

KfW Research

# KfW SME Innovation Report 2017

»» Trend towards fewer innovators  
continues

## **Imprint**

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## Trend towards fewer innovators continues

The share of innovators – that is, the proportion of innovative enterprises in the overall SME sector – has recently risen by five percentage points to 27%. The number of innovative SMEs has thus grown by 199,000 to a good one million enterprises. The share of innovative SMEs has strongly recovered from the slump of the previous year but it is still below the level of the period 2012/2014. The recovery does not therefore signal a reversal of the long-term trend towards fewer innovators. The proportion of innovative SMEs has dropped by a good one third from the peak reached in 2004/2006.

SMEs spent EUR 32.2 billion on innovation in 2016. Unlike the share of innovators, total innovation expenditure has remained almost unchanged since as far back as the mid-1990s.

This underscores that a gap is opening up in SME innovation activity. On the one hand, more and more SMEs are abandoning innovation activities of their own. This mainly applies to formerly imitative product innovators. The remaining innovators on the other hand are investing more and more in innovation activity. The share of SMEs conducting research and development (R&D) of their own has been nearly steady in the past seven surveys, with values oscillating between 9 and 11%.

The trend towards fewer innovators is reflected in company turnover: In 2004, 43% of SMEs were still able to generate more than half their turnover with their innovations. That share has dropped to 25%. The share of SMEs that generate only up to one tenth of their turnover from innovations, however, has risen from 30 to 59%.

Financing innovation is fundamentally different from financing investments in tangible assets. SMEs fund 82% of their innovation expenditure from their own resources and only 9% with bank loans. The corresponding shares for investment in tangible assets are 50 and 30%, respectively. The reason is that external providers of debt capital are very reluctant to finance innovation because they find it hard to assess opportunities and risks. In addition, innovation projects generate only few tangible assets that are suitable as collateral for bank loans.

Different factors have contributed to the long-term trend towards fewer innovators and various

approaches are needed to stop the decline.

Economic policy has a mandate to not only stabilise the currently robust business cycle but also to revive start-up activity. This replenishes the supply of innovative SMEs.

Businesses need to build innovation skills. To achieve this, they need to more strongly systematise learning and innovation processes and play an active role in training and ongoing education. This allows them to harness and develop the skills of its employees and enables them to recruit new staff. Economic-policy measures can provide important support here and in the transfer of scientific-technical expertise. Mitigating difficulties in accessing finance – which represent a significant barrier for many businesses that have no innovation activities – is a key mandate of economic policy.

Trailblazers' innovation efforts should also receive more support. Raising target R&D expenditure to 3.5% of GDP and introducing tax incentives to promote R&D in Germany are key measures in this regard.

Economic growth across a broad front is a prerequisite for bringing higher levels of income and prosperity to wide sections of the population. The decline in productivity growth in Germany has been observed for decades and is a cause for concern. It reduces the scope for income growth.

The classic drivers of economic growth – corporate investment and demographic development – can hardly be expected to provide any expansionary impetus anymore. Corporate investment as a percentage of economic output has fallen in a long-term comparison, and in the coming years the demographic trend is set to significantly exacerbate the skills shortage that is often being deplored already.<sup>1</sup>

On the other hand, investment in intangible capital such as education and innovation expenditure has become more significant in the past years. Innovation improves the allocation of resources, leads to improved products and services and accelerates structural change.<sup>2</sup> This improves competitiveness and creates additional employment – provided the labour force potential has the necessary skills.

Numerous studies confirm the positive impact of innovation on employment, turnover, returns and productivity.<sup>3</sup> Innovation is therefore an important prerequisite for businesses to position themselves in the market and successfully compete with others. Digitalisation as a specific type of innovation activity is currently being ascribed high potential for efficiency improvements and the development of new products, services and business models. We explore the ‘special case’ of digitalisation in the SME sector in a separate report.

**Innovation means more than research and development**

It is often overlooked that something newly introduced is an innovation not just if it is based on research (such as driver assistance systems or navigation devices with real-time traffic information). Small and medium-sized enterprises, in particular, often develop innovations out of the normal production process (e.g. ‘learning-by-doing and using’) or in cooperation with customers and suppliers (‘learning-by-interacting’).<sup>4</sup> Innovation may also mean the introduction of a new food delivery service or a type of ice cream with a new flavour. A product (including a service) or manufacturing process is regarded as an innovation when it is new or significantly improved in essential aspects for the relevant enterprise or the market.<sup>5</sup>

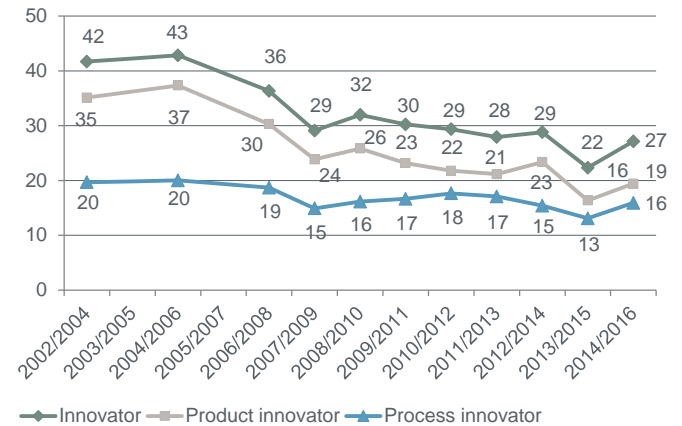
**A rebound at the current margin but the trend to fewer innovators continues**

After the slump in the previous period, the share of SME innovators – that is, enterprises that bring forth innovations – increased sharply in the period under review by nearly 5 percentage points to 27% (2014/2016) (Figure 1).<sup>6</sup> Currently there are a good one million innovative small and medium-sized enterprises. This figure increased by 199,000 enterprises on the previous year. But this increase does not mean a reversal of the trend to fewer innovators in the SME sector which has persisted since the middle of the last decade. The share of innovators is still below the levels achieved in 2011/2013 or 2012/2014. Compared with the peak reached in 2004/2006, the share of SME innovators has fallen by more than one third.

The current increase in the share of innovators is due to the trend in both process and product innovators. Both types of innovation increased by three percentage points. For the share of process innovators, that is in line with the level achieved before the slump of the previous year. The share of product innovators, in turn, was lower than in 2011/2013 or 2012/2014. At 19 and 16%, respectively, 705,000 SMEs introduced new or improved products into the market and 594,000 SMEs

**Figure 1: Development of innovators among SMEs**

In per cent



Note: Figures extrapolated to the number of enterprises.

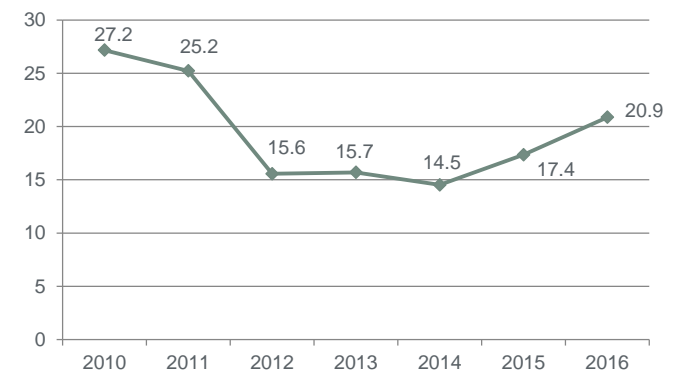
Source: KfW SME Panel, own calculations

modernised their manufacturing processes.

SMEs’ medium-term business expectations increased significantly from the low levels of the year 2014 (14.5 balance points) to just under 21 balance points in 2016 (Figure 2). The current rise is likely due to the fact that many small and medium-sized enterprises are more optimistic about where the economy is heading than in the previous period. However, the development of the share of innovators generally depends on a number of factors.

**Figure 2: Development of SMEs’ turnover expectations**

Balance of positive minus negative responses on three-year turnover expectations



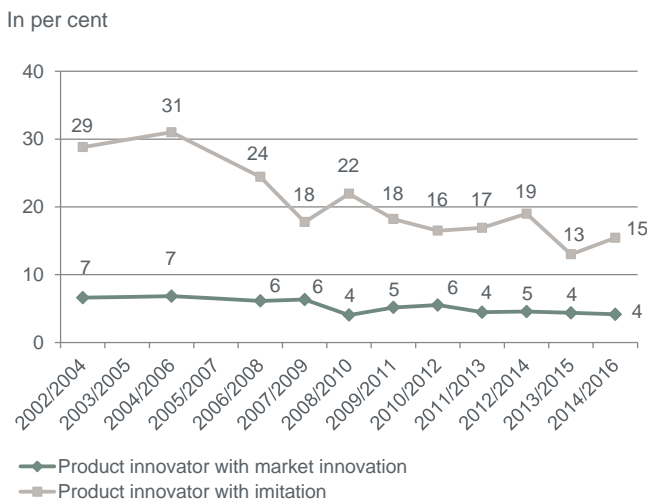
Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

**New-to-market innovations vs. product imitations: economic recovery mainly bolsters imitative innovations**

Positive turnover expectations greatly boost product innovation because new products and services penetrate the market particularly easily when demand increases. Development and market introduction are then easier to finance, too. Process innovations also respond indirectly to the business cycle because changes in manufacturing processes are often needed as well to make new products.

**Figure 3: Product innovators: new-to-market innovations and imitations**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

During favourable cyclical phases, enterprises focus on imitative innovations that can be implemented quickly.<sup>7</sup> Imitative innovations are defined as the adoption of ‘inventions’ from competitors – possibly with certain modifications. Accordingly, changes in the share of product imitators generally tend to be volatile. The share of SMEs with product imitations has recently increased by two percentage points on the previous period (Figure 3). Since its peak, however, this share has fallen most sharply – by more than half since 2004/2006.

The adoption of inventions and ideas from competitors constitutes the bulk of innovations. The diffusion of new developments is important from a macroeconomic point of view because it ensures more efficient use of resources as well as competitiveness across the overall economy. The benefit of imitative innovations for consumers is that as the number of suppliers (and users) rises, the price of the products or services tends to drop.<sup>8</sup>

New-to-market innovations are planned not so much

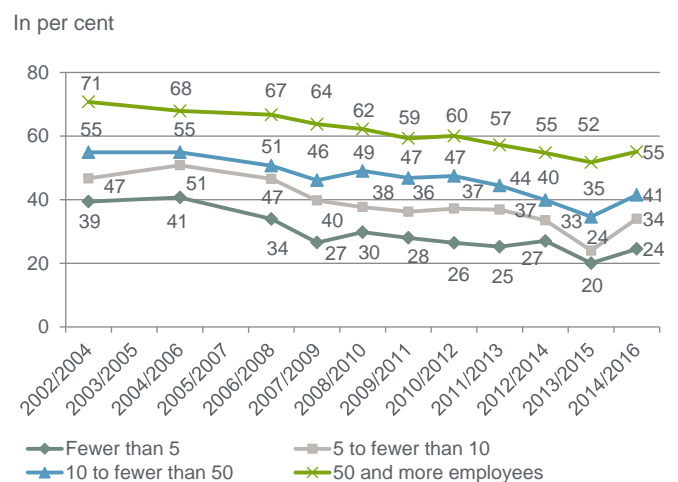
for the short term but out of strategic considerations. They usually require higher innovation expenditure and longer development phases than imitative innovations.<sup>9</sup> However, a new-to-market innovation does not necessarily mean that the product is being offered for the first time in the world. Rather, new-to-market innovation always refers to the market that is relevant for the innovator. Particularly for businesses that operate solely on local markets, new-to-market innovation therefore often cannot be equated to ‘new-to-world-market innovation’. So, for example, a newly opened restaurant serving foreign cuisine can be a new-to-market innovation in a particular city if there has been no such restaurant there previously.

The share of businesses introducing new-to-market innovations typically varies only little across the economic cycle. In the SME sector, that share has been between 4 and 6% since 2008/2010. In absolute figures, some 557,000 SMEs developed imitative product innovations and 148,000 new-to-market (product) innovations in 2014/2016.

**Innovator shares are growing in all company size classes**

The recovery of the share of innovators on the previous year can be seen in all company size classes (Figure 4).<sup>10</sup> In enterprises with five to fewer than 10 employees, the rebound was strongest, at 10 percentage points. It was in this group of enterprises that the share of innovators had dropped most sharply in the previous period. The share of innovators is therefore back to the level of 2012/2014 in three of the four size classes surveyed. Only in small enterprises (with fewer than five employees) is the share of innovators still below the level of that period, at 24%.

**Figure 4: Innovators by company size**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

However, the current increase should not obscure the fact that the share of innovators has decreased in all size classes since the middle of the last decade. The smaller the surveyed companies are, the greater the loss of innovators. The decrease was lowest among enterprises with 50 and more employees, at just under one fifth (compared with 2004/2006). In enterprises with fewer than five employees, by contrast, the drop was more than two fifths. The pronounced decline in the share of innovators among small businesses presumably reflects the diminishing share of innovators with (product) imitations set out above.

**Small enterprises innovate less**

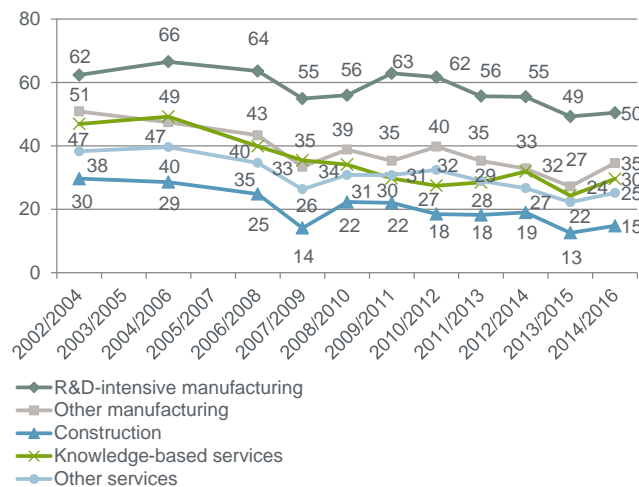
Across the entire observation period, enterprises innovate less often the smaller they are. The reasons for this are that small businesses have fewer resources and less market coverage. These disadvantages are exacerbated by the fact that innovation projects often cannot be split up at will.<sup>11</sup> Minimum project sizes and high fixed costs mean that innovations place a higher financial strain on small enterprises than on large ones.<sup>12</sup>

**Share of innovators is rising again in all sectors**

A sector analysis shows that innovation activity has recently increased at least moderately in all business sectors (Figure 5). At eight percentage points on the previous period, other (non-R&D-intensive) manufacturing has had the highest increase. ‘Other manufacturing’ comprises the food and animal fodder production and metal products industries, for example.

**Figure 5: Innovators by industry**

In per cent



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

The share of innovators in R&D-intensive manufacturing (such as mechanical engineering, electronics and chemicals), on the other hand, grew by only one percentage point, the lowest rate. This muted development is not surprising. In the course of the recovery after the financial and economic crisis, the strong increase was already one year behind most other economic sectors. This presumably reflects the fact that innovations in this sector are more often based on research and development (R&D) and require longer development periods.

**Long-term decline is most pronounced in construction and services**

With values around one fourth, manufacturing saw the lowest long-term decline in the shares of innovators (compared with 2004/2006). R&D-intensive manufacturing in particular bucked the general downward trend for a long time. With the exception of the slump during the financial and economic crisis, the proportion of innovators in the R&D-intensive manufacturing industries remained nearly stable up to the period of 2010/2012. Only in the past few years did innovation activity decline noticeably in R&D-intensive manufacturing industries as well.

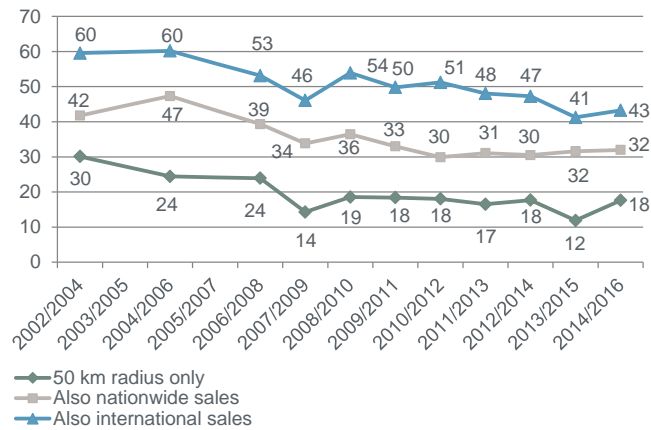
In the service sector, the share of innovators decreased by just under two fifths and only in the construction sector did it drop even more sharply since 2004/2006 (-48%). Services – especially other services such as hospitality, transport and storage – and construction are also the sectors that are typically the least innovative.

**Share of innovators has rebounded especially among regionally active businesses**

It was primarily the regionally operating firms that expanded their share of innovators, posting a six percentage-point increase on the previous period. Thus they have recovered from the slump of the previous period. At the current margin, internationally operating businesses also show moderate gains (Figure 6). The generally higher share of innovators in that segment trended downward in the course of the weak growth phase in Europe from 2011/2013 and only began to recover in the period under review. As enterprises with international operations often belong to the R&D-intensive manufacturing sector, the hesitant recovery can probably be attributed to the longer development periods for R&D-based innovations – besides uncertainties resulting from geopolitical events such as Brexit and the outcome of the US presidential election.

**Figure 6: Innovators by sales region**

In per cent



Note: Figures extrapolated to the number of enterprises.

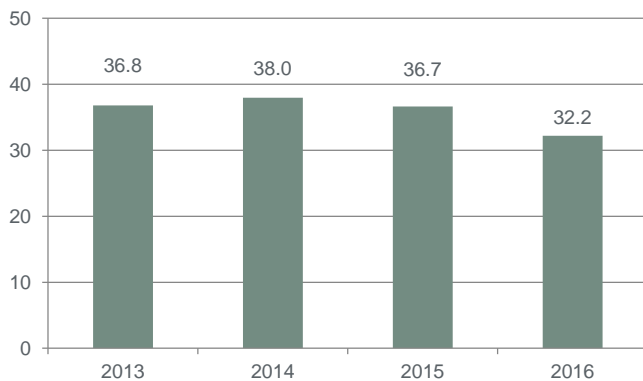
Source: KfW SME Panel, own calculations

**Innovation expenditure down slightly**

SMEs' expenditure on innovation developed steadily in the past years, although it is currently slightly lower than in the previous years, at EUR 32.2 billion (Figure 7).<sup>13</sup> Innovation expenditure includes all expenditure on innovation including personnel costs and capital expenditure related to developing innovations and bringing them into the market.<sup>14</sup>

**Figure 7: Aggregate innovation expenditure**

in EUR bn



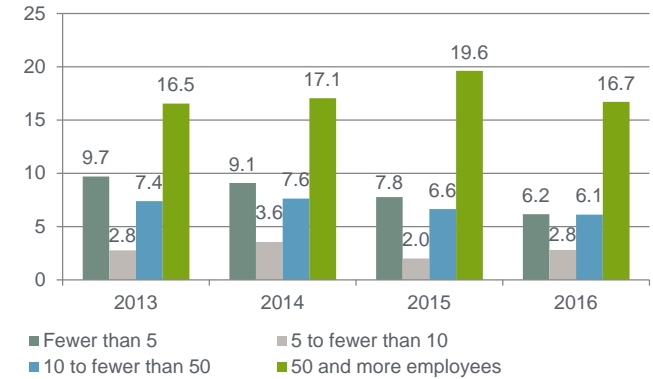
Note: Values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

A long-term comparison (on the basis of the surveys by the Centre for European Economic Research – ZEW<sup>15</sup>) shows that innovation expenditure incurred by enterprises with up to 499 employees has changed only little in real terms (i.e. adjusted by inflation) since the mid-1990s. Along with the decreasing rate of innovators, this shows that while innovation expenditure has remained at almost the same level, it is concentrated in increasingly fewer SMEs. The figures ascertained by the ZEW also demonstrate that small and medium-

**Figure 8: Aggregate innovation expenditure by enterprise size**

in EUR bn



Note: Values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

sized enterprises are unable to keep up with increases in large-scale enterprises' innovation expenditure.<sup>16</sup>

Small enterprises (with fewer than five employees) have contributed to the decrease in innovation expenditure at the current margin by reducing their expenditure by EUR 1.6 billion on 2015, thereby continuing the trend of previous years in this group. In addition, innovation expenditure incurred by large SMEs (with 50 and more employees) has settled on the levels of the years 2013 and 2014 after increasing in the previous year (Figure 8).

**Internal funds are the dominant source of innovation funding**

Internal funds such as current cash flow, reserves and cash reserves are by far the most important sources of innovation funding. SMEs cover 82% of their innovation expenditure from these funds. Bank loans rank second with 9%. Promotional funds such as promotional loans, promoted equity, grants and subsidies account for 6% of SMEs' innovation expenditure. All remaining sources of funding such as mezzanine capital, third-party investments and leasing amount to 3% (Figure 9).

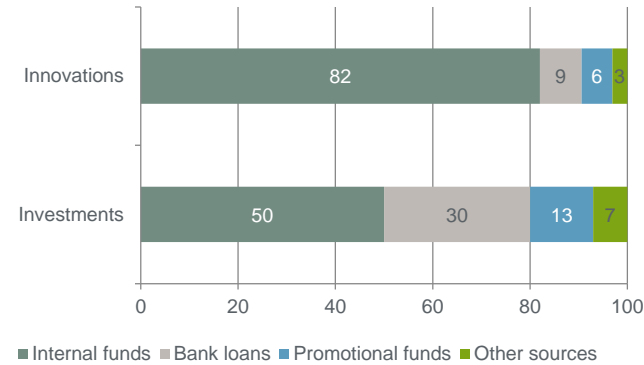
Innovation funding thus differs greatly from investment funding, in which internal funds amount to merely half the investment expenditure and bank loans 30%.<sup>17</sup>

The low proportion of bank loans is likely due to the fact that assessing the chances of success of innovation projects is a challenge for credit institutions in particular. Moreover, for potential lenders the relatively low funding volumes mean an unfavourable ratio between transaction costs and returns, so that it is often not worthwhile for them to commit funds (and

perform the necessary project appraisal). At the same time, tangible investments constitute only a small share of the investment expenditure. As a result, innovation projects generate only a limited amount of assets that could be used as collateral for bank loans.<sup>18</sup>

**Figure 9: Comparison of innovation and investment funding**

Proportions of funding sources in relevant expenditure in per cent



Note: Values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

**Internal financing capacity grows with company size**

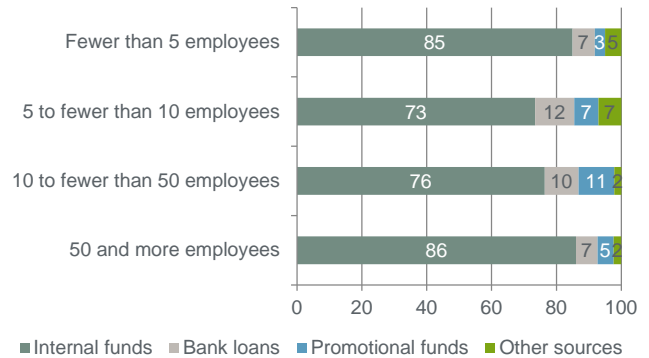
The share of internal funds in innovation expenditure is highest in small SMEs with fewer than five and in large SMEs with 50 or more employees (Figure 10).

In small enterprises, this is likely attributable to the fact that these firms typically request only low amounts of finance while presenting the highest risk from the lender’s perspective. Thus, the risk of failure is generally highest in small (and young) enterprises.<sup>19</sup> At the same time, innovation projects put a higher strain on small firms than larger ones. This is evidenced by the fact that small innovators invest a higher share of their turnover in innovation than large ones.<sup>20</sup> Small firms therefore have less opportunity to diversify risks, for instance by conducting several projects at once. On average, enterprises with 5 to 19 employees, for example, carry out two to three innovation projects at the same time. But enterprises with 500 to 999 employees work on average on 22 projects at once.<sup>21</sup>

For large SMEs, on the other hand, the primary driver for using more internal sources is likely to be their high internal funding capacity. The share of bank loans in innovation expenditure initially rises with company size, in opposition to the share of funds obtained from internal sources. The share of bank loans drops again in firms with a workforce of ten and above.

**Figure 10: Innovation funding by company size**

Proportions of funding sources in innovation expenditure in per cent



Note: Values extrapolated from the number of employees.

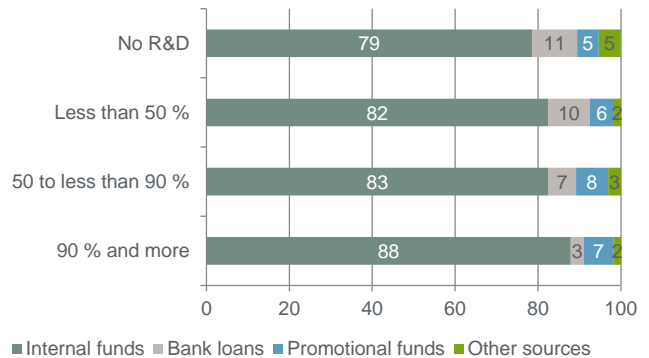
Source: KfW SME Panel, own calculations

**Bank loans are uncommon in R&D projects**

It can also be observed that the greater the share of R&D in an enterprise’s investment expenditure, the higher the share of internal funding. Enterprises without R&D cover 79% of their innovation expenditure from internal funds. When R&D expenditure rises to more than 90% of total innovation expenditure, internal funding also grows to a share of 88%. Conversely, when the R&D share increases, the proportion of bank financing drops from 11 to 3% (Figure 11).<sup>22</sup> One likely reason for this is the fact that the inhibitory characteristics occur in R&D projects in concentrated form. The consequence is that bank loans are increasingly refused or offered only at a high risk premium, so that bank loans come about less often.

**Figure 11: Innovation funding by R&D intensity of innovation expenditure**

Proportions of funding sources in relevant expenditure in per cent



Note: Values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

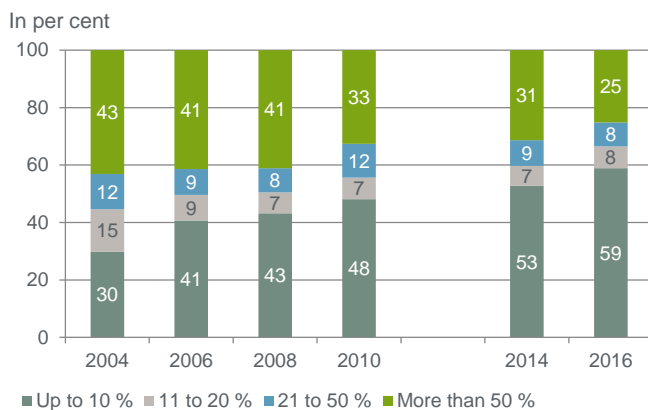
Innovation projects with an R&D share of more than 50 %, in turn, are financed more with promotional funds. Here the share of promotional funds ranges between 7 and 8 %. Promotional funds thus benefit enterprises with high R&D expenditure in particular.



### Turnover shares of new products and services have fallen

The long-term decline in the share of innovators in the SME sector is reflected in how up-to-date the product ranges are (Figure 12). The turnover shares that were achieved with innovations have decreased continuously since 2004. During that year, 43% of SMEs generated more than half their turnover with new products and services. That share has now dropped to 25% of SMEs. In return, the share of enterprises that generate not more than 10% of turnover with innovations has grown to 59%. In 2004, that group made up only 30% of SMEs.

**Figure 12: New products and services as a share of turnover – variation over time**



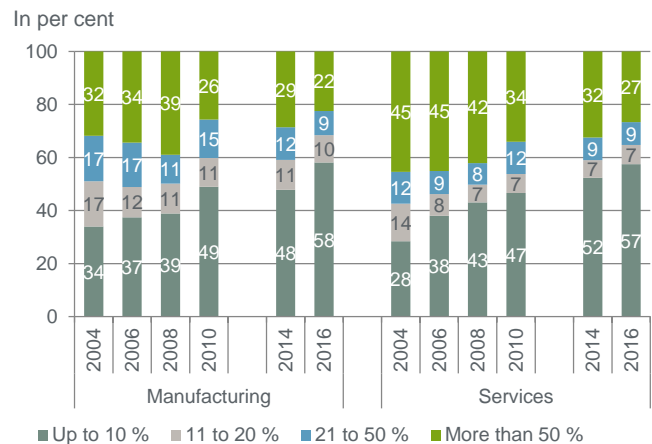
Note: A product or service is deemed new when the respective enterprise introduced it into the market within the past five years. Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

Significant sectoral differences are evident in the development of turnover shares with new products and services (Figure 13). In the service sector, the share of enterprises with a high share of innovation in overall turnover has fallen continuously. In manufacturing that proportion initially increased up to 2008. The economic and financial crisis then caused a noticeable turnaround. The proportion of SMEs in which new products accounted for more than 50% of turnover dropped from 39 to 26%. That share rose again slightly after the financial crisis. But since then, manufacturing has also been following the overall trend among SMEs. The share of SMEs in manufacturing in which innovations account for 50% or more of turnover is down to 22%.

In the service sector the trend has been even more negative. Here the share of enterprises with a high innovation to turnover ratio (more than 50%) has dropped from 45 to 27%. At the same time, the share of enterprises with low turnover from innovation (not more than 10%) has doubled from 28 to 57%.

**Figure 13: New products and services as a share of turnover by sector**



Note: A product or service is deemed new when the respective enterprise introduced it into the market within the past five years. Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

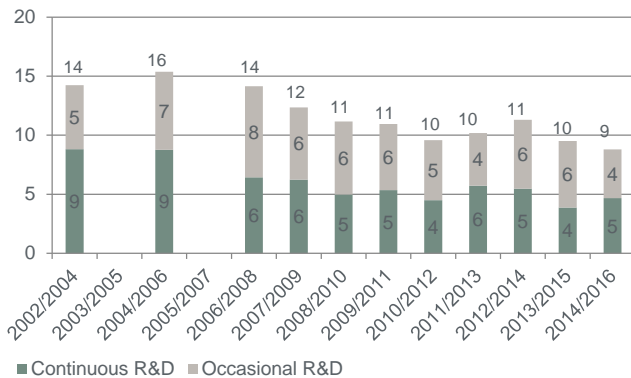
Compared with manufacturing, the service sector also presents a slightly different picture overall. The proportion of service enterprises with a high share of innovation in turnover (greater than 50%) is slightly higher in general. This is likely to be due, among other things, to the different sizes of enterprises. Because small enterprises have smaller product ranges, innovations they successfully bring to the market have a stronger impact on the turnover share than those of large enterprises. Besides, it is evident that the innovations of service enterprises are more often designed to achieve fast innovation success than in manufacturing.<sup>23</sup>

### Own R&D as a source of innovation is rather uncommon

R&D is defined as 'systematic creative work aimed at expanding existing knowledge [...] and using it with the objective of finding new potential applications'.<sup>24</sup> It is rather uncommon for SMEs to conduct R&D. In 2014/2016, a mere 5% of SMEs conducted R&D of their own on a continuous basis and a further 4% did so occasionally (Figure 14). In absolute figures, that was 173,000 SMEs with continuous and 154,000 with occasional R&D. That means a total of just under 71% of innovative SMEs bring forth new products and processes without conducting their own R&D.

**Figure 14: Enterprises with research and development activities of their own**

In per cent



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

**Share of SMEs conducting R&D almost steady since 2008/2010**

The share of SMEs undertaking R&D activities decreased in the course of the financial and economic crisis. While that share of SMEs was still at around 16% in the period 2004/2006, it fell to around 11% by 2008/2010. It then hovered between 10 and 11%, and dropped slightly to 9% in the period under review.

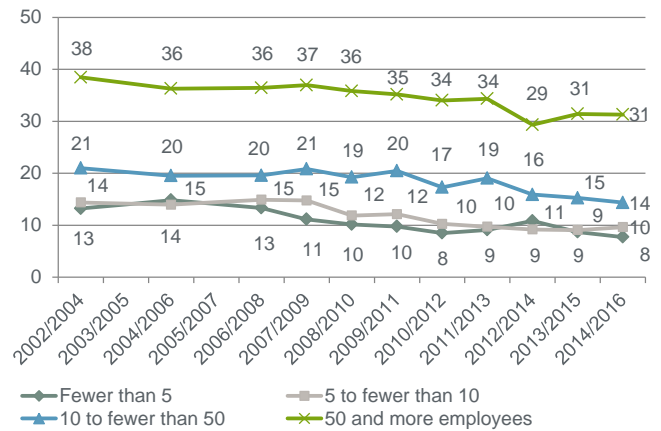
Enterprises conducting R&D of their own are characterised by the fact that they innovate more regularly and pursue innovation strategies designed to introduce a technology that is new to the market and, hence, to assume the role of a pioneer.<sup>25</sup> A decline in SMEs that conduct R&D is therefore cause for concern because to a certain extent they are at the forefront of innovators in the SME sector, a position that can benefit the German economy as a whole. And yet, for an individual company it may be an attractive choice not to undertake own R&D efforts and must not be a necessity.<sup>26</sup>

A long-term downward trend in the shares of enterprises conducting R&D can be observed in all size classes. In the past three years, larger SMEs with more than ten employees in particular have discontinued own R&D activities (Figure 15).

Nonetheless, it is still primarily the large SMEs that undertake own R&D most often. At 31%, SMEs with 50 or more employees are twice as likely to undertake R&D projects than enterprises with ten to fewer than 50 employees. Among large SMEs, that share is actually nearly four times higher than in enterprises with fewer than five employees. This is an indication that larger enterprises undertake innovation activities more systematically and make innovation processes more permanent.<sup>27</sup>

**Figure 15: Enterprises with own (occasional or continuous) R&D by size**

In per cent



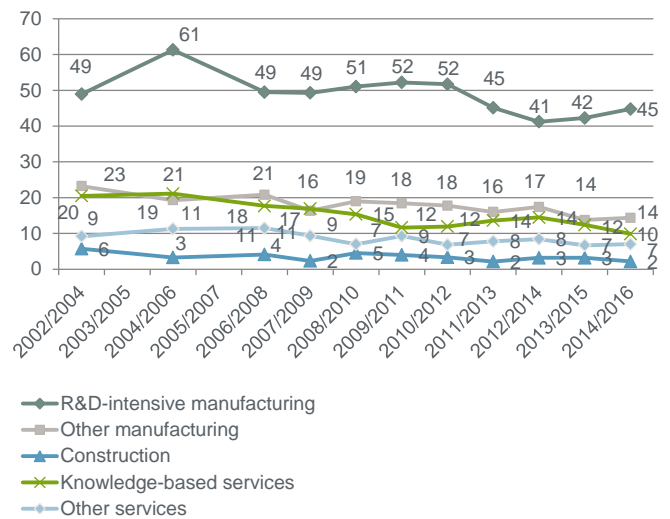
Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

The sector comparison shows that since 2004/2006 the share of businesses conducting continuous or occasional research has decreased primarily in R&D-intensive manufacturing and the knowledge-based services sector (e.g. IT and information providers, law, tax accounting and management consulting firms) (Figure 16). After the share of enterprises conducting R&D in the R&D-intensive manufacturing sector dropped to its low of 41% in the period 2012/2014, it has now rebounded to 45%. In the service and construction sector there are very few businesses with R&D activities. The current shares are 10% or less.

**Figure 16: Enterprises with own (occasional or continuous) R&D by sector**

In per cent



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

### Motives for refraining from innovating altogether

Finally, enterprises without innovation activities were asked for the first time why they refrained from carrying out innovation projects in the period 2014/2016.<sup>28</sup> The reasons for refraining from innovating altogether are in part different from the inhibiting factors which innovators mention as restricting their innovation activities. This is because enterprises do not encounter specific difficulties until the moment they set about innovating. Many obstacles are not foreseeable.

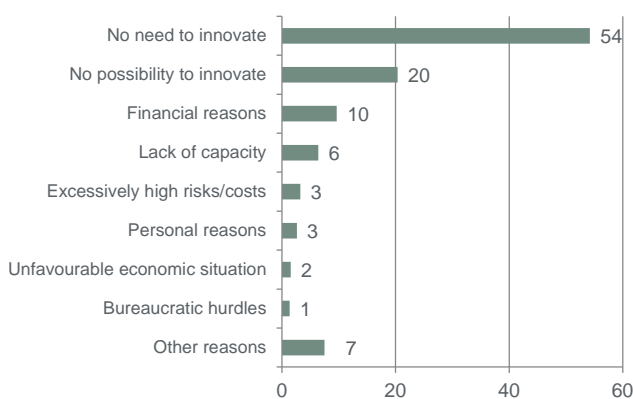
### 'No need to' is the main reason for not innovating

The bulk of SMEs, 54 %, reported that they did not consider it necessary to innovate during the period under review (Figure 17). This can be seen as an indication that those enterprises do not currently see innovation activity as useful for their business.

One likely reason is that, according to the study by ZEW and Prognos<sup>29</sup>, the returns on innovation have fallen noticeably in the past decade. Enterprises have little incentive to invest in innovating if it is less profitable. One likely reason behind falling returns on innovation is growing competition, which is primarily reflected in higher pressure on prices and costs and is likely to deter possible latecomers in particular from initiating innovation activities.<sup>30</sup>

**Figure 17: Reasons for not innovating in 2014/2016**

Shares of enterprises without innovation activities in per cent



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

It is also possible that other factors play a role here as well. For example, it is conceivable that the technological complexity of innovations increases over time. That makes it harder to imitate them. With respect to the growing importance of digital technologies for innovation, it is plausible that network effects favour pioneer enterprises, making possible imitations such as those often produced by small businesses less profitable.<sup>31</sup>

Another circumstance that may have contributed to the decline in innovation activity is that the low inflation rate and stable exchange rates of the past years have bolstered the competitiveness of German enterprises. Small and medium-sized enterprises are currently achieving high returns,<sup>32</sup> so that they have less of a need to innovate. This is particularly true given the high utilisation of production capacities and general skills shortage, which would make it challenging to redirect resources or recruit additional workers for innovation purposes.

Furthermore, it can be presumed that the statement 'No need to' masks a lack of demand for innovative products and services in the relevant market segment. A study by ZEW confirms that 17 % of non-innovating enterprises surveyed by the institute state this as a reason. In the public discussion it is often argued that innovation is more necessary than ever. But the share of enterprises reporting a lack of demand for innovative products or services has more than doubled against 2004/2006.<sup>33</sup>

Not least, some market segments can afford to do without innovation activities for a certain period of time on the back of successful past innovation.

The share of enterprises that see no need to innovate differs very little by company size (Figure 18). In contrast, significant differences exist from one sector to another. Enterprises in R&D-intensive manufacturing and construction mentioned this reason most frequently (Figure 19).

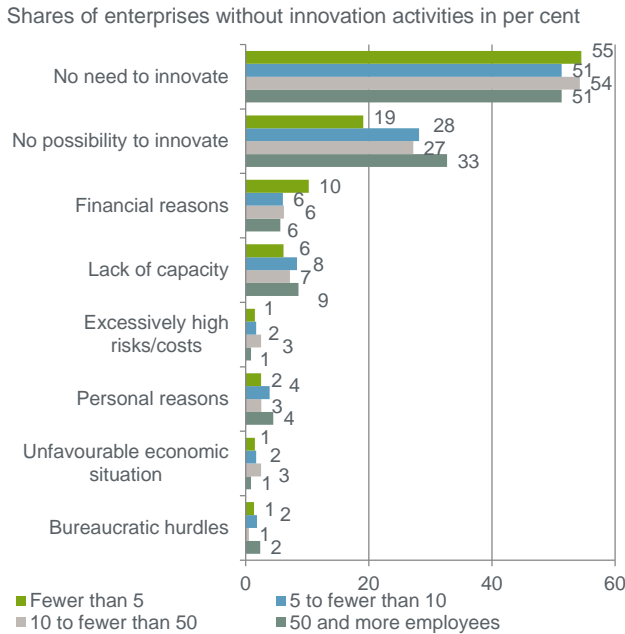
R&D-intensive manufacturing is characterised by a high share of innovators and lively innovation activity. The large share of enterprises that see no need to innovate is therefore based on a relatively small group. This is not so in the construction sector. Traditionally, construction has a low rate of innovators. So the high share of enterprises that reported no need for innovating can probably be explained with the specific circumstances of the construction sector and, at present, with the prevailing construction boom as well.

### Lack of innovation ideas ranks second

Twenty per cent of enterprises see no possibilities for innovating in their market segment. This probably conceals the fact that different market segments have different technological possibilities. But the lack of innovation ideas can also be attributed to the fact that enterprises do not have the skills needed to harness innovation opportunities and develop ideas. The absence of skills gains more significance because the internet boom has not yet been followed by a new

technological wave. Thus new innovation opportunities for the wider SME sector have not thrust themselves upon the enterprises in the past years either.

**Figure 18: Reasons for not innovating by company size**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

At first glance, it is surprising that the share of enterprises mentioning this reason is lowest among the small ones. It could also have been expected that small enterprises in particular would be most severely restricted in the development of innovation ideas by their limited resources. This is probably because small, non-innovative enterprises face other specific barriers more directly (e.g. financial constraints). The lack of innovation ideas appears therefore less relevant for them.<sup>34</sup>

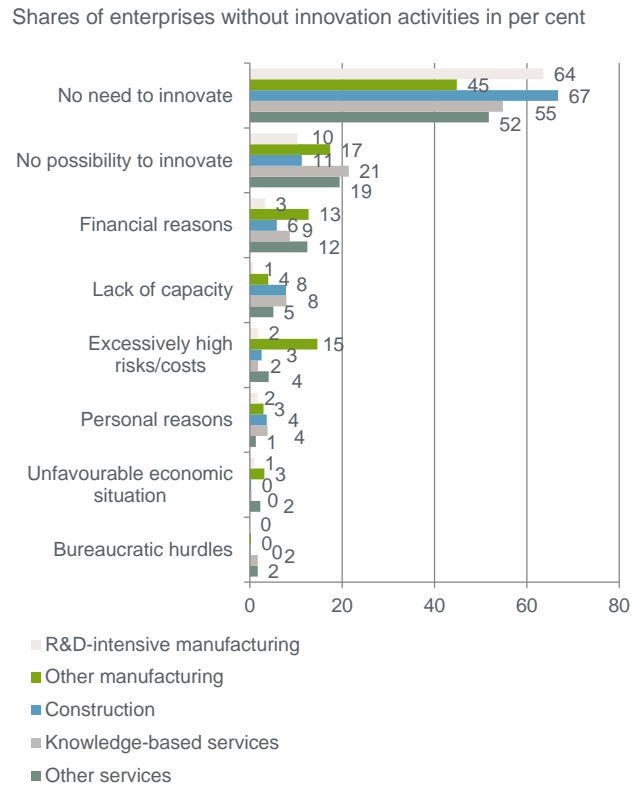
Lack of innovation ideas is mentioned most often in the service sector as well. Thus it applies at the same time to sectors with a generally low innovator rate. By contrast, lack of innovation ideas is mentioned least often in the construction sector, which also has a low share of innovators. In return, the highest share of enterprises here – around two thirds – see ‘no need to innovate’.

**Financing difficulties rank third**

Financial reasons were reported as a motive by 10% of SMEs that do not innovate. The current survey thus confirms the findings of a study by the ZEW which arrived at similar results.<sup>35</sup> If we apply this value to the share of non-innovators among SMEs, the share of innovators could be seven percentage points higher if

financing difficulties were removed. In a similar way as for innovators, non-innovative SMEs reporting financing difficulties were also mostly small firms.<sup>36</sup> Enterprises indicating financial reasons were mainly from the segments of other manufacturing and other services – segments that have a relatively low profit margin<sup>37</sup> as well as, along with the service sector, below-average credit ratings.<sup>38</sup>

**Figure 19: Reasons for not innovating by economic sector**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

**Lack of capacity ranks fourth, at six per cent**

Lack of capacity for innovation was reported by 6% of SMEs. The healthy business cycle is likely to be one of the reasons this aspect was mentioned – if only by a small percentage of enterprises. This finding is consistent with the fact that few enterprises (2%) mention an unfavourable economic situation as a reason for not innovating.

Construction firms and knowledge-based service providers mentioned lack of capacity most often. The construction sector in particular has been in a boom phase for some time now. Companies are likely prioritising the completion of existing jobs over the development of new products and processes.

Non-innovative SMEs are least likely to mention the

factors 'excessively high risks/costs', 'personal reasons' and 'bureaucratic hurdles'. These are the aspects which innovators mention most frequently. This is attributable to the initially outlined problem complex that enterprises often do not perceive barriers until they start working on specific innovation projects.

## Conclusion

The share of innovators has rebounded noticeably since the slump in the previous period and improved by five percentage points on the previous year. At 27 %, however, it remains below the levels of the periods 2011/2013 and 2012/2014. The continuing downward trend in the share of innovators can be attributed to the trend among small enterprises with fewer than five employees. In enterprises with five or more employees, the current shares of innovators are at similar levels as in the two preceding periods mentioned.

This year as well, the ongoing downward trend among small SMEs has affected the share of innovators in almost all economic sectors except 'other manufacturing'. Since the peak of 2004/2006, the share of innovative SMEs has fallen most noticeably in the service and construction sectors. The decline in the share of innovators originated not so much among pioneer enterprises but in the large number of latecomers. This can be seen, for example, in the noticeable decline in the share of innovators with product imitations (-52 % on 2004/2006). By contrast, the share of SMEs that conduct R&D of their own has remained nearly constant since 2008/2010.

Furthermore, the stable long-term development of innovation expenditure among SMEs (latest figure: EUR 32.2 billion) shows a widening gap between innovative and non-innovative enterprises. On the one hand, more and more SMEs are abandoning innovation activities of their own. The remaining innovators, on the other hand, are investing all the more in innovation. The steady volume of innovation expenditure among SMEs, however, must not hide the fact that SMEs were far from being able to keep up with the development of innovation activities among large enterprises.

The long-term decline in the overall share of innovators is reflected in how up-to-date the SMEs' product ranges are. The share of SMEs that achieve only 10 % or less of their turnover with new products or services has risen from 30 to 59 % since 2004. At the same time, the share of enterprises in which innovations make up half or more of their turnover has fallen from 43 to 25 %.

Significant differences are apparent between the

financing of innovations and the financing of (tangible) assets. At more than four fifths, internal funds are the dominant source of innovation funding. Bank loans account for only 9 %, a small share. By contrast, SMEs fund 30 % of their capital expenditure on assets with bank loans and only half from internal funds. These differences illustrate that it is much more difficult to obtain external finance for innovations than for investments in tangible assets. R&D-based innovation projects in particular, in which the inhibiting characteristics are more pronounced (uncertain success, low share of investment in tangible or physical assets), are least likely to be financed with bank loans.

The survey of non-innovative SMEs revealed that more than half do not currently see the need to innovate. This probably conceals the fact that innovations are now less profitable than in previous times – particularly for imitators. Other factors that presumably play a role are lack of demand for innovative products and services and SMEs' good profitability.

Lack of innovation ideas ranks second, demonstrated by the statement 'no possibilities for innovating'. Among other reasons, this is likely due to the fact that lack of expertise makes it hard for SMEs to identify innovation opportunities and develop innovation projects. What is also true, however, is that Germany has not experienced any impetus from major technological breakthroughs in the past years. The current digitalisation wave may represent such a new technological push. The coming years will show whether this will in fact give rise to a renewed increase in the rate of innovators.

SMEs mention funding difficulties as one of the main innovation barriers; for non-innovators it is the third most frequently stated reason for not innovating. On the other hand, non-innovative SMEs rarely perceive costs and risks, lack of human resources and red tape as problematic. On the other hand, these factors are relevant for innovative SMEs, which often refer to them as obstacles as well. The reason these aspects are probably of minor importance to non-innovators is that barriers do not appear until enterprises actually initiate innovation projects and that they are impossible to anticipate.

Some factors that decrease the rate of innovators are perceived less clearly by enterprises.<sup>39</sup> Start-up activity has dropped significantly since 2003. While the start-up rate was still at 2.84 % in 2003, it is now down to 1.30 %. Young enterprises typically innovate more often than older ones. The decline in start-up activity thus means that the supply of new innovative enterprises

has stalled.

Ageing workforces also have an adverse impact on enterprises' innovation output. The share of workers over the age of 54 has risen significantly in the past decade as a result of demographic change.<sup>40</sup>

Another factor that has probably played a role is that innovation promotion in Germany in the past years has increasingly focused on enterprises that conduct R&D activities on a continuous basis. Of the enterprises that received promotional funds, the share of enterprises that conduct no R&D fell from 31 % in the period 2004/2006 to 25 % in 2012/2014. In total, only 7 % of innovators conducting no R&D received innovation funding (compared with 12 % in 2006/2008).<sup>41</sup>

### Recommendations for action

Two economic-policy approaches can be derived from the polarisation in innovation activity. First, the development of new technologies and promotion of pioneer enterprises needs to be further reinforced. This is important to safeguard Germany's technological leadership and occupy new fields of technology.

The new federal government should therefore effectively work to achieve the target of raising R&D expenditure to 3.5 % of GDP. Many OECD countries pursue ambitious R&D objectives. Germany's progress in R&D expenditure therefore has not yet been sufficient to recover lost ground. It is therefore also necessary to increase the number of enterprises conducting R&D. An international comparison shows that state support for innovation activity in the business sector is rather low compared with the USA, the UK, France and Italy, for example.<sup>42</sup> So there is definitely potential to expand this support.

In addition to expanding existing promotional measures, an important measure is to introduce additional tax incentives to support R&D. Already most OECD countries successfully provide tax incentives to promote R&D. Broadening the R&D basis is likely to benefit less innovative SMEs indirectly as well, as customers' demands within the value chain represent an important incentive for these enterprises to innovate.<sup>43</sup>

In order to counteract the decline in the rate of innovators, however, it is also necessary to strengthen innovation activities across the breadth of predominantly imitative SMEs. These innovators ensure that new technologies are diffused across the economy. Innovations will not have macro-economic impacts such as the hoped-for increase in productivity until technological progress is realised across the

economy as a whole. Besides, this segment employs the bulk of the workforce. Strengthening the competitiveness of these enterprises will therefore benefit a large number of workers. Still, economic policy cannot tackle all reasons identified for the decline in the rate of innovators with the same degree of effectiveness. Areas that provide particularly good starting points are outlined below:

Typically, young enterprises innovate more often. It is therefore necessary to ensure a sufficient supply. Consequently, more people need to be motivated to be entrepreneurs. In order to achieve this, they need to be taught business skills and shown income alternatives at an early stage.

Lack of innovation ideas is an indication that more attention needs to be paid to developing them. Learning and innovation processes need to become more systematised, particularly in firms that conduct no R&D of their own. So, to make this possible, enterprises need to develop an innovation management system that is adapted to their needs. Studies demonstrate that even simple employee-specific measures lead to advances in innovation. Incentives such as employee suggestion schemes, relevant agreed targets or different types of teamwork are recognised as helpful and relatively easy measures to implement.<sup>44</sup>

Particularly with a view to ageing workforces, measures such as putting together multi-age teams and training employees are deemed important for harnessing and expanding existing skills within enterprises and maintaining their innovative capacity.

In addition, SMEs that do not conduct R&D often need better access to scientific-technological expertise.<sup>45</sup> Economic-policy measures – such as advisory services or information – can also be supportive here.

Not least, lack of innovation ideas may also reflect lack of human resources. The skills shortage is a barrier to innovation frequently mentioned by innovative SMEs. Playing an active role in training and ongoing education helps enterprises recruit new skills, keep existing skills up to date and mitigate the consequences of an ageing workforce.

Financing problems are a significant obstacle to innovation for innovators and SMEs without innovation activities. Despite the generally good financing climate, the share of innovators with external and internal funding difficulties has grown by around two fifths since 2004/2006.<sup>46</sup> This primarily affects small enterprises and those with ambitious innovation strategies.<sup>47</sup> It

underscores the fact that in addition to expanding support for top innovators, promotional measures that reach the breadth of the SME sector must be stepped up as well.

It is important to note in this regard that the decline in imitative innovators goes hand-in-hand with decreasing support offers for innovations of enterprises that do not conduct R&D. Programmes that focused on advice, human resources development and the use of property rights in particular have been scaled back.<sup>48</sup> The important task here is to apply the lessons learned from these promotional schemes to the specific design of new and the further development of existing programmes.

Last but not least, generating imitative innovations in particular is heavily dependent on the cyclical situation. The current business cycle is exceptionally positive and business expectations are significantly better than in past years. Not least, all economic-policy measures that contribute to maintaining the favourable cyclical situation therefore also bolster innovation activity across the SME sector as a whole. ■

**The structure of innovative SMEs in 2014/2016**

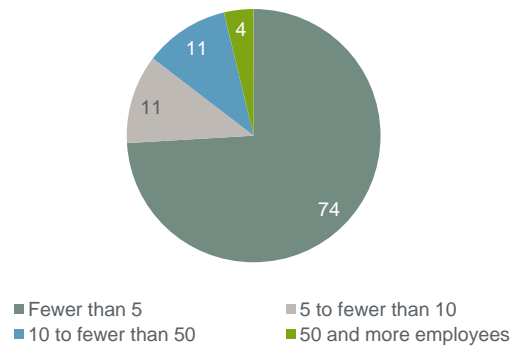
The SME sector, according to KfW’s definition, covers all enterprises in Germany whose annual turnover does not exceed EUR 500 million. By this definition, around 3.71 million SMEs exist in Germany. The SME sector thus accounts for 99.95% of all enterprises in Germany. A good one million of these enterprises are innovators.

The majority of innovative SMEs are small enterprises. Most innovative SMEs (744,000 enterprises, or 74%) have fewer than five employees. This high proportion of small innovative SMEs is due to the overall structure of small and medium-sized enterprises, as 81% of all SMEs have fewer than five employees. The manufacturing industry accounts for 9% of innovators while the service sector represents 87%.

Seventy-one per cent of innovative SMEs do not conduct any R&D of their own. A mere 17% perform research continuously while 13% undertook some R&D activities only occasionally in the past three years.

**Figure 20: Innovative SMEs by company size**

In per cent

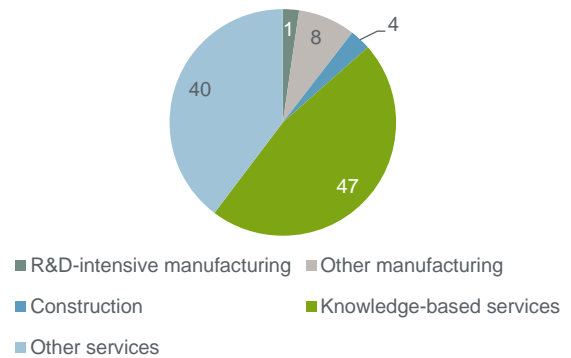


Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

**Figure 21: Innovative SMEs by industry**

In per cent



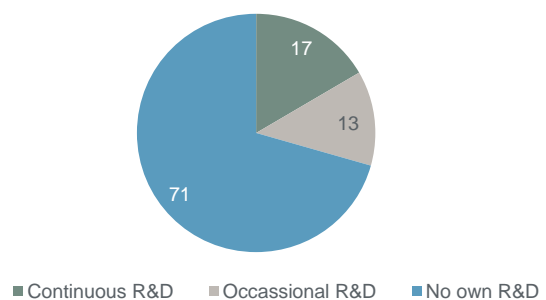
Note: Figures extrapolated to the number of enterprises.

Source:

KfW SME Panel, own calculations

**Figure 22: Innovative SMEs by own R&D activity**

In per cent



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations



## KfW SME Panel

The KfW SME Panel (KfW-Mittelstandspanel) has been conducted since 2003 as a recurring postal survey of small and medium-sized enterprises in Germany with annual turnover of up to EUR 500 million.

With data based on up to 15,000 companies a year, the KfW SME Panel is the only representative survey of the German SME sector, making it the most important source of data on issues relevant to the SME sector. Due to the fact that it is representative of all SMEs of all sizes and across all branches in Germany, the KfW SME Panel offers projections for even the smallest companies with fewer than five employees. A total of 11,043 SMEs took part in the current wave.

Analyses of long-term structural developments in the SME sector are performed on the basis of the KfW SME Panel. It gives a representative picture of the current situation and the needs and plans of SMEs in Germany. It focuses on annually recurring information on companies' performance, investment activity and financing structure. This tool is the only way of determining quantitative key figures for SMEs such as investment spending, loan demand and equity ratios.

The basic population used for the KfW SME Panel comprises all SMEs in Germany. These include private-sector companies from all sectors of the economy with annual turnover of not more than EUR 500 million. The population does not include the public sector, banks or non-profit organisations. Currently there are no official statistics providing adequate information on the number of SMEs or the number of people they employ. The survey used the German Company Register (Unternehmensregister) and the official employment statistics (Erwerbstätigenrechnung) to determine the current population of SMEs.

The KfW SME Panel sample is designed in such a way that it can generate representative, reliable data that are as precise as possible. The sample is split into four groups: type of promotion, branches, firm size as measured by the number of employees, and region. In order to draw conclusions on the basic population based on the sample, the results of the survey are weighted/extrapolated. The four main stratification criteria are used to determine the extrapolation factors. These factors look at the distribution in the net sample (in line with the four group characteristics) in relation to their distribution in the population as a whole. Overall, two extrapolation factors are determined: an unlinked factor for extrapolating qualitative parameters to the number of SMEs in Germany, and a linked factor for extrapolating quantitative parameters to the number of employees in SMEs in Germany.

The survey is conducted by the Financial Services Division of GfK SE on behalf of KfW Bankengruppe. The project received expert advice from the Centre for European Economic Research (ZEW) in Mannheim. The main survey of the 15th wave was conducted in the period from 13 February 2017 to 23 June 2017.

- <sup>1</sup> Cf. Borger, K., Lüdemann, E., Zeuner, J. and Zimmermann, V. (2013): Deutschlands Wachstum in der Demografiefalle: Wo ist der Ausgang? (Germany's growth in demographic trap: Where is the way out?), Papers and Proceedings, KfW Economic Research (in German).
- <sup>2</sup> Cf. Ulku, H. (2004): R&D, Innovation, and Economic Growth: An empirical Analysis, IMF Working Paper 04/195, and Dachs, B., Hud, M. Koehler, C. and Peters, B. (2016): Innovation, Creative Destruction and Structural Change: Firm-level Evidence from European Countries. *Industry and Innovation* 2(4), p. 346–381.
- <sup>3</sup> Cf. e.g. Zimmermann, V. (2015): What are the hallmarks of consistently successful businesses? Focus on Economics No. 113, KfW Research; Zimmermann, V. (2015): KfW SME Innovation Report 2014. Standstill in Europe is slowing down innovation. KfW Research; Zimmermann, V. (2014): Innovation and Employment Die Beschäftigungswirkung verschiedener Arten von Innovationen in expandierenden und schrumpfenden mittelständischen Unternehmen (*The employment effect of different types of innovation in expanding and contracting SMEs*), *Journal of Business Economics*, ZfB-Special Issue 4/2013 (in German): p. 131–149 Kritikos, A. S., Hafenstein, M. and Schiersch, A. (2017): Auch kleinste Betriebe stoßen erfolgreich Innovationen an, sie tun es nur seltener (*Micro-businesses, too, stimulate innovation successfully, they just do it less often*), *DIW Wochenbericht* 27, p 755–761 (in German) and Gerstenberger, J. (2017): Productivity of German SMEs has flatlined – time to act, Focus on Economics No. 172, KfW Research.
- <sup>4</sup> Cf. Jensen, M. B.; Johnson, B.; Lorenz, E. and Lundvall, B. A. (2007): Forms of knowledge and modes of innovation. *Research Policy* 36(5): p. 680–693.
- <sup>5</sup> Cf. OECD (2005) (Hrsg.): Oslo Manual. Guidelines for collecting and interpreting innovation data.
- <sup>6</sup> The KfW SME Panel captures whether an enterprise has brought forth innovations for a three-year period using the method commonly applied across Europe. Initially the KfW SME Panel surveyed innovative activity only every two years.
- <sup>7</sup> Cf. Poschen, K. and Zimmermann, V. (2014): Falling sales expectations curb SME innovation activity in Germany. *Economics in Brief* No. 58, KfW Research, and for more details Zimmermann, V. (2010): Innovation und Konjunktur (Innovation and economic activity). *Points of View* No. 10, KfW Economic Research.
- <sup>8</sup> A rapid spread of innovations can also have negative effects, however. It can reduce the profitability of new-to-market innovations, so that the earnings they generate may be insufficient to recoup the (usually high) development costs. That can lower the incentive to develop new-to-market innovations. Patent laws and other intellectual property rights (e.g. models, copyrights) should therefore provide adequate protection for the interests of pioneer businesses.
- <sup>9</sup> Cf. Mansfield, E. (1981): Imitation costs and patents: an empirical study, *Economic Journal* 91, p. 907–918 and Peters, B. et al. (2014): Firm Growth, Innovation and the Business Cycle. Background Report for the 2014 Competitiveness Report.
- <sup>10</sup> The number of employees is calculated including the active owners but excluding trainees and apprentices. Two part-time employees are counted as one full-time employee.
- <sup>11</sup> Cf. Galbraith, J. K. (1952): *American Capitalism. The Concept of Countervailing Power*. Boston, Houghton Mifflin, p. 92, Cohen, W. M., Levin, R. C. and Mowery, D. (1987): Firm Size and R&D Intensity. A Re-Examination. *Journal of Industrial Economics* 35, p. 543–563 or Cohen, W. S. and Klepper, S. (1996): Firm Size and the Nature of Innovation within Industries: The Case of Process and Product R&D. *Review of Economics and Statistics* 78(2), p. 232–243.
- <sup>12</sup> Cf. Zimmermann, V. (2017): KfW SME Innovation Report 2016. Innovation is concentrated in increasingly fewer enterprises. KfW Research or Zimmermann, V. (2014): KfW SME Panel 2013: How German SMEs finance their innovations. Focus on Economics No. 50, KfW Research.
- <sup>13</sup> Owing to changes in the structure of the questionnaires, older surveys of innovation expenditure under the KfW SME Panel are not directly comparable with current figures.
- <sup>14</sup> This includes expenditure on internal and external research and development (R&D), innovation-related expenditure on machinery, equipment, software and external knowledge (e.g. patents and licenses). It also includes expenditure on product design, construction, service design and preparation for the manufacture and sale of innovations. Expenditure on training conducted in the context of innovations and their introduction into the market is included as well.
- <sup>15</sup> The Centre for European Economic Research in Mannheim (ZEW) has surveyed the innovation activities of German enterprises on behalf of the Federal Ministry of Education and Research (BMBF) since 1993. This survey is at once the German contribution to the Community Innovation Survey (EIS) of the European Commission.
- <sup>16</sup> Cf. Behrens, V.; Berger, M.; Hud, M.; Hünermund, P.; Iferd, Y.; Peters, B.; Rammer, C. and Schubert, T. (2017): Innovation Activities of Firms in Germany - Results of the German CIS 2012 and 2014. Background Report on the Survey of the Mannheim Innovation Panel Conducted in the Years 2013 to 2016, ZEW Documentation No. 17-04.
- <sup>17</sup> Cf. Schwartz, M. (2017): KfW SME Panel 2017. Volume of tables, KfW Research.
- <sup>18</sup> For more details cf. Zimmermann, V. (2014): KfW SME Panel 2013: How SMEs finance their innovations, Focus on Economics No. 50, KfW Research.
- <sup>19</sup> Cf. Müller, S. and Stegmaier, J. (2014): Economic failure and the role of plant age and size. First evidence from German administrative data, IAB Discussion Paper 13/2014.
- <sup>20</sup> Cf. Zimmermann, V. (2017): KfW SME Innovation Report 2016. Innovation is concentrated in increasingly fewer enterprises, KfW Research.
- <sup>21</sup> Cf. Behrens, V.; Berger, M.; Hud, M.; Hünermund, P.; Iferd, Y.; Peters, B.; Rammer, C. and Schubert, T. (2017): Innovation Activities of Firms in Germany - Results of the German CIS 2012 and 2014. Background Report on the Survey of the Mannheim Innovation Panel Conducted in the Years 2013 to 2016, ZEW Documentation No. 17-04.
- <sup>22</sup> These correlations were also apparent in a multivariate regression analysis which took into account the influences of further factors. Cf. Zimmermann, V. (2013): Bestimmungsfaktoren der Innovationsfinanzierung in mittelständischen Unternehmen (*Determining factors of innovation finance in small and medium-sized enterprises*), *Zeitschrift für KMU und Entrepreneurship* 3/61, p. 197–218 (in German).
- <sup>23</sup> Cf. Rammer, C., Gottschalk, S., Peters, B. and Erdsiek, D. (2016): Die Rolle von KMU in Forschung und Innovation in Deutschland (*The role of SMEs in research and innovation in Germany* – in German). *Studien zum deutschen Innovationssystem* No. 10/2016.
- <sup>24</sup> Cf. OECD (2015) (publisher): Frascati Manual 2015. Guidelines for collecting and reporting data on research and experimental development.

- <sup>25</sup> 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.
- <sup>26</sup> Cf. Rammer, C.; Köhler, C.; Schwiebacher, F.; Murmann, M.; Kinkel, S.; Kirner, E.; Schubert, T. and Som, O. (2011): Innovationen ohne Forschung und Entwicklung. Eine Untersuchung zu Unternehmen, die ohne eigene FuE-Tätigkeit neue Produkte und Prozesse einführen. (*Innovation without research and development. A survey of enterprises that introduce new products and processes without own R&D activity* – in German). Studien zum deutschen Innovationssystem No. 15-2011.
- <sup>27</sup> Cf. Zimmermann, V. (2017): KfW SME Innovation Report 2016. Innovation is concentrated in increasingly fewer enterprises, KfW Research.
- <sup>28</sup> The response could be submitted as free text and allowed for various reasons to be stated. However, only few enterprises actually stated more than one reason. The responses were subsequently classified into nine categories.
- <sup>29</sup> Cf. Astor, M., Rammer, C., Klaus, C. and Klose, G. (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* – in German). Study commissioned by the German Federal Ministry for Economic Affairs and Energy.
- <sup>30</sup> Cf. Zimmermann, V. (2017): SME innovations: Seven reasons for the decline in the share of innovators. KfW Research. Focus on Economics No. 185, 3 November 2107, and Aghion, P., Bloom, R., Blundell, R., Griffith, R. and Howitt, P. (2005): Competition and Innovation: an inverted-U relationship, Quarterly Journal of Economics 120(2), p. 701–728.
- <sup>31</sup> Cf. Commission of Experts for Research and Innovation (ed.) (2018): Report on Research, Innovation and Technological Performance in Germany, 2018 Report.
- <sup>32</sup> Cf. Schwartz, M. (2017): KfW SME Panel 2017. Germany's domestic economy continues to break records– sectoral transformation poses new challenges, KfW Research.
- <sup>33</sup> Cf. Behrens, V.; Berger, M.; Hud, M.; Hünermund, P.; Iferd, Y.; Peters, B.; Rammer, C. and Schubert, T. (2017): Innovation Activities of Firms in Germany - Results of the German CIS 2012 and 2014. Background Report on the Survey of the Mannheim Innovation Panel Conducted in the Years 2013 to 2016, ZEW Documentation No. 17-04.
- <sup>34</sup> This explanation is significant particularly because the bulk of enterprises reported only one reason for not innovating.
- <sup>35</sup> Cf. Rammer, C., Gottschalk, S., Peters, B., Bersch, J. and Erdsiek, D. (2016): Die Rolle von KMU für Forschung und Innovation in Deutschland (*The role of SMEs for research and innovation in Germany* – in German), Studien zum deutschen Innovationssystem No. 10/2016.
- <sup>36</sup> Cf. Zimmermann, V. (2016): KfW Innovation Report 2015. Germany's innovation performance remains low despite slight increase, KfW Research.
- <sup>37</sup> Cf. Schwartz, M. (2017): KfW SME Panel 2017. Germany's domestic economy continues to break records– sectoral transformation poses new challenges, KfW Research.
- <sup>38</sup> Gerstenberger, J., Zimmermann, V. and Bretz, M. (2016), Unternehmensbonität – eine nicht zu vernachlässigende Größe (*'A company's credit rating – a factor not to be neglected'* – in German), in: van Koevorden, A.; Schneiser-Maessen, Schumann, M. and Weiss, B. (eds.): Verlässliches Credit Management in turbulenten Zeiten (*Reliable credit management in times of turmoil*), p. 25–48, Kleve, Credit & Finance Verlag (in German).
- <sup>39</sup> Cf. Zimmermann, V. (2017): SME innovations: Seven reasons for the decline in the share of innovators. Focus on Economics No. 185, KfW Research.
- <sup>40</sup> Cf. Zimmermann, V. (2016): SMEs and innovation - enterprises innovate less as their workforce ages. Focus on Economics No. 125, KfW Research.
- <sup>41</sup> Cf. Rammer, C. and Schmitz, F. (2017): Fortentwicklung der EFI-Indikatorik: Förderlandschaft. Studien zum deutschen Innovationssystem Nr. 9-2017 (in German).
- <sup>42</sup> Cf. Rammer, C. and Schubert, T. (2016): Concentration on the Few? R&D and Innovation in German Firms 2001 to 2013, ZEW Discussion Paper No. 16-005.
- <sup>43</sup> Cf. Zimmermann, V. (2016): KfW SME Innovation Report 2015. Germany's innovation performance remains low despite slight increase, KfW Research.
- <sup>44</sup> Cf. Rammer, C., Czarnitzki, D. and Spielkamp, A. (2009): Innovation success of non-R&D performers: substituting technology by management in SMEs. Small Business Economics 33(1), p. 35–58.
- <sup>45</sup> Cf. Zimmermann, V. and Thomä J. (2016), SMEs face a wide range of barriers to innovation activity – support policy needs to be broad-based, Focus on Economics No. 130, KfW Research.
- <sup>46</sup> Cf. Zimmermann, V. (2017): SME innovations: Seven reasons for the decline in the share of innovators. Focus on Economics No. 185, KfW Research.
- <sup>47</sup> Cf. Zimmermann, V. (2016): KfW SME Innovation Report 2015. Germany's innovation performance remains low despite slight increase. KfW Research.
- <sup>48</sup> Cf. Rammer, C. and Schmitz, F. (2017): Fortentwicklung der EFI-Indikatorik: Förderlandschaft. Studien zum deutschen Innovationssystem Nr. 9-2017 (in German).