

»» SME innovations: Seven reasons for the decline in the share of innovators

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Author: Dr Volker Zimmermann, phone +49 69 7431-3725, volker.zimmermann@kfw.de

The share of innovators among SMEs has decreased noticeably since the middle of the last decade. The decline is due to cyclical, macroeconomic, structural and, above all, innovation-specific aspects.

Among other things, SMEs have lacked distinct sales prospects. This was the result of the weak business cycle and uncertainties caused by political imponderables. The falling start-up rate has also led to a decline in innovative junior entrepreneurs.

Returns on innovation have dropped as well. This is likely to have discouraged enterprises and caused innovative activities to be discontinued across the breadth of the SME sector in particular. It has also added to the challenge of accessing finance for innovations over the past decade.

Increased problems in filling innovation-relevant jobs and the ageing of the workforce have also combined to weaken the capacity of small and medium-sized enterprises to innovate.

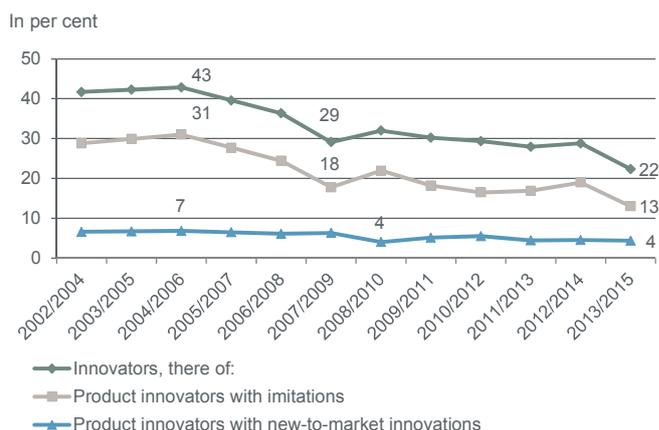
To make matters worse, the 'new economy boom' was not followed by a further technological push that would have offered SMEs a broad field of innovation opportunities. The widely discussed digitalisation wave might be such a technological push.

Innovation is concentrated in increasingly fewer enterprises

The share of innovators among SMEs has fallen noticeably since the middle of the last decade.¹ In the period from 2004/2006 to 2013/2015, it fell from 43 to now only 22%. The drop was particularly sharp in the share of SMEs that introduced imitative product innovations. However, the share of enterprises with new-to-market product innovations remained relatively stable by comparison (Figure 1).²

The aggregate sum of innovation expenditure by small and medium-sized enterprises (SMEs) has changed only little, unlike the share of innovators. Innovation expenditure by SMEs (with up to 499 employees) rose by around 14% in nominal terms since the middle of the past decade. This was a slight decline in relation to turnover.³ SMEs' innovation efforts are thus concentrated in increasingly fewer enterprises. Large enterprises (with 500 or more employees), by contrast, have increased their innovation expenditure by some 50% since the middle of the past decade.

Figure 1: Development of innovators among SMEs



Source: KfW SME Panel, own calculations

The share of innovators has dropped in all size classes of SMEs but mostly in small enterprises with fewer than ten employees. In sector terms, it is evident that R&D-intensive manufacturing firms in particular (e.g. engineering, electronics and chemical industries) have bucked the downward trend. In other sectors where innovation-based business models are less common (such as construction and services), the share of innovators has dropped much more sharply.⁴ There are a number of reasons for this.

Weak business cycle reduces sales prospects

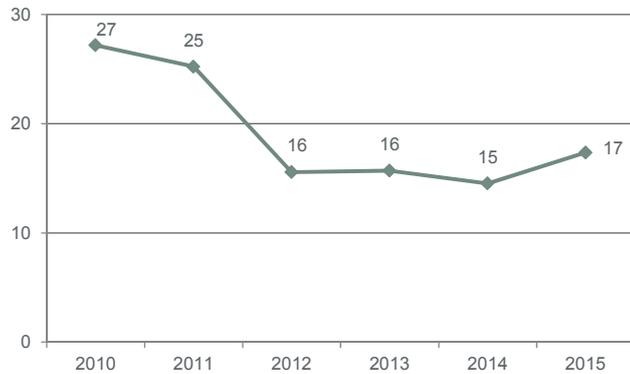
In the past years, the weak business cycle led to a situation in which enterprises lacked distinct sales prospects. Uncertainty resulting from political imponderables is likely to have contributed to it as well.⁵ Consequently, the balance of SMEs' medium-term sales expectations fell from 27% in 2010 to 15% in 2014. It is only at the current margin that initial signs of a recovery are appearing, with the balance rising to 17% (Figure 2).

Surveys by KfW Research show that bringing forth imitative product innovations (imitations) in particular depends heavily on the cyclical situation. The likelihood of a typical SME generating imitative product innovations when turnover expectations are relatively good, such as in the year 2010, is around 21%. When turnover expectations are comparatively low (2014), that likelihood is around 18%, or three percentage points lower. Genuine new-to-market innovations, on the other hand, are hardly affected by fluctuating business cycles. Thus, the likelihood of generating new-to-market innovations changes by a mere 0.3 percentage points in relation to different turnover expectations (Figure 3).

Variations in turnover expectations may explain the decline of just under four percentage points in the likelihood of generating any innovations at all (irrespective of the type of innovation).⁶

Figure 2: Development of turnover expectations

Balance of positive minus negative reports on three-year expectations for turnover development



Source: KfW SME Panel, own calculations

Figure 3: Probability of generating innovations as a function of turnover expectations

Probability in per cent



Note: Model calculations on the basis of regression analyses

Source: KfW SME Panel, own calculations

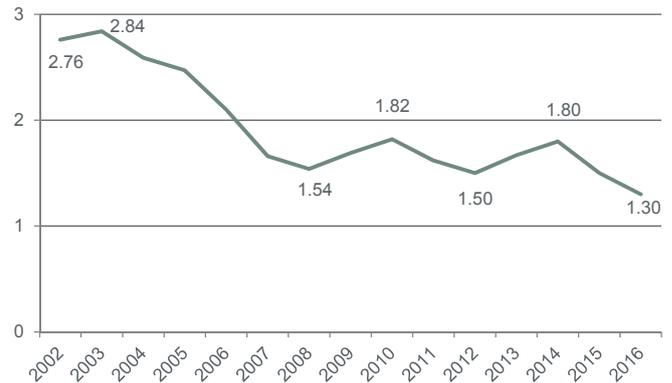
These findings reflect the fact that innovations are easier to place in the market when demand is expanding. Moreover, development and market introduction are easier for businesses to finance in a favourable cyclical situation. In favourable cyclical phases, enterprises typically generate mainly imitative innovations because they are relatively easy to implement. New-to-market innovations, on the other hand, are more commonly developed over longer periods of time and placed in the market only after a strategic decision.⁷

Declining start-up numbers reduce share of innovators

The development of start-up activity is one of the more structural causes of the decline in the share of innovators. The start-up rate has declined since 2003 from 2.84 % to now 1.30 % (Figure 4). The main reason for this is the good labour market situation which offers attractive alternatives to self-employment.⁸

Figure 4: Start-up rate continues to decline

Start-up rate in per cent



Note: The start-up rate is the annual share of business founders in the population aged 18 to 64 years

Source: KfW Start-up Monitor

This general decline in the start-up rate is also reflected in the number of innovative business founders.⁹ Besides, young enterprises innovate more often than older enterprises. The share of innovators in the current survey of the KfW SME Panel is 31 % among businesses that are less than six years old. For enterprises that have been operating for 20 or more years, that rate is a mere 20 %.

This is because in the first years young enterprises are usually still busy expanding their product range. Besides, newly founded businesses in innovative market segments are often the first to embrace new technologies from which they develop marketable products and services.¹⁰ A decline in the comparatively innovative group of younger businesses thus reduces the overall share of innovators in SMEs.

Declining returns on innovation discourage latecomers

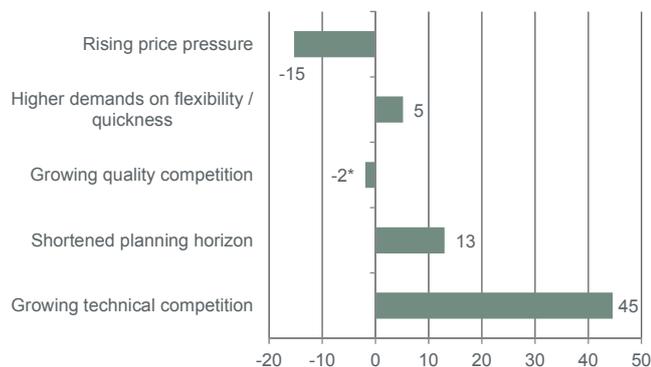
According to calculations on the basis of the Mannheim Innovation Panel (MIP), in the past years SMEs experienced a significant decline in income from innovations. Since 2006, returns on innovation (profit from innovations in relation to innovation expenditure) have fallen almost continuously to a good one half of their original level.¹¹

One consequence of this will likely be that those businesses, in particular, that do not rank among the innovation pioneers, will stop innovating. The model of Aghion et al. (2005) assumes that increasing competition de-motivates latecomers in particular, causing them to bring product innovations to the market less often.¹² The reason for this is that growing competition reduces income from catching up with technology leaders.

In fact, a decline in innovation activity can currently be observed primarily among innovators that generate imitations. At the same time, innovation efforts are increasing in some segments that are typically counted among the pioneers – such as in large enterprises or in the automotive industry. According to the above model, growing competition would be a cause for the decline in returns from innovation and the share of innovators.

Figure 7: Consequences of growing competition on innovation probability by type of competition

Variation in the probability of generating innovations in per cent



Note: * Statistically not significant; model calculation based on regression analyses

Source: KfW SME Panel, own calculations

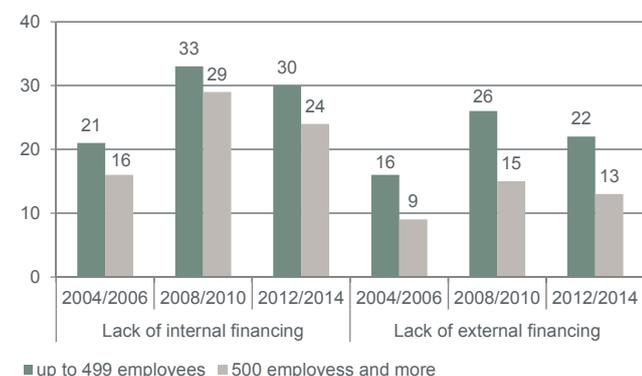
It is also evident that, broadly, small and medium-sized enterprises actually do not respond to growing competition by stepping up their innovation efforts at all – with the exception of the R&D-intensive manufacturing sector – but with cost reductions and price adjustments.¹³ Mounting price pressure in particular leads to reduced innovative activity. In contrast, growing technological competition of the type expected primarily from technological pioneers does increase innovative activity (Figure 7).¹⁴ Rammer et al. (2012) have also demonstrated that a high number of competitors and a high threat from market entrants curb investment in technological knowledge. On the other hand, rapid technological change and short product life cycles motivate businesses to step up investment in technological knowledge.¹⁵

Growing financing difficulties hamper innovation activity

The barrier to innovation most often cited by SMEs – besides high costs and high risk – is lack of internal or external funding.¹⁶ Compared to the middle of the past decade, the share of affected SMEs (with up to 499 employees) has risen by around two fifths (Figure 5).

Figure 5: Distribution of funding barriers to innovation

In per cent of all innovative enterprises

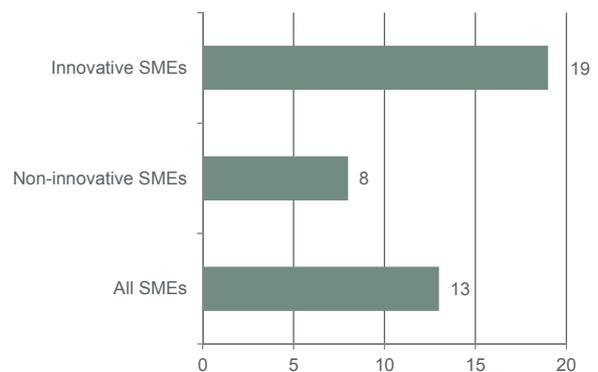


Source: ZEW

The decline in returns from innovation over the past years is likely to be one reason for increased difficulties in funding innovation projects from internal resources. ZEW and Prognos attribute the greater difficulty in accessing external funding to banks' heightened sensitivity to risk as a result of the financial and economic crisis, and to tightened regulatory requirements.¹⁷ It is conceivable in this regard that the more extensive reporting obligations and, for example, limits to maximum credit exposures through the leverage ratio imposed on banks have made it less attractive to lend money to innovation projects of SMEs that are comparatively small and, from banks' point of view, less profitable, and hold less promise of success.

Figure 6: SMEs that did not innovate because of lack of funds in 2011–2013

In per cent



Note: SMEs are classified here as enterprises with up to 249 employees

Source: Rammer et al. (2016)

For the period of 2011/2013, the ZEW calculated that 13% of all SMEs (classified here as businesses with up to 249 employees) did not carry out innovation activities because of funding difficulties. In 8% of SMEs that did not innovate, funding difficulties prevented the implementation of innovation projects entirely (Figure 6).¹⁸ If we apply this figure to the share of non-innovators in the KfW SME Panel during the same period, that means the share of innovators without funding difficulties would have been nearly six percentage points higher.

Skills shortage as a barrier to innovation

The second biggest barrier to innovation after funding difficulties is a shortage of skilled workers. Analyses conducted on the basis of the Mannheim Innovation Panel (MIP) confirm that enterprises indicated a shortage of skilled workers more than twice as often as a barrier to innovation than in the middle of the last decade. This is probably due to the fact that recruiting workers is becoming increasingly difficult – although the labour force potential has not changed significantly since then.¹⁹ For one thing, the number of school leavers is on the decline. For another, the pool of unemployed workers has shrunk considerably in the past years. At the same time, enterprises have not expanded their basic and advanced training measures at the same rate as the availability of skilled workers on the job market has decreased.

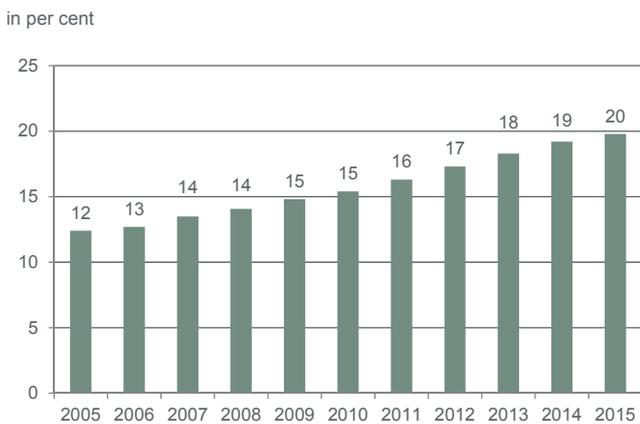
Large SMEs and enterprises not considered pioneers are most affected by the skills shortage. One reason for this is probably the fact that innovation-relevant expertise in these enterprises is often concentrated in only a few employees. Replacing such expertise is difficult because it often takes the form of implicit knowledge of which there are no written records.²⁰ Besides, specialising in niche markets and aligning innovative activity with customers' requests very specific knowledge that is often not directly available on the labour market.²¹

Ageing of the workforce is slowing innovation activity

Germany's working age population is growing older on average. The share of over 54-year-olds in the workforce has already reached 20 %. This share has grown by eight percentage points since 2005 (Figure 8).

The analysis on the basis of the KfW SME Panel shows that an enterprise's innovative output declines as its workforce ages. This applies to both product and process innovations. The likelihood of a typical SME innovating diminishes by nearly one fourth when the share of over 54-year-olds in the workforce is 75 and not 16 % (Figure 9).²² When the share of over 54-year-old workers rises from 12 to 20 %, a 1.2 percentage point decline in the probability of a typical SME innovating can be ascertained. Reasons include decreasing mental flexibility²³, a dwindling stock of relevant human capital, and a preponderance of experiential knowledge (as opposed to newly created knowledge).²⁴

Figure 8: Share of over 54-year-olds in the workforce



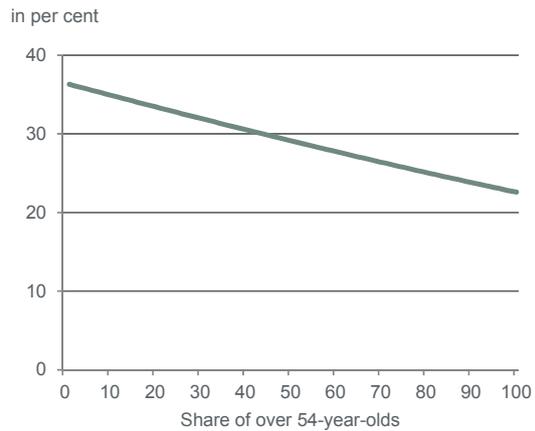
Note: The workforce is defined as including blue-collar and white-collar employees but excluding apprentices, trainees, public servants, and unpaid contributing family members.

Source: Destatis, own calculations

Absence of technological push is preventing innovation

The absence of a technological push may offer another explanation for the decline in innovation activity. ZEW and Prognos pointed out that the trend towards less innovation began to set in already at the turn of the millennium. The high share of innovators at the start of the new millennium was also the consequence of the digitalisation push at the time, when the catchword was 'New Economy'.

Figure 9: Influence of workforce age on the probability of innovating



Note: Model calculation based on a regression analysis

Source: KfW SME Panel, own calculations

The possibility of creating their own websites and the introduction of e-commerce and electronic communication provided many opportunities to innovate, even for small and less innovative enterprises.²⁵ In the years that followed, this innovation potential was clearly exhausted and new, technological impetus of comparable breadth has failed to come about so far. The decline in the share of innovators could therefore also be attributed to the absence of such a technological push. The digitalisation wave which is currently being debated might help to increase the share of innovators again.

Conclusion

Besides technological start-ups, the most innovative SMEs include, first and foremost, large enterprises and R&D-intensive manufacturers. Innovative SMEs usually employ graduates and are more often managed by entrepreneurs with a tertiary degree. Innovative SMEs are often active in foreign markets as well. They are often domiciled in urban regions and cooperate with other enterprises. Enterprises that generate new-to-market innovations in particular often conduct their own R&D and cooperate with research institutes.²⁶

The observable decline in the share of innovators is attributable not so much to pioneer enterprises but to the bulk of latecomers. This is a worrisome trend as well because these innovators have the function of disseminating new technologies. Their innovations help to increase productivity across the business landscape. In this way they enhance the competitiveness of German businesses overall. Concern is justified particularly because a trend reversal in the share of innovators is not to be expected even in the currently favourable cyclical conditions.

A number of reasons are responsible for the decline in the share of innovators in SMEs. These include, besides cyclical factors, macroeconomic and structural as well as innovation-specific aspects. Economic policy is unable to address all of them in equal measure. At which points this is particularly worthwhile for economic policy with a view to expanding

innovation is illustrated in the following.

First, enterprises need to identify favourable sales prospects so that investing in new products and processes appears worthwhile from a business perspective. A sustained positive cyclical development in Germany and further recovery in the euro area appear to be the most important guarantors for this. Reducing political uncertainties is another influencing factor. All measures that bolster the positive cyclical development in Germany and Europe therefore contribute to strengthening innovation in SMEs as well.

Start-up activity needs to be expanded in order to ensure a sufficient supply of new enterprises as well as ownership and management successors. This means more people have to be encouraged to found their own business. One important way of doing this is to teach students entrepreneurial skills and indicate alternative forms of gainful activity while they are still at school.

Declining returns on innovation hamper innovation activity in the SME sector. This underscores how important it is for enterprises to generate sufficient income from their innovation efforts. This applies not just to imitators but, in particular, to the original innovators. Initial innovators must invest disproportionate amounts in their innovation projects – compared with possible imitators – in order to successfully develop new products and processes. Adequately protecting these efforts, including for SMEs, is therefore a precondition for high innovation activity.²⁷

Despite the generally good funding climate, problems accessing innovation finance are the obstacle most frequently mentioned. Supporting innovation finance and developing promotional schemes further is a permanent function of economic policy. An international comparison shows that state support for innovation activity in the business sector is low compared with the USA, the UK, France and Italy, for example.²⁸ So it can definitely be

assumed that there is potential to expand this support. Introducing tax concessions for R&D investment in the SME sector – as is done in the majority of OECD countries – would support a large number of businesses in their innovation efforts.

At the same time, skills shortages and ageing workforces restrict the innovative potential of SMEs. Training and professional development of skilled workers are the key to counteracting future skills shortages. Particularly with a view to ageing workforces, putting together multi-age teams and training employees are deemed important measures for harnessing and expanding existing skills within enterprises and maintaining their innovative capacity. Enterprises therefore need to further intensify their training and professional development efforts – supported, where necessary, by economic policy measures.

The currently debated trend towards digitalisation might be a driver of innovation in SMEs in future. Informing about the benefits and usefulness of further digitalisation and eliminating specific barriers to digitalisation might help to develop this innovation potential for small and medium-sized enterprises. In this regard, the core demands are: improve IT skills in the workforce, speed up the rollout of broadband internet, and eliminate uncertainty over IT security, future standards and liability aspects.²⁹

Not least, the innovation system as a whole needs to be strengthened. The German government has stepped up its efforts significantly since 2005. Nevertheless, it is important not to be satisfied with what has been achieved,³⁰ but to pursue ambitious goals. For example, the target for SME expenditure of 3.5% in relation to GDP, which was debated again this spring, should be addressed in the coming legislative period. ■

¹ An enterprise is classified as innovative when it has introduced at least one new or improved product or one new or improved process – from the viewpoint of the enterprise – in a period of three years.

² For details on the development of innovation activity in the SME sector cf. Zimmermann, V (2017): KfW Innovation Report 2016. Innovation is concentrated in increasingly fewer enterprises, KfW Research.

³ Cf. Rammer, C., Berger, M., Doherr, T., Hud, M., Hünemund, P., Iferd, Y., Peters, B. and T. Schubert (2017): Innovation behaviour in German enterprises. Indikatorenbericht zur Innovationserhebung (*Indicator report on innovation survey 2016*), Mannheim (in German).

⁴ The share of innovators is surveyed by the KfW SME Panel in accordance with OECD guidelines. Cf. OECD and Eurostat (2005) (Hrsg.): Oslo Manual. Guidelines for collecting and interpreting innovation data, OECD publishing. This publication covers the introduction of innovations within an enterprise over a three-year period. In the first years of the KfW SME Panel, innovation activity was collected only in every other wave.

⁵ Various studies have determined negative effects of uncertainty on economic parameters. Cf. Heymann, E. (2017): Uncertainty is slowing capital expenditure. Germany Monitor, DB Research, Grimme, C. and M. Stöckli (2017): Shortages of skilled workers in SMEs: Makroökonomische Unsicherheit in Deutschland, ifo Schnelldienst 6/2017, P. 41–50 or Belke, A. and D. Kronen (2017): The Impact of Uncertainty on Macro Variables – an SVAR-Based Empirical Analysis for EU Countries, Ruhr Economic Papers No. 699. One fundamental challenge to the concept of uncertainty is that the degree of uncertainty is not observable. Common measures of uncertainty range from expected volatility of stock market prices to volatility of business cycle expectations in company surveys to newspaper reports containing catchwords related to economic uncertainty. Depending on which measure is selected, the degree of uncertainty at a particular point in time varies significantly. The newspaper report-based indicator showed the highest rate at the time of the Brexit vote. Indicators referring to the stock market or corporate uncertainty, on the other hand, were highest during the financial and economic crisis of 2008/2009.

⁶ Cf. Poschen, K. and V. Zimmermann (2014): Falling sales expectations curb SME innovation activity in Germany, Economics in Brief No. 58, KfW Economic Research.

⁷ Cf. Zimmermann, V. (2000): Innovation und Konjunktur (Innovation and economic activity – our translation, in German). Standpunkt Nr. 4, KfW Economic Research.

⁸ Cf. Metzger, G. (2017): KfW Start-up Monitor 2017. Record employment with side-effects: fewer start-ups than ever. KfW Research, Frankfurt am Main.

⁹ Cf. Rammer, C., Gottschalk, S., Peters, B., Bersch, J. and D. Erdsiek (2016): Die Rolle von KMU für Forschung und Innovation in Deutschland (*The role of SMEs for research and innovation*

in Germany – our title translation, in German), Studien zum deutschen Innovationssystem No. 10/2016.

- ¹⁰ Cf. Niefert, M. and V. Zimmermann (2009): Die Dynamik im Innovationsverhalten kleiner und mittlerer Unternehmen, SME Monitor 2009, p. 107–134, KfW Economic Research (in German).
- ¹¹ Cf. Astor, M., Rammer, C., Klaus, C. and G. Klose (2016): Final report: Innovativer Mittelstand 2015 – Herausforderungen, Trends und Handlungsempfehlungen für Wirtschaft und Politik (*Innovative SMEs in 2015 – challenges, trends and recommendations for action for business and policy-makers* – our title translation, in German). Study commissioned by the German Federal Ministry for Economic Affairs and Energy.
- ¹² Cf. Aghion, P., Bloom, R., Blundell, R., Griffith, R. and P. Howitt (2005): Competition and Innovation: an inverted-U relationship, Quarterly Journal of Economics 120(2), p. 701–728.
- ¹³ Cf. Zimmermann, V. (2013): The innovation motor is sputtering, Focus on Economics No. 13, KfW Economic Research.
- ¹⁴ Zimmermann, V. (2015), KfW Innovation Report 2014: Standstill in Europe is slowing down innovation, KfW Research.
- ¹⁵ Cf. Rammer, C. and C. Köhler (2012): Innovationen, Anlageinvestitionen und immaterielle Investitionen (*Innovation, investment in plant and equipment and immaterial investment* – our title translation, in German), Wirtschaftspolitische Blätter 2/2016, p. 287–308.
- ¹⁶ Cf. Zimmermann, V. (2016): KfW SME Innovation Report 2015: Germany's innovation performance remains low despite slight increase, KfW Research, Frankfurt am Main.
- ¹⁷ Cf. Astor, M., Rammer, C., Klaus, C. and G. Klose (2016): Final report: Innovativer Mittelstand 2015 – Herausforderungen, Trends und Handlungsempfehlungen für Wirtschaft und Politik (*Innovative SMEs in 2015 – challenges, trends and recommendations for action for business and policy-makers* – our title translation, in German). Study commissioned by the German Federal Ministry for Economic Affairs and Energy.
- ¹⁸ Cf. Rammer, C., Gottschalk, S., Peters, B., Bersch, J. and D. Erdsiek (2016): Die Rolle von KMU für Forschung und Innovation in Deutschland (*The role of SMEs for research and innovation in Germany* – our title translation, in German), Studien zum deutschen Innovationssystem No. 10/2016.
- ¹⁹ Cf. Fuchs, J., Söhnlein, D. and B. Weber (2017): Projektion des Erwerbsspersonenpotenzials bis 2060. Arbeitskräfteangebot sinkt auch bei hoher Zuwanderung. IAB Kurzbericht 6/2017 (*Projection of labour force potential up to 2060. Labour supply will decline even with high immigration*). IAB short report 6/2017 (in German).
- ²⁰ Cf. Thomä, J. and V. Zimmermann (2016): Innovationshemmnisse im Mittelstand. Eine empirische Analyse unter Berücksichtigung des Handwerks (Barriers to innovation in SMEs. An empirical analysis which includes the skilled crafts). Göttinger Beiträge zur Handwerksforschung Nr. 6, Institute for Small Business Economics at the University of Göttingen.
- ²¹ Cf. Zimmermann, V. (2012): To be the Leader of the Pack? Innovation strategies in the German SME sector, Focus on Economics No.11., KfW Economic Research and Reize F. (2011): Fachkräftemangel im Mittelstand: Generelles oder partielles Problem? (*Shortages of skilled workers in SMEs: A general or partial problem?*) Akzente No. 41, KfW Economic Research (in German).
- ²² Cf. Zimmermann, V. (2016): SMEs and innovation - enterprises innovate less as their workforce ages, Focus on Economics No. 125, KfW Research, Frankfurt am Main.
- ²³ Cf. e.g. Schneider, L. (2010): Alterung und Arbeitsmarkt: Eine Untersuchung zum Einfluss des Alters von Beschäftigten auf Produktivität, Innovation und Mobilität. Dissertation at the Technical University of Dresden, or Arntz, M.; and T. Gregory (2014): What Old Stagers Could Teach Us – Examining Age Complementaries in Regional Innovation Systems, in: ZEW Discussion Paper No. 14-050, Centre for European Economic Research (ZEW), Mannheim.
- ²⁴ Cf. MacDonald, G. and M. S. Weisbach (2004): The economics of Has-beens. Journal of Political Economy 112(1), p. S289–S310, Aubert, P.; Caroli, E. and M. Roger (2006): New technologies, organization and age: firm level evidence. The Economic Journal 116, p. F73–F93.
- ²⁵ Cf. Astor, M., Rammer, C., Klaus, C. and G. Klose (2016): Final report: Innovativer Mittelstand 2025 – Herausforderungen, Trends und Handlungsempfehlungen für Wirtschaft und Politik (*Innovative SMEs in 2025 – challenges, trends and recommendations for action for business and policy-makers* – our title translation, in German). Study commissioned by the German Federal Ministry for Economic Affairs and Energy.
- ²⁶ Cf. Zimmermann, V. (2016): KfW SME Innovation Report 2015: Germany's innovation performance remains low despite slight increase, KfW Research, Zimmermann, V. (2016): SMEs and innovation - enterprises innovate less as their workforce ages. Focus No. 125, KfW Research and Zimmermann, V. (forthcoming): Sinkt mit zunehmendem Alter des Unternehmers der Innovationsoutput mittelständischer Unternehmen? (*Does innovation output of SMEs decline as entrepreneurs age?* - our title translation) Zeitschrift für KMU und Entrepreneurship.
- ²⁷ Cf. Thomä, J. and V. Zimmermann (2013): Knowledge Protection Practices in Innovating SMEs. Jahrbücher für Nationalökonomie und Statistik 233(5+6), p. 691–717.
- ²⁸ Cf. Rammer, C. and T. Schubert (2016): Concentration on the Few? R&D and Innovation in German Firms 2001 to 2013, ZEW Discussion Paper No. 16-005.
- ²⁹ Cf. Zimmermann, V. (2016): SMEs and digitalisation: The current position, recent developments and challenges, Focus on Economics No. 138, KfW Research.
- ³⁰ Cf. Zimmermann, V. (2017): R&D expenditure in Germany: positive trend since 1995, but levels need to increase further, Economics in Brief No. 128, KfW Research.