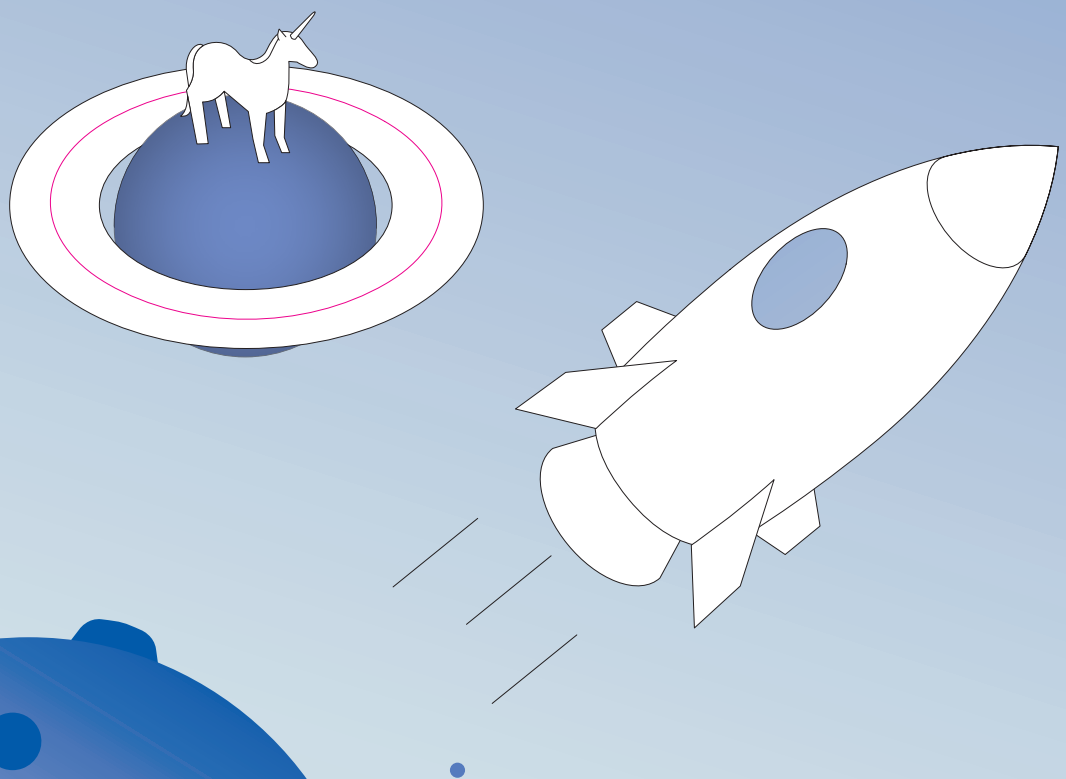
B 1 The role of start-ups in the innovation system

Download data

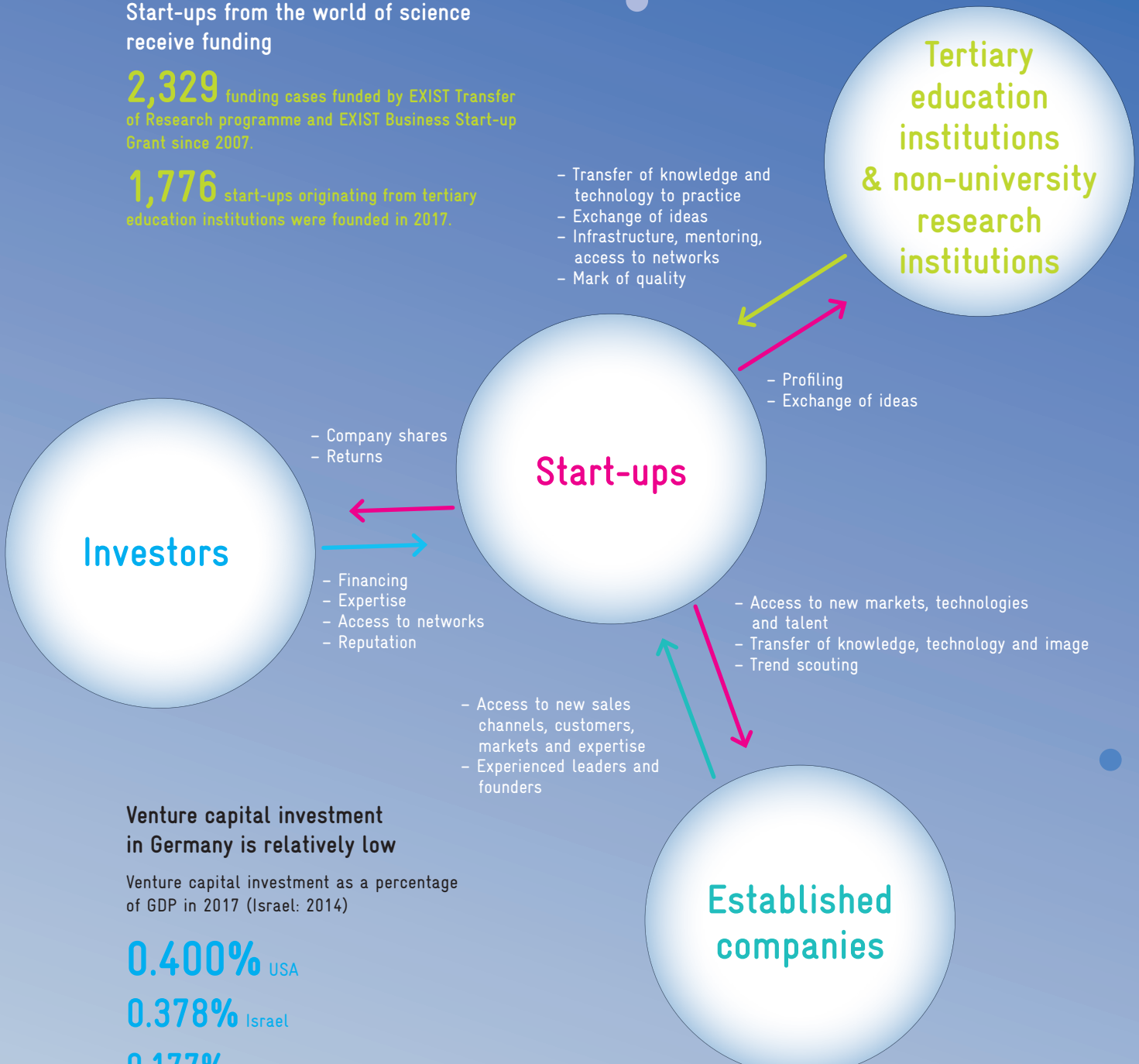
Start-ups explore new business models and produce innovations, thereby both augmenting and modernizing the array of products and services on offer. Start-ups from the world of science play an important role in the transfer of knowledge and technology into practice. Start-ups are also trend scouts and provide crucial impetus for established companies that are always challenged anew by the competition with start-ups. As cooperation partners of established companies, start-ups contribute to the joint development and marketing of innovations.



Start-ups from the world of science receive funding

2,329 funding cases funded by EXIST Transfer of Research programme and EXIST Business Start-up Grant since 2007.

1,776 start-ups originating from tertiary education institutions were founded in 2017.



Venture capital investment in Germany is relatively low

Venture capital investment as a percentage of GDP in 2017 (Israel: 2014)

0.400% USA

0.378% Israel

0.177% Canada

0.083% South Korea

0.076% United Kingdom

0.035% Germany

Established companies' interest in start-ups is clear

84% Proportion of German accelerators operated by established private companies.

48% Proportion of large family-owned companies in Germany cooperating with at least one start-up in 2018.

Source: number of EXIST funding cases: BMWi/PtJ data. Number of start-ups originating from tertiary education institutions founded in 2017: Frank and Schröder (2018: 5). Proportion of German accelerators operated by established private companies: Zinke et al. (2018: 60). Proportion of large family-owned companies cooperating with start-ups: Löher et al. (2018: 6). Venture capital investment in international comparison: OECD (2018a: 15).

B 1 The role of start-ups in the innovation system

Start-ups are young companies with innovative business ideas and considerable potential for growth.[154] They explore new business models and produce innovations, thereby both augmenting and modernizing the array of products and services on offer. In light of their specific capabilities and their incentives, start-ups are often better able to take up disruptive ideas and implement them in the form of market-ready solutions. As newcomers to the market – and in contrast to established companies – they do not need to worry about disruptive ideas cannibalizing their existing business model. Start-ups from the world of science play an important role in the transfer of knowledge and technology into practice. Start-ups are also trend scouts and, by exerting competitive pressure, stimulate established companies and challenge them to explore new approaches. Start-ups also contribute to the joint development and marketing of innovations as cooperation partners to established companies.

This chapter illustrates the geographical distribution of start-ups in Germany, discusses the various contributions start-ups make to the innovation system and highlights potential ways to further boost such contributions.

B 1-1 Geographical distribution of start-ups in Germany

A vibrant start-up scene has developed in Germany. However, reliable data on the growth of the German start-up population is currently not available.

Estimating the evolution of the number of start-ups based on the overall number of business foundations is problematic. The overall number of business foundations in Germany is in decline (cf. chapter C 5).[155] However, considering the favourable economic environment, it seems plausible that this is driven by a fall in the number of businesses founded to secure livelihoods – that is to say, due to unemployment or a lack of suitable alternatives.[156] Such motives are not typical reasons behind the foundation of a start-up. A study of the USA has shown that the development trends of company foundations in general and for start-ups in particular do not always run parallel.[157] The evolution of venture capital investment in Germany (cf. chapter C 4) indicates that the number of start-ups in Germany is higher today than it was five year ago.

Yet it is not only the overall number of start-ups that is interesting but also their geographical distribution within Germany. One point of reference for this distribution is venture capital investments and state funding for start-ups from the world of science, even though not all start-ups receive venture capital or government funding.[158]

Start-ups are often financed through state funding and by business angels in the early phase and receive external capital from venture capitalists during the subsequent growth phase.

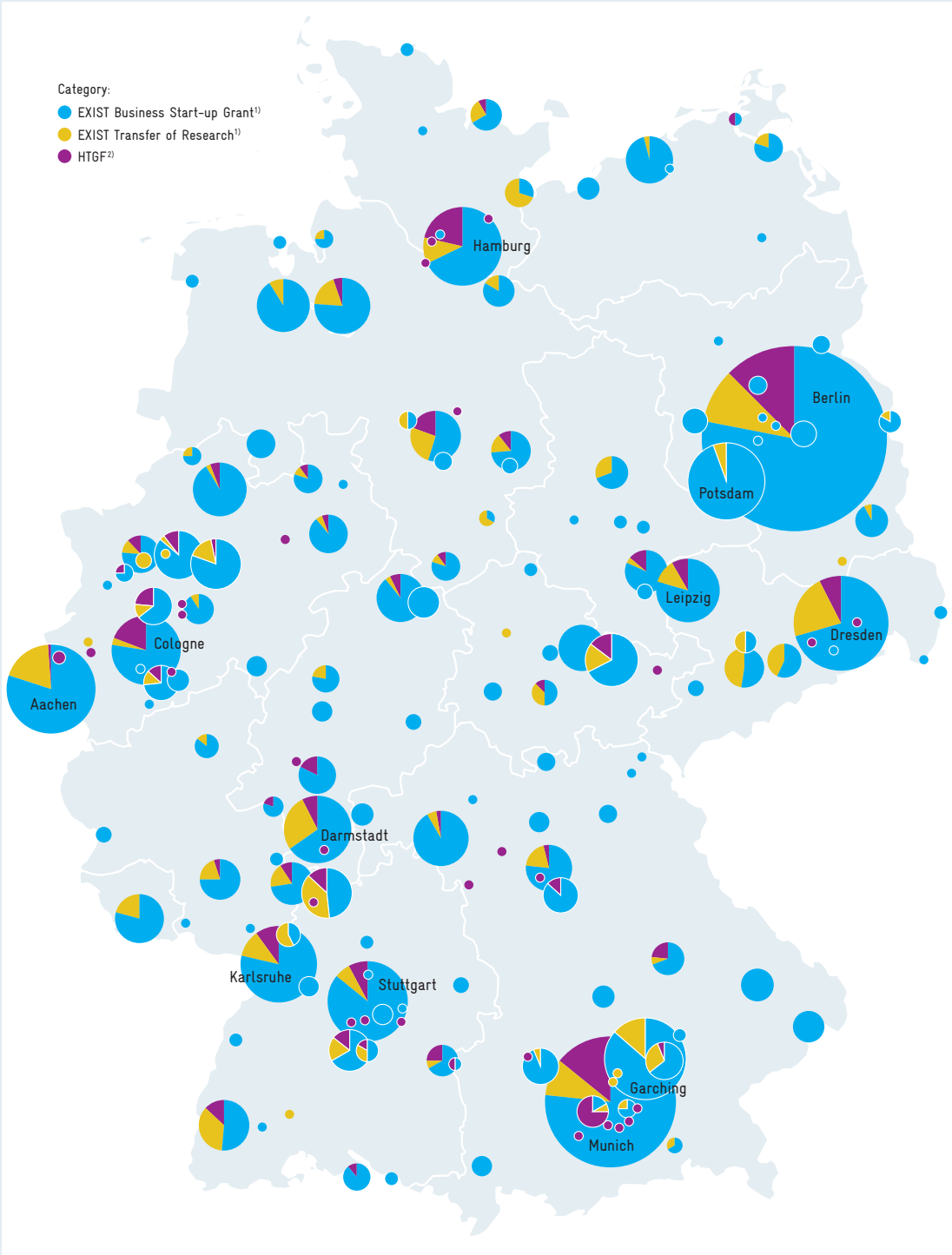
For the early phase of start-ups originating from academic institutions, the geographical distribution can be described using funding data from the EXIST programme, which supports start-ups from the world of science (cf. box B 1-5). In this regard, the number of funding cases supported by the EXIST Business Start-up Grant and EXIST Transfer of Research programme is examined since these funding lines were launched in 2007.

The High-Tech Gründerfonds (HTGF) is an important provider of venture capital for early-phase start-ups (cf. box B 1-9). The locations of start-ups that currently form part of the HTGF's active portfolio therefore make it possible to draw conclusions as to the geographical distribution of early-stage start-ups.

Fig. B 1-1

Download data

Geographical distribution of funding cases for the EXIST Business Start-up Grant and the EXIST Transfer of Research programme as well as start-ups in the portfolio of the HTGF



[1)] Period from 2007 to 2018.
[2)] Active portfolio of HTGF I, II and III as of November 2018.
The pie charts' size increases proportionate to the number of funding cases for the EXIST Business Start-up Grant and the EXIST Transfer of Research programme as well as start-ups in the portfolio of the HTGF.
It is possible that isolated start-ups and start-up projects may be included in more than one category.
Sources: Data from the BMWi/PtJ and the HTGF (2018). Own calculations.

Tab. B 1-2

Download data

Distribution of funding cases for the EXIST Business Start-up Grant and the EXIST Transfer of Research programme as well as start-ups in the portfolio of the HTGF across the Länder

	EXIST Business Start-up Grant[1]		EXIST Transfer of Research[1]		HTGF[2]		Venture capital investments by companies organized in the BVK[3]	
	Number of funding cases	Funding amount in €m	Number of funding cases	Funding amount in €m	Number of start-ups in portfolio	Estimated investment volume (early phase) in €m	Number of portfolio companies	Investment volume in €m
Baden-Württemberg	228	22.7	52	36.1	35	21.0	43	78.8
Bavaria	401	37.4	49	31.1	56	33.6	104	215.8
Berlin	325	33.0	39	23.7	52	31.2	174	490.2
Brandenburg	108	11.1	7	2.9	5	3.0	27	29.4
Bremen	32	2.7	8	3.9	2	1.2	2	1.1
Hamburg	51	5.4	8	6.0	16	9.6	26	60.1
Hessen	102	9.6	18	11.0	10	6.0	16	12.8
Lower Saxony	104	10.7	20	11.3	11	6.6	12	12.4
Mecklenburg-West Pomerania	42	3.9	3	2.0	1	0.6	4	2.3
North Rhine-Westphalia	294	28,4	43	28.2	36	21.6	58	84.0
Rhineland Palatinate	32	3.0	5	2.6	2	1.2	10	7.8
Saarland	23	2.4	6	3.8	–	–	5	1.6
Saxony	145	14.1	48	30.7	15	9.0	27	22.1
Saxony-Anhalt	34	3.3	5	2.5	3	1.8	4	3.3
Schleswig-Holstein	15	1.4	10	4.6	3	1.8	38	4.4
Thüringen	62	5.9	10	6.2	7	4.2	16	5.9

[1] Period from 2007 to 2018.
[2] Active portfolio of HTGF I, II and III as of November 2018. This includes the assumption that investment in the early phase totals €600,000 per start-up. The estimate does not include any ongoing finance.
[3] Investments in 2017.
Sources: Data from the BMWi/PtJ and the BVK as well as the HTGF (2018). Own calculations.

The venture capital investments documented by the German Private Equity and Venture Capital Association (Bundesverband Deutscher Kapitalbeteiligungsgesellschaften, BVK) covers both the early and growth phases. However, these investments are only documented at Länder level.

As illustrated in figure B 1-1, particularly high numbers of start-up projects supported by the EXIST programmes can be found in Berlin and Munich. The HTGF also invests particularly heavily in these two locations.

This geographical concentration is also reflected in the distribution of venture capital investment across the German Länder, as documented by the BVK (cf. table B 1-2), in which Berlin and Bavaria again lead the way.

A glance at other countries makes clear that such a geographical concentration is far from a German phenomenon.[159] In all countries, start-ups are founded and develop particularly well in locations that feature an effective start-up ecosystem with tertiary education institutions and non-university research organizations

(außeruniversitäre Forschungseinrichtungen, AUFs), established companies and investors, as well as other start-up founders and skilled workers. The following sections cast light on how start-ups interact with these actors.

B 1-2 Start-ups from the world of science as a transfer channel

A core component of the contribution made by start-ups from the world of science is the transfer of knowledge and technology to the market. In this context, start-ups from the world of science are start-ups founded by current or former scientists applying the knowledge and insights they gained through their research activities in tertiary education institutions and AUFs. In all developmental stages, start-ups originating from research institutions are more innovative than other new businesses.[160] An assessment of the IAB/ZEW Start-up Panel – conducted by the ZEW on behalf of the Commission of Experts – indicates that start-ups from the world of science conduct an above-average level of R&D activities and develop a relatively higher number of product innovations that are new to the market than is the case for new businesses overall.[161]

Despite intensified efforts by tertiary education institutions and AUFs to promote start-ups from the world of science, such as through an increasing supply of incubator programmes,[162] the number of start-ups originating from tertiary education institutions and AUFs in Germany remains low (see below).[163] In its 2017 report, the Commission of Experts already warned that the potential of start-ups from the world of science was not being sufficiently exploited.[164]

Start-ups from non-university research institutions

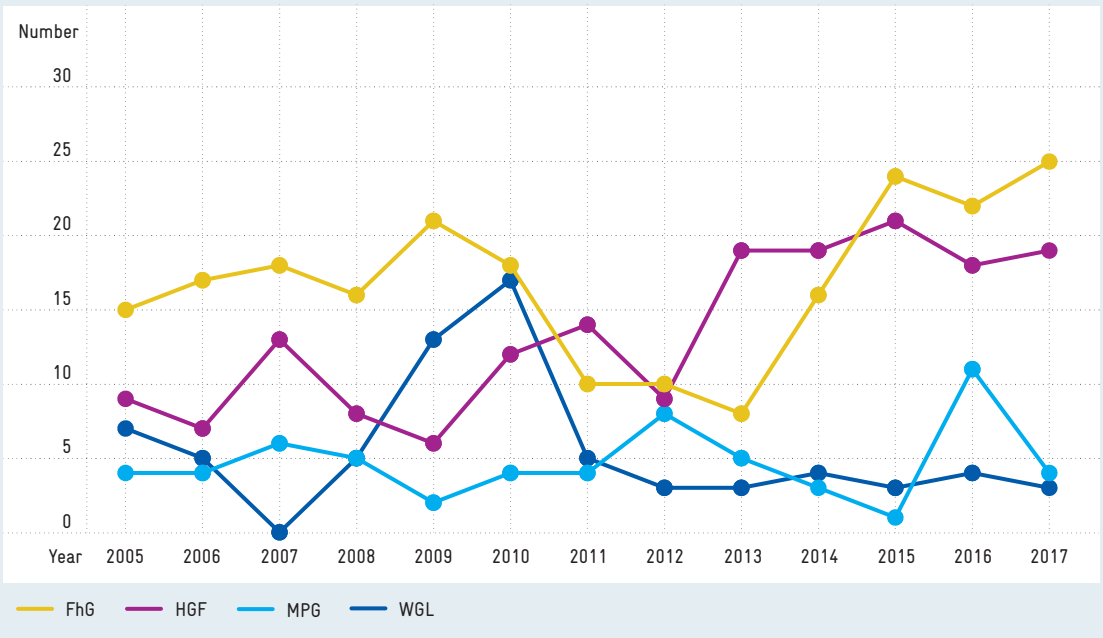
When considering start-ups originating from AUFs in the period 2005 to 2017, it is clear that start-up activities were highly volatile across this period and have not systematically increased (cf. figure B 1-3).[165] The average number of all start-ups originating from the entire Fraunhofer-Gesellschaft or the Helmholtz Association is comparable with the

Fig. B 1-3

Download data

Start-ups from non-university research institutions 2005–2017

Number of start-ups established in the calendar year for the exploitation of intellectual property or expertise developed at the institution following conclusion of a formal agreement.



FhG: Fraunhofer-Gesellschaft, HGF: Helmholtz Association, MPG: Max Planck Society, WGL: Leibniz Association.
Source: own diagram based on GWK (2018a: 113).

number of all start-ups from individual universities such as ETH Zürich or Stanford University.[166] In light of the stagnating rate of start-ups from AUFs, the Commission of Experts welcomes the commitment from AUFs to intensify measures to promote start-ups as part of the Pact for Research and Innovation (Pakt für Forschung und Innovation, PFI) III.[167]

A look at the revenue generated by AUFs from intellectual property rights agreements or licences in the period from 2005 to 2017 shows an overall increase of almost 11 percent (cf. figure B 1-4). The Fraunhofer-Gesellschaft recorded by far the highest licensing revenue over the entire period; its licensing income for 2017 was €143 million. The Max Planck Society, the Helmholtz Association and the Leibniz Association recorded licensing revenues in 2017 of €20 million, €15 million and €7 million respectively.[168] The high stability of licensing income could indicate that AUFs purposefully focus on a stable income stream from licensing agreements with established companies. Similarly stable revenues can only partially be collected from start-ups as founders initially have only limited resources with which to pay licensing fees.

Start-ups from tertiary education institutions

Far more start-ups originate from tertiary education institutions than from AUFs.[170] A survey conducted as part of the Gründungsradar showed that 1,776 start-ups originating from tertiary education institutions were founded in 2017.[171] Of these, 767 start-ups transferred knowledge or technology from tertiary education institutions to the newly founded company. 232 start-ups were based on specific intellectual property rights (e.g. patents or registered designs).[172] Between 2012 and 2017, the number of recorded start-ups at tertiary education institutions rose by around 40 percent.[173]

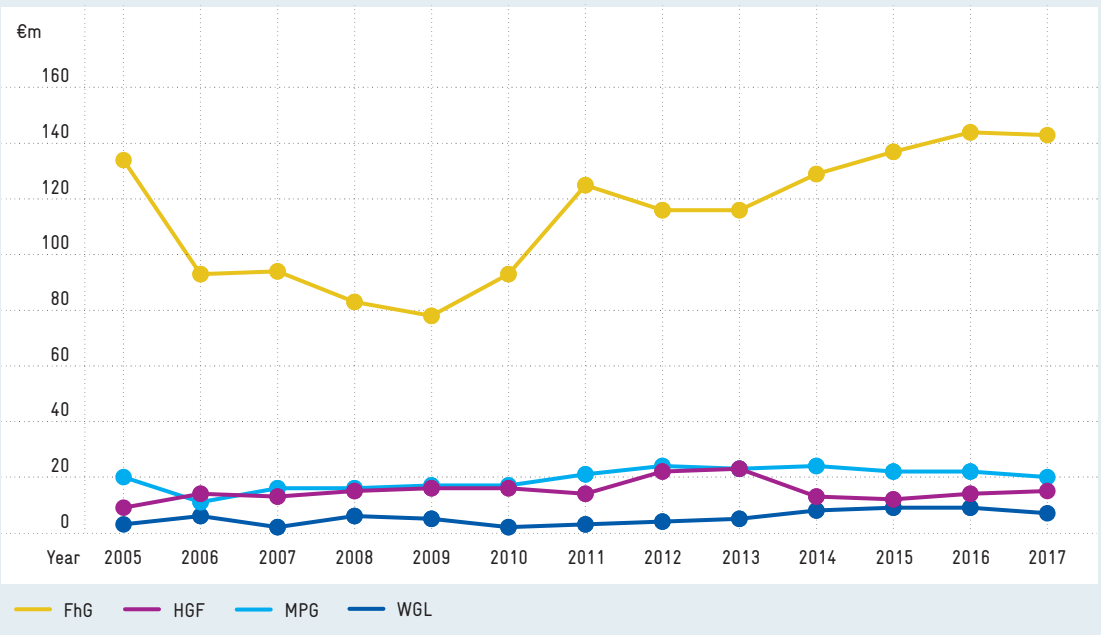
The EXIST programme (cf. box B 1-5) has contributed to the positive evolution of the start-up culture at German tertiary education institutions.[174] In light of the break in funding following the second round of competition in EXIST IV,[175] the new EXIST Potentials programme – launched in November 2018 as part of the EXIST Culture of Entrepreneurship initiative – is to be welcomed. The EXIST Potentials programme is intended in particular to help small and medium-sized tertiary education institutions

Fig. B 1-4

Download data

Revenues from intellectual property rights 2005–2017 in €m

Revenues received in the calendar year from intellectual property contracts/licences.[169]



FhG: Fraunhofer-Gesellschaft, HGF: Helmholtz Association, MPG: Max Planck Society, WGL: Leibniz Association.
Source: own diagram based on GWK (2018a: 111f.).

to implement measures that promote start-ups.[176] However, the Commission of Experts regrets that the EXIST Potentials programme has been allocated only moderate funding.[177] Some German Länder have also set about promoting start-ups from tertiary education institutions which, in light of the fact that tertiary education institutions financing is a matter devolved to the Länder, appears logical. North Rhine-Westphalia, for example, is providing a total of €150 million to up to seven universities over five years as part of its competitive Exzellenz Start-up Center initiative.[181] At the same time, as is always the case when the Federal Government and Länder intervene in the same field, it must be asked how well coordinated the various start-up support measures actually are.

Box B 1-5

EXIST funding programme[178]

Through its EXIST – University Based Business Start-Ups programme, launched in 1998, the BMWi funds start-up activities at tertiary education institutions and AUFs and helps research organizations to spread entrepreneurial spirit. The programme comprises three funding lines: EXIST Culture of Entrepreneurship (launched 1998), EXIST Business Start-up Grant (launched 2007, formerly EXIST Seed) and EXIST Transfer of Research (launched 2007). The EXIST Culture of Entrepreneurship scheme supports tertiary education institutions in formulating and implementing a comprehensive and sustained institution-wide strategy to increase entrepreneurial culture and spirit. The EXIST Culture of Entrepreneurship funding line features several programme phases: EXIST I (1998 to 2005), EXIST II (2002 to 2006), EXIST III (2006 to 2011), EXIST IV, also known as the EXIST Culture of Entrepreneurship - Entrepreneur University (2011 to 2018) – and the new EXIST Potentials programme, launched in November 2018 (2018 to 2023).[179] The EXIST Business Start-up Grant is a line of funding which supports innovative technology-based and knowledge-based start-up projects in the preparatory phase. The EXIST Transfer of Research programme funds resource development measures that are necessary to prove the technical feasibility of research-based start-up ideas. Recent evaluations of the funding programme, as well as the Gründungsradar 2018 report, attest to the positive impact of this funding. The tertiary education institutions supported as part of the EXIST Culture of Entrepreneurship – Entrepreneur University show a clear increase in the level of support for start-ups. Moreover, EXIST supports the emergence of an array of start-ups in highly diverse technological fields and sectors. The survival rate of the created start-ups is comparably high.[180]

Barriers to start-ups from the world of science

On behalf of the Commission of Experts, the Technical University of Munich (TUM) surveyed 50 people who had founded, led or advised a start-up in the last ten years, either in their own right or as part of a team. As part of this survey, the lack of practice-oriented qualifications, heavy administrative burdens and a shortage of resources (e.g. capital, office space) were named as barriers to start-ups from tertiary education institutions.[182] Another challenge is the potential competition between the commercial use of scientific knowledge and its distribution in the form of publications if the company founders remain active at the research organization.[183]

Legal framework conditions and uncertainty may also represent barriers to entrepreneurship. Start-ups from the world of science are complicated by protracted licensing negotiations between their founders and transfer organizations. In the USA, for instance, numerous technology transfer organizations at universities offer founders optional so-called express licence contracts to expedite licensing.[184] If founders find the conditions of express licence contracts unattractive, they can also conduct specific negotiations with the respective technical transfer organization. Express licence agreements could also help to accelerate the process of founding a start-up in Germany and lower the hurdles for start-ups from the world of science.[185]

Start-ups as drivers of innovation in established companies B 1–3

Start-ups provide crucial impetus and drive innovation in established companies. By competing, start-ups exert pressure on established companies to continuously improve in order to maintain their

market position.[186] However, start-ups can also serve as trend scouts for new technologies and innovations.[187] Statements from start-up founders confirm that large companies take great interest in monitoring start-ups – allowing them, for instance, to discover new markets and commercial channels. Start-ups can help small and medium-sized enterprises (SMEs) to accurately appraise the future viability of technologies and innovations.

However, start-ups can also be effective cooperation partners for established companies. In addition, it can be part of the innovation strategy of established companies to buy up innovative start-ups.

Collaborations between established companies and start-ups

Collaborations can help to promote new innovations, expedite the diffusion of knowledge and technologies and test the marketability of technologies more quickly.[188] In recent years in particular, established German companies' interest in cooperating with start-ups has markedly increased, meaning that companies increasingly compete over attractive start-ups (in part by necessity).[189] A survey of 248 large, family-owned companies in Germany conducted by the Institut für Mittelstandsforschung (IfM) Bonn suggests that almost half of those companies surveyed were in cooperation with at least one start-up.[190] The number of incubators and accelerators offered by companies in Germany has risen continuously in recent years. Some 84 percent of all German accelerators (121 in 2017) are now operated by established companies.[191]

Collaborations are established in particular where companies and start-ups offer complementary products. The results of the study carried out by the TUM conducted on behalf of the Commission of Experts indicates that start-ups and established companies in partnerships particularly aim to facilitate both partners' access to sales and supply markets or enhancing their offering to customers.[192]

– In a partnership that aims to tap into new markets, the cooperation partners benefit from an exchange of information on customers, suppliers and/or capital investors. The reasons given for pursuing joint market development include increased overall turnover, an upgraded product portfolio and an enhanced public image for the participating cooperation partners (cf. box B 1-6).

– By jointly expanding the offerings made to customers, start-ups and established companies can together develop new, complementary products and services. In many cases, a new technology developed by the start-up is integrated into the established company's existing products. Start-ups can access the resources and infrastructure of their more established cooperation partner. The primary reasons given for such collaborations are the continuous improvement of a company's own products and a sustained positive impact on the culture of established companies.

However, collaborations also present start-ups and established companies with challenges.[194] In this regard, start-up founders with experience of collaborations particularly highlight the unbalanced power relationships due to the asymmetric allocation of resources, conflicts when cooperative relationships become competitive and differences in corporate cultures. SMEs are in need of support in terms of how to initiate cooperative relationships with start-ups, suitable means of exchange and what information to offer.[195] With this in mind, the Digital Hub Initiative – launched in 2017 by the BMWi and tasked with promoting cooperation between start-ups and companies – as well as plans to intensify networking

Box B 1-6

Cooperation for market expansion[193]

The Karlsruhe-based start-up Cubuslab manufactures an adapter that extends the functionality of laboratory equipment. This adapter makes it possible to export and transfer data, allowing laboratory equipment to transfer measurements to other devices more quickly and more easily. Cubuslab uses the sales channels of its cooperation partner, a laboratory equipment manufacturer. Prototypes of the adapter can therefore be tested on the market more quickly – and non-viable prototypes then adapted to customer requirements. At the same time, the laboratory equipment manufacturer also benefits from the fact that its products are digitized to a greater extent and made more competitive.

between start-ups and established companies as part of the ministry's Start-up Initiative are to be welcomed.[196] However, industry experts have criticized the resources allocated to the Digital Hubs as being insufficient. An interesting international example from experience of making information available to potential cooperation partners is the Israeli information platform Start-Up Nation Central (cf. box B 1-7).

Box B 1-7

Start-Up Nation Central[197]

Start-Up Nation Central is an online platform providing information on the start-up ecosystem in Israel. The platform presents start-ups (including their business model, location, year founded), hubs, investors, established SMEs, scientific institutions and multi-national corporations. It allows users to search purposefully for potential cooperation partners; by creating a company profile of their own and providing information, users can also present themselves to potential business partners. The platform also provides information on new technological trends. It reduces the effort required to find players in the start-up ecosystem while simultaneously boosting the visibility of Israeli start-ups – including for international investors.[198] The volume of company profiles created on the platform is evidence of its acceptance as a medium for companies to share information and present themselves. A systematic evaluation of the platform's success has not yet been carried out.

Acquisition of start-ups by established companies

Acquiring start-ups can enable established companies not only to accelerate their innovation projects but also to reduce the costs of technology procurement and market entry.[199] A ZEW study has shown that established companies from knowledge-intensive sectors acquire innovative companies more often than companies from other sectors. They are also more likely to acquire start-ups from outside their own sector.[200] Consequently, companies from knowledge-intensive sectors expand their portfolio more than companies from other sectors. This trend is most pronounced in the field of cutting-edge technology.[201]

Acquisitions by well-financed Chinese and US corporations have attracted particular attention in recent years. Some commentators have voiced concerns that technologies developed in Germany – and the added value they entail – could be lost overseas. As a basic principle, the Commission of Experts considers an open, international transfer of capital and technology to be a crucial driver of innovation and growth. It shares the concern, however, that unequal market access conditions and market distortions caused by state-financed companies, such as in China, could impair the market opportunities of German companies.

The acquisition of start-ups by powerful digital giants from the USA is also contentious. In this case, the fear is that market giants are systematically removing start-ups from the market, which, over the long-term, might have the potential to threaten large corporations' business models.[202] In Germany, lawmakers have sought to address these competition concerns in the 9th Amendment to the Act against Restraints of Competition (GWB). In future, mergers will also be subject to pre-emptive merger control in cases where the purchased company records a turnover of less than €5 million in Germany but the return (usually the purchase price) is in excess of €400 million. In future, the Federal Cartel Office (Bundeskartellamt, BKartA) will therefore be able to examine mergers through which large, established companies seek to gain or reinforce market control by acquiring young, innovative companies with a high commercial value.[203]

Start-up entrepreneurs have responded to this change with some scepticism. From their point of view, selling their start-up to an established company can be an attractive option – for instance, it can be an effective method by which to gain access to capital or the customers of their new parent company. They fear that the new competition regulation could restrict the financing and exit options available to them.

The Commission of Experts believes that the concerns expressed by start-up entrepreneurs are understandable. When the situation as a whole is considered, however, there is much to be said in

favour of efforts to counter strong concentration tendencies following mergers because they can act as barriers to innovation. In addition, the amendment will not inhibit acquisitions in general; it will only subject acquisitions to examination by the competition authorities in cases where the purchase price exceeds a high threshold. Their task is then to assess the potential consequences of the planned corporate acquisition on competition.

B 1-4 Start-up financing using equity capital

Start-ups are heavily depending on equity capital to finance their investments.[204] Most start-up projects require significant financing and entail a high degree of risk – but, if successful, can generate considerable growth.[205] Venture capitalists acquire holdings in start-ups with the aim of achieving the maximum possible returns from the company's growth. To increase the expected returns on their investments, venture capitalists often not only provide financial support but also offer strategic consultancy to start-up managers, monitor their operating performance and support them in establishing networks, sourcing additional financing and recruiting senior staff.

Typical actors on the venture capital market include business angels[206] and venture capital funds. The average sum invested by business angels is markedly lower than that of venture capital funds.[207] Business angels are primarily engaged in the early phases; venture capital funds are generally more reticent to invest funds in risky early-phase financing, and instead mainly play an important role in financing the growth phase.[208]

Germany has become an increasingly attractive investment location for international venture capitalists.[209] A recent analysis showed that, between 1993 and Q3 2018, around one-fifth of German start-ups financed by venture capital had at least one investor from the USA.[210]

Following the financial and economic crisis, venture capital investment in Germany has risen – not least due to the low level of interest rates (cf. figure C 4-3). However, venture capital investment as a percentage of GDP remains low compared to other key countries (cf. infographic and figure C 4-2). German start-ups still face difficulties when it comes to sourcing venture capital, especially during the growth phase. Financing options are restricted by a range of factors. The following sections examine several of these in further detail, namely: the lack of anchor investors, the modest size of venture capital funds, inadequate fiscal regulations and weak exit channels.[211]

Lack of anchor investors and modest size of venture capital funds

In Germany, there is a lack of institutional investors who act as anchor investors in the venture capital market and give important signals to domestic and international investors. Due to the predominantly pay-as-you-go structure of its public pension system, Germany lacks a class of institutional investors that play a significant role in other countries: pension funds.

The fact that relatively few major venture capital funds exist in Germany is a further problem.[212] However, institutional investors are loath to invest in small-volume funds. Insurance companies, for instance, therefore often look to make venture capital investments in the USA and Asian markets due to their size.[213] This is further reinforced by the tendency of investors to base their investment decisions on funds' previous success, sometimes referred to as their track record. Unfortunately, European funds' track records are usually decidedly short. Yet it is not only in terms of the size of its venture capital funds, but also with respect to the number of business angels where Germany has ground to make up.[214]

In recent years, both the Federal Government and the Länder have developed and created various programmes that offer incentives for investors considering venture capital funds and start-up investments (cf. box B 1-9 for more information on Federal Government programmes). In 2015, the KfW (a German state-owned development bank) returned to the market as an investor for venture capital funds as part of the ERP Venture Capital Fund Financing programme. This move aimed to help attract further institutional investors both within Germany and from abroad.[215] KfW Capital, a KfW subsidiary operational since 15 October 2018, focuses and expands KfW's financing activities in the field of venture capital.[216] Plans for KfW Capital include an increase in the investment volume in venture capital funds and

Box B 1-8

Dansk Vækstkapital

Dansk Vækstkapital is a joint project of the Danish state and Danish pension funds. It aims to make equity capital available to start-ups and SMEs with potential to grow.[217] Dansk Vækstkapital is comprised of two independent umbrella funds – Dansk Vækstkapital I and Dansk Vækstkapital II – which invest in small-cap and mid-cap funds, venture capital funds and mezzanine funds. The investment phase of Dansk Vækstkapital I was from 2011 to 2015. Dansk Vækstkapital II is currently in its investment phase. Both umbrella funds feature two sources of financing.

Source 1: Pension funds lend the state-established but independent Vækstfonden a determined share of the investment volume and, in return, receive a fixed rate of interest. Vækstfonden invests this capital in the umbrella fund.

Source 2: The pension funds invest other financing in the umbrella fund directly.

In the case of Dansk Vækstkapital I, three-quarters of the capital was invested in the Vækstfonden, with one-quarter invested in the umbrella fund directly. In the case of Dansk Vækstkapital II, the pension funds were given the option of investing one-third in Vækstfonden and two-thirds directly in the umbrella fund – or vice versa. The third option is for the pension funds to invest 100 percent of the capital in private equity.

venture-debt funds to an average of €200 million per year by 2020. In an effort to attract further institutional investors, the Federal Government is currently in dialogue with the insurance industry.[218] The intention is to develop models to facilitate an increase in venture capital investment from this sector. In this context, the Commission of Experts believes that Denmark's Dansk Vækstkapital programme could be an interesting model to encourage institutional investors to invest venture capital in start-ups (cf. box B 1-8).[219]

Inadequate fiscal conditions

While the fiscal conditions for venture capital investments were improved by the changes to regulations governing the offsetting of losses in 2016,[220] it still does not provide sufficient incentives for venture capital investment. In contrast to many other European countries, fund managers' administrative services are subject to VAT.[221] This makes the prospect of establishing and managing venture capital funds in Germany less attractive than doing so elsewhere.

Weak exit channels

The most important exit channels for holdings in start-ups include selling to a strategic investor (cf. Acquisition of start-ups by established companies, p. 53 ff.) and initial public offerings (IPOs).[222] In Germany, exit routes for investors are complex.[223] To invigorate stock markets as a source of financing for young, growing companies and to provide a crucial exit channel for investors, the Deutsche Börse Venture Network was set up in June 2015.[224] Since its launch, USD 2.4 billion has been invested in its member companies and seven IPOs carried out.[225] Furthermore, Scale – a new segment for SMEs – was opened on the Frankfurt Stock Exchange in March 2017.[226] Euronext, the European stock exchange operator, is also trying to attract young German technology companies.[227] The first IPO by a company financed by the HTGF (NFON, in May 2018) and Home24's IPO in June 2018 can be seen as positive signals for the exit environment.[228]

Box B 1-9

Federal Government programmes relating to venture capital and venture debt

Foundation phase[229]

High-Tech Gründerfonds: The High-Tech Gründerfonds (HTGF) is an early-phase fund established in 2005 as a public-private partnership.[230] Following the expiry of the HTGF I investment phase, HTGF II began in 2011.[231] HTGF III commenced operations in 2017.[232] Investors in HTGF III, which comprises capital of €316.5 million, include the Federal Government (ERP Special Fund, ERP-SV), KfW Capital,[233] the Fraunhofer-Gesellschaft and 32 private companies.[234] Acting as lead investor or in collaboration with partners, the HTGF finances innovative technology start-ups by either granting convertible loans or buying shares in companies.[235]

IINVEST – Grant for Venture Capital: Through its INVEST – Grant for Venture Capital programme, launched in 2013, the BMWi encourages private investors (and business angels in particular) to invest in young, innovative companies. The programme currently comprises two components:[236] The investment grant affords business angels a tax-free grant on top of their investment. The exit grant represents fixed compensation for the taxes due on the gains realized by a sale.

German Micro-Mezzanine Fund: The German Micro-Mezzanine Fund, launched by the BMWi in 2013 and financed by the ERP Special Fund (ERP-SV) and the European Social Fund (ESF), aims to increase the equity base of micro-enterprises and start-ups through silent participations.[237] The silent participation is overseen by the Mittelständische Beteiligungsgesellschaft (MBG) of the federal state in which the investment is made.[238] The German Micro-Mezzanine Fund had initial capital of €35 million, which was then gradually increased to €75 million (Fonds I). A further €85 million is now available in the new ESF funding period (Fonds II).

Growth phase

Coparion: Coparion, a co-investment fund jointly overseen by the Federal Government (ERP-SV), KfW Capital and the EIB, started operations in 2016. Together with private lead investors, Coparion invests in innovative start-ups that develop new products, processes and services and/or bring them to market and thereby perform their own R&D activities.[239] Coparion started operations with capital of €225 million. In December 2018, this figure increased by €50 million to €275 million after the EIB joined the fund.[240] The Federal Government provided €180 million while KfW Capital's share is €45 million.[241]

ERP/EIF Fund of Funds: The European Investment Fund (EIF) and the ERP Special Fund together finance a fund of funds which participates in venture capital funds that invest in young technology companies, primarily those based in Germany.[242] The initial resources of the ERP/EIF Fund of Funds, which was established in 2004, amounted to €500 million; this was increased to €1 billion in May 2010 and to €2.7 billion in July 2017.[243] A proportion of the funding made available for the ERP/EIF Fund of Funds is allocated to the European Angels Fund (EAF) (see below).[244]

European Angels Fund: Established in 2012, the European Angels Fund (EAF) provides co-financing for selected experienced business angels and other non-institutional investors who invest in innovative companies.[245] The EAF's funding was increased by €130 million to €285 million in 2015. The ERP/EIF Fund of Funds provides €270 million of this funding, while a further €15 million stems from the EIF's equity facility with the LfA Förderbank Bayern.

ERP Venture Capital Fund Financing: By launching ERP Venture Capital Fund Financing programme in 2015, the state-owned KfW development bank returned to the market as a venture capital fund investor with a budget of €400 million.[246] KfW Capital took over control of programme operations in October 2018. At the risk of the ERP Special Fund, KfW Capital participates in venture capital funds that invest primarily in Germany and finance technology-oriented start-ups and young, innovative companies.[247]Since 2017, the programme has also been open for participations in venture debt funds.

ERP/EIF Growth Facility: Launched in 2016 and funded by the ERP Special Fund and the EIF, the ERP/EIF Growth Facility aims to boost venture capital support for fast-growing companies.[248] Venture capital funds and fund managers receive funding to refinance co-investment funds they manage.[249] In total, some €500 million of funding is available for individual co-investment funds, of which €330 million comes from the ERP Special Fund and €170 million from the EIF.[250]

ERP/EIF/Länder Mezzanine-Fund of Funds: Set up in 2013 by the EIF, the BMWi/ERP Special Fund, LfA Förderbank Bayern and NRW.BANK, the ERP/EIF/Länder Mezzanine-Fund of Funds participates in private professional mezzanine funds that invest in German SMEs, including younger growth-phase companies.[251] The ERP/EIF/Länder Mezzanine-Fund of Funds was initially given a budget of €200 million.[252] In 2016, a second mezzanine fund was set up with an investment period of five years and a budget of €400 million.[253]

Venture Debt

The Federal Government's aim is to make venture debt financing – that is to say, loans with equity-like elements – available to companies, especially those in the growth-phase.[254] This includes venture debt fund finance as part of the ERP Venture Capital Fund Financing programme (see above) and ERP/EIF/Länder Mezzanine-Fund of Funds (see above). A new feature introduced in 2018 was the use of the EIB's InnovFin MidCap guarantee for the KfW Loan for Growth programme. There KfW also has plans to introduce co-venture debt financing with private partners in the form of smaller individual commitment volumes and EIB venture debt deals in which the KfW participates at its own discretion (with EIB underwriting). There are also plans to create a new segment in the ERP/EIF/Länder Mezzanine-Fund of Funds to enable the facility to offer larger-scale venture debt financing.

Challenges for start-ups B 1–5

Due to their small size and their business model, start-ups face specific challenges, some of which are caused or influenced by the legal framework.

Difficulty accessing R&D funding

Start-ups develop innovative products and business ideas that often require R&D activities. The public purse funds R&D activities at companies in order to stimulate innovations.[255] However, start-ups often find it more difficult than established companies to obtain R&D funding.

- Applying for funding entails significant administrative effort. This represents a barrier to start-ups, who have less experience of submitting such applications. Another problematic aspect is that companies are required to demonstrate their ability to remain solvent for the duration of the project.[256] Start-ups often find this condition difficult to fulfil. The formal requirements of the solvency check – and how they are interpreted – vary depending on the funding provider or project sponsor and, in some cases, from one funding programme to the next.[257] This creates serious uncertainty for start-ups who, in some cases, are forced to forgo innovation projects as a result.
- The German fiscal system still lacks any tax incentives for R&D activities. However, such incentives are set to be introduced in the current legislative period (cf. chapter A 1). Nevertheless, whether start-ups conducting R&D work will be able to benefit from tax incentives for R&D activities depends very much on how such measures are structured. In its 2017 report, the Commission of Experts presented options for tax incentives for R&D activities.[258] During the initial phase, start-ups have little to no income and therefore have little to no tax liabilities. Therefore, if a tax credit instrument were to be implemented, in the event that the credit exceeds a start-up's tax liabilities, it should be possible to disburse the amount exceeding the tax liability directly. Alternatively, start-ups should be able to carry the residual credit forward to the following year.

Barriers to recruiting skilled workers

In order to realize demanding R&I projects, start-ups need qualified and motivated workers. However, in light of their limited liquidity and low turnover, start-ups are usually not able to offer skilled workers competitive salaries in the classical form of fixed monthly remuneration.

- Employee participation programmes are one method by which a start-up can attract and retain skilled workers (cf. box B 1-10). Compared to alternative employment opportunities, employees are cutting back on their fixed monthly remuneration, but have the opportunity to share in a start-up's success. Employee participation programmes are particularly common among start-ups financed by venture capital. However, the start-up often has to contend with major uncertainties in terms of the legal interpretations of specific regulations in employee participation programmes.[259]
- Recruiting skilled workers from abroad can help overcome staff shortages and develop competencies that promote the internationalization of the company. According to the German Start-up Monitor (DSM), start-ups are very internationally positioned in terms of their workforces.[260] In start-ups that took part in the 2017 DSM survey, 23 percent of employees came from other EU countries, with a further 6 percent from non-EU countries. In Berlin, Hamburg and Munich, the proportions of employees from non-EU countries were particular high at over 20 percent.[261] Around one-third of start-ups that took part in the 2017 DSM survey found it (somewhat or very) difficult to recruit staff from abroad.[262] The Commission of Experts welcomes the Federal Government's efforts to prepare a skilled worker immigration law for well-qualified workers from third countries. Nevertheless, there will still be bureaucratic hurdles to overcome even if this new law comes into force. Such hurdles place a particular burden on start-ups.

Box B 1-10

Employee participation programmes

A distinction can be made between two basic models of employee participation programmes.[263] In an employee stock ownership plan (ESOP), employees gain an ownership interest in the company; a virtual stock option plan (VSOP) allocates virtual shares (sometimes known as phantom shares). A transfer of shares as part of an ESOP must be recorded in the commercial register. Employees become shareholders and therefore also receive corresponding rights to co-determination and information. However, this aspect may not be desirable to start-up founders and venture capitalists. For employees, on the other hand, one negative aspect of an ESOP is that tax authorities consider a transfer of shares to be remuneration and tax it directly – even if the shares are yet to yield returns. Virtual shares awarded as part of a VSOP do not represent a participating interest but instead constitute an entitlement to payment that does not entail co-determination or information rights. Employees are then entitled to a payment in the event of an exit. Taxation only occurs when proceeds are generated, i.e. in the case of an exit or a dividend pay-out. In practice, VSOPs are far more common.[264]

Companies implement employee participation programmes with the aim of retaining staff. With this in mind, it would render the programme futile if employees were to leave the company as soon as the shares had been transferred. To solve this issue, employee participation programmes usually entail cliffs and vesting. Vesting is an agreement by which an employee forfeits their share entitlement either in whole or in part if they leave the company before working for the company for a pre-determined period of time. A cliff is an agreed period of employment after which vesting actually comes into effect.

Legal uncertainties in dynamic technology areas

A significant proportion of start-ups are currently internet-based.[265] However, start-ups are increasingly active in other technology areas. The Global Startup Ecosystem Report 2018 analysed start-ups' activities in various technology areas.[266] The four areas currently seeing the highest growth rates in terms of early stage deals, exits and start-up rates are "Advanced Manufacturing & Robotics", "Agtech & New Food", "Blockchain" and "Artificial Intelligence, Big Data & Analytics". In total, 8.4 percent of start-ups around the world operate in these technology areas.

For German start-ups which operate in these fields and drive technological developments forward, the challenge is to assert themselves in the global competition. Their chances of success are influenced by the German and European legal frameworks. Such regulations relate, for instance, to issues of security and liability when using AI applications (cf. chapter A 2), the potential users of blockchain technologies in regulated markets such as the energy industry (cf. chapter B 3), and the protection of personal and company data in Industry 4.0.[267]

Setting up Regulatory Test Beds (RTBs) makes it possible to obtain insights into the effect of alternative approaches to regulation. Regulatory Test Beds are a research concept in which potential solutions to a problem are tested within a defined framework.[268] The objective is to gather experience of complex social dynamics and form a basis upon which decisions can be taken, such as in relation to the make-up of legal framework conditions. The German political sphere has seized on the idea of Regulatory Test Beds: they are explicitly referenced as an instrument in the HTS 2025 and the AI Strategy.[269] An inter-departmental working group (Arbeitsgruppe "Reallabore") has been established to examine the topic and convened for the first time on 27 November 2018. The BMBF already funds a series of Regulatory Test Beds in the energy field.[270] The BMWi presented a Regulatory Test Beds Strategy on 14 December.[271]

Recommendations B 1–6

Start-ups play a crucial role in the innovation system. Not only do they provide innovative products, processes and business models, they also act as a catalyst and cooperation partner for innovations in established companies

Promoting start-ups from the world of science

- Efforts to promote a culture of entrepreneurship at tertiary education institutions through the Federal Government's EXIST programmes and Länder initiatives have begun to yield results. Nevertheless, the culture of entrepreneurship at tertiary education institutions must still be strengthened. Start-up training should be anchored in all courses of study.
- In the continuation of the PFI, start-ups from the world of science as a transfer channel should again be addressed under the science policy objectives.
- The management of technology transfer organizations should not be guided solely by financial objectives but should also take into consideration the wider economic and social implications of the transfer. Even if start-ups are unable to generate licensing revenue, they create added value for society that is afforded little attention at present.
- Tertiary education institutions and AUFs should develop express licence contracts to transfer rights to spin-off companies to reduce uncertainties and to enable founders to licence products and services swiftly. The express licence contracts already offered by certain US technology transfer organizations could be examined as examples of good practice in this regard.
- To ensure that scientists are not forced to contend with the conflicting goals of the academic and commercial applications of research results, a grace period should be introduced into patent law.[272]

Strengthening start-up ecosystems and collaborations

- Start-ups – and particularly those originating in the high-tech sector – benefit from geographically concentrated ecosystems in which they enjoy close proximity to research institutions, investors, established companies and other start-ups. Rather than being an issue requiring resolution, the regional concentration of innovation actors is symbolic of a successful innovation system. In order to promote globally visible start-up ecosystems in cutting-edge technologies, the challenge now is not to counteract this geographical concentration but instead to foster and expand existing and emerging start-up ecosystems.
- Internet-based approaches (such as cooperation platforms) and other techniques can enable companies outside of these ecosystems to access cooperation opportunities and the knowledge and technologies these sites generate. The Federal Government should therefore move to support the setup of central platforms that service to facilitate initiation of business relationships and collaborations. The Israeli platform Start-Up Nation Central can serve as a role model in this regard.
- In addition, supporting individual start-ups outside of geographically concentrated start-up ecosystems is also a worthwhile means of leveraging innovation potential and exploiting the positive effects of start-ups for established companies outside these centres.

Further improving the framework conditions for private investment in start-ups

- As Germany suffers from a lack of anchor investors, the Commission of Experts is in favour of creating incentives to encourage institutional investors to invest in venture capital funds. The Commission of Experts recommends that, as part of its ongoing dialogue with the insurance industry, the Federal Government examine to what extent Denmark's Dansk Vækstkapital model could be applied in Germany.
- The fiscal framework conditions for venture capital funds are in need of further improvement. The fact that fund managers' administrative services are subject to turnover tax should be reversed.

Enhancing start-ups' means of accessing R&D funding

- Opportunities for start-ups to share in project funding should be further extended. The formal requirements of start-ups' solvency checks should be more favourably structured and uncertainty in their interpretation removed.
- Start-ups' demands should be afforded particular consideration in the introduction of tax incentives for R&D activities. If this tax incentive took the form of a tax credit, in the event that the credit exceeds a start-up's tax liabilities, it should be possible to disburse the amount exceeding the tax liability directly. Alternatively, the start-up should be able to carry the remaining credit forward to the following year.

Helping start-ups to recruit skilled workers

- Employee participation programmes are an important instrument by which start-ups can attract skilled workers and retain them for the long term. However, the legal (and, more importantly, fiscal) interpretation of the contracts start-ups and investors require to implement such programmes often entails significant legal uncertainty. To increase the legal certainty for start-ups introducing employee participation programmes, associations that represent start-ups should coordinate with federal authorities to develop standard contracts for employee participation programmes that provide the greatest possible degree of legal certainty.[273]
- Although start-ups often rely on skilled workers from abroad, various bureaucratic hurdles complicate the process of recruiting employees from third countries. Start-ups should be supported in overcoming these hurdlers.

Adjusting regulation in dynamic technology areas

- In dynamic technology areas – such as blockchain applications and AI – the Federal Government should be proactive and work to establish a reliable legal framework that reduces uncertainty for start-ups.
- Regulatory Test Beds (RTBs) represent an effective experimental instrument to allows legislators to develop innovation-friendly framework conditions. The Commission of Experts therefore

expressly welcomes the Federal Government's increased use of Regulatory Test Beds. The task now is to move quickly to identify suitable areas of application.