects from the **Energy Line Expansion Act / Power Grid Expansion Act** ('*Energieleitungsausbaugesetz*', EnLAG) are estimated to need around €5 billion (DIHK 2017, 14).

Concerning the complete costs of the grid expansion, a BMWi study estimates that between €23 billion and €40 billion of investments in distribution grids will become necessary for between 130,000 and 380,000 kilometres of new grids until 2032, 70% of which will be needed until 2022 (DIHK 2017, 17). The lobby association of energy, gas and water utility providers and grid operators, BDEW, even estimates that up to €50 billion of investments in distribution grids might become necessary until 2032 (BDEW 2016c). These numbers show that the invested amounts must

increase further to even meet the lowest projected investment needs. Because of this discord of investment needs and actual investments by distribution grid operators, the revised **Incentive Regulation Ordinance** (discussed below) aims at making investing more attractive.

Public opposition one of the main obstacles

One of the main reasons cited for delays is the massive public opposition (Council of the European Union 2017, 8). While consumers want electricity as reliably and as cheaply as possible, nature conservationists want to protect fauna and flora and property owners want as little damage to and devaluation of their property as possible. At the same time, investing in transmission lines must be profitable for the grid operators. While the Federal Network Agency acts as a mediator between the different interests (BNetzA n.d.), it often cannot avoid protests, conflicts or lawsuits when parties see their interests threatened.

3.1.2. Main Reforms 2013-2017

After the decision to quit nuclear energy in 2011, expanding the grid network to incorporate renewable energies became even more urgent. Therefore, the *Bundestag* and *Bundesrat* amended several laws, so that now four laws form the basis for the grid expansion (BMWi n.d.a):

- The **Energy Industry Act** ('*Energiewirtschaftsgesetz*', EnWG) defines the responsibilities of both distribution and transmission grid operators. It also harmonises the process of planning new high voltage energy lines and ensures that public and environmental concerns are considered.
- The **Grid Expansion Acceleration Act** (*'Netzausbaubeschleunigungsgesetz'*, NABEG) places the responsibility of planning and approving transmission grid expansion projects which cross federal state or national boundaries with the Federal Network Agency.[28]
- The **Federal Requirement Plan Act** (*'Bundesbedarfsplangesetz'*, BBPIG) is continually updated every two years. It contains the transmission grid expansion projects with the highest priority (depicted in Figure 21) on the basis of the Grid Development Plan and the Offshore Grid Development Plan. The Federal Network Agency regularly presents monitoring reports on the progress made in the different projects.
- In contrast to the BBPIG the **Energy Line Expansion Act / Power Grid Expansion Act** (*'Energieleitungsausbaugesetz'*, EnLAG) from 2009 covers only transmission grid projects managed by the federal states (BNetzA 2017b, 61). A report on the progress of grid expansion projects under the EnLAG is presented to the German *Bundestag* every even-numbered year, the latest capturing the status quo of the second quarter of 2016. Meanwhile the Federal Network Agency regularly presents monitoring reports on the progress made in the different projects.

Moreover, to enable a smoother implementation of the Energy Transition, the 2011 Grid Expansion Acceleration Act ('*Netzausbaubeschleunigungsgesetz*', NABEG) and the 2005 revision of the Energy Act ('*Energiewirtschaftsgesetz*', EnWG) bundle a variety of central competencies concerning extra-high voltage networks within the Federal Network Agency.

Adapting grid charges and decreasing costs

On 22 July 2017 the **Grid Charge Modernisation Act** ('*Netzentgeltmodernisierungsgesetz*', NEMoG) came into force. There are two goals (BMWi 2017c). First, the law harmonises grid charges within Germany. Currently, grid charges from two of the four transmission grid operators are twice as high as those from the remaining two (Wolf and Dobler 2017, 2). This is due to the high feed-in from renewable energies in the area of the former two. To distribute the costs of the energy transition more equally, grid charges will be centrally determined while the incentive regulation for the individual grid operators is to remain intact. Between 1 January 2019 and 1 January 2023 the grid charges will be standardised in five steps (BMWi 2017c). The mechanism necessary to conduct

[28] The coalition agreement states that the NABEG is planned to be further simplified in this legislation period (also see main points from the Coalition Agreement, CDU/CSU and SPD 2018).

this calculation is to be specified in the **Electricity Grid Charges Ordinance** ('*Stromnetzentgeltverordnung*', StromNEV) (Wolf and Dobler 2017, 3).

Second, the Grid Charge Modernisation Act adapts the structure of grid charges to the growing production of renewables. Since locally produced energy is in many cases no longer consumed locally but often is transported on long distances (e.g., wind energy from northern Germany is consumed in industrial centres in southern Germany). Doing so strains the electricity grids just like traditionally produced energy does and they should therefore be treated alike. Thus, the Grid Charge Modernisation Act seeks to gradually reduce payments for distributed feed-in. This is to contribute to lowering the costs of the grid. Newly built plants for volatile forms of energy (solar and wind energy) will not receive any payments from 2018 onwards while the subsidies for existing plants will be lowered in three steps also starting in 2018. This is expected to considerably slow down the rise of network charges in the North and the East of Germany. The funding of controllable generation plants will end in 2023.

An evaluation is not yet planned and since the provisions of the NEMoG only went into force in 2018, its intended effects can likely not be measured for some time[29]. An obvious indicator to look at would be the amount of subsidies paid per number of plants, where the act is expected to lead to lower expenditures. In addition, since reduced subsidies naturally change incentives for installing and maintaining capacities, looking at the development of the total number of volatile and controllable plants in operation seems appropriate. For example, critics, among them many enterprises owned municipalities, point out that for many combined heat and power (CHP) plants the subsidy was and still is crucial for its profitability (BDEW 2017; Deutscher Städte- und Gemeindebund 2017). If this is the case, one will observe a corresponding drop in active CHP plants in 2023 when the funding is reduced. Moreover, since this policy has been known since the act was first publicly discussed, the number of newly installed plants should already have dropped around this time. The reasoning works analogously for other forms of sustainable energy generation.

Lowering public resistance to new energy lines

The **Act to Amend Provisions of Energy Grid Construction** (*'Gesetz zur Änderung von Bestimmungen des Rechts des Energieleitungsbaus*', EnLBRÄndG) came into force on December 31, 2015. The law was passed in order to decrease the massive public resistance to the traditional overhead lines (Wirtschaftswoche 2016). It contains three main points (BMWi 2015, BMWi 2016c):

- First, for new extra-high voltage, direct current (EHV-DC) transmission lines, the Act gives precedence to underground cabling in federal planning. At distribution grid level, underground powerlines are already the norm in Germany. In contrast, the transport of electricity across large distances at high-voltage level, via the transmission grids, has generally taken place using overhead powerlines. Also, alternating current is mostly used. Following the new Act to Amend Provisions of Energy Grid Construction, erecting overhead lines near residential areas is no longer permitted. EHV-DC overhead lines will only be possible in certain cases by way of exception, e.g. in nature conservation areas or where existing powerlines can be used without major impact to the environment or if a municipality explicitly requests overhead lines. In the future, high voltage direct current (HVDC) transmission will also be used instead of alternating current for the major north-south electricity highways (e.g. *SuedLink*).
- Second, the criteria and the number of pilot projects for underground cabling will be increased for new extra-high voltage three phase AC lines. This means that in particular for nature conservation reasons, it will be possible to place the powerlines partially underground. Since the deployment of underground AC lines is technically more demanding and many questions about certain feasibility aspects have not been addressed yet, the Federal Government opted for extensive testing in the designated projects.

[29] Moreover, the coalition agreement states that grid charges are to be reformed again in this legislation period (also see 'Main Points from the Coalition Agreement (CDU/CSU and SPD 2018) which will likely introduce new elements to be assessed.

- Last, the Federal Requirement Plan ('*Bundesbedarfsplan*') is redrawn on the basis of the 2024 grid development plan and confirms the grid expansion projects identified by the Federal network Agency.

Underground cabling will increase the costs of deploying the transmission lines by several billions and delay the completion of each of the large projects by two to three years (Wirtschaftswoche 2016). Proponents argue, however, that without underground cabling, lawsuits by private actors would make the completion nearly impossible so that underground cabling is the only way to work for and not against the public (Wirtschaftswoche 2016).

An evaluation of whether underground cabling will actually speed up the grid expansion process is not planned. Lacking a counterfactual possible evaluation aspects could - if the numbers will be available - be the swiftness and speed of grid expansion, as measured by, e.g. kilometres of networks installed, number of (pilot) projects started and/or completed, number of public consultations, suits filed by citizens or actual trials. Numbers and percentages from preceding years could provide a benchmark.

In order to better integrate citizens in the planning and approval process, several measures have been taken. On the legal level, the inclusion of the public in the planning process is explicitly set out. To facilitate public participation different agencies try to lower transaction costs for citizens by providing information about and access to the processes on online portals (e.g. *www.netzausbau.de* by the Federal Network Agency or *www.buergerdialog-stromnetz.de* supported by the BMWi). In addition, most private transmission grid operators have instituted procedures for public participation in the planning stages and claim that this has had improved the project planning in many cases (DIHK 2017, 12).

A new problem generated by the underground cabling of transmission lines is that many farmers fear adverse impact on their fields' soil quality if cables are deployed underneath. The German Farmers' Association therefore demands monetary compensation from the grid operators and lobby for corresponding legal changes (DBV 2017). This illustrates that winning public approval is an ongoing challenge with many different actors and interests that need to be addressed.[30] Moreover, instituting simple and transparent rules for whether or how to compensate actors is important to create clear expectations for the investing grip operators.

Harmonising the paces of energy transition and network expansion

Following the target to slow down the costs of the energy transition the **Renewable Energy Sources Act** (*'Erneuerbare-Energien-Gesetz'*, EEG) was reformed first in 2014 and later in 2016. Among other things, the 2016 revision reinforced the expansion corridors/deployment corridors set in the 2014 revision. At the same time it tried to synchronise it with the pace of grid expansion: In congested areas, designated by the Federal Network Agency as 'Network Expansion Areas', a maximum of 58% of the average capacity added in the last three years can be added. This stresses the crucial role that grid expansion plays for the success of the energy transition and illustrates its (potential) bottleneck function. Official evaluations of the EEG are scheduled but they are to appear only after this report has been submitted. Moreover, the state of the grid expansion and possible bottlenecks are not an explicit focus. If network expansion remains a bottleneck, the amount of non-approved energy plants in the 'Network Expansion Areas' could serve as an indicator of whether this restriction is actually binding.[31]

Fostering the digitalisation of electricity grids

Modern technology will play an increasing role in coordinating and guaranteeing a reliable supply of electricity. In addition, it can also reduce the investments needed for the grid expansion if it allows for using existing grids more intelligently. To pave the way for this development the **Act on the**

[30] The coalition agreement states that speeding up the deployment of underground cabling is one of their energy policy priorities in this legislation period (also see main points from the Coalition Agreement (CDU/CSU and SPD 2018)).

[31] However, since the overarching goal is to speed up grid expansion, the restriction should be not binding if the expansion succeeds and the Network Expansion Area status is removed. In this case the removal of Network Expansion Area titles could be an indicator.

Digitalisation of the Energy Transition (*'Gesetz zur Digitalisierung der Energiewende'*) focuses on the introduction of smart meters (BMWi n.d.b). These help to enable the development of a digital infrastructure that is capable of connecting more than 1.5 million electricity producers and large-scale consumers. By a better synchronisation of producers and consumers, of supply and demand, fluctuations can be reduced and a more efficient and reliable operation of the grid system can be achieved.[32]

The funding programme **Smart Energy Showcases - Digital Agenda for the Energy Transition** (*'Schaufenster intelligente Energie - Digitale Agenda für die Energiewende'*, SINTEG) aims at testing some of the new possibilities offered by digital technologies (BMWi n.d.b). In five model regions, new approaches to safeguarding secure grid operation with high shares of intermittent power generation based on wind and solar energy are introduced. At the same time market structures are implemented, thus fostering competition and creating incentives for improving energy efficiency. The five showcase regions receive up to €230 million in subsidies from the BMWi, which estimates that this should generate an additional €300 million in private investment. The projects started on 1 December 2016 and 1 January 2017, respectively, and receive funding over a period of four years. They have the explicit aim to become a blueprint for the rest of Germany and will therefore likely be evaluated extensively.

Improving cross-border cooperation

A necessary condition for a successful exchange of energies to a higher share of renewables is the **interlinking of grids across national borders**. For Germany to achieve its aim of a power grid interconnection level of at least 10% of the installed electricity generation capacity, it is essential that the cross-border line expansion projects that are already planned or under construction will be completed on time. Germany is currently implementing **20 projects of common interest** (PCI)[33], ten of these are cross-border projects (BMWi 2017a). Of these, no less than three will improve the interconnection capacity with Denmark. In addition, for the first time a connection to Belgium and one to Norway will also be created. The international cooperation and integration of the electricity grid is supposed to diversify risks and minimise weather-induced fluctuations in electricity generation. While an evaluation is not explicitly envisioned in the law, monitoring the international electricity flows as well as the network stability should be informative about the effectivity of this endeavour. However, since the first regular auctions have not yet been established, an evaluation is not feasible during the scope of this report.

To speed up regional collaboration and spread knowledge and innovation, Germany is actively involved in **three regional electricity collaboration formats**: the PENTA forum with the BeNeLux countries, France, Austria and Switzerland; the CEEE forum with Poland and the Czech Republic, among other countries; and the BEMIP with Denmark along with other countries. The aim of the regional collaborations is to develop specific joint measures to increase the interconnection of the national electricity markets.

Strengthening investment incentives for distribution grid operators

The central instrument of grid system regulation is the **Incentive Regulation Ordinance** ('*Anreizregulierungsverordnung*', ARegV), which was originally implemented in 2009 and determines the remuneration of electricity distribution grid operators.[34] While the incentive regulation approach is generally considered to have proven successful in practice, different aspects still leave room for improvements. A major concern is that the investments by the distribution grid operators lag behind the amount of investments likely needed to successfully implement the energy transition (see 'Projected investment needs higher than current investment trends'). In order to adjust it to the challenges posed by the energy transition and based on the evaluation report by the Federal Network Agency (BNetzA 2015), it was thoroughly revised before it re-entered into force on 3 August 2016, instituting changes for the 3rd regulation period (2019-2023).

[32] The coalition agreement states that additional regulatory measures and incentives will be passed in this legislation period (also see 'Main Points from the Coalition Agreement (CD/CSU and SPD 2018)).

[33] Projects of common interest (PCI) bridge gaps in the infrastructure of the European power system and as such will contribute to the improvement of the security of supply and the development of renewable energy in the EU.

[34] Gas grid operators are affected by the revision of the Incentive Regulation Ordinance as well, which is however, separated from the regulation of electricity grid operators and it therefore not discussed here.

Since the new rules will only enter in force in 2019, an empirical evaluation is not possible yet. However, arguments from different stakeholders are presented in the following section to give an outlook on the expected effects. There were three main changes in the 2016 revision (BMWi 2016e) that have been discussed in the public debate and will be presented in turn.

The *first* change introduced a **yearly capital cost adjustment** (*Kapitalkostenabgleich*) for distribution grid operators to improve investment incentives (BMWi 2016d). As could be seen in Figure 23, the investment sum of distribution grid operators stagnated since incentive regulation was introduced. At the same time, investments by the transmission grid operators increased more than threefold (Figure 22). This clearly indicates that higher investment by distribution grid operators is necessary and desirable. Consequently, starting with the third regulation period on 1 January 2019 investment costs of distribution grid operators are immediately recognised. The change allows for a higher revenue cap and thus for higher grid charges right after the investment, so that investment costs can be refinanced straight away.[35] The hope is that this change will not only increase investment incentives but also that consumers will benefit from reduced capital costs more quickly (BMWi 2017a).

Since the time lag in returns on investments had been one of the major criticisms of the grid operators, this change was widely welcomed and it is expected to improve the investment climate (BNetzA 2015, 156-158; BDEW 2016a; DIHK 2016, 3-4; Monopolies Commission 2017b, 135, 143; Schröder 2017). However, the Monopolies Commission (2017b, 143) points out that the new incentive regime shifts the focus from efficiency to high capital intensity, potentially leading to inefficiently high capital-intensities (Averch-Johnson effect). This is due to the fact that the additional capital costs are now recognised immediately while operating costs are still subject to the old regulatory framework. This can also adversely impact incentives for innovations that cause relatively higher operating costs (Monopolies Commission 2017b, 143). The Monopolies Commission (2017b, 144) therefore recommends removing the bias towards capital-intensive investments in the next reform.

In return for introducing a yearly capital cost adjustment, the **'base effect**' ('*Sockeleffekt*'), which was used in the first two regulation periods, is to be **abolished** after a transition period of five years, in which it can still be claimed for newly activated assets.[36] The envisioned transition period is criticised by the grid operators as insufficient compared to depreciation periods used in unregulated markets (BDEW 2016a; Monopolies Commission 2017b, 144). This would devalue existing investments in energy grids, which is why grid operators demand that the transition period should be at least two periods long (BDEW 2016a; Schröder 2017). The Federal Network Agency argues that the comparison to single investments in unregulated markets is inappropriate because the profitability of the whole grid is decisive (Monopolies Commission 2017b, 144). Moreover, since investments activated before the start of the first regulation period were compensated as well, the grid operators are in sum not deprived of their regulated profits on investments (Monopolies Commission 2017b, 144).

In general, decisions that (at least partially) devalue existing investments can seriously impair the investment climate as it signals lacking reliability of the regulatory framework. In this regard, the DIHK (2016, 4) argues that extending the period to guarantee protection of legitimate expectation ('*Vertrauensschutz*') for investments that have already been made should be examined. The Monopolies Commission, however, argues that no expectations concerning individual investments could have been developed since the old system provided a budget for the total investment, not individual ones (Monopolies Commission 2017b, 144-145). Therefore, the business expectations analogy would not be applicable. If hardships for some grid operators are to be expected, individual solutions should be found rather than granting the base effect indiscriminately to all operators (Monopolies Commission 2017b, 145).

[35] Currently, the time lag for the recognition of investments can be up to seven years long (Boß and Kuhn 2016, 7).

[36] Assets that were activated between 2007 and 2016 form a temporary exception and benefit from the base effect in the third regulation period, to facilitate adjustment by the grid operators to the new remuneration rules and avoid inducing hardships for some operators (BMWi 2016e; Monopolies Commission 2017b, 140). The costs for this measure are expected to be around €360 million (Monopolies Commission 2017b, 140).

Strengthening efficiency incentives for operators on different levels

The *second* change of the Incentive Regulation Ordinance involves the creation and **strengthening of technology-neutral efficiency incentives**. This becomes especially important since the new capital cost adjustment approach incentivises capital-intensive over efficiency-increasing investments (Monopolies Commission 2017b, 145).

In order to improve the practical implementation of the system, the **competencies of the Federal Network Agency** have been expanded: While the required efficiency parameters had been laid down under the law beforehand, the Agency can now determine them itself. The Monopolies Commission (2017b, 147) welcomes the fact that the Federal Network Agency can now conduct more realistic efficiency comparisons. At the same time, it acknowledges the grid operators' concerns that even small changes in the parameters can considerably change the resulting assessments (Schröder 2017) and recommends extensive testing before changing any parameters.

While grid operators still have a full regulation period (5 years) to eliminate inefficiencies,[37] the most efficient grid operators can now receive a financial bonus to make quick adjustment more attractive. The introduced **efficiency premium** grants the most effective grid operators a premium on their revenue cap (in contrast to a deduction as was the case before) of 1.25% per year or 5% over the regulation period. The regulated grid operators complain that, firstly, the 5% cap is too low to be effective (Monopolies Commission 2017b, 146). They, secondly, point out that only a very small number of operators can even qualify since only operators evaluated by the DEA ('*Dateneinhüllungsanalyse*') can participate (Monopolies Commission 2017b, 146). In consequence, the bonus will not show any significant effects (Schröder 2017). The Monopolies Commission (2017b, 146) does not object to the 5% cap but suggests that operators assessed by other methods should (with the necessary methodological adjustments) be able to qualify for the premium, too. This would expand the scope of operators incentivised by the premium.

Other stakeholders do not object to the 5% cap, either, but wonder whether the sharp cut-off at 100% efficient grid operators is sensible (DIHK 2016, 5-6). To promote innovative (digital) solutions, even operators below the 100% efficiency threshold[38] should be allowed to receive the bonus, because innovations can still lead to efficiency gains and thus lower prices (DIHK 2016, 5-6).[39] However, this would also necessitate additional tests to determine the actual productivity gains by new digital technologies.

A potentially more important aspect of the incentive regime is the level of the **general sectoral productivity factor** (Xgen) since it affects every grid operator. It was introduced to skim off some of the profits accruing to grid operators as natural monopolists even if they work 100% efficient, i.e., let consumers participate in gains from technological progress (Henseler-Unger 2016). Operators would like to see it abolished. They argue that determining a procedure to calculate the productivity factor and collecting the required data of a sufficiently high quality, is difficult (Monopolies Commission 2017b, 148). Nevertheless, the Federal Network Agency started the consultation process for the data collection. The deadline for submitting data is set to 31 May 2018.

The Monopolies Commission (2017b, 148) welcomes the preservation of the productivity factor and notes that it was set moderately low compared to non-regulated sectors, which makes the grid operators' complaints appear inappropriate. However, it is also open to the possibility that the empirical determination of the Xgen might lead to a factor of 0 as long as it is determined on a neutral and empirical basis.

A third factor influencing revenue caps is **return on equity**. On 12 October 2016, the Federal Network Agency announced its plans to lower the interest rate on new investments from 9.05% to

[37] This was criticised by the Monopolies Commission (2017b, 146) because the originally envisioned shortening of the regulation period and the time frame for eliminating inefficiencies would have created considerable efficiency pressures on the grid operators.

[38] The Association of German Chambers of Commerce and Industry (DIHK 2016, 6) suggests a threshold of 95 percent.

[39] In this sense, the current regulation mirrors the problem that innovative public procurement faces, namely that innovations are politically encouraged but more strongly discouraged by the incentives on the ground (also see Public Procurement and especially Public Procurement of Innovation).

6.91% for the next regulation period because the yield of ten-year bonds, which forms the basis for the calculation risk-free interest rates, is on a historical low (BNetzA 2016).

The lower return rate for operators has been criticised on several levels: One point is that in keeping with economic theory and existing data the market risk premium (and therefore the operators' risk allowances) should rise as well (BDEW 2016b, 11-13), which has been rejected by the BNetzA but is argued to be international standard. A second point is that the reference countries selected by the BNetzA are claimed to be not representative and bias the interest rate downwards (BDEW 2016b, 6-8). However, even if the cross-country comparison were be conducted in an unbiased manner, it would still fail to incorporate the higher demand for investments in Germany because of the energy transition (BDEW 2016b, 6).

The Monopolies Commission (2017b, 151) generally considers lowering the rate of returns appropriate given the low-risk environment but does not comment on the specific number. The Federation of German Consumer Organisations (vzbw 2016) also points out that grid operation is comparatively low in risk so that market arguments do not apply to the natural monopoly status. Instead, consumers should profit from the low risks as well, so that the vzbw demands even lower rates. The Association of Energy Market Innovators (bne) and the renewable energies provider *LichtBlick* argue that errors in assumptions actually bias the rate of return upwards and that it should be further lowered to 5.04% (LichtBlick 2016).

The level of the interest on equity capital therefore remains one of the main conflicts around the Incentive Regulation Ordinance. About 1,100 municipal utility providers and distribution grid operators filed a lawsuit at the Higher Regional Court ('*Oberlandesgericht*') in Dusseldorf against this low rate of return to equity capital. In January 2018, a legal expert expressed sympathy with the operators' arguments in court (Spiegel Online 2018). The senate decision was published on 22 March 2018. It judged the rate of returns invalid because they were calculated on a methodically flawed basis (Stuttgarter Nachrichten 2018). Hence, new rates have to be calculated on an improved methodological basis. However, the ruling is not yet final and the Federal Network Agency can still appeal to the Federal Supreme Court.

Strengthening transparency for consumers and investors and simplifying procedures for operators

The *third* category of changes introduced by the Incentive Regulation Ordinance revision **simplifies some of the procedural rules and enhances transparency requirements**. Grid regulation procedures are complex and often difficult to understand for both consumers and investors. While the incentive system for grid operators will basically remain unchanged, some procedures have been simplified and rules for more transparency have been integrated. The latter have raised data protection concerns and some lawsuits are pending (Pape 2016). While some argue that these rules are unlikely to influence investment decisions directly (Schröder 2017), others (DIHK 2016, 7) foresee that investors will profit from more possibilities of estimating and comparing risks, which will foster competition. The Monopolies Commission (2017b, 159) points out that in comparison to other EU countries, relatively few data are published in Germany. It therefore welcomes the enhanced transparency rules and recommends investigating whether even more extensive transparency requirements would be appropriate. In a related manner, the Open Government Network (Arbeitskreis Open Government Partnership Deutschland 2017) recommended a national action plan Open Government Partnership, which includes publishing all grid charges and energy (grid) data in an easily accessible Open Data standard at the end of 2018.[40] The Monopolies Commission (2017, 159) also points out that the incentives for regulators are currently biased in favour of the regulated since these can directly object to any new regulations whereas other stakeholders cannot.

Moreover, **simplified reporting procedures for small firms** will be maintained, thus saving them from administrative overload (Pape 2016). While the DIHK generally considers this right, it also warns that this must not lead to a systematic advantage for some firms (DIHK 2016, 7). Since small operators can choose which reporting method (standard or simplified) to use, the large fraction (80% of all distribution grid operators generating 10% of the grid costs) using this method implies that it is far more profitable for them. The Monopolies Commission (2017b, 147-148) also notes this point: While it considers preventing bureaucratic overload for small grid operators

[40] See section 5.1 on E-government for more information on Open Data.

important, too, the high number of firms considered 'small' seems overproportioned. In addition, since only the remaining 20% of companies deliver the data that form the basis for the efficiency comparison the calculation of the efficiency parameters is less robust (Monopolies Commission 2017b, 148). The Federal Network Agency will produce a report during the third regulation period on the structure and efficiency of grid operators using simplified procedures, which can then be used to evaluate the appropriateness of the conditions for using those procedures (Monopolies Commission 2017b, 148).

In general, keeping stability in the basic system of a cost examination in the basis year followed by a five year regulation period was welcomed by the regulated grid operators (Pape 2016; Schröder 2017). Other stakeholders, such as the Association of German Chambers of Commerce and Industry (DIHK 2016, 4) argue that with a shorter regulation period of four years the benefits for private and commercial consumers would be more impactful than the additional bureaucratic burden for the regulated. It also argues that this move would incentivise the deployment of digital technologies for smart grids since those have relatively higher operating costs (DIHK 2016, 4).

The evaluation report of the effects of the revised Incentive Regulation Ordinance will be published by 31 December 2023 by the Federal Network Agency (Monopolies Commission 2017b, 142).

3.1.3. Need for Further Reforms

Electricity Grids remain a bottleneck of the energy transition. Due to the increasing share of renewables, electricity supply becomes more decentralised and fluctuating. This requires investments in both distribution and transmission grids (as well as electricity storing solutions) in order to enlarge and stabilize markets so that businesses and consumers profit from a reliable electricity supply and affordable prices. This need for grid expansion is intensified by the continuing integration of European electricity markets as well. Currently, however, investments in distribution grids lag behind expectations. At the same time, the expansion of the transmission network is being realised considerably slower than envisioned, which seems to be largely due to public resistance and the administrative procedures necessary to include all stakeholders. This justifies regulatory adjustments by the government to address the relatively low investment as well as the slow realisation of projects.

Main points from the coalition agreement

The new government has acknowledged the need for further reforms. In its coalition agreement, it emphasises its focus on the energy policy triangle ('*Energiepolitisches Zieldreieck*') of the equally important goals of climate and environmental compatibility, security of supply and affordability ('*Umweltverträglichkeit*, *Versorgungssicherheit und Bezahlbarkeit*') (CDU/CSU and SPD 2018, 71-74). They plan to increase the share of renewable energies to 65% until 2030 (from 36% in 2017) and strengthen European cross-border cooperation. However, for these goals to be achievable, the capacity of electricity grids needs to be strengthened and the synchronisation of supply and demand needs to be improved. To this end, the federal government declares that it wants to:

- develop an action plan to optimise existing electricity grids and speed up the building of new ones. New and digital technologies are to be employed and better cooperation of grid operators is to be supported. The federal government also plans to reform and simplify the Grid Expansion Acceleration Act (NABEG). It acknowledges the necessity to improve economic incentives for grid optimisation.
- support and speed up the deployment of underground cabling instituted by the Act to Amend Provisions of Energy Grid Construction, focusing on alternating currents and existing bottlenecks where possible in order to improve public acceptance.
- continue to reform grid charges (after the Grid Charge Modernisation Act (NEMoG) was decided upon in July 2017 as a first step).
- improve the regulatory framework to incentivise digitalisation-related investments, especially in distribution grids.
- monitor affordability and security of supply and from 2019 onwards conduct stress tests to infer where actions are needed.

Monitoring and adjusting the regulatory framework to foster investments

The revision of the Incentive Regulation Ordinance aims at enhancing the weak investments by the distribution grid operators by increasing their guaranteed return on investment. This step is generally to be welcomed. Moreover, since the changes by the Incentive Regulation Ordinance only come into force from 2019 onwards its effects obviously need to be observed before any conclusive recommendations for further reforms can be given.[41] However, judging from the discussion beforehand, there are at least two relatively uncontroversial points to consider: First, while the new yearly capital cost adjustments are unanimously seen as improving the investment climate, the actual implementation might lead to overinvestments (due to the Averch-Johnson effect) (Monopolies Commission 2017b, 143). Since the efficient level of capital employment in a natural monopoly is hard to observe for outsiders (Averch and Johnson 1962), legislators need to think about if or when and how they wish to react to the predicted problem.

Second, more grid operators should be enabled to compete for the efficiency bonus. This requires the development and adjustment of methodologies used by the Federal Network Agency but can improve the overall incentives for efficiency-enhancing investments and innovations.

Continuing to secure public approval for a timely expansion

Due to massive public -and in some cases political- resistance, the envisioned grids, and especially transmission lines, take longer to be realised and become more expensive, e.g. by the requirement of underground cabling.[42] While the existing measures taken to gain public approval are already helpful and important, citizens in regions affected by grid expansion need to be continuously offered the opportunity to participate in an open and transparent process. Taking citizens' concerns seriously is a crucial step in avoiding further slow-downs of the grid expansion through protests, lawsuits, etc. To this regard, the efforts of the private transmission as well as distribution grid operators are an important contribution, which should be supported by the federal government when specific opportunities emerge. For example, Fratzscher et al. (2014, 11) point out that it is necessary to transparently discuss the costs of the energy transition if it succeeds and if it does not succeed as well as the pro- and contra-arguments.

It remains an open question, however, whether the massive extent of cost additions and delays to underground cabling are the most expedient solution. It should therefore be carefully investigated where and when conventional energy lines are sufficient and adapt legislation and planning accordingly.

Finally, the change to underground cabling has rekindled some controversy with regard to one-time versus regular compensation for landowners affected by cabling. Finding the balance between an investment-friendly business climate and securing stakeholder approval and creating reliable expectations for all parties involved will remain important.

Supporting the development and implementation of digital technologies for more efficient grid use

If existing power lines are used more intelligently, e.g., by using innovative digitalisation solutions, fewer capacities and thus less physical grid expansion might be necessary. However, the public discourse as well as subsidy policies with regard to digitalisation are currently almost exclusively focused on industrial production ('Industry 4.0') and the Internet of Things (IoT) (Expert Panel on Smart Energy Grids 2018). The digitalisation of infrastructures (not only in the electricity but also the gas, health, traffic, education and administration sectors) is currently very fragmented and receives comparatively little political emphasis (Expertengruppe Intelligente Energienetze 2018; Prognos 2018a). A stronger commitment to developing an overarching strategy for the digitalisation of infrastructure would seem necessary. However, the coalition agreement has so far failed to reduce fragmentation and offer clear visions strategies for infrastructure digitalisation.

[41] The next evaluation report by the Federal Network Agency is due before 31 December 2023.

[42] An alternative way to speed up the realisation of projects would be to reduce the information and participation rights for the public. This would lift a considerable bureaucratic burden from the investing firms. However, since this is obviously politically undesirable, decreasing administrative burden is an unlikely candidate for efficiency gains here.

While the introduction of the Act on the Digitalisation of the Energy Transition was an important milestone, the introduction and spread of smart meters must now be managed. For this, stakeholders from the private sector, politicians and consumers must be engaged. Besides technical questions, making the advantages for consumers salient as well as creating simple processes for implementing smart meters is crucial. In addition, fostering digital skills in the energy and grid operation sectors remains a challenge for the private sector, which must be matched by developing digital expertise on the public administrative and regulatory side (Expert Panel on Smart Energy Grids 2018).

The incentive regulation will have to account for the digital transition as well. Here a careful consideration of the balance of technology-neutral incentives and promoting digitalisation is necessary. Analyses as well as suggestions for incentive regulation come from, inter alia, the '*Expertengruppe Intelligente Energienetze*' (Expert Panel on Smart Energy Grids 2018).[43]

While a highly digitised system is necessary for coordinating the rising share of renewable energies, aspects of cybersecurity have been largely ignored so far (Prognos 2018a). This could lead to underinvestment if there are no standards and procedures for an inventive-compatible cost distribution, e.g. concerning the user-investor dilemma, and therefore requires legislative as well as technological attention.

In addition, while not being a priority, the continued work on cross-links with neighbouring countries remains important to strengthen the integration of a robust single European electricity grid.

[43] http://deutschland-intelligent-vernetzt.org/wp/expertengruppen/expertengruppe-intelligente-energienetze

3.2. Railways

3.2.1. Current Situation and Main Challenges

In the **long-distance rail passenger sector** ('*Schienenpersonenfernverkehr*', SPFV) the *DB AG* continues to hold a market share of 99% (Monopolies Commission 2017a). In the **regional rail passenger sector** ('*Schienenpersonennahverkehr*', SPNV) the market share of competing railway undertakings in relation to operating performance was 29.3% in 2015, measured in track kilometres (DB 2016). In public tendering, *DB AG* competitors won 47%, up from 46% in 2014. The **rail freight sector** finally reached its pre-2009 levels again in 2015. However, its modal split share remains at 17.5%, which is lower than it was in 2008 (17.7%). In spite of the overall unfavourable conditions (see below for a more extensive discussion), competition in the rail freight sector in the last years has increased: The market share of competitors providing transport services in the rail freight sector has risen from around 5% in 2002 to 39.1% in 2015 (DB 2016). This corresponds to about thirty larger private railway companies offering freight services besides the incumbent (FIS 2018a). Therefore, the market shares and the number of competitors have increased considerably (European Commission 2016f).

In sum, while in the **regional rail passenger sector** and in the **rail freight sector** competition seems to increase, in the **long-distance rail passenger sector** the *DB AG* continues to be monopolist. This has raised concerns by the European Commission who has repeatedly asked the Federal Government to increase competition, especially in this subsector (European Commission 2013, 2014a, 2015, 2016e, 2017). The Federal Government sees less need for action and points to the effective competition of the growing long-distance coach services (BMWi 2017d). Another argument is that thanks to digitalisation, consumers can compare transport services and prices much more easily. Together with the aforementioned liberalisation of long-distance coaches, the growth of low-cost airline carriers and the continued growth of ride-sharing platforms, this strengthens competition and thus lowers prices at least on certain connections (DB 2016). As an indicator for this, the substantial growth of long-distance bus journeys is often cited: When the market for long-distance travel was liberalised in 2013, about 8 million people used long-distance coach services. This number doubled to 16 million in 2014 and to at least 20 million in 2015, at least 40% of which declared to have switched from the railway as a mode of transport (DB 2016, 11). On the supply side, the DB AG points to the high investment costs in locomotives and wagons with simultaneously increasing competition by bus and private cars, which translates into a high risk and makes this segment unattractive for most private investors.

The Monopolies Commission has dealt with the question of de facto **substitutability** in its 2017 special report. It still sees an extremely low intensity of competition without any positive tendencies (Monopolies Commission 2017a, 10). The report cites several surveys which indicate that there is a certain degree of substitutability between traveling by bus and by train (Monopolies Commission 2017a, 84-85). However, this only applies to price-sensitive customers. For consumers who value comfort and speed more than low ticket prices, e.g. business travellers, buses are not or only in exceptional cases a substitute. The Monopolies Commission thus concludes that long-distance buses are only a partial competitor for the *DB AG* and more efforts are needed to increase competition in the long-distance rail passenger sector.

In late March 2018, the private operator *FlixMobility*, which already operates the *FlixBus* long-distance coach network, launched its *FlixTrain* passenger services (Railway Gazette, 2018).[44] In doing so, it relies on a model similar to its coach network where *FlixMobility* handles development, sales and marketing while operations and fleet management are provided by specialised partners. The first route is Hamburg-Köln, Berlin-Stuttgart is scheduled to follow in April 2018. It remains to be seen whether this new competitor, who is considerably cheaper than the incumbent, will significantly increase competition on the long-distance rail passenger sector in Germany.

Since the rail freight sector is more relevant for private businesses, the remainder of this section will focus on the latter.

[44] See Tagesschau: "Konkurrenz auf der Schiene. Flixtrain fordert den Platzhirschen heraus", article from 23 March 2018.

Incumbent DB AG still struggles with its cargo sector, announces grid investments

Single wagonload transports, which constitute one third of DB Cargo's orders, remain the sector with the lowest margins in rail transport (DB AG 2016, 20, 29). Other European rail companies have already reduced or completely shut down their activities, e.g. in Norway or the UK (FIS 2018b). Since *DB AG* (2016, 21) does not expect any improvement in the rail freight business in the foreseeable future in spite of the overall economic recovery, it outsourced the unprofitable rail freight business into the *DB Cargo AG* from the highly profitable *DB Schenker* logistics company on 1 January 2016 in the hope of being able to restructure it. As of March 2018, however, this has not (yet) been successful. *DB Cargo AG*'s earnings before interest and taxes (EBIT) show a deficit of €90 million, which is 12% worse than the year before and far from the originally envisioned break-even (Verkehrsrundschau 2018).

For the incumbent operator *DB AG*, the **repeated wage raises** with an average annual increase of about 3.5% since 2008, which lies well-above inflation and productivity gains, pose another relevant cost factor (Handelsblatt 2018). At the same time, an estimated number of 5,000 positions are unfilled in the whole *DB AG* (Handelsblatt 2018), which is an argument against deteriorating working conditions by wage cuts.

In February 2018, *DB AG* (2018b) announced its intention to invest a total €9.3 billion in its **grid infrastructure** in 2018, which translates into an increase of €800 million (or over 9%) compared to 2017.

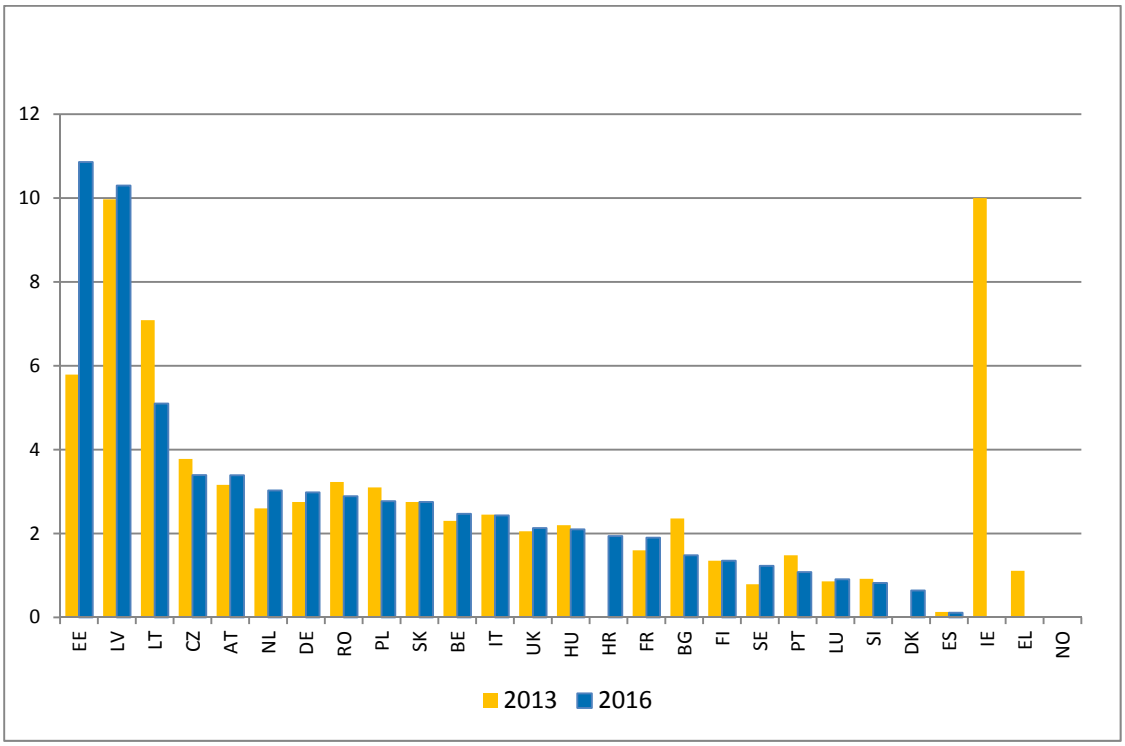
Overall costs of rail transport remain high with track access charges being the main problem

Rail freight transport remains a low-margin business. This is not primarily due to well-functioning competition, which has increased in the last few years. Instead, lobby groups frequently point out that compared to road or air traffic, rail traffic has experienced growing cost disadvantages in the last few years (e.g. Pro-Rail Alliance 2017). Chief among them are rising **electricity prices, taxes** and track access charges. **Track access charges**, i.e. charges for intercity services, in Germany are the highest of all Member States and thus remain one of the main obstacles for new entrants (European Commission 2017a, 48). Figure 24 shows the track access charges for European countries in 2013 and 2016 with Germany overtaking Latvia as the highest-charging country between 2013 and 2016.[45] At the same time prices for diesel fuel and HGV tolls have fallen, thus making road transport comparatively more competitive (Pro-Rail Alliance 2017).

These cost arguments are supported by the BMVI-sponsored centre for research and information on mobility and transport ('*Forschungs-Informations-System für Mobilität und Verkehr*', FIS 2016, 2018a). In addition, the FIS (2016) observes that the rail network in Europe has shrunk while roads have been significantly expanded in the last few years. In spite of these developments, train operators incur up to 30% of their production costs by track access charges, while road users hardly pay for their infrastructure.

[45] The load of track charges, however, is heterogeneously distributed among the different rail sectors: While in most Member States charges for freight trains are higher than for passenger trains, in Germany the opposite applies with freight charges being only half as high as in the intercity passenger sector (€3 vs. more than €6 per train-km) (European Commission 2016f, 6).

Figure 24: Track access charges for freight trains in Europe, 2013 and 2016



Notes: DK – break in time series from 2016; HR and DE – 2014 charges; LV – 2015 charges; LT and SI – arithmetic mean of min./max. charges; FR – some train services excluded; UK – increase only in line with inflation and currency movements; data for several EU countries missing, NO – does not apply charges.
Source: European Commission (2017a, Figure 28).

Lacking international coordination weakens the attractiveness of rail freight transport

Other disadvantages rail freight transport faces could be improved upon or solved but require better international cooperation.

First, **technical and organisational incompatibilities** between different EU countries cause competitive disadvantages for cross-border logistics (FIS 2016). For example, due to the history of monopolisation and market isolation in the rail sector, countries use different track systems. This necessitates the change of locomotives or the use of multisystem locomotives at the borders, which leads to higher costs, longer delivery times and less reliable arrival times at the destination (FIS 2016). Harmonising the EU rail network therefore remains a central task to make international rail freight transport more attractive. A corresponding **Interoperability Directive (2008/57/EG)** was passed in 2008 which makes interoperability of interfaces mandatory for all new or rebuilt locomotives or tracks (BMVI n.d.). However, even the smaller focus of harmonising interfaces (in contrast to harmonising the complete network) constitutes a costly and protracted endeavour, which requires combined international efforts. The same is true for differing safety rules between countries that can significantly raise the cost of cross-border rail freight (Zunder n.d.). Moreover, there is not a single language for railway operation and locomotive operators have to qualify in each country independently. In consequence, very few drivers are licensed to drive locomotives in more than one country (Zunder n.d.).

Second, since the road freight transport market was **liberalised** earlier (in two steps in 1994 and 1998) than the rail freight transport market (partial liberalisation in 1994, not completed yet), the former had a head start (Puls 2014, 35-36, 57). In addition, road transport does not constitute a natural monopoly (i.e. entry costs are relatively low) and transport services are a homogenous good, so that strong competition developed quickly (Puls 2014, 35). In contrast, prices of rail freight remain higher because neither the *DB AG* in Germany nor rail incumbents in other countries are privatised or consistently regulated in a competition-increasing manner. If international rail freight transport is to become more attractive, the rail market liberalisation processes (especially with respect to unbundling) not only in Germany but also in the neighbouring countries will have to be strengthened (FIS 2016). Although the rail freight market was officially opened in 2007 (following an EU directive), there remains potential for discrimination, e.g. in awarding train paths

('*Trassenvergabemodalitäten*') or limiting access to ancillary services ('*Netznebenleistungen*') (FIS 2016).

Some negative trends are exogenous

Rail transport suffers from certain **systemic disadvantages**, which cannot be solved by law (FIS 2016). The necessity of train schedules limits the temporal flexibility of rail transport. High security standards drive up costs for train operators, which are constantly monitored, in contrast to road freight transport, where security, driving times and social legislation is only checked for a small random sample. Production structures have shifted from bulk goods ('*Massengüter*') to general goods ('*Stückgüter*') (FIS 2016; Puls 2014, 48-49). This lowers demand for the more cost effective block train ('*Ganzzugverkehr*') in favour of hardly profitable single wagonload transports ('*Einzelwagenverkehr*', EWV).[46]

In summary, while the number and market share of competitors in the rail freight segment has increased, the overall situation is not promising. Due to high regulatory costs compared to road freight and a number of unfavourable secular developments and disadvantages, the rail freight sector currently lags behind other forms of logistics. Considering the expected 40% growth (from 2010) of freight traffic until 2030, considerable transport and environmental issues are likely to arise if rail freight transport is not strengthened (BMVI 2017a, 5).

3.2.2. Main Reforms 2013-2017

The **Act to Strengthen Competition in the Rail Sector** ('*Gesetz zur Stärkung des Wettbewerbs im Eisenbahnbereich*'), which contains the **Rail Regulation Act** ('*Eisenbahnregulierungsgesetz*', ERegG) as a centrepiece, went into force on 2 September 2016 (Federal Railway Authority 2016).[47] The aim of the Rail Regulation Act is to improve competition in the rail sector further. The act implements **EU Directive 2012/34/EU** on establishing a single European railway area (SERA).[48] It contains different measures to foster competition in the railway sector, e.g. a provision restricting increases in track access charges for regional passenger services provided under public service obligation contracts. Given the limited ability of freight services to pay higher track access charges, it can be expected that long-distance passenger charges will further increase when the ongoing revision of the track access charges by the German infrastructure manager *DB Netz AG* shall be completed and enters into force in December 2018 (see also *Main points from the Rail Freight Masterplan*).

Main points from the Rail Freight Masterplan

The BMVI (2017a) together with the Pro-Rail Alliance and other stakeholders developed the **Rail Freight Masterplan** to position rail freight transport as the central element of a sustainable transport strategy.[49] The masterplan focuses on three aspects, namely expanding and improving the existing infrastructure, using the existing potential for innovation (e.g. by digitalisation) and improving the transport policy framework (BMVI 2017a, 8). The most important actions are (BMVI 2017a, Pro-Rail Alliance 2018a):

- Reduce **track access charges**. For a significant reduction in charges €350 million are to be earmarked in the 2018 federal budget, which should reduce the related costs by about 50%. This is not intended as a one-time measure but as an annual subsidy to compensate the regulatory advantages other modes of transport are currently enjoying.[50]

[46] The British "NewRail" Research Centre at Newcastle University (see Zunder, n.d., and www.ncl.ac.uk/newrail) are conducting research on innovative rail transport, tackling some of these very issues.

[47] In its coalition agreement, the new Federal Government announced to re-evaluate the contents of the Rail Regulation Act in this legislative period in order to strengthen competition further.

[48] The second part of the Act to Strengthen Competition in the Rail Sector amends the '*Allgemeines Eisenbahngesetz*' (AEG) mainly in changing reporting requirements and increasing insurance sums and is therefore not directly relevant for questions of competition (Federal Railway Authority 2016).

[49] In its coalition agreement, the federal government has announced to implement the rail freight masterplan, even though most of the measures presented here are only included in a weakened and less precise wording (CDU, CSU and SPD 2018, 77-79; see Main points from the coalition agreement (7 February 2018)).

[50] See Tagesschau „Masterplan Schienengüterverkehr". Bund will Gebühren für Güterzüge senken, article from 26 June 2017. In the coalition agreement, CDU, CSU and SPD (2018, 79) only announce to 'consequently

- Reduce the **regulatory costs** on rail freight transport, e.g. by exemption from the EEG surcharge, to compensate the rising costs in the last few years.[51]
- Expand the **740 metre network** as quickly as possible to accommodate EU standards and enable the deployment of longer and thus more efficient freight trains. Develop solutions for trains of more than 1,000 metres length.
- Upgrade the **six major rail hubs** (Hamburg, Cologne, Frankfurt, Ludwigshafen/Mannheim/Heidelberg/Karlsruhe, Munich, Hanover) to remove bottlenecks.
- Invest in **further electrification** of the rail network and in electrically powered solutions for initial and terminal hauls to and from the railways.
- Expand and invest in **digital infrastructures** within the *DB Netz AG* and modernise its IT systems, e.g. with funds from the BMVI's Investment Programme for the Future ('*Zukunftsinvestitionsprogramm*').
- Starting the federal research programme entitled 'The Future of Rail Freight' *('Zukunft Schienengüterverkehr'*).[52]

An estimation of the overall costs of the masterplan does not exist. Only a few aspects have been quantified in terms of sums invested and amounts that will likely need to be invested (BMVI 2017a, 39-41):

- Equipping around 100,000 freight wagons with telematics and sensor technology to adapt the digitalisation until the end of 2020 will probably require at least €50 million. It is not yet clear, however, whether this sum will include public subsidies.
- Converting the entire wagon fleet to noise-reducing braking systems (retrofitting and procurement of new wagons) will likely amount to over €1 billion between 2013 and 2020. 15% of this amount is expected to consist of public subsidies.
- The research programme 'Innovative Freight Wagon' ('*Innovativer Güterwagen'*), which works on the evolution of the freight wagon from different perspectives and is funded by the Federal government, will require about €5 million.

Outlining the Deutschlandtakt

The ***Deutschlandtakt*** follows the Swiss model of a synchronised timetable for all of Germany's passenger transport (BMVI 2017c). It aims to provide better and more reliable connectivity and coordination of all public freight and passenger traffic carriers with short waiting times, not only between agglomerations but also in rural regions. A synchronised timetable would also lead to more reliability in the availability (and likely a higher overall availability) of rail tracks (BMVI 2017c), increasing the flexibility and thus attractiveness of rail freight transport.

Preconditions are significantly increasing infrastructure investments in junctions and bottlenecks as already mentioned in the Federal Transport Infrastructure Plan 2030 *('Bundesverkehrswegeplan 2030'*) (BMVI 2016, 2017c). This could significantly increase the competitiveness of the rail passenger sector and the rail freight sector compared to road transport. In addition, increasing the modal split of rail transport would help to decrease climate-damaging emissions. The respective highly synchronised timetable 2030plus integrating long-distance and regional-distance rail passenger transport as well as rail freight transport shall be finished in 2018 (BMVI 2017c).

The BMVI (2017b) estimates that about €42 billion will be invested to realise all track construction and expansion projects that are necessary to implement the *Deutschlandtakt*. While these

pursue the lowering of track access charges' without offering any numbers or reference to permanent measures.

[51] In the coalition agreement, CDU, CSU and SPD (2018, 79) only state that they 'will examine how single wagonload transport can be conducted in an economically sustainable way' without offering any specifics or consideration for other rail freight subsectors.

[52] No further information on its contents or costs are currently available.

investment will certainly also benefit the rail freight transport, it primarily caters to passengers' needs.[53]

Main points from the coalition agreement

The federal government has pledged to double the number of rail passengers until 2030 and shift more freight transports from the roads to the rails in its **coalition agreement**. At the same time, it demands better services, reliability and innovations from the rail companies. Among other things, it has also committed to implementing the measures outlined in the **Rail Freight Masterplan** (CDU/CSU and SPD 2018, 77-79; see *Main points from the Rail Freight Masterplan*). With regard to the Rail Freight Masterplan, the federal government intends to:

- permanently lower track access charges to make rail transport more competitive,[54] and re-evaluate the contents of the Rail Regulation Act (*'Eisenbahnregulierungsgesetz'*, ERegG) in this regard. The new Long-Distance Rail Freight Network Funding Act (*Leistungs- und Finanzierungsvereinbarung*, LuFV III, with LuFV II ending after 2019) is to focus on availability and contain incentives for a more customer-oriented construction site management (see *Improving the resiliency of rail networks*).
- realise the prioritised projects for the creation of a nationwide 740 metre network for freight trains until 2020.
- electrify 70% of the rail network until 2025 with a subsidy programme for both electrification of tracks as well as procurement of electricity-powered locomotives. [55] The focus will be on regional railway lines.
- support digitalisation measures such as the expansion of the European Train Control System (ETCS) and the corresponding upgrading of locomotives.[56] Research and funding will be provided to support the automation of rail freight traffic and autonomous trains. In a related manner, an independent research centre for rail traffic is to be founded to conduct application-oriented engineering-based research.

Since single wagonload transports remain the sector with the lowest margins in rail transport (DB AG 2016, 29), the federal government intends to examine how it can be operated more profitably (without giving any specifics).

The realisation of the *Deutschlandtakt* is also planned. After the timetable has been decided upon, which is scheduled to be completed in 2018 (BMVI 2017c), extension and new construction projects necessary for a successful implementation are to be built preferentially. This includes rail freight lines.

The *DB AG* will remain state-owned. In order to fulfil its public service obligations better, political common good-related goals such as the increase of the modal split of rail transport are to be set as explicit contractual aims for the whole *DB* group. To strengthen the position of rail transport in the government, a high-level federal government representative for rail traffic will be appointed.

The *mFUND*, which supports open innovation in the areas of innovative traffic solutions and mobility 4.0, will receive funds until at least the end of 2020 (CDU/CSU and SPD 2018, 121).

The Pro-Rail Alliance (2018b) welcomes the fact that the most important aspects developed in the Rail Freight Masterplan were taken on by the Federal Government. Critics, however, point out that

[53] In order to make the former more attractive for businesses, a focus on the rail freight masterplan rather than the *Deutschlandtakt* would seem appropriate. This could be justified under environmental aspects but it is unlikely to happen under the new federal government, which withdrew from its former ambitious environmental plans.

[54] Up to now track access charges have been continually raised every year by the DB AG. In addition, DB AG filed a lawsuit against the Federal Network Agency after it had limited the requested increase in standard track access charges in January 2018 (Heinrici 2018). The Federal Administrative Court, however, has not decided yet.

[55] The respective number in 2017 was 60% (Pro-Rail Alliance 2017).

[56] In the Rail Freight Plan (BMVI 2017a, 18) it is estimated that equipping a single locomotive with ECTS ranges between €300,000 and €700,000, depending on the model and the number of countries it needs to be certified for.

while important financial reliefs and investment programmes are envisioned, no strategy for financing these is laid out (Prognos 2018a).

3.2.3. Need for Further Reforms

Due to the natural monopoly status of the railway networks and the only partially unbundled DB AG, competitors still face high entrance costs compared to road freight transport. However, the unbundling of the *DB AG* is a regular point of discussion between the EU and the Federal Government and too complex to be adequately presented here. It is therefore excluded from the subsequent discussion, which focuses instead on aspects that are pertaining to rail freight transport in particular.

In general, rail freight transport in Germany currently is too expensive and too inflexible compared to road freight transport to attract more private investors and clients. This is unlikely to pose a serious obstacle to growth of private businesses in Germany as long as the substitute of road freight transport is widely available.

However, road transport is significantly more environmentally harmful. Thus, the strong growth of freight traffic (of about 40% from the 2010 basis) expected until 2030 (BMVI 2017a, 5) makes a shift of the modal split in favour of rail transport advisable – not only to reduce environmental damage but also to reduce economically wasteful road congestion and increased depreciation of road infrastructure. While there have been recurring public commitments to railway transport, little has been achieved to actually make it more attractive for both private persons and businesses. The new German government committed to doubling the number of railway passengers until 2030. In its coalitional agreement it describes a number of measures it would like to take with regard to improving railway services for individuals as well as for private businesses (see '*Main points from the coalition agreement*'). However, since it hardly mentions how these aims are going to be reached nor quantifies how much will be spent and where it will come from, it seems unlikely that important milestones will be reached during the next legislation period (see, e.g., Prognos 2018b, for a comment). In order to make rail freight transport more attractive, a variety of measures can be taken:

Implementing the Rail Freight Masterplan

Many actions that could make rail freight transport considerably more attractive have already been laid out in the **Rail Freight Masterplan,** which was written by the BMVI in close collaboration with a wide range of stakeholders. The measures prominently include the halving of the track access charges, possibly with a focus on rail freight, and the reduction of taxes and the EEG surcharge to make the level comparable to the costs incurred by road freight transport.[57] It also includes supporting investments in the railway network, especially at bottlenecks, to improve the flexibility rail freight businesses can offer. The new Federal Government has committed itself to implement the Rail Freight Masterplan. How the Masterplan can be financed is unclear, however. Rail traffic interest groups have argued for financing rail infrastructure investment by cutting (indirect) subsidies for road transport, e.g. by introducing a motorway toll for all users and adjusting car taxes (also see the discussion in section 0 on Motorways).

Supporting the digitalisation of railway infrastructure

Digitalisation promises to significant efficiency gains in the rail sector. 'Smart' tracks and 'smart' trains can make the planning and operating of the railway network and of the trains more efficient e.g. by reducing the capacities and manpower needed. If European standards and interfaces are consistently implemented, this will likely decrease the costs of domestic and intra-European transportation for private businesses in Germany and Europe.

The incumbent provider DB AG (2018) started the programme '*Digitale Schiene Deutschland*' in January 2018. Its main goal is to increase rail capacities by up to 20% by investing only in **new interlockings** (DSTW) as physical infrastructure and not in new tracks. It relies on the **European Train Control System (ETCS)**, which offers a pan-European standard for digital train control. Since many of the old interlockings will have to be replaced in the next few years anyway, *DB AG*

[57] Alternatively, the indirect subsidies for road and air transport could be lowered. This would be in line with institutional economics arguments that actions (e.g. road use) and responsibilities (e.g. for maintaining the roads) should coincide to keep incentives aligned. This is, however, politically much more difficult to implement.

plans successively replacing them with a new standardised model, which needs less maintenance and offers better features. Using the new system, a shorter succession of trains at comparable (high) levels of safety becomes possible, while overall safety is increased through additional sensors in tracks and trains detecting obstacles or damages early. A higher succession of trains with lower energy consumption and lower maintenance costs will reduce prices for passenger as well as for freight transport. Since this technology, once installed by the incumbent, is open to all market participants, it is expected to benefit competitors as well. Moreover, due to its standardised nature, it is also predicted to facilitate and increase European cross-border rail traffic. Complying with the EU requirements the Federal Government has announced its intention to support ETCS-related measures. However, since it has so far lagged behind its own promises pertaining to ETCS, it is important to monitor and demand the actual implementation.

However, the lobby alliances (VDB 2017, 4) point out that Germany has so far not executed its pledges to the EU: It committed to install ECTS on the four main rail freight corridors between 2015 and 2020. However, in contrast to other European countries, e.g. Denmark, it is still far from achieving this goal. The VDB (2017, 4) also argues that the government should subsidise installing ECTS in trains, since it transfers infrastructure functions from the tracks to the individual trains. This measure would be especially important for smaller competitors.

Moreover, supporting the introduction and testing of sensor systems, locating technologies and obstacle recognition should be considered. Promoting safety as well as efficiency, these technologies can lower the costs of domestic and European transport in an environment-friendly manner.

However, in order to successfully implement and operate digital systems, most staff will likely have to develop and (continually) improve their **digital skills**.

In order to create incentives for innovative operators, **tendering conditions** have to be adapted. Currently, tenders are often based exclusively on price, as this is an easy to measure metric. Qualitative criteria, such as different forms of environmental impact, new or additional amenities for passengers, etc. are discarded or discounted. This is likely due to the additional work caused by more complex contract awarding procedures and by the lack of support by decision-makers. Consequently, there are hardly any incentives for public procurers to relinquish established procurement patterns in favour of qualitative criteria (Falck and Wiederholt 2013). If innovative solutions and the businesses offering them are to be supported, which is in the interest of passengers and the public, it seems advisable to move from accepting the cheapest offer to accepting the most economical advantageous tender" (MEAT), i.e., broadening selection criteria to include qualitative aspects such as sustainability or innovation (see *Public Procurement* for more details, as well as the corresponding discussion in *Motorways*). In addition, the VDB (2017, 6) suggests to make participation for **SMEs** in R&D discussions easier and cheaper to incorporate their innovative potential. This would entail, e.g., standardising and simplifying procedures as to lower the administrative costs of participating.

Investing in the railway network to reduce bottlenecks and increase electrification

As long as digitalisation efforts are not accompanied by **investments in the physical infrastructure** going beyond aspects directly related to digitalisation (such as sufficient track lengths or a sufficient number of tracks permitting overtaking), the potential of digitalisation will not be fully realised (VDB 2017, 3).

One important precondition for fostering digitalisation in the railway sector is the **comprehensive electrification** of railway tracks. Since this also contributes to lowering emissions by substituting for electricity from renewable energies, electrification constitutes an important next step. Since the new government only committed to increasing the share of electrified tracks by ten percentage points up to 70%, it incurs the danger of further putting rural regions, whose less-frequented tracks are naturally electrified last, at a disadvantage. Since large production plants, which are the most likely customers for rail transport, are often not centrally located, neglecting less-densely populated areas will harm their attractiveness for (local) producers and contribute to the urban-rural gap.

On the other hand, it can be argued that already highly frequented passages should be relieved preferably. This implies focusing on the bottlenecks, e.g. identified in the Rail Freight Masterplan, and **expanding tracks** where necessary, e.g. to accommodate longer trains or overtaking or making the network more resilient in crucial places (see *Improving the resiliency of rail networks*).

Improving the resiliency of rail networks

A potentially important blind spot is the **resiliency** of the railway networks, which is important to ensure smooth and uninterrupted operations. Resiliency of the railway network includes several different aspects:

While the potential of digitalisation is undoubtedly enormous, increasing digitalisation also makes railway transport susceptible to either failures of the digital infrastructure or hacking.[58] Developing comprehensive **digital security standards** is therefore paramount. This point, however, has not received any attention in the current coalitional agreement draft (Prognos 2018b).

Several violent storms, most recently in October 2017 and January 2018, have shown that the physical railway network in Germany is currently vulnerable to **extreme weather events**. After the storms, important railway connections could not be used for days. Since the occurrence of these events is likely to increase due to climate change, not investing in a more resilient railway system could potentially disrupt and endanger productivity and growth of businesses relying on freight transport.

Lacking resiliency and **international cooperation** were illustrated after an accident in Rastatt, South-West Germany, when on 12 August 2017 a highly frequented track section had to be shut down for over seven weeks. Passenger trains as well as freight trains were cancelled substituted by rail replacement bus or truck services or redirected to considerably longer routes. The Network of European Railways (NEE 2017) estimated that each week €12 billion in revenues were lost due to the interruption for the all rail freight companies. For example, the Swiss *SBB* alone calculated with €22.8 million of lost revenue and the *DB AG* with €75 million, €45 million of which were incurred by the DB Cargo (Verkehrsrundschau 2017, 2018). This illustrates how vulnerable the rail network in Germany currently is and how this negatively effects the rest of Europe.

In the aftermath of this event it has been severely criticised that *DB AG* did not have any 'plan B' when a serious incident like this one happens (Plusminus 2017). The inability of *DB AG* has shaken the trust of many private companies: The Rastatt incident led to a decline in orders of over 20% for rail freight companies and the long-term consequences of businesses avoiding rail transport is not yet clear (EGTC 2017; Plusminus 2017). Rebuilding trust by guaranteeing a reliable delivery of goods therefore constitutes one of the main challenges for the rail freight companies in the near future. This, however, is only possible with adequate support and infrastructure investments by the governments in Europe.

As a reaction to the Rastatt incident, *DB AG*, *SBB* and the Rhine-Alpine Corridor started efforts to institute operational guidelines for cross-border freight transports, among them standardizing technical and staff requirements and instituting a second operating language for train drivers to enable seamless international transport and reduce waiting times at border crossings (DB Netz AG 2017; EGTC 2017; Verkehrsrundschau 2017). In addition, international crisis management along the main freight routes have to be improved. Ideally, construction coordination along the construction corridors is to be intensified while potential detour routes are planned and kept open while rail freight companies are integrated in the whole process (DB Netz AG 2017). In 2018, a new incident management is planned to be presented to the European Commission (Verkehrsrundschau 2017). These challenges cannot be mastered by the DB AG alone but require better **international cooperation and coordination**, which demands time and resources from all stakeholders.

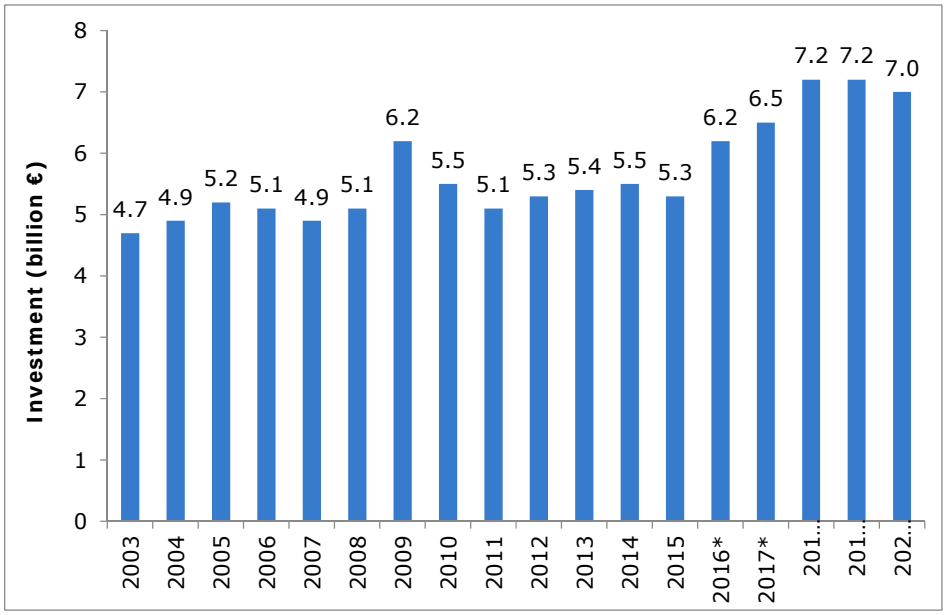
[58] The latter happening at a large scale most recently in Spring 2017 where the electrical display boards on the train platforms were unusable for several hours (FAZ 2017).

3.3. Motorways

3.3.1. Current Situation and Main Challenges

Investment in federal motorways in Germany has been weak for years. This was already documented by the commission "*Zukunft der Verkehrsinfrastrukturfinanzierung*" (Daehre et al. 2012) in 2012 and can still be seen in the stagnating amount of investment in federal trunk roads depicted in Figure 25. Only the projections from 2016 onward show significantly growing investments. Not only has this been noted by political actors such as the Federal Government or the European Commission (European Commission 2016e). It is also mirrored in, for example, Germany's continually falling grades in transport infrastructure in the Global Competitive Index of the World Economic Forum (World Economic Forum 2017).

Figure 25: Investments in federal trunk roads by the federal government, 2003-2020 (billion €)



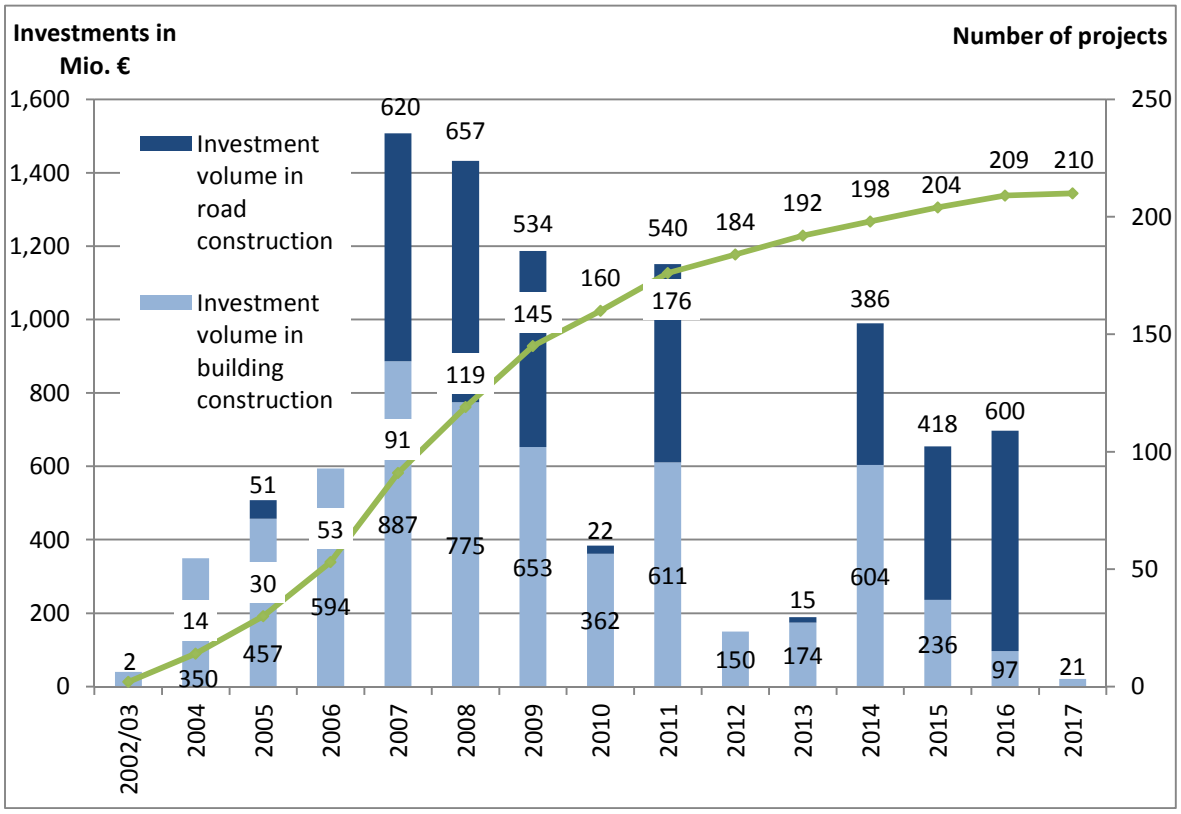
* targeted; ** planned
Source: ProMobilitaet (2016).

While public expenditures have stagnated for years, the investment backlog does not seem to be considered an obstacle for private businesses yet. This is illustrated in, e.g., in the recent business survey by IW Köln (2017) in which deficiencies in infrastructure only ranked 8th out of 15 factors. One in five of the surveyed businesses saw it as a strong impediment for its investments. In contrast, bureaucratic burden, which was ranked first, was seen as problematic by more than half of all businesses, and even the least problematic aspect, uncertainty due to technological developments, posed a problem for over 10%. In addition, in its latest report, the IW Köln (2018, 40-41) observes that thanks to a number of new infrastructure (maintenance) projects, the road situation is most likely going to improve slightly in the near future. Nevertheless, IW Köln admonishes that these maintenance investments need to be sustained and complemented by selective investments in bottlenecks.

Even though road infrastructure is currently not a pressing issue for most businesses, maintaining a well-functioning road system is an important permanent task. Since continuous investment in infrastructure is obviously expensive, activating private capital in place of or in addition to public investment could improve the overall situation. The most prominent way for this would be in the form of **Public Private Partnerships (PPPs)** (e.g. Fratscher et al. 2014, 3, 30). Provided there is a proper contractual framework, PPPs can in principle lead to lower costs over the entire project cycle than traditional projects. However, PPP activities in infrastructure construction projects are comparatively rare in Germany, particularly those in in motorways. According to the German PPP database released by *Partnerschaft Deutschland* (2017), there have been a total 210 PPP projects signed from 2002 until January 2017, among them 19 with respect to highway construction.

Besides the cumulative number of projects, Figure 26 also shows the investment volume of PPP projects in motorway and building construction. The investment sum in motorway construction oscillates, which is largely because there are only a few projects with a very high volume so that no clear trend emerges.

Figure 26: Signed PPP projects in motorway and building construction by investment volume, 2002 to 2017



Source: Partnerschaft Deutschland (2017).

One reason for the continually low level of PPP projects is that, especially in motorway construction, **public experiences** have so far been unfavourable. The most prominent recent example is the private part 'A1 Mobil' of a PPP project, which sued the Federal Republic of Germany for additional money in August 2017. This kind of renegotiation tactics decreases public acceptance and the openness of public bodies to engage in PPP. In addition, the Federal Supreme Audit Institution criticised that in 5 out of 6 PPP motorway projects completed by the end of 2015, additional costs of close to €2 billion had occurred while the BMVI rejected this number (Greive 2016). This kind of public disagreement has fostered the opinion with many critics that some policy makers want to realise PPP projects on purely ideological and not economic reasons.

Furthermore, many public actors reject PPP projects on principle. One prominent example for this are the labour unions, who publicly advertise against any kind of private or PPP-based engagement in building motorways (see e.g. the labour union statement in Fratzscher et al. 2014, 13-16). They argue that theoretical analyses (e.g. Beckers et al. 2014) as well as empirical evaluations from both academia (Hodge and Greve 2009) and policy makers (House of Commons 2010; Presidents of the State and Federal Supreme Audit Institutions 2011) have shown that PPP do not hold their promises of lower costs and improved efficiency. The labour unions (e.g. recently summarised by Funk 2016) claim that economic feasibility studies are biased in favour of PPP and should be adjusted. They maintain that traditional public procurement is judged too harshly and demand that, independent of founding or supporting infrastructure companies (such as the *Partnerschaft Deutschland*), personal and financial capacities are to be strengthened on the municipal level so that municipalities are not completely dependent on external expertise (labour union statement in Fratzscher et al. 2014, 13-16).

The negative image of PPP is also fostered by **the repeated criticisms of the State and Federal Supreme Audit Institutions** (Presidents of the State and Federal Supreme Audit Institutions 2011; Federal Supreme Audit Institutions 2013). The BMVI ameliorated some of their criticisms, which contributed to adaptations in PPP execution (e.g. the switch from toll-based remuneration (F model) to availability-based compensation (V model) in the third wave of PPP models). However, other issues such as the potential incentive to distort economic feasibility analysis in favour of PPP or the discrimination of SMEs remain. The Supreme Audit Institutions (BRH) still critically observe all developments (BMVI and BRH 2015, 17-19, and subsection "Need for Further Reforms").

In an extreme case, the state of Saxony decided in August 2014 to stop conducting PPPs on the state level altogether after the State Supreme Audit Institution and the State Parliament's Finance Committee had severely criticised the inefficiencies of existing PPPs in Saxony (MZ 2014).

3.3.2. Main Reforms 2013-2017

To fight the investment backlog, the Federal Government has pledged to increase public spending on motorway infrastructure. In 2016 €7.355 billion were earmarked in the federal budget for federal trunk roads, which is well above the €7.2 billion projected in Figure 26, and the number is likely to increase for the next years (BMVI 2017d, 154). Of these, two thirds are planned to be used for road maintenance and one third for new construction projects (BMVI n.d.a).

As part of the restructured fiscal relations between the Federation and the federal states, the Federal Government and the federal states have agreed on 14 December 2016 to introduce a **new administrative structure for federal motorways** (*Infrastrukturgesellschaft für Autobahnen und andere Bundesfernstraßen* (IGA), BMWi 2017). Its purpose is to realise efficiency gains in the life cycle of federal trunk roads and to alleviate the problems the federal states are having with contract management for federal trunk roads. Currently, for example, funds provided by the Federal Government are often not invested because the federal states, which are responsible for the planning procedures, lack capacities for planning the construction or maintenance of specific roads (IW Köln and GDV 2016, 9-11; Kaiser 2017). Therefore, the changes to the Basic Law envisage that the Federation shall take on the administration of the federal motorways. The management of around 39,000 km federal trunk roads will remain under state management but can be transferred to the Federation if the respective federal state requests this (BMWi 2017). The IGA, which will be located in Berlin and probably maintain ten state branches, is to start operations on 1 January 2021 (BMWi 2017; Focus Online 2017). The limited liability company (*GmbH*) will not be permitted to take out loans but has to finance itself from private car and truck tolls. Direct participation of third parties in its financing is precluded by the basic law (§90(1), (2)). The complete opening of the federal or state road networks to PPP projects will not be possible, either: Federal law limits the length of PPP projects to 100 km. However, this restriction is unlikely to be binding in the near future since all existing and envisioned PPP projects are of shorter lengths and there is no limit set to the maximal number of projects. Critics even fear an 'indirect privatisation' because of the relatively high 100 km limit, e.g. the Green Party (Kindler 2017) and the Left Party (Troost 2017). More moderate sceptics (e.g. the DGB labour union, Körzell and Neumann 2017) call for close monitoring of the development of the legal status of the IGA and of the number and quality of resulting PPP contracts.

In summary, the introduction of the IGA will likely not impair PPP projects. In contrast, a centralised administration could, especially if it is better equipped with personnel and expertise than the federal states are, improve the prospects of successful PPPs by strengthening the public side in tendering and negotiations.

A second means of financing infrastructure could potentially be the introduction of a motorway toll (*Infrastrukturabgabe*) for private cars. Similar to the existing HGV toll, this would (at least partially) shift the financing from taxes to user fees. While in the model envisioned by the BMVI all users will be required to pay the toll, it is intended to reimburse nationals by cutting the motor vehicle tax by (roughly) the same amount so that non-nationals will be over proportionally affected by the toll. An assessment by the BMVI (2017e) estimates the motorway toll will generate an additional net revenue of about €3.77 billion p.a., €500 million of which are scheduled to be invested in the motorway infrastructure.

The bill passed in the Bundestag on 27 March 2015 and was accepted by the Bundesrat on 31 March 2017. The European Commission opened infringement procedures due to an assumed discrimination against non-national EU citizens in June 2015 but after consultations with the

Federal Government agreed to close the case in December 2016 (European Commission 2016g). However, it is still likely that the envisioned format of the motorway toll will be realised any time soon for several reasons. First, Austria filed a lawsuit against Germany before the European Court of Justice in October 2017 because of indirect discrimination on grounds of nationality and infringement of the free movement of goods and transport services (European Court of Justice 2017). Then, similar to early PPP motorway projects, a remuneration based on the number of users (and not on availability) is envisioned, which would likely lead to the same problems: Since the actual numbers of non-nationals crossing the border is not known, it is unclear what the user-based remuneration has to be in order to operate the system profitably. Lastly, a number of administrative and technical problems have already slowed down the implementation process considerably (Delhaes 2018). For example, data protection issues when identifying motorway users have not been solved. Contracts for potential private operators have not been finished on time and the cashier stations at the borders still pose a problem because they will have to accept different currencies in a cash as well as electronic payments, thus increasing maintenance costs. Therefore, although a shift from tax-based financing to user-based financing can in general be advisable, the current model envisioned by the Federal Government is far less desirable not only on equity but also on practical grounds.

Since public authorities often lack the required planning and negotiating capacities, the Federal Government has set up a special advisory service to provide support in the implementation of public investment projects. The former *'ÖPP Deutschland AG'* was reorganised into the '***Partnerschaft Deutschland – Berater der öffentlichen Hand GmbH***' (PD) in January 2017 while still being 100% state-owned. The consultancy's mission is to support public authorities in planning and executing their investment projects, irrespective of the selected procurement method, while also exploring possibilities of using private capital and expertise more extensively. Evaluations of projects are in some cases conducted by independent institutes and surveys of the public partners are conducted regularly, although the quality of evaluations does not seem to be consistent.

As far as **current PPP projects** are concerned, 11 "next generation PPP" motorway projects covering approximately 670km were announced in April 2015 (BMVI n.d.b). While they still include traditional toll-based models, availability-based models are possible as well. The tendering process for some of the projects has already been completed. In this new, third generation capital from institutional investors will be permitted (BMVI 2015b). The construction and operating company can either opt to issue bonds instead of or in addition to traditional bank loans. Or institutional investors can take the lead and engage construction and operating companies. Due to the low capital market interest rates, PPP offer a relatively low-risk investment opportunity and should therefore be attractive.

Main points from the coalition agreement

According to the **coalition agreement** (CDU/CSU and SPD 2018, 74-75), the federal government plans to continue its motorway policies and execute projects decided upon in the last legislative period. Among other things, it plans to

- keep public investments in transport at least on its existing level, focusing on maintenance rather than construction.
- complete the first three generations of PPP motorway projects if their economic efficiency has been demonstrated on the basis of the criteria agreed upon with the Federal Supreme Audit Institution. Contracts will be published if the contractor agrees.
- institute the new administrative structure for federal motorways (IGA) with the involvement of labour unions and staff councils. Privatisation of either the motorway infrastructure or the IGA is rejected.

Since the wording is relatively vague and no further references to PPP are made, the topic seems relatively unimportant to the new government and no major changes are to be expected.

3.3.3. Need for Further Reforms

While road quality is currently not considered a problem by most businesses, maintaining a well-functioning road network is an ongoing task. Public investment could potentially be supported / substituted by private investment in the form of Public Private Partnerships. However, in light of the existing political and societal climate, it seems unlikely that private investment will significantly

contribute to reducing the investment backlog in the federal motorway system. PPPs are highly controversial in the German public as well in politics, with a sizable number of public actors and citizens rejecting them. Nevertheless, PPPs remain a way for using private funds for public infrastructure, which can and has in several cases benefited all parties involved. In order to ensure that PPPs consistently yield profits for both public and private actors, a number of potential measures could be taken:

Improve predictability of policies and stability of expectations

Maintaining predictability of policies and **stability of expectations** as well as protecting existing investments is seen as a major roadblock to more private engagement for PPP projects, especially after negative signals in other sectors, e.g., retroactive cuts in subsidies in the renewable energies' sector (IW Köln and GDV 2016, 34-45). This point is obviously not specific to motorway and other PPP investments but to private investment in general.

Reform procedure and execution of feasibility studies

Sceptics as well as proponents agree that **economic feasibility studies** comparing conventional public procurement with other options such as PPP have to be improved (e.g. IW Köln and GDV 2016, 24; Fratzscher et al. 2014, 30-32; Federal Supreme Audit Institution 2013; BMVI and BRH 2015). This includes several aspects from removing incentives that bias the public partners in favour of PPP (BMVI and BRH 2015, 17-19) and more effective risk distribution (Fratzscher et al. 2014, 36-37) to incorporating qualitative aspects beside price (BMVI 2015a, 42-44) and evaluating past feasibility studies to improve future studies and tenders (IW Köln and GDV 2016, 42-44).

Ensure transparent and frequent supply of PPP tenders to make entrance of institutional investors possible/profitable

Institutional investors such as large insurance companies have shown interest in participating in PPPs in Germany for years (e.g. Gould and Copley, 2015; IW Köln and GDV, 2016, 33-34; GDV, 2017). However, creating projects that are attractive for both public and private partners remains a challenge. In addition, since insurers have to assess all proposals and select their projects carefully, small insurers in particular do not necessarily have the capacities to analyse a large number of projects. In order to justify maintaining the expertise needed for assessing PPP proposals, a reliable stream of PPP tenders is necessary. To this end, IW Köln and GDV (2016, 34) suggest pooling projects on an **infrastructure investment platform**. This is broadly in line with the Fratzscher Commission (Fratzscher et al. 2014, 44-45), which recommends a public infrastructure funds open to institutional investors. This makes it easier to reach sufficient investment volumes (between €10 million and €100 million), which justify the costs for the extensive vetting and documenting processes (IW Köln and GDV, 2016, 37).

In general, however, the large insuring companies are sceptical that private investments or PPP will ever contribute more than a tiny fraction to infrastructure investments in Germany (Gould and Copley, 2015).

Facilitate using existing non-traditional tendering measures and reduce risk of lawsuits

As a reaction to the public discussion between the Federal Supreme Audit Institution (BRH 2013) and the BMVI in 2013-4, the **Reform Commission 'Building of Large-Scale Projects'** ('*Reformkommission Bau von Großprojekten*') was instituted. It presented its report, which contains recommendations for public institutions and its private cooperation partners as well as for the local administrative bodies, in June 2015. Among other things, it (BMVI 2015a, 41) points out, that competitive tendering procedures offering a range of mechanisms are in force since 2005 but have scarcely been used. Instead, traditional narrowly defined and exclusively price-based procedures are employed more often. This is largely due to the fact, that the tendering authorities (in this case: the federal states) lack capacities or expertise or prefer conservative procedures because they are less prone to lawsuits after tendering (BMVI 2015a, 41). The latter point of lacking capacities as well as the high degree of risk aversion to the danger of costly lawsuits is also stressed by other authors (e.g. IW Köln and GDV 2016, 24). All studies recommend further standardizing procedures in tendering and executing PPPs, which both lowers transaction costs for conducting alternative tendering procedures and reduces legal uncertainties. The BMVI offered to compose a **sample project agreement for federal motorway expansion projects** to support standardisation (IW Köln and GDV 2016, 24), which seems not to have been published yet.

Consider how to meet SME needs in PPP projects

While the new financing options in the third generation of motorway PPP projects aim at including investments from institutional investors, they are still not suited for most **SMEs**. This has been criticised from the beginning of PPP projects but so far, little has changed for them. While SMEs receive special treatment in conventional public procurement, investment sums of more than one million euros and project durations of 30 years are too demanding for SMEs (Epoch Times 2017). This poses a problem since SME needs are (currently) incompatible with those of large institutional investors. If PPPs are to be open for both SMEs and large investors, tendering projects of very different scopes might become necessary. However, since the lifecycle approach of PPPs might in general be difficult to implement with SMEs it is questionable whether this goal is achievable or even desirable. Still, as long as promoting SMEs remains a political priority, thinking about (alternative) ways of supporting them seems necessary.

Monitor and possibly adjust the IGA and related laws

Some experts consider instituting the **IGA** until 2021 too ambitious. Since sizes and structures of the Road Construction Agencies ('*Straßenbauverwaltungen*') vary tremendously between states, it might take longer to harmonise and centralise their territories and competencies while at the same time keeping the motorways network fully functioning (Körzell and Neumann 2017).

The shifting of competencies has created some overlap between state and federal responsibilities, which need to be streamlined to ensure proper workings of the company (Körzell and Neumann 2017).

Moreover, the planning of federal highways and the supervision of the IGA will be centralised at a new **Federal Highways Office** (*'Fernstraßen-Bundesamt'*), which is to be instituted in 2021. This has raised some concerns that local knowledge is crucial to understanding and advocating local needs and problems (Körzell and Neumann 2017).

Overhaul the implementation plans for the motorway toll

Since the envisioned motorway toll over proportionally affects non-German nationals moving in or passing Germany, it is questionable whether this particular model should be implemented. In order to finance and improve the maintenance of federal motorways, a toll can be a highly effective measure since it generates revenue and at the same time likely decreases traffic and thus wear and tear of roads. It then should affect all users independent on their nationality but rather based on their intensity of use and/or environmental protection goals.

4. BUSINESS ENVIRONMENT

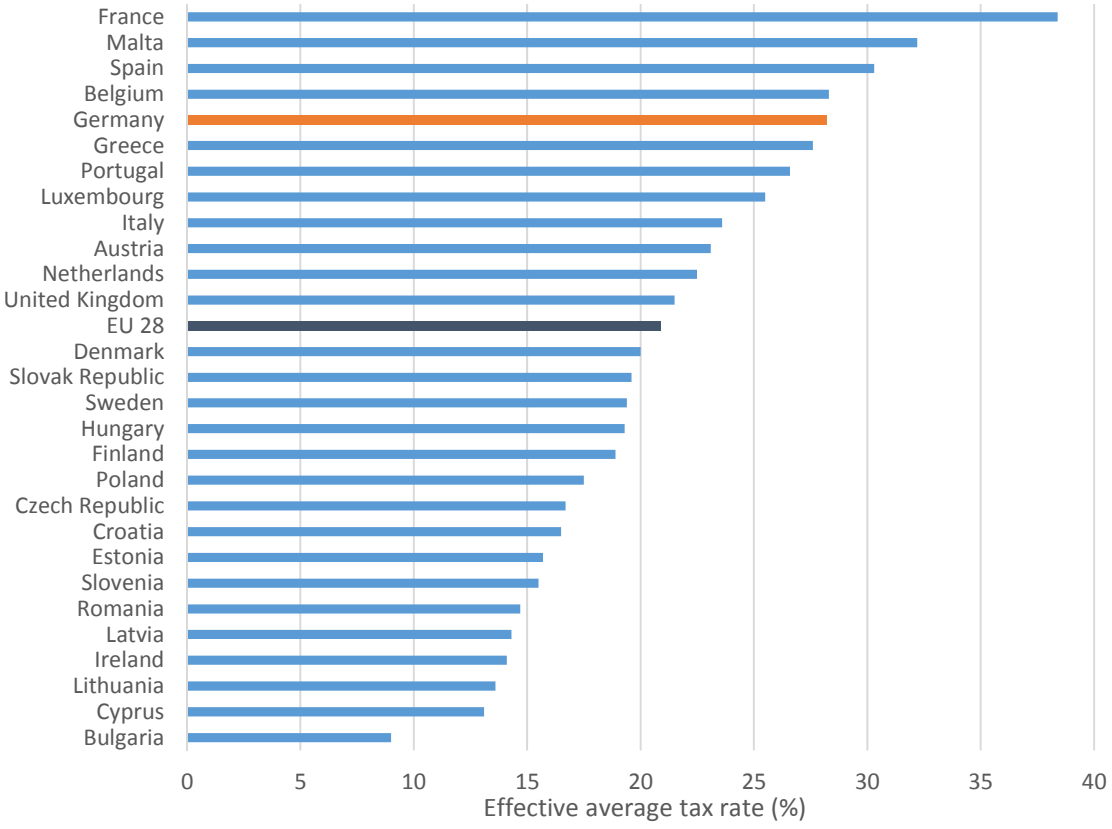
This area of reform covers government regulations and initiatives to improve the conditions for doing business in Germany, particularly with respect to taxation and the bureaucratic burden of running a business.

4.1. Corporate Taxation

4.1.1. Current Situation and Main Challenges

One important element of a business environment that may hamper investment is taxation. In this regard, not only low tax rates, but also favourable depreciation schedules, financing neutrality, legal certainty, and low compliance costs can foster investment. The business environment in Germany is, by international comparison, characterised by a rather **high effective tax rate at corporate level**. Calculations by the Centre for European Economic Research (ZEW) on behalf of the European Commission show that the effective average tax rate in Germany - when taking not only statutory tax rates of (non-) income taxes but also tax base effects into account - is one of the highest among the EU-28 Member States (Figure 27, see also Spengel et al. 2017b).

Figure 27: Effective average corporate tax rates in EU member states, 2016



Source: ZEW, European Commission

This result is mainly driven by the relatively high statutory profit tax rate of 31.0% (national corporate income tax, solidarity surcharge and local trade tax), which is – after France, Malta, Belgium and Italy – the fifth highest among the EU Member States. Still, although the statutory tax rate can provide a first rough indication of the level of taxation in a country, it is the effective tax rate which is relevant for investment decisions (see Devereux and Griffith 1998). In that regard, elements of the tax base computation, such as depreciation schedules or provisions for inter-temporal loss relief, are taken into account. Although the effective average tax rate in Germany is by 2.8 percentage points lower than the statutory tax rate at corporate level, the regimes for

depreciation and loss relief are rather unfavourable in an international comparison, such that the ranking position of Germany remains unaffected (see Figure 27). Germany only provides a straight-line method for depreciating buildings or business assets, such as machinery and equipment. While the straight-line method is indeed the most common method in all EU Member States, several Member States provide more favourable, methods, such as the declining-balance method or accelerated depreciation. As the latter allows an expense of capital expenditure earlier in time, they can result in positive liquidity effects compared to the straight-line method. This affects especially start-up companies with high investment needs. With respect to losses, although they can be carried forward indefinitely, there exists a limitation on the allowable amount of loss which can be set off against future profits: Losses exceeding the threshold of €1 million may only be set off against 60% of taxable income, which leads to a minimum taxation of 40%. Again, this restriction can be particularly problematic for start-up companies often generating losses in the first years which can hence only be offset against profits over a relatively long time horizon.

Germany does neither provide special tax incentives for SMEs, such as reduced corporate income tax rates, nor for investments in R&D. Especially with respect to **R&D tax incentives** (see section 2.1.3), this can constitute a competitive disadvantage since the majority of the EU Member States has some form of R&D tax incentive in place (see EY 2017; BDI and ZVEI 2016). Several types of R&D tax incentives can be distinguished (see BDI and ZVEI 2016, 18). They can generally be classified into those that relate to the input used for R&D activities and those that relate to the output produced by R&D activities. Input-oriented R&D tax incentives can further be differentiated according to incentives resulting in a reduction of the tax base (e.g. accelerated depreciation, enhanced deduction) and incentives reducing the tax liability (e.g. tax credit, temporary exemption from tax). Output-oriented R&D tax incentives reduce the applicable tax rate, such as IP/patent boxes. There exists vast empirical evidence on the effectiveness of R&D tax incentives in stimulating R&D investment (see BDI and ZVEI 2016 for a summary of the most recent empirical findings). But even beyond investment in R&D in particular, R&D incentives have the potential to stimulate overall investment in a certain country by reducing the effective tax burden. Elschner and Ernst (2008) found R&D tax incentives in the EU Member States to result in a decrease of the effective corporate tax burden. The exact amount of the tax subsidy for R&D depends on the specific design of the incentive, the interplay with the corporate income tax system, and the company's profitability relative to the level of R&D expenditures.

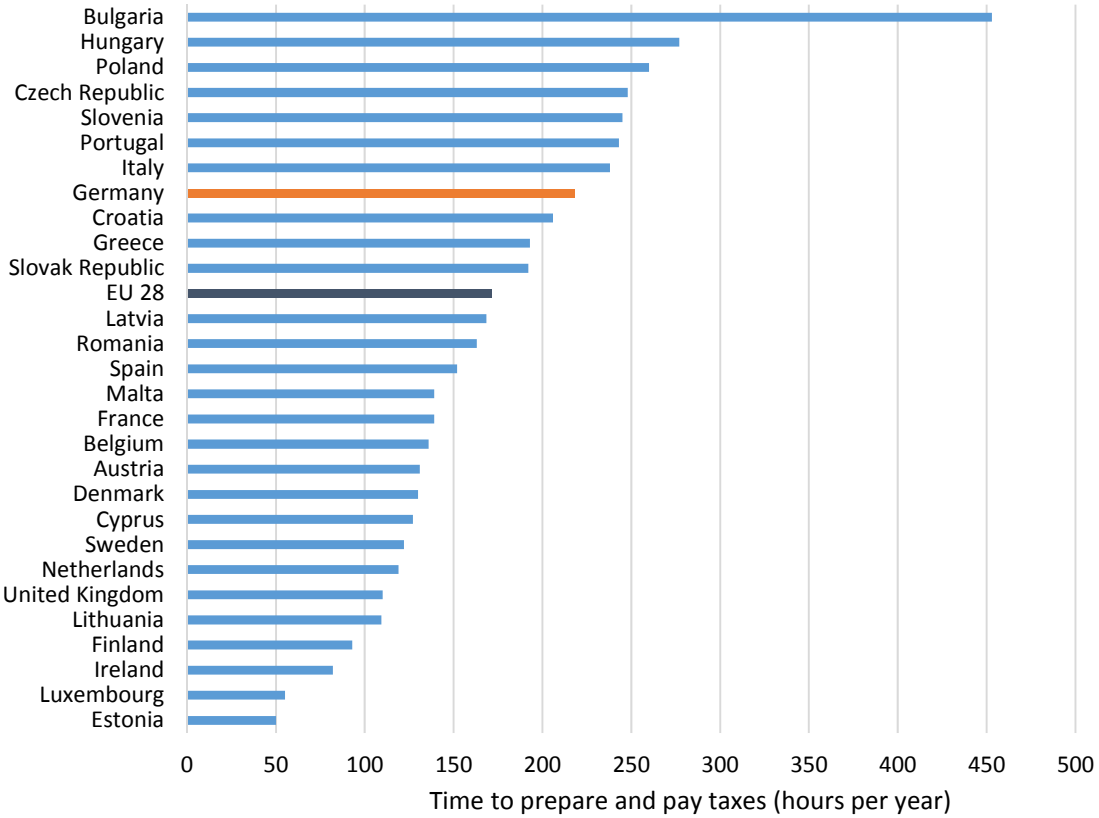
Another concern relates to the **bias towards debt** when it comes to financing decisions of corporations. The asymmetric tax treatment of debt and equity financing, whereby interest paid on loans is deductible (subject to certain limitations) whilst this is not the case for dividends paid to shareholders. This encourages companies to rely on debt rather than on equity, making them potentially more vulnerable to shocks and bankruptcy. The debt bias is particularly problematic for young companies that often have only limited access to external funding. Notional interest deduction (NID) schemes allowing the deduction from the tax base of a fictitious amount of interest on the equity capital of a company can help to alleviate this bias. Still, Germany does not provide such a scheme. Currently, only five EU Member States (Belgium, Cyprus, Italy, Malta, and Portugal) have a NID system in place, whereby the calculation of the qualifying equity and the notional interest yield vary substantially. Recent empirical findings demonstrate the effectiveness of an allowance for corporate equity (ACE) in reducing the debt ratio of firms (see e.g. Princen 2012; Hebous and Ruf 2017). Still, its effect on investment remains unclear. The German Council of Economic Experts ('*Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung*', SVR) argues that an allowance for corporate equity can reduce the effective tax burden which is regularly considered for investment and location decisions. Hence, it can create an advantage in international tax competition (see SVR 2012, 230; SVR 2015, 368). Empirical evidence on this question is ambiguous: While Aus dem Moore (2014) finds an increase in investment activity by small and medium-sized firms in response to the Belgian ACE reform, Hebous and Ruf (2017) and Princen (2012) find no clear impact of an ACE on investment. Hence, it is hard to assess in how far the debt bias results in a location disadvantage for Germany, especially in light of the fact that this bias also prevails in the majority of the EU Member States.

The time to prepare and pay taxes can serve as a good proxy for the **tax compliance costs** in a country. Those costs are driven not only by the complexity of the tax system and its rules, but also by how simple it is to deal with tax administrations. Germany ranks in the upper third of the EU-28 countries with respect to the time to prepare and pay taxes, namely the corporate income tax, the value added tax, and labour taxes (Figure 28). The parallel application of the corporate income tax and the local trade tax can create additional compliance costs for firms operating in Germany compared to other countries that only impose a single tax on corporate income. The trade tax base is based on the corporate income tax base, but several elements need to be adjusted, such as the

add-back of 25% of interest payments. Due to the federal system in Germany, tax administrations operate at state level and barely exchange information on taxpayers. This can result in inefficient processes, both for taxpayers and for tax authorities. The recent reform to modernise the tax administration (see below) is a first step towards reducing the tax compliance burden in Germany and making the tax declaration and collection process more efficient for all parties involved.

Although the complexity of the tax system is less visible than tax rates and elements of the tax base computation, it can have a considerable effect on investment decisions. Lawless (2013) considers two proxies for the complexity of the tax code, namely the time an average firm needs to comply with its tax obligations and the number of payments it needs to make. She shows that both measures exert a significantly negative impact on the existence of a relationship of foreign direct investment between countries. A ten percent reduction in tax complexity is estimated to be approximately comparable to a one percentage point reduction in the effective corporate tax rate and would raise total FDI inflows by approximately six percent. Once an FDI relationship exists between a country pair, however, tax complexity is shown to have a negligible effect on the level of FDI flows. This difference in reaction at the intensive and the extensive margin might be due to a high level of tax complexity being interpreted as a fixed cost that firms incur once they establish an FDI flow, regardless of the actual size of the flow. The estimated impact of Lawless (2013) lies within previously found boundaries of studies estimating the impact of a reduction in the effective corporate tax rate on FDI. However, one need to be cautious by interpreting this result as this is the first study trying to estimate the impact of tax compliance on FDI.

Figure 28: Time to prepare and pay taxes in EU member states, 2017



Time to prepare and pay taxes is the time, in hours per year, it takes to prepare, file, and pay (or withhold) three major types of taxes: the corporate income tax, the value added or sales tax, and labour taxes, including payroll taxes and social security contributions.
Source: World Bank

High effective tax burdens for corporations can result in incentives for multinational firms to **shift profits** to low-tax countries. Still, this is not only a problem in Germany, but concerns other jurisdictions as well, as is demonstrated by current initiatives of the EU and the OECD. In order to ensure a fair and efficient taxation and to curb extensive tax avoidance and the erosion of the tax base, the German government has introduced several reform measures, in particular the

introduction of country-by-country reporting and the limitation of the deductibility of royalty payments (see below).

4.1.2. Main Reforms 2013-2017

In 2016, Germany implemented the recommendations in the final report on Action 13 of the OECD 'Base Erosion and Profit Shifting' Project and the provisions of Directive 2015/2376/EU and 2016/881/EU. Accordingly, an ultimate parent company of a multinational group resident in Germany with consolidated revenue of €750 million or more in the previous tax year must prepare a country-by-country report which contains certain **tax-related information on a per-country basis**. The German tax administration shall exchange the reports with tax administrations in other jurisdictions where the multinational firm has operations. The report must be prepared for the first time for tax years starting after 31 December 2015. The information disclosed therein shall increase tax transparency and assist tax authorities in detecting abuse tax sheltering of multinational firms. The new disclosure requirement can result in additional compliance costs for corporations that fulfil the reporting criteria.

Royalty payments for the use of intangible property are generally deductible. However, with effect from 1 January 2018, **intra-group royalties** are not fully deductible anymore if they are taxed in the hands of the recipient at an effective rate below 25%. The non-deductible part depends on the extent to which the effective tax rate falls below the threshold of 25%. If the preferential taxation in the hands of the recipient is in line with the OECD's nexus approach, i.e. there is actually a substantial activity in the state of the recipient and meanwhile royalties remain fully deductible. The new regulation aims at curbing profit shifting of multinational firms, in particular the relocation of intellectual property to low-tax countries.

With the aim to support the financing of corporations, a **new loss forfeiture exemption** was introduced with effect from 2016. Generally, losses can be carried forward infinitely. However, to prevent the sale of a loss carry-forward, the taxpayer who uses the loss must be legally and economically the taxpayer who suffered it. A loss carry-forward is disallowed completely or pro rata if, within five years, a certain amount of the capital or voting rights of a company is transferred to a purchaser or related person. Loss forfeiture only occurs to the extent that the losses exceed the hidden reserves of the company. It does not apply where the change of ownership takes place within the same corporate group. Another exception rule was introduced for transfers after 31 December 2015. It applies – on application – to cases where the company's business operations are continued unchanged from the time of incorporation, or at least during the three fiscal years prior to the change in ownership. The rule is in favour of those companies that require a change in ownership for financing reasons and for which unused loss carry-forwards would be lost. It aims at removing obstacles with respect to the capital endowment of the companies affected.

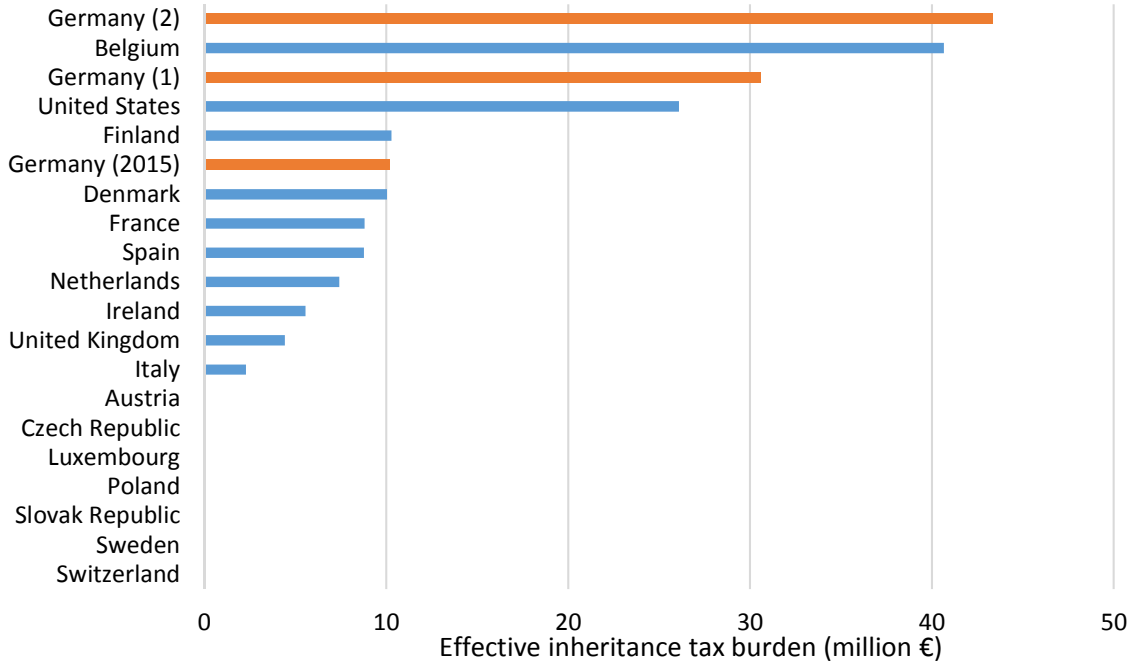
In order to facilitate investments in business assets, the **regulation on investment deductions** has been simplified, such that companies can invest more flexibly. Qualifying taxpayers may deduct up to 40% of the costs for fixed business assets up to three years prior to the acquisition or manufacture. This investment deduction aims at a forward displacement of depreciation potential of future investments, allowing the taxpayer to save resources for future investments. Before 2016, the investment deduction was only granted for investments in business assets the function of which was sufficiently specified. From 2016 onwards, taxpayers do not need to specify a concrete investment. The investment deduction applies if they invest in a fixed asset within three years after claiming the deduction, regardless of the concrete nature of the asset. The omission of the requirement to indicate a concrete investment makes investment planning more flexible and reduces compliance costs for taxpayers and tax authorities. The change in regulation is particularly beneficial for start-up companies with increased investment needs.

With effect from 2018, the **value limit of acquisition or production costs** for the qualification for **immediate depreciation of movable assets** which are capable of individual use and depreciation increases from €410 to €800. In addition, the value limit for the depreciation on a pool basis over five years increases from €150 to €250. Assets with a value below €250 (before: €150) do not need to be included in the pool, but can be depreciated immediately. These amendments shall result in a positive liquidity effect for firms and offer more room for new investments.

Another important reform concerns the **reform of the Inheritance Tax Act**. In late 2014, the German Federal Constitutional Court ruled that certain provisions of the German Inheritance Tax Act were unconstitutional. The bill on the reform of the inheritance and gift tax applies with effect

from 1 July 2016. The main focus of the reform is on the relief for business assets. This includes a reduction of relief when the value of the business assets qualifying for relief exceeds €26 million, a change in the number of employees above which the so-called salary requirement is applicable, a change in the fraction of passive assets required for the application of the relief, and a new relief for family businesses. Before the reform, an 85% relief has been possible without any size-specific restriction. After the reform, the relief is only granted up to a certain threshold of business assets. Other elements considered are the capitalisation factor for the valuation of assets and the possibilities for tax deferral. The precise effect of the reform mainly depends on the value of the transferred assets and on the number of heirs. In an international ranking of 18 different countries, the position of Germany worsens substantially for the post-reform situation (Figure 29, see Bräutigam et al. 2017, 21-26). This also holds true for cases where the newly introduced deduction for family businesses of a maximum of 30% becomes applicable.

Figure 29: Effective inheritance tax burden in selected European countries, 2016

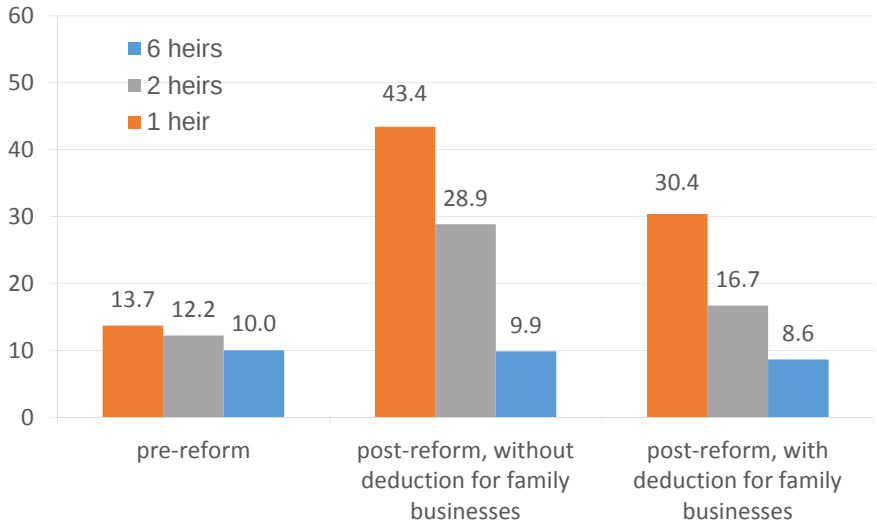


Average of effective inheritance tax burden when passing to a child and to a partner; for Germany additionally average of passing on shares in a corporation and a sole proprietorship
Germany (2015): legal status as of 2015 (pre-reform)
Germany (1): post-reform, including special deduction for family businesses
Germany (2): post-reform, without special deduction for family businesses
Calculations based on model firm with business assets with a net market value of €82.69 million. For more information, see Stiftung Familienunternehmen (2016, 139-142).
Source: ZEW, Stiftung Familienunternehmen

Figure 30 displays the effective inheritance tax burden in Germany before and after the 2016 reform (see Bräutigam et al. 2017, 12-13). Different scenarios are simulated, i.e. the transfer of shares in a model family business to one, two or six heirs (children) (for more information on the model, see Stiftung Familienunternehmen 2016, 139-142). In the pre-reform situation, the total inheritance tax payment does not vary substantially with the number of heirs. Small differences are due to the fact that the applicable tax bracket for each heir is usually lower in case of several heirs and that the personal relief is granted for each heir separately. After the 2016 inheritance tax reform, the tax burden increases considerably for one or two heirs. When transferring the shares to one child, the relief for business assets diminishes completely since the value of business assets qualifying for relief exceeds €89.75 million. For two heirs, the value of the qualifying business assets falls in the range between €26 million and €89.75 million such that the relief diminishes partially, i.e. in the underlying scenario, it amounts to 41%. For six or more heirs, the qualifying business assets of each heir do not exceed the threshold of €26 million, hence, the full deduction of 85% is granted. The total tax burden is even lower than before the reform since the advantage of the lower capitalisation factor outweighs the disadvantage with respect to the definition of passive assets. In case the special deduction for family businesses amounting to a maximum of 30% is

granted, the negative impact of the reform becomes smaller in all three scenarios. The results demonstrate that the effect of the reform is driven by the reduction of the relief for business assets above the threshold of €26 million and hence mainly depends on the value of the transferred assets and on the number of heirs. For large inheritances, the tax burden is likely to increase substantially in the years after the German inheritance tax reform. Small and medium-sized businesses are only affected to a smaller extent. Still, one should keep in mind that the final tax burden depends on the specific circumstances. If the taxpayer can e.g. prove that he is not able to pay the tax from his disposable capital, he can apply for a remission of the tax due.

Figure 30: Effective inheritance tax burden in Germany pre-reform and post-reform (million €)



Effective inheritance tax burden in Germany when transferring shares in a corporation to a child
Calculations based on model firm with business assets with a net market value of €82.69 million. For more information, see Stiftung Familienunternehmen (2016, 139-142).
Source: ZEW, Stiftung Familienunternehmen

With effect from 2017, the law on the **modernisation of the tax administration** entered into force. The law aims at facilitating the tax declaration and collection process, both for individuals and businesses. Various measures are introduced in order to keep pace with the digitalisation, such as an increased use of IT, extended deadlines, and a stronger risk orientation. The compliance burden for firms will probably decline, especially with respect to the declaration of payroll taxes withheld on behalf of employees. As the technical adjustment of all relevant systems and processes requires some preparation time, the reform is expected to be fully implemented until 2022.

4.1.3. Need for Further Reforms

In order to respond to the rather high level of corporate taxes, the German government could reduce the tax rate and/or the tax base. A starting point for **reducing the tax rate** would be to abolish the solidarity surcharge of 5.5% which is levied on the corporate income tax liability. This could be done stepwise as suggested in the recent coalition agreement of CDU/CSU and SPD (2018, 68). Reducing the tax rate can have substantial effects on the level of investment in a country, for both domestic and multinational firms, and on the amount of profits shifted to more attractive countries. As Feld and Heckemeyer (2011) showed in their meta-study, the mean tax semi-elasticity of foreign direct investment is 2.49 in absolute terms. That means foreign direct investment in a country decreases by an average of 2.49% for every increase of one percentage point in the country's tax rate. This is even higher than the estimated tax semi-elasticity of reported pre-tax profits, reflecting only the shifting of book profits, not of real economic activity, which Heckemeyer and Overesch (2017) estimated in a meta-study to be 0.8.This means that reported pre-tax profits decrease by an average of around 0.8% for every one percentage point increase in the tax rate differential exploitable for tax arbitrage. Still, an increase in the total tax base due to higher levels of investment and lower tax avoidance efforts in response to a lower tax rate could go along with a potential decrease in tax revenues since for every euro of taxable income generated a lower amount of taxes is collected. Clausing (2007) showed that the

relationship between tax rates and corporate tax revenues as a share of GDP is parabolic: While at low tax rates, increasing tax rates are likely to result in higher tax revenues; revenues may fall as tax rates increase at higher tax rate levels. Still, the revenue-maximizing tax rate is hard to predict and depends on individual country characteristics, such as the openness of the economy.

Apart from reducing the tax rate, certain elements of the tax base computation could be amended in order to reduce the effective tax burden. A recent finding in the tax competition literature (Egger and Raff 2015) shows that countries do not only compete for foreign direct investment over statutory tax rates, but also over determinants of the tax base, such as depreciation allowances. Hence, one possibility for Germany would be to introduce the **declining-balance method** for depreciating plant or business assets. Due to positive liquidity effects, this method is more favourable than the straight-line method which is commonly in use. The fact that a change in the depreciation scheme can have an impact on investment becomes also evident from a study by Park (2016) demonstrating that firms increased investment in response to a U: S. reform shortening the depreciation period. Still, the German Council of Economic Experts considers the introduction of the declining-balance method to result in an overheating of the economy and suggests to better invest the lost tax revenues in more sensible reforms (see SVR 2017, 26).

As shown above, Germany restricts the carry-forward of losses in amount. A potential reform would be to provide a more **comprehensive loss relief**. This could be based on the proposal on a Common Corporate Tax Base (CCTB) which has recently been relaunched by the European Commission (see European Commission 2016a). In particular, Article 41 (1), (2) and (4) suggests to provide a carry-forward of losses without restrictions in time or amount. If losses can be set off earlier, the effective tax burden declines, which makes the business environment more attractive for investment.

Further improvements could still be made by providing **R&D tax incentives** stimulating R&D investment and innovation which are key drivers of productivity and growth. Several initiatives and economists have put forward proposals on the introduction of an R&D tax incentive in Germany. For more details see section 2.1.3 of this report.

As demonstrated above, there is little evidence on the impact of the debt-equity bias on investment. Still, as only few EU Member States provide for a **notional interest deduction** to date, introducing such an allowance for corporate equity could create a location advantage for Germany in international tax competition. However, with the reform proposals discussed above, a trade-off between increasing business performance and investment and losing tax revenues should be kept in mind. De Mooij (2012) estimates for several selected countries that the tax base narrowing through an allowance for corporate equity costs on average about 15% of corporate tax revenues or 0.5% of GDP. In its recent annual report, the German Council of Economic Experts takes up its idea of a deduction of notional interest on the share capital of a firm, excluding retained earnings (see SVR 2017, 25; SVR 2012, 230ff.). Assuming a notional interest rate of 1.5%, the Council estimates the annual loss in tax revenues to amount to €3 billion (see SVR 2015, 345). This could be further reduced by only considering new equity capital, such that the existing equity stock would not qualify for the deduction (see SVR 2015, 378). A similar system is currently in place in Italy and Cyprus and is also suggested in Article 11 of the CCTB draft Council Directive (see European Commission 2016a) according to which the relevant base for calculating the deductible amount shall be defined as the increase of the equity base at the end of the relevant tax year compared to the equity base on the first day of the first year under the rules of the Directive. After the first ten tax years that a taxpayer is subject to the Directive, the reference equity base shall annually be moved forward by one tax year. Only including new equity in the NID scheme could create stronger incentives for new investments compared to the case where both new and old equity qualify for the deduction such that a firm does not need to generate new investments in order to benefit from the scheme (see Princen 2012).

The German business environment could also be positively influenced by a **harmonisation** of the corporate tax base with other EU Member States, as suggested by the European Commission in its proposal for a Council Directive on a Common (Consolidated) Corporate Tax Base (CC(C)TB) (see European Commission 2011, 2016a, 2016b). Common rules for computing the taxable income cannot only help to close tax loopholes across countries, thereby preventing tax avoidance and the erosion of the tax base, but can also reduce the compliance burden for multinational firms being currently subject to many different rules in each country where they operate. The provisions of the

EU Anti-Tax Avoidance Directive[59] (e.g. rules on interest deduction limitations, hybrid mismatches, and controlled foreign companies) which shall be implemented with effect from 2018 are a further step towards the fight against profit shifting on a common basis. The idea of a common tax base in Europe is also supported in the recent coalition agreement (see CDU/CSU and SPD 2018, 69). Still, this only works in close cooperation with other Member States. In 2012, Germany and France worked on a limited harmonisation of their corporate tax bases by identifying certain key areas in which convergence of the national tax systems would be desirable. Although this project was discontinued, the German government now plans to take common actions with France again (see CDU/CSU and SPD 2018, 69).

[59] Council Directive (EU) 2016/1164 of 12 July 2016 laying down rules against tax avoidance practices that directly affect the functioning of the internal market.

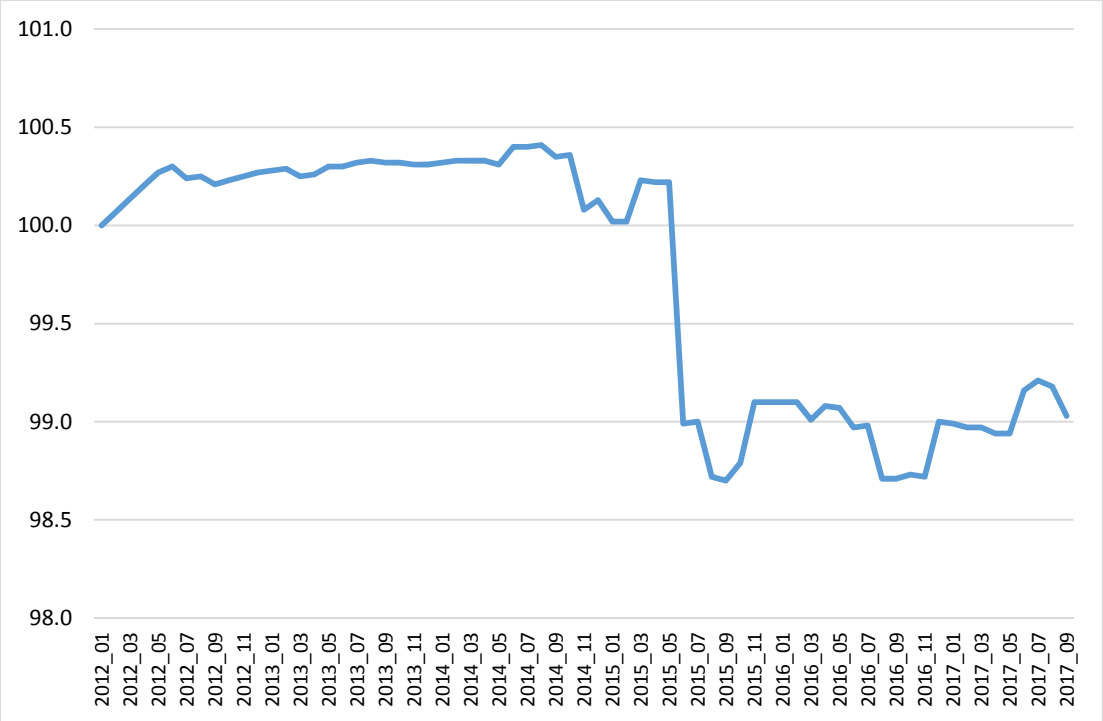
4.2. Bureaucratic Burden

4.2.1. Current Situation and Main Challenges

Administrative requirements and red tape can result in substantial costs to enterprises of all sizes. As such, the presence and amount of red tape that a company faces in the carrying out of its business activities can profoundly impact the respective organisations' ability to do so. The overall impact and cost associated with the introduction and enforcement of new rules and regulations on the company level is documented by the National Regulatory Council ('*Normenkontrollrat'*, NKR) and published in annual reports tracking the development of compliance cost over time.

Bureaucratic burden for enterprises in Germany is tracked by the **Bureaucratic Burden Index** (BKI) which is calculated by the Federal Statistical Office based on an assessment of the costs for legally required activities of enterprises that would not have been undertaken in the absence of legal requirement (e.g. required applications, certifications, reporting, statistics, product identifications, approvals). Starting from the bureaucratic costs of January 1st, 2012, the BKI monitors the change in total bureaucratic costs for the entire enterprise sector in Germany. The BKI did not show much change until the end of 2014. In June 2015, the index dropped by more than one percent as a result of the first Bureaucracy Relief Act (Figure 31). Since then, bureaucratic costs tend to go up and down again, which reflects on the one hand the introduction of new administrative requirements through new or amended laws, and a reduction in bureaucratic costs by stopping or lifting certain regulations that result in red tape. The one-in, one-out rule contributes to this development of the BKI.

Figure 31: Bureaucracy Cost Index (BKI) in Germany, 2012 to 2017

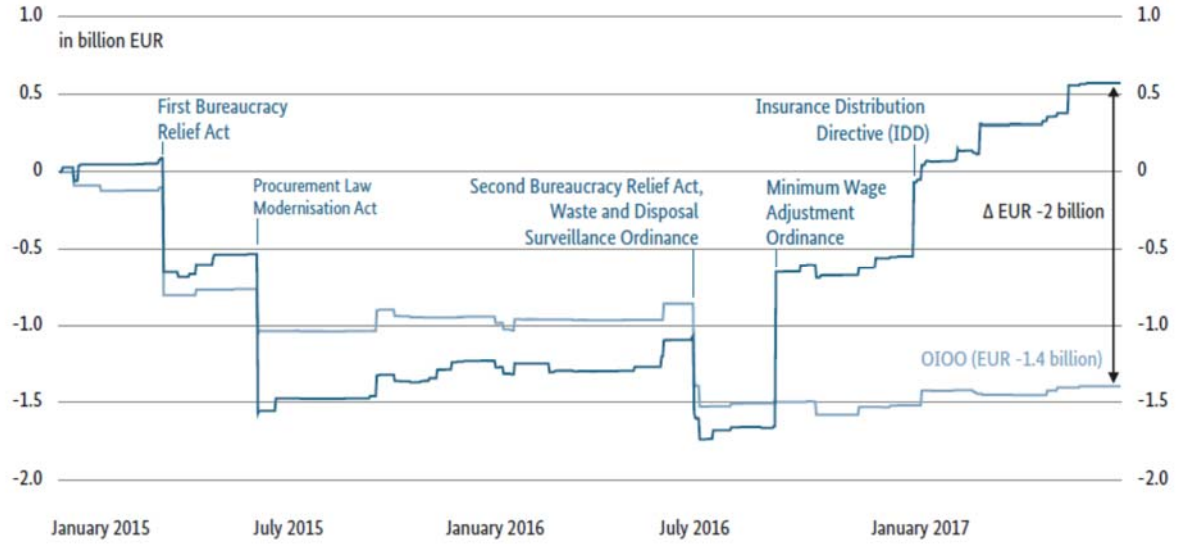


Source: Federal Statistical Office

Since its inception in 2015, the **one-in, one-out rule** has led to a net reduction in business sector burden of about €1.4 billion, according to the NKR. While there was a net increase in costs levied on enterprises by about €200 million in the 2015/16 reporting window, net relief amounted to more than €500 million in 2016/2017 and about €1 billion in 2015/16. Figure 32, compiled by the National Regulatory Council and reported in their 2017 annual report, details the described development and greatly resembles the indexed bureaucracy costs depicted in Figure 31 further below. Besides leading to hard savings in terms of limiting firms expenses to bureaucratic burden, the NKR further supposes that the introduction of the one-in, one-out rule has contributed to an improved awareness of the financial burden levied on businesses within the federal administration

and government (see NKR 2017). In particular, the NKR states that the introduction of the OIOO mechanism has "led to a significant increase in cost-awareness within federal ministries" (NKR 2017, p. 17) and therefore not only quantitatively but also qualitatively affects the development of bureaucratic burden.

Figure 32: One-in, one-out monitor, 2015 to 2017



Source: National Regulatory Council, Annual Report 2017, Figure 9, page 17.

However, when evaluating the efficacy and net effect of the one-in, one-out rule, one should consider the scope of measures. Namely, the mechanism does not account for the transposition of rules and regulations mandated by the European Union, one-off spending requirements (which, as the NKR reports, can be especially burdensome to firms) and policies or regulations that have been signed into law before 2015 but enter into force at a later point in time. This last point notably includes the federal minimum wage provisions adopted in 2014. Altogether, it seems as if the one-in, one-out rule can contribute to reducing upward trajectories in compliance cost but may be overestimating the actual savings provided.

Besides maintaining index measurements of bureaucratic burden in Germany, the Federal Statistical Office further estimates the burden levied by the introduction of individual norms using a Standard Cost Model-approach. The resulting dataset summarises the estimated cost impact of federal norms and selected EU regulatory initiatives based on the Standard Cost Model. The data can in part be accessed online. However, the data does not provide insights in who is affected by a specific norm. In particular, the norms with the highest volume of burden levied mostly fall in the category of procedures required for maintaining a functioning administration and concern the provision of base data to the government (see Table 8).

In addition to the ten highest impact regulations reported in Table 8, a large share of overall bureaucratic burden is tied to mandatory social security contributions for employees as well as reporting and documentation requirements connected to these social security contributions. While these norms, by their sheer magnitude alone, certainly impact the business conduct and investment decisions of companies and corporations, they are also essential to the maintenance of a functioning bureaucracy and provide base information to administrative bodies and stakeholders that these require to comply with their responsibilities.

A more nuanced picture can be observed when disaggregating the overall bureaucratic burden levied on businesses by their sector or economic activity. Given that the burden levied is estimated based on the Standard Cost Model maintained by the Federal Statistical Office, the distribution of burden across industries cannot be obtained easily for all norms. In particular, burden resulting from non-sector-specific norms have to be attributed systemically. The Federal Statistical Office publishes estimations of this disaggregation on an irregular basis. Figure 33 summarises a breakdown of bureaucratic burden per sector and company based on Federal Statistical Office

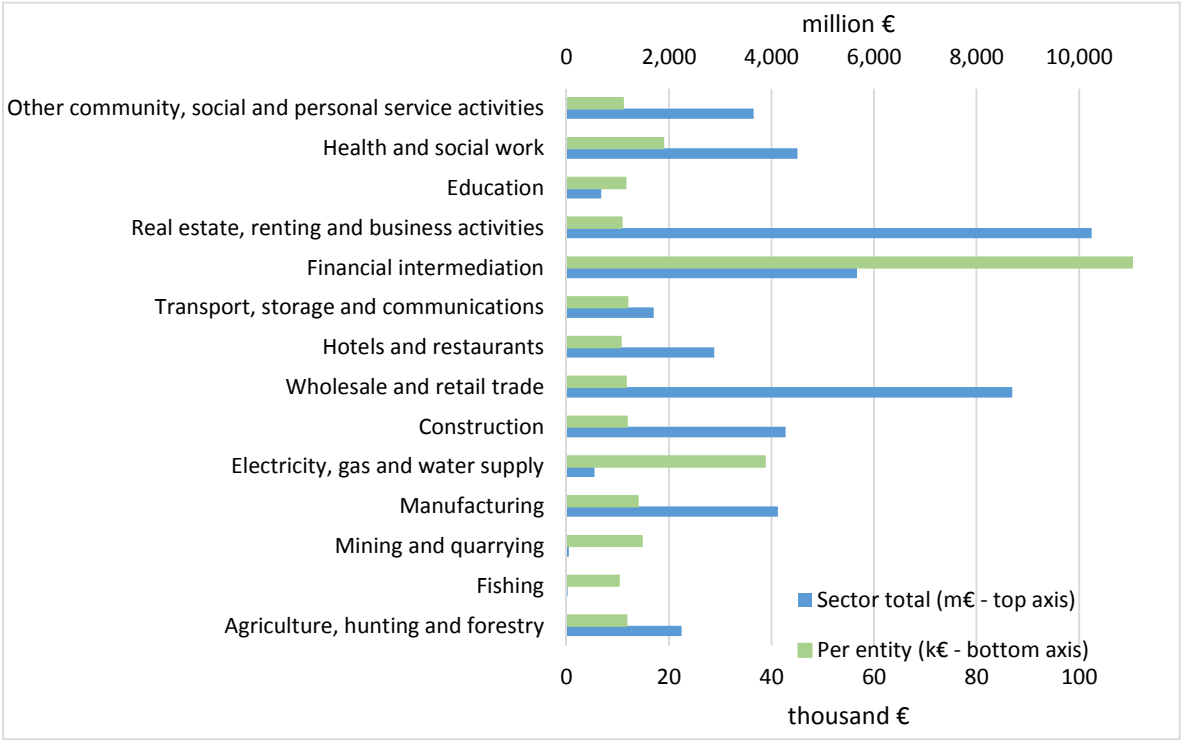
(2014), where non-sector-specific burden is attributed based on the affected number of companies per sector.

Table 8: Top 10 bureaucratic burdens in Germany for the business sector

	Norm	Reference	Burden (m€)
1	General Accounting	§238 HGB	4,194
2	Preparation of annual financial statements and consolidated financial statements	§§264, 325 HGB	3,576
3	Storing invoices	§14b(1) UStG	3,344
4	Submission of tax return	§18(3) UStG	3,070
5	Issuing invoices	§14(2) No.2 UStG	2,590
6	Annual inventory	§240 HGB	2,274
7	Identification and recording requirements for long-term contractual relations	§§8(1,2,4), 11(4), 10(3) No.1 GwG	2,162
8	Collective indication requirements for large exposures	§§13(1), 13a(1), 13b(1) KWG	2,035
9	Submission of local business tax return	§14a GewStG	1,858
10	Submission of corporate tax return	§§31(1), (25(3) EStG, KStG	1,453

Source: Federal Statistical Office

Figure 33: Bureaucratic burden in Germany by industry, 2014



Source: Federal Statistical Office, *Die Bestandsmessung der Bürokratiekosten der deutschen Wirtschaft nach dem Standardkosten-Modell* (2014), Figure 2 (page 32) and Figure 3 (page 33).

Comparing the bureaucratic burden levied on different industries there are striking differences in the amount of financial resources, a sector has to dedicate to regulatory compliance. The picture further changes drastically when glancing at the per-firm burden of rules and regulations. Sectors such as real estate, manufacturing or wholesale and retail trade are subject to large amounts of bureaucratic burden. However, the burden levied on these sectors is spread across a large number of companies, leading to much lower per-entity cost. In contrast, sectors such as financial intermediation (including insurance) and electricity, gas and water supply face substantially higher per-entity burden. This difference is likely the result of differences in the number of active firms per

sector, the size of the respective firms and the regulatory attention on a sector (Which is arguably higher for utilities and financial services than for trade or manufacturing.). It is tempting to, based on the above data, conclude that bureaucratic burden per company in e.g. the manufacturing sector is rather low and should therefore not have significant impact on investment decisions. However, one has to mind the difference in average firm size: even though the absolute level of burden levied is much lower, a small manufacturing firm might be impacted to a greater extent than a large provider of financial services.

Historically, Germany has been keeping rather strict regulations regarding product and service markets. While specific sectors, such as originally state-owned network industries, have been subject to deregulation in the last three decades, recent research suggests that the country's service industries remain subject to stronger regulation than comparable sectors in other countries (European Central Bank 2018). In particular, barriers to firm entry into service sectors and the overall high complexity of regulatory procedures remain beyond OECD-averages (ibid, p. 124).

Another indicator for bureaucratic costs is the **amount of compliance costs** (*'Erfüllungsaufwand'*) which measures the total costs from complying with law, including both enterprises and private households. Bureaucratic costs are a subcomponent of total compliance costs. In order to monitor progress, the Federal Statistical Offices calculated the amount of additional compliance costs resulting from newly introduced or altered laws as well as the decrease in compliance costs as a result of abandoning or changing law. The balance of increase and decrease compliance costs for enterprises varies considerably over time (Table 9). In 2012 and 2015, there was a net decrease while 2014, 2014 and 2016 show net increases. The single largest reported increase was in 2014 as a result of the introduction of the general minimum wage. Estimated additional wage costs of almost €10 billion were considered as additional compliance costs for enterprises.

Table 9: Compliance costs of the enterprise sector in Germany, 2012 to 2016

million €	2012	2013	2014	2015	2016
Increase	999.2	1,706.8	10,482.2	838.2	1,595.8
Decrease	1,101.6	111.5	203.3	2,193.9	918.3
Balance	-102.4	1,595.3	10,278.9	-1,355.7	677.5

Source: Federal Statistical Office

This example already points to one shortcoming of a mere cost perspective on bureaucracy and law. Complying with law and regulation is usually producing some benefit for enterprises, either directly or indirectly. For example, complying with product safety regulation can increase consumer confidence in products and raise the consumers' willingness to pay. Another example is approval of operation for a firm's production facilities which shifts part of the responsibility in case of damage to the public authorities that gave approval (as long as the facilities are run in accordance with the approval of operation). In case of the minimum wage, additional labour costs of firms may be partly counterbalanced by less low-price competition and a larger supply of labour.

The National Regulatory Council's reporting, as well as the data collected by the Federal Statistical Office, are inherently focused on regulations and requirements that originate on the federal level (or, in part, above). The measurements made and conclusions based on this information therefore inevitably fail to account for additional bureaucratic burden that might originate on lower levels of government, such as state or municipal administration. It is currently not possible to quantify the impact of such regulation as no appropriate measurements are available.

However, several state-level governments have recently announced intentions to introduce administrative structures similar to a regulatory council. The 2016 coalition agreement for a new state government in North Rhine-Westphalia specified intentions to introduce such an authority and the state government of Baden Wurttemberg confirmed it similar plans in September 2017.

While these initiatives remain in a planning phase, the state of Saxony introduced a functioning state-level regulatory council (*'Sächsischer Normenkontrollrat'*) in the beginning of 2016. Similar to its national counterpart, the state-level regulatory council publishes annual reports on the development of bureaucratic burden and compliance cost to businesses and citizens, but also to the state and its municipalities. See Table 10 for the findings of the 2016 report.

Table 10: State-level bureaucratic burden – Saxony 2016

	Relevant norms (number)	One-off material expenses (mn €)	Annual material expenses (mn €)	One-off staff cost (mn €)	Annual staff-cost (mn €)	Other not monetarised expenses
Citizens	6	0	0	0	0	26,150 h/year
Business	4	0	20	100	131	5,800 h/year
State	9	2,890	97	1,923	1,199	406 FTE
Municipalities	8	188	218	180	504	5,800 h/year
Total	**12**	**3,078**	**335**	**2.203**	**1,834**	

Source: Sächsischer Normenkontrollrat, Annual Report, 2016

4.2.2. Main Reforms 2013-2017

The main federal government activities to reduce bureaucratic burden to enterprises in the period 2013 to 2017 include two laws on reducing red tape (Bureaucracy Relief Acts), a one-in, one-out rule for new legislation, and the better regulation programme.

At the initiative of the NKR, the Federal Government introduced a so-called **one-in, one-out ('OIOO') rule** in Germany. The OIOO rule took effect in 2015 and stipulates that any increase in compliance cost to businesses has to be compensated by a comparable level of relief. While the OIOO rule aims to offset increased requirements for administrative compliance on the national level, changes in compliance cost associated with the transposition of EU initiatives into national law are notably exempt from the relief requirements. Hence, even though the National Regulatory Council reports that the resulting relief exceeds corresponding cost increases by €1.4 billion since 2015 (see National Regulatory Council Annual Report 2017), this figure does not fully account for compliance cost rooted in the 1:1 transposition of EU requirements.

In 2016, the Federal Government introduced an addendum to the 2014 **'Better Regulation' work programme**. The 2016 work programme, like its 2014 predecessor, aims at ensuring that applicable law is 'simple, comprehensible and target-oriented' (National Regulatory Council Annual Report 2016, 62). The work programme includes various measures designed to mitigate undue administrative burden on businesses, such as the modernisation of the trade and crafts code ('*Handwerksordnung*') and the increased inclusion of administrative data in the compilation of economic statistical data. Moreover, the work programme emphasises ambitions to investigate the possibility to modify due dates for contributions to social security and to further explore the efficiency potential of federal **E-governance** models.

Following up on the 2014 work programme, the Federal Government furthermore introduced a set of **guidelines** ('*KMU-Leitfaden*') intended to support the management of and **compliance with legal regulations in SMEs** which frequently lack the resources and personnel to adequately address the administrative and bureaucratic burden placed on them. The guidelines are to be used by ministries to assess the effects of draft regulation on SMEs. Once such an assessment concludes that the draft would indeed put particular burden on small and medium-sized enterprises, the corresponding ministry is supposed to investigate alternatives and/or opportunities for corresponding relief in compliance (such as, for instance, exemptions, information campaigns or financial support).

Further relief, focused on small and medium-sized enterprises in particular, has been encoded in two **Bureaucracy Relief Acts** ('*Bürokratieentlastungsgesetz*' or 'BEG' I & II) which took effect in 2016 and 2017 respectively. The First Bureaucracy Relief Act was passed in 2015 and aimed to support young firms and start-ups by reducing their obligations for compliance with legal rules and regulations. For instance, the law codifies a twenty percent increase to revenue and profit thresholds mandating maintenance and documentation of accounting and bookkeeping systems within a business. The Bureaucracy Relief Act further simplifies certain taxation rules and provides exemptions regarding duties to report data to public registries. The Second Bureaucracy Relief Act also aims to cut red tape for small and medium-sized firms. The new regulation includes provisions to facilitate the estimation of social security contributions, raises lump sum limits on invoices and income tax registration thresholds, and reduces specific documentation requirements. In addition, the Second Bureaucracy Relief Act aims to foster digitalisation initiatives in terms of both,

documentation requirements and communication with public authorities. To this end, the regulation further promotes increased centralisation and standardisation within the competent public administration.

Further recent policy initiatives pursue the objectives of simplifying the assessment and increasing the transparency of adopting new rules and regulations. In particular, these initiatives aim at assessing the impact of incorporating European rules and regulations into national law (**EU ex ante procedure**). That way, regulators (mainly ministries) are to be encouraged to either inquire about impact assessments by competent bodies or to conduct such assessments themselves with the goal of gauging the potential impact on the compliance burden for individuals and, particularly, businesses in Germany. In a similar vein, the Federal Government demands that – since March 2013 – regulatory proposals and undertakings to be subject to mandatory evaluation if they imply costs exceeding €1 million (**Ex post evaluation**). The resulting assessments of the effects of implementing regulation relative to initial objectives and cost estimates are to be scrutinised by the National Regulatory Council.

4.2.3. Need for Further Reforms

Reducing bureaucratic burden for firms is an ongoing government activity that requires a large number of small steps in many areas of administration and regulation. The current policy initiatives (Bureaucracy Relief Acts, one-in, one-out rule, better regulation programme) and the attempts to monitor progress in reducing bureaucratic burden provide a useful framework for achieving further progress.

While maintaining stock on the state of bureaucracy costs in Germany and monitoring the implementation of policy measures designed to curtail the impact of these, the German National Regulatory Council also discusses perceived areas for improvement. As documented earlier, the introduction of so-called 'E-government' facilities and initiatives should be a key component in continuing the reform of bureaucratic burden and red tape in Germany for the coming years. In particular, the NKR notes two dimensions along which further effort and political reform should be focused.

- First, Germany still faces substantial shortcomings regarding the digitalisation of public services and E-government applications (see section 5.1). Among other factors, transforming the usage of ICT in communication and collaboration efforts across government levels and agencies could yield substantial gains in both spending efficiency and ease of access.
- Second, in order to enable the implementation of digital public services – but also to improve efficiency and transparency overall – more attention should be paid to the modernisation and defragmentation of registry data. In particular, the improvement of administrative data management practises should be focused on the utility to citizens and businesses: Basic information should not be accessed more than once and features should be in place to control and ensure appropriate data access.

In addition, multiple other fields of work remain regarding the proper assessment and treatment of bureaucracy and compliance cost going forward. These include the establishment of fit-for-purpose cost evaluation standards, guidelines for comprehensive cost-benefit-analysis of policy proposals, as well as maintaining caps on increasing one-off compliance costs. Moreover, challenges persist concerning the presence exceptions to current cost-control measures such as the 'one-in, one-out' rule.

5. E-GOVERNMENT AND PUBLIC PROCUREMENT

5.1. E-government and Open (Government) Data

5.1.1. Current Situation and Main Challenges

E-government (electronic government) means using information and communication technologies to run governmental and administrative processes. Ideally it provides significant potential for value creation and greatly improves the quality of services provided for citizens and firms as well as within public authorities. This can play a key role in further reducing the administrative burden for businesses making a country more attractive for businesses, which is regarded a considerable international competitive advantage (Bahrke et al. 2016; EFI 2016). Thus, about half of the total relief of bureaucracy costs for businesses between 2006 and 2012 (€12 billion) in Germany can be attributed to E-government progress: €4 billion through simplifications in electronic invoicing, €750 million through electronic social security registration and €240 million through the electronic wage tax card (NKR 2015).

In addition the intensive use of E-government creates a strong demand for information technology (IT) and therefore acts as a driver of innovation for the IT and Internet industry. In this sense E-government is also an important area of application for innovation-oriented public procurement (EFI 2017).[60] Furthermore open government data can be used by companies to develop new services and innovative business models (Bahrke et al. 2016, EFI 2016), and are also a valuable source for scientific research (OECD 2017b).

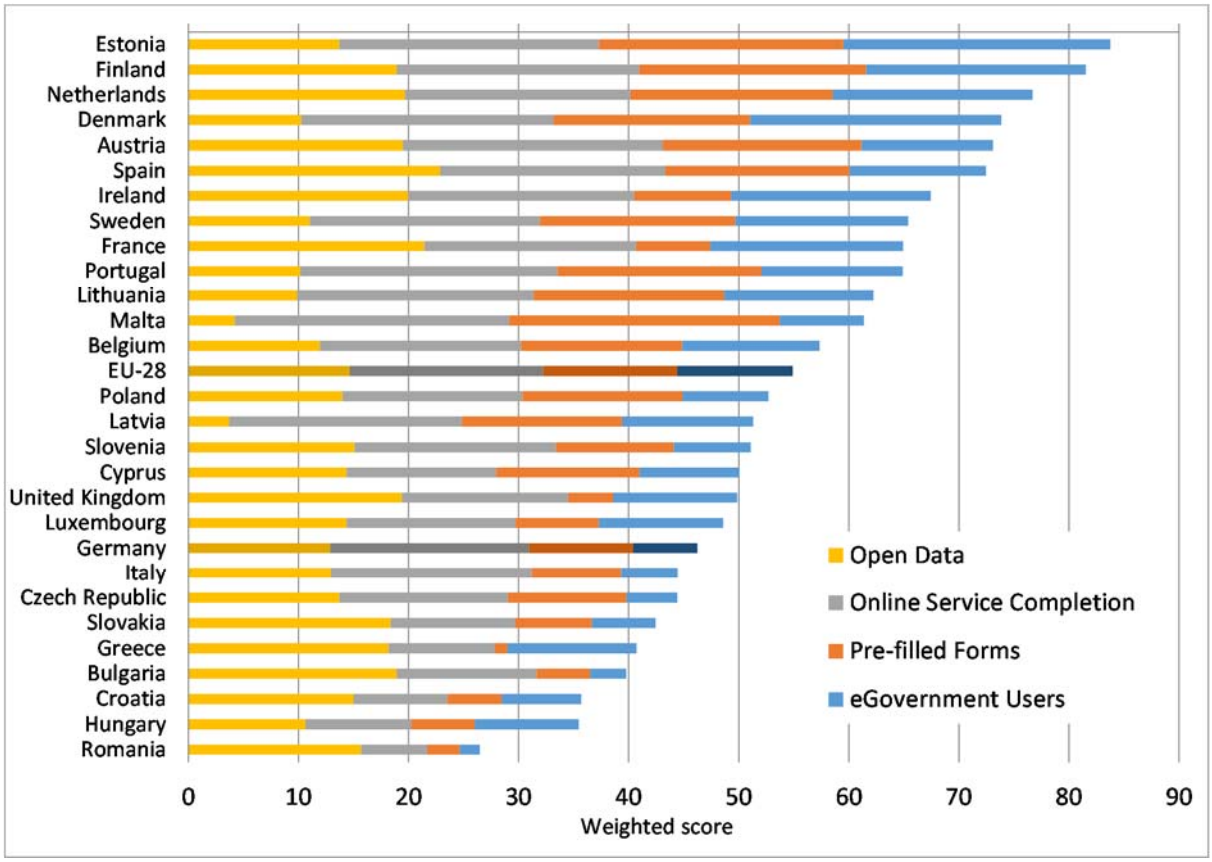
In their 2010 national E-government strategy, the federal government, the *Länder* and the municipalities formulated the goal of making Germany's E-government the international standard for effective and efficient administration by 2015 (EFI 2016). However, Germany's performance in digital public services is still below the EU average and the country has one of the lowest online interaction rates between public authorities and citizens in the EU.[61] Concerning electronic service provision, the German public authorities lag far behind the countries with the highest performance like Estonia, Finland, the Netherlands, Denmark, Austria, and Spain. In total Germany was ranked 20th out of 28 EU member states in 2017 with respect to digital public services (Figure 34). Particular deficits are the share of E-government users (rank 23: 18,8%; EU average: 33,6%) and Open Data (rank 20: 0,515; EU average: 0,587), with the latter being a composite indicator ranging from 0 to 1 that measures to what extent countries have an Open Data policy in place (see below for more details).

Furthermore, whereas other countries have achieved significant progress during the last years, Germany hardly improved (EU 2017, OECD 2017c). The E-government Monitor 2017 (D21 Initiative 2017), based on an online panel of 1,000 interviews in Germany, even comes to the conclusion that the use of E-government in Germany has recently fallen behind the level of 2012, caused by lacking satisfaction with the existing offers provided online and increasing data security concerns. Moreover, there is a persistent lack of awareness with respect to the existing digital public services (Tinholt et al. 2017).

[60] According to estimates made by the Fraunhofer Institute for Open Communication Systems, the creation of an efficient system of E-government in Germany would require a total investment volume of around €1.7 billion for the development and five subsequent years of operation (Fromm et al. 2015).

[61] The E-Government Development Index of the United Nations (2014, 2016) that analysed the state of e-government services on the basis of four quality levels depicts particular unfavourable results for Germany with respect to services fulfilling the requirements of full digitisation, e.g. individualised services (EFI 2017).

Figure 34: E-government in EU countries 2017, by sub-dimension



Source: EU Digital Scoreboard 2017.

Thus, the National Regulatory Control Council ('*Normenkontrollrat*': NKR) states in its latest annual report (NKR 2017) that Germany does not make enough use of the opportunities of the digital transformation in public administration. It argues that there is insufficient evidence of a joint approach across territorial boundaries and disciplinary borders. Germany's federal structure implies specific challenges in this context as the majority of public services relevant for businesses are run by governments or authorities at the state or municipal level. Currently, a wide variety of systems that are not always interoperable creates inefficiencies and are the main reason for the ongoing lack of user friendliness of public digital services. This seems to be the main barrier for significant progress in E-government in Germany (Bahrke et al. 2016, D21 Initiative 2017), although the recent E-government Benchmark Report 2017 by the European Commission indicates some progress with respect to transparency and digital post solutions (Tinholt et al. 2017). Ideally, digital information and services should be bundled and offered in one place, a so-called 'one-stop shop', as already realised in Estonia, Finland, South Korea or the USA (EFI 2016).

According to the NKR (2017), the lack of progress concerning E-government in Germany prevents savings and bureaucracy reductions running into billions of euros. If Germany does not succeed bridging the increasing gap between private and public developments in this field, this will become a competitive disadvantage for the economic development in Germany. Moreover, public administration officials themselves will suffer from a delayed digital transformation. The failure to modernise and digitise means that no or hardly any labour savings will be realised through digital technologies. As a consequence, retiring personnel will have to be replaced with a ratio of 1:1, which will hardly be possible given the imminent waves of retirements and the increasing shortage of specialised personnel.

Policies to promote E-government can be split broadly into three categories (OECD 2017b). The *first* involves creating or promoting E-government services for individuals, e.g. allowing citizens to pay their taxes, submit various forms and update their personal information online. Given that many of these E-services include the transfer of personal data, E-ID and E-authentication services have to be developed to make these online services more secure. The *second* involves creating or promoting E-government services for firms. Policies are similar to those directed towards

individuals, e.g. web portals for a 'one-stop' point for E-government information and online submissions of forms, including tax services. Digital public services available to firms can also be seen as an effort to make internal processing of business administration more efficient and to reduce the regulatory burden where possible. Information dissemination and awareness of available online tools is integral to stimulate further use of E-government services among citizens and firms. The *third* category is focussed on improving the internal functioning of governments themselves and making them more transparent through the public availability of information. This includes publishing governmental documents and registries online, keeping them up to date and easy to find and access. Further, it promotes zero paper policies through digital communication, increasing internal information sharing and collaboration between public authorities as well as improving interoperability between governmental platforms (OECD 2017b).

Whereas E-government particularly refers to technical aspects that facilitate the implementation of open government with the help of new information and communication technologies and digital media, open government stands for a completely new administrative organisation in which transparency and participation are strategic factors with respect to external interaction as well as to internal processes (Müller 2010). According to the OECD (2017d, 184) open government is defined as "a culture of governance based on innovative and sustainable public policies and practices inspired by the principles of transparency, accountability, and participation that fosters democracy and inclusive growth". Implemented in a well-coordinated manner, open government reforms can also help to overcome the increasing disenchantment with politics that can be observed in Germany during the last years.

Open (government) data is believed to have a high potential for re-use in new services and applications, as well as for addressing societal challenges, fostering participation of citizens in the political and social life, increasing transparency and accountability and achieving efficiency gains by sharing data between public administrations (Berends et al. 2017a). One main reason for governments for launching open data programmes is the impact on economic growth, including business innovation and the creation of companies and jobs. Particularly knowledge-based enterprises, specifically SMEs or start-ups, can use open data to refine existing or to develop new business models such as advertiser-pays rather than end-user-pays and create innovative services (The World Bank 2014). Easily accessible and interoperable open data can help enterprises to generate added value and serve as a measure of business development at all federal levels (Klessmann et al. 2012; Berends et al. 2017a). Thereby, the main impact of exploiting open data stems from outside the traditional ICT sector, and is driven by entrepreneurs and innovators seeing market opportunities for data-rich services rather than through "pushing" technological solutions (The World Bank 2014).

The combination of open data and open innovation enables the realisation of applications in areas such as health, energy, traffic, as well as shaping aspects of everyday life in the smart city of tomorrow. Hence, motivating public and private institutions to open their data also requires a fundamental change in administrative processes and thinking.

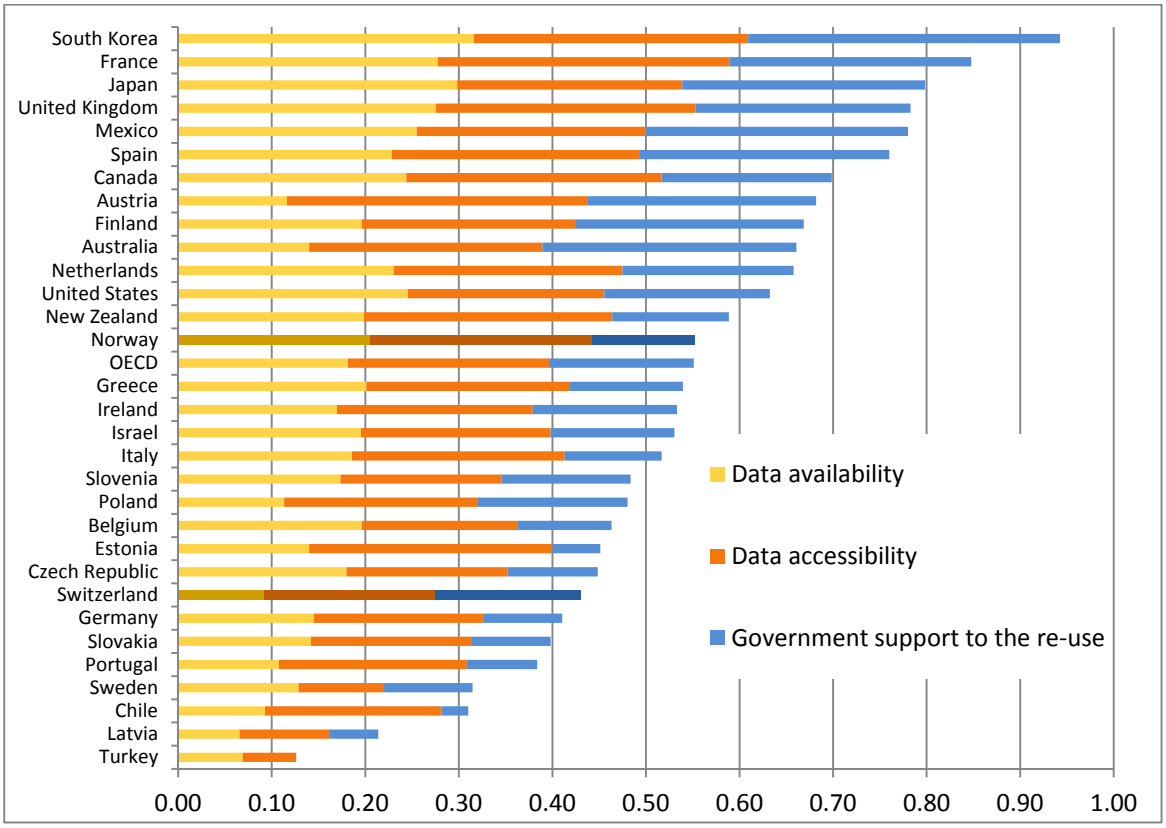
Several country and sectoral studies with differing analytical approaches depict significant economic potential of open data. Despite the method applied by the studies and the estimates they provide, there is one finding that is beyond dispute: when opened, data can become a force of growth and development for all countries, regardless of geography and level of economic development.[62] The potential becomes even larger when public sector information is combined with privately held data of public interest (European Commission 2017b).[63] Yet the process to achieve the full potential of open data will require several years, depending on the frequency and scope of data releases and the resulting network effects. Benefits take time to emerge, as for instance entrepreneurs are more likely to act as a result of spotting a market opportunity, and then seek the data needed to build a product or service to address it, rather than observing the availability of data and then try and invent ways of using it (The World Bank 2014).

[62] The World Bank (2014) and more recently Berends et al. (2017) provide an overview. On a global level, initiatives such as the Open Data Barometer and the OECD Government at a Glance assess the impact of Open Data.

[63] For examples see also http://datacollaboratives.org

Compared to other countries Germany finds itself in the bottom third regarding the establishment and development of national open data ecosystem and risks falling behind.[64] The reason for this is not a decrease of open data initiatives in Germany but rather the rapid progress in other countries. For example, recent analyses from the OECD Survey on Open Government Data, summarised in the "Open-Useful-Reusable Government Data Index"[65], show that Germany is significantly lacking behind with respect to data availability, data accessibility and particularly government support for data re-use (Figure 35).

Figure 35: Open-Useful-Reusable (OUR) Government Data Index, 2017



Source: OECD Survey on Open Government Data

The European Data Portal Study 'Creating Value through Open Data' (Carrara et al. 2015) quantified the economic benefits for open data in the EU28+[66] by looking at four key indicators: direct market size, number of jobs created, cost savings and efficiency gains. The study clusters the economic benefits derived from the use of open data into direct and indirect benefits. *Direct* benefits are monetarised benefits that are realised in market transactions in the form of revenues and Gross Value Added, the number of jobs involved in producing a service or product, and cost savings. *Indirect* economic benefits include new goods and services, costs or time savings for users of open data applications (e.g., in terms of energy use or finding parking), knowledge economy growth, increased efficiency in public services, and growth of related markets. The authors estimate the direct market size for open data in the EU28+ of €325 billion for the period 2016-2020, increasing from €55.3 billion in 2016 to €75.7 billion in 2020. The number of jobs in Open Data in the EU28+ private sector is predicted be 100,000 in 2020. This constitutes an increase of 25,000 compared to 2016. Another study of the European Data Portal (Berends et al. 2017b)

[64] For an overview of the existing surveys with respect to open data performance and the respective methodologies see Table A1 in the Annex.

[65] The OUR Data Index is a composite index based on several indicators.

[66] Including all 28 European Member States and the European Free Trade Association countries (Switzerland, Liechtenstein, Norway, Iceland).

shows that nearly half of those additional jobs refer to data scientists, underlying the further increasing demand of 'digital skills'.

A study for Germany (Dapp et al. 2016) estimates the economic potential of open data within a ten-year period. This medium-term perspective is adopted because it may take longer to reach the pay-off-phase. And only in this phase will the wider benefits of open data be realised, and the initial investment costs will be outbalanced by higher tax revenues and wider employment and welfare effects (Peische 2014). The estimations are based on a large set of existing studies and range from a potential of €12 billion p.a. in the conservative scenario to €43 billion in the ambitious scenario to €131 billion p.a. in the optimistic scenario (Dapp et al. 2016):

- The conservative scenario implies that Germany pursues a reactive strategy in order to catch up to other countries by nationwide extension of the already existing activities in the context of open government data.
- In the ambitious scenario, Germany would need to follow a proactive strategy (‘open by default’) by increasing the benefits through an additional opening of business and personal data.
- The optimistic scenario requires open data to be a central part of an overall national strategy to address major social challenges. Such a plan would go beyond the digital transformation: Germany would challenge itself as a nation with regard to the development of an encompassing national open data ecosystem, with the goal of becoming the leading open data nation.

It depends mainly on the political will to shape the necessary administrative, commercial and civil framework which of the three scenarios will finally be achieved. A recently published strategic guideline may support associates of public authorities who tackle the task of implementing open data (Klessmann and Staab 2018).

5.1.2. Main Reforms 2013-2017

The Act to promote E-government (**E-government Act: EGovG**) from July 2013 was intended to facilitate electronic communication with the public administration. It also enabled federal, state and local authorities to offer more simplified, user-friendly and efficient electronic administrative services.[67] The effects of the E-government Act have to be evaluated till the end of July 2018.

In September 2014 the federal government, managed by the Federal Ministry of the Interior (BMI), implemented the programme **'Digital Administration 2020'** ('*Digitale Verwaltung 2020*') with concrete measures to implement the E-government Act. Examples are the mandatory installation of digital access to governmental authorities, digital documents and the availability of public data in digital form (Open Data).[68] The first evaluation report 2016 has been published in April 2017.

One result of the E-government Act is the implementation of a data portal through which the data collected from federal, state and municipal authorities shall be made publicly available. At the beginning of 2015 '**GovData – The Data Portal for Germany**'[69] began regular operations.

A revision of the **National E-government Strategy (NEGS)** was adopted in October 2015 (*IT-Planungsrat* 2015) as a part of the Digital Agenda 2014-2017 bill. Its goal is to foster the digital transformation of the public administration by promoting a close and reliable cooperation across all levels of public administration.[70]

In general, the **Digital Agenda 2014-2017** and the E-government Act created important legal conditions for the development of E-government in Germany and increased planning reliability for all partners. Yet the federal structures impede the implementation process, because the states are responsible for the organisation of administration and formulate the rules for E-government at the

[67] See www.bmi.bund.de/EN/topics/administrative-reform/e-government/e-government-node.html

[68] See www.verwaltung-innovativ.de/SharedDocs/Publikationen/Artikel/englisch_eckpunkte_digitale_verwaltung_2020.pdf

[69] See www.govdata.de

[70] See www.it-planungsrat.de/EN/it-planing-council/negs/negs_node.html

state, district and municipal level (Bahrke et al. 2016). Thus, coordinating the cooperation between the federal and state governments in the field of information technology is one of the tasks of the **IT Planning Council**, set up in 2010.[71] However, the council has only very limited resources and political power at its disposal. To improve this situation, in December 2016 the **Online Access Improvement Act** ('*Onlinezugangsverbesserungsgesetz*') was adopted by the Cabinet as part of the reform of federal fiscal relations (BMWi 2016[72], BMF 2016). It rules that all federal, state and municipal authorities must also offer their administrative services online within five years and make them accessible via a network of administrative portals using comparable IT standards, so that all users should be able to access all digital administrative services from any connected portal in a barrier-free way using one single account (EFI 2017). If implemented effectively, this legal reform could significantly accelerate the progress of E-government in Germany (European Commission 2018a).

In January 2017 the cabinet decided to amend the first act of the E-government Act (**Open Data Act**). It aims to lay the foundations for the active provision of data from federal authorities based on internationally recognised open data principles. The envisaged legislation change intends to accelerate the process and make federal administration the front-runner in the provision of open data in uniform, machine-readable formats (BMWi 2017a). Together with this open data act, the Federal Ministry of the Interior (BMI) announced the participation of Germany in the Open Government Partnership (OGP) along with an action plan of two years comprising 15 commitments such as implementing international transparency standards and promoting the provision of open data.[73]

Since the end of June 2017, **E-government tasks have been bundled** within a newly founded BMI department ('*Verwaltungsmodernisierung, Verwaltungsorganisation*').[74]

In July 2017, the **Act on Identity Cards and Electronic Identification** has been amended (PauswG-E) in order to further promote the use of the E-ID, which is also key for the authentication when using digital public services provided for citizens in Germany. Furthermore, the Act implements the European **eIDAS** (electronic identification, authentication and trust services) Regulation that has created standards for which electronic signatures, qualified digital certificates, electronic seals, timestamps, and other proof for authentication mechanisms enable electronic transactions with the same legal standing as transactions that are performed on paper.[75]

From 2014 to 2016, the Federal Government together with three local authorities' national associations – the Association of German Cities, the Association of German Counties and the Association of German Cities and Municipalities – carried out a pilot project for E-government in model local authorities (***Modellkommune E-government***). The pilot project aimed at showcasing the potential of the 2013 E-government Act (EGovG) at local level (The Federal Government 2017).[76]

This pilot project for E-government was followed by another project with the same partners in May 2017. Thereby, nine model local authorities were selected to participate in an open government project (***Modellkommune Open Government***). Their initiatives are intended to show how open government can be established in local administrations, how citizens use the services and how these measures can be both innovative for the community and generate cost savings for local authorities (Die Bundesregierung 2017b; The Federal Government 2017).

[71] Other tasks are adopting IT interoperability and security standards, managing the NEGS and its projects as well as planning and developing the core network (see www.it-planungsrat.de/EN/it-planing-council/Aufgabenspektrum/Tasks_node.html).

[72] See www.bmi.bund.de/SharedDocs/pressemitteilungen/DE/2016/12/buergerportal.html.

[73] See www.bmi.bund.de/SharedDocs/pressemitteilungen/DE/2017/08/ogp-aktionsplan.html

[74] See www.verwaltung-innovativ.de/SharedDocs/Nachrichten_NL/2017/nl_06_news5.html

[75] See https://ec.europa.eu/digital-single-market/en/trust-services-and-eid

[76] See also www.verwaltung-innovativ.de/DE/E_Government/Modellkommune_E_Gov/modellkommune_e_gov_node.html

5.1.3. Need for Further reforms

E-government

Estimations from McKinsey (2017a) on behalf of the NKR come to the result that a full digitalisation of the top 35 public services for citizens would save 47% of the time currently required for visits to authorities (about 84 million hours per year). Companies could save up to 54% (€1 billion) of the expenses for their top 30 public services, and administrations would have about 60% more time to invest in more worthwhile tasks with approximately 64 million hours saved (see McKinsey 2017a). For example, in Germany, the census costs more than €700 million. These costs could be reduced by almost 90%if the census were to be conducted in an automated fashion on the basis of modern registries, as shown by the examples of Austria, Switzerland or Denmark (NKR 2017). This illustrates the enormous efficiency potential of the operationalisation of E-Government in Germany. However, the impact achieved by the E-Government reforms in the 18th legislative term remains far behind expectations thus forfeiting significant opportunities for simplification and saving money for both public administration and private businesses (NKR 2017). Even though important decisions – such as the decision to develop a composite platform, establish service accounts, and decisions on the digital transformation programme of the IT Planning Council – have been made, tangible implementation results are absent. Only relatively simple projects of the E-Government Act such as the introduction of De-Mail, accessibility for persons with disabilities and electronic payment procedures were realised. In contrast, important components of the government programme, which would provide a significantly greater impetus for digital administrative services, are still at the concept or initiation stage. For example, Germany has made no progress in the digital transformation of the top 100 administrative services during the 18th legislative term. The same applies to the project 'Single Point of Contact 2.0' ('*Einheitlicher Ansprechpartner 2.0*') that remains in the concept stage.[77]

Particularly with respect to **municipalities**, which offer by far the largest part of administrative services in Germany, the picture is still sobering ('*Index Digitale Kommune*', Opiela et al. 2017). Although the access to and the usability of the existing digital services are rather satisfactory, the offerings are still very limited and hardly mandatory. Hence, there is no real progress compared to the initial study of Fromm et al. (2015).[78] Less attractive digital services and low use are mutually dependent. From the supplier's point of view profitability aspects have an important role besides legal and political aspects. The common development and provision of basic components will be an effective instrument to lower the investment costs and to increase the profitability of user-friendly E-government solutions (see also PwC 2015, Bertschek et al. 2017).

Several internal and external barriers have to be addressed to accelerate the digital transformation of administration in Germany

A recent representative survey of administrators of all federal levels in Germany[79] indicates where decisive measures are needed the most, and it shows that the sluggish implementation of E-government in Germany is attributable to four main barriers:

- **insufficient collaboration among the authorities** in terms of developing common solutions and an insufficient federal coordination,
- high costs and absence of funding,
- **legal barriers** with focus on data security requirements, and the public procurement law,
- **internal issues**, e.g., a culture that is safety-driven and sceptical to innovation, the lack of corresponding skills or of management support.

[77] According to the announcement on the website of the IT Planning Council, the project shall be finished by the end of 2018. Main target groups are start-ups in Germany as well as businesses and employees in other EU Member States and third countries (www.it-planungsrat.de/DE/Projekte/Koordinierungsprojekte/ EA2_0/EA2.0_node.html).

[78] However, some mostly medium-sized municipalities perform much better than the average, proving that size is not the only determinant of high-quality digital services (Opiela et al. 2017).

[79] Hertie School of Economics and Wegweiser (2017) provide additional information. More information on the project '*Zukunftspanel Staat und Verwaltung*' can be found on www.wegweiser.de/de/zukunftspanel-staat-verwaltung-2017.

Those barriers coincide with the typical factors of success identified within the project '***Modellkommune eGovernment***', that were, inter alia, efficient personnel structures, user-oriented supply, strategic project management, standardised and high quality IT infrastructure, and proactive intercommunal and cross-level cooperation (BMI 2017). In some cases, some savings could already be realised within the short project period from January 2014 to September 2016, e.g., in the context of fewer required storing capacities for files and lower expenditures for postal services (BMI 2017, 99). A 'digital rent' in form of higher savings than initial investment and current costs, however, can only be expected in the long run (Stember and Klähn 2016).[80] With respect to policies, the above-mentioned survey reveals that federal authorities particularly expect **binding implementation requirements, more standardisation, stronger federal cooperation, and better funding** (Hertie School of Economics and Wegweiser 2017). Each authority needs its own **digital strategy**, which defines targets and action programmes, allocates resources, and lies in the responsibility of the chief administrator (Hölterhoff et al. 2018). Moreover, the interviewees demand that E-government competencies should be bundled, e.g., in a newly founded specific ministry or a public institution borne by the Federal Government and the federal states, as already recommended in a similar fashion by the NKR (2016, 2017) or the EFI (2016, see below).

The **lack of digital skills within governmental authorities** seems to be one of the key obstacles for the successful deployment of digital administration including open data. This aspect not only refers to technical skills but also to the understanding for the benefits and preconditions for the transformation into digital services and the application of open data (see also BMI 2017). To improve this situation, a **systematic and strategic staff development** is required and the curricula for administrative education and training must be adapted as quickly as possible (Hölterhoff et al. 2018).

Successful implementation requires a binding form of federal collaboration based on the highest echelon of political leadership and an appropriate financial budget

It is undisputed that the **Online Access Improvement Act** implemented in December 2016 offers the opportunity to promote the digital transformation of Germany in the next legislative term much more rapidly and profoundly than before.[81] At the same time, the decisions made by the IT Planning Council with regard to the establishment of a composite platform and the development of a digital transformation programme aim at offering comprehensive digital services for a number of everyday life and business situations, preferably across Germany.

Yet, the NKR (2017) as well as the EFI (2017) admonish that these opportunities must be taken quickly and implemented thoroughly by politicians and public authorities to significantly improve the quality of digital services. Segmenting the digital transformation of public administration into separate domains dealing with citizens, businesses or justice and taxation runs counter to the proposed aim of harmonising and consolidating the IT landscape and will likely lead to a proliferation of simultaneous but disjoint development initiatives for digital public services. As the development of a comprehensive, digitally integrated E-government service platform *('one-stop-shop'*) requires the introduction of **binding milestones** for the Federal Government, federal states and municipalities, also the EFI and the NKR already 2016 recommended that the Federal Government should create a **central coordination office for E-government** ('*Digitalisierungsbüro'*) **in the Chancellery** (EFI 2016, NKR 2016a). This should be supported by the IT Planning Council, which would have to be equipped with the corresponding authority to ensure the constructive cooperation of all stakeholders.[82] In its 2017 report, the NKR again demands a **binding form of** federal **collaboration**, which is based on the explicit intention of the highest echelons of political leadership (e.g. a Digital Minister) and underpinned by a **joint digital transformation budget** of the Federal government and the federal states (NKR 2017). Under

[80] Cost savings for businesses were not analysed or even mentioned in the evaluation.

[81] According to the coalition agreement of CDU, CSU and SPD €500 million shall be provided for the implementation of the Online Access Improvement Act with focus on the comprehensive digital service portal where users only have to enter basic data once (see 'Main points from the coalition agreement').

[82] Some of these recommendations can be found within the new coalition agreement. Besides the new minister of state for digitisation, the new coalition plans to appoint a digital council to enable close cooperation between policy and national as well international experts, to install an e-Government agency to develop standards and pilot solutions and to strengthen the role of the IT-Planning Council (see 'Main points from the coalition agreement').

these circumstances, cost savings in the billion-euro-range can be realised, opening up significant value-added potential (Fromm et al. 2015).

Main targets are the efficient operationalisation of an integrated E-government portal and the modernisation of public registries

Digital administration has to become the norm as soon as possible ('**digital-by-default**'). For this purpose the creation of an internet-based portal offering services to citizens and businesses in Germany is a strategic objective (NKR 2015). The **integrated E-government portal** should offer as many services as possible from the federal government, the *Länder* and municipalities in centralised form, consistently arranged according to the needs they address and in a user-friendly manner (Bahrke et al. 2016). For this, the implementation of the **once-only rule** is decisive, meaning that data referring to the same circumstance, person or enterprise should be requested once. Legal challenges, e.g., with respect to the collection of personal data, and technical preconditions, such as common IT standards, have to be tackled as fast as possible, so that the concept of a platform for services can be put to the test at an early stage. In order to continuously provide a stimulus for a cultural change and impact-focused administrative action, the NKR (2017) furthermore recommends the **establishment of a public innovation lab** based on comparable organisations in other nations.

One indispensable precondition for making digital public services a success in Germany, is the **modernisation of the fragmented Germany registry landscape**. At the same time, basic information from citizens and businesses should be requested only once. In its 2017 report, the NKR (2017) developed proposals for gearing data management towards the needs of citizens and businesses. This extends to issues of transparency and control, governing who is authorised to retrieve and use data. Main objectives are (McKinsey 2017b):

- standardised and easy digital access for important registries via secure and centralised communications infrastructure
- clear allocation and linking of data (see 'once-only' rule mentioned above) using a SourcePIN system following the Austrian model
- a central agency for the modernisation of registries that will pool the professional resources of authorities across all levels and ministries and will coordinate the players.

To achieve these targets, the NKR (2017) demands that the objectives of the registry must be included in the government programme for the 19th legislative period, and that a **registry modernisation act** must be passed as quickly as possible.[83] Registry modernisation would then have to be implemented administratively. This will require the swift establishment of a central agency that will, at short notice, launch and advance important initiatives, such as a programme for the wide availability of basic data. At the same time, E-government infrastructure must be expanded (e.g., with improved digital identification and signatures, and a user-friendly nationwide administration portal) and authorities and municipalities must be actively supported in the use of this infrastructure.

Thereby, a digital transformation programme for the 19th legislative term should include the following elements (NKR 2017):

- A clear description of the target status to be achieved until 2021, a thorough analysis of the current status and of the obstacles to achieving the target status as well as a careful formulation of the programme objectives and of the main measures to be taken in order to achieve these objectives,
- operationalisation of the objectives and development of indicators for measuring and evaluating the implementation status (impact monitoring),
- a clear specification of implementation deadlines and of an agreement on effective escalation mechanisms in case the deadline is endangered or exceeded,
- pooling implementation resources and sustainably strengthening the role played by the CIO of the Federal government, and the enforcement capability of central programme

[83] This topic has been included in the coalition agreement of CDU, CSU and SPD (see 'Main points from the coalition agreement').

management vis-a-vis federal ministries, complemented by an adequate management structure for a federal context by making the Federal IT Coordination (FITKO) a high-performing digital transformation agency,

- upgrading the Federal IT Council and the IT Planning Council of the federal and *Länder* governments to become strategic decision-making bodies with a strong mandate and an ambitious policy design role. It is imperative to increase the pace and to obtain majority decisions.

Following the NKR (2017) it is important that the ministries as well as the federal states and local governments gain confidence and assurance that a more binding and more consistent approach will not be at the expense of their autonomy, but will yield clear benefits in the end.

Particularly important is the improvement of digital services at the municipal level as local authorities are the first port of call for citizens and businesses. To promote this process the federal government and the *Länder* should finance and provide the necessary IT basic components. In return the municipalities should commit to bringing in their expertise and to implementing the results efficiently, escalation mechanisms included (Fromm et al. 2015).[84]

Open (Government) Data

Although the existing data portal for Germany GovData has been continuously refined since 2015[85], several issues referring to technical standards, user friendliness, data availability and data quality remain unsolved. One main criticism refers to the fact that six states are not participating in the funding and have therefore been excluded from access to the portal (Bahrke et al. 2016). Only with one central portal it is possible to ensure that data are clearly structured and comparable in order to avoid transaction costs and potential multiple investments, which makes it superior to decentralised solutions at the state or municipal level (EFI 2016). Thus, GovData should be developed into an open data portal that makes available the topical data of the Federal Government, federal states and municipalities in machine-readable format for further use. Experiences show that users are also interested in more and other data than those available now.

The **Open Data Act** set into force in January 2017 will support the establishment and operation of efficient public data stocks (EFI 2017). Yet, the further development of the portal with regard to content should focus on demand-oriented aspects, e.g. by using participatory approaches such as intensifying the dialogue with potential users (EFI 2017, World Bank 2014).[86]

Following World Bank (2014), a number of specific **policies and practices** are recommended with the target to improve the innovative potential of Open Data. They can be summarised as follows:

- *Release data which businesses and others request (demand-driven approach)*: Government institutions need to make publicly visible more details of their overall data holdings - including those datasets which are not yet available as Open Data. When data is requested businesses must receive a quick answer. Individual ministries should not be permitted to refuse the publication of data without a comprehensive and fast review by the government of the arguments for and against data release. Furthermore, government authorities on all federal levels shall actively encourage and enable businesses and citizens to help lead the evolution of GovData and other connected open data portals, e.g., by establishing contact between officials responsible for the supply of data and developers responsible for their innovative use.
- *Prioritise the release of core reference data and release detailed and disaggregated data*: Data such as maps, address databases, demographic data from the census, data about roads and other transport links, official data about registered companies and other

[84] Besides, initiatives to promote the advantages of digitalization on the municipal level can also help to reduce reservations against digital services. Examples are the 'Digital Cities Competition' conducted by Bitcom in 2016/17 (http://www.digitalestadt.org/bitkom/org/Digitale-Stadt/Wettbewerb/) and its impacts on municipal level, e.g., the implementation of a digital agency in Heidelberg (www.heidelberg.de/hd,Lde/HD/service/03_07_2017+heidelberg+gruendet+digitalagentur.html)

[85] An exemplary change implemented in December 2017 refers to the transition from OGD to DCAT-AP.de (see www.govdata.de/web/guest/neues/-/blogs/govdata-auf-dcat-ap-de-umgestellt).

[86] According to the plans of the new coalition the availability of Open Data shall be enlarged by a second Open Data Act (see 'Main points from the coalition agreement').

businesses as well as data about public procurement can be important resources for innovative businesses and big data applications. Thereby, businesses mostly need less aggregated data. It is therefore important to ensure that the right level of detailed data is released while protecting national security and personal privacy.

- *Ensure that data can be found*: It can be a challenge for potential users to find the data that they need within the structures of government at national, regional, or municipal level. The Open Data portal can help address this issue if it has a collection of the richer metadata on each dataset needed to assist locatability. It also requires that all other portals collaborate and share their metadata and that the data are visible on third party search services.
- *Ensure continuity of data supply*: To give businesses the confidence to invest, it must be guaranteed that the data will continue to be released, maintained and updated regularly. Governments should establish policies and actively monitor compliance with them, escalating to ministerial level quickly any failure in data supply which is endangering businesses.
- *Extend the release of data beyond government ministries*: In addition to the data which governments themselves hold, they will need to provide both policies and active leadership and encouragement to other institutions to release data important to economic growth and business innovation. This includes public institutions at regional and city level, state-owned enterprises, and private sector companies providing important public services.
- *Ensure that government data is properly explained, and that issues can be raised with the relevant expert officials*: This should involve not only answering questions and supplying documentation about standards and coding, but also actively reaching out to developers by contributing to online communities and through seminars and workshops.
- *Reach out not just to developers but to innovators and entrepreneurs in specific sectors*: Promotional activities for the use of Open Data can focus not only on Open Data in general but additionally on specific sectors - or indeed on specific issues on which the government would like more innovation. Each ministry should have a strategy and a target for generating economic growth and business innovation in its sector from the data it and other public institutions hold.
- *Actively support and incubate innovation using Open Data and create institutional structures to do that on a sustainable basis*: Examples for such 'centres of excellence' to engage and bring together both the data suppliers within public institutions and the data users in the private sector are the UK Open Data Institute or the US Open Data Institute. In Germany the Fraunhofer Institute for Open Communication Systems (FOKUS) is working on Open Data concepts, new technology based solutions, organising workshops and offering trainings.[87]
- *Leverage existing government support programmes to ensure that they also contribute to Open Data objectives where possible*: It may be possible to leverage the substantial existing funding for innovation, ICT industry stimulation and start-up incubation to accelerate the exploitation of Open Data.
- *Develop Open Data skills within the government institutions, regions, and municipalities*: The re-use of Open Data has opportunities for the efficient and collaborative operations of government itself. Exploiting this potential requires the development of 'Open Data skills' among the relevant officials considering a sound understanding of Open Data laws including their interpretation and limits as well as technical skills for data preparation and knowledge how to assist businesses and other data users. Success in Open Data represents a new way of working for officials that will require sustained leadership and change management.
- *Ensure that the Government is using innovative data services and products from the private sector* (see also innovative public procurement): Governments should be leading and proactive customers for innovative private sector products and services using open data, including advanced analytic services to improve internal decision making and to help create new services. This public procurement demand will help stimulate early investment.

However, the recent representative survey of administrators performed by Hertie School of Economics and Wegweiser (2017) showed that there are still considerable doubts, insecurity and a

[87] See http://open-data.fokus.fraunhofer.de/en/service/

lack of knowledge with respect to Open Data within German authorities. This squares with the experiences made during the call for proposals for the project *'Modellkommunen Open Data*' in 2017. Only very few (26 of more than 11,000) municipalities were willing to participate (Die Bundesregierung 2017b).

Main points from the coalition agreement

Several recommendations with respect to E-government, registry modernisation and Open Data have been included in the coalition agreement of CDU, CSU and SPD signed in February 2018:

- €500 million shall be provided to implement the Online Access Improvement Act. The target is that digital access to governmental services shall become the rule ('digital first'; 'digital-by-default') through the implementation of a standardised comprehensive digital service portal where users only have to enter basic data once.[88]
- E-ID will become a comprehensive, secure and mobile usable mode of authentication. User friendliness will significantly increase.
- An E-government agency shall be instituted to develop standards and pilot solutions for all federal levels as quickly as possible. At the same time, keywords like think tank, regional open government labs, innovation labs, or accelerator found in the NKR expertise (2015, 2016) are referred to.
- A digital council shall be appointed to enable close cooperation between policy and national as well international experts.
- Electronic processing (*E-Akte*) in public authorities shall be established quickly.
- Public registries shall be modernised considering the NKR proposals.
- Strong efforts will be made to promote IT consolidation and standardisation, regulation, and control will be improved further. The role of the IT-Planning Council will be strengthened. The *Informationstechnikzentrum Bund* (ITZ Bund) shall be transformed into a public institution to set planning reliability for client authorities.
- Considering E-Legislation, all existing and future laws shall be reviewed according to their digital transformation (*'Normen-Screening plus'*). All drafts of the federal government shall be published on a platform to foster transparent participation of citizens and NGOs.
- The Federal Government shall become international trailblazer for Open (Government) Data. Across all federal levels the digital publication of data shall become a common element of governance ('open by default'). The availability of Open Data shall be enlarged by a second Open Data Act. Government data shall generally be available for free, thus also helping to stimulate innovative technologies and new business models.
- Digital skills shall become more relevant in job descriptions and the selection of management staff in public authorities. This implies also the modernisation of education and further training.

Many of these aspects only repeat requirements connected to already existing legislative regulations (e.g., the E-Government Act, the Online Access Act and its accompanying digital transformation programme, the Open Data Act). The upcoming government programme and its deployment will show whether the announcements will be implemented by – as demanded by NKR (2017) - an adequate and flexible funding, a strong management and a highly effective federal organisation.

According to further negotiations between the coalition parties it is not intended to install a separate digital ministry for digitalisation. Instead, a new minister of state for digitalisation has been established at the Federal Chancellery. Dorothee Bär has been appointed who has already worked on this topic as state secretary at the Federal Ministry of Transport and Digital Infrastructure (BMVI) for four years. Nevertheless, it is still unclear whether she will really have the authority and resources required to promote this interdisciplinary subject as long as the

[88] To the status quo of this so-called *'Serviceportal des Bundes'* see www.cio.bund.de/Web/DE/ Innovative-Vorhaben/Serviceportal-des-Bundes/serviceportal_des_bundes_node.html.

responsibilities for subdomains remain part of a large number of different teams, departments, and ministries on the federal and *Länder* level.

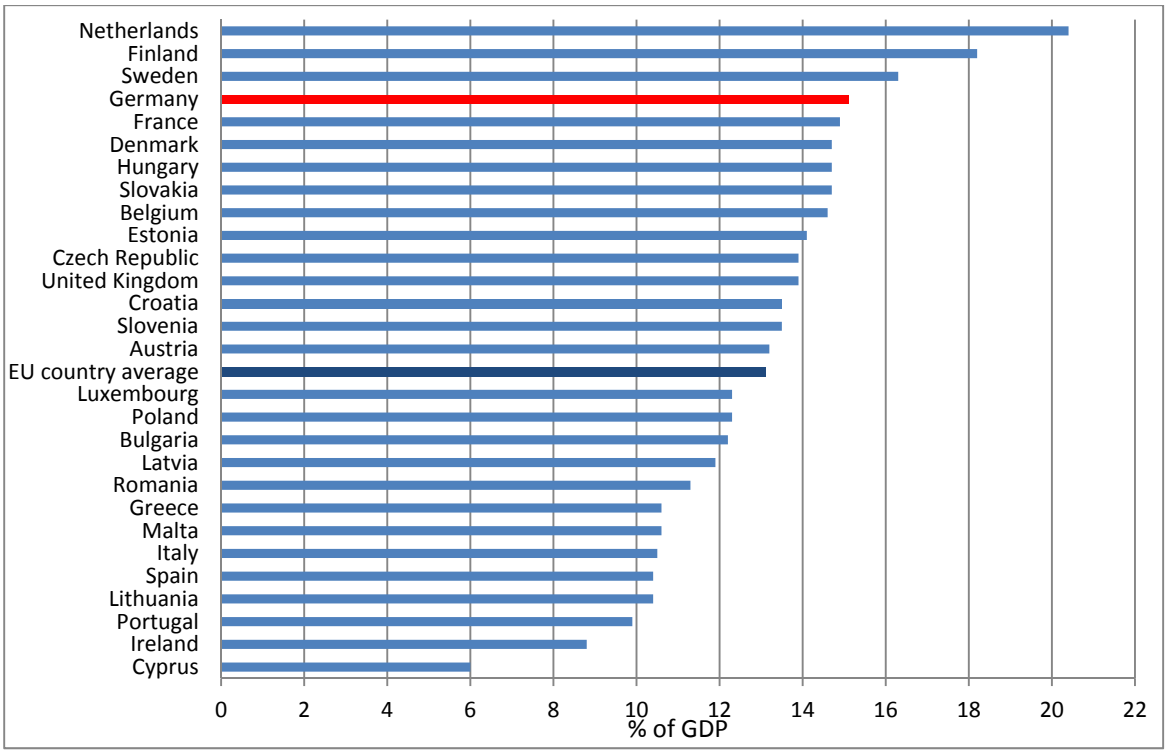
5.2. Public Procurement

5.2.1. Current Situation and Main Challenges

Public procurement is another important government activity that has direct impact on the business environment. It accounts for a significant portion of overall demand for goods and services. As having the opportunity to choose between different options, public procurement is increasingly seen as an attractive and feasible demand-oriented instrument for furthering the goals of innovation policy (Iszak and Edler 2011, Edquist et al. 2015, Georghiou et al. 2014, Chicot and Matt 2015).

The estimate of total expenditure on goods, services and works for the government sector is based on national accounts (household statistics, state expenditures) considering all public non-personnel expenses. It can be interpreted as expenditures which could have been publicly procured (European Commission 2016h). For Germany, this value amounted to €460 billion in 2015, and this accounted to 15% of German GDP (Figure 36). It is estimated to grow to €504 billion (15.5% of GDP) in 2017.[89] This illustrates the large size of public procurement budget and its significance for the economy as a whole. In some sectors, public purchasers command a significant share of the market, such as in health (74%), education (91%), transport infrastructure, telecommunications, and defence (100% each) (Chiappinelli and Zipperer 2017). This high volume also indicates how the public sector can support policy objectives through public procurement (OECD 2017b).

Figure 36: General government expenditure on works, goods, and services (excluding utilities) as a percentage of GDP, 2015



Source: EU Single Market Scoreboard. Public Procurement Indicators. Annual Report 2015, Table 2.

Yet, this top-down approach based on national accounts is not entirely unproblematic. On the one hand, it excludes utilities and other public enterprises while on the other hand it includes particular expenditures that do not constitute government public procurement such as the (personnel) costs

[89] Calculations are based on the Eurostat series 'gov_10a_main', which is calculated as the sum of government's general expenditures on 'intermediate consumption' (P2), 'gross fixed capital formation' (P51G), and 'social transfers in kind purchased market production, payable' (D632PAY).

of health care paid by health insurances. Thus, it is only suitable for a rough estimate of public procurement in international comparison.

The alternative is a bottom-up approach using data from national procurement authorities. Those analyses typically yield much lower procurement volumes than estimations based on household statistics (Falk and Wiederhold 2013). Every year the BMWi publishes statistical tables including all types of orders (supplies, services, public works) above and below EU-thresholds that have to be announced across Europe. However, sub-federal authorities only have to record contracts above EU-thresholds. According to this compilation, all contracts above the EU-threshold amounted to €28 billion in 2016.[90] Yet, it can be assumed that procurement authorities do not always fulfil their reporting obligations, resulting in an unquantifiable under-reporting of the procurement volume (Wegweiser et al. 2009, Eßig and Schaupp 2016a). Moreover, further information on the kind of procured goods or services, the selected procurement procedures, and the awarded contractor is not recorded so far. Although some public authorities regularly release information on their public procurement, they generally only provide core data with respect to the number and volume of contracts (supplies, services, works), sometimes supplemented by information on the kind of award procedure, but without any insights into strategic goals.[91] The only possibility to obtain these data is the analysis of public procurement tender databases. A database for Germany will be installed at the German Federal Statistical Office, but is still in the set-up period (see chapter 5.2.2). [92]

Thus, up to now and for a considerable time to come, the TED (Tenders Electronic Daily) database is the only available source to depict the public procurement situation in Europe. However, as only public orders above the EU-threshold have to be published in TED, the sample is rather limited. This is particularly problematic with respect to Germany because about 75% of all public procurement refers to contracts below the EU threshold. Thus Germany registers the lowest contract value published under EU rules with 1.2% of GDP in 2015 (EU average 4.2%). This restricts the informative value of TED for analysing public procurement activities in Germany.

The potential procurement volume for innovative products and services is estimated to be at least as high as 10% of the overall public procurement volume (Berger et al. 2016; Wegweiser et al. 2009; Eßig and Schaupp 2016a), proving the high leverage effect of innovation-oriented public procurement. Thus, measures to make public procurement procedures simpler, more flexible, more user-friendly and more innovation-oriented can provide important incentives for businesses, particularly small and medium-sized enterprises (SMEs), to invest into R&D&I and digitalisation.

As innovation-oriented public procurement can significantly stimulate innovation within the economy, 'green public procurement' (GPP) holds large potential to decarbonize the economy, also relative to other decarbonisation policies currently implemented or discussed (Chiappinelli and Zipperer 2017). Moreover, public authorities have the size and the role to push the public awareness and the political commitment for environmental protection as well as sustainable consumption and production (Neuhoff et al. 2017). A recent study on the behalf of the European Commission (PwC 2016, 88) comes to the result, that 'overall, the public procurement framework in Germany is effective to achieve the primary goals of realizing value for money and promoting open and fair competition'. This statement is supported by the development of the number of cases against procurement decisions filed by losing applicants. In Germany the public procurement tribunals are in charge of investigating whether procurement procedures above the EU thresholds comply with legal requirements. The number and results of review proceedings, graphically

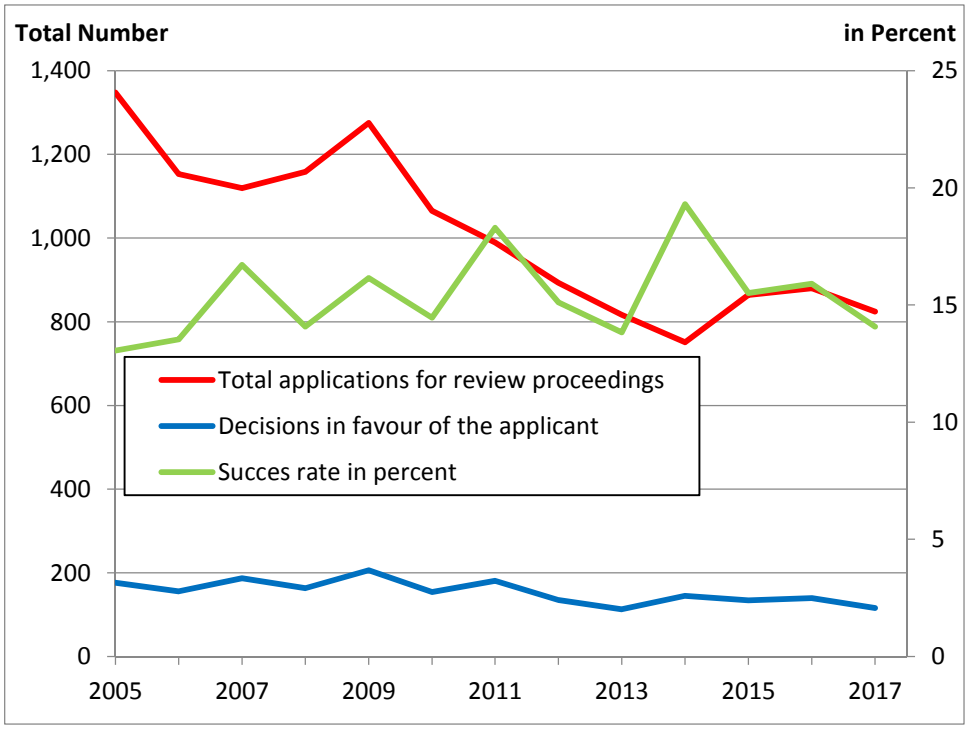
[90] Own calculations based on BMWi: *EU-Statistik – Übersicht statistische Meldungen*, www.bmwi.de/Redaktion/DE/Textsammlungen/Wirtschaft/eu-statistik.html

[91] One example is the data report on public procurement in Saxony, which has been released regularly since 2004. It provides data on public procurement contracts below the EU-thresholds awarded on the federal state level (excluding municipalities). The recent report covers the 2015/2016 period (SMWA n.d.). Others, e.g., the procurement report for Berlin reports on, inter alia, the inclusion of social and green aspects in public procurement. As public procurement is very fragmented in Berlin and reliable statistical data are missing, the evaluation relies on voluntary interviews with the responsible authorities (Senatsverwaltung für Wirtschaft, Energie und Betriebe 2017).

[92] National audit reports of the federal state ('*Bundesrechnungshof*') and the *Länder* provide a general evaluation of the budget management based on core receipts and expenditure figures from household statistics as well as a selection of bad examples. It is not possible to use them for generalizable statements about the efficiency of public procurement in Germany, since they do not collect representative data. The same is true for the reports by the '*Bundeskartellamt*'.

depicted in Figure 37, have to be annually reported to BMWi. It can be seen that the number of applications for review proceedings significantly decreased from 2005 (1,350) to 2014 (750), followed by a slight increase. Simultaneously, the number of decisions in favour of applicants has fallen so that the success rate varies between 15 and 20%. In contrast to this, the total number of public procurement contracts above the EU thresholds reported to the BMWi by federal and *Länder* authorities has risen from about 10,350 in 2005 to more than 18,000 in 2016.[93] This could indicate a growing legal conformity of public procurement in Germany, although it does not mean that all issues have been solved.

Figure 37: Applications for review proceedings of public procurement tribunals in Germany 2005 to 2017



Source: BMWi.

However, there are still substantial weaknesses or challenges to be overcome to achieve the strategic goals of public procurement. This is particularly true in order to tap the full potential of innovation-oriented public procurement, as currently the focus of strategic procurement in Germany on the Federal as well as on the *Länder* level lies on social aspects (e.g., minimum wages) and 'green public procurement' (GPP), mainly with respect to energy efficiency and the use of low-carbon materials (Die Bundesregierung 2017d).[94] Yet, a recent analysis based on the TED database for Germany concludes that the use of environmental criteria for large-scale procurement contracts is only 2.4% of all public contracts awarded in 2015, although a positive trend can be observed during the 2009 to 2015 period (Chiappinelli and Zipperer 2017).[95]

The most significant weaknesses in the German procurement system have been **inefficiencies resulting from the separation of legal and institutional structures** both within and between the various federal and regional administrations (*Länder*, municipalities). The duplication of efforts, e.g., among the four at federal level centralised purchasing bodies (CPBs) and their numerous regional counterparts, creates substantial costs for administrations and economic operators (PwC

[93] Own calculations based on BMWi: EU-Statistik – Übersicht statistische Meldungen. www.bmwi.de/Redaktion/DE/Textsammlungen/Wirtschaft/eu-statistik.html

[94] For *Länder* examples see Wegweiser (2016) for Schleswig-Holstein or Senatsverwaltung für Wirtschaft, Energie und Betriebe (2017) for Berlin.

[95] Based on a keyword search of awards; awards were classified as 'GPP' if an environmental criterion was present among the award criteria (c.f. Chiappenelli and Zipperer 2017).

2016). To improve the coordination, the federal government has recently developed an **E-procurement** standard, which ensures the comparability of data processed by different procurement platforms. Once fully operational the system should significantly reduce the complexity of public procurement processes (European Commission 2017a).

Furthermore, at least based on TED database, collaborative public procurement[96] in Germany was only 6% within the period 2006 to 2016, whereas countries as the UK (24%), Ireland (19%), Sweden or Finland (15% each), Denmark (13%) or Italy (11%) depict significantly higher values (European Commission 2017d). Although collaborative purchasing seems to gain importance on the federal and the *Länder* level in Germany (Die Bundesregierung 2017b), its advantages, particularly with respect to strategic markets such as IT or health, have not been used comprehensively. Those advantages include the following: best value for money through large-scale economy benefits, professionalising of units engaged in public procurement, more effective planning and monitoring of procurement projects, and facilitating the implementation of strategic goals in public procurement (like innovative or 'green' procurement).

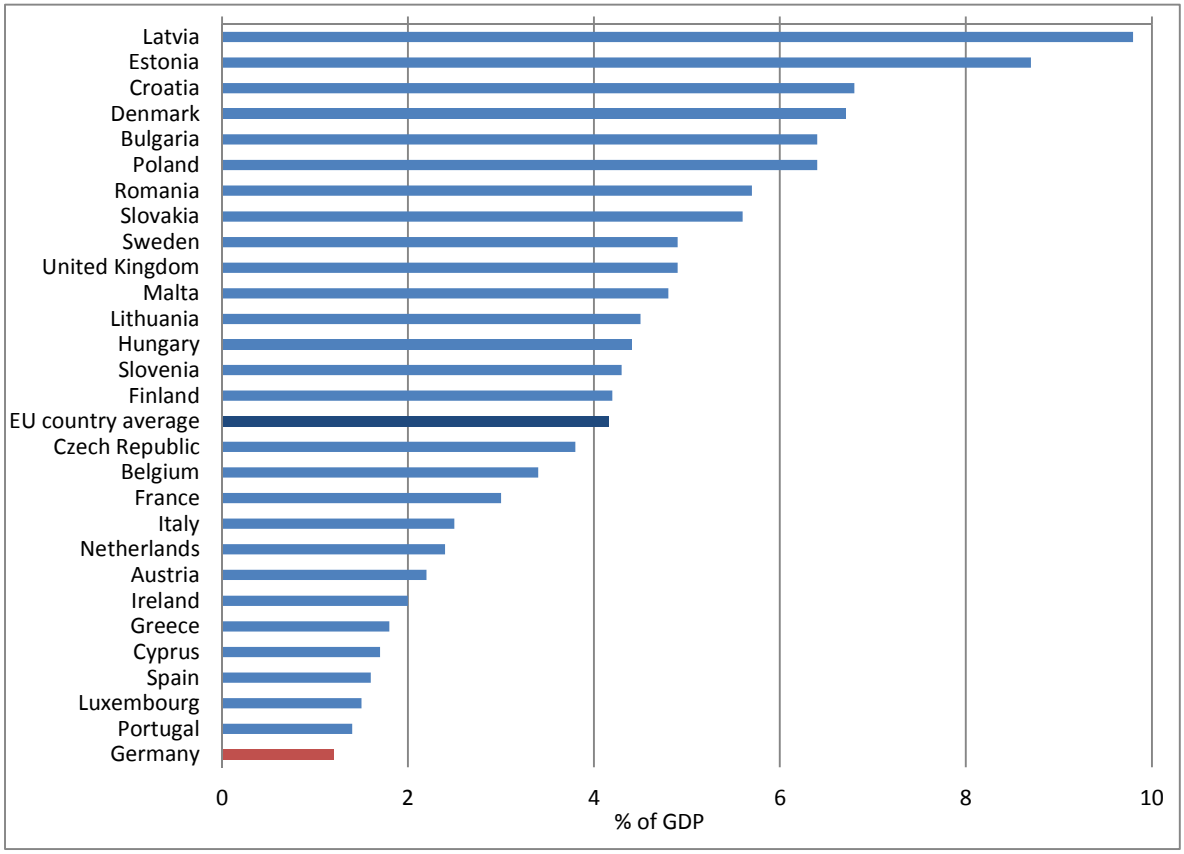
The fragmentation of the German public procurement system is also a key barrier to the better **availability of public procurement data**. The German system currently impedes the collection of comprehensive, nationwide statistics of procurement, and of data required to analyse the implementation and effectiveness of procurement policies. The BMWi has launched a study addressing the relevant issues, including e-procurement. However, the costs and complexity of data collection and compilation would considerably decrease by addressing the complexity of the system at the same time.[97] The current issues with respect to general data on public procurement become even more relevant when focussing on innovation-oriented procurement (Falck and Wiederholt 2013).

In several country reports (European Commission 2014a, 2016b, 2017, 2018), the European Commission expresses criticism of the public procurement market in Germany, which is still the most closed market in Europe, measured by the disproportionately **low number of tenders open to procurement across Europe**. According to Tenders Electronic Daily (TED) database, with 1.2% of GDP (2015), Germany registers the lowest contract value published under EU rules (EU average: 4.2%, Figure 38). This could also be due to the large number (roughly estimated at about 30,000, probably even more) of decentralised contracting authorities at federal, *Länder* and municipal level. A high proportion of contracts (about 90%) and of contract volumes (about 75%) is below the EU threshold (BMWi 2014, 2016b; Die Bundesregierung 2017b). However, this national focus limits competition and the access to markets, as the EU-wide publication of public tenders could increase transparency, competition, and thus improve the quality of services while enabling further efficiency gains (European Commission 2017a; PWC 2016).

[96] Collaborative public procurement is measured by the average proportion of contract award notices where the contracting authority is purchasing on behalf of other contracting authorities (European Commission 2017d).

[97] See also the section to Open Data in chapter 'E-government'.

Figure 38: Public procurement publication as a share of GDP, 2015



Source: EU Single Market Scoreboard. Public Procurement Indicators. Annual Report 2015, Table 9. http://ec.europa.eu/DocsRoom/documents/20679/attachments/1/translations/en/renditions/native

In Germany, **innovation-oriented public procurement** is part of the overall innovation strategy of the German federal government. The 'High-Tech Strategy – Innovation for Germany' encompasses all research, technology and innovation measures of the German government (see chapter 2.1). Innovative procurement is the most important measure under the framework of demand-oriented policy instruments. Six federal German ministries agreed in 2007 to promote innovation-oriented public procurement (OECD 2017b). As a consequence, Germany's Law on Modernisation Public Procurement ('*Gesetz zur Modernisierung des Vergaberechts*') in 2009 permitted strategic procurement targets like environmental, social-policy and innovation-promoting aspects as procurement criteria for the first time (Eßig and Schaupp 2016b). With the so-called 'negotiation procedures' and 'competitive dialogue', procedures for procurement processes that offer more flexibility and offer room for autonomous decisions in public procurement were introduced. Innovative procurement can also be fostered within classic procedures by using functional tender specifications or quality criteria, but these instruments had hardly been used. Furthermore, two instruments were created that specifically allow greater focus on innovative procurement: pre-commercial procurement (PCP) and public procurement of innovation (PPI).[98] Germany applies here a rather broad definition of innovation including non-technological products and services (OECD 2017b).

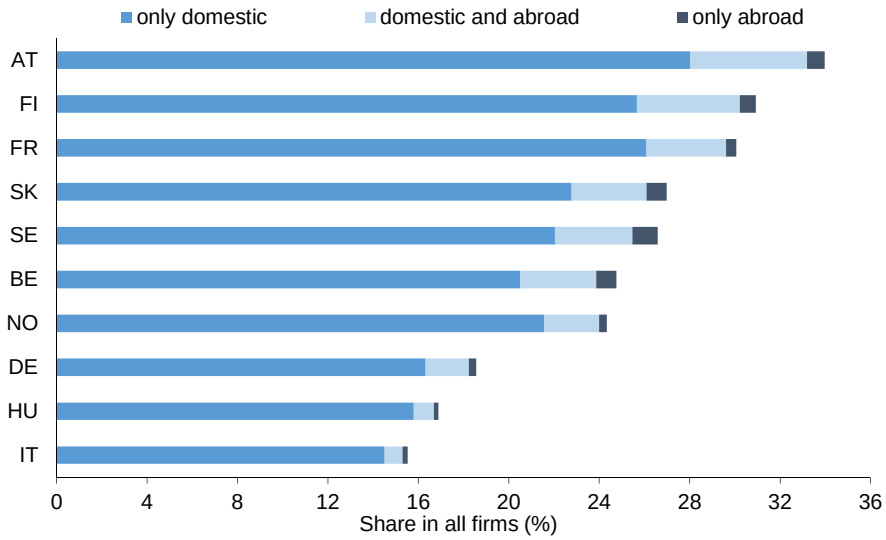
In addition, *Länder* and municipalities are to be encouraged to opt more frequently for innovative products and services. To this end, the economic ministers of the federal states have adopted a

[98] PCP refers to inviting tenders for R&D services in the pre-commercial phase. The PCP instrument is supposed to make it possible to initiate the development of technologically innovative solutions within the framework of public procurement. PCP usually involves the (further) development of a product or service which is taken forward in several stages by two or more companies. In the case of PPI, a public procurement agency operates as a (first) user of innovative products, services or system solutions that are at an early market stage (Falck and Wiederhold 2013; Edquist et al. 2015; Berger et al. 2016; OECD 2017b).

resolution aimed at having procurement guidelines apply sustainability and innovation criteria (BMBF 2014, 43).

Yet, there is a clear agreement that the progress made at federal and regional levels in stimulating environmental goals and innovation through public procurement is not satisfying in Germany (European Commission 2018a; EFI 2017; OECD 2017b). The fact that about 50% of large-scale public procurement contracts is still awarded on the basic of the lowest price offer instead of the 'most economical advantageous tender' (MEAT) criterion which allows to consider quality dimensions may also be an obstacle to such strategic goals (European Commission 2018a). Public procurement too often resorts to established or not very innovative solutions, thus leaving potential for developing innovative products and services untapped. One reason for this may be that SMEs as important drivers for innovation are likely to be discriminated against by the current procurement procedure in Germany – indicated by the comparably low share of enterprises with procurement contracts to provide goods or services for domestic or foreign public sector organisations (Figure 39).

Figure 39: Firms with public procurement in 2010 to 2012



Source: Eurostat, CIS 2012

Although the so-called '*Mittelstandsklausel*' requires the division of contracts into lots in order to facilitate the participation of SMEs, this requirement does not apply in case of conflicting economic or technical reasons. Falck and Wiederholt (2013) show that these criteria have been applied liberally: few large lots cause less administrative burden from the procurer's perspective and the bankruptcy risk of SMEs – and therefore the loss of warranty and liability claims – is comparably higher. Whether this situation has significantly changed with the implementation of the Law on Modernising Public Procurement since April 2016 (see chapter 5.2.2) stipulating further facilitations for SMEs, e.g., with respect to minimum sales or other references cannot be judged satisfactorily yet. The first monitoring report in 2017, which covers procurement contracts above the EU thresholds under the new legislative conditions, only states that all requested federal and *Länder* authorities acknowledge the importance of the division of lots to support the participation of SMEs in public procurement in principle. However, most respondents report that no concrete data are available and refer to the outstanding procurement statistic. Concrete numbers or participation rates for SMEs are only provided from a small number of authorities[99] and cannot be used as verifiable and general statements. They mostly mention participation rates from 50 to 70% which are comparably low given the fact that SMEs represent 99% of all enterprises in Germany.

[99] Only the procurement office as the central purchasing body of the Federal Ministry of Interior, Building and Community (BMI) regularly publishes data on procurement orders including the participation rate of SMEs, see www.besdcha.bund.de/DE/Das BeschA/DatenFakten/node.html.

Other issues referring to the insufficient use of innovation-oriented public procurement as well as GPP result from the lack of political support, the lack of qualified staff and risk aversion in public authorities as well as financial restrictions (OECD 2017b; Chiappinelli and Zipperer 2017). A recent analysis based on a representative sample of German firms found a robust and significant effect of PPI on turnover from new products and services (Czarnitzki et al. 2018).[100] The effect is largely attributable to innovations that are new to the firm but not to the market. This result is not very surprising in view of risk aversion among public procurers: Incremental innovations and adaptations of already existing products are easier to understand and pose a smaller risk to procurers than radically new approaches. Hence, public procurement of innovation is mainly suitable for inducing the diffusion of technologies and upgrading of already existing product portfolios.[101] Nevertheless, by improving public risk management and strengthening the commitment to innovation procurement at the level of decision-makers, incentives for more radical innovations could be increased, e.g. via using pre-commercial procurement (PCP) in situations where commercial solutions to address public needs do not yet exist (Edquist et al. 2015; Müngersdorff 2015).

5.2.2. Main Reforms 2013-2017

Main reforms in the area of public procurement in the period 2013-2017 refer to public procurement law, connected regulation and the implementation of the Centre of Excellence for Innovative Procurement (KOINNO).

In order to transpose three EU directives (EU/23/2014, EU/24/2014, EU/25/2014) governing public procurement above the EU thresholds[102] into national law, a comprehensive reform of procurement law was undertaken in April 2016 (**Law on Modernising Public Procurement** - *'Gesetz zur Modernisierung des Vergaberechts'*). The aim of these directives is to create simple and user-friendly rules for public procurement, which offer greater flexibility in awarding public contracts within European law boundaries, facilitate the participation of small and medium-sized enterprises in procurement procedures, and thereby strengthen competition (BMWi 2016, 23).[103] Furthermore, the reformed legal framework permits contracting authorities to make more use of public procurement to support strategic objectives, particularly social, environmental and innovative aspects. Thus, public procurers are explicitly encouraged to prepare calls for tenders that include functional and performance-based specifications in order to promote innovation. Furthermore, the possibility to consider innovative aspects and life-cycle costs of proposed solutions rather than initital purchasing costs has been put on a legal basis (Czarnitzki et al. 2018).

The general rules of the 'Law on Modernising Public Procurement' were implemented by a revision of Part 4 of the **Act against Restraints of Competition** (*'Gesetz gegen Wettbewerbsbeschränkungen*': GWB). Detailed regulations regarding the different phases of the procurement process or the requirements with respect to data collection can be found in the corresponding **Regulation on Modernising Public Procurement** ('*Vergaberechtsmodernisierungsverordnung*': VgV).

In order to achieve nationwide rules that are as uniform and simple as possible, a reform of procurement law below the EU thresholds (**Ordinance on Procurement below the Thresholds** – '*Unterschwellenvergabeverordnung*') entered into force by September 2017. It takes the flexible provisions in the new rules for procurement above the EU thresholds implemented by the 'Law and Corresponding Regulation on Modernising Public Procurement' and applies them to the awarding of

[100] The analysis refers to data from the 8th Community Innovation Survey 2010 to 2012, the period immediately after the 2009 revision of public procurement regulations in Germany. They enable the investigation of firms with public procurement contracts in which innovative solutions are an explicit part of the contractual arrangement.

[101] A current example is the highly increased demand for electric or hybrid buses for local public transport in German cities to reduce fine particulate matter from traffic.

[102] €5.225 million for public works, €135,000 for public supply and public service contracts of supreme and higher federal authorities, €418,000 for public supply and public service contracts in the fields of drinking water, energy, transport, defence and security, €209,000 for all other public supply and public service contracts.

[103] E.g. the former Regulations on Contract Awards for Public Supplies and Services (VOL/A) and the former Regulations on Contract Awards for Independent Professional Services (VOF) have been consolidated into the VgV law.

below threshold public contracts for supplies and services at national level. The *Länder* will adapt their budget rules on procurement below the EU thresholds in the coming months (BMWi 2017a).

Furthermore, since April 2016 all contracts above the EU thresholds, all tender documents, and particularly the specification, must be freely accessible and available free of charge online (**E-procurement**). This reduces the cost and time for companies to get informed about and bid for contracts, so that procurement procedures will become quicker and more transparent (OECD 2017a, b). Furthermore, E-procurement is an important precondition for the comprehensive collection of public procurement data (see '*Vergabestatistikverordnung'* below). By 18 October 2018, all contracting authorities and contractors must have moved entirely to the online handling of procurement procedures for public procurement and concessions above the EU threshold. Procurement procedures for contracts below the EU thresholds have to be conducted entirely online by the end of 2019.[104]

Part of the new legislation is the '*Vergabestatistikverordnung*' which intends to improve the collection and quality of public procurement data by implementing **central, nationwide public procurement statistics**. All procurement data shall be collected and whenever possible automatically and electronically analysed to get representative information on the annual volume and structure of public procurement above and below EU thresholds. Nevertheless the data collected for procurement below the EU threshold remains very limited. The new nationwide statistics requires suitable and user-friendly IT solutions like procurement management systems and E-procurement platforms. For this purpose, the BMWi has commissioned a research project involving all relevant actors to develop the respective framework and technical provisions for data communication as well as the necessary interfaces.[105] The concept stage has been completed and currently technical conversion is in process (*Die Bundesregierung* 2017b).

A better implementation of strategic procurement on all administrative levels not only requires legislative regulations, but particularly accurately fitting advisory services for procurement operators. For this purpose, the **Centre of Excellence for Innovative Procurement** (*'Kompetenzzentrum innovative Beschaffung*': KOINNO) and the **Competence Centre for Sustainable Procurement** (*'Kompetenzstelle für nachhaltige Beschaffung':* KNB) have been established in Germany (*Die Bundesregierung* 2017b).

In March 2013, the **Centre of Excellence for Innovative Procurement** (*'Kompetenzzentrum innovative Beschaffung*': KOINNO) was set up in Germany as a central political initiative by the BMWi. According to the BMWi (2014, 61), 'it aims to strengthen the innovative direction of public procurement, thereby making a contribution to modernising administration and providing impetus for more innovation in the business community'. KOINNO was assigned several tasks including (Eßig and Schaupp 2016b; OECD 2017b):

- advising and networking procurement managers at the federal, *Länder* and municipal levels
- collecting successful practical examples ('best practices')
- building up a database for innovative products, services, procedures and other solutions, which can be used by procurers, as well as information on areas where innovative solutions are required
- organising conferences for the exchange of good practice, including an annual conference hosted by the Federal Ministry for Economic Affairs and Energy (BMWi);
- supervising the award of the prize 'Leadership through Innovation', that the BMWi, in cooperation with the German Association for Supply Chain Management, Procurement and Logistics (*'Bundesverband Materialwirtschaft, Einkauf und Logistik*': BME) initiated in 2006 for contracting authorities with top performances in the procurement of innovations and in innovative procurement processes[106];

[104] See www.bmwi.de/Redaktion/DE/Dossier/oeffentliche-auftraege-und-vergabe.html

[105] Within a research project called '*Statistik der öffentlichen Beschaffung in Deutschland – Grundlagen und Methodik'* (in short: *'Elektronische Vergabestatistik*') basic requirements for the establishment of this new statistics were analysed and published in several reports. For the results see Böggild et al. (2014, 2015a, 2015b, 2016).

[106] See www.koinno-bmwi.de/koinno/das-kompetenzzentrum/innovationspreis

- supporting pre-commercial procurement (PCP) as a model.

Furthermore, Germany's federal government published a **guideline for procurers** that supports the use of instruments to foster innovative procurement (BMWi/KOINNO 2017).

The higher flexibility provided by the reform in 2016 and especially the consideration of environmental aspects in the procurement process was facilitated and the use of sustainability labels as a requirement in procurement orders explicitly allowed. The provision of publicly available information and guidelines for the new environmental-friendly procurement possibilities aims at lowering procurement and operation costs as well as at creating a healthier working environment for employees in public institutions. To achieve a higher proportion of sustainable products in public procurement and the cooperation between all three administrative levels (national, federal and regional) the **Alliance for Sustainable Procurement** (*'Allianz für nachhaltige Beschaffung'*) established in 2010 by the BMUB (Federal Ministry for The Environment, Construction and Nuclear Safety) continued its work. The tasks of the alliance consist among other things of establishing and operating expert groups that publish reports, recommendations and guidelines regarding several topics such as 'Green IT', green energy, sustainable construction, and statistics and monitoring. The **Competence Centre for Sustainable Procurement** provides specific information and supports the coordination and diffusion of information between different institutions by offering workshops and administrating a forum for topics in sustainable procurement. It also provides direct links to respective *Länder* information. This refers to the respective email contact in state ministries or other responsible authorities, often supplemented by information on legislation, regulation, guidelines, or best practice examples.[107] Moreover, in 2010 the internet platform Sustainability Compass *('Kompass Nachhaltigkeit'*) has been established. It is intended to motivate and support procurement operators in integrating social and environmental aspects into purchasing and can also be used by SMEs to inform on respective standards or labels. In 2014, the web portal was upgraded to include a particular service for municipalities: the Municipality Compass *('Kompass Kommune'*) has the objective to support local procurement operators offering a product search function and providing information on legal and regulative frameworks at all administrative levels in Germany, as well as on sustainability labels and best-practice examples.[108]

5.2.3. Need for Further Reforms

More efficient public procurement requires more mandatory centralised purchasing and the integration of the existing E-procurement systems

Public procurement is not only relevant for central governments, but also for sub-central governments, as nearly two third of public procurement spending in the OECD countries in 2015 was carried out at this level, in Germany even 78%.[109] The large purchasing power of governments could be leveraged for impacts on the broader economy. During the last decade, many governments have promoted reforms in their procurement systems by developing and adopting new technologies and tools. Examples include capacity development strategies, digitalisation and automation of procurement processes, and strategic aggregation of demands mainly through central purchasing bodies. Thus, in Germany, the '*Kaufhaus des Bundes*' ('Federal Mall') as the electronic platform for the four at federal level centralised purchasing bodies fills the role of establishing framework agreements (FAs) to create economies of scale in both supply and demand. However, in contrast to the majority of OECD countries, contracting authorities *can* use these FAs on a voluntary basis, but *do not have to* do so. This lack of obligation impedes the stronger use of centralised purchasing in Germany.

With respect to the digitalisation of public procurement (**E-procurement**), an OECD comparison (OECD 2017a) shows that every country surveyed has implemented E-procurement systems, often in the format of a central platform accompanied by E-procurement systems of specific procuring entities. Yet, the functionalities covered vary widely across countries, and the integration of e-

[107] *See* www.nachhaltige-beschaffung.info/DE/Home/home_node.html

[108] See ttp://oeffentlichebeschaffung.kompass-nachhaltigkeit.de/en/site/ueber-den-kompass.
One example for sub-federal initiatives also considering sustainable procurement is the 'Sustainable City' dialogue, established early 2010. Since then about thirty mayors of German cities meet regularly to discuss strategic issues concerning sustainable municipal development, see www.nachhaltigkeitsrat.de/en/projects/sustainable-city-dialogue.

[109] OECD.Stat, Government at a Glance 2017 database.

procurement systems into other E-government systems has not been realised in several OECD countries including Germany. This can be a result of various obstacles to centralisation, such as regulatory heterogeneity and reflects the main issue in Germany: The decentralised system of contracting authorities with an estimated number of 30,000 purchasing authorities and a large number of private and public E-procurement platforms hamper synergies and efficient purchasing processes.

The diffusion and utilisation of E-procurement shall significantly improve in Germany in the course of the implementation of the **Ordinance on Procurement below the Thresholds** ('*Unterschwellenvergabeverordnung*'), stipulating, inter alia, the digitalisation of awards below the EU thresholds until the end of 2019 (see chapter Main Reforms 2013-20175.2.2). Projections are that enterprises will be discharged of personnel and non-personnel costs of €3.9 billion p.a. and administrations on all levels will realise cost savings of about €1.8 billion.[110] E-procurement will not only remove unnecessary bureaucratic burden, but it will also strengthen competition and transparency.

In compliance with the OECD survey mentioned above (OECD 2017a), the 2016 **evaluation of the "Digital Administration 2020" programme** (BMI 2017) also confirms that the development of uniform technical standards for connected applications (e.g. E-invoice, E-file) has to be advanced in Germany. Moreover, there is still a large deficit with respect to the use of enterprise resource planning (ERP) systems for procurement processes within federal authorities. Positive is that more than 80% of the demanded 130 federal authorities have internally bundled their procurement activities in 2016, about 10%age points more than 2014 (BMI 2017, 92-93), enabling higher transparency and standardisation as well as a higher professionalism of procurement competence. However, the evaluation rests upon a survey of federal administrations, exclusively.

Data situation still dissatisfying due to the ongoing development process of the envisaged central procurement statistics

Furthermore, as comprehensive **public procurement data** are not yet available nationwide in Germany, no specific control of public procurement and no real chance for strategic procurement is possible (von Oertzen Becker n.d.). To date the collection of procurement data mainly serves to fulfil statistical obligations, although most of the procurement authorities also call for other aspects like controlling, fighting corruption, or answering political or civil requests. The collection process is time-consuming and error-prone as E-procurement systems are not widely used, particularly in smaller authorities on the municipal level. Moreover, data quality needs to be improved. Only few (particularly large) procurement authorities use procurement data for process optimisations or for strategic objectives (Böggild et al. 2014, 2015b).

Data availability will improve through the operationalisation of the new nationwide electronic procurement statistics, legally based on the '*Vergabestatistikverordnung*' set up in 2016 and located at the Federal Statistical Office of Germany. The envisaged central data platform has been conceptually and technically developed considering the requirements of procurement authorities and appropriate experts in Germany as well as experiences with already implemented statistics in other countries (best practices).[111] Firstly, this refers to technical requirements, e.g., to allow the automatic electronic collection and analysis of the data. Secondly, the set of recoded indicators that has to balance elicitation effort and predicted benefits, has been investigated. Further aspects apply to the dealing with order extensions and framework agreements, and the introduction of a threshold value for public procurement below the EU thresholds:

- With respect to public procurement above the EU thresholds all process steps between contracting authorities and economic enterprises are affected by the obligation to use ICT for data transfer and communication (electronic offers, electronic evaluation of the offers, electronic award, and electronic communication). All procurement notices have to be published on the internet and all public tenders must be made available for download.
- Generally, identical reporting requirements apply to public procurement below the EU thresholds. Yet, there are some important exceptions: The reporting requirements only

[110] See www.bmwi.de/Redaktion/DE/Artikel/Wirtschaft/reform-der-nationalen-vergaben.html

[111] See Böggild et al. (2014, 2015a, 2015 b).

hold for the purchase of supplies and services, so that public works are excluded. Furthermore, they only cover purchases above €25,000 (von Oertzen Becker n.d.).

- The recording of SMEs with respect to offers and awarding of contracts will be part of the new procurement statistics. Yet, the mandatory statistical collection of strategic objectives in public procurement does not occur until this information is required for European publications. Concerning this matter, the Commission has started to elaborate its standard forms in 2017; currently, data on strategic public procurement are only collected on a voluntary basis (*Die Bundesregierung* 2017b, 14).

Once operational, the new electronic procurement statistics is a step in the right direction to improve the unsatisfying data situation in Germany (European Commission 2018a). However, to date it is not clear when the new electronic procurement statistics will start operations. Instead, it is assumed that it will not be fully operational before 2021-23, at the earliest.

Lack of data impedes the evaluation of the effective participation of SMEs in public procurement

A number of features might lead public procurement to favour large firms (Guellec 2016):

- The Bidding process is very complex (cost and capacity issue).
- Payment might come late (liquidity issue).
- SMEs have a higher risk to fail to innovate, which might deter panels to select them (risk issue).

Therefore, not only the EU and Germany, but also many other OECD countries try to improve competition in their public procurement system, e.g. by procuring in smaller packages, improving information (platforms) or simplifying procedures. Yet, the lack of data does not allow a comprehensive evaluation of SMEs' participation in public procurement in Germany. Actually, the envisaged comprehensive implementation of E-procurement procedures until the end of 2019 should raise the participation of SMEs. Simultaneously, the consideration of strategic goals should strengthen the competitive position of innovative SMEs and start-ups.

Also, the coalition agreement of CDU, CSU and SPD (2018, 64) states that public offers shall be procured SME-friendly. In this context, it is intended to investigate the consolidation of procurement rules for public supply and public service contracts on the one hand and public works on the other hand within a uniform public procurement regulation. Although the high economic importance of public procurement is pointed out generally, no reference to strategic objectives such as innovation or sustainability (see below) can be found in the coalition agreement.

Special PPI support programmes for SMEs have to be thoroughly designed and evaluated to avoid misallocations

With respect to support SMEs via PPI, several countries, including the US, Japan, the United Kingdom, Ireland, the Netherlands, and Australia pursue different models of **Small business Innovation Research (SBIR)** programmes (OECD 2017b). All programmes provide early stage financial support to high-risk innovative small firms. Major common features are high selectivity, staged financing (similar to venture capital), that the recipient retains the intellectual property rights, and that the programmes are usually handled at a specialised agency level (Guellec 2016).

Trailblazer were the US with their SBIR programme already set up in 1982. According to this programme, all federal agencies with an R&D budget of at least 100 million US dollars must pay out a certain percentage of this budget to innovative SMEs via a competition-based procedure. SMEs are invited to compile feasibility studies for innovative projects in societal fields like health, safety, energy, or environment, which are then financed by the SBIR programme (Falck and Wiederhold 2013). In a second step, the R&D activities to implement a project proposal can be promoted, e.g. in the form of a prototype.

The Commission of Experts (2017) recommends carefully assessing the costs and benefits of the existing SBIR programmes from the point of view of their innovation effects. In case of positive evaluation, the implementation of such a programme could also be an option for Germany. Indeed, evaluation of those programmes is rare because data is not available. The few existing evaluations have drawn mixed conclusions (Guellec 2016). Overall, they depict little additionality but some encouragement to entrepreneurship and venture capital raising. In general, EFI (2017, 27) cautions against assigning public authorities the key role as an investor and initiator of innovations,

because such an understanding of roles would risk causing considerable misallocations by weakening market-based innovation dynamics.

Stronger promotion of public procurement of innovation (PPI) requires clear concepts and targets, guidance, education and training

In view of the high volume of public procurement, the German Commission of Experts (2017) calls for a part of these funds to be used to promote innovation more intensely and in a more coordinated way than in the past. To achieve this, it would in particular be necessary to adjust both the legal framework and the practical operations of public procurement to give priority to more innovative offers. One important area of application for innovation-oriented procurement can be the development of a comprehensive and user-friendly system of E-government (see Chapter 5.1). Building an efficient E-government structure can, in turn, help conduct innovation-oriented procurement in a transparent and efficient manner (EFI 2017).

According to a recent OECD report (OECD 2017b), the majority of OECD countries use public procurement to support innovative goods and services. Various measures range from legal instruments and more comprehensive government programmes to non-legal instruments, such as guidance, which is the most widely used approach and also the main task of the Centre of Excellence for Innovative Procurement (KOINNO) in Germany (see below). Less often, specific legislative provisions and policies stipulate preferences for innovative goods and services through set-aside and bid preferences, such as in Austria, Latvia and Turkey, and sometimes even preferential treatments including waiving fees and quotas for innovative firms, such as in Mexico and Spain. There are also government programmes that support pre-commercial procurement (PCP) to help late-stage innovative products and services to enter the market. Examples include Canada's Build in Canada Innovation Program and Denmark's Market Development Fund.

Although the legal basis for using public procurement to support innovation and to achieve societal objectives in Germany already exists since 2009, the impact on public procurement still seems to be rather low in practice (EFI 2017, European Commission 2018a). Particularly local purchasing authorities have no incentive for considering the social costs of their purchase decisions. Caused by additional work referring to contract awarding and often absent support of decision-makers, there are hardly any incentives for public procurers to relinquish established procurement patterns in favour of strategic and innovation-oriented procurement (Falck and Wiederholt 2013). Besides the lack of political support (OECD 2017b), several further obstacles are:

- The existing skill sets of procurement agencies are not well aligned and established organisational cultures only adapt slowly to the new requirements (Czarnitzki et al. 2018, Georgiou et al. 2014). There is a lack of qualified staff, who think more strategically instead of regulation-oriented.
- Moreover, public procurers are often not aware of their potential for spurring innovation (Eßig and Schaupp 2016b, Georgiou et al. 2014).
- Public procurers as well as users mostly prefer well-known products and services, not new ones. Relevant market knowledge about the range of possible innovative solutions to a given problem and their potential suppliers is missing and procurers hesitate to exchange with businesses and to learn about new technologies (Georghiou et al. 2014).
- Even more decisive is a skewed incentive structure in the public sector: Procurers are directly accountable for failures in the procurement process whereas, at the same time, a much broader group of stakeholders reaps the benefits of the procured innovative products and services.
- Financial restrictions are also a relevant issue. Mostly, the budget for investment costs is separate from the budget for operating costs. Consequently, the advantage of an innovative product is not always obvious for the procurer.
- Pre-commercial procurement (PCP) is a very complex instrument and it is rather costly to start a competition between companies and research organisations. As procurers have to finance more than one organisation, for them it is not obvious that these higher costs at the beginning will pay off in the future (OECD 2017b).

To tackle these problems, the following policies and strategies address the necessary preconditions for public procurement of innovation (see Eßig et al. 2014, Eßig and Schaupp 2016b):

- The establishment of **innovative culture and innovative processes** within procurement authorities including, e.g., a clear strategy, e-procurement systems, qualified and highly motivated staff, interaction between procurers and businesses, interdisciplinary project teams, risk management.
- A **superordinate procurement strategy** that determines the range of application and constraint conditions, legal basics and relevant documents, targets (e.g., agreement of a quote for PPI), values and principles, description of processes with competencies and interdependencies, checklists and guidelines, reporting and evaluation criteria.
- A comprehensive **communication strategy** with respect to proactive procurement marketing in terms of advance information about public needs, in-depth market surveys, inclusion of purchasing before the allocation of final funding, and interaction with other procurement authorities.
- **Education, qualification and training** measures to overcome the lack of qualified staff include, such as internal training (e.g. E-learning), external related training (procurement law, market analysis, etc.), team-related training (negotiations, team building, conflict management), or vocational courses at universities. Furthermore, appropriate incentives shall be offered to increase the motivation of procurers, e.g., bonus entitlements.

The existing Competence Centers have to be optimized (KOINNO) and promoted more strongly; coordination between authorities have to be strengthened

All these barriers shall be addressed by the Centre of Excellence for Innovative Procurement **(KOINNO)**, set up in 2013. In 2016, KOINNO has been evaluated on behalf of the BMWi (Berger et al. 2016). The appraisal of KOINNO's work is mixed. Although the evaluators recommend the continuation of the competence centre, they criticise the fact that KOINNO's impact has remained restricted to a rather small group of procurement managers. There was no indication that KOINNO's work led to a comprehensive change of mentality among the procurement managers. Nor did KOINNO succeed in establishing new procurement procedures such as pre-commercial procurement (PCP) to any extent in Germany. Only one of the three PCP projects originally planned had been implemented until then (Berger et al. 2016). Overall, only limited progress seems to have been made at federal and regional levels towards encouraging innovation through public procurement (European Commission 2018a).

As a consequence of the 2016 evaluation it is intended to increase the work on public relations, individual case consultation and the involvement of the professional decision making level (mayors, head of departments, ministers) (EFI 2017). In detail, the evaluators recommend to establish 10 to 15 PCP projects in different regions, optionally in collaboration and co-financing with the federal states ('flagship projects'). As the project database is hardly used, Berger et al. (2016) propose to phase it out and to expand the presentation of best practices, instead. An integrated communication strategy and the promotion of national and international networking shall help to raise awareness around KOINNO's activities. To use synergy effects with the topic 'sustainable procurement' the evaluators recommend to bundle KOINNO and the 'Competence Center for Sustainable Development (KNB)' to a common one-stop-shop for all questions of procurement. It should be put under the direction of a private executing agency with a strong participation of the respective federal ministries (BMWi, BMI). This will secure flexibility as well as crucial political support (Berger et al. 2016).

The KNB as the central portal for sustainable public procurement was already set up in 2010 and follows similar goals as KOINNO with respect to PPI. One objective was the implementation of an internet platform providing comprehensive and up-to-date consulting services for procurement operators at all administrative levels. After five years of operation, the platform includes more than 1,300 different documents on sustainable public procurement, legal foundations, guidelines, and practical examples (see also chapter 5.2.2). A main advantage is the involvement of all federal states and Federal resorts in autonomously filling and maintaining the platform with their own content, also from the municipalities. Further contributions come from the Federal Environmental Agency ('*Umweltbundesamt*': UBA), the Agency for Renewable Raw Materials ('*Fachagentur für nachwachsende Rohstoffe e.V.*': FNR), der German Energy Agency ('*Deutsche Energieagentur*': dena) and several NGOs. The interest in the KNB website as well as in its specific local training courses for procurement operators is high. This also depends on already longer existing administrative directives (e.g. '*Allgemeine Verwaltungsvorschrift zur Beschaffung energieeffizienter*

Produkte und Dienstleistungen': AVV-EnEff[112]) demanding the consideration of sustainable aspects in public procurement (GPP). However, their effects are obviously less measurable regarding large-scale procurement contracts (see chapter 5.2.1), but rather with respect to orders for environmental-friendly products as recycled paper, LEDs or cleaning services using ecologically sound products.

As KOINNO's and KNB's missions are collecting and providing comprehensive information and advising purchasing operators on all administrative levels, *Länder* initiatives to promote PPI and GPP as a rule use the available knowledge, experience and network of the existing centres instead of establishing own institutions at the cost of double-funding.

In sum, the main and common objective for all participating players to support strategic goals is optimising public procurement with respect to qualification and training, funding, and incentives for innovative and sustainable performance. Advantages of PPI and GPP need to be publicised more widely in the public sector and procurement agencies need to be equipped with the necessary skills to apply these strategic instruments (Eßig et al. 2014, Eßig und Schaupp 2016, Bouwer et al. 2006). Strengthening the communication and coordination between authorities is also proven to foster a broader implementation of PPI and GPP (Chiappenelli and Zipperer 2016). Coordinating efforts is particularly valuable at the local level, e.g. with the establishment of networks of municipalities that implement joint procurement as practiced by the German Municipal Purchasers Group ('*Einkaufsgemeinschaft Kommunaler Verwaltungen eG')* since 2011 following the longer existing services and purchasers group of municipal hospitals ('*Dienstleistungs- und Einkaufsgemeinschaft kommunaler Krankenhäuser':* GDEKK). [113]

However, with respect to innovative public procurement, Berger et al. (2016) conclude that the implementation of more PPI in Germany requires a 'comprehensive change of mentality' within the system that will presumably only be achieved on a medium-term to long-term basis.

[112] See www.bmwi.de/Redaktion/DE/Downloads/A/avv-eneff.html

[113] Both joint procurement initiatives are coordinated by the German Association of Cities ('*Deutscher Städtetag*') and allow especially small local authorities to coordinate their efforts and to reach the size and the expertise needed to optimize public procurement, e.g. using MEAT criteria and promoting GPP and PPI.

6. ENTREPRENEURSHIP AND INNOVATIVE START-UPS

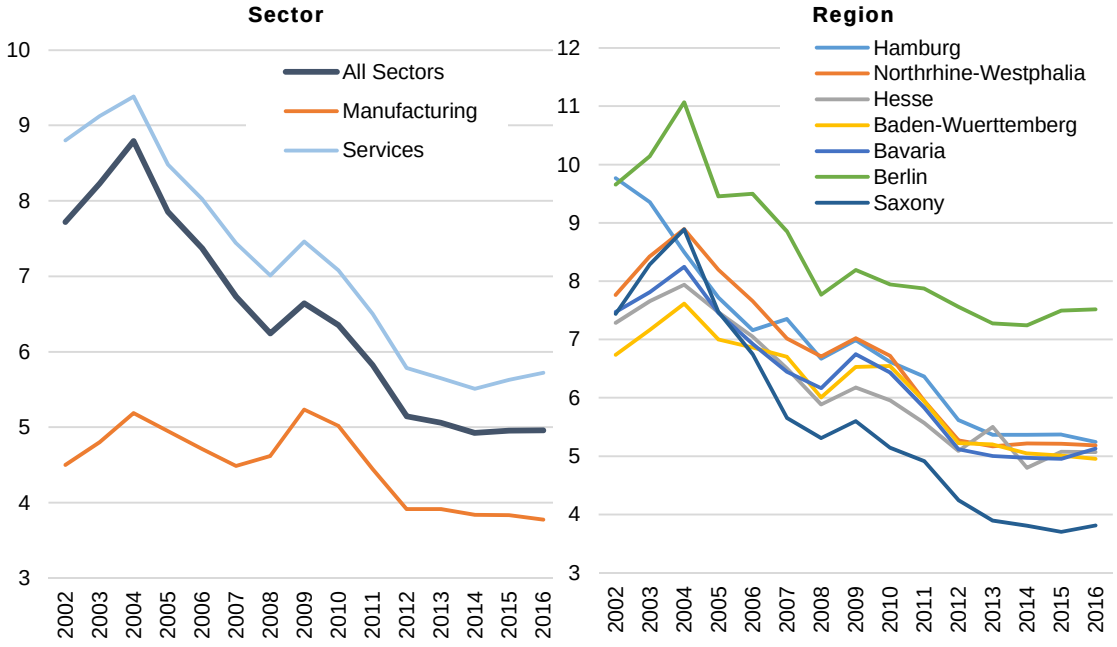
This area of reform covers government policies and initiatives to stimulate entrepreneurship and innovative start-ups, including the provision of venture capital to start-ups and young firms with a growth strategy ('scale-ups'). While support to entrepreneurship has been a government priority for a long time, the number of start-ups in Germany tends to decrease for more than a decade. The number of high-growth innovative firms and employment in such firms has decreased. On the one hand, cost, time and number of procedures required to start a business are higher than in many other EU member states and the complexity of the licence and permit system is also not in favour of a high start-up activity. On the other hand, opportunity costs for potential entrepreneurs are also high as the demand for high-qualified labour is rising, providing excellent job and income perspectives for people with high labour skills.

6.1. Entrepreneurship

6.1.1. Current Situation and Main Challenges

Start-up rates in Germany have been declining substantially in the last 15 years. While in 2000 about 250.000 firms were founded annually[114], this number decreased to 160.000 in 2014 and did not change since then. Figure 40 shows the development of start-up rates in manufacturing and services and for selected federal states over time. The decline in start-up activity can be observed across sectors and across regions. The only exception to the ongoing trend were the post-recession years 2003 and 2004, as well as 2009 and 2010.

Figure 40: Start-up rates in Germany, 2002 to 2016, by sector and region



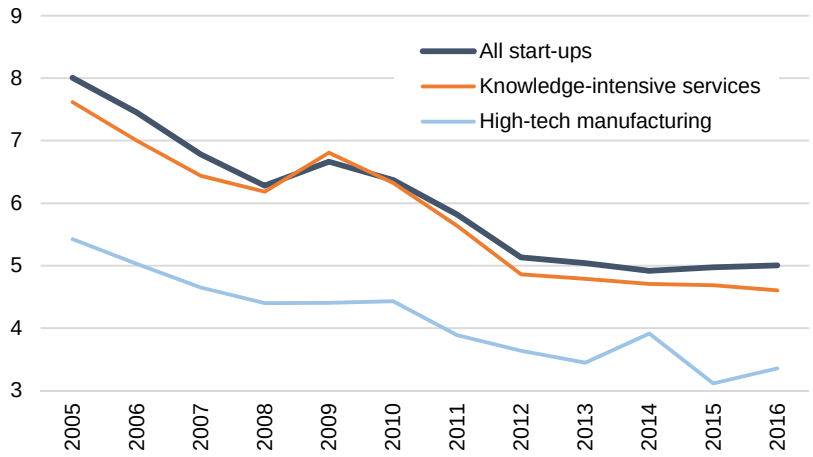
Start-up rate: start-ups by 100 incumbent firms.
Source: Mannheim Enterprise Panel (MUP). Own calculations.

The time series has to be interpreted with caution because, apart from business cycle movements, several policy measures that were undertaken within the last 15 years may have tainted the picture. First of all, Germany introduced a new type of solo self-employment, the so called "Ich-AG"

[114] A firm foundation is identified in the Mannheim Enterprise Panel (MUP) as soon as the credit rating agency *Creditreform* registers the firm as starting economic activity, including all firms registered in the commercial register ('*Handelsregister*').

in 2003 which promotes the start-up of a business by an unemployed person who receives subsidies for the setting-up of the business by the federal government. This measure explains why especially the service sectors saw a sharp increase in start-up rates in 2003. In addition, the federal government introduced the legal form '*Unternehmergesellschaft*', which is similar to the British limited and represents a special type of a limited liability company, yet with a simplified legal framework such as a minimum capital stock of just one Euro.

Figure 41: Start-up rate in Germany, 2005 to 2016, by selected key industries

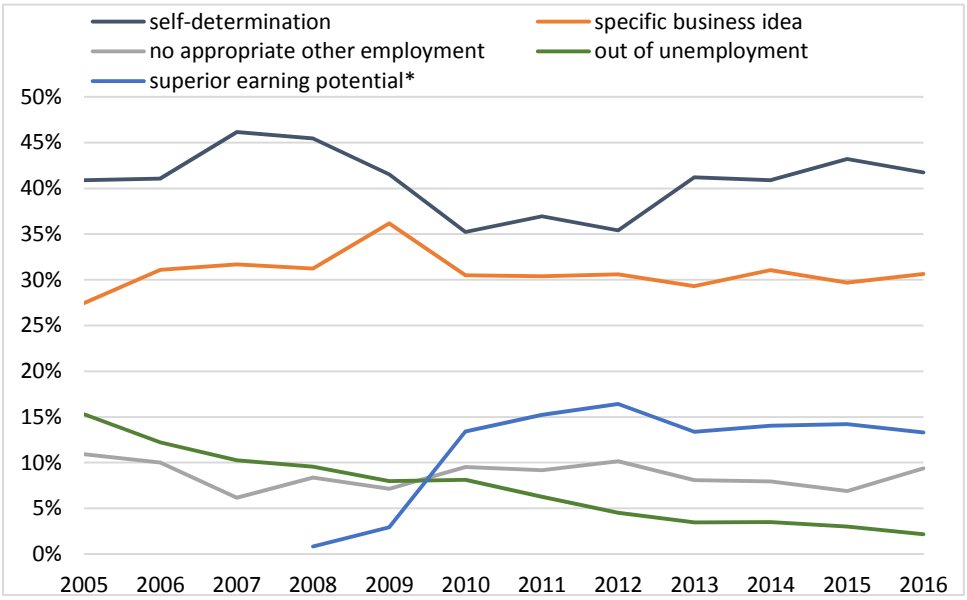


Source: Mannheim Enterprise Panel (MUP). Own calculations.

In theory, aggregate national start-up activity reflects both an economy's degree of competitiveness and adaptiveness to new technologies: Young firms enter the market with new technologies in completion to established enterprises and during the further procedure these technologies motivate established firms to increase their innovation efforts. Nevertheless, a decline in start-up activity is not per se a sign of technological regress or reduced innovativeness. For example, start-up activity is usually higher in times of unfavourable economic circumstances when unemployment is high and new employment is stagnating or falling. In economic boom phases, fewer persons start-up a new firm since employment opportunities for wage earners are manifold and wage levels for dependent employment tend to raise. Figure 41 reveals that start-up activity has not only been declining in non-technological sectors but also in the knowledge-intensive industries, among them cutting-edge technology manufacturing. Many researchers and policy makers claim that the employment chances of the high-skilled labour force are on an unparalleled high level and result in low incentives to start-up a business. In such circumstances, the opportunity cost of starting a business are particularly high.

An analysis using data from the IAB/ZEW Start-Up Panel shows that the number of founders who started their business due to either lacking availability of other appropriate employment or as a way out of unemployment has been declining in recent years (Figure 42). While the share of newly created firms founded out of unemployment or due to non-availability of appropriate dependent employment jointly accounted for 18% of new ventures in 2010, this figure was down to less than 10% by 2015. Correspondingly, the share of start-ups initiated to work on a specific business idea or which achieve a greater degree of self-determination in the work environment has risen from 65% in 2010 to almost 73% five years later.

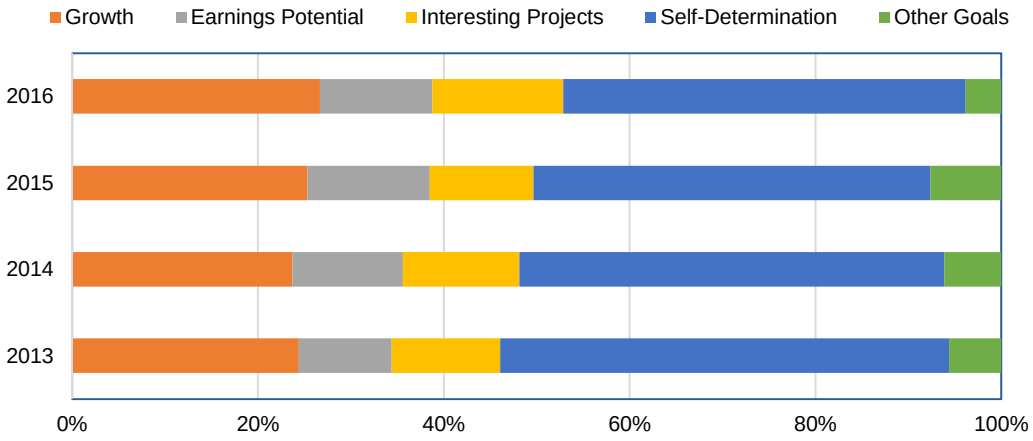
Figure 42: Motivation for starting a business in Germany, 2005 to 2016



* not surveyed prior to 2008.
Source: IAB/ZEW Start-Up Panel. Own calculations.

Similar trends can be observed when gauging the goal or ambition that founders pursue with their business foundation. The importance of self-determination and the opportunity to engage in a specific project/business idea seem to be important drivers both of founding a venture in the first place and of goalsetting in start-ups (Figure 43). While firm growth and the founders' earning potential are of substantial importance as well (jointly more than 36% on average), the majority of founders state that the main goal of their company is to either pursue projects of interest (12% on average) or to achieve higher degrees of professional self-determination (more than 45% on average).

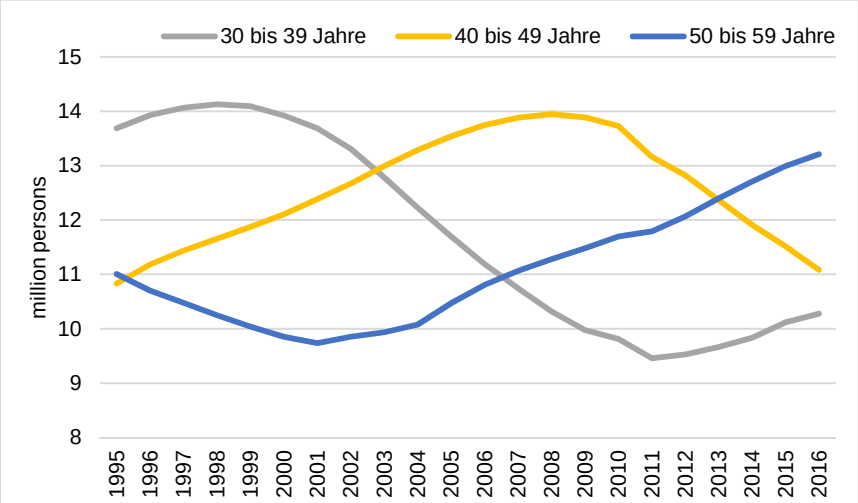
Figure 43: Goals pursued by entrepreneurs in Germany, 2013 to 2016



Source: IAB/ZEW Start-Up Panel. Own calculations.

While low unemployment and increasing opportunity cost of starting a business may be the major reasons why German start-up activity is stagnating at a low level, it cannot completely explain the strong decline in self-employment. In addition to economic incentives, demography has been identified as another major driving force. The key argument is that age groups with usually high entrepreneurial activity (i.e. between 30 and 50 years) have constantly been declining for the last 15 to 20 years (see Figure 44). Therefore, both the stock of potential entrepreneurs erodes and established enterprises have to satisfy their labour demand from a smaller pool of potential employees. Yet, this merely numerical argument is not sufficient to explain the magnitude of the decline in entrepreneurial activity.

Figure 44: Population in Germany 1995 to 2016 by age groups with high founding propensity



Source: German Statistical Office (Destatis). Own calculations.

Table 11 provides further granularity on the demographic aspects covered above. When comparing demographic developments in different regions, one can detect differences in the degree to which regions and states are affected by the changing composition of the population in ages associated with high founding propensity. Besides this, overall population movement and evolvement might exacerbate related issues. The data below point to two general trends: One, a weak shift of relative population shares from area to city states and, two, a notable move shift from east to west. In particular, the eastern states of Germany experience a decline in absolute population share while also witnessing a clear increase in the relative share of older groups in the population. At the same time, Berlin is experiencing inverse demographic changes. The capital state's absolute population has been increasing between 2000 and 2015, while also - at least in recent years – there has been a growing number of inhabitants in the 30-39 age group of potential entrepreneurs.

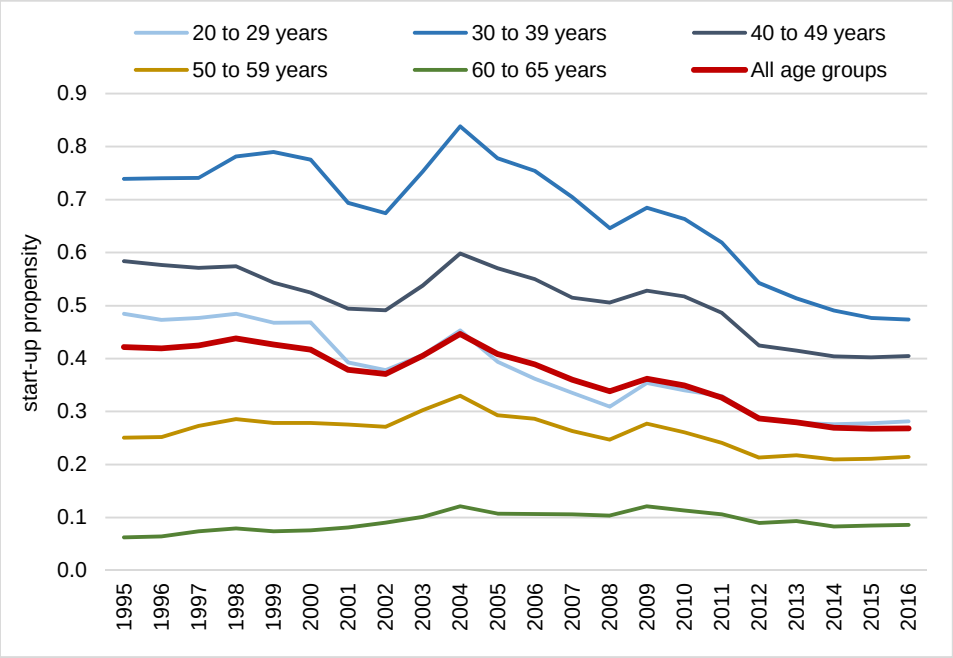
Table 11: Age groups with high founding propensity by German regions, 2000 to 2015

	Age group (years)	2000	2005	2010	2015	Change in Population 2000/15 (%)
		million persons				
Area States	30-39	12,86	10,77	8,95	9,20	-0,30
	40-49	11,28	12,59	12,74	10,68	
	50-59	9,11	9,76	10,93	12,15	
City States	30-39	1,06	0,92	0,86	0,92	0,22
	40-49	0,82	0,94	0,99	0,83	
	50-59	0,75	0,71	0,76	0,84	
Western States	30-39	11,12	9,49	7,88	8,04	1,03
	40-49	9,40	10,71	11,05	9,42	
	50-59	7,73	8,21	9,14	10,37	
Eastern States	30-39	2,17	1,67	1,43	1,52	-1,25
	40-49	2,21	2,26	2,09	1,61	
	50-59	1,68	1,84	2,09	2,12	
Berlin	30-39	0,63	0,53	0,50	0,55	0,14
	40-49	0,50	0,57	0,58	0,48	
	50-59	0,45	0,43	0,46	0,50	

The following states are considered 'Area States' ('*Flächenländer*'): Baden-Wuerttemberg, Bavaria, Brandenburg, Hesse, Lower Saxony, Mecklenburg-Vorpommern, North Rhine-Westphalia, Rhineland-Palatine, Saarland, Saxony, Saxony-Anhalt, Schleswig-Holstein, Thuringia. The following states are considered 'City States' ('*Stadtstaaten*'): Berlin, Bremen, Hamburg. Eastern states include: Brandenburg, Mecklenburg-Vorpommern, Saxony, Saxony-Anhalt, Thuringia. Western states do not include Berlin. Own calculations.
Source: German Statistical Office (Destatis)

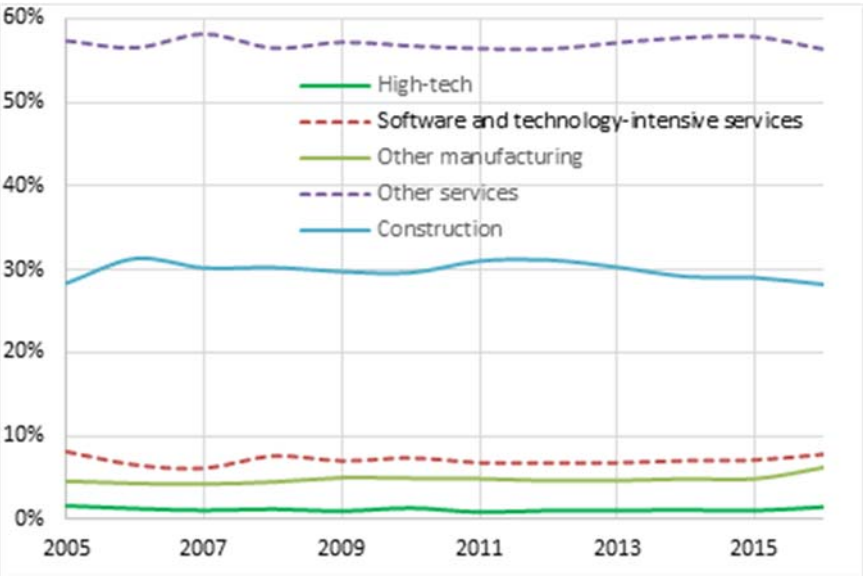
Figure 45 shows the share of a certain age group that engages in entrepreneurial activity. This activity can either involve the foundation of a firm alone or within a founding team. The graphs show that besides the reduction in the potential stock of entrepreneurs, also the affinity to start a business is reduced in younger age groups up to 39 years while for older age groups, the affinity either stagnates or even rises for older entrepreneurs.

Figure 45: Share of persons involved in founding activity in Germany by age group, 1995 to 2016



Source: Mannheim Enterprise Panel (MUP), German Statistical Office (Destatis). Own calculations.

Figure 46: Sector composition of start-ups in Germany, 2005 to 2016



Source: Extrapolation based on IAB/ZEW Start-Up Panel. Own calculations.

Figure 46 portrays the sectoral composition of start-up firms over time. While there seem to be clear trends in demographics and overall declining numbers of firm foundations as referenced above, this development does not appear to effect the sectoral component of the entrepreneurs' occupational choice. Clearly, the steadily decreasing overall number of businesses started (see Figure 40 and Figure 41) does impact the resulting absolute number of firms per sector, but little

seems to have changed in terms of the relative composition of the resulting cohorts. Most young firms are founded in non-technology-intensive service industries, followed by the construction sector. Roughly 7% of firm foundations occur in the software and technology-intensive service sectors, while manufacturing firms make up around 5% of cohort size. High-tech industries typically account for just above one percent of new venture foundations.

Firm acquisitions in innovative economies

Acquisitions of firms are an important element of innovative economies. A subset of founders found a firm with the aim to successfully sell it to an established firm at a later point in time. The anticipated expected profit in the future gives the entrepreneur the incentive to take the financial risk and spend the effort involved with a firm foundation. Especially if a start-up succeeds in realising an innovation that is relevant for established firms, the entrepreneur can strongly benefit. An analysis of the all start-ups in Germany founded in the years 1999 to 2014 reveals that 2.3% have been acquired by other firms within the first 8 years after foundation (see Table 12). Start-ups in innovative industries are acquired by other firms with a higher probability.[115] For example, 8.8% of all start-ups in high-tech manufacturing have been acquired, compared to only 3.3% in low-tech manufacturing. Columns 2 and 3 depict that also within each industry the share of acquired start-ups that conduct R&D is higher than the average share of R&D performing start-ups. Across all industries, 5.4% of acquired start-ups perform R&D, compared to 1.3% for all start-ups.

Table 12: Start-ups in Germany acquired by other firms by sector of start-up (1999 to 2014 cohort, acquisition in first 8 years)

	Share of start-ups that are acquired	Share of start-ups with R&D	Share of acquired start-ups with R&D
High-tech manufacturing	8.8%	21.7%	37.8%
Medium-tech manufacturing	7.1%	10.6%	24.7%
Low-tech manufacturing	3.3%	2.9%	13.1%
Technology-oriented services	2.8%	8.4%	22.7%
Other knowledge-intensive services	2.6%	2.0%	6.1%
Business services	1.8%	0.5%	3.0%
Consumer-oriented services	2.1%	0.4%	2.4%
Energy and mining	9.6%	1.1%	6.3%
Construction	1.8%	0.2%	1.5%
Trade	2.1%	0.8%	4.4%
Transportation, postal services	2.8%	0.3%	3.0%
Financial services	2.3%	0.2%	1.2%
Total	**2.3%**	**1.3%**	**5.4%**

Source: Mannheim Enterprise Panel (MUP). Own calculations.

Table 13 stresses that the acquisition of innovative firms is an important element of the innovation strategy of acquiring firms. Firms conducting R&D are clearly overrepresented among the acquiring firms in almost every industry. While 2% of all firms in Germany conduct R&D, 11% of firms that acquired start-ups are R&D active. 59% of acquiring firms from high-tech manufacturing report R&D activities, compared to 34% of all firms in this sector.

[115] We consider the founding cohorts of the years 1999 to 2014 and count acquisitions up to the eight year of the start-ups' existence. It should be noticed that the founding cohorts starting from 2008 have not completed the eight years of existence and will accumulate more acquisitions accordingly.

Table 13: R&D activity of firms acquiring start-ups in Germany (1999 to 2014 start-up cohort)

	Share of all firms with R&Ds	Share of aquiring firms with R&D
High-tech manufacturing	34%	59%
Medium-tech manufacturing	14%	49%
Low-tech manufacturing	4%	29%
Technology-oriented services	12%	20%
Other knowledge-intensive services	3%	2%
Business services	0%	17%
Consumer-oriented services	1%	1%
Energy and mining	2%	12%
Construction	1%	8%
Trade	2%	2%
Transportation, postal services	0%	1%
Financial services	0%	7%
Total	**2%**	**11%**

Source: Mannheim Enterprise Panel (MUP).Own calculations.

6.1.2. Main Reforms 2013-2017

Fostering entrepreneurship in Germany takes place through a variety of financial and non-financial measures at different government levels. As the funding system is well-developed and highly differentiated, no major reforms with respect to general support to entrepreneurship took place at the federal level during the period 2013 to 2017. Policy rather focused on fostering high-tech start-ups and young innovative firms (see section 6.2). The most important policy measures in the area of general entrepreneurship support include start-up funding by the state-owned KfW banking group ('*ERP-Gründerkredit*', '*ERP-Kapital für Gründung*', '*Mikrokreditfonds Deutschland*') and financial support for unemployed who want to start their own business offered by the Federal Labour Agency. Loans or subsidies for start-ups are also offered by state governments. Further measures include services to help firm founders in the start-up process (advice, provision of office space), various awareness measures (initiative 'entrepreneurship in schools, start-up competitions for digital innovations, the German Start-up Award, the Start-up Week, coaching measures such as 'start-up your future') and information provision to potential entrepreneurs. Reducing bureaucratic burden in the start-up process is another policy activity.

The following policy reforms to further improve support to entrepreneurship took place at the federal level during 2013 and 2017:

- In autumn 2013, the BMWi started a new programme, **Micro-mezzanine Fund Germany**, which offers equity capital to firm founders and young firms of up to €50,000. The total volume of the fund is €35 million.
- The federal government aims at increasing the number of women starting a business. For this purpose, the initiative *'Frauen unternehmen'* (**women venture**) presents successful female entrepreneurs who can act as role models for women who want to start a business. The initiative started in 2014 and has been continued until 2017.
- The integration of refugees in the labour market is of upmost importance both for the individuals themselves and also for German society. To activate the entrepreneurial potentials of refugees a **pilot initiative 'Founder-Godparenthood'** aims to support refugees to start their own company. The pilot study shall explore and develop a framework for large-scale projects, initiatives and policy measures.
- In a joint activity, BMWi and KfW aim to support nascent founders and actual founders of young firms by establishing a **Digital Entrepreneurship Platform**. Business planning has been identified as an important determinant of start-up success. Starting in March 2018 the digital platform provides online coaching of entrepreneurs in idea generation and business

coaching. The platform will also provide comprehensive information to the selection of suitable promotion and financing opportunities.

6.1.3. Need for Further Reforms

Potential reforms aiming to improve the prospects of start-ups and young firms in Germany can be grouped in two categories: Measures to ease financial frictions of young firms, and measures that have non-financial aims. The Association of German Start-ups ('*Bundesverband Deutsche Startups*') has published a comprehensive agenda with claims regarding the objectives behind these measures (AGS 2018). The main claims will be presented and compared to the recent coalition agreement in the following (CDU/CSU and SPD 2018).

Looking at the attempts to ease financial frictions for start-ups, in recent years several programmes were implemented to provide financing to firms in the early stage segment in Germany. But still start-ups face problems to finance their expansion at a later point in time. Especially in comparison to the US market the later-stage segment is far behind. In the US, pension funds invest 5% of their funds in start-ups while this source of funding is not established in the German pay-as-you-go pension system. Other European countries currently make steps towards the US systems. For example, Switzerland is establishing a fund-of-funds "Future Fond Switzerland" ('*Zukunftsfonds Schweiz*') that is channelling funds from institutional investors to specialised venture capital funds. The coalition agreement of the current German government also contains the objective to establish a large-scale national investment fund open to institutional investors to foster investments in digital firms. Additionally, a so-called High Tech Growth Fund that is supposed to provide venture loans to expanding start-ups is planned. However, an initiation date or investment volume has of now not been disclosed for either of these measures.

Also non-financial policy measures should be considered. As documented by declining start-up rates above, during times of low unemployment and in the presence of attractive opportunities as dependent employees, the number of individuals that naturally strive to become entrepreneurs is limited. Nevertheless, policy measures could be taken to increase this number by providing incentives to develop business ideas and consider the life perspective of an entrepreneur. Examples for such measures include proposals to offer entrepreneurial training to students or the option to take leave from studies to develop and realise entrepreneurial ideas.

As the declining number of firm foundations can partly be explained by the demographic development, one potential policy measure is the attraction of foreign founders. The German Association of German Start-ups introduces the concept of a "start-up visa" that could meet the needs of highly educated foreign founders. These measures can only be efficiently established if the administration is prepared to reduce or remove bureaucratic hurdles, such as the provision of support non-German speakers.

The consequences of firm insolvencies are anticipated by (potential) founders. The German Association of German Start-ups is arguing that reducing the time period of discharge of residual debt to a year would benefit founders by giving them a second chance at an earlier point in time. However, since July 2014, 35% of the debt needs to be repaid to grant the discharge of residual debt after 3 years. On a note of caution, a trade-off should be observed between early second chances and rising costs of debt-financing. Research has shown that interest rates increase due to debtor-friendly legislation (Serrano et al. 2016). Hence, a too debtor-friendly legislation is indirectly harming young firms via high interest rates.

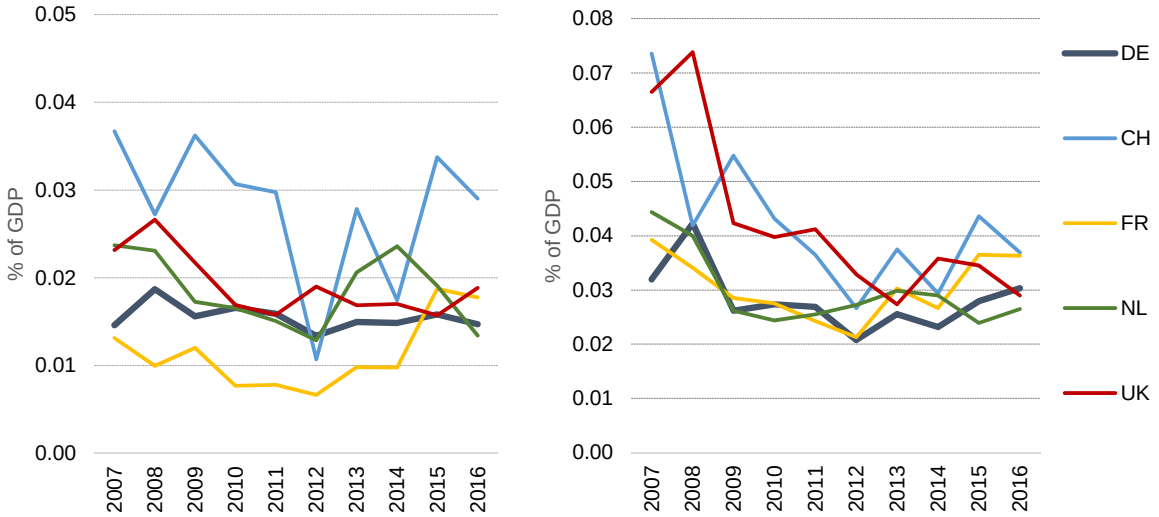
6.2. Venture Capital and Innovative Young Firms

6.2.1. Current Situation and Main Challenges

Changes in the German VC market

VC investment in Germany was rather low during the past ten years by international comparison, though showing an upward trend in recent years. Based on the official figures published by Invest Europe, total VC investment in Germany in 2016 (early and later stage) was equal to 0.03% of GDP (Figure 47). This figure went up from 0.02% in 2012. In 2016, Germany reached the same level of VC investment as in the UK for the first time and showed a higher VC to GDP ratio than the Netherlands. Switzerland and France report higher VC investment activities in 2016 (0.37 and 0.36%). When looking at early stage investment (seed and start-up) only, VC investment stayed rather low at 0.015% during the past 5 years.

Figure 47: VC investment as a percentage of GDP, 2007 to 2016, in selected countries

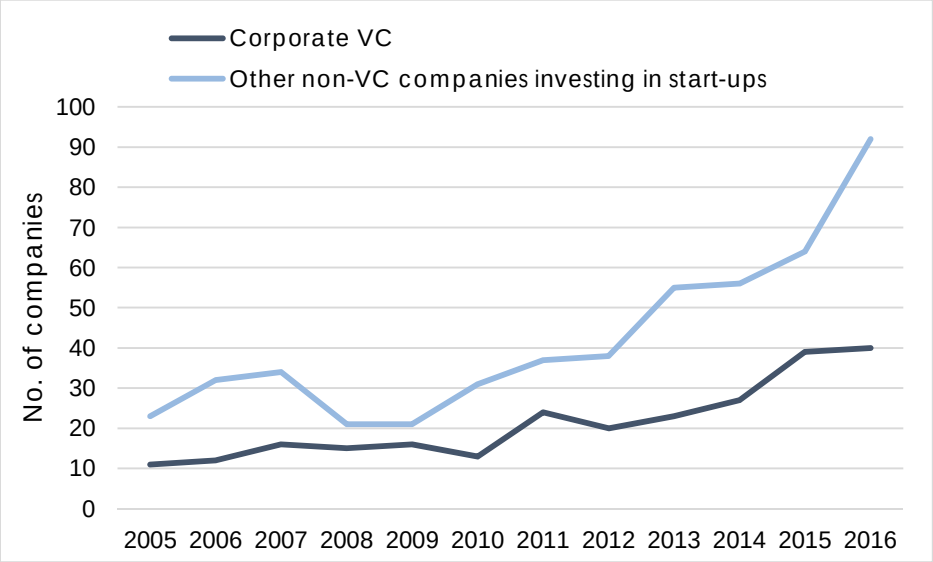


Source: Invest Europe.

The data from Invest Europe basically cover VC activities by dedicated private equity and venture capital funds, including both independent funds, public funds and corporate funds. In recent years, new players in the German VC market appeared. On the one hand, the number of corporate VC organisations has significantly increased after 2010, from a few more than 10 organisations to about 40 investors in 2016.

At the same time, more and more companies engage directly through minority stake acquisitions in start-ups and young technology firms. Since 2009, the number of these companies has grown from about 20 to more than 90 (Figure 48). This development is driven by different factors. On the one hand, historically low interest rates and a booming German economy might squeeze companies to seek for attractive investment opportunities. On the other hand, established companies may increasingly rely on the innovation capabilities of start-up companies, and integrate acquisitions of start-up companies into their broader innovation strategy. Yet, the precise reasons for this development remain to be clarified.

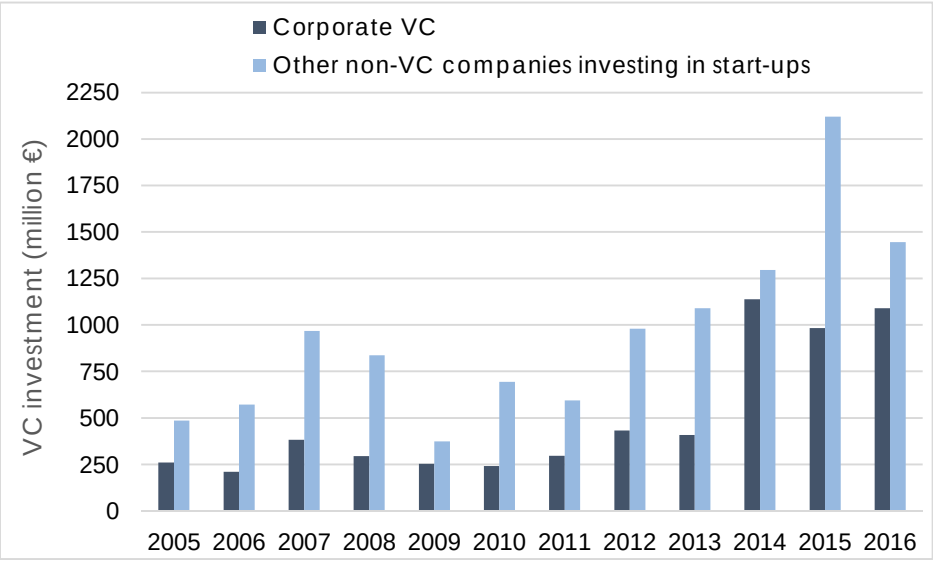
Figure 48: Number of corporations investing in start-ups in Germany by type, 2005 to 2016



Source: Majunke, Bureau van Dijk, ZEW calculations

The increasing number of corporate players in the German venture capital market is also reflected in the deals volumes. Figure 49 shows that in 2014 to 2016 corporate VC investors have participated in deals totalling to around €1 billion per year. Note that the total volume of VC investment in early and later stage in Germany according to Invest Europe was €0.68 billion, €0.85 billion and €0.95 billion in 2014, 2015 and 2016. Only a fraction of corporate VC investors are covered by Invest Europe statistics. Thus corporate investors have become an increasingly important funding source for start-up companies in Germany and contributed to a significant expansion of the market in recent years.

Figure 49: Deal volumes in Germany by type of VC corporate investor, 2005 to 2016



Note that the figures show the volume of deals in which at least one corporate VC or at least one other non-VC company investing in start-ups has been involved. Figures may not be added since there are deals with investors from both groups.
Source: Majunke, Bureau van Dijk, own calculations

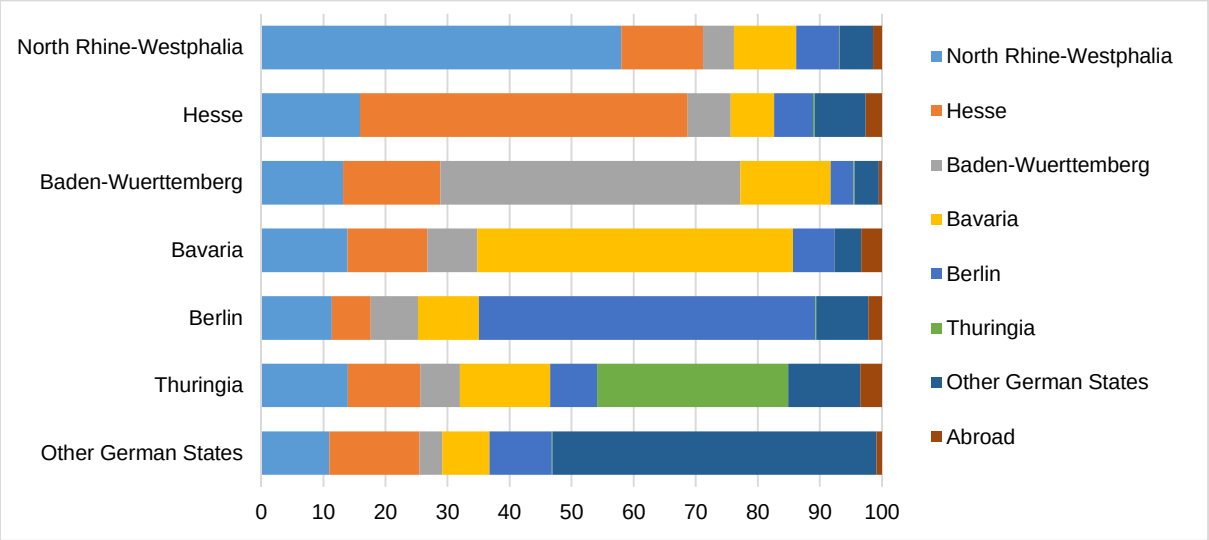
In addition, non-VC companies investing in start-ups also increased their investment volumes and play an even more important role for financing start-ups. For analysing the German VC market and for identifying reform needs, one has to consider this significant change among the group of VC actors in recent years.

Regional concentration of VC

Within the German VC market, corporate investment has become more and more concentrated on a few metropolitan areas, with Berlin and Munich attracting a particularly large share of investment. VC investors also tend to concentrate regionally in the same areas. In 2015 there were around 570 VC investors that have been active in Germany at least once between 2001 and 2015 (Bersch et al. 2016). Around two thirds of these investors are independent venture capital investors, 25% are public venture capital funds, and around 10% are corporate VCs. 10% of investors are located abroad. The majority of German investors (21%) are located in *Bavaria*, followed by *North Rhine-Westphalia*, where 18% of German investors are located. *Berlin* ranks third (15%) and *Baden-Wuerttemberg* (12%) and *Hesse* (9%) rank fourth and fifth. This suggests that venture capital investors are less clustered than is for example the case in the United States, where most investors are located in Silicon Valley (CA), Route 128 (MA), and more recently New York City (NY) (NVCA 2018).

A comparison of the sources of venture capital by location of portfolio companies reveals regional differences (see Figure 50). While most portfolio companies in North Rhine-Westphalia (58%) receive funding from an investor in the same state, in Baden-Wuerttemberg (48%) and Thuringia (31%), this number is lower. Assessing the availability of venture capital is challenging though, as a low number of investors or deals in a given area does not necessarily reflect a scarcity of supply, but potentially also a lack of demand for venture capital. The same holds true for deal sizes, since not all companies require large capital injections for their growth strategy.

Figure 50: Sources of venture capital by location of portfolio companies



Source: ZEW Mannheim Enterprise Panel (MUP), Bersch et al. (2016)

6.2.2. Main Reforms 2013-2017

In recent years several policy initiatives have been implemented to improve conditions for early stage venture capital deals. Besides several venture capital funds that have been established by the state development banks, the two most prominent policy measures were the establishment of the High-tech Start-up Fund ('*Hightech-Gründerfonds*') and the INVEST grant.

While the funding conditions on the early stage market have improved markedly in recent years, growth capital, especially for very large deals, is still underdeveloped. The activity of international venture capital investors in very large funding rounds indicates that the domestic venture capital industry is not yet fully developed.

To stimulate venture capital investments in Germany, a number of reforms have been implemented in the period 2013-2017. Main reforms include the following:

- In 2016, a new law on improved loss carry-forwards under the corporate income taxation system came into force (*'Gesetz zur Weiterentwicklung der steuerlichen Verlustverrechnung bei Körperschaften'*).
- Changes to the EXIST programme for start-ups form universities.
- The activities of the High-tech Start-up Fund have been extended.
- The INVEST programme that provides subsidies to business angels has been modified.
- In 2015, a new initiative of the German Stock Exchange, the *Deutsche Börse* Venture Network, was launched in order to guide young firms towards IPOs.
- In March 2017, a new stock market segment for young, fast-growing firms (scale) started.
- The KfW programme *'ERP-VC-Fondsinvestment'* was introduced.
- In March 2016, the new ERP/EIF Growth Fund came into operation which invests into VC funds.
- In March 2016, the new VC fund *coparion* started as a spin-off of the ERP Start Fund, providing VC to young technology firms.

In German corporate tax law, tax losses of corporations are forfeited partially when more than 25% of ownership are transferred to an acquirer within a five year period, and completely when more than 50% of ownership are transferred within five years. This tax rule put venture capital backed start-up companies at a disadvantage, as recent ownership changes are typical of the venture capital investment model. Under the **new corporate tax law provision on loss carry forwards**, introduced in 2016, tax losses remain fully deductible when a company satisfies certain conditions. To be eligible, the company must have carried on the same business activity for at least three years. Essentially, this means the company has to maintain a consistent profit motivation within that period, defined by qualitative criteria, such as the offered services or products, the targeted market, the qualification of employees etc. Termination or suspension of the business activity, as well as changes in the business purpose or the start of additional businesses are regarded as harmful events, in which case the company disqualifies.

The German Ministry for Economic Affairs and Energy has **increased and extended the grants of the EXIST program**. The programme promotes spin-offs from universities and research institutes by granting a one year scholarship to successful applicants with a promising business idea. In 2015 the **start-up scholarships and research transfers were increased by ~25%**. Depending on the degree of applicants, grants are now between €1,000 per month for applicants without a degree to €3,000 per month for applicant founders with a PhD. Furthermore EXIST has introduced an **incentive premium for universities** that provide access to laboratories, working spaces and coaching to start-ups. The incentive premium gives universities up to €10,000 for start-ups receiving EXIST scholarship and €20,000 for start-ups with research transfer grant.

Since its foundation in 2005, the **High-tech Start-up Fund** (HTGF) has become the largest and most active early stage investor in Germany. The HTGF is a co-investment fund, jointly initiated by the German Ministry for Economic Affairs and Energy, the KfW and large industry partners. Until 2017 the fund has invested in almost 500 early stage companies and achieved follow-up funding with a total volume of €1.4 billion. In May 2017, the HTGF has announced the **first closing of** its **third fund HTGF III with a volume of €245 million**. The fund has a targeted volume of €300 million of which €90 million are foreseen to come from private investors and industry.

In January 2017 the **INVEST grant for private venture capital investors**, so called Business Angels, has been **extended and modified**. INVEST gives investors a 20% rebate on their investments in innovative young companies. The modified grant covers investments up to €500,000 per investor and year, gives an exit grant of 25% on capital gains, comprises the eligibility of the legal form UG ('*Unternehmergesellschaft*') for financing vehicles and convertible loans as financing instruments, and has extended the criteria for the classification of *innovative companies*.

In 2015 the German stock exchange (*Deutsche Börse AG*) has launched the **Deutsche Börse Venture Network**, a matching platform for promising start-ups and venture capital investors. Its goal is to connect growth oriented start-ups that are potential candidates for an initial public offering (IPO) with the right investors. The platform entails an incubator to support firms along all development stages. It is part of an action plan initiated by the German Ministry for Economic Affairs and Energy to foster IPO activity in Germany.

Scale is a new exchange segment in the German stock exchange for SMEs, aimed at facilitating and increasing SMEs' range of initial placements of stocks. The goal is to facilitate access to national and international capital markets for German SMEs. Scale is also part of the action plan initiated by the German Ministry for Economic Affairs and Energy to foster IPO activity in Germany.

The German development bank KfW has continued and started several initiatives to stimulate venture growth investments in Germany and close the existing equity gap in growth capital. The initiatives comprise:

- **ERP/EIF-Fund-of-Funds**. The fund was initiated in 2004 and invests on a pari passu[116] basis along private co-investors into venture capital funds with a portfolio targeted at young technology oriented companies. Since 2013 the funds **capitalisation has increased from €1.0 to €2.7 billion**.
- **ERP-Venture Capital-Fund.** The programme was started in 2015. The fund's investment strategy is similar to the ERP/ EIF-Fund-of-Funds, but includes first investments into first time VC teams and first closings, as well as venture debt funds. The total fund volume is up to €400 million for 5 years. Its aim is to close the equity gap for venture growth capital in Germany.
- **ERP/EIF Mezzanine-Fund-of-Funds for Germany.** The fund's investment strategy is similar to the ERP/ EIF-Fund-of-Funds, with a focus on mezzanine funds (incl. venture debt funds). In 2016, the total fund volume was increased from €200 million to €600 million.
- **ERP/ EIF Growth Facility.** The fund's investment strategy is similar to the ERP/ EIF-fund-of-funds, putting on co-investment funds with successful venture capital investors on a pari passu basis. The total fund volume is €500 million.
- **coparion** is a co-investment fund on a pari-passu basis. Unlike the previously mentioned investment vehicles, *coparion* is a subsidiary of KfW and directly co-invests into growth oriented companies alongside other venture capital funds in series A, B and C investments. Individual investments go up to €10 million per funding round. The total fund volume is €225 million.

6.2.3. Need for Further Reforms

Despite changes in corporate tax law, some elements of corporate taxation may still hamper private investment in start-ups and scale-ups.[117] In their 2013 coalition agreement the coalition partners of the federal government committed themselves to adopt a comprehensive regulatory framework for venture capital investments that would improve conditions for venture capital investors in Germany. Eventually the government failed to pass the foreseen venture capital law, due to objections by the Federal Ministry of Finance. In response to these objections, the current coalition partners agreed to scrutinise tax incentives for venture capital in the coming term.

In 2015, the German private equity industry association BVK (2015) published a draft for a German venture capital law containing amongst others the following claims:

- tax awards for research and development expenditures
- tax deductions on revenues from intellectual property ("patent boxes")
- a value added tax exemption on management fees of venture capital funds
- tax exemptions on rollover investments, i.e. reinvestments into VC asset class within four years

[116] Investments made by the fund are subject to the same terms as the investments made by the private sector co-investor.

[117] The European Union loosely defines scale-ups as '[companies] […] that rapidly expand and grow in terms of market access, revenues or number of employees. High-growth companies are generally defined as those having annual turnover growth of 20% on average in the past three years.'
See www.lisboncouncil.net//index.php?option=com_downloads&id=126

- clarification and harmonisation of existing European VC legislation (EuVECA[118]) with German law (KAGB[119])

The draft contains further minor adjustments of existing rules. While some of the claims have passed into law[120], most remain subject to discussion. Generally the industry association's requests reflect tax incentives for R&D related activities of SMEs and potential tax obstacles to (re-)invest into German venture capital funds. Establishing these tax incentives would provide start-up companies both directly and indirectly with more capital by freeing up additional resources. Empirical evidence on the effectiveness of different types of R&D tax incentives for firms is summarised in BDI and EVEI (2016).

More recently, the Bavarian financial administration considered the conversion of convertible notes a tax relevant operation. Convertible notes are often used by venture capital investors as an instrument to reduce risk and align incentives with investees. Taxing the conversion of notes makes them less attractive to use as a financing instrument and may eventually harm start-up companies seeking capital during liquidity squeezes. In March 2018, the finance ministers of the states and the federal government have clarified that conversion of convertible notes will not be subject to taxation, so that convertible notes remain an attractive financing instrument for start-up companies.

Removing obstacles to investment and creating favourable framework conditions for venture capital investors in Germany should be a key objective. As part of the claimed tax incentives reflect existing legislation in other EU countries, establishing the same rules for Germany would level playing field for venture capital investors within the European Union. Nevertheless, the requested tax incentives should remain subject to scrutiny and be assessed case-by-case basis.

[118] Regulation on European venture capital funds

[119] German Capital Investment Code ('*Kapitalanlagegesetzbuch*')

[120] The aforementioned loss forfeiture exemption which was introduced in 2016 was also included in the draft.

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8. APPENDIX

Table A-1: Selected open data surveys in comparison

	OD Barometer	GODI	OURData Index	ODIN	Open Data Maturity Report
Readiness	✓	-	Government support for data re-use	-	Open Data Readiness (Policy)
Implementation	✓	✓	- Data availability - Data accessibility	- Coverage score - Openness score	Portal Maturity
Impact	✓	-	-	-	Open Data Readiness (Impact)
Weighted / Composite Indicator	✓ ; Score of 0-100	✓ ; Score of 0%-100%	Min 0 to Max 1	✓ ; Score of 0-100	✓ ; Score: 0-19% Beginners 20-59% Followers 60-74% Fast-trackers 75-100% Leaders-Trendsetters
Available Years	2013-2016	2016/2017	2011; 2013; 2015; 2017	2015; 2016	2015; 2016; 2017
Reports	✓	✓	✓	✓	✓
Data download	✓	✓	✓ Not all years	✓	✓ Not 2015
Germany	2016: Rank 14 out of 114 Score: 70/100	2016/2017: Rank 24 out of 94 Score: 51%	2017: Rank 20 out of 25 OURdata 0,4155 /1	2017: Rank: 25 out of 180 Score: 64/100	2017: Fast-trackers (1050/1500)
Weblinks	https://webfoundation.org/research/open-data-barometer-fourth-edition/	https://index.okfn.org/	http://stats.oecd.org/Index.aspx?QueryId=78414	http://odin.opendatawatch.com/	https://www.europeandataportal.eu/de/dashboard#2017

Table A-2: Assessment of government reform measures in Germany by reform area, 2013 to 2017

a) R&D&I

Reform measure	Implementation year	Responsible unit	Main objectives	Main content	Main challenges addressed	Cost of measure per year	Expected results
New ZIM directive	2015	BMWi	Strengthen R&D in SMEs	Extension of ZIM to firms with 250-499 employees, more incentives for international cooperation	Low investment of SMEs in R&D&I	Total annual costs of ZIM ~€550 million, additional costs of new directive rather low	Increase in R&D&I expenditure of SMEs, increase in innovation results of SMEs
SME Action Plan	2016	BMBF	Strengthen R&D and innovation in SMEs	Increase in R&D support to SMEs, strengthening transfer activities of public research organisations, introducing Innovation Fora, support to SMES for recruiting high qualified personnel	Low investment of SMEs in R&D&I	Hard to assess, most measures were already in place, little additional cost	Increase in innovation output and growth of R&D active SMEs
SME innovative - access module	2017	BMBF	Advancing SMEs towards high-quality R&D projects	Offering subsidies for SMEs to develop innovative ideas into R&D projects that are eligible for funding and for finding appropriate R&D partners	Low investment of SMEs in R&D&I	Depending on the uptake of the measure by SMEs, probably <€5 million per year	Increasing the number of new SMEs applying for funding in KMU innovative
Internationalisation of clusters and networks	2015	BMBF	Leaping high-tech innovation through internationalisation	Offering funding to clusters or large projects targeting societal challenges for including international partners in technology development activities	Lack of international orientation of publicly funded innovative clusters and networks	About €20 million per year	Strengthening international competitiveness of firms in high-tech clusters, achieving more ambitious R&D results
VIP+	2015	BMBF	Accelerating technology transfer from public science	Offering grants to researchers for evaluating the innovative potentials of new research findings	Lack of transfer of basic research into innovation	About €18 million per year	Higher number of innovations stemming from new public research results
ERP Digitalisation and Innovation Loan	2017	KfW	Increasing investment in digitalisation and R&D&I	Providing loans with 70% release from liability	Low uptake of digitalisation in SMEs, falling share of innovative SMEs	Loan programme, actuals costs depend on share of failed loans	Increase in R&D&I investment by SMEs and medium-large enterprises
ERP Mezzanine for Innovation	2017	KfW	Increasing investment in digitalisation and R&D&I	Providing loans and subordinate capital for	Low uptake of digitalisation in SMEs, falling share of innovative SMEs	Loan and equity programme, actuals costs depend on share of failed loans	Increase in R&D&I investment by SMEs and medium-large enterprises

b) Digitalisation

Reform measure	Implementa-tion year	Respon-sible unit	Main objectives	Main content	Main challenges addressed	Cost of measure per year	Expected results
Industry 4.0	2013	BMWi/BMBF	Platform bringing together actors to develop technological solutions, standards, digital working environments	Platform for joint activities	Combining Germany's competitive advantages in the field of engineering with ICT	Meetings, working groups, etc.	Enabling Germany and the relevant industries to be leader in supplying Industry 4.0 solutions
Smart Service World	2014-2019; 2016-2021	BMWi	Supporting R&D of digital solutions; second round focussed on rural areas and small municipalities	Providing funds for cooperation projects of science and industry	Digital Divide between urban and rural areas	€50 million per funding phase	Development of smart services for societal purposes and basic supply
Mittelstand 4.0	2015	BMWi	Supporting digitalisation of SMEs	Providing information via regional competence centres	Low uptake rate of industry 4.0 solutions / low digitalisation of SMEs and medium-sized enterprises	No funds, but information via networking activities e.g. workshops, live demonstrations, best practices	Increase digitalisation and in particular investment in industry 4.0 by SMEs and medium-sized enterprises
Go-ditigal	2017	BMWi	Supporting digitalisation of SMEs with up to 100 employees or €20 million turnover	Providing loans for consulting services by authorised consultants supporting digitalisation projects	Low uptake of digitalisation in SMEs	50% of €1,100 daily rate for consultants, for a maximum of 30 days per 6 months	Increase the use of digitalisation in SMEs

c) Digital Infrastructure

Reform measure	Implementation year	Responsible government unit	Main objectives	Main content	Challenges addressed	Cost of measure	Expected results
Digital Agenda 2014-2017	2014	BMWi, BMVI, BMI	Promote and shape digital structural change	Support the creation of a high-speed digital infrastructure nationwide (esp. in rural areas)[, promote the digitalisation of industry (industry 4.0), expand E-government, spread digital literacy, support research of consequences, increase security in cyberspace, increase international cooperation in regulation of networks]	Germany is lagging behind in digital infrastructure[, while the effects of digitalisation are not well understood and its benefits are unevenly distributed]	No assessments published, numbers exist possibly only for subareas, e.g. broadband expansion: a total of €100 billion of public and private investment until 2025	Reliable, high speed data transmission to enable future growth e.g. based on IoT and industry 4.0 applications
Digital Networks Act (DigiNetzG)	2016	BMVI	Facilitate deployment of high speed fibre cables	Requires all future public transport infrastructure projects to include the laying of optical fibre cables where needed and outfitting all newly developed areas with optical fibre networks.	Low expansion speed of the deployment of optical fibre cables	None directly for the federal government; low additional costs for developers (often municipalities) since existing building projects are concerned	Increase the speed of optical fibre deployment
Broadband funding programme	2015	BMVI	Support broadband deployment in rural areas	Municipalities can apply for one-time subsidies for their broadband expansion programmes, up to 70%, €15 million	Broadband supply in rural areas increases only slowly	€3 billion in 2015 and 2016	Speed up broadband deployment in rural areas
Special Programme for Business Parks	2017	BMVI	Support broadband deployment in existing business parks	Municipalities or counties can apply one-time subsidies for deployment of broadband infrastructure in their business parks, up to 70%, €1 million	Existing business parks suffer a competitive disadvantage without high speed internet	€350 billion	Keep existing business parks attractive for new businesses requiring high speed internet
Strategy 'Future-Oriented Gigabit-Germany'	2017	BMVI	Create a nationwide gigabit infrastructure before 2026	Four-step plan: 1. Provide at least 50Mbit/s to all households until 2018 (cf. DigiNetzG) 2. Supply existing business parks with optical fibre cable (cf. Special Programme for Business Parks) 3. Complete regulatory and administrative framework for 5G rollout by 2020 4. Establish gigabit-ready convergent network, including the technical, financial	Less than desired private engagement and public-private cooperation in achieving the broadband expansion goals	Hard to say, no direct investments planned, no estimates of bureaucracy or administrative costs available	Increase private investment and engagement in reaching the Federal Government's broadband expansion goals

				and legal framework, as well as physical infrastructure.			
Digital Strategy 2025	2016	BMWi	Promote and shape digital structural change	Concretises and discusses challenges posed by the digital transformation, complements the Strategy 'Future-Oriented Gigabit-Germany'	Many effects and challenges of the digitalisation are not well-understood or no plans to deal with them exist	Strategy paper, no direct costs	Lay the foundation for future reforms in the area of digitalisation

d) Energy Infrastructure

Reform measure	Implementation year	Responsible government unit	Main objectives	Main content	Challenges addressed	Cost of measure	Expected results
Revision of the Incentive Regulation Ordinance (ARegV)	2016	BNetzA	Adjust remuneration of electricity and gas grid operators to changes caused by the Energy Transition	Introduction of a yearly capital cost adjustment, technology-neutral efficiency incentives for the most efficient grid operators, simplified procedural rules and enhanced transparency requirements	Regulation of grid operators had to be adapted to the Energy Transition	No assessment published	Better efficiency incentives for grid operators leading to lower costs for consumers
Act to Amend Provisions of Energy Grid Construction (EnLBRÄndG)	2015	BMWi	Increase public approval of grid expansion by preferring underground to overhead cabling where possible	New extra-high voltage, direct current (EHV-DC) transmission lines must be deployed underground wherever possible	Grid expansion is slowed down by lawsuits of citizens or municipalities who want to avoid overhead cabling in their vicinity	No assessment published but likely to increase the costs of grid expansion considerably	Faster grid expansion due to less public resistance
Grid Charge Modernisation Act (NEMoG)	2017	BMWi	Harmonise grid charges nationwide and adapt them to the growing production of renewable energies	Between 1 January 2019 and 1 January 2023 grid charges will be standardised in five steps and reduced payments for distributed feed-in	Energy Transition requires changes in grid regulation	None, savings for consumers envisioned	Lower costs of grid maintenance and thus indirectly also for consumers
Renewable Energy Sources Act	2016	BMWi	Concerning electricity grids: synchronise expansion of renewable energies with the pace of grid expansion	In congested areas ('Network Expansion Areas') a maximum of 58% of the average capacity added in the last three years can be added, thus temporarily slowing down production growth of renewable energy	Grid expansion is not keeping up with the growth of renewable energy production	No direct costs	Better harmonised grid and renewable energy expansion speeds, lower costs from emergency cutouts
Act on the Digitalisation of the Energy Transition	2016	BMWi	Introduce regulation on smart meters, which eventually help to reduce fluctuations in the grid	Introduce regulation on smart meters	New, potentially efficiency-enhancing and grid stabilizing technology is available but needs regulation to be used on a large scale	No direct costs	Better synchronization of energy producers and consumers leading to more grid stability and thus lower costs
Smart Energy Showcases - Digital Agenda for the Energy Transition (SINTEG)	2016	BMWi	Test new approaches to safeguarding secure grid operation with high shares of intermittent power generation based	Five showcase regions receive subsidies to implement and test different aspects of the interaction of smart grids and renewable energies	New technologies are developed but need to be tested before being implemented (and	Up to €230 billion in subsidies	Gain experiences about potentially efficiency enhancing and future-proof

			on wind and solar energy		possibly subsidised) on a large scale		technologies concerning grid management and renewable energies, hopes to generate an additional €300 billion in private investment

e) Railway and Motorway Infrastructure

Reform measure	Implementation year	Responsible government unit	Main objectives	Main content	Challenges addressed	Cost of measure	Expected results
Act to Strengthen Competition in the Rail Sector	2016	EBA (Federal Railway Authority)	Implement EU Directive 2012/34/EU on establishing a single European railway area	Different measures to foster competition in the railway sector, notably a provision restricting increases in track access charges for regional passenger services provided under public service obligation contracts	DB AG still holds a monopoly in the long-distance rail passenger sector and in rail network operation leading to the highest track access charges in Europe	None	More competition und the rail sector, lower track charges contributing to lower prices and better service for passengers
Rail Freight Masterplan	2017 taken on by the coalition agreement in February 2018	BMVI, Pro-Rail Alliance and other stakeholders	Position rail freight transport as the central element of a sustainable transport strategy	Reduce track charges and regulatory costs, expand the 740 meter network as quickly as possible to accommodate EU standards, upgrade the six major rail hubs, invest in further electrification, expand and invest in digital infrastructure, start a specific research programme	Many enterprises still use other, less sustainable transport modes for their freight than rail transport	€350 million annually as a compensation for reduced track charges, at least €50 million until the end to 2020 to foster the digitization of freight wagons, more than €1 billion for noise-reducing braking systems between 2013 and 2020, €5 million for a specific research programme	Higher competitiveness of rail freight transport compared to road transport
Deutschlandtakt	2017, taken on by the coalition agreement in February 2018	BMVI	Increasing the competitiveness of the rail passenger sector and the rail freight sector compared to road transport	Developing a synchronised timetable with short waiting times, not only between agglomerations but also in rural regions; preconditions are increasing investments in junctions and bottlenecks	Lack of competitiveness of the rail sector compared to road transport	Overall, about €42 billion are estimated by BMVI	Better and more reliable connectivity and coordination of all public freight and passenger traffic
Restructuring of fiscal relations between the Federation and the federal states: Changing of the Basic Law	2016	BMF	Concerning motorways: Make management of federal motorways more efficient	The Federation takes on the administration of the federal motorways. The management of other federal roads can be taken over by the Federation if the respective federal state requests this. A new limited company (GmbH) is to be set up to	Federal states are less adept to handle contract management of federal trunk roads than the federal government,	Unclear	Efficiency gains in federal trunk road management, leading to, inter alia, increased investment in motorways

				implement this measures, starting its operations on 1 January 2021	leading to costly inefficiencies		
Reorganisation 'ÖPP Deutschland AG' into the 'Partnerschaft Deutschland – Berater der öffentlichen Hand GmbH'	2017	BMF	Consult the municipalities in planning and executing their investment projects, irrespective of the selected procurement method	Internal reorganisation while maintaining 100% state ownership	Municipalities often lack the capacities to plan, negotiate and implement PPP projects	Unclear, likely relatively low administrative costs	More efficient procurement and investment by the municipalities, increasing realization of PPP projects

f) Taxation

Reform measure	Implementation year	Responsible unit	Main objectives	Main content	Main challenges addressed	Cost of measure per year	Expected results
Country-by-country reporting	2016	BMF	Curb profit shifting of multinational firms; increase tax transparency	An ultimate parent company of a multinational group resident in Germany with consolidated revenue of €750 million or more in the previous tax year must prepare a country-by-country report containing certain tax-related information on a per-country basis	Profit shifting of multinational firms	According to justification of law (*Bundestag Drucksache* 18/10506, 30.11.2016), compliance costs for economy of €536,000 annually, compliance costs for tax administration between €4.69 million and €5.10 billion annually, and onetime cost for tax administration of €1.3 billion	Decline in profit shifting of multinational firms
Limitation of deductibility of royalty payments	2018	BMF	Curb profit shifting of multinational firms, especially the relocation of intellectual property to low-tax countries; ensure fair taxation	Intra-group royalties are not fully deductible anymore if they are taxed in the hands of the recipient at an effective rate below 25% (exception if preferential taxation requires a substantial activity in the state of the recipient)	Harmful tax practices	According to justification of law (*Bundestag Drucksache* 18/11233, 20.02.2017), €30 million increase in tax revenues annually, and compliance costs for economy of €82,000 annually	Decline in profit shifting of multinational firms
New loss forfeiture exception	2016	BMF	Remove obstacles with respect to the financing of companies by a change in ownership	No loss forfeiture (on application) in case of change in ownership where the company's business operations are continued unchanged from the time of incorporation, or at least during the 3 fiscal years prior to the change in ownership	Financing of companies	According to justification of law (*Bundestag Drucksache* 18/10495, 30.11.2016), €600 million decline in tax revenues annually, plus compliance costs for economy of €214,000 annually, compliance costs for tax administration of €285,000 annually, and onetime cost for tax administration of €360,000	Support of financing of companies
Simplification of regulation on investment deduction	2016	BMF	Increase flexibility in the context of the investment deduction which aims at a forward displacement of depreciation potential of future investments	Omission of the requirement to indicate a concrete investment	Financing difficulties with respect to future investments	According to justification of law (*Bundestag Drucksache* 18/4902, 13.05.2015), €40 million decline in tax revenues annually, plus a decline in compliance costs for economy of €162,000 annually	Increase in investments in business assets

Change in thresholds for depreciation of low-value assets	2018	BMF	Offer more room for new investments	The value limit of acquisition or production costs for the qualification for immediate depreciation of movable assets which are capable of individual use and depreciation increases from €410 to €800. The value limit for the depreciation on a pool basis over five years increases from €150 to €250. Assets with a value below €250 (before: €150) do not need to be included in the pool, but can be depreciated immediately.	Liquidity problems	Hard to assess; probably decline in tax revenue	Increase in investments in business assets

g) Bureaucratic Burden

Reform measure	Implementation year	Responsible government unit	Main objectives	Main content	Challenges addressed	Cost of measure	Expected results
One in, one out ('OIOO') rule	2015	Federal Government	Provide a ceiling to compliance costs (transposition of EU requirements exempted)	Increased administrative burden through new regulation has to be accompanied by a corresponding level of relief	Compliance cost, red tape	no information	Reduced bureaucratic cost
Better Regulation work programme	2014, 2016	Federal Government	Ensure simple, comprehensible, and target-oriented law	Measures to mitigate the bureaucratic burden placed on businesses, modernisation of regulations and requirements	Red tape	no information	Reduced bureaucratic cost
SME guidelines	2014	Federal Government	Facilitate compliance for SMEs	Impact assessments, exemptions, information campaigns, funding	Red tape	no information	Reduced bureaucratic cost
First Bureaucracy Relief Act	2016	Federal Government	Administrative relief for young firms and start-ups	Reduced compliance obligations, simplification of tax rules	Red tape	no information	Reduced bureaucratic cost
Second Bureaucracy Act	2017	Federal Government	Administrative relief for SMEs	Facilitated social security contributions, lump sum limits, registration thresholds, digitalisation	Red tape	no information	Reduced bureaucratic cost
EU ex-ante procedure	2016	Federal Government	Ex-ante impact assessment	Inquire about existing estimates, production of impact assessments regarding compliance cost of new regulation	Transparency, compliance cost	no information	
Ex-post evaluation	2013	Federal Government	Ex-post impact assessment	Post-implementation effects relative to targeted objectives and original cost estimates	Transparency, compliance cost	no information	

h) E-government

Reform measure	Implementation year	Responsible unit	Main objectives	Main content	Main challenges addressed	Cost of measure per year	Expected results
E-government Act (EgovG)	2013	BMI	Promoting E-government	Facilitating electronic communication with public administration; enabling federal, state and local authorities to offer more simplified, user-friendly and efficient electronic services (e.g. implementing De-Mail-access, eID, e-invoicing, one central data portal 'GovData')	Insufficient supply and low use of E-government; lack of user-friendliness	No information available	Realizing savings by reducing bureaucracy and modernizing public administration
Digital Administration 2020 (part of the Digital Agenda 2014-2017)	2014	BMI	Providing concrete measures to implement EGovG by fostering coordinated, collaborative action; networked processes which divide tasks among staff; harmonised, standardised, interoperable IT	The programme bundles selected projects. Infrastructure and basic services have initial priority. Examples are mandatory installations of digital access to governmental authorities, replacement of written forms by digital documents, and the availability of public data in digital form (Open Data).	Insufficient supply and low use of e-Government; lack of user-friendliness	No information available	Realizing savings by reducing bureaucracy and modernizing public administration
Revision of the National E-government Strategy (NEGS) firstly implemented in 2010	2015	IT-Planning Council	Promoting a close and reliable cooperation across all levels of public administration in further developing E-government	Setting the framework for common and coordinated strategic action, defining 5 guiding principles, 16 goals and respective areas of action	Insufficient supply and low use of E-government; lack of user-friendliness; data security concerns	Budget of IT planning council: €11 billion in 2016 increased to nearly €15 billion in 2018; 2/3 for applications, 15% for projects, 10% for coordination of IT standards and administration of the IT planning council	Reducing administrative burden for businesses and fostering demand for innovative IT solutions, both strengthening international competitiveness
Online Access Improvement Act	2016	BMWi	Ensuring that all public authorities offer their services online within 5 years	Creating a network of administrative portals using comparable IT standards, so that all users can access all digital administrative services from any connected portal in barrier-free way using one single account	The federal structures in Germany impede the development of uniform standardised solutions	No information available	Preventing isolated solutions and redundancies in E-government services; accelerating E-government in Germany

Amendments of EgovG: Open Data Act	2017	BMI	Promoting open data and strengthening innovation in the field of the digital economy	Accelerating the process and, on the basis of a law, making federal administration the front-runner in the provision of open data in uniform machine-readable formats under free licensing conditions.	Insufficient provision of data by federal authorities	No information available	Accelerating the process towards open administrative data initiated by the EgovG
Amendments of EgovG: Participation in the Open Government Partnership (OGP)	2017	BMI	Further promoting open government along with the first national action plan (NAP) developed in consultation with civil-society organizations	The NAP includes 15 commitments by several federal ministries such as fulfilling international transparency standards in the fields of development cooperation and extractive industries, promoting the provision of open data and support local integration projects	Lack of transparency in governmental processes; poor participation of NGOs	No information available	Improving the "openness" of public administration and strengthening the innovative potential
Amendment of the Act of Identity Cards and Electronic Identification (PAuswG-E)	2017	BMI	Promoting the use of eID	The eID function will be mandatory for newly ordered ID-cards; allowing on-site reading without PIN; notification to the European eIDAS Regulation; implementation of "eID as a service"	Little usage of the eID function integrated in the national ID-card	No information available	Many business and government transactions can be performed easily and safely online thus lowering transaction costs for all actors

i) Public Procurement with a focus on innovation-oriented PP

Reform measure	Implementation year	Responsible unit	Main objectives	Main content	Main challenges addressed	Cost of measure per year	Expected results
High-Tech Strategy - Innovation for Germany	Revised version 2014	Federal Government	Promoting innovative PP	Highlighting innovative PP as the most important demand-oriented innovation policy instrument; requiring PP guidelines to apply sustainability and innovation criteria	PP too often resorts to established and not innovative solutions	No information available	Stimulating innovation; strengthening competition
Law on modernising PP - Regulation on modernising PP	2016	BMWi	Bringing 3 EU directives with respect to PP above the EU thresholds into national law; the reforms target to enable greater flexibility for PP tendering criteria, facilitate the participation of SME; make more use of PP to support strategic objective	Creating simple and user-friendly rules for PP; strategic objectives refer particularly to social, environmental and innovative aspects in PP; new regulation is due to PP contracts above the EU thresholds	Insufficient use of PP for developing innovative products and services; high information and bidding costs for firms	No information available	Stimulating innovation through PP; increasing the participation of SME; strengthening competition
Part of the new legislation Vergabestatistik-verordnung	2016	BMWi	Improving the central collection and quality of PP data	Implementing a central, nationwide contract statistic, all PP data shall be collected automatically and electronically analysed to get information on the annual volume and structure of PP above and below the EU thresholds	Insufficient information on PP volume and structure particularly below the EU-thresholds	No information available	Better information helps to improve the processes and quality of PP
Part of the new legislation: Online handling on PP procedures	2016	BMWi	Free online access to all contracts above the EU thresholds and all tender documents	By October 2018, all contracting authorities and contractors must have moved to the online handling for PP and concessions above the EU threshold. Optionally, this is also possible for PP procedures below the EU thresholds	High information and biding costs for firms, lack of transparency for the public	No information available	PP procedures will become quicker thus lowering transaction costs and increasing competition
Ordinance on Procurement below the Thresholds	2017	BMWi	Implementation of PP rules that are as uniform and simple as possible	The ordinance adapts the flexible provisions in the new rules for PP above the EU thresholds and applies them to the awarding of below threshold PP contracts at national level, initially on the federal level, then also on the federal states level	Insufficient use of PP for developing innovative products and services; high information and biding costs for firms	No information available	Stimulating innovation through PP; increasing the participation of SME, strengthening competition
Centre of Excellence for Innovative Procurement (KOINNO)	2013	BMWi	Strengthening the innovative direction of PP, thereby collaborating with the Competence Centre for Sustainable	Advising and networking PP managers at all authority levels, collecting successful practical examples, building up a database for innovative solutions, initiating conferences, supervising the award of the	Insufficient use of PP for developing innovative products and services, little transfer of	No information available	Increasing innovation-oriented PP, stimulating innovation through PP, making PP more effective

			Procurement, set up in 2012.	prize 'Leadership through Innovation' for contracting authorities with top performances in innovation-oriented PP; providing a guideline for procurers	knowledge/ experiences between the different authority levels		through exchange of knowledge between authority levels

j) Start-ups

Reform measure	Implementation year	Responsible government unit	Main objectives	Main content	Challenges addressed	Cost of measure	Expected results
Micro-mezzanine Fund Germany	2013	KfW	Strengthening the equity capital base of start-ups and young firms	Equity investment by KfW (non-voting, non-control) of up to €50,000 which subsequently increases the firm's credit rating and access to credit	Weak equity base of many firm founders, particularly founders who were unemployed or are migrants or refugees	total volume of the fund: €35 million	Increase in number of viable start-ups
Pilot study 'Founder-Godparenthood' (Pilotstudie Gründungs-patenschaft)	2016	BMWi	Activate refugees' potential to become successful entrepreneurs	Refugees are supposed to have less experience with the bureaucratic procedures necessary to found a business in Germany and also less knowledge about social norms in business life in Germany. To overcome this barriers an experienced business person is assigned as a mentor each of the participating refugees.	The integration of refugees in the labour market is a challenge. A fraction of the refugees could found a company	Hard to assess, but rather low	Increase in successful start-ups by refugees
Digital Entrepreneurship Platform (Gründungs-plattform)	2017	BMWi, KfW	Provide online support for idea generation, business planning, and information of subsidies.	The centralised platform shall bundle all necessary information for potential founders to successfully set up their business. The founders get an online account and can complete modules to develop their business idea over a longer period of time.	Decentralised access to information (e.g. on subsidy programmes) is a barrier to found firms; also online tools to develop a business idea were missing	Hard to assess, but rather low	Increase successful start-ups in the area of digitalisation
'Frauen unter-nehmen' (Women venture)	2014	KfW	Increasing firm foundation activity by women	Present successful female entrepreneurs who can act as role models for other women who want to start a business	Lack of entrepreneurial attitudes among women	Hard to assess, but rather low	Increase in number of start-ups by women

k) Venture Capital

Reform measure	Implementation year	Responsible government unit	Main objectives	Main content	Challenges addressed	Cost of measure	Expected results
Increase in EXIST grants	2015	BMWi	Promote spin-offs from universities and research institutes	Increase in EXIST start-up scholarship and in EXIST research transfer by ~ 25%	Barriers to starting a business by university researchers	no information available	Increase in the number of viable start-ups from universities
EXIST incentive premium for universities		BMWi	Incentivise universities to supply laboratories, working spaces and coaching for start-ups	Universities can receive up to €10,000 for start-ups with EXIST start-up scholarship and €20,000 for start-ups with research transfer grant	Lack of entrepreneurial culture at universities	no information available	Increase in the number of viable start-ups from universities
High-tech Start-up Fund (HTGF III)	2017	BMWi, KfW	Provide innovative, technology oriented start-ups with 'basic supply' of venture capital	Target volume next closing: €300 million (€90 million (~30%) from private investors as well as established medium sized and large firms); First Closing in May 2017, volume: €245 million	Low availability of seed capital for young technology oriented start-ups	Hard to assess; depends on management fees and the amount of write-offs	Increase availability of seed capital; attract follow-on investors
INVEST 2.0 Program	2017	BMWi, BAFA	Support innovative start-ups to find and attract private investors	Max. eligible investment volume doubled to now €500,000; exit grant of 25% on capital gains; Eligibility of UG as investment vehicle; Eligibility of follow-on investments; Eligibility of convertible loans; Extension of innovation criteria (firms can now apply to be classified as 'innovative' by an independent expert report)	Low investment of private investors in seed and early stage start-ups	~ €62 million in approved grants since start in 2013 (until October 2017)	Increase availability of private funds for young innovative start-ups
German Accelerator	2015	BMWi	Support internationalization of German start-ups	Offers selected start-ups from the ICT and life sciences a three month visit to the US (Silicon Valley, New York and Boston) to network with US companies, investors, start-ups and potential customers; Start-ups receive coaching by professional mentors, Additional accelerator for South-East Asia is planned		no information available	Increase in internationalisation activities of start-ups
Deutsch Börse Venture Network	2015	German Stock Exchange (Deutsche Börse)	Connect growth oriented start-ups with investors	Matching platform and for promising start-ups and venture capital investors;	Equity gap in growth capital	no information available	Increase transparency of venture market,

				Incubator supports firms in all development stages, also prepares for IPO			increase efficiency and availability of private venture capital
Scale	2017	German Stock Exchange (Deutsche Börse)	Access to national and international capital markets for SMEs	Support and coaching for IPO	Equity gap in growth capital	no information available	Facilitate and increase range of initial placement of stocks for SMEs
Capital increase of ERP/ EIF Fund of Funds	2016		Increase capitalization of venture capital funds for growth investments	Invest in venture capital funds investing in young technology oriented start-ups (mainly in Germany); Co-investment fund (pari passu); Typical investment ranges from €20 million to €60 million Capital increase from €1.0 billion to €2.7 billion	Equity gap in growth capital	Hard to assess; depends on management fees and the amount of write-offs	Close equity gap in growth capital
Top-up to European Angel Fund	2014	BMWi	Provide a flexible investment to support Business Angel investments	€135 million top-up to EAF Germany	Lack of business angel activity	Hard to assess; depends on the amount of write-offs	Increase in Business Angel investment
coparion	Early 2018	BWi, KfW	Close equity gap in growth capital for start-up companies	Co-investment fund (pari passu)[121]; Total fund volume: €225 million; Average investment €0.5 million to €3 million (max. €10 million), stage focus on series A, B and C	Equity gap in growth capital	Hard to assess; depends on management fees and the amount of write-offs	Close equity gap in growth capital
ERP/ EIF/ Mezzanine Fund of Fund for Germany	2016	BMWi, LfA Förderbank Bayern, NRW.BANK	Close equity gap in growth capital for SMES	Invests in private, professional mezzanine funds (incl. venture debt funds; Total fund volume was increased from €200 million to €600 million in 2016; Average investment volume is €10 million to €20 million	Equity gap in growth capital for growth oriented German SMEs	Hard to assess; depends on management fees and the amount of write-offs	Close equity gap in growth capital
ERP-Venture Capital Fund-of-Funds	2015	BMWi, KfW	Close equity gap in growth capital for	Similar to ERP/ EIF Growth Facility; Allowed to invest in funds with first time teams and first closings as well as venture debt funds;	Equity gap in growth capital	Hard to assess; depends on management fees and the	Leverage €2 billion in equity based growth capital in the

[121] Investment made by the fund will be subject to the same terms as the investment made by the private sector co-investor

			technology oriented start-ups	Total fund volume: up to €400 million for 5 years		amount of write-offs	following ten years
ERP/ EIF Growth Facility	2016	BMWi, KfW	Provide high growth SMEs with access to growth capital	Put on co-investment funds with successful venture capital investors (pari-passu); Total fund volume: €500 million; Average investment €20 million to €60 million	Equity gap in growth capital	Hard to assess; depends on management fees and the amount of write-offs	Close equity gap in growth capital
tax law on preservation of loss carry-forwards after shareholder change	2016	BFM	Allow tax deductibility of losses for new investors in a company	Under certain conditions (e.g. firm must be in the same business for at least three years) loss carry-forwards remain fully deductible when new investors enter the company; Formerly forfeit of loss carry forward fully (partially) when acquired shares exceeded 50% (25%)	Remove barriers to investment for start-up companies with frequent change in investor composition	Hard to assess; depends number of firms that are affected by the change in legislation, as well as the change in accounting and investment behaviour	Increase incentives for start-up investors; free up additional resources for start-up companies

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