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## »»» KfW SME Digitalisation

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Digitalisation has reached broad areas of the SME sector – average expenditure on digitalisation remains low

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## Digitalisation has reached broad areas of the SME sector – average expenditure on digitalisation remains low

Digitalisation is increasingly making inroads into small and medium-sized enterprises. Between 2015 and 2017, 30% of SMEs completed digitalisation projects successfully – up four percentage points on the previous period. In absolute terms, this means around 1.1 million SMEs have stepped up their digitalisation efforts. What is particularly pleasing is that this development is being driven by businesses of all sizes and in nearly all economic sectors. It is not limited to narrow segments.

Spearheading the transformation are large SMEs, which account for the highest share (49%), and knowledge-based service providers (37%), as well as research and development-intensive manufacturing firms (36%). The groups of enterprises that also rank among the precursors of traditional innovations, such as internationally operating businesses or companies that conduct their own research and development (R&D), also exhibit high shares of digital transformers.

In 2017, SMEs spent just under EUR 15 billion in total on digital transformation. That was around EUR 1 billion more than in the previous year. One negative, however, was that average digitalisation expenditure has stagnated on the previous year at EUR 17,000. A spending gap has opened up particularly between small and large SMEs, as SMEs with 50 and more employees invest around 24 times more in digitalisation than small SMEs with fewer than five employees. This gives rise to concerns of a potential divide emerging between large, heavily digitalised SMEs and small SMEs left behind in the digital transformation.

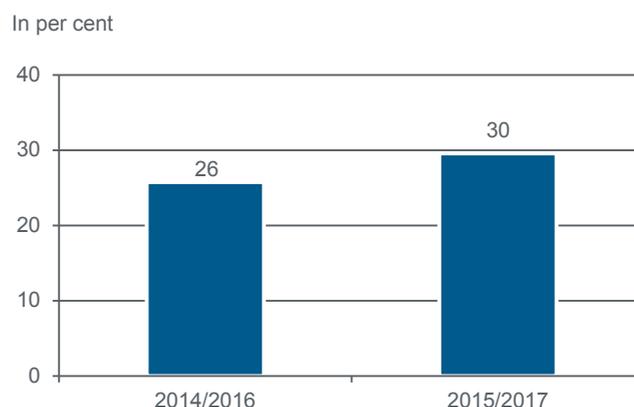
The most common digitalisation projects involve contacts with the business environment. They are closely followed by the renewal of IT structures and deployment of new applications. Building digitalisation expertise ranks third. Companies that are not among the forerunners, in particular, appear to have recognised their deficits and are actively addressing them. The development and introduction of digital products and services, however, is rarely on their agenda.

Given the great importance being attributed to digitalisation for businesses' competitiveness and economic growth, the digital transformation of the

SME sector needs to be further promoted. The main barriers to digitalisation such as lack of IT skills, unsatisfactory quality of Internet connections, problems in adapting the corporate structure and workflow management, as well as unresolved data security and data protection issues, are starting points for economic policy measures. Difficulties in financing digitalisation projects and promoting awareness of the benefits and opportunities offered by digitalisation are other important areas that merit intervention.

Since the 2013 Hanover Trade Fair, the German public has been broadly familiar with digitalisation under the catchwords 'Industry 4.0', 'Business 4.0' or 'SMEs 4.0'. As general-purpose technologies, new digital technologies represent an important source of innovation, competitiveness and growth across broad sectors of the economy.<sup>1</sup> As with traditional innovation projects, numerous studies have shown that digitalisation has positive effects at aggregate and microeconomic level.<sup>2</sup>

**Figure 1: SMEs with completed digitalisation projects**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

Digitalisation represents an expansion of the traditional innovation concept. It involves more than product and process innovations – the traditional German approach. We define digitalisation as the implementation of projects that involve introducing or improving the use of digital technologies in an enterprise's processes, products and services and in its contacts with customers and suppliers. Digitalisation includes measures aimed at building corresponding skills within

the enterprise and implementing new digital marketing and sales strategies. However, the technological areas considered in digitalisation are limited. Typically, digitalisation involves only the technological areas of IT, information and communications technologies (ICT) and microsystem technology. The broad overlap between both types of projects is visible in the fact that, for example, 43% of digital transformers have also brought forth product or process innovations.

In general terms, there is nothing new about the penetration of information technologies into the economy and society. We all remember the New Economy Boom of the second half of the 1990s, the rise of the PC since the 1980s and industrial robots since the 1970s. It must be stressed, however, that digitalisation is a far-reaching process that is creating major changes in the economy and society.

International comparisons show that Germany's digital transformation is only in a midfield position, ranking 14th within the EU 28 on the (DESI) Digital Economy and Society Index of the European Union.<sup>3</sup> In the monitoring report 'Wirtschaft DIGITAL' of the Federal Ministry of Economics and Technology, Germany ranks fifth among the world's ten most important locations.<sup>4</sup> The monitoring report concludes that Germany does not have any pronounced digitalisation-specific strengths. The study identified Germany's pronounced weakness in exporting digitalisation technologies, which is likely symptomatic of the situation in the country.

The bulk of SMEs is not making full use of the available digitalisation potential either. Most SMEs are lagging behind the technological evolution. Around half of SMEs can be regarded as digital midfield. These businesses use individual applications of digitally linked information and communication but only a good quarter of these enterprises have a digitalisation strategy. One third of SMEs are clear latecomers. In these enterprises, even basic digital applications are less common than average. Digital forerunners, on the other hand, make up just under one fifth of SMEs. What makes these enterprises stand out is that they are already implementing Industry 4.0 projects or offering digital products and services.<sup>5</sup>

### Share of digital transformers is growing

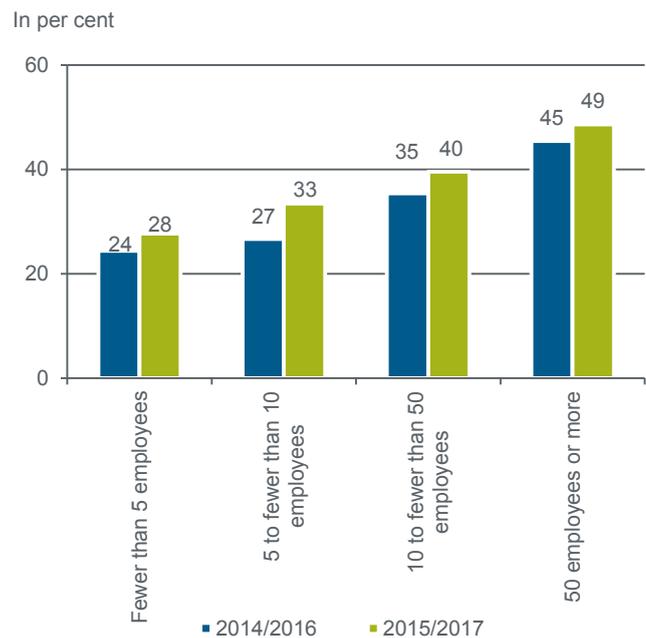
Against this backdrop, it is pleasing that the share of digital transformers in the SME sector is growing.<sup>6</sup> Between 2014 and 2016, a mere 26% of SMEs completed digitalisation projects successfully. That share grew by around four percentage points to nearly 30% in the period from 2015 to 2017 (Figure 1). The number of

digital transformers rose to a good 1.1 million SMEs. This confirms a clear trend towards digitalisation, which has also become apparent in other surveys.<sup>7</sup>

### Large SMEs are more digitally active

The share of digital transformers is growing across enterprises of all sizes. At rates between four and five percentage points, that share has risen to a similar extent in all size classes surveyed (Figure 2). This confirms that digitalisation has arrived in a further group of enterprises of all kinds of sizes.

**Figure 2: Digital transformers by enterprise size**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

Significant differences between size classes are apparent in the proportion of enterprises with completed digitalisation projects, however. The share rises noticeably with the size of the company, ranging from 28% in small enterprises with fewer than five employees to 49% in large SMEs with 50 employees and more.<sup>8</sup>

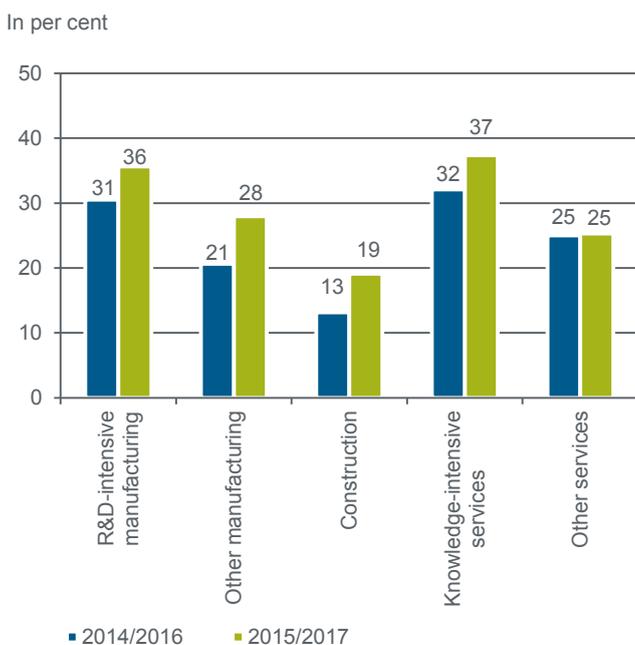
There are many reasons for this: Larger enterprises tend to have more reasons to undertake digitalisation measures, such as their more extensive IT equipment and closer integration into supra-regional value chains as a result of their broader activities. They also tend to have a higher degree of automation. Besides, minimum project sizes and fixed cost shares lead to higher burdens on small enterprises. Not least, smaller businesses have greater difficulties in obtaining external finance<sup>9</sup> for their digitalisation projects.

### Knowledge-based service providers and R&D-intensive manufacturing firms lead the way

A sector comparison shows that enterprises providing 'knowledge-based services' have taken the lead with a share of 37% (Figure 3). These include, for example, media, IT and information services, law firms, tax consultancies and management consulting firms. R&D-intensive manufacturing is just behind, where 36% of enterprises have completed digitalisation projects. This includes mechanical engineering, electrical engineering and chemistry, for example. The trend here is similar to that of innovation activity, as enterprises in these sectors also have the highest share of product and process innovators.

Construction (19% share of digital transformers) typically has the lowest digitalisation potential. Digitalisation possibilities are particularly limited in the direct provision of services. The use of building information modelling (BIM) is often referred to as a key step towards digitalisation in this sector. The debate over the extent to which such a tool can also be useful for small and medium-sized enterprises has not ended yet, however. With shares of 25 and 28%, respectively, digital transformers are in midfield in the sectors of 'other services' (e.g. hospitality, transport and storage) and 'other manufacturing' (e.g. metal production and processing, garment production or animal feed production).

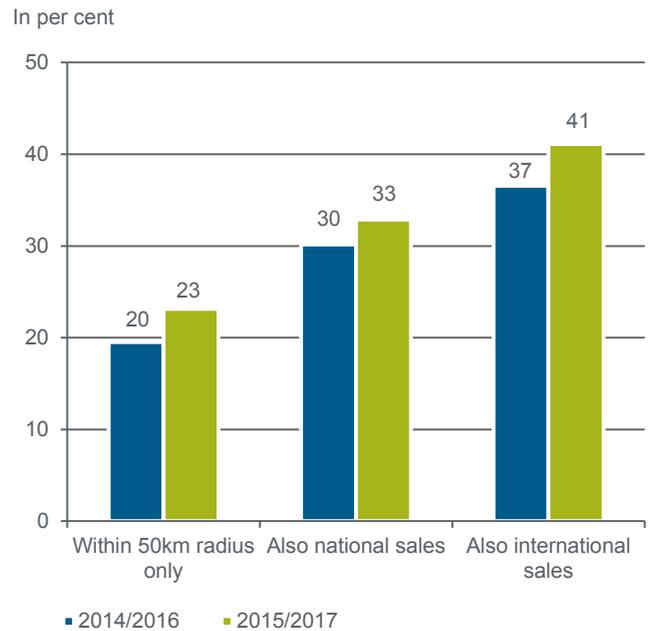
**Figure 3: Digital transformers by economic sector**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

**Figure 4: Digital transformers by sales region**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

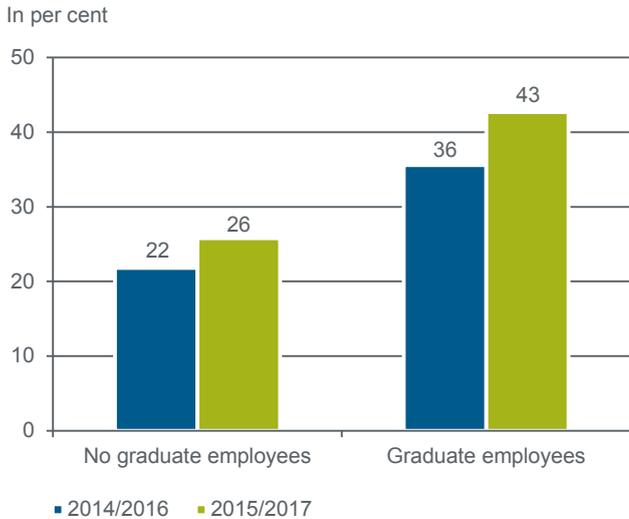
### Tough competition is forcing businesses to digitalise

The regional scope of a company's sales market plays a role in digitalisation. The share of digital transformers grows with the size of the sales market (Figure 4). It is known that this correlation also applies to SMEs' innovation activity.<sup>10</sup> This is because the relevant enterprises are in closer competition and therefore under particular pressure to keep their products up-to-date and their business processes efficient. Another reason given is that a presence in supra-regional and international markets is a source of new knowledge and ideas<sup>11</sup> that can lead to traditional innovation and to an expansion of digitalisation. Evidence also shows that, with a view to the region of the sales market, the share of digital transformers is growing across a broad front and not limited to individual segments.

### High education levels facilitate digitalisation

Human capital is regarded as the most important source of innovation.<sup>12</sup> This also holds true for digitalisation. Companies that employ graduates expand the digitalisation of their business at a rate of 43% (for 2015/2017), around two thirds more often than businesses without graduates (Figure 5). An academic education thus facilitates digitalisation to a particular extent. A university degree obviously builds particular skills for such creative activities. This has also been confirmed for innovation activity, for example.<sup>13</sup>

**Figure 5: Digital transformers with and without graduate employees**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

**In-house research and development facilitates digitalisation**

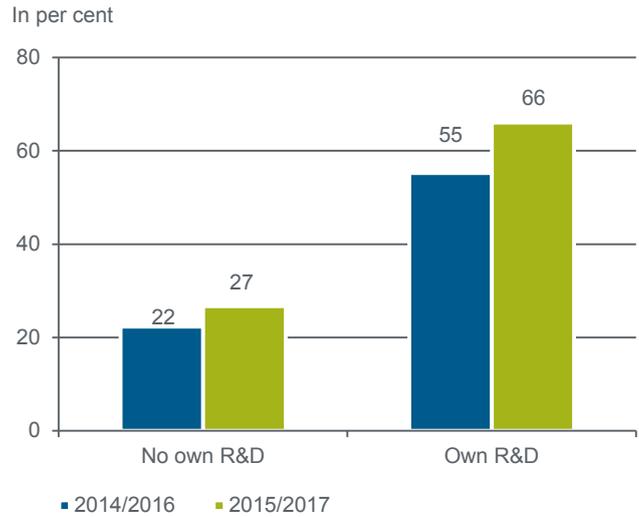
Another source for the development of digitalisation ideas and their implementation can be own research and development (R&D) activity. R&D is defined as ‘systematic creative work aimed at expanding existing knowledge [...] and using it with the objective of finding new potential applications’<sup>14</sup>. It enables new digital products and production processes to be developed, for example, but also further business applications as part of R&D projects. What is also conceivable is that digitalisation ideas in enterprises conducting R&D do not emerge directly from their own research activity. Rather, conducting own R&D may indicate that the business is operating in an innovative environment where enterprises are also more active in advancing their digital transformation than other enterprises (without conducting R&D specifically targeted at digitalisation).

Indeed, enterprises that perform own R&D do implement digitalisation projects more often than enterprises without R&D. At 66%, this share is more than twice as high among SMEs conducting R&D as among those who do not (Figure 6). For the development of the share of digital transformers it is evident that both groups exhibited roughly the same relative increase between 2014/2016 and 2015/2017.

**At the top of the list: digitalising links to the business environment**

A closer look by type of project shows that SMEs are prioritising the digitalisation of contacts within the value chain and to their final customers. This often involves

**Figure 6: Digital transformers with and without own R&D activity**

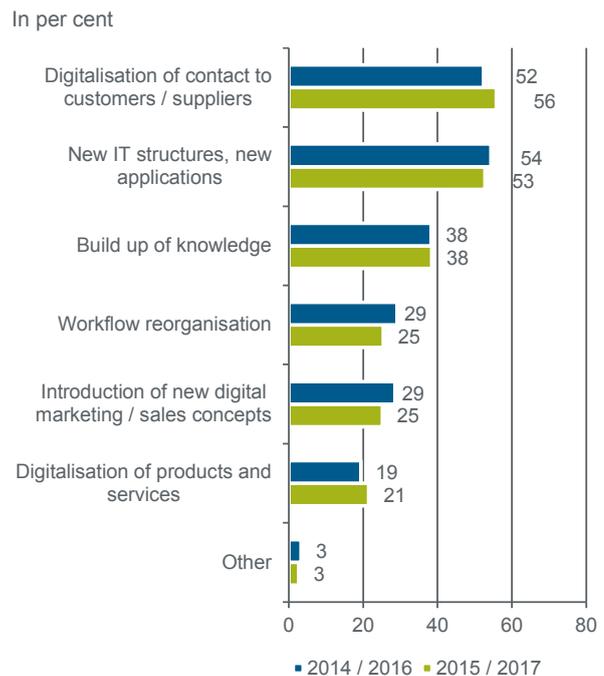


Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

the redesign of websites and the use of internet applications such as online ordering and payment systems, the use of social media and customer feedback mechanisms. Data exchange within the value chain is also likely to play a role. The share of SMEs that have completed projects of this type has grown by four percentage points on the previous period. This category currently tops the list, representing 56% of enterprises that have completed digitalisation projects (Figure 7).

**Figure 7: Types of digitalisation projects**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

Businesses attach similar importance to the renewal of IT structures, at 53%. This includes the installation of new hardware, the implementation of new systems or individual, new applications. Modernising IT is therefore the second most common project type.

As in the previous period, projects aimed at building digitalisation expertise were the third most common type – although at a considerably lower 38%. They include the contracting of IT advisory services or training for company employees. Lack of in-house expertise is among the most important obstacles to digitalisation.<sup>15</sup> The frequency with which this type of project was mentioned shows that a considerable percentage of SMEs are actively addressing this obstacle and investing in their digital skills. Advanced applications, in particular, often cannot be utilised unless an enterprise has the requisite competencies, so improving digital skills is of great importance.

This is followed by the reorganisation of workflows and introduction of new, digital marketing and sales strategies, at around 25% each. Workflows likely have to be reorganised when digitalisation penetrates deeply into an enterprise's existing processes and organisation. This indicates that the affected enterprises are putting complex digitalisation measures in place more often.

New, digital marketing and sales strategies can also be introduced in connection with the digitalisation of the customer interface described above. This would rather be an indication that digital latecomers are also implementing these projects. The reorganisation of workflows and the introduction of digital marketing/sales strategies are the only two project types mentioned slightly less often than in the previous period.

Just as in the previous period, the digitalisation of products and services ranks last. What is encouraging is that more enterprises have addressed this issue than before. However, the product range still plays a relatively minor role in digital transformation efforts. This is consistent with the frequently voiced complaint that digitalisation in Germany focuses too much on efficiency gains and does not adequately consider the search for new fields of sales and activity, for example by further developing the business models.<sup>16</sup>

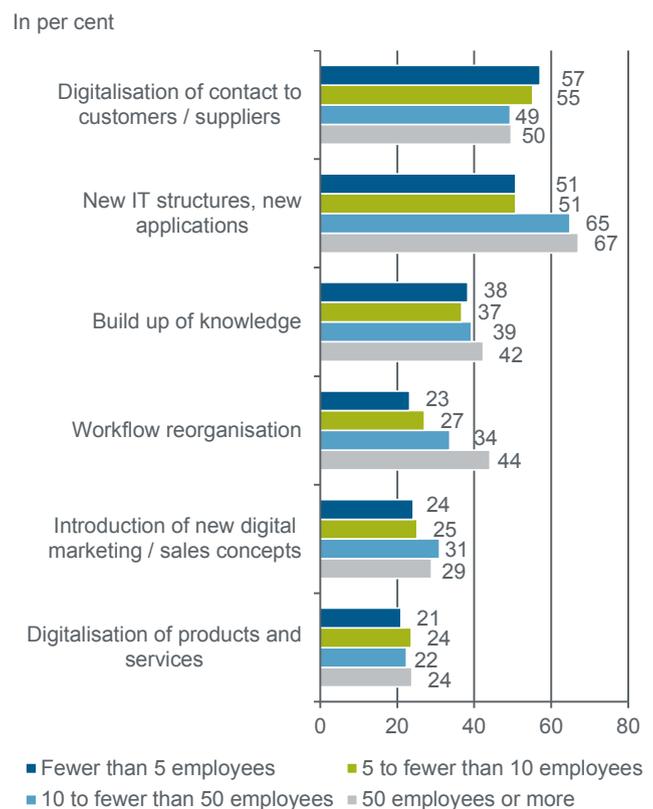
### Large SMEs that conduct R&D have sophisticated digitalisation projects

Digitalisation of the points of intersection with customers and suppliers is currently being driven primarily by small businesses, construction firms and enterprises with sales across Germany (Figure 8, Figure 9, Figure 10, Figure 11). This is more of an

indication that these are mainly latecomer enterprises. Large SMEs that are already more digitally advanced and operating internationally are likely to have already completed this step. The fact that businesses operating across Germany are in the lead with respect to the sales market region is not a contradiction. It is likely due to the fact that companies operating regionally are still even less likely to regard digitalised points of intersection as relevant to their business because of the shorter distances.

By contrast, larger SMEs focus on the renewal of IT structures and the introduction of new applications. This was also found to be the case for enterprises that operate internationally and conduct R&D. It is likely to be purely a size effect because large enterprises also more often have a need to digitalise activities. And it is probably also due to the fact that these are usually enterprises that are generally more innovative than others. Such enterprises are also quicker to implement digital innovations.

**Figure 8: Types of digitalisation projects by size of enterprise.**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

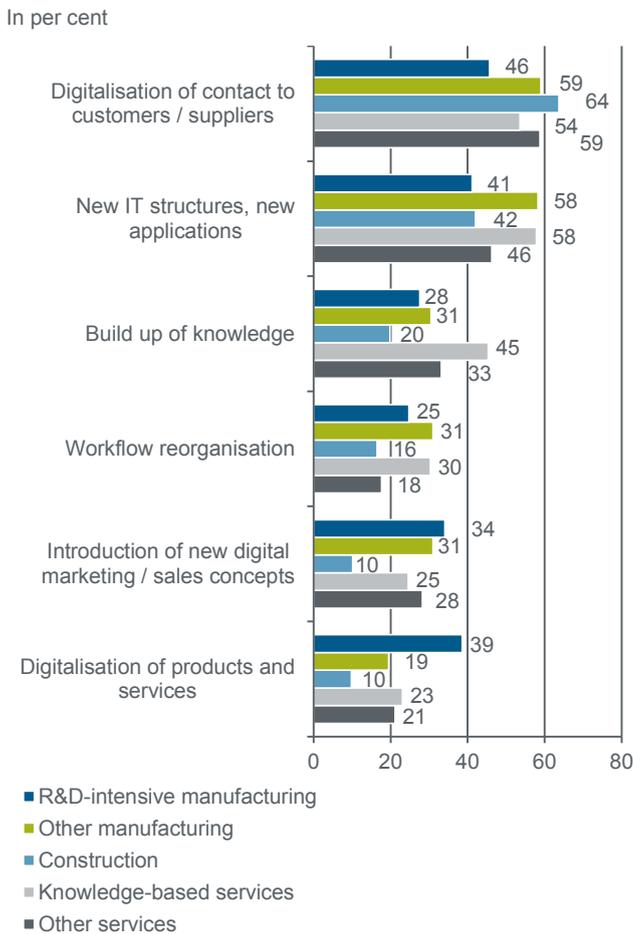
### Many latecomers are improving their digital skills

Building digital expertise was also mentioned most often by large SMEs. But the differences between size

classes are minor. Businesses that operate in knowledge-intensive sectors are particularly active here, representing 45% of digital transformers. But their sales area is often confined to a specific region or they are firms that do not conduct R&D activities of their own. This finding is noteworthy especially with regard to firms that conduct R&D as they are more active in all other types of projects surveyed.

Some of these enterprises therefore have characteristics that are not typically associated with forerunners. This shows that at least some of the latecomers have realised their deficits and taken the first step of familiarising themselves with the topic of digitalisation.

**Figure 9: Types of digitalisation projects by economic sector**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

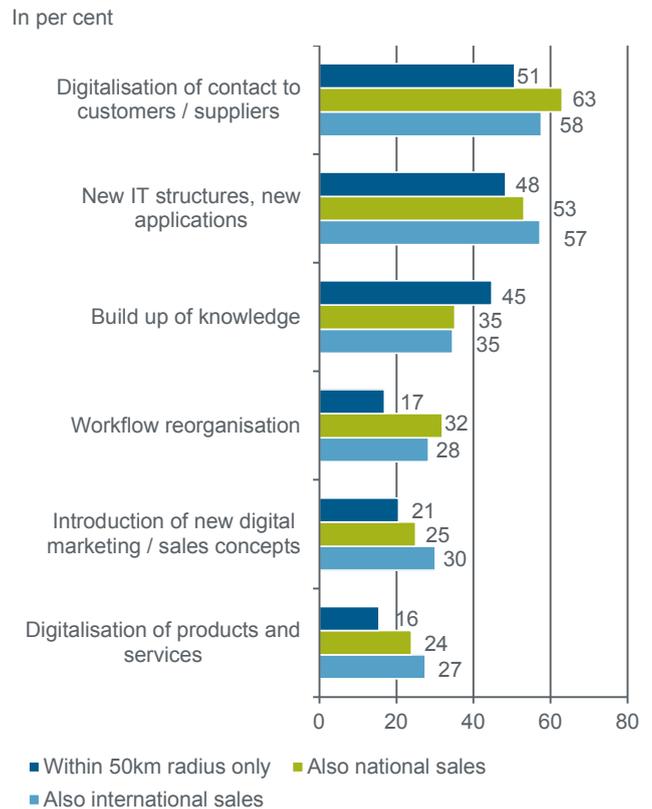
**Digital forerunners are reorganising their workflows as part of digitalisation projects**

The reorganisation of workflows in the context of digitalisation projects is more common with increasing company size. Projects of this type are also more common in companies that provide knowledge-based

services and in manufacturers, as well as in enterprises with supra-regional operations. With respect to R&D activities, in this type of project the most pronounced differences of all project types surveyed can be seen between enterprises with and without own R&D. This confirms the above consideration that these are more far-reaching projects that are typically more likely to be rolled out by forerunner enterprises.

New digital marketing and distribution projects are also carried out more often by larger SMEs. These projects are also very common in the manufacturing sector, in SMEs that conduct R&D and with increasing regional expansion of the sales area. Therefore, they are also more likely to be carried out by the types of enterprises that are more common among forerunner enterprises.

**Figure 10: Types of digitalisation projects by sales region**

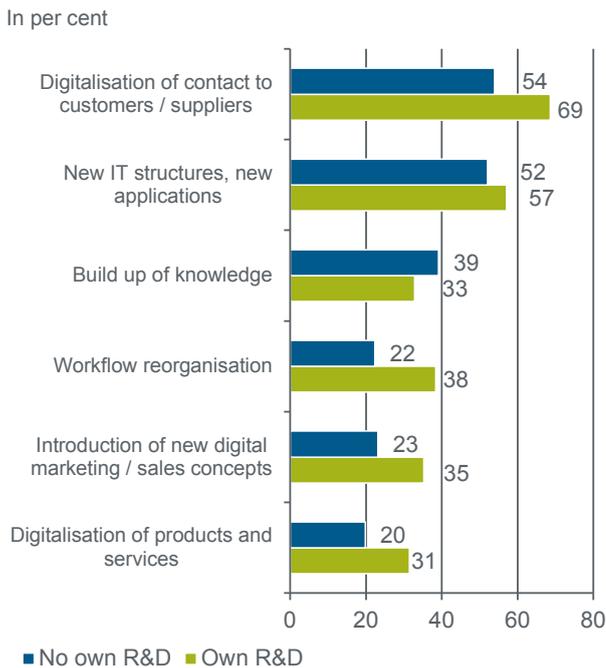


Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

Finally, digitalised products and services were brought to market primarily by R&D-intensive manufacturers, internationally operating enterprises and those that conduct R&D. They, too, are therefore groups of enterprises that are also among the forerunners of traditional innovations.

**Figure 11: Types of digitalisation projects by own R&D activity**



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

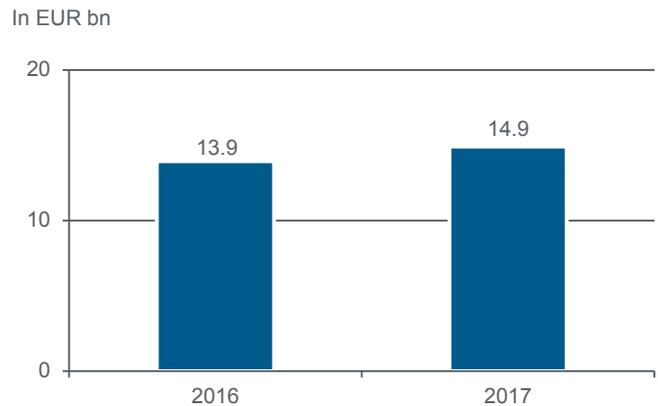
### SMEs spent EUR 15 billion on digitalisation

SMEs with completed digitalisation projects spent a total of EUR 14.9 billion on digitalisation projects in 2017 (Figure 12). That was an increase of around EUR 1 billion on the previous year. Although this increase is pleasing, it should not obscure the fact that a multiple of that amount was spent on traditional innovation or investment, for example. In 2017, SMEs invested EUR 211 billion in machinery, equipment and similar items and spent EUR 31 billion on traditional innovations.

Enterprises with fewer than five employees have a high share of this, at around EUR 4 billion and 26% (Figure 13). At first glance, this finding may come as a surprise because the share of digital transformers in this group is relatively low. It can be attributed to the fact that enterprises with fewer than five employees make up the bulk of small and medium-sized enterprises – 81%.

This group's aggregate digitalisation expenditure decreased slightly on the previous year (EUR -0.4 billion). Enterprises of other size classes, however, more than offset this decline, as their expenditures grew moderately.

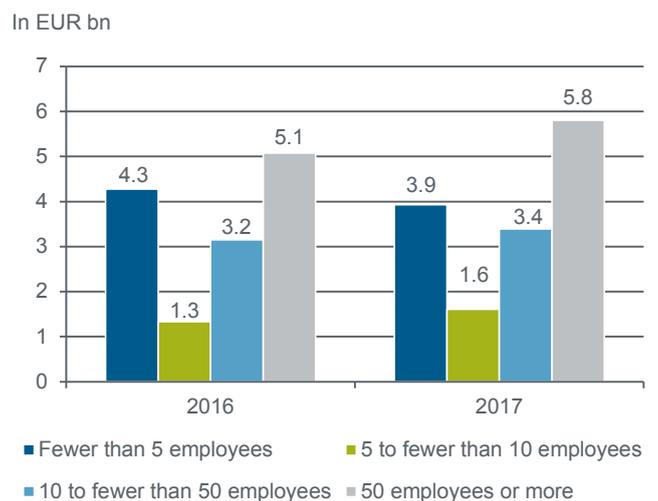
**Figure 12: Aggregate expenditure on digitalisation in the SME sector**



Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

**Figure 13: Aggregate expenditure on digitalisation by SME size**



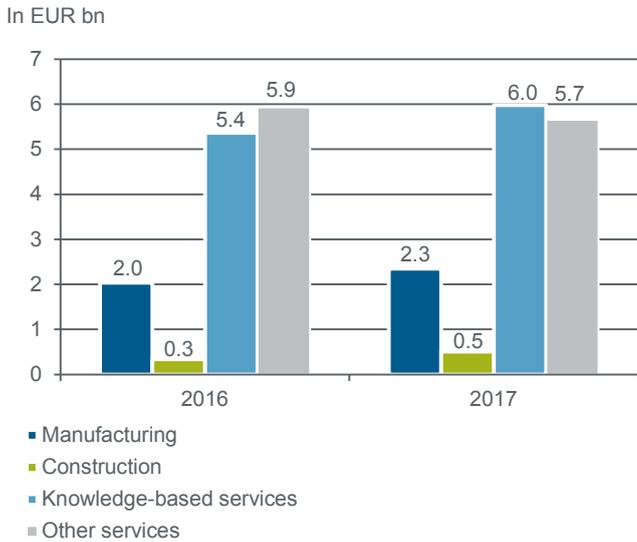
Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

A breakdown by economic sector shows that knowledge-based service providers and other service providers have the equal highest aggregate digitalisation expenditure, at EUR 6 billion and just under that amount (Figure 14). With around 40% of digitalisation expenditure each, their expenditure roughly matches the corresponding proportion of these enterprises in all SMEs. Manufacturing firms spent an aggregate EUR 2.3 billion on digitalisation, which represents around 15% of digitalisation expenditure. The fact that manufacturers make up only 7% of SMEs shows how actively these enterprises are pursuing their digital transformation. Compared with the previous year, digitalisation expenditure has grown moderately in all economic sectors – with the exception of other

services.

**Figure 14: Aggregate expenditure on digitalisation by SMEs by economic sector**



Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

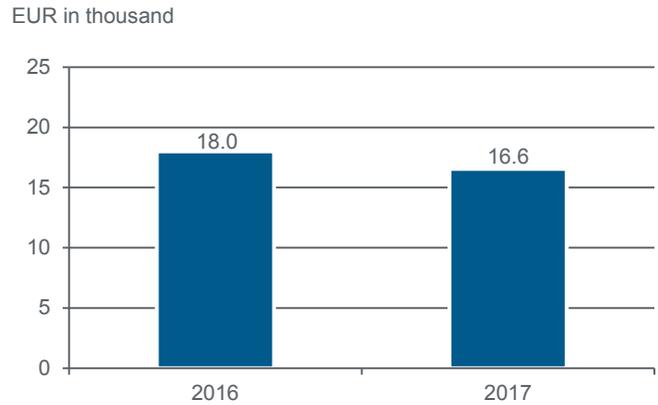
**Average expenditure on digitalisation has stagnated**

Finally, the following graphs show how much enterprises with completed digitalisation projects spent on digital transformation on average. SMEs' average spend on digitalisation in 2017 was just under EUR 17,000. That was a minor decrease on the previous year (Figure 15).

The level of expenditure depends heavily on the size of the company. Enterprises with fewer than five employees spent a good EUR 6,000 on digitalisation on average in 2017. In enterprises with 50 and more employees, this proportion rises almost exponentially to nearly EUR 150,000 (Figure 16), around 24 times more than what small businesses spent.

In this comparison it must generally be noted that small enterprises also need to invest only small amounts in digital transformation because of their size. They have less hardware and software, for example. The high discrepancy between small and large enterprises' expenditure, however, is raising concerns that a gap will open up in the medium term between heavily digitalised large enterprises and typically small enterprises that lag behind in the digitalisation of their business. This risk has even grown since the previous year as enterprises with fewer than 50 employees spent slightly less on digitalisation on average. By contrast, large SMEs have slightly increased their average digitalisation expenditure.

**Figure 15: Average expenditure on digitalisation in the SME sector**



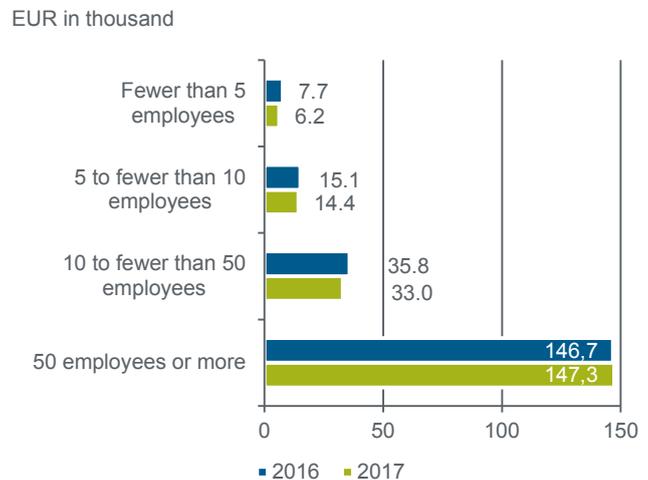
Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

A glance at average digitalisation expenditure confirms the intense activity of manufacturers previously mentioned. Enterprises with completed digitalisation projects invest around EUR 41,000 each, about twice the amount of the next sectors (Figure 17).

This is most likely due to the fact that digitalisation in production in the manufacturing sector is very costly because it often involves replacing or retrofitting machines and equipment. In service enterprises, on the other hand, the processes of service delivery are often not so capital-intensive and less costly to implement. Compared with the previous year, average expenditure has dropped in all economic sectors (with the exception of construction).

**Figure 16: Average expenditure on digitalisation by SME size**



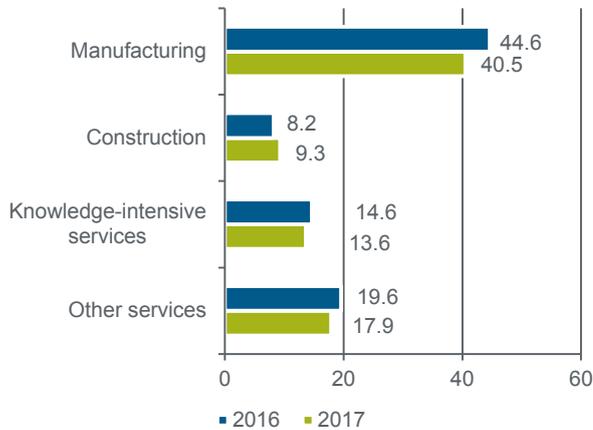
Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

**Figure 17: Average expenditure on digitalisation by economic sector**

EUR in thousand



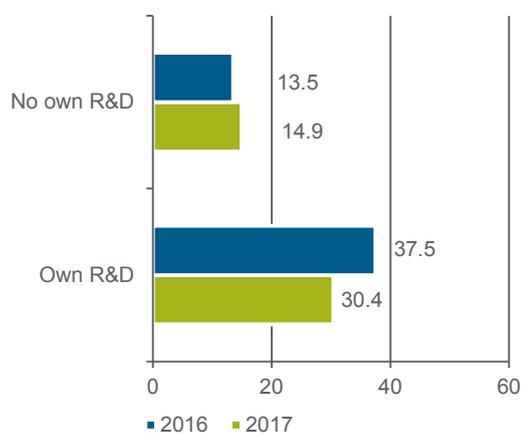
Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

SMEs that conduct their own R&D not only digitalise more often and are more likely to carry out more ambitious projects, they also spent more on digitalisation, a good EUR 30,000 on average in 2017 and around twice as much as enterprises without own R&D activities. However, digital transformers with own R&D could not avoid the trend towards lower digitalisation expenditure. Average expenditure actually dropped by a notable EUR 7,000 on the previous year. In the coming years it will be worth watching whether this will develop into a trend or whether it was a purely coincidental fluctuation.

**Figure 18: Average expenditure of SMEs on digitalisation by R&D activity**

EUR in thousand



Note: Only enterprises with completed digitalisation projects, values extrapolated from the number of employees.

Source: KfW SME Panel, own calculations

## Conclusion

The survey revealed that digitalisation in the SME sector is advancing.

- The proportion of enterprises with completed digitalisation projects increased by four percentage points on the previous period to 30%. It is currently significantly higher than for traditional innovation activity.
- What is particularly pleasing is that this development is taking place all across the SME sector. An increase in the digitalisation rate can be identified among enterprises of all size classes and in nearly all economic sectors.

- In all SME segments, growing shares of digital transformers can also be identified on the basis of further criteria such as sales region, employment of graduates or own R&D.

Still, clear differences in the proportions of digital transformers are apparent between different types of enterprises:

- Large SMEs with 50 and more employees carry out digitalisation projects almost twice as often as small businesses with fewer than five employees.
- A sector-based comparison shows that knowledge-based service providers and R&D-intensive manufacturers implement digitalisation projects most often.
- High digitalisation levels are also found in enterprises that are typically forerunners in traditional innovation activity as well: businesses with international operations, those that employ graduates and those that conduct R&D.

The following findings on digitalisation activity merit highlighting:

- Most of the projects are aimed at digitalising links to the business environment and – following closely behind – renewing IT structures and adopting new applications.
- Acquiring the skills to use digital technologies and applications ranks third. Encouragingly, this position is being driven particularly by enterprises that typically do not count among the forerunners. Many small and regionally operating businesses, as well as those without R&D, are familiarising themselves with

digitalisation.

- By contrast, the development and introduction of new or improved digital products and services still ranks last.
- Thus, digitalisation efforts remain focused on achieving efficiency gains and are less intended as a means of acquiring new groups of customers or tapping into new business models.

As the share of enterprises implementing digitalisation projects rises, so does the aggregate sum of digitalisation expenditure in the SME sector:

- At around EUR 15 billion, however, this sum is still much lower than other expenditure categories such as innovation or investment.
- Moreover, a fly in the ointment is the fact that digitalisation expenditure per digital transformer is stagnating as well. It is just EUR 17,000 per enterprise.
- Along with manufacturing firms, it is primarily large SMEs that spend large sums on digital transformation. Large enterprises spend around 24 times more on digitalisation measures than businesses with fewer than five employees.
- This gives rise to concerns that this may split the SME sector into large, heavily digitalised SMEs and small SMEs left behind in the digital transformation. The finding that average digitalisation expenditure has decreased in small enterprises but increased in larger enterprises (if by a slim margin) fuels these fears.

Given the high importance being attributed to digitalisation for future competitiveness, growth and prosperity, it appears advisable to further advance digitalisation in the SME sector. From a business perspective, the main obstacles include lack of IT skills, unresolved issues relating to data security and data protection, problems in adapting the corporate structure and workflow management and unsatisfactory quality of internet connections.<sup>17</sup> Besides solving legal issues, training and professional development activities and expansion of broadband networks therefore constitute important starting points for economic policy measures.

In addition, more businesses have to be made aware of the benefits and opportunities of digitalisation. Economic policy measures aimed at creating broader awareness of digitalisation have been expanded in the past years. They should be sustained in the years ahead as well. Last but not least, small businesses – in particular – that apply for loans for digitalisation projects are reporting growing difficulty in accessing credit.<sup>18</sup> This is not really surprising given the similar characteristics of digitalisation and innovation projects. So in addition to providing finance for the development of digitalisation technologies, supporting businesses in the implementation of digitalisation measures would appear to be a helpful economic policy measure. ■

### The structure of digital transformers in the SME sector in 2015/2017

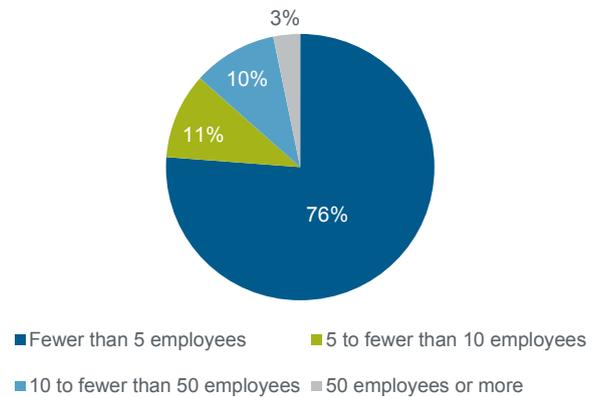
The SME sector, according to KfW's definition, covers all enterprises in Germany whose annual turnover does not exceed EUR 500 million. By this definition, around 3.76 million SMEs exist in Germany. The SME sector thus accounts for 99.95% of all enterprises. A good 1.1 million of these enterprises have successfully completed digitalisation projects.

Most small and medium-sized digital transformers are small businesses. The majority of digital transformers in the SME sector – nearly 900,000 enterprises or 76% – have fewer than five employees. This high proportion of small digital transformers is due to the overall structure of small and medium-sized enterprises. Eighty-one per cent of SMEs have fewer than five employees. Around 12% of digital transformers come from the manufacturing sector and a further 86% from the services sector.

Eighty-three per cent of digital transformers in the SME sector do not conduct any R&D of their own. A mere 8% perform research continuously while 9% undertook some R&D activities only occasionally in the past three years.

### Figure 19: Digital transformers in the SME sector by enterprise size

In per cent

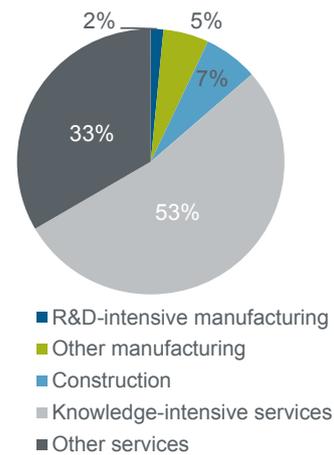


Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

### Figure 20: Digital transformers in the SME sector by economic sector

In per cent

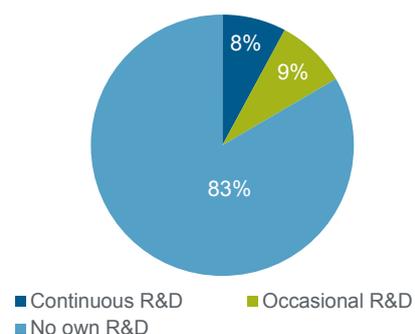


Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

### Figure 21: Digital transformers in the SME sector 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 9,666 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 as a starting point.

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 Group. The project received expert advice from the Leibnitz Centre for European Economic Research (ZEW) in Mannheim. The main survey of the 16th wave was conducted in the period from 12 February to 22 June 2018.

<sup>1</sup> Cf. Bresnahan, T.F. and Trajtenberg, M. (1995): General purpose technologies, engines of growth? *Journal of Econometrics* 65(1), p. 83–108.

<sup>2</sup> Cf. Van Ark, B. and Inklaar, R. (2005), *Catching Up or Getting Stuck? Europe's Troubles to Exploit ICT's Productivity Potential*. Research memorandum GD-79, Groningen Growth and Development Centre; Kretschmer, T. (2012), *Information and Communication Technologies and Productivity Growth: A Survey of the Literature*; OECD Digital Economy Papers, No.195, OECD Publishing; Cardona, M.; Kretschmer, T. and Strobel, T. (2013), *ICT and productivity: conclusions from the empirical literature*, *Information Economics and Policy* 25, p. 109-125, Bertschek, I.; Cerquera, D. and Klein, G.J. (2013), *More Bits – More Bucks? Measuring the Impact of Broadband Internet on Firm Performance*, *Information Economics and Policy* 25(3), p. 190–203, Niebel, T., Rasel, F. and Viète, S. (2019), *BIG Data – BIG gains? Understanding the link between Big Data Analytics and Innovation*; *Economics of Innovation and New Technology* 28(3), p. 296–316.

<sup>3</sup> Cf. DESI (2018); <https://ec.europa.eu/digital-single-market/en/desi>; last retrieved on 13 February 2019.

<sup>4</sup> Cf. Federal Ministry of Economics and Technology (2018): *Monitoring-Report Wirtschaft DIGITAL 2018* (in German) *Der IKT-Standort Deutschland und seine Position im internationalen Vergleich (Germany as an ICT location and its position in international comparison – our title translation, in German only)*.

<sup>5</sup> Cf. Saam, M., Viète, S. and Schiel, S. (2016): *Digitalisierung im Mittelstand: Status Quo, aktuelle Entwicklungen und Herausforderungen ('Digitalisation in SMEs: status quo, current trends and challenges' – our title translation, in German only)*. Research project on behalf of KfW Group.

<sup>6</sup> The following analysis is based on the KfW SME Panel, a representative longitudinal data section for small and medium-sized enterprises in Germany with an annual turnover of up to EUR 500 million.

<sup>7</sup> Cf. Zimmermann, V. (2018): **Business Survey 2018: Digitalisation is gaining momentum**, KfW Research (in German, summary in English).

<sup>8</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>9</sup> Cf. Zimmermann, V. (2018): **Business Survey 2018. Digitalisation is gaining momentum**, KfW Research (in German, summary in English).

<sup>10</sup> Cf. Zimmermann, V. (2018): **Determinants of digitalisation and innovation behaviour in the SME sector**. Focus on Economics No. 236, KfW Research.

<sup>11</sup> Vgl. Schlegelmilch, B. (1988): Der Zusammenhang zwischen Innovationsneigung und Exportleistung (*The correlation between innovation propensity and export performance* – our title translation, in German only). Results of an empiric survey of the German engineering industry. *Zeitschrift für betriebswirtschaftliche Forschung* 50(3), p. 227–269; Greenaway, D. and Kneller, R. (2007), Firm heterogeneity, exporting and foreign direct investment, *The Economic Journal* 117(517), p. F134–F161 and Anderson, M. and Lööf, H. (2009), Learning by Exporting Revisited – the role of intensity and persistence, *Scandinavian Journal of Economics* 111(4), p. 893–913.

<sup>12</sup> Cf. Innovative capability and financing constraints for innovation – more money, more innovation? *Review of Economics and Statistics* 94(4), p. 1126–1142.

<sup>13</sup> Cf. Zimmermann, V. (2018): **Determinants of digitalisation and innovation behaviour in the SME sector**, Focus on Economics No. 236, KfW Research.

<sup>14</sup> Cf. OECD (2015) (publisher), *Frascati Manual 2015. Guidelines for collecting and reporting data on research and experimental development*.

<sup>15</sup> Cf. Zimmermann, V. (2017): **Business Survey 2017. Digital transformation of industries: broad basis, multiple barriers**, KfW Research (in German).

<sup>16</sup> Cf. Zimmermann, V. (2018): **Business Survey 2018. Digitalisation is gaining momentum**, KfW Research (in German).

<sup>17</sup> Cf. Zimmermann, V. (2017): **Business Survey 2017. Digital transformation of industries: broad basis, multiple barriers**, KfW Research (in German).

<sup>18</sup> Cf. Zimmermann, V. (2016): **Access to credit varies considerably depending on the purpose**, Focus on Economics No. 148 and Zimmermann, V. (2018): **Business Survey 2018. Digitalisation is gaining momentum**, KfW Research.