



acatech STUDY

Enhancing innovation in Germany by strengthening the growth finance ecosystem

Ann-Kristin Achleitner, Reiner Braun,
Jan Henning Behrens, Thomas Lange

KfW



DEUTSCHE BÖRSE
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Contents

| | |
|---|-----------|
| Executive Summary | 5 |
| Project | 8 |
| 1 Objectives | 10 |
| 2 Status quo | 12 |
| 2.1 There is a lack of venture capital in Germany and Europe | 12 |
| 2.2 More domestic venture capital would strengthen value creation in Germany | 14 |
| 2.3 Measures to improve the accumulation of capital for financing growth trigger positive chain reactions | 15 |
| 2.4 There are not enough alternative external financing instruments outside of the established venture capital model | 16 |
| 2.4.1 There is not enough patient capital | 16 |
| 2.4.2 There is a lack of hybrid capital and innovative debt capital | 17 |
| 2.5 Cooperation between growth companies, established businesses and academic institutions strengthens the growth finance ecosystem | 18 |
| 3 Recommendations | 21 |
| 3.1 Mobilise more domestic capital for financing growth in Germany | 21 |
| 3.1.1 Mobilise venture capital from institutional investors, foundations, family offices and high-net-worth business angels | 21 |
| 3.1.2 Expand and improve the effectiveness of existing government instruments in order to mobilise more capital | 22 |
| 3.2 Address the demand of alternative external and internal financing instruments – outside of the established venture capital model | 23 |
| 3.2.1 Increase the offer of hybrid capital and innovative debt, e.g. by raising the profile of the first successful innovative initiatives in these areas | 23 |
| 3.2.2 Launch a stakeholder dialogue on “patient capital” | 24 |
| 3.2.3 Establish a co-investment platform for direct investment in growth companies | 24 |
| 3.3 Get better at leveraging the (win-win) potential of cooperation between growth companies, established businesses and academic institutions | 27 |
| 3.3.1 Establish a jump-up initiative for fast-growing tech companies | 27 |
| 3.3.2 Strengthen regional innovation clusters | 27 |
| 3.3.3 Optimise conditions at universities to increase the number of high-tech start-ups | 28 |
| Appendices | 29 |
| Appendix A: Abbreviations | 29 |
| Appendix B: Illustrations | 29 |
| References | 30 |



Executive Summary

Germany needs innovative and successful growth companies if it is to maintain and develop its strong competitive position as a location for innovation. The ideas of these companies can fundamentally transform existing markets and create new ones. It is not merely a question of establishing “unicorns” (start-ups valued at over \$1 billion) in Germany – growth companies operating in the business-to-business (B2B) market are also key to innovative ecosystems and the digital transformation of existing industries.

Status quo

1. Germany is not doing enough to tap into the growth potential of young high-tech companies.

- a. More and more capital is becoming available for start-ups in Germany, especially in the business-to-consumer (B2C) market.
- b. However, even though the situation has improved in recent years, raising finance to establish and grow knowledge-/technology- and capital-intensive growth companies remains a significant challenge, particularly in the B2B market.¹ And it is this sector that provides the greatest opportunities for Germany in the context of digitalisation (Industrie 4.0, Internet of Things (IoT), etc.).²

2. Insufficient access to growth finance (including venture capital) remains one of the key weaknesses of Germany's innovation system. Moreover, it takes longer to raise capital because access to venture capital is less standardised, especially in comparison to the United States of America (USA).

- a. The availability of capital in the seed and early start-up phase is increasing in Germany (although it still lags

behind other countries around the world). However, technology-driven growth companies frequently need between 10 and 50 million euros for each financing round during their growth phase, and it can be very difficult for them to raise capital on this scale among German and/or European investors. By way of comparison, total venture capital investment by region in 2017 was 300% higher in Asia and the USA than in Europe. This “venture capital gap” between Europe and the USA and Asia is particularly pronounced during the later growth stages.³

- b. **Existing initiatives** to increase the availability of venture capital **are welcome**.⁴ However, although these make an important contribution, they would be even more effective if they were **on a larger scale**, more transparent and/or **less bureaucratic** in certain respects.
- c. The lack of venture capital (external finance/equity capital) in Europe and Germany is not without consequences. Compared to domestically financed businesses, a higher proportion of successful high-tech growth companies that are co-financed by **foreign investors** are subsequently sold to foreign investors or floated on foreign stock exchanges. This trend has increased in recent years.⁵
- d. Initiatives to help companies raise capital domestically during their growth phase would create a larger venture capital scene in Germany and trigger a **positive chain reaction**: as the number of home-grown exits⁶ increased, Germany would become a more attractive location for further venture capital investments. A bigger and more established domestic venture capital scene with more competition between investors would make it easier for growth companies to find and raise capital from/in Germany, thereby strengthening the growth finance ecosystem.

1 | See BVK 2018a, Ernst & Young 2019a, Handelsblatt 2018, Madhvani 2017, Metzger 2019.

2 | See Achleitner/Lange 2019a; Achleitner/Lange 2019b; Kagermann/Winter 2018; Kagermann et al. 2016.

3 | See BVK et al. 2018. See also section 2.1 (Status quo) of this study.

4 | These include e.g. the recently established KfW Capital with its Fund Investment programme, the European Investment Fund (EIF), the seed and early-stage investor High-Tech-Gründerfonds (HTGF) and coparion.

5 | See Braun et al. 2019b.

6 | An exit is a planned move by a private equity or venture capital company to sell an equity stake in order to realise a financial return. See Achleitner 2018b.



3. There is a lack of alternative external financing instruments outside of the established venture capital model.

- a. There is a lack of **patient** (equity) capital: It often takes high-tech companies ten years or more to go from the start of the product development stage to profitability. Traditional venture capital business models do not usually invest over this length of time.
- b. Increasingly, growth companies are asking for **hybrid financing**⁷ (especially venture debt⁸) and innovative **debt capital**. However, the demand for these instruments is not currently being met in Germany. Some financial intermediaries (primarily banks) are starting to respond to this demand with innovative concepts and ideas, for instance by making venture debt and innovative debt capital available to growth companies that are still in their loss-making phase.

4. The (win-win) potential of cooperation between growth companies, established businesses and academic institutions is not being fully leveraged.

- a. Growth companies benefit from **learning effects** if they directly deploy and/or continue the development of their technology or business model in an industrial environment. The established businesses also benefit from cooperation with growth companies: They get "fresh ideas" and cutting-edge digital technologies in the growth companies' portfolios to drive their own digital transformation.
- b. Major customers have a positive impact on the **evaluation** of growth companies. They diminish concerns among other customers and investors that the company could fail due to its small size (**liability of smallness**) or its lack of experience (**liability of newness**). This enhances the company's prospects of raising capital and continuing to grow.
- c. Orders from and joint projects with established companies are also an important source of revenue for growth companies, allowing them to strengthen their **internal financing** and to increase their long-term investment possibilities in areas such as Research and Development (R&D).

Such links and causalities should get more attention and policy-makers could do more to address them. There is a huge opportunity for Germany to build pioneering, internationally important ecosystems through collaboration between world-leading industrial enterprises and innovative growth companies in the fields of Artificial Intelligence (AI), the IoT and Smart Services.⁹

Recommendations

1. Mobilise more growth capital for companies in Germany.

To do this, Germany needs a stronger domestic venture capital scene. This can be achieved through the following measures:

- a. Mobilise venture capital from institutional investors, family offices, foundations and high-net-worth business angels: relax **investment restrictions** for institutional investors and bring together the four **investor groups** referred to above for taking joint action to strengthen the domestic venture capital market and create positive feedback effects for raising capital.
- b. Leverage existing government instruments in order to mobilise more private capital: **Successful government financing instruments**¹⁰ **should be expanded** – both in terms of their size (make more public capital available for direct and fund investment, provided that it is at least equally matched by private investors) and their structure (focus on financing instruments that are specially tailored to growth-companies). Some existing instruments also have room for improvement, particularly in terms of transparency, speed of decision-making and effectiveness.

2. Create alternative external and internal financing instruments over and above the established venture capital model.

- a. Raise the profile of successful pioneering initiatives to strengthen hybrid financing (such as **venture debt**) and **innovative debt financing** in Germany, and make more capital available to them (for instance through the new "Tech Growth Fund" initiative).

7 | Hybrid financing combines debt and equity characteristics.

8 | Regulatory law in Germany defines venture debt as a form of debt financing. In practice, however, venture debt financing often makes use of "equity kickers", an option for the lender to benefit from possible value increase of the company. In economic terms and effects, the use of equity kickers means that venture debt becomes a hybrid financing instrument.

9 | Smart Services are individually configured bundles of products and services that are supplied via the Internet. Smart Services are centred around users with their respective preferences and needs as consumers, employees, citizens, patients, tourists, etc. Digital platforms are a key requirement for the formation and organisation of Smart Services (See Working Group Smart Service World 2015 p. 4).

10 | These include the seed and early-stage instruments HTGF and coparion, the KfW Capital fund investors and the European Investment Fund (EIF).

- b. **Develop supplementary models and evaluation tools** that are not based purely on a company's historic financials, so that these can be used by banks to provide **innovative debt capital** to growth companies.
 - c. Launch a stakeholder dialogue on **"patient capital"** that first and foremost brings together potential investors and intermediaries in order to discuss the key question: which additional instruments outside of the established venture capital model could help to make "genuinely" patient capital available for financing disruptive, capital-intensive business ideas?
 - d. **Establish a co-investment platform for direct investment in growth companies.** This new platform would seek to create a liquid market for direct investment with a focus on high-tech growth companies. Lead investors would provide reliable evaluations and risk assessments of growth companies. These could then be analysed, providing a basis for other (co-)investors to come on board. The platform could also help to provide (more) patient capital (see 2c) if investors could trade passive investment interests on a secondary market. This would diminish the pressure for a rapid exit.
3. **Get better at leveraging the (win-win) potential of cooperation between established businesses, growth companies and academic institutions.**
- a. **Establish a jump-up initiative for fast-growing high-tech companies.** This would bring established businesses and growth companies together with experienced "consultants" (e.g. top scientists from the fields of technology and engineering) and successful entrepreneurs (who would also contribute their own capital) with the goal of working together in specific (cutting-edge) technology fields – in small high-level taskforces.
 - b. **Regional innovation clusters** (comprising established businesses, growth companies and academic institutions) should be strengthened in order to get more high-tech/B2B companies onto the growth path – for instance through the creation and/or strengthening of professional **entrepreneurship centres** at universities throughout Germany (the UnternehmerTUM centre at the Technical University of Munich is one possible model). The success of these professional centres will depend on a number of key factors such as: market-oriented approach, decoupled from traditional university structures, own legal status and the inclusion of industry. The German federal state North Rhine-Westphalia and Hessen have already embarked on this path with specific initiatives such as the "Exzellenz Start-up Center.NRW" or the "Masterplan" for the region in and around Frankfurt.
 - c. **Optimise conditions at universities so that the potential of experienced professors**, especially in the technological sciences, can be leveraged in order to create more high-tech start-ups. This should include transparent regulations and faster procedures for resolving questions about the rights and responsibilities of university lecturers who wish to start a company and engage in entrepreneurial activities in parallel with their role at the university. Universities should also use the number of spin-offs as one of the quality criteria for their technological science evaluation. Moreover, universities should take applicants' practical commercial experience into account in the recruitment process for professors.



Project

Project management

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Expert panel

The following experts contributed to the project through interviews, the development of a "mood map" at a joint workshop in summer 2018 and a stakeholder dialogue in March 2019.

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- Josef Brunner, Relayr, Founding Investor und CEO
- Dr. Michael Diederich, HypoVereinsbank, Spokesman of the Management Board
- Prof. Dr. Michael Dowling, University of Regensburg, Chair of Innovation and Technology Management/acatech
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- Marvin Meyer, Software AG, Senior Vice President, Head of Mergers and Acquisitions
- Kurt Müller, Target Partners, Partner
- Prof. Dr.-Ing. Wolfgang Nebel, Carl von Ossietzky University of Oldenburg, Professor of Integrated Circuit Design within the Department of Computing Science/Chair of the Board of OFFIS/acatech
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- Alfred K. Roth, Naka, Partner
- Arisla dos Santos, MEAG Munich Ergo Asset Management, Senior Investment Manager for Private Equity and Infrastructure
- Jenö Schadrack, NavVis, Chief Financial Officer
- Prof. Dr. Helmut Schönenberger, UnternehmerTUM, Co-Founder and CEO
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Project partners

- KfW
- Deutsche Börse

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- Hauke Stars, Member of the Executive Board of Deutsche Börse/acatech



1 Objectives

A lack of capital for high-tech growth companies is one of the key weaknesses of Germany's innovation system. This weakness is becoming a serious competitive disadvantage, especially in the context of the radical technological innovation, new business models and rapid growth demanded by the digital transformation.

In a joint project with KfW and Deutsche Börse, acatech brought together a range of actors from the financial sector with high-tech growth companies, representatives of academia and industry (see Figure 1) in order to carry out a detailed analysis of the status quo and formulate recommendations for government, academia and industry.

acatech sought to provide a neutral platform that could help to build a targeted growth finance know-how interface between the technology and finance sectors.

The project focused on the field of AI and its applications in the business-to-business (B2B) sector, an area that offers particularly promising opportunities for Germany (keywords: Industrial IoT¹¹ and Industrie 4.0¹²). In this study, the term **high-tech companies** specifically refers to knowledge-intensive companies that produce technology-driven innovations and have business models focused on industrial applications.

This study also concentrates on the **growth phase** of high-tech companies. This is the phase in which companies scale up their business model, for instance by expanding and developing their production capacity and/or tapping into new markets. It is during this phase that it becomes clear whether the company's business model has the ingredients to be competitive and successful over the longer term. The growth phase is also of interest from a macroeconomic perspective, in terms of value creation, job creation and innovation.

In Germany and Europe there is currently a lack of capital to finance specifically this growth phase. Thanks to a range of



Figure 1: Expert panel for the project "Strengthening the growth finance ecosystem" (Source: Authors' own illustration)

11 | The Internet of Things (IoT) is a term used to describe the evolutionary development of embedded systems. It encompasses the use of the Internet in manufacturing industry (to connect data, services and things) and the comprehensive value chain integration that this enables (see acatech 2015, acatech 2011).

12 | The term "Industrie 4.0" refers to the fourth industrial revolution, a new stage in the organisation and management of the entire value chain throughout a product's lifecycle. The product lifecycle is geared towards customers' increasing desire for customisation and encompasses everything from the original concept to ordering, development, manufacture, delivery to the end customer and recycling, as well as all the associated services (see Plattform Industrie 4.0 2015).

factors including new financing instruments such as the High-Tech Gründerfonds (HTGF)¹³, recent years have seen some improvement in the availability of capital in the earlier financing stages (seed/start-up phase), although there is still room for improvement compared to other countries around the world.¹⁴ However, the same cannot be said of the growth phase.

The study's recommendations are not confined to the mobilisation of traditional venture capital.¹⁵ They also highlight alternative forms of financing and in particular the **interfaces** between high-tech growth companies, established businesses¹⁶ and academic institutions. These interfaces are key to building a strong competitive position in Germany with regard to industrial digitalisation.

Scope of this study

This study focuses explicitly on innovation finance for growth companies and **does not address innovation finance for established businesses**. Innovation finance for established businesses is of course equally important as it enables them to maintain and strengthen their innovativeness.¹⁷ However, the (innovation) financing of established businesses is characterised by different requirements and structural challenges, the analysis of which would require a separate project. **Fiscal incentives are also excluded from the scope of this study.**

13 | The HTGF claims to be Germany's largest and most active seed investor, offering up to three million euros of capital per high-tech company (see HTGF 2019).

14 | For instance, there is still insufficient financing for the pre-seed phase in Germany. Businesses in this phase are not yet eligible to receive capital from the HTGF, but are too advanced to receive further grants from the EXIST programme for university-based business start-ups, for example.

15 | Venture capital is equity capital from private and/or institutional investors that is invested in young, innovative companies with high growth potential through investment companies in order to earn a financial return. The investors acquire a stake in the companies in question for a limited period of time. Unlike debt capital, where the investors earn their financial return in the form of interest, with venture capital they rely entirely on the successful disposal of their stake in the company, for instance through an Initial Public Offering (IPO) or by selling it to a third party. The high risk of such investments is offset by the high potential returns. In a broader sense, venture capital can be described as a form of private equity (PE) investment. It is often also referred to as risk capital (see Achleitner 2018a, Breuer 2018, BVK et al. 2018, BVK 2019).

16 | In this study, the term "established businesses" refers to large corporations and small and medium-sized enterprises (SMEs) that have been successfully competing in the market for some time.

17 | See Zimmermann 2019.



2 Status quo

Growth companies play an important role in an economy's innovation system and in driving macroeconomic structural changes: They continuously create new markets and their innovative technologies increase competition in existing markets.

This chapter provides an overview of the status quo with regard to growth financing in Germany.

2.1 There is a lack of venture capital in Germany and Europe

Venture capital performs important functions within a growth finance ecosystem, especially in the three following respects:¹⁸

- **The importance of venture capital for growth companies:** Venture capital provides growth companies with the capital they need to finance their growth. Furthermore, venture capital generally allows growth companies access to experienced investors and the know-how and networks that they bring with them ("Smart Money"). Many of the largest companies in the world today were financed with venture capital when they started out, including the likes of Microsoft, Alphabet (Google), Amazon and Apple.¹⁹
- **The importance of venture capital for innovation:**²⁰ Venture capital investments often focus on high-tech companies and fast-growing industries. They support innovation in these

industries, for example through the identification of innovations²¹ and by boosting patent activity.²²

- **The importance of venture capital for value creation:** There is a close link between venture capital's importance for innovation and its importance for creating value in the economy.²³ Several studies describe positive impacts on the number of startups and jobs and on economic income and/or growth.²⁴ Venture capital can also act as a catalyst for the digital transformation, as illustrated by China's rise to become an AI superpower.²⁵

However, and in comparison to other regions of the world, there is a lack of venture capital in Europe.²⁶ It is true that there has been substantial progress in recent times, with venture capital investment in Europe almost quadrupling between 2012 and 2017 (see Figure 2).²⁷ However, this improvement started from a very low base. Moreover, there has been similar or even much higher growth in venture capital investment in other parts of the world that are in competition with Europe or rather Germany. In 2017, for example, venture capital investment in the USA and Asia was around four times higher than in Europe (see Figure 2).²⁸

The differences between Europe, Asia and the USA are particularly pronounced during the late growth phase.²⁹ Average venture capital investment per company in Asia and the USA is substantially higher than in Europe during this phase (see Figure 3).

Overall, it is evident that the volume of venture capital in Europe and Germany has risen in recent years, even for the growth phase, when between 10 and 50 million euros of capital is required for each financing round.³⁰

18 | See especially Da Rin et al. 2013.

19 | See BVK et al. 2018, Hengster 2016, Telekom Capital Partners/OC&C Strategy Consultants 2017.

20 | See Da Rin et al. 2013.

21 | See Hellmann/Puri 2000, Puri/Zarutskie 2012, Tian/Wang 2014.

22 | Venture capital has a bigger impact on patent activity than R&D funding by large corporations. See Kortum/Lerner 2000, Hirukawa/Ueda 2008. Popov/Roosenboom 2012 also show that venture capital has a positive impact on patent activity.

23 | See Da Rin et al. 2013.

24 | See Engel/Keilbach 2007, Popov/Roosenboom 2012, Puri/Zarutskie 2012.

25 | See CB Insights 2018, Lee 2018.

26 | See Achleitner/Lange 2019a, BMWi 2019, BVK et al. 2018, EIB 2019, IHK 2017.

27 | See BVK et al. 2018.

28 | N.B.: It is relatively difficult to find well researched and edited data comparing venture capital investments in Germany with the leading non-European venture capital countries (e.g. comparing Germany with Japan, the USA and China). For instance, non-European countries are not included by the European Data Cooperative (EDC) pan-European statistics platform, which is the source of some of the figures used by BVK et al. 2018. CB Insights and PitchBook supply figures for Germany, but they are not as detailed as their data for Asia and the USA (they provide less comprehensive market coverage and thus do not paint as complete a picture of venture capital investment in Germany). Consequently, the figures reported both in this section of the current study and in BVK et al. 2018 are mainly for the major global regions/countries: Europe, Asia and the USA. Additional data relating specifically to Germany that allows comparison with other countries in Europe can be found e.g. in BVK 2018b. These figures reveal that Germany is one of the top three European countries for venture capital investment, after the UK and France. However, it is important to remember that venture capital investment in Europe lags a long way behind other parts of the world.

29 | See BVK et al. 2018.

30 | See BVK 2018a, Ernst & Young 2019a, Hengster 2016, Madhvani 2017, Metzger 2019.

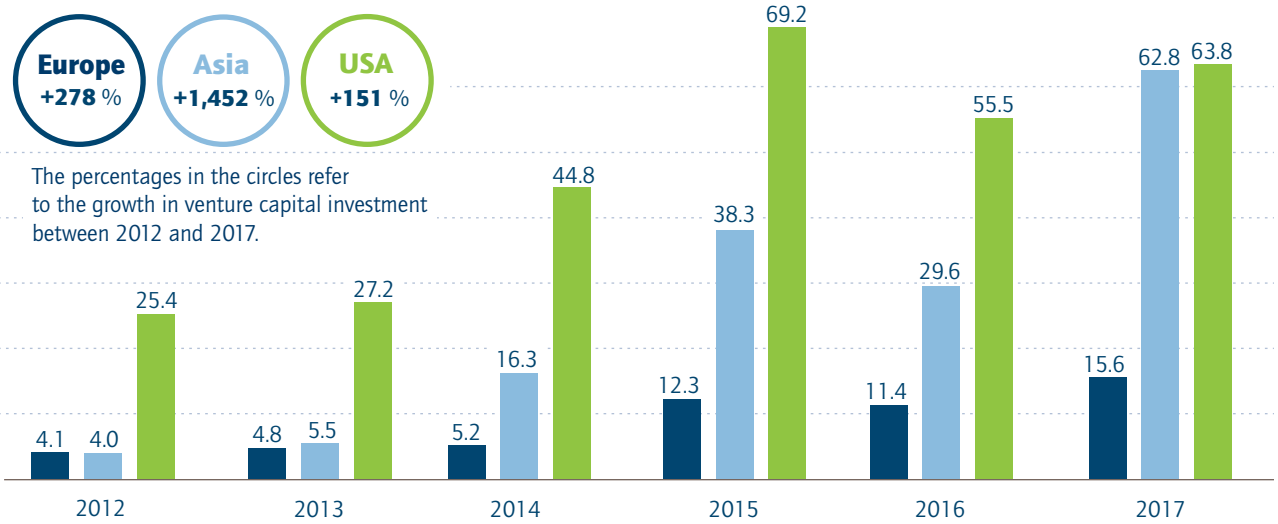


Figure 2: Venture capital investment by portfolio company location in € bn (Source: BVK et al. 2018, graph slightly modified by acatech. Source of figures: PwC, CB Insights, Roland Berger)

Despite these increases, however, the overall volume remains relatively low compared to other parts of the world.³¹

standardisation of access to venture capital in Germany and Europe, a factor closely linked to the lack of capital. This further hinders the establishment and ongoing professionalisation of the venture capital landscape in Germany.

Some of the experts interviewed also criticised the **inadequate**

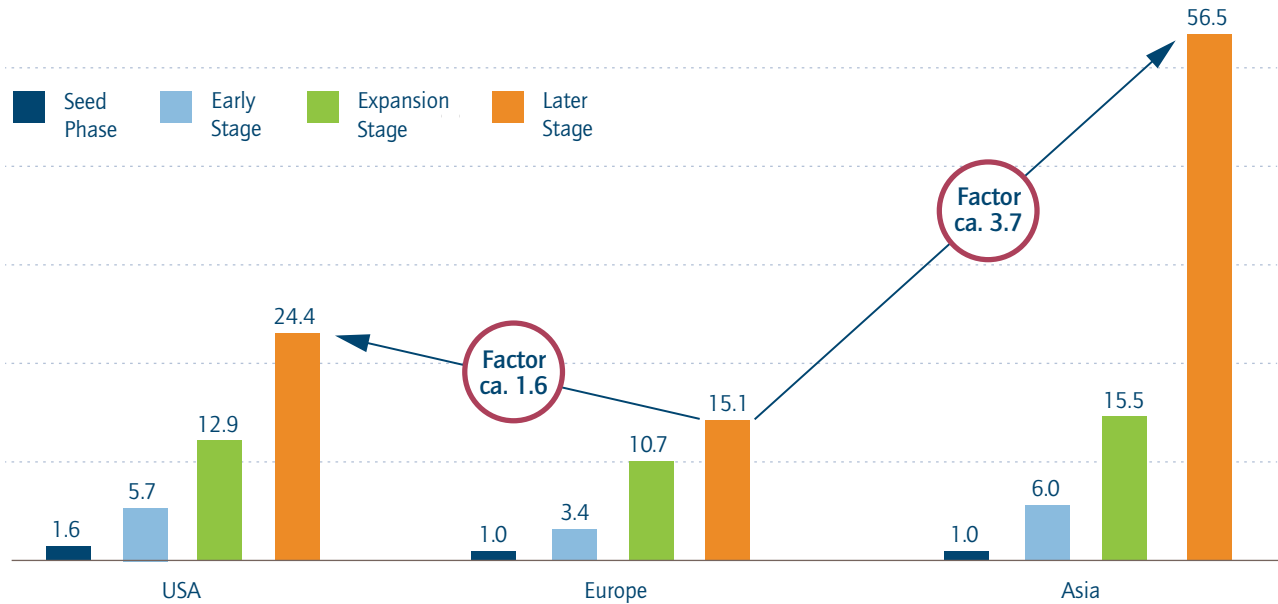


Figure 3: Median venture capital investment per company by development stage, Q1 2018, in € mn (Source: BVK et al. 2018, graph slightly modified by acatech. Source of figures: PwC, CB Insights, Roland Berger)

31 | Some participants in the expert interviews and workshops felt that rather than a lack of venture capital, the problem in Europe is the insufficient number and size of high-tech companies to invest in (in other words, it is a chicken and egg problem). However, various studies demonstrate that a lack of access to venture capital has a negative impact on the growth finance ecosystem. For more on this, see the beginning of this section and section 2.3 (which explains how capital accumulation for financing growth trigger positive chain reactions).



"In the US, all the contracts and legal procedures for making an investment are standardised. It makes no difference whether it's Facebook, Google or our own company – in the US, everyone has to follow the same standardised procedures. As a result, the negotiation of contractual clauses is fully transparent and takes no more than three to four days. In Germany, nothing is standardised. You can't negotiate a twenty million euro contract without employing the services of a notary and spending a lot of time and money. Rather than a couple of days, it takes weeks, if not months. And the process is different every time. This puts Germany at a clear competitive disadvantage to the US."

[View of a growth company]

2.2 More domestic venture capital would strengthen value creation in Germany

Some experts are concerned that the lack of venture capital will cause European growth companies to leave Europe for other parts of the world, especially the USA,³² resulting in a **"sell-off" of European technology**.

"I know lots of people with really good ideas who were all too quick to go to America because they felt there was no chance of raising capital here in Germany. (...) The problem is that there are very few people in Germany who are prepared to provide risk capital. (...)"

[SAP founder D. Hopp in an interview with the Sunday edition of the Frankfurter Allgemeine Zeitung]³³

"While Europe develops the technology, the business often ends up in the US. Take iZettle, a Swedish company that develops mobile payment technology. It was sold to PayPal for 2.2 billion dollars. There is no shortage of similar examples."

[View of a growth company]

A recent study³⁴ by the Chairs of Entrepreneurial Finance at the Technical University of Munich found that

- significantly more capital is invested in European growth companies in financing rounds that include foreign investors compared to financing rounds only involving domestic investors,³⁵
- foreign investors invest in the most innovative and promising growth companies, and
- compared to domestically financed businesses, a very high proportion (approx. two thirds) of growth companies that are co-financed by foreign investors are subsequently sold to foreign investors or floated on foreign stock exchanges (this exodus from Europe has increased in recent years). The proportion for domestically financed businesses is only around one third.

What are the **policy implications** of this situation? Companies with high capital requirements shouldn't have to turn to non-European investors simply because they can't raise enough venture/growth capital in Europe. This purely capital-led exodus could be prevented by mobilising more domestic capital both in Germany and in Europe as a whole (see recommendations in Chapter 3).

It should be stressed that this is not an argument in favour of restricting German growth companies' access to foreign capital or markets. On the contrary – many companies want to operate in global markets or need the global market in order to successfully scale up their business as quickly as possible. Foreign investors help to provide know-how about and access to the major global markets (especially the USA and China).

"In the US, we can find investors with over twenty years' experience – this is hugely beneficial for us. Some of the big venture capitalists in the US have teams of up to fifty people dedicated entirely to advising companies like ours. They even do some of the marketing for us. We urgently need such services if we want to compete with the rest of the world."

[View of a growth company]

32 | Based on own interviews with growth company founders. See also Braun et al. 2019b, BVK et al. 2018, Ernst & Young 2019b.

33 | Frankfurter Allgemeine Sonntagszeitung 2019, p. 19 (authors' translation).

34 | See Braun et al. 2019b.

35 | Approximately one third of all private growth financing rounds in Europe since 1990 have included foreign investors. The (total) sum invested in these international rounds is almost four times as high as in domestic rounds. See Braun et al. 2019b.

Consequently, an effective innovation policy must enable access to *additional* sources of financing rather than making it harder for German growth companies to access foreign capital. Ideally, it must find ways of attracting foreign capital without impacting negatively on value creation and employment in Germany.

2.3 Measures to improve the accumulation of capital for financing growth trigger positive chain reactions

From the individual company's perspective, a lack of venture capital during the growth phase can prevent them from fulfilling their potential. At a macroeconomic level, a break in the financing chain at the growth stage can result in negative feedback effects on start-up financing as well as on the "liveliness" and dynamics of a startup ecosystem as a whole: IPOs often call for pre-IPO financing of between 50 and 100 million euros. If a lack of venture capital prevents growth companies from being floated on the stock exchange, it means that they are being denied an important vehicle for achieving long-term independence, while venture capitalists miss out on a key exit channel. The result is that potential entrepreneurs are deterred from starting their own company, while investors are deterred from investing in growth companies (the chicken and egg problem).

For this reason alone, measures to improve capital accumulation for financing growth would be an important trigger for a further development of the German start-up-scene and to strengthen the innovation system in Germany. Furthermore, such measures would also trigger positive chain reactions within the growth finance ecosystem, creating the following positive feedback effects.³⁶

More venture capital would enable more successful exits for German businesses and make Germany a more attractive location for capital investment:

Especially in the context of the digital transformation, the majority of successful, fast-growing companies and business ideas come from the USA and, increasingly, China.³⁷ Successful large-scale exits among German high-tech companies are comparatively rare,

particularly if they stay in Germany. More venture capital in Germany would help to increase the number of exits. These success stories would fuel interest among other venture capitalists, further increasing Germany's attractiveness as a location for capital investment.

"It is the lack of venture capital that is holding back innovation in Germany. We simply aren't able to finance major innovations."

[View of a growth company]

Bigger venture capital funds make this asset class more attractive to major investors and enable larger financing rounds.

German venture capital funds are small compared to other countries around the world, rarely exceeding 300 to 350 million euros in size. The largest venture capital funds in the USA and China are around nine times bigger.³⁸ Bigger German funds would make this asset class more attractive, especially to major investors such as pension funds and insurance companies, but also to family offices and foundations. Funds usually only make a limited number of deals. Accordingly, the bigger the fund, the more capital a portfolio company can obtain in a financing round. Moreover, bigger funds are also able to engage in riskier deals, because they are able to spread the risk across a more diversified portfolio. As a rule, this means that they are also better equipped to support the development of global market leaders.³⁹

"Venture capitalists make most of their money from follow-up financing, i.e. if they were already involved during the early phase and then stay on board during the growth phase. But if no money is available to finance the growth phase in Germany, venture capitalists lose out on the best part of their investment. They miss out on the bit after the early phase, which is precisely when things start to get exciting."

[View of an intermediary]

Large funds and financing rounds attract (top) venture capitalists⁴⁰, while increased competition between investors can lead to higher company valuations.

The best investors make their know-how, networks and capital available to the funds that promise to deliver the highest absolute

36 | BVK et al. 2018 presents a similar argument.

37 | See CB Insights 2018, Lee 2018.

38 | See BVK et al. 2018, IHK 2017. Exceptions include the billion euro fund of Rocket Internet and the billion euro fund being raised by Lakestar.

39 | See BVK et al. 2018, Metzger/Bauer 2015.

40 | By this, we mean the best managers of the relevant venture capital funds.



returns – and these will usually occur in large funds and large financing rounds. A bigger venture capital scene generally also promotes greater investor specialisation. (Top) venture capitalists – of which there are currently not enough in Germany – play an important role in the growth finance ecosystem.⁴¹ Moreover, increased competition between investors for “good” investment opportunities can potentially lead to higher growth company valuations.

“Meanwhile, we have trained a lot of people in the financial sector in Germany and have built up a good talent pool. But we need to train even more, as we have not yet reached a critical mass. There is a point at which a network develops among these people – this is absolutely key. It is still early days – we are at a similar stage to where investment banking was ten years ago.”

[View from academia]

“We are witnessing a noticeable decline in generalist investors – the need for investors to specialise has become much greater. Highly specialised investors are able to evaluate a company’s business model much more quickly. The US is ahead of us in this respect – they have more specialised investors than Germany.”

[View of an intermediary]

“I know of one case where a major German investor was planning to make a relatively small investment. Then a big foreign technology company came along with a higher valuation and the German investor increased their investment accordingly. Without this competition, the German investor would only have invested one third as much. We need this competition! A lack of competing investors drives down the valuations of young businesses.”

[View of an intermediary]

2.4 There are not enough alternative external financing instruments outside of the established venture capital model

2.4.1 There is not enough patient capital

Capital- and knowledge-intensive technologies can take a particularly long time to develop.⁴² It often takes high-tech companies ten years or more to go from the start of the product development stage to the exit. The traditional venture capital model with its inherent incentive systems is not geared towards these long timescales. This can result in a failure to fully leverage the potential of extremely innovative companies.

Patient capital⁴³ can help to close the gap, making it possible to finance the often lengthy development process of complex technologies and systems which enable associated innovative and disruptive business models. However, there is currently not enough patient capital in the markets.

“We need more sources of patient capital. No investor wants to wait 15 years! But that is exactly what disruptive business models need.”

[View of an intermediary]

Some countries have launched initiatives aimed at improving availability of patient capital, for instance the British Patient Capital Programme and the recently approved Long-Term Stock Exchange (LTSE) in the USA.⁴⁴ However, it remains to be seen whether such initiatives will actually succeed in improving access to patient capital. While the UK programmes are worth billions of pounds, most are still based on the traditional venture capital model with its well-known incentive structures. But there is no guarantee that simply injecting more capital will necessarily lead to more patience in the system. It will nonetheless be important to keep monitoring the UK initiatives, despite these doubts about whether they will actually result in more patient capital. Alongside the other alternatives discussed below, patient capital is an important structural element for external financing outside of the established venture capital model – and it is currently underdeveloped in Germany.

41 | See section 2.1.

42 | See Ewens et al. 2018.

43 | Also referred to as long-term capital. For more details, see also Braun/Lange 2018, Dodgson/Gann 2018, HM Treasury 2018.

44 | See Dodgson/Gann 2018, HM Treasury 2018, LTSE 2019.

2.4.2 There is a lack of hybrid capital and innovative debt capital

Hybrid capital and innovative debt capital are two further alternative external financing instruments that could be made more widely available in Germany.

1. There is not enough hybrid capital

Also known as mezzanine capital, hybrid capital combines debt and equity characteristics. One form of hybrid capital is venture debt, a specific loan to a growth company which is often combined with the option for the lender to benefit from possible value increase of the company (known as an “equity kicker”).⁴⁵

Venture debt has a number of advantages as a complementary source of capital for growth companies. These include:

- **Partnership interests not diluted:** Unlike the recruitment of additional equity investors, venture debt does not initially dilute the value of the shares and voting rights of the company’s existing partners.⁴⁶
- **Lower capital costs:** As a rule, the costs associated with venture debt are lower than the returns expected by venture capitalists.
- **Greater flexibility:** Growth companies can use venture debt for whatever they need to, without first having to obtain the approval of equity investors.

Technology-intensive growth companies in Germany are increasingly asking for hybrid capital.⁴⁷

“We are witnessing growing demand for mezzanine capital among businesses, including those requiring large sums of capital. Alongside other financing instruments, mezzanine is a good source of capital for innovative companies.”

[View of an intermediary]

However, this increased demand is currently not being met in Germany. This is partly due to the relatively underdeveloped venture

capital market (see section 2.1). Companies can only take on venture debt if they have already obtained venture capital – that’s why venture capitalists perform a kind of gatekeeper function for venture debt providers.⁴⁸ Moreover, venture debt products are a relatively recent phenomenon in Germany compared to other countries such as the USA. While some domestic and foreign banks are starting to experiment with such products in Germany, many growth companies have little knowledge of the products in question or of where to obtain them. Furthermore, many banks still lack the experience needed to establish the relevant products in the German market.

“Venture debt products are still fairly new in Germany – we are only just starting to develop them. These products are usually more complex, it is a specialised segment. It is likely that a handful of actors offering this type of product will emerge on the German market, for example KfW, HypoVereinsbank, Deutsche Handelsbank, Silicon Valley Bank and perhaps a couple of the major savings banks. The number of providers will remain relatively low.”

[View of an intermediary]

The insufficient supply of these instruments in Germany is also linked to the **design of existing government funding programmes**. These focus primarily on⁴⁹

- **earlier financing phases such as the seed and start-up phases** (e.g. European Recovery Program (ERP) Capital for Start-ups, EXIST and the HTGF) or
- **other types of business (i.e. not growth companies)**, with examples including the KfW funding programme “ERP-Mezzanine for Innovation” with a focus on established small and medium sized companies (SMEs) and the Micro-Mezzanine Fund Germany which is aimed specifically at microenterprises (max. €50,000 per company).

While there is no denying the importance of these programmes, they cannot adequately meet the capital requirements of technology-intensive growth companies in terms of their goals and/or maximum investment level.

The merger of the ERP special fund with the European Investment Fund (EIF) in spring 2016 to create the “ERP/EIF Mezzanine Fund of Funds for Germany” (which includes venture debt funds)

45 | Regulatory law defines venture debt as a form of debt financing. However, the use of equity kickers means that in economic terms venture debt is effectively a hybrid financing instrument.

46 | See EIB 2019, Jazdowski 2018.

47 | In addition to the expert interviews carried out for this study, see also EIB 2019 and Jazdowski 2018.

48 | This gatekeeper function works as follows: if (leading) investors have invested in a company, it follows that they must have already carried out due diligence (to a high standard) and established that the company has good growth and success prospects. The specialised venture capitalists’ assessment then feeds into the lender’s decision on whether to offer the company venture debt.

49 | See BMWi 2019 for a comprehensive overview of existing government funding instruments for financing start-ups and growth.



constitutes a step in the right direction. Through this initiative, the ERP, EIF and other partners are strengthening equity and mezzanine financing by a total volume of €600 million (as of January 2019). Once again, however, the focus is not on high-tech growth companies with high capital demand, but on investments in "German SMEs and young fast-growing companies. (...)" The average volume of investment is between €10 million and €20 million.⁵⁰ Furthermore, access is only provided to capital from private-sector funds – direct investment in growth companies is not catered for.

2. There is not enough innovative debt capital

Debt capital has some advantages over other types of financing, particularly the fixed/predictable interest rates and the generally short period between applying for a loan and receiving the capital. However, banks usually require certain conditions to be met before they will grant a loan, for example adequate levels of working capital/current assets, a positive cash flow and a business model that has demonstrated its sustainability in terms of both sales and customer base. Since most growth companies are unable to meet these requirements, it is almost impossible for them to access conventional bank loans and other traditional forms of debt financing.⁵¹

"The traditional banks couldn't help us even if they wanted to. Their in-house processes and compliance regulations don't allow them to lend to us. We have a borrowing limit of 1,000 euros with our company bank."

[View of a growth company]

"We need a lot of working capital, for example to cover our stock and accounts receivable. We also offer our products for hire, so we only get the money when they are returned. Although this means that we have to find a lot of cash up front, the risk of default is relatively small and manageable. We are desperately keen to borrow more capital for these purposes, but the banks won't give us anything because we are a growth company and don't meet their lending criteria."

[View of a growth company]

Innovative debt instruments for growth companies must use alternative assessment models that are not based purely on an analysis of the company's past balance sheets and are in some respects more reminiscent of project financing instruments. In other words, decisions on whether to grant loans to finance growth or working capital should place greater emphasis on a company's future potential and employ sub-market testing when assessing the risks.

2.5 Cooperation between growth companies, established businesses and academic institutions strengthens the growth finance ecosystem

Growth companies can benefit enormously from collaboration with established businesses and are increasingly open to this form of cooperation.⁵² For instance, growth companies benefit from **learning effects with regard to the application of their technology** or business model if they are able to directly deploy their solutions in an industrial environment. Moreover, major/key customers can have a positive impact on the evaluation of growth companies by sending a **strong signal to other investors and potential new customers** that they believe in the growth company and are successfully using its products and services in their own business. Orders from and joint projects with established companies are also an important source of revenue for growth companies, allowing them to strengthen their **internal financing** and increase their long-term investment in areas such as R&D.⁵³

"We were also able to finance ourselves right from the outset, because we were providing services to customers at the same time as we were developing our software. The first time we resorted to external financing was when the company was floated on the stock exchange in 1988 [it was founded in 1972]. By that point, we were already the undisputed market leaders in Europe."

[SAP founder D. Hopp in an interview with the Sunday edition of the Frankfurter Allgemeine Zeitung]⁵⁴

50 | BMWi 2019, p. 3.

51 | In the future, debt could also play a more important role in financing innovation in established businesses. Today, SMEs in particular primarily use internal financing (mainly their retained operating profits) to finance innovation. However, this constitutes a very limited source of capital, especially for delivering costly cutting-edge innovations connected with the digital transformation. Debt could provide a valuable additional source of innovation financing specifically for SMEs. At present, however, very few providers offer access to this kind of facility (see Zimmermann 2019).

52 | See BDI 2016, BDI/Deutsche Bank 2018, BVK 2018a, Can et al. 2018, Ernst & Young 2019a, IHK 2017, UnternehmerTUM/Wissensfabrik 2014, Wallisch/Hemeda 2018.

53 | See Achleitner et al. 2016, Achleitner/Lange 2019b, UnternehmerTUM/Wissensfabrik 2014.

54 | Frankfurter Allgemeine Sonntagszeitung 2019, p. 19 (authors' translation).

Cooperation with established businesses also provides an important **source of external financing for growth companies**. They can benefit from the fact that many established businesses have their own venture capital firms that they use specifically to invest in innovative new technologies.⁵⁵

“Private investors are particularly important for us. I’m talking about wealthy entrepreneurs in the manufacturing industry, cash-rich SMEs with their own manufacturing operation that have often been run by the same family for decades. These guys are bold, they have the money, and they know the market. They want to establish links with the new world of digital business models – our world. We work with people like this, they finance our growth.”

[View of a growth company]

Case studies highlight importance of cooperation between growth companies and established businesses

By cooperating with BMW, **3D printing specialist EOS** gained a strategically important customer that boosted its internal financing at an early stage in their development. The partnership with BMW also helped to improve the quality of its technology and provided access to new areas of application. Today, EOS is a leader in the field of industrial 3D printing.⁵⁶ The fact that the company has now established its own venture capital fund demonstrates the leverage effects that can be created by successful growth companies in the growth finance ecosystem.

relay is a **technology company** focused on IoT, AI and B2B. Cooperation with reinsurance provider Munich Re helped relay to win new orders and customers, e.g. by providing data insights for container ship insurance. The partnership ultimately provided relay with a domestic exit channel when it was bought by Munich Re for €300 million.

But it is not just the growth companies that stand to gain – there are also benefits for **established businesses**. **Cooperation with growth companies allows them to access new technologies that help accelerate their own digital transformation** and review their business model in the light of digitalisation. In many cases, it also provides an opportunity to forge ties with the providers of an innovative solution before their competitors get their hands on it.⁵⁷ For some smaller established businesses, cooperation with growth companies can even be key to their survival, since they may lack sufficient resources of their own (such as capital or technical expertise) to independently develop strategies for digitalisation and for unlocking the potential of new technologies.⁵⁸ The cooperation with growth companies can take various different forms: Established businesses may choose to acquire an interest in a growth company, or they may adopt a targeted strategy of identifying and developing start-ups and growth companies as future suppliers and partners.⁵⁹

However, many established businesses are failing to leverage the potential of cooperation with German growth companies – either because their primary focus for investment opportunities is in the USA and Asia (even though the opportunities to invest are improving in Germany and Europe⁶⁰) or because their initial contacts/demonstration projects don’t always translate into long-term cooperation. Moreover, particularly with smaller established businesses, if cooperation occurs at all it is often entirely down to chance (e.g. thanks to management’s personal network).⁶¹

Practical example

Viessmann is an established family business which makes heating, industrial and refrigeration systems. It launched the venture capital firms Vito Ventures and Vito.One specifically for investments in digital transformation business models. In order to pool even more capital for larger financing initiatives, Viessmann has also invested in the La Famiglia technology fund. This fund aims to promote links between traditional, established businesses in Germany and the country’s innovative high-tech scene.⁶²

55 | See CB Insights 2018, Ernst & Young 2019a.

56 | See Beise/Schäfer 2016.

57 | See Achleitner/Lange 2019b, BDI/Deutsche Bank 2018, Can et al. 2018, UnternehmerTUM/Wissensfabrik 2014, VDMA/EBS 2019.

58 | See BDI/Deutsche Bank 2018, VDMA/EBS 2019.

59 | BMW refers to this as the “Venture Client” model. Through the targeted approach of its BMW Startup Garage, it becomes a customer of innovative start-up solutions and promotes direct cooperation in real projects with the business units – all with the aim of building a long-term relationship.

60 | See section 3.1.

61 | See BDI/Deutsche Bank 2018, IHK 2017, Wallisch/Hemeda 2018.

62 | See Handelsblatt 2016.



The win-win potential also applies to the cooperation with **academic institutions**. These play an important role in the growth finance ecosystem, especially in terms of the establishment of new high-tech start-ups, the transfer of know-how and personnel from research to industry and the technical expertise needed to evaluate innovative technologies.⁶³

Linking academic research to industrial applications creates huge potential for innovation – and this is an area where Germany still has room for improvement. Especially at universities, the current conditions and incentive structures make it difficult for academics to start a business connected with their academic work and engage in entrepreneurial activities in parallel with their role at the university.⁶⁴ Moreover, there are growing signs of a shift in recruitment policy for technological science posts – the appointment of university professors with industry experience and a practical focus is becoming less and less common. If this trend persists over the longer term, it could weaken the links between academia and industry.⁶⁵

“We have several globally unique, relevance-driven engineering science institutes in Germany that carry out outstanding research. They are home to an incredible wealth of expertise and capabilities – everything you need to create high-tech start-ups is right there. However, the terms of most university professorships prevent these competencies from being used to establish and grow new high-tech companies. There is a huge amount of untapped potential here.”

[View from academia]

“If you visit some of the big universities in Switzerland, you’ll find academics who know about digitalisation and put this knowledge into practice. The Swiss have better mechanisms for transferring research into practice. For example, a professor in Switzerland will meet more colleagues who sit on company supervisory boards in the space of three weeks than they would in three years at a German university.”

[View from academia]

Germany does have some public and private initiatives aimed at facilitating cooperation or at least finding potential partners. These include the new Digital Hub Initiative and associated Startup Finder⁶⁶ from the German Federal Ministry for Economic Affairs and Energy (BMWi), regional technology clusters such as it’s OWL⁶⁷, UnternehmerTUM and RWTH Aachen University’s Technology Campus⁶⁸, a variety of mostly regional mentoring programmes and workshop series (Founders Foundation, Paderborn University’s Garage 33, Bielefeld University’s Innovation Centre Campus, etc.) and the “Plug-and-Play” platform.

However, the potential of cooperation between growth companies, established businesses and academic institutions in Germany is still not being fully leveraged. For instance, individual flagship initiatives are only found in certain regions and are completely absent from others, including some where there is a strong university tradition.⁶⁹ As well as a shortage of locations for networking, there is also often a lack of concrete formats for promoting **functional cooperation**.

“Why do I still have to fly to Silicon Valley to sit around a table and discuss cooperation and financing options with established German companies? We’re both from Munich, but we only ever meet in Silicon Valley. It’s absurd.”

[View of a growth company]

For example, the BMWi’s Startup Finder facilitates initial contacts between established businesses and growth companies. However, it can prove difficult to progress from these initial contacts to the development of concrete forms of cooperation such as a project/network involving several relevant actors and the targeted pooling of know-how and capital. Ongoing support and networking is required at this stage, for instance in the shape of the jump-up initiative proposed in Chapter 3.

63 | See Achleitner/Lange 2019a, Madhvani 2017.

64 | See BMBF 2017.

65 | See acatech 2018a, acatech 2018b.

66 | The Startup Finder is a public database aimed at facilitating contacts between SMEs and industrial entrepreneurs from all the digital hubs. See www.de-hub.de

67 | This network has 200 partners, including 19 universities.

68 | The aim is to build strong networks of research and industrial partners. 360 tech companies have “enrolled” on the campus.

69 | See Deloitte 2018.

3 Recommendations

3.1 Mobilise more domestic capital for financing growth in Germany

3.1.1 Mobilise venture capital from institutional investors, foundations, family offices and high-net-worth business angels

Increased venture capital investment by pension funds and insurance companies is by far the most important means of mobilising more venture capital. However, this will require three conditions to be met: the investments must be a) **attractively implementable given regulatory restrictions**, b) they must be **possible** (i.e. there must be sufficient investment opportunities) and c) they must be **profitable**.

At a policy level, it will therefore be necessary to relax the regulatory restrictions on investments by big institutional investors. Insurance companies, pension funds and banks are required to maintain an equity risk buffer for their investments.⁷⁰ The high equity requirements are one of the reasons that venture capital currently remains an unattractive asset class for institutional investors.⁷¹

Institutional investors are also the focus of efforts to stimulate and support the capital raising feedback effects described in section 2.3. Europe's largest pension funds and schemes manage assets worth approximately €7 trillion. It would take less than one percent of this to close the venture capital gap between Europe and the USA.⁷² It is figures on this scale that can make a telling contribution to strengthening the growth finance ecosystem. At the same time, **growing numbers of globally competitive growth companies are emerging in the B2B sector in Europe as a consequence of the continent's industrial structures. These companies also constitute an attractive investment opportunity for global investors and major institutional investors (see information panel in the blue box on this page). This development still requires increased visibility in some quarters**, in order to increase awareness of investment opportunities in Europe among as many institutional investors as possible.

Investment opportunities in Europe are improving

Major insurers, pension funds and established businesses generally prefer to make venture capital investments in the USA or Asia rather than in Germany, among other things because of a perception that the returns will be higher. However, investment opportunities in Germany and the rest of Europe are becoming increasingly attractive, particularly at the current point in time. German growth companies are attaining a maturity level that ought to attract interest from major investors. There are some particularly good investment opportunities in the field of Industrie 4.0. Smart factories connect products, machinery, warehousing systems and operating resources in order to provide customers with highly customised products at mass market prices. The solutions required to make this possible are increasingly coming from innovative, fast-growing start-ups in Germany and the rest of Europe.⁷³

"Silicon Valley has become expensive. Nowadays, investing in an average to below-average idea can cost you a small fortune. In Germany, the opposite is true – you can invest in some incredibly good ideas without breaking the bank. The opportunities are huge."

[View of a growth company]

"All our major companies hang around the West Coast of the US looking for investment opportunities. But they are only third-class citizens there, they would have a much better chance of finding something here in Germany. Germany is exceptionally well placed to position itself as a leader in B2B growth financing. I'm not saying they should stop looking for opportunities in the US, but they would be well advised to also invest here in Germany, particularly at the moment."

[View of an intermediary]

As well as the big institutional investors and venture capital funds of established businesses, **other institutional investors** such as family offices, foundations and wealthy private investors can also play **an important part in mobilising more capital in**

70 | Insurance companies are covered by the EU's Solvency I and II directives, while banks are covered by Basel regulations I to III.

71 | See BVK et al. 2018, Telekom Capital Partners/OC&C Strategy Consultants 2017.

72 | See BVK et al. 2018, Welt 2018.

73 | See Beise/Schäfer 2016, BVK 2018a, Ernst & Young 2015, Ernst & Young 2018, Ernst & Young 2019a, Handelsblatt 2018, Kagermann/Winter 2018, Madhvani 2017, Metzger 2019, NKF 2018, Wirtschaftswoche 2019.



Germany. In addition to investing capital, such investors would ideally also bring their market knowledge and technological expertise to the table, e.g. they have previously held positions as (technical) managers with major companies and/or started their own successful businesses (keyword: “Smart Money”). Significantly more capital could be mobilised for financing growth if a way could be found to pool some of their capital investments (at present, smaller investors often operate in a highly fragmented, individual manner and only invest relatively small sums). The new co-investment platform proposed in section 3.2 is one possible vehicle for achieving this.

The potential role of foundations in the growth finance ecosystem

During the current period of sustained low interest rates, foundations are coming under growing pressure to invest their capital more profitably so that they can support their work more effectively or at least maintain the capital’s real value in order to secure their long-term viability.⁷⁴ In recent years, the growth rate of the capital available from foundations has increasingly fallen short of its potential, creating a “foundation shortfall”.⁷⁵ In some cases, investing in venture capital could help to tackle this problem. Investments that address both an interest in alternative forms of investment and promotion of the foundation’s goals could prove to be especially attractive (for example direct investment in an environmental technology start-up by a foundation that works in the field of sustainability).

3.1.2 Expand and improve the effectiveness of existing government instruments in order to mobilise more capital

The State can itself act as an investor in professionally managed private funds, e.g. by providing capital on the same terms as

other fund investors. These government instruments can help to mobilise more private venture capital in the relevant funds. Instruments such as fund investments by KfW Capital and the co-investment fund coparion (which invests directly in start-ups)⁷⁶ are positive examples of government initiatives in this area.

While these instruments are both welcome and necessary, the size of the investments needs to increase. At present, KfW Capital can invest a maximum of €25 million in any one fund. This is simply not enough to make a meaningful difference for innovative, technology-intensive growth companies with high capital requirements.

“Here in Germany, we are unable to deliver big innovations. Not because there is any shortage of ideas, but because we lack the necessary financing models. When it comes to financing, we think small. Then we start small. And we end up staying small.”

[View of a growth company]

Moreover, all future government initiatives and (fund) investments should observe the following two principles. Firstly, they should be managed by experienced professional investors. And secondly, the government’s involvement in the funds should not stand in the way of quick and transparent decision-making.

“The EIB [European Investment Bank] is becoming increasingly important for growth companies, too. It has funds worth billions of euros. But there is a lack of transparency regarding its instruments and funding programmes. It’s all very unclear and confusing. Hidden away in the small print in paragraph 100 on page 150, it says that companies like ours are eligible for support worth €300,000. But how is anyone supposed to find this information?”

[View of a growth company]

74 | According to the Association of German Foundations (Bundesverband Deutscher Stiftungen), in 2018 almost 40% of all foundations said that the rate of return on their investments was below the current inflation rate – this compares to a figure of 11% in 2016. See BVDS 2018.

75 | See BVDS 2019.

76 | KfW Capital is a wholly-owned subsidiary of the KfW Group that started trading in October 2018. Its goal is to strengthen the venture capital ecosystem, improving access to capital for innovative tech companies in Germany. With the support of the Federal Government’s ERP Special Fund, KfW Capital will invest approximately two billion euros in German and European venture capital- and venture debt funds over the next ten years. See KfW 2018a, KfW 2018b, KfW Capital 2019.

3.2 Address the demand of alternative external and internal financing instruments – outside of the established venture capital model

3.2.1 Increase the offer of hybrid capital and innovative debt, e.g. by raising the profile of the first successful innovative initiatives in these areas

A few pioneering (and in some cases new) actors on the German market are starting to respond to the growing demand for hybrid capital and innovative debt capital for growth companies by developing innovative business models and/or initiatives. The boundaries of former no-go areas – such as granting loans to growth companies that lack collateral – are being challenged and pushed forward.

Raising the profile of these new initiatives would help to further stimulate the market. The following developments are especially relevant in this context:

Some providers in Germany are now starting to make venture debt available for companies to finance their growth and/or operating resources. Instead of requiring traditional collateral, these providers evaluate companies on the basis of their future value creation potential and whether any (top) venture capitalists have invested in them.⁷⁷ Some domestic and foreign banks are currently experimenting with such products in Germany, for example KfW and Silicon Valley Bank.⁷⁸ German companies such as the language learning platform Babbel and air taxi manufacturers Lilium are already using these offers to help finance their growth.⁷⁹ A number of **venture debt funds** have also been established, for example the Davidson Shamir Technology Growth Debt Fund, which specialises in European tech companies, with a strong focus on Germany. Other European providers include the Harbert Management Corporation, Kreos Capital and Bootstrap

Europe. In addition, KfW Capital invests part of its budget explicitly in venture debt funds.⁸⁰

In 2018, the Federal Government launched the **“Tech Growth Fund Initiative”**.⁸¹ The initiative aims to strengthen the venture debt financing market in Germany – which is still underdeveloped compared to other countries – through a range of measures such as the KfW programme “Venture Tech Growth Financing”. Under this programme, which is set to run for at least five years, KfW will make a total of €50 million a year directly available to innovative tech-sector growth companies. Financing under the programme requires the involvement of a private lender as a financing partner who generally contributes 50% of the financing (on the same terms). Moreover, private venture capitalists must have a stake in the company.⁸² Most of the current financing partners are banks such as the HypoVereinsbank, Silicon Valley Bank and Deutsche Handelsbank. In principle, however, funds and family offices can also act as financing partners.

Since the end of 2016, the **EIB** has been providing **venture debt financing** for innovative tech companies requiring **between €7.5 million and €50 million**. According to its own figures, this makes the EIB the biggest venture debt investor in Europe.⁸³ While in this case, too, companies are not required to provide the usual collateral or evidence of profitability, they must have high growth potential and innovative technologies.⁸⁴

Innovative debt capital is another area where investors are faced with the challenge of developing appropriate evaluation tools that take a balanced view of typical growth company features (high degree of innovation, very limited collateral, low/no profits) when assessing the risk of default. However, some innovative initiatives are starting to appear. The Deutsche Handelsbank provides special loans for start-ups and growth companies in the digital sector. Through interviews with applicants, the Deutsche Handelsbank seeks to gain an impression of how sustainable the business model is and assesses the composition and experience of their team and current investors. The loans can be used for various purposes, e.g. to finance growth or operating resources.⁸⁵ The HypoVereinsbank is another provider that offers similar instruments in Germany.

77 | See Hesse et al. 2016.

78 | See Gründerszene 2018a, Gründerszene 2018b.

79 | See Gründerszene 2018a.

80 | See KfW Capital 2019.

81 | A joint initiative of the Federal Government and KfW, the European Investment Bank (EIB) and the European Investment Fund (EIF).

82 | The funds are made available directly to the company at market conditions. See KfW 2019.

83 | See EIB 2019.

84 | See EIB 2018a, EIB 2018b.

85 | See Deutsche Handelsbank 2019.



In the future, innovative debt instruments could also be established in connection with the IoT. For example, Commerzbank offers pay-per-use loans for IoT-enabled machinery that automatically sends usage data to the bank. The repayment terms are adjusted based on the actual usage of the asset on which the loan was taken out.⁸⁶

3.2.2 Launch a stakeholder dialogue on "patient capital"

The relevant actors from industry, academia and government should launch a new, high-level stakeholder dialogue to address the following question:

Which additional instruments – in addition to the established venture capital model – could help to make patient capital available for financing disruptive, capital-intensive business ideas? Some pointers as to how this question might be answered can be provided by other asset classes (e.g. private equity⁸⁷) with its open-ended or evergreen funds.⁸⁸ The previously mentioned patient capital initiatives in other countries also offer valuable food for thought.

The stakeholder dialogue should first and foremost include actors from the following areas:

- **The Federal Government and KfW** (e.g. to address the regulatory framework and how government instruments can be leveraged to mobilise more patient capital).
- **Major institutional investors and other venture capitalists** (who might be induced to invest more in patient capital if the right instruments and incentive systems existed).
- **Foundations** (which usually have long-term goals and long-term investment horizons).
- **Wealthy private individuals/high-net-worth business angels and family offices** (some of these stakeholders are particularly well qualified to evaluate technologies, either because they have previously started their own business or have worked in the relevant industries).

The stakeholder dialogue could also be used to discuss ways of highlighting differences in the planning horizons of investors and businesses in order to prevent unrealistic expectations on both

sides. Investor business models are geared towards obtaining a financial return without tying up their capital in the company for too long. From the entrepreneur's perspective, however, the development of knowledge-intensive technologies and the associated business models requires patience on behalf of investors.

"Investors don't understand the technical side of what we do here. I always keep our conversations very simple, I talk a bit about our industry and all the stuff you can do with our technology. We also tell them that we have lots of patents. But investors simply aren't interested in the technical details of our technology and why we need longer financing horizons for it."

[View of a growth company]

3.2.3 Establish a co-investment platform for direct investment in growth companies

A platform for direct investment in high-tech growth companies with a secondary market would help to reconcile the shorter investment horizons of investors with companies' need for longer-term financing in order to realise business models with a particularly long development phase, thereby providing more patient capital. A new co-investment platform could fulfil this function operationally.

The conditions for establishing such a platform appear to be favourable – especially among institutional investors, there is growing interest in investing directly in innovative, fast-growing companies without having to go through a fund. Many choose to do this through co-investments, where they invest in a company directly alongside a venture capital firm. One of the main reasons for going down this route is that they themselves are not usually able to make an informed decision about these investments – as a rule, only specialist investors like venture capital fund managers possess the specific knowledge needed to evaluate a young high-tech company. Any market for direct investment therefore relies heavily on the experience and expertise of these specialist investors who a) provide professional assistance with selecting suitable investments by making their knowledge available to the market and by investing their own money ("signalling") and b) actively support the growth companies with their market expertise.

86 | Commerzbank 2019.

87 | Private equity (PE) is equity capital provided by private and/or institutional investors that is used by private equity firms to acquire stakes in companies for a limited period of time in order to obtain a financial return. In the narrow sense, it only includes financing of established businesses, but venture capital investments may also be included in the wider definition. See Achleitner 2018a.

88 | In open-ended or evergreen funds, returns from the investment are repaid back to the fund or company vehicle for subsequent reinvestment in order to make returns over longer periods. See Dodgson/Gann 2018.

Accordingly, specialist investors play a key lead investor role in the proposed co-investment platform outlined below.

“The market for growth financing is not working in terms of supply and demand. It needs to be automated, standardised and made more objective.”

[View of a growth company]

Outline of the proposed co-investment platform

A lead investor such as a highly-specialised venture capital fund provides information on the platform about what they consider to be a profitable investment in an innovative high-tech company. This lead investor plans to invest in the company itself and use its own market expertise to actively support its growth.

The lead investor uses the platform to seek other investors who would be prepared to put money into the company as passive co-investors on the basis of the lead investor’s recommendation and evaluation.

Interested potential co-investors make their investment decision based on the lead investor’s evaluation, which can be shared with them via the platform. The stakes that they acquire in this manner (or the corresponding securitised assets) can then be traded on a secondary market, provided that certain conditions are met. The design of an acceptable price setting mechanism for these secondary transactions could be based on structures within the private equity market.⁸⁹

Growth companies, specialised active investors and non-specialised passive investors would all benefit from the proposed co-investment platform for direct investment with a secondary market:

Growth companies would have more time to develop complex technologies and the associated business models (keyword: patient capital) because, unlike the traditional venture capital model with its inherent incentive structures, the model is not focused on a rapid exit: The secondary market allows individual investors to acquire/dispose of an interest without the entire company having to be sold. The co-investment model also facilitates larger financing rounds and significantly reduces the time and effort that growth companies need to devote to raising capital.

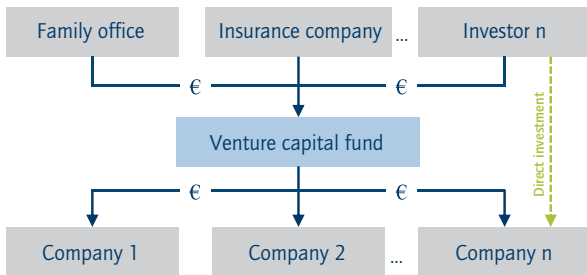
Active investors also benefit from larger financing rounds, which they are able to realise thanks to the involvement of passive co-investors. This approach affords them greater independence from other (currently often foreign) active investors, allowing them to remain in the role of lead investor for longer. There is also a strong case for passive investors to pay active investors a compensation for their services. Moreover, the secondary market provides investors with an additional exit option that improves the liquidity of their portfolio – without the company having to be sold.

Passive investors can use the platform to invest directly in high-tech growth companies without needing any specific knowledge about the technology and market. This allows them to diversify their portfolio. Moreover, the fees for using the platform are also expected to be lower than for a traditional venture capital fund. These factors could help to make the venture capital asset class attractive to investors who have hitherto been reluctant to invest in this area (e.g. foundations). As with active investors, passive investors will also benefit from greater portfolio liquidity thanks to the ability to trade their investments on the secondary market.



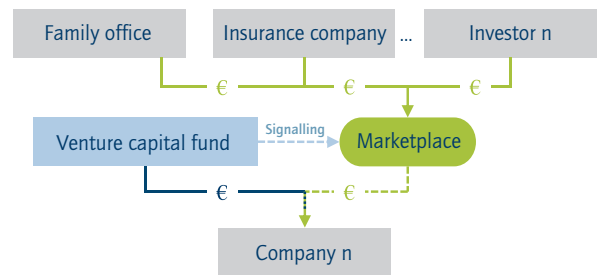
Current market (Venture capital model)

- Capital usually made available through traditional venture capital model.
- Exits are an inherent part of the model.
- Investor interest in direct investment is growing (especially co-investment alongside venture capital funds).



New co-investment platform with secondary market

- Co-investment mobilises additional capital thanks to greater transparency and effectiveness.
- Venture capital funds use their technology assessment expertise to perform signalling function. They benefit from ability to realise larger financing rounds and can also earn a management fee.
- The ability to trade investments on a secondary market (which also applies to venture capital funds) reduces exit pressure and illiquidity for investors.



Legend:
 → current model → new, expanded model

Figure 4: Outline of a new market for private growth capital (Source: Authors' own illustration based on Braun 2019)

3.3 Get better at leveraging the (win-win) potential of cooperation between growth companies, established businesses and academic institutions

3.3.1 Establish a jump-up initiative for fast-growing tech companies

In order to better leverage the potential of cooperation between established businesses, academic institutions and growth companies, a top-level jump-up initiative should be established for fast-growing, innovative high-tech companies.

This new jump-up initiative should pool the available financial strength and technical expertise in Germany in a targeted manner.

A new top-level jump-up initiative for fast-growing, innovative high-tech companies would serve to promote cooperation between established businesses, growth companies and academic institutions. It would need to go beyond non-binding networking and matchmaking at industry contact events, focusing instead on the systematic and targeted initiation of concrete cooperation between the relevant actors on highly specific technology/cutting-edge themes.

The initiative should promote project-based cooperation between decision-makers from several established businesses (e.g. chief technology officers) and hand-picked high-tech growth companies on concrete issues (e.g. how can as-a-service business models based on a particular new technology be implemented in practice?). Experienced tech scene entrepreneurs and the relevant venture capitalists should also be able to participate, both by contributing their expertise and potentially also by being prepared to invest their own capital in promising ventures. Leading academic experts in the relevant fields should also be included in the partnership.

The key to the success of the proposed jump-up initiative is to choose the right partners. In order to ensure that the best participants are selected, a professional support function will need to scout and pre-evaluate potential companies and individuals. In this regard, the expertise and networks of institutions such as acatech, the joint Center for Digital Technology and Management (CDTM) of the Technical University of Munich and Ludwigs-Maximilians-Universität München, the UnternehmerTUM from the Technical University of Munich, the "it's OWL" leading-edge cluster

and the BMW's Digital Hub Initiative could play a particularly valuable role. The criteria for selecting the right growth companies should be confined to the composition of their management teams, the company's prospects of success, the potential and scalability of the business idea and the technology's disruptive potential.

3.3.2 Strengthen regional innovation clusters

Regional innovation clusters promote networking between growth companies, established businesses, academic institutions and investors involved in new technological developments by providing them with opportunities and spaces to meet each other. When these actors are all located in close proximity to each other it becomes easier to build the personal contacts that help to get joint projects and concrete partnerships off the ground. It is also easier to link such innovation clusters to the activities of venture capitalists.

Universities are often at the centre of successful innovation clusters. Accordingly, the **establishment and strengthening of professional entrepreneurship centres at universities throughout Germany** is a key strategy for strengthening innovative ecosystems. These centres tend to be most successful when they adopt a market-oriented approach, are decoupled from traditional university structures, have their own legal status and ensure the targeted inclusion of industry. At the Technical University of Munich, for example, entrepreneurial education, start-up advice and start-up support are largely provided through the Center for Innovation and Business Creation called UnternehmerTUM. It is decoupled from the academic side of the university. The centre has its own legal status, recruits experienced, professional personnel from leading consultancies and industry, provides its own training for some 2,000 students a year through its entrepreneurship programmes and receives strong financial support from industry. This has helped UnternehmerTUM to become a professional entrepreneurship centre in Germany.

"If another twenty German universities did what UnternehmerTUM does and launched and accelerated over fifty scalable tech start-ups a year, Germany would have one of the highest start-up rates in the world alongside Israel, China and the US."

[View of an intermediary]

With the competition called "Exzellenz Start-up Center.NRW", the German federal state North Rhine-Westphalia has embarked on a targeted initiative to strengthen entrepreneurship centres at



the region's universities. Over the next five years, the regional government will make up to €150 million available to help the six chosen universities significantly expand their start-up initiatives and become centres of regional start-up ecosystems.

In the German federal state Hessen, universities, government and industry have been pursuing a joint master plan for the "Startup Region Frankfurt Rhine-Main" since the beginning of 2017. Furthermore, in 2016 the cross-university TechQuartier has been founded, a start-up hub that supports the development of growth companies primarily through networking with established businesses, co-working and access to capital and talent. The next stage is to scale up existing initiatives – including a new €250 million growth fund (initiated, among others, by the WerteStiftung) and further centralizing single entrepreneurship-activities.

3.3.3 Optimise conditions at universities to increase the number of high-tech start-ups

Germany has several top-quality engineering research institutions. However, their potential in terms of establishing new (high-tech) start-ups is not being fully leveraged, among other things because the incentive systems and conditions for encouraging academics to develop practical applications for their knowledge are either lacking or in some cases counter-productive.

"We need incentives for professors to get more involved in start-ups – they should be able to share their knowledge and share in the profits. At Berkeley and Stanford, for example, professors are involved in AI start-ups. They have a financial interest and also contribute their knowledge as consultants and technical developers. That would be unthinkable in Germany because of the damage it would do to their academic reputation."

[View from academia]

There are two areas in particular where action will be required to improve the conditions at universities:

1. Universities should have transparent regulations and efficient procedures for resolving questions about the rights and responsibilities of academics who wish to start a company and engage in entrepreneurial activities in parallel with their role at the university. In this context, "entrepreneurial activities" means that the founder of the business has and retains a relevant equity interest in the company. Stanford University, for example, has drawn up guidelines on best practices for faculty start-ups that seek to provide guidance and a stable framework for striking the right balance between the promotion of entrepreneurship and the prevention of conflicts of interest with research and teaching.
2. Universities should also use and value the number of spin-offs as one of the key quality criteria for their technological science⁹⁰, since this is an important indicator of the successful transfer of academic research into industrial practice. acatech also recommends that, particularly in the technological sciences, universities should continue to appoint experts from industry to professorships and increase the number of such appointments.⁹¹ This recommendation explicitly includes successful start-up founders and entrepreneurs – they enrich research and teaching with their specific knowledge and experience and they can also perform a valuable brokering and networking function between academia, start-ups, established businesses and investors. In doing so, they can make an important contribution to strengthening the growth finance ecosystem.

90 | See acatech 2018a.

91 | See acatech 2018b.

Appendices

Appendix A: Abbreviations

| Abbreviation | Full form |
|--------------|---|
| AI | artificial intelligence |
| B2B | business-to-business |
| B2C | business-to-consumer |
| BDI | Federation of German Industries |
| BMBF | Federal Ministry of Education and Research |
| BMWi | Federal Ministry for Economic Affairs and Energy |
| bn | billion |
| BVDS | Association of German Foundations |
| BVK | German Private Equity and Venture Capital Association |
| CDTM | Center for Digital Technology and Management |
| CEPR | Center for Economic Policy Research |
| Ed./Eds. | Editor(s) |
| EDC | European Data Cooperative (pan-European statistics platform) |
| e.g. | exempli gratia (for example) |
| EIB | European Investment Bank |
| EIF | European Investment Fund |
| ERP | European Recovery Program |
| etc. | et cetera |
| FIR | Forschung. Innovation. Realisierung (Institute for Industrial Management at RWTH Aachen University) |
| HTGF | High-Tech Gründerfonds |
| IE.F | Internet Economy Foundation |
| IHK | German Chamber of Commerce and Industry |
| IoT | Internet of Things |
| IPO | Initial Public Offering |
| LTSE | Long-Term Stock Exchange |
| M&A | Mergers and Acquisitions |
| mn | million |
| N.B. | nota bene |
| p. | page |
| PE | Private Equity |
| R&D | research and development |
| SME | small and medium-sized enterprise |
| USA | United States of America |
| VDMA | Mechanical Engineering Industry Association in Germany |

Appendix B: Illustrations

| | | |
|-----------|--|----|
| Figure 1: | Expert panel for the project "Strengthening the growth finance ecosystem" | 10 |
| Figure 2: | Venture capital investment by portfolio company location in € bn | 13 |
| Figure 3: | Median venture capital investment per company by development stage, Q1 2018, in € mn | 13 |
| Figure 4: | Outline of a new market for private growth capital | 26 |



References

acatech 2011

acatech (Ed.): *Cyber-Physical Systems: Innovationsmotor für Mobilität, Gesundheit, Energie und Produktion*. (acatech POSITION), Munich: Springer Verlag 2011.

acatech 2015

acatech: *Das Internet der Dinge verstehen*, 2015.

URL: <https://www.acatech.de/allgemein/das-internet-der-dinge-verstehen/> [accessed 04.04.2019].

acatech 2018a

acatech (Ed.): *Qualitätskriterien in den Technikwissenschaften. Empfehlungen zur Bewertung von wissenschaftlichem Erfolg* (acatech POSITION), Munich: Herbert Utz Verlag 2018.

acatech 2018b

acatech (Ed.): *Berufungen in den Technikwissenschaften. Empfehlungen zur Stärkung von Forschung und Innovation* (acatech POSITION), Munich: Herbert Utz Verlag 2018.

Achleitner et al. 2016

Achleitner, A.-K./Braun, R./Metzger, G./Schmidt, M.: "The impact of the financial crisis on financing technology ventures." In: *International Journal of Entrepreneurship and Small Business*, 29: 1, 2016, pp. 4-24.

Achleitner 2018a

Achleitner, A.-K.: *definition of private equity*, 2018.
URL: <https://wirtschaftslexikon.gabler.de/definition/private-equity-45569/version-268861> [accessed 10.05.2019].

Achleitner 2018b

Achleitner, A.-K.: *definition of exit*, 2018.
URL: <https://wirtschaftslexikon.gabler.de/definition/exit-36164/version-259628> [accessed 25.05.2019].

Achleitner/Lange 2019a

Achleitner, A.-K./Lange, T.: "Wo sind die deutschen Hightech-Gründer?". In: *Frankfurter Allgemeine Zeitung* (guest column), 14.01.2019, p. 16.

Achleitner/Lange 2019b

Achleitner, A.-K./Lange, T.: "Europa braucht mehr Hightech-Startups – und muss einen eigenen Weg finden, diese zu finanzieren". In: *Neue Zürcher Zeitung* (guest column), 29.03.2019, p. 9.

BDI 2016

Bundesverband der Deutschen Industrie (Ed.): *Industrie-Startups stärken. Die nächste Unternehmensgeneration erfolgreich machen*, Berlin: Industrie-Förderung 2016.

BDI/Deutsche Bank 2018

Bundesverband der Deutschen Industrie (BDI)/Deutsche Bank (Eds.): *Die größten Familienunternehmen in Deutschland. Unternehmensbefragung 2018 – Kooperationen mit Start-ups*, Bonn 2018.

Beise/Schäfer 2016

Beise M./Schäfer, U.: *Deutschland Digital – unsere Antwort auf das Silicon Valley*, Frankfurt/Main: Campus Verlag 2016.

BMBF 2017

Bundesministerium für Bildung und Forschung (Ed.): *Mehr Chancen für Gründungen. Fünf Punkte für eine neue Gründerzeit*, Bonn 2017.

BMWi 2019

Bundesministerium für Wirtschaft und Energie: *Überblick zu Förderinstrumenten zur Gründungs- und Wachstumsfinanzierung*, Berlin 2019.

Braun 2019

Braun, R.: "Private Capital Marketplaces – A Note on How Venture Capital Might Evolve", SSRN working paper, 2019.

Braun et al. 2019a

Braun, R./Jenkinson, T./Schemmerl, C.: "Adverse Selection and the Performance of Private Equity Co-Investments", in press.
In: *Journal of Financial Economics*, 2019.

Braun et al. 2019b

Braun, R./Weik, S./Achleitner, A.-K.: "Foreign Venture Capital in Europe: Consequences on Ventures' Exit Routes and Entrepreneurial Migration", SSRN working paper, 2019.

Breuer 2018

Breuer, W.: *definition of venture capital*, 2018.
URL: <https://wirtschaftslexikon.gabler.de/definition/venture-capital-49706/version-272933> [accessed 10.05.2019].

BVDS 2018

Bundesverband Deutscher Stiftungen: *Beurteilung der eigenen Rendite: Lag Ihre Stiftung mit der Rendite der Vermögensanlage nach Abzug aller Kosten oberhalb der jährlichen Inflationsrate?* (Results of BDVS online survey), 2018. URL: https://www.stiftungen.org/fileadmin/stiftungen_org/Stiftungen/Zahlen-Daten/2019/Beurteilung-Rendite.pdf [accessed 24.05.2019].

BVDS 2020

Bundesverband Deutscher Stiftungen 2019: *Studie zur Zukunft des Stiftens*, in press 2020.

BVK 2018a

Bundesverband Deutscher Kapitalbeteiligungsgesellschaften: *German Private Equity Barometer: Ergebnisse 2018*. URL: <https://www.bvkap.de/markt/private-equity-barometer/ergebnisse-2018> [accessed 10.03.2019].

BVK 2018b

Bundesverband Deutscher Kapitalbeteiligungsgesellschaften: *Der Beteiligungskapitalmarkt in Europa 2017 und die Rolle Deutschlands*, 2018. URL: https://www.bvkap.de/sites/default/files/page/20180510_statistik_europa_2017_praesentation_final.pdf [accessed 11.05.2019].

BVK et al. 2018

Bundesverband Deutsche Kapitalgesellschaften (BVK)/Internet Economy Foundation (IE.F)/Roland Berger (Eds.): *Treibstoff Venture Capital: Wie wir Innovation und Wachstum befeuern*, Berlin 2018.

BVK 2019

Bundesverband Deutscher Kapitalbeteiligungsgesellschaften (Ed.): *Fragen und Antworten – was ist Wagniskapital?*, 2019. URL: <https://www.bvkap.de/beteiligungskapital/fragen-antworten/was-ist-wagniskapital> [accessed 07.05.2019].

Can et al. 2018

Can, E./Forster, J./Frank, B./Franke, M./Henseleit, L./Hoffmann, J./Kawohl, J./Michael, A./Rafat, S./Schiensstock, A./Sonnenberg, Y.: "Kooperation outside the Box". In: *Unternehmer Edition/Venture Capital Magazin* (Ed.): *Corporates & Start-ups. Kooperation outside the Box (E-Special)*, Munich: GoingPublic Media 2018, pp. 6-8.

CB Insights 2018

CB Insights (Ed.): *The 2018 Global CVC Report. A comprehensive, data-driven look at global corporate venture capital activity*, CB Insights 2018.

Commerzbank 2019

Commerzbank (Ed.): *Pay-per-Use: Maschinen nutzungsorientiert finanzieren*, 2019. URL: https://www.firmenkunden.commerzbank.de/portal/de/cb/de/firmenkunden/insights/pay_per_use.html [accessed 25.05.2019]

Da Rin et al. 2013

Da Rin, M./Hellmann, T./Puri, M.: "A Survey of Venture Capital Research". In: Constantinides, G.M./ Harris, M./ Stulz, R.M. (Eds.): *Handbook of the Economics of Finance*, 2: A, 2013, pp. 573-648.

Deloitte 2018

Deloitte (Ed.): "Germany's Digital Hubs. The Geography of Tech Talents". In: Deloitte (Ed.): *Series of Studies: Data Nation Germany*, 11, 2018.

Deutsche Handelsbank 2019

Deutsche Handelsbank (Ed.): *Fragen und Antworten zur Wachstumsfinanzierung*, 2019. URL: <https://www.handelsbank.com/geschaeftskunden/finanzierung/wachstumsfinanzierung.html> [accessed 28.05.2019]

Dodgson/Gann 2018

Dodgson, M./Gann, D.: *The missing ingredient in innovation: patience*, 2018. URL: <https://www.weforum.org/agenda/2018/04/patient-capital/> [accessed 26.04.2018].

EIB 2018a

European Investment Bank (EIB): *Venture Debt: Finanzierungen für kleine, risikoreiche und unglaublich innovative Projekte*, 2018. URL: <http://www.eib.org/de/products/lending/venture-debt/index.htm> [accessed 30.01.2019].

EIB 2018b

European Investment Bank (EIB): *Erster Venture Debt Summit der European Investment Bank*, 2018. URL: <https://www.eib.org/de/events/1st-eib-venture-debt-summit.htm> [accessed 06.04.2019].

EIB 2019

European Investment Bank: "EIB bleibt größter Venture-Debt-Anbieter in der EU" (press release 28.03.2019). URL: <https://www.eib.org/de/press/all/2019-087-eib-remains-the-largest-venture-debt-provider-in-the-eu.htm> [accessed 23.05.2019].

**Engel/Keilbach 2007**

Engel, D./Keilbach, M.: "Firm level implications of early stage venture capital investments – An empirical investigation". In: *Journal of Empirical Finance*, 14: 2, 2007, pp. 150-167.

Ernst & Young 2015

Ernst & Young (Ed.): *Liquidity meets perspective. Venture Capital and Start-ups in Germany*, Berlin 2015.

Ernst & Young 2018

Ernst & Young (Ed.): *Fast growth beyond borders: Tech start-ups reshaping the economy. Venture Capital and start-ups in Germany*, Berlin 2018.

Ernst & Young 2019a

Ernst & Young (Ed.): *Start-up-Barometer Deutschland*, Berlin 2019.

Ernst & Young 2019b

Ernst & Young (Ed.): *Fast growth beyond borders: Tech start-ups reshaping the economy. Venture Capital and start-ups in Germany*, Berlin 2019.

Ewens et al. 2018

Ewens, M./Nanda, R./Rhodes-Kropf, M.: "Cost of experimentation and the evolution of venture capital". In: *Journal of Financial Economics*, 128: 3, 2018, pp. 422-442.

Fang et al. 2015

Fang, L./Ivashina, V./Lerner, J.: "The disintermediation of financial markets: Direct investing in private equity". In: *Journal of Financial Economics*, 116: 1, 2015, pp. 160-178.

Frankfurter Allgemeine Sonntagszeitung 2019

Frankfurter Allgemeine Sonntagszeitung: "Ich würde auch 80 Prozent Steuern zahlen" (Interview with SAP founder Dietmar Hopp). In: *Frankfurter Allgemeine Sonntagszeitung*, 10.03.2019, p. 19.

Gründerszene 2018a

Gründerszene: *115 Milliarden Dollar und ein Plan für Deutschland*. (Interview with Greg Becker, Chief Executive Officer and with Christian Hoppe, Managing Director for the German market, both from the Silicon Valley Bank), 2018.
URL: <https://www.gruenderszene.de/business/silicon-valley-bank-ceo-interview> [accessed 24.05.2019].

Gründerszene 2018b

Gründerszene: *So lief der Deutschlandstart der Silicon Valley Bank*. (Interview with Oscar Jazdowski, German Chief Executive Officer of the Silicon Valley Bank), 2018.
URL: <https://www.gruenderszene.de/business/silicon-valley-bank-so-lief-der-deutschland-start?interstitial> [accessed 24.05.2019].

Handelsblatt 2016

Handelsblatt: "Mittelständler legen Gründerfonds auf: Wage-mütige Familien". In: *Handelsblatt*, 16.12.2016.

Handelsblatt 2018

Handelsblatt: "Europäische Start-ups erleben gerade ihren Durchbruch" (Interview with Skype founder Niklas Zennström). In: *Handelsblatt*, 11.12.2018.

Hellmann/Puri 2000

Hellmann, T./Puri, M.: "The Interaction between Product Market and Financing Strategy: The Role of Venture Capital." In: *The Review of Financial Studies*, 13: 4, 2000, pp. 959-984.

Hengster 2016

Hengster, I.: "Schwungrad für mehr Innovation und Wachstum: Venture Capital in der Start-up- und Wachstumsphase". In: *Kreditwesen*, 10, 2016, pp. 21-23.

Hesse et al. 2016

Hesse, M./Lutz, E./Talmor, E.: "Liquidity Runway and Horizon of Disappointment: Business Model of Venture Lending". In: *The Journal of Alternative Investments*, 19: 2, 2016, pp. 28-37.

Hirukawa/Ueda 2008

Hirukawa, M./Ueda, M.: "Venture Capital and Industrial Innovation". In: *CEPR Discussion Paper*, DP7089, 2008.

HM Treasury 2017

HM Treasury (Ed.): *Financing growth in innovative firms: consultation*, London: Crown 2017.

HM Treasury 2018

HM Treasury (Ed.): *Financing growth in innovative firms: one-year on*, London: Crown 2018.

HTGF 2019

High-Tech Gründerfonds (Ed.): *High-Tech Gründerfonds. Vom Pre-Seed zum Exit*, 2019.

URL: https://high-tech-gruenderfonds.de/wp-content/uploads/2017/11/Image-Flyer__FIII__016__de.pdf [accessed 20.05.2019].

IHK 2017

Industrie- und Handelskammer (Ed.): *Positionspapier zur Finanzierung von Startups*, Munich: IHK für München und Oberbayern 2017.

Jazdowski 2018

Jazdowski, O.: *Venture Debt: Was ist das eigentlich und wie können Risikokredite Startups helfen?* (guest article by Oscar Jazdowski, Co-Head of Silicon Valley Bank Deutschland), 2018.

URL: <https://www.munich-startup.de/42330/venture-debt/> [accessed 05.05.2019].

Kagermann et al. 2016

Kagermann, H./Anderl, R./Gausemeier, J./Schuh, G./Wahlster, W. (Eds.): *Industrie 4.0 im globalen Kontext – Strategien der Zusammenarbeit mit internationalen Partnern* (acatech STUDIE), Munich: Herbert Utz Verlag 2016.

Kagermann/Winter 2018

Kagermann, H./Winter, J.: "Die zweite Welle der Digitalisierung. Deutschlands Chance". In: Mair, S./Messner, D./Meyer, L. (Eds.): *Deutschland und die Welt 2030. Was sich verändert und wie wir handeln müssen*, Berlin: Econ 2018.

KfW 2018a

KfW: "Neue Beteiligungstochter KfW Capital: Wagniskapitalfinanzierung in Deutschland wird gestärkt" (press release 09.10.2018).

URL: https://www.kfw.de/KfW-Konzern/Newsroom/Aktuelles/Pressemitteilungen-Details_490496.html [accessed 28.05.2019].

KfW 2018b

KfW: *Die Geschäftsführer von KfW Capital, Dr. Jörg Goschin und Alexander Thees, über die Wirkung des neuen Tochterunternehmens der KfW auf den Venture-Capital-Markt in Deutschland* (published in "KfW-Stories"), 2018.

URL: <https://www.kfw.de/stories/wirtschaft/gruenden/inter-view-kfw-capital-geschaeftsfuehrer/> [accessed 04.05.2019].

KfW 2019

KfW: "Gründungsoffensive: KfW und Bund starten Venture Debt Finanzierung für innovative Unternehmen in der Wachstumsphase" (press release 27.03.2019).

URL: https://www.kfw.de/KfW-Konzern/Newsroom/Aktuelles/Pressemitteilungen-Details_513152.html [accessed 23.05.2019].

KfW Capital 2019

KfW Capital: *Investmentfokus von KfW Capital / ERP-VC-Fondsinvestments*, 2019.

URL: <https://kfw-capital.de/investmentfokus/> [accessed 28.05.2019].

Kortum/Lerner 2000

Kortum, S./Lerner, J.: "Assessing the Contribution of Venture Capital to Innovation". In: *The RAND Journal of Economics*, 31: 4, 2000, pp. 674 - 692.

LEE 2018

Lee, K.-F.: *AI Super-Powers. China, Silicon Valley and the New World Order*, Boston: Mariner Books 2018.

LTSE 2019

Long-Term Stock Exchange: "A stock exchange for a new generation of public companies. More than a market; a movement" (press release 10.05.2019).

URL: <https://ltse.com/articles/stock-exchange-for-new-generation-of-public-companies> [accessed 10.05.2019].

Madhvani 2017

Madhvani, M./ Casartelli, A./ Kuperman, A./Maerz, M./Ezerzer, J.: *Titans of Tech. Europe's Flagship Companies*, London: GP Bullhound 2017.

Metzger 2019

Metzger, G.: "Gemischte Stimmung zum Jahresende". In: *KfW Research – German Private Equity Barometer*, 02: 2019, pp. 1-3.

Metzger/Bauer 2015

Metzger, G./Bauer, A.: "Beteiligungsmarkt in Deutschland – Lücke bei Venture Capital". In: *KfW Research – Fokus Volkswirtschaft*, 98: 7, 2015, pp. 1-3.

NKF 2018

NKF Media (Ed.): *The Hundert 11 – Startups of Germany*, Berlin: NKF Media 2018.



Plattform Industrie 4.0 2015

Plattform Industrie 4.0 (Ed.): *Industrie 4.0. Whitepaper FuE-Themen*, 2015.

URL: <https://www.din.de/blob/67744/de1c706b159a6f1baceb95a6677ba497/whitepaperfue-themen-data.pdf> [accessed 30.04.2019].

Popov/Roosenboom 2012

Popov, A./Roosenboom, P.: "Venture capital and patented innovation: evidence from Europe." In: *Economic Policy*, 27: 71, 2012, pp. 447-482.

Puri/Zarutskie 2012

Puri, M./Zarutskie, R.: "On the Life Cycle Dynamics of Venture-Capital- and Non-Venture-Capital-Financed Firms". In: *The Journal of Finance*, 67: 6, 2012, pp. 2247-2293.

Telekom Capital Partners/OC&C Strategy Consultants 2017

Telekom Capital Partners/OC&C Strategy Consultants (Eds.): *Wagniskapital in Deutschland. Bestandsaufnahme und Massnahmenkatalog zur Förderung der Wagniskapitalindustrie in Deutschland*, Bonn 2017.

Tian/Wang 2014

Tian, X./Wang, T.Y.: "Tolerance for Failure and Corporate Innovation". In: *The Review of Financial Studies*, 27: 1, 2014, pp. 211-255.

UnternehmerTUM/Wissensfabrik 2014

UnternehmerTUM/ Wissensfabrik - Unternehmen für Deutschland (Eds.): *Collaborate to innovate*, Garching 2014.

VDMA/EBS 2019

VDMA Startup-Maschine/EBS Universität für Wirtschaft (Eds.): *Maschinenbau ist hungrig auf Startups*, Frankfurt am Main 2019.

Wallisch/Hemeda 2018

Wallisch, M./Hemeda, A.: *Mittelstand meets Startup 2018. Potenziale der Zusammenarbeit*, Düsseldorf: RKW Kompetenzzentrum 2018.

Welt 2018

Welt: "Sieben Billionen Euro – dann ist unser Rückstand aufgeholt". In: *Welt*, 09.11.2018.

Wirtschaftswoche 2019

Wirtschaftswoche: "Deutschlands nächste Jobmaschinen". In: *Wirtschaftswoche*, 10: 2019, pp. 66-71.

Working Group Smart Service World 2015

Arbeitskreis Smart Service Welt/acatech (Eds.): *Smart Service Welt – Umsetzungsempfehlungen für das Zukunftsprojekt Internetbasierte Dienste für die Wirtschaft. Final report*, Berlin 2015.

Zimmermann 2019

Zimmermann, V.: "Die Finanzierung von Innovationen und Investitionen in mittelständischen Unternehmen im Vergleich". In: *KfW Research – Fokus Volkswirtschaft*, 237: 1, 2019, pp. 1-6.

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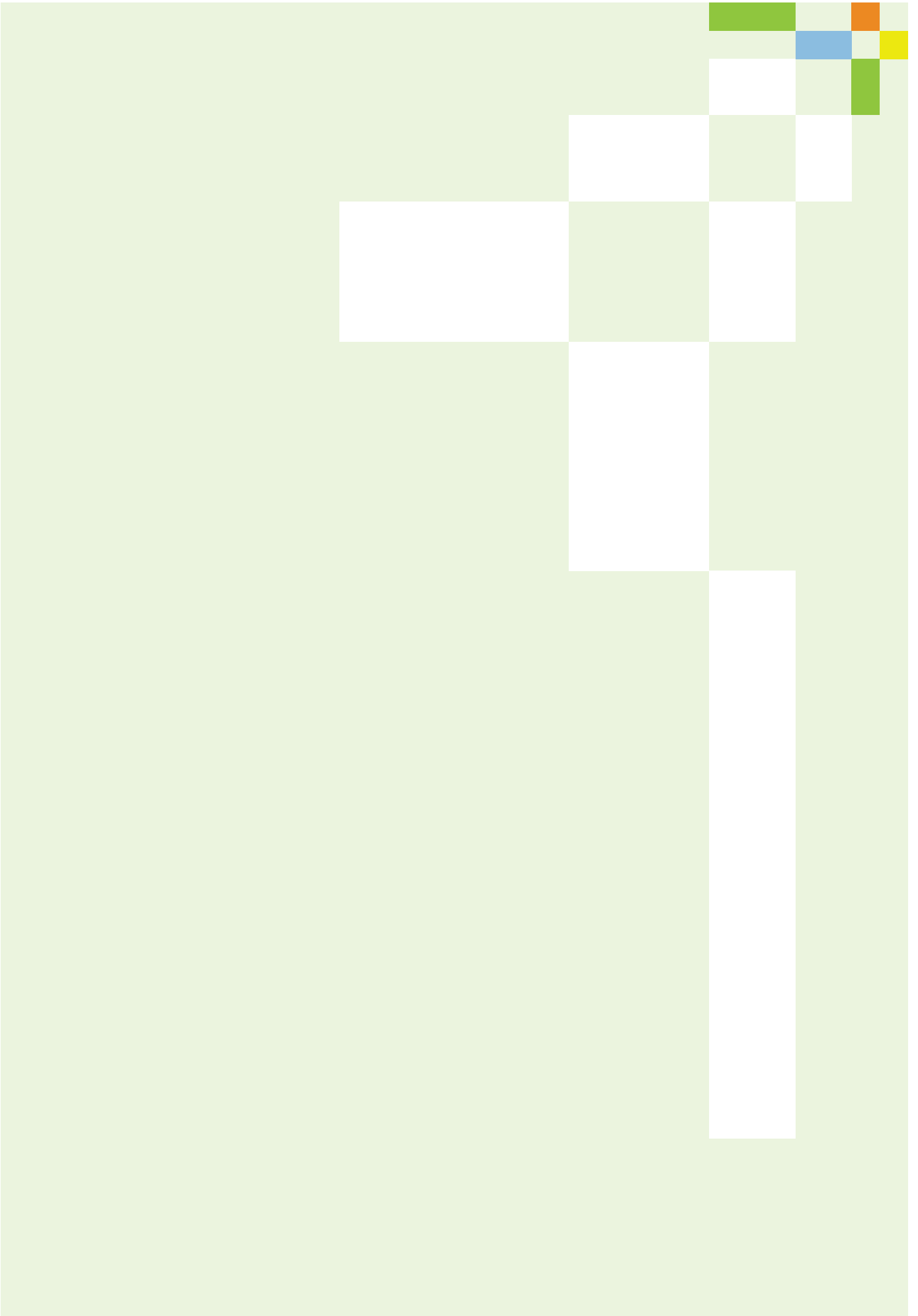
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Insufficient access to capital for high-tech growth companies is one of the key weaknesses of Germany's innovation system. This weakness is becoming a serious competitive disadvantage, especially in the context of the radical technological innovation, new business models and rapid growth demanded by the digital transformation.

In a joint project with KfW and Deutsche Börse, acatech brought together a range of actors from the financial sector with high-tech growth companies and representatives of academia and industry in order to carry out a detailed analysis of the status quo and formulate recommendations for government, academia and industry.

The study's recommendations are not confined to the mobilisation of traditional venture capital. They also highlight alternative forms of financing and in particular the interfaces between high-tech growth companies, established businesses and academic institutions. These interfaces are one important key to build a strong competitive position in Germany with regard to industrial digitalisation.