

KfW Research

## »»» KfW SME Digitalisation Report 2022

Digitalisation grew considerably in the second year of the COVID-19 pandemic, gap between pioneers and latecomers threatens to widen

## **Imprint**

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In its second year, the coronavirus pandemic triggered a significant surge in digitalisation efforts among SMEs. To be sure, the share of small and medium-sized enterprises with completed digitalisation projects dropped slightly to 31%. However, this is merely due to developments among small businesses. Among enterprises of medium size, that share increased for the second time in a row from a pre-pandemic 32 to now 43% in businesses with 5 to 10 employees and from 44 to 52% in businesses with 10 to fewer than 50 employees. Large SMEs, too, now complete digitalisation projects much more often than directly before the outbreak of the pandemic, with their share rising from 60 to 65%.

Furthermore, SMEs' digitalisation expenditure also increased significantly for the second time in a row, rising to EUR 23 billion (EUR 17.5 billion in 2019). This is also the highest level since surveys began. Large SMEs and those that undertake their own research and development (R&D) in particular are now spending more than before the outbreak of the pandemic. Their average expenditure rose from EUR 139,000 and EUR 43,000, respectively, to EUR 174,000 and EUR 73,000.

The recent rise was due to the fact that most of the crisis management measures have now been completed and businesses are increasingly approaching digitalisation projects from a longer-term and, in part, strategic perspective. Large enterprises whose projects have a strategic focus on average spend up to 61% more on digitalisation than businesses that carry out digitalisation projects for crisis management purposes.

The realignment of digitalisation activities can be seen from the completed projects. Typical crisis management projects have decreased. These include, for example, projects aimed at a digitalising interactions with customers and suppliers and introducing digital sales. At the same time, projects involving the reorganisation of workflows and work management were carried out significantly more often. The more strategic focus of digitalisation activities gives hope that the digitalisation boost is here to stay.

The increased digitalisation efforts undertaken by a portion of the SME sector, however, have also caused the gap between large and small SMEs as well as pioneers and latecomers to widen compared with pre-pandemic times. Thus, the share of companies with digitalisation projects is 2.4 times higher among large enterprises than among small businesses. They spend around 21 times more on digitalisation than small ones. The share of SMEs with R&D activities that have digitalisation projects is 2.2 times higher and their average digitalisation expenditure is 3.6 times higher than among businesses without R&D activities.

Possible economic policy approaches for additionally supporting digitalisation activities can address both pioneers and latecomers. Starting points can be key digitalisation obstacles and business segments that have so far received less support.

With respect to improving the environment for digitalisation activities by small and medium-sized enterprises, they range from expanding scientific research into digital technologies and setting standards for application to harmonising the legal framework and further improving digital infrastructure.

Of key importance are also the issues of digital skills development and knowledge transfer in the SME sector. Digital skills gaps must be closed through increased basic and advanced training. This also includes focusing even more closely on the strategic importance of digitalisation and helping businesses generally improve their strategic capabilities. Knowledge transfer in the business sector can be improved with specific measures aimed at exploring the potential for application and disseminating new scientific findings.

Last but not least, the financing of digitalisation projects poses challenges for both pioneers and latecomers. The use of specific promotional tools must be guided by the degree of maturity of the technologies and ranges from grants and tax relief for R&D activities through equity capital and quasi-equity instruments to promotional loans.

## 1. Introduction

Digitalisation is deemed a key driver of innovation, competitiveness and growth for businesses as well as the overall economy. As a general-purpose technology<sup>1</sup>, digitalisation is an opportunity for developing new value creation potential, increasing the competitiveness of broad sections of the economy and kick-starting productivity growth, and not only in new technological fields such as artificial intelligence, blockchain technology and quantum computing. Digital technologies are also becoming increasingly pervasive in Germany's traditional areas of technological strength such as mechanical and automotive engineering. In the future it will hardly be possible for Germany to develop new value creation potential or assert its existing strengths unless it develops adequate capacity in the area of digital technologies.

The fact that digitalisation and innovation activity are interconnected in many different ways also contributes to this. Thus, digitalisation is often the technological basis that makes innovation possible in the first place.<sup>2</sup> On the other hand, it is particularly innovative enterprises that are driving digitalisation forward in great strides.<sup>3</sup> So from a business perspective, digitalisation activities are important investments in the future that help them position themselves in the market.

Numerous studies have thus found that digitalisation has benefits not just for individual businesses but for the whole economy.<sup>4</sup> The coronavirus pandemic in particular recently brought to light the benefits of modern information and communication technologies as well as digitalised workflows. It has also revealed of the deficits existing in Germany.

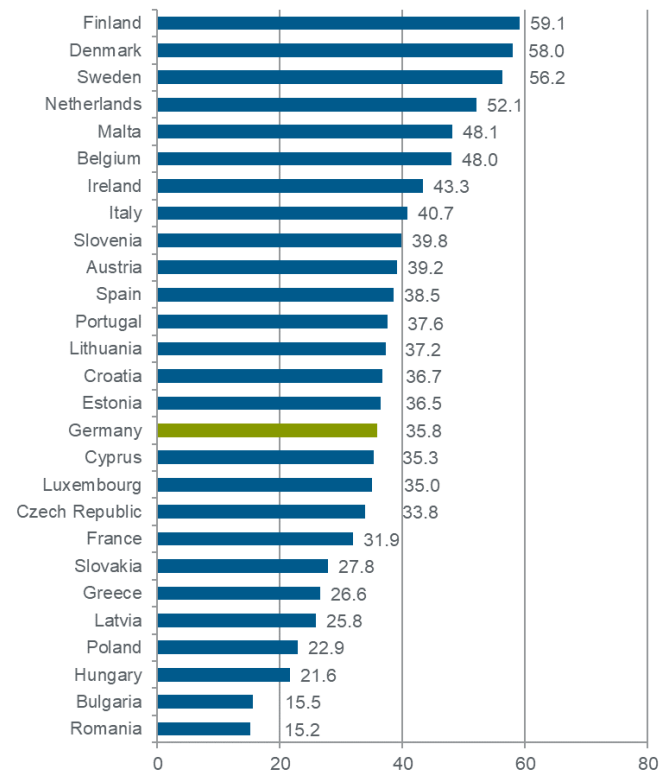
We define digitalisation in businesses as the implementation of projects that involve introducing or improving the use of digital technologies in an enterprise's processes, products, services and interactions with customers and suppliers. It also includes measures aimed at building corresponding skills within the enterprise and implementing new digital marketing and sales strategies.

The diffusion of information technologies in the economy and society is not a new trend. Only the word 'digitalisation' was coined more recently. Examples of earlier digitalisation waves were 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. Nevertheless, the current digitalisation wave is a far-reaching process that is generating profound

changes in business and society.

**Figure 1: Germany's rank in the integration of digital technologies**

Index points



Source: DESI 2022

What is causing concern is that the development of digital technologies is not among the strengths of Germany's innovation system<sup>5</sup> and that the country is not exactly a pioneer in the application of digital technologies either. Thus, Germany ranks 13th within the EU 27 on the revised Digital Economy and Society Index of the European Union (DESI).<sup>6</sup> In fact, the country also merely ranks 16th in integrating digital technologies into business processes (Figure 1).

This rank near the top of the bottom third of the EU countries is likely a direct consequence of Germany's comparatively low investment in information technologies.<sup>7</sup>

This is likely due in large part to the fact that digitalisation activities are faced with numerous barriers. It has also been found that in many businesses, strategic considerations are still not playing a large enough role in the way they design their digitalisation activities.



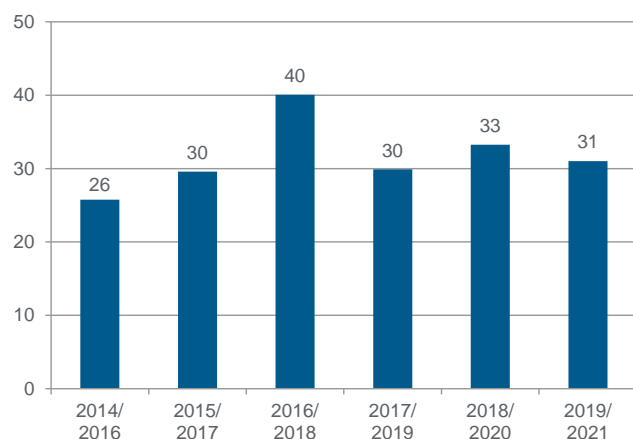
## 2. SMEs with completed digitalisation projects

### Even in the second pandemic year, digitalisation activities are more common than before

After small and medium-sized enterprises scaled back their digitalisation efforts in response to the cyclical downturn in 2019, a digitalisation boost could be observed in the first year of the coronavirus pandemic. For example, home working capacity was developed and expanded within a short period of time.<sup>8</sup> Online transactions also increased strongly.<sup>9</sup> The use of online trade, cashless payment systems, virtual communication forms and e-health services experienced strong growth. For businesses it was of critical importance to respond flexibly to changes in demand and supply bottlenecks, to ensure distancing and remain visible for customers and cooperation partners.<sup>10</sup> Digitalisation measures were able to contribute to these objectives precisely under the pandemic conditions.<sup>11</sup>

**Figure 2: SMEs with completed digitalisation projects**

In per cent



Note: Figures extrapolated to the number of enterprises. Source: KfW SME Panel, own calculations

In the current primary survey of the KfW SME Panel (box: KfW SME Panel at the end), which comprises the 2019–2021 period, the share of small and medium-sized enterprises with completed digitalisation projects fell moderately to 31% (Figure 2). However, it is still higher than immediately before the outbreak of the pandemic. Since the previous year's survey, the number of small and medium-sized enterprises with completed digitalisation projects dropped by a good 100,000 to just under 1.2 million.

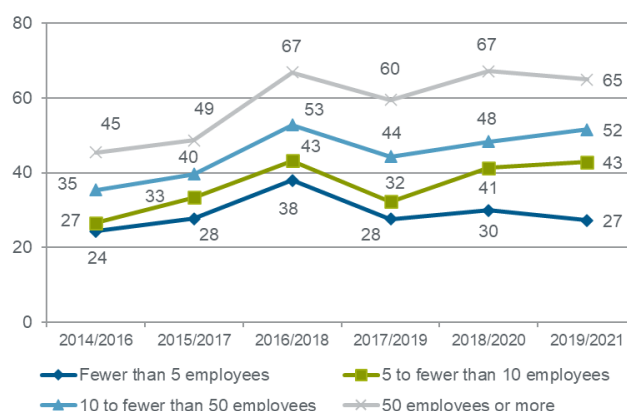
### Large SMEs are more digitally active

The decline in the share of businesses with digitalisation projects is essentially driven by the development among small businesses with fewer than five

employees<sup>12</sup> (Figure 3). In this group, which makes up more than four fifths of SMEs, the share of enterprises with digitalisation projects fell from 30 to 27%. That is even lower than in the year before the outbreak of the pandemic.

**Figure 3: SMEs with completed digitalisation projects by enterprise size**

In per cent



Note: Figures extrapolated to the number of enterprises. Source: KfW SME Panel, own calculations

Already in the first year of the pandemic, the response of these businesses – measured by the share of companies with completed digitalisation projects – was also weaker than among large enterprises. That means the coronavirus pandemic had the least effect on businesses of this size class with respect to the implementation of digitalisation projects.

By contrast, that share increased for SMEs of medium size in the current survey as well. Compared with the pre-pandemic survey, the shares of businesses with completed digitalisation projects in the two relevant company size classes were 8 percentage points higher in the group of companies with 5 to fewer than 10 employees and 11 percentage points higher in the group of firms with 10 to fewer than 50 employees. In the comparatively small group of businesses with 50 or more employees (which make up 2% of SMEs), the proportion of firms with completed digitalisation projects has now dropped slightly. That means the peak level of the first pandemic year was not matched again. But at 65% it remains significantly higher than immediately before the pandemic.

Thus, digitalisation activities continue to differ significantly between enterprise size classes. The share of businesses with completed digitalisation projects is

2.4 times higher among large SMEs than in the group of small businesses.

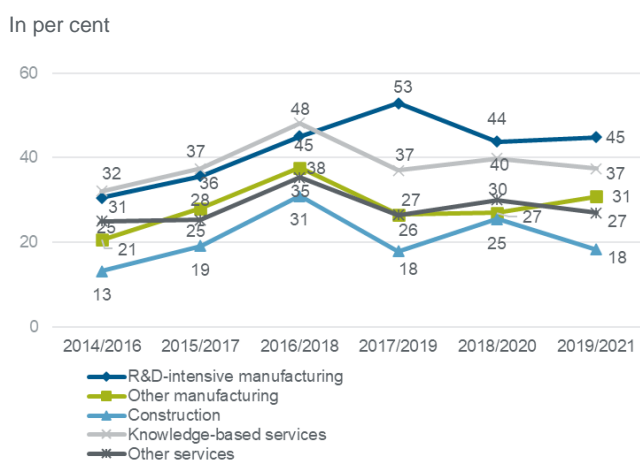
The percentage of businesses with digitalisation projects rises with enterprise size for a variety of reasons. Larger enterprises have more complex coordination problems to solve for which they require more information.<sup>13</sup> Large enterprises also tend to have a higher degree of automation and a broader range of activities. This means they have more extensive IT equipment which, in turn, more often provides starting points for further digitalisation measures.

As they implement their projects they benefit from the ability to allocate the (fixed) costs incurred to a larger sales volume.<sup>14</sup> That gives them more capacity to absorb the risks involved and makes internal and external financial resources more readily available.<sup>15</sup> For small businesses in particular, minimum project sizes and a higher proportion of fixed costs create a heavier burden<sup>16</sup>, so that they are more likely to delay digitalisation projects. Finally, smaller businesses have greater difficulty accessing external finance for digitalisation projects.<sup>17</sup>

### R&D-intensive manufacturing and knowledge-based services top the list

The coronavirus pandemic had a significantly lower impact on digitalisation activities in a sectoral comparison than in a comparison by business size. This is primarily due to the fact that the proportion of enterprises found to have digitalisation projects in each economic sector is essentially shaped by the large group of small businesses.

**Figure 4: SMEs with completed digitalisation projects by sector**



Note: Figures extrapolated to the number of enterprises.  
Source: KfW SME Panel, own calculations

The latest survey found that the share of enterprises with completed digitalisation projects increased in the

manufacturing sector. This applies to a lesser extent to R&D-intensive manufacturing<sup>18</sup>. The share of businesses with completed digitalisation projects grew more strongly in the segment of other manufacturing. That share decreased in all other sectors, however (Figure 4). Services in particular were heavily affected by the consequences of the coronavirus pandemic.<sup>19</sup> Accordingly, increased adaptation measures were required in the first year of the pandemic which were not continued with the same intensity in the second year. Construction also showed a brief increase in digitalisation measures in the first pandemic year.

The coronavirus pandemic had a comparatively small effect on the manufacturing sector, so the need to put in place adaptation measures in the first pandemic year was not as great as in the services industries. Furthermore, businesses operating in sectors that often carried out digitalisation projects already before the pandemic – such as R&D-intensive manufacturers, but also knowledge-based service providers<sup>20</sup>, – had likely achieved a higher digitalisation level already before the outbreak of the pandemic, so that they needed to adopt immediate adaptation measures less often. In knowledge-based services industries the share of businesses with digitalisation projects increased only relatively little in the first year of the pandemic. In the segment of R&D-intensive manufacturing, it even decreased. Various businesses in these sectors obviously delayed longer-term projects as well.

As in previous years, R&D-intensive manufacturing and knowledge-based services had the highest proportions of businesses with completed digitalisation projects. The share of businesses with digitalisation projects is 45% in R&D-intensive manufacturing and 37% in knowledge-based services. There are similarities to innovation activity here as well. Enterprises of these sectors also have the highest share of product and process innovators, which underscores the fact that innovation and digitalisation in businesses are closely linked.

The remaining sectors follow at a considerable distance with shares ranging from 18 to 31%. The shares of SMEs with digitalisation projects in 'other services' sectors (e.g. hospitality, transport and storage) and 'other manufacturing' (e.g. metal production and processing, garment production or animal feed production) were almost on the same level. The construction sector, in which 18% of companies have completed digitalisation projects, typically exhibits less digitalisation potential than other sectors, which is due in part to the fact that it has limited possibilities to digitalise the direct provision of services.

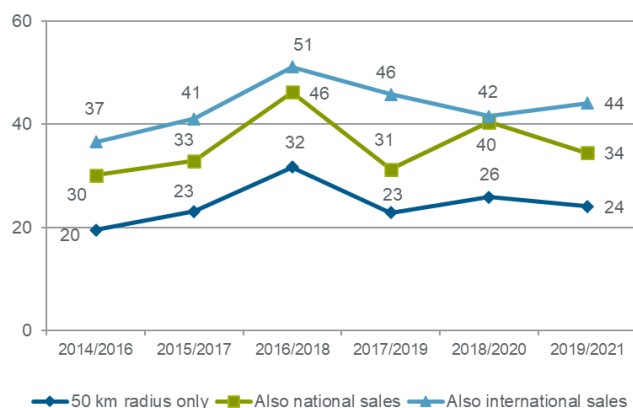
### Intense competition in supra-regional markets is forcing businesses to go digital

The regional extent of a company's sales market also plays an important role in its digitalisation (Figure 5). The share of digital transformers is significantly higher among enterprises that operate in an international sales market than among those with merely regional activities (44 vs. 24%). It is known that this pattern also applies to SMEs' innovation activity.<sup>21</sup>

The reason for this is that the relevant enterprises are in more intense competition and therefore under particular pressure to keep their products up-to-date and their business processes efficient. Early adoption of new technologies and the offering of high-quality products with the latest technology provide competitive advantages over rivals.<sup>22</sup> The use of digital technologies also provides advantages in communicating across long distances. This applies to a company's visibility in foreign markets, for example, or in its communication with customers and other business partners.<sup>23</sup> At the same time, innovative capacity and a certain degree of digitalisation are also likely important prerequisites for gaining a foothold in international markets. Not least, having a presence in supra-regional and international markets is a source of inspiration and new knowledge<sup>24</sup> that can lead to both traditional innovation and to broader digitalisation.

**Figure 5: SMEs with completed digitalisation projects by sales region**

In per cent



Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

During the pandemic, the share of internationally active enterprises with completed digitalisation projects did not rise, defying the trend. To be sure, these companies were hit particularly hard by the impact of the pandemic,<sup>25</sup> but they probably did not consider further digitalisation steps such as continuing the expansion of

digital communication to be conducive to mitigating its impact because many of them had already achieved a higher degree of digitalisation. In addition, the share of internationally active enterprises with digitalisation projects was already higher than that of other enterprises before the outbreak of the pandemic.

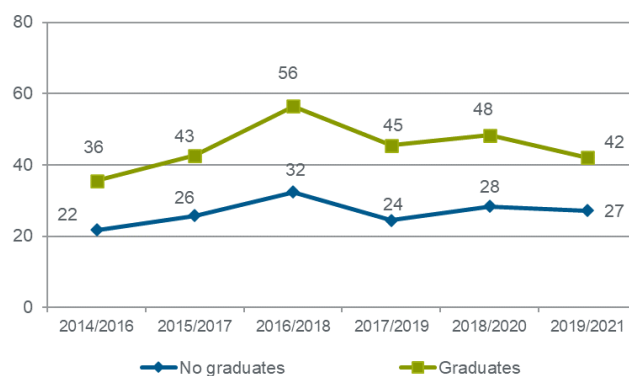
By contrast, enterprises that were less active digital transformers in the past probably increasingly acted on digitalisation incentives at the start of the pandemic. Companies with Germany-wide operations in particular, which often tend to be larger than regionally operating businesses, implemented digitalisation projects more often in the first pandemic year than before. The share of these enterprises with digitalisation projects is also higher at the current margin than it was immediately before the outbreak.

### Having university graduates in the workforce is an asset for digitalisation

At present, 42% of enterprises that employ graduates have completed digitalisation projects (Figure 6). This share is thus significantly higher than in businesses without graduates.

**Figure 6: SMEs with completed digitalisation projects with and without graduate employees**

In per cent



Note: Figures extrapolated to the number of enterprises.

Sources: KfW SME Panel, own calculations

The likely reason for this is that human capital is an important source of innovation.<sup>26</sup> Having higher formal qualifications also makes it easier to use information technologies, an observation that is also confirmed for the use of other advanced technologies.<sup>27</sup> Among other things, this may be attributed to the fact that the relevant enterprises are better organised to prepare for the use of information technologies and that tertiary degree courses promote the development of problem-solving abilities more strongly than other qualifications. Both can increase the benefit from the use of such technologies.<sup>28</sup>



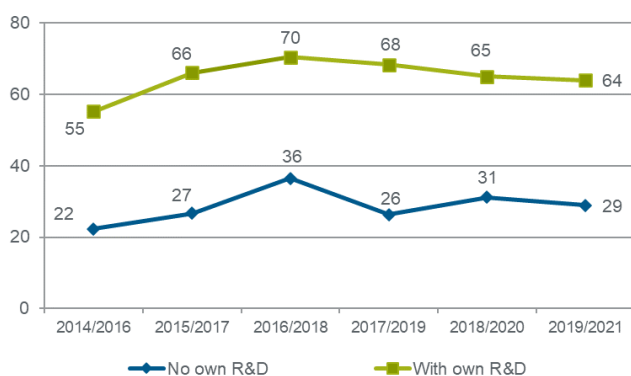
As the share of enterprises with digitalisation activities was high already before COVID, the influence of the pandemic on the implementation of digitalisation activities in businesses that employed university graduates is relatively low.

### Enterprises engaged in R&D are more likely to carry out digitalisation projects

Own research and development (R&D) activities can be another source for designing and implementing digitalisation projects. R&D is defined as 'creative and systematic work undertaken in order to increase the stock of knowledge and to devise new applications of available knowledge'<sup>29</sup>. It enables a company to develop new digital products and production processes as well as further business applications in the context 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, engaging in own R&D may also indicate that the business is operating in an innovative environment and that this also translates into higher digitalisation activities – without meaning that it conducts R&D specifically targeted at digitalisation. The close correlation can also be explained by the fact that innovation and digitalisation activities generally reinforce each other.<sup>30</sup>

**Figure 7: SMEs with completed digitalisation projects with and without own R&D activities**

In per cent



Note: Figures extrapolated to the number of enterprises.

Sources: KfW SME Panel, own calculations

These considerations also hold true for SMEs. Businesses that perform own R&D implement digitalisation projects significantly more often than those that do not. At currently 64%, that share is roughly on the same level among SMEs with R&D as in the previous year. It is more than 2.2 times as high as among those without R&D (Figure 7).

The coronavirus pandemic did not cause the share of businesses with digitalisation projects among those with R&D activities to increase. Particularly at the beginning of the pandemic, surveys found that R&D activity was also hampered by pandemic-related obstacles such as hygiene requirements, solidarity-driven short-time working schemes in R&D departments, inadequate internet connectivity in home working environments and worker absences due to childminding responsibilities. Not least, turnover losses and uncertainty surrounding further economic developments are likely to have hampered the financing of R&D-based digitalisation projects and delayed the completion of projects. R&D expenditure by German companies plummeted by a considerable -7.8% in 2020.<sup>31</sup>

Especially at the start of the pandemic, digitalisation measures were swiftly implemented.<sup>32</sup> This suggests that these could mostly be implemented with little effort and expenditure<sup>33</sup> and mainly served to safeguard the businesses' immediate survival during the coronavirus crisis. Many of the more strategically oriented, longer-term projects that were not expected to have immediate positive effects on the earnings situation and whose success was even uncertain were probably deferred. This, too, suggests that particularly at the start of the pandemic, R&D was not the driver of digitalisation activities.

Not least, a very high share of businesses who pursued R&D of their own – a good two thirds – already had digitalisation projects before the pandemic began, so that a further increase in this share did not occur during the pandemic. In general, the higher degree of digitalisation is also likely to have meant that businesses engaged in R&D often did not urgently require further pandemic-related digitalisation measures – such as the typical ones involving interaction with customers, etc.

### 3. Types of digitalisation projects completed

#### Digitalisation of business processes gained importance in the second year of the pandemic

A closer look at specific types of projects reveals that the coronavirus pandemic had a significant impact on the type of digitalisation projects that were carried out in its second year as well. Different types of projects exhibited greater variations in relative shares than were seen in the preceding years.

In the first year of the pandemic, SMEs primarily digitalised their interactions within the value chain and with their final customers. As already set out above, this probably involved measures designed to address the immediate impact of the pandemic. These measures were largely completed in the second year of the pandemic. Companies are clearly scaling these measures back again in the current year. In return, SMEs are currently stepping up measures aimed at digitalising internal processes (Figure 8). Thus, the share of SMEs that completed digitalisation projects aimed at the reorganisation of workflows during the 2019–2021 period has risen from 25 to 32% (based on all businesses with completed digitalisation projects). Measures aimed at digitally integrating different functional areas also show a slight rise – against a generally opposite trend.

The two types of projects mentioned last are ambitious, more in-depth projects that have longer timelines and are likely to be of strategic importance for the business in question. Businesses that carry out digitalisation activities in pursuit of strategic goals, such as implementing a pioneer strategy, standardising and improving their range of offerings or increasing their flexibility, are stepping up such projects.<sup>34</sup> This shows that in the second year of the pandemic, digitalisation projects were characterised by a shift away from immediate crisis management towards a more long-term and strategic orientation.

This is consistent with other research findings, which revealed that in the second year of the pandemic, many businesses anticipated long-term changes in customer behaviour in their markets as a result of the pandemic and that many of the affected businesses therefore stepped up their digitalisation activities.<sup>35</sup>

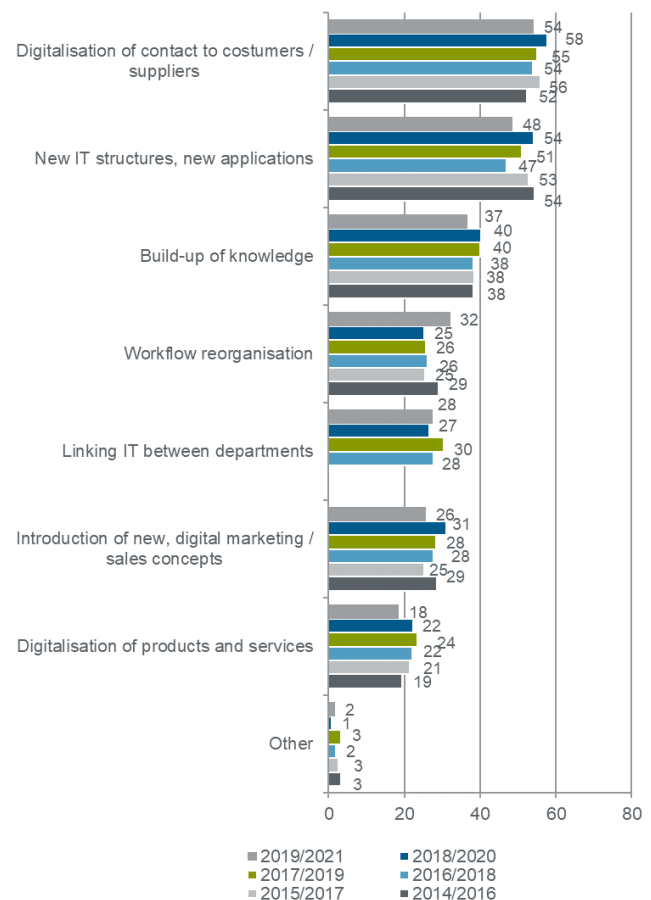
#### Digitalisation of interactions with customers and suppliers remains most common project type

Despite falling by 4 percentage points, digitalisation of interactions with customers and suppliers remains the most common project type (54% of businesses with

digitalisation projects) currently being implemented by SMEs. This often involves redesigning websites and adopting internet applications such as online ordering and payment systems, using social media or setting up customer feedback mechanisms. It is also likely to include automating and, thus, digitalising the sharing of data within the value chain.

**Figure 8: Types of digitalisation projects**

In per cent



Note: Figures extrapolated to the number of enterprises, for all enterprises with completed digitalisation projects

Sources: KfW SME Panel, own calculations

IT infrastructure upgrades follow closely behind, with 48% of mentions. This includes installing new hardware, implementing new systems and adopting individual, new applications. IT modernisation is therefore the second most common project type. The share of enterprises implementing digitalisation projects of this type has also fallen by 6 percentage points on the previous period.

As in the previous period, projects aimed at boosting digitalisation expertise were the third most common

type, coming in at a very distant 37%. This includes contracting digitalisation consultancy services and training employees. Lack of in-house expertise is among the most important obstacles to digitalisation. Digital skills deficits within the workforce and shortages of IT specialists both constitute a bottleneck for businesses.<sup>36</sup> Sought-after digital skills range from the basic ability to use computers and standard software through the ability to operate specialist software or digital production machines to programming and statistical analysis skills.<sup>37</sup>

The fact that developing expertise ranks third in the list of digital project types shows that a significant portion of SMEs are actively tackling this obstacle and developing their digital capabilities. Advanced applications in particular often require businesses to have a minimum of expertise. Improving digital skills therefore plays a particularly important role in digitalisation.

### **More digitalisation projects aimed at reorganising workflows**

Digitalisation measures aimed at reorganising workflows rank fourth, with a currently reported share of 32%. Enterprises need to reorganise workflows when digital transformation profoundly alters existing processes and business organisation. This indicates that affected enterprises are more likely to undertake complex digitalisation measures. Projects of this type were much more common than in the previous period, increasing by +7 percentage points.

One likely reason for the increase is that many businesses were unable to complete such projects in the first pandemic year because of their complexity. Prospective considerations are also likely to have played a role. Thus, reorganising workflows allows businesses to open up lasting efficiency potentials by further developing work processes and adapting workflow management.

Businesses are also likely to pursue the digital integration of different functional areas from a longer-term perspective. Its aim is to connect all digital applications at a whole-of-company level. It can therefore be seen as a long-term project that often has strategic significance. Besides the reorganisation of workflows, this project type – with 28% of mentions – is the only one to be implemented more often than in the previous year (+1 percentage point). The increased significance of workflow reorganisation and digital integration of functional areas indicates that after overcoming the crisis was the main focus in the first year of the pandemic, realigning operations for the long term through digitalisation was now gaining importance.

In return, the introduction of new, digital marketing and sales strategies lost importance in the second year of the pandemic. It now only ranks sixth, with 26% of mentions (-5 percentage points). That was a drop of two ranks on the previous period.

New, digital marketing and sales strategies can also be adopted in connection with the digitalisation of the customer interface previously described. The frequent mention of this aspect in the first year of the pandemic is likely due to the fact that many digital latecomers were also carrying out such projects as a way of responding to the crisis. The introduction of meal pickup and delivery services by hospitality businesses was a typical example. However, enterprises that conduct R&D, in particular, also mention this type of digitalisation projects often. This suggests that at least some of these projects can also be more complex in nature.

Just as in the previous periods, digitalising products and services ranked last in the survey. The share of businesses that completed projects of this type has dropped further to 18%. The likely main reason for this is that businesses generally bring new products and services to market more often during positive business cycles because that is when they are better received by the market.<sup>38</sup> This effect is likely to have overshadowed the application of necessary crisis response measures to the services and products on offer.

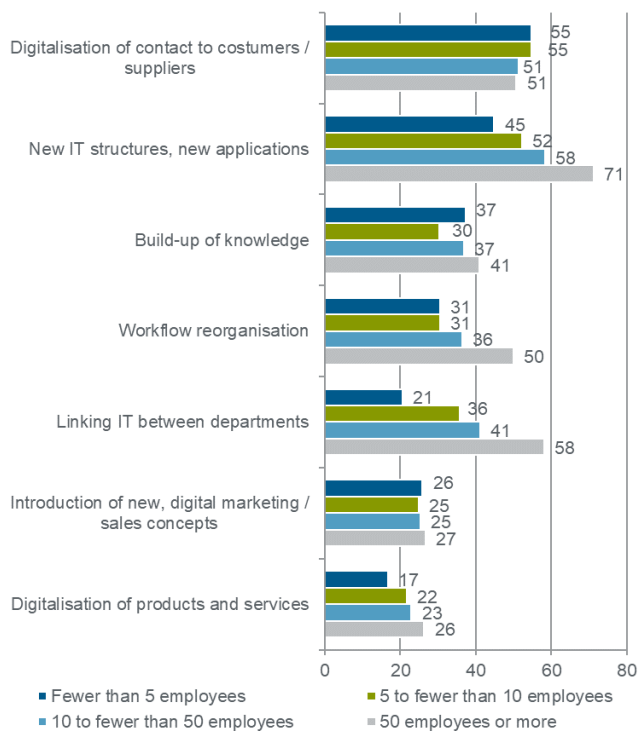
The range of services on offer also played a relatively minor role in digital transformation efforts in the preceding surveys. This is consistent with frequently voiced complaints that digitalisation in Germany focuses too much on efficiency gains<sup>39</sup> and rarely includes the search for new areas of sales and activity, as well as failing to sufficiently evolve business models.

### **Ambitious digitalisation projects are implemented mainly by large SMEs that conduct R&D**

As in the previous period, small businesses with fewer than 10 employees and businesses without R&D activities were most active in digitalising their interactions with customers and suppliers, each taking a share of 55% (see Figures 9 and 12). This suggests that these enterprises are often latecomers. Large SMEs and those that are already more digitally advanced are likely to have completed this step already.

**Figure 9: Types of digitalisation projects by size of enterprise in 2019–2021**

In per cent



Note: Figures extrapolated to the number of enterprises, for all enterprises with completed digitalisation projects.

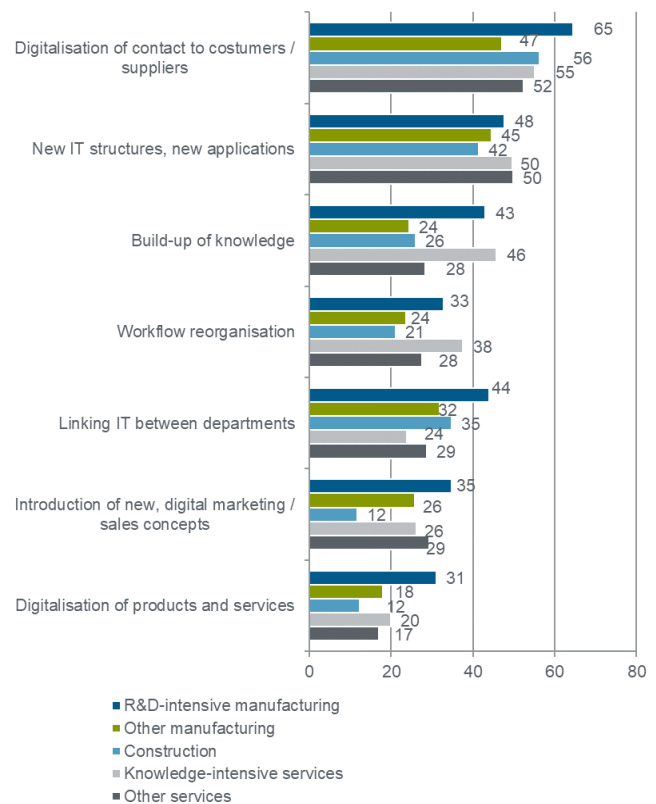
Sources: KfW SME Panel, own calculations

The fact that businesses with Germany-wide operations are in the lead, at 58%, with respect to sales market region as well does not contradict this (Figure 11). It is likely due to the fact that companies operating regionally still continue to rarely see digitalised interaction as relevant to their business because of the shorter distances, and that businesses operating internationally are more likely to have completed this step already.

By contrast, the focus of large SMEs with 50 and more employees lies on the modernisation of their digital infrastructures and the introduction of new applications, with 71% of mentions. Furthermore, large SMEs are particularly active in carrying out projects that involve the digital integration of functional areas (58%), workflow reorganisation (50%) and the development of expertise (41%).

**Figure 10: Types of digitalisation projects by economic sector in 2019–2021**

In per cent



Note: Figures extrapolated to the number of enterprises, for all enterprises with completed digitalisation projects.

Sources: KfW SME Panel, own calculations

It is likely that the more widespread renewal of digital infrastructures, introduction of new applications and digital integration of functional areas is partly a size effect. After all, large enterprises have a greater need to digitalise such activities. Measures aimed at digitalising workflow reorganisation in particular are probably also driven by the fact that these are usually enterprises that are generally more innovative and already more digitalised than others. Such enterprises also carry out complex digitalisation projects more often than others.

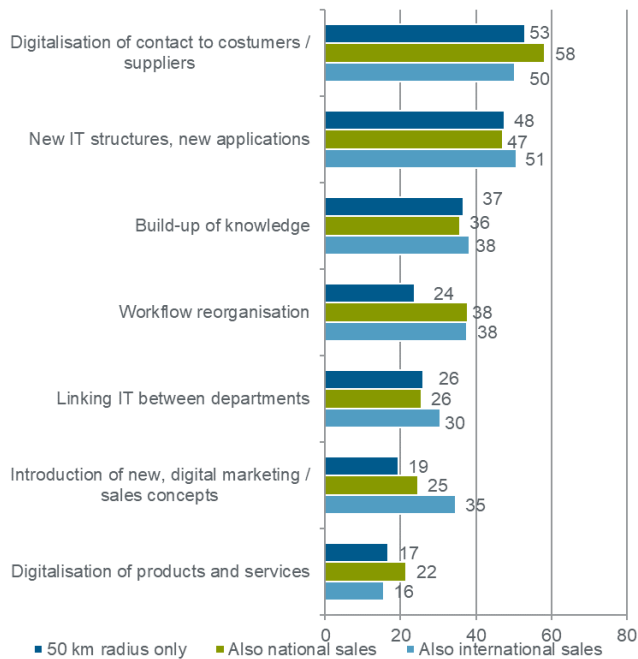
### Digital pioneers are upgrading their digitalisation expertise ...

Developing digital expertise was a measure mentioned more often by large SMEs (41%) than small businesses (37%). Knowledge-intensive service providers and R&D-intensive manufacturers are particularly active in this area, with 46 and 43% of enterprises, respectively, implementing digitalisation projects (Figure 10). This is consistent with the fact that enterprises with own R&D (49%) also invest more often in expertise than other enterprises. The relevant enterprises thus possess characteristics typically

associated with pioneer companies. This finding is in line with study results according to which pioneer companies are particularly likely to perceive a lack of digital skills as a barrier to digitalisation.<sup>40</sup>

**Figure 11: Types of digitalisation projects by sales region in 2019–2021**

In per cent



Note: Figures extrapolated to the number of enterprises, for all enterprises with completed digitalisation projects

Sources: KfW SME Panel, own calculations

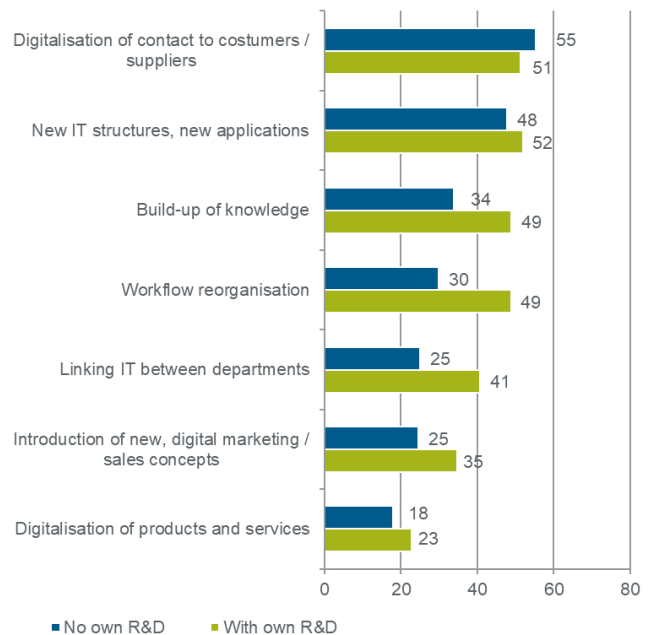
### ... and reorganising their workflows as part of digitalisation projects

Apart from large SMEs, workflow reorganisation as part of digitalisation projects is also more widespread in R&D-intensive manufacturing enterprises, knowledge-based services businesses, businesses with supra-regional operations and those engaged in R&D. This confirms the above consideration that these are more far-reaching projects that are typically more likely to be rolled out by pioneering enterprises.

Projects that involve the digital integration of functional areas are pursued by large businesses that conduct R&D and by manufacturing enterprises. To a large extent, this likely reflects a size effect because only companies larger than a certain size have clearly demarcated functional areas that can be integrated. However, the type of product or service the business provides and how much innovative capacity it has is also likely to play a role.

**Figure 12: Types of digitalisation projects of enterprises with and without own R&D activities in 2019–2021**

In per cent



Note: Figures extrapolated to the number of enterprises, for all enterprises with completed digitalisation projects.

Sources: KfW SME Panel, own calculations

Besides, this type of project is often being implemented in the construction sector as well. This relatively high frequency in the construction sector may be due to the fact that various other types of projects tend to be of rather limited importance for construction firms. The digital integration of functional areas is likely to play a certain role in construction as well, as it does in other economic sectors. On the other hand, the potential in the construction sector for projects aimed at, for example, the digitalisation of products and services or the introduction of digital marketing/sales strategies is likely to be rather limited.

### Small businesses and those that conduct R&D are active in introducing new, digital marketing and sales strategies

There are only minor business size-related differences in how actively SMEs introduce new digital marketing and sales projects (25 to 27%). A wide variation is evident in regard to R&D (35% among those with R&D vs. 25% for non-R&D conducting businesses) and in regard to sales markets (35% for companies with international operations vs. 19% for regionally active businesses). As mentioned above, this indicates that there is a broad range of projects of this type carried out not just by companies that are typically more often latecomers but also by pioneering enterprises.



Finally, digital products and services are brought to market primarily by large enterprises, businesses that conduct R&D and R&D-intensive manufacturing firms. A sector comparison shows that R&D-intensive manufacturing enterprises are in the top position,

followed by knowledge-based service providers. These sectors also occupy the top ranks for overall innovation and digitalisation activity. Thus, the digitalisation of products and services is heavily concentrated in pioneering enterprises with high innovative potential

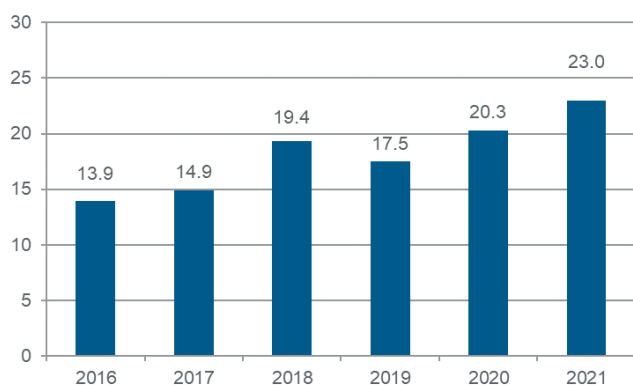
## 4. Development of digitalisation expenditure

### Digitalisation expenditure has risen to record level

In 2021, small and medium-sized enterprises spent EUR 23.0 billion on digitalisation projects (Figure 13). In contrast to the share of businesses with completed digitalisation projects, the amounts spent on digitalisation increased significantly on the previous year. That means companies with relatively low digitalisation expenditure, in particular, suspended their activities and those who were already active intensified their efforts compared with the first year of the pandemic. A comparison with investment expenditure (on machinery, plant, equipment and similar items), however, shows that digitalisation expenditure continues to be clearly lower. SMEs invested EUR 215 billion in assets in 2021.<sup>41</sup> That means SMEs spent a good nine times more on investments in traditional assets than on digitalisation.

**Figure 13: Aggregate expenditure on digitalisation in the SME sector**

in EUR bn



Note: Values extrapolated from the number of employees.

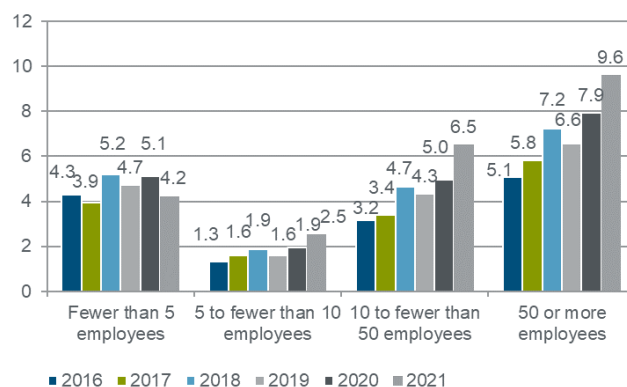
Sources: KfW SME Panel, own calculations

Businesses with fewer than five employees account for a high share of EUR 4.2 billion or just under one fifth of digitalisation expenditure (Figure 14). At first glance, this may come as a surprise because the share of enterprises with digitalisation projects in this group is relatively low. This finding can be attributed to the fact that enterprises with fewer than five employees make up the bulk of small and medium-sized enterprises –

82%. Although they represent a small proportion of 2% of small and medium-sized enterprises, large SMEs with 50 and more employees account for the largest share of digitalisation expenditure – EUR 9.6 billion, or 41%. Medium and large SMEs spent more than in the previous year. Small businesses with fewer than five employees, on the other hand, spent less. Large SMEs stepped up their digitalisation efforts most sharply, spending EUR +1.7 billion more.

**Figure 14: Aggregate expenditure on digitalisation by SME size**

EUR in bn



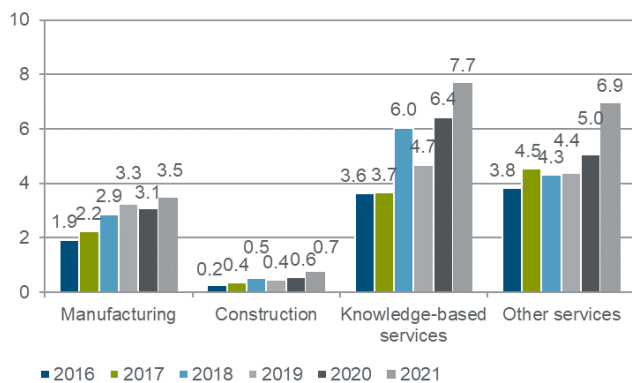
Note: not counting enterprises of the remaining sectors, values extrapolated from the number of employees.

Sources: KfW SME Panel, own calculations

A breakdown by economic sector shows that services businesses continued to spend the most on digitalisation overall, with knowledge-based service providers spending EUR 7.7 billion and other service providers investing EUR 6.9 billion (Figure 15).

**Figure 15: SMEs' aggregate expenditure on digitalisation by economic sector**

in EUR bn



Note: not counting businesses with fewer than five employees, values extrapolated from the number of employees.

Sources: KfW SME Panel, own calculations

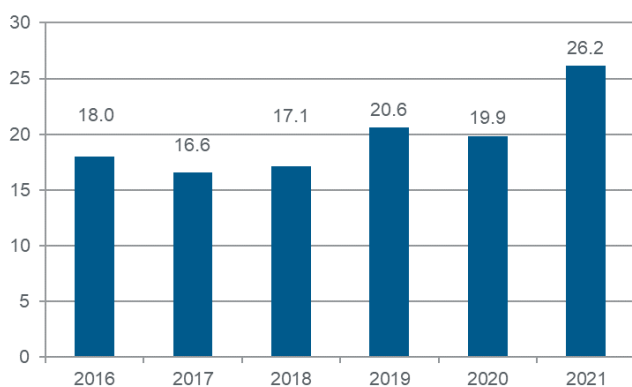
Both groups also accounted for the highest shares of small and medium-sized enterprises. Manufacturing accounted for EUR 3.5 billion in digitalisation expenditure. Construction firms spent the lowest amount: EUR 0.7 billion. The level of expenditure thus also confirms the relatively low level of digitalisation activities of these businesses.

### Average digitalisation expenditure has surged

In order to shed a light on the concentration of expenditure in different types of enterprises, the following figures illustrate SMEs' average digitalisation expenditure. Each SME spent a good EUR 26,000 on average on digitalisation in 2021. That was a significant jump after the slight drop in the previous year (Figure 16).

**Figure 16: Average expenditure on digitalisation in the SME sector**

EUR in thousand



Note: Values extrapolated from the number of employees, only enterprises with digitalisation expenditure.

Sources: KfW SME Panel, own calculations

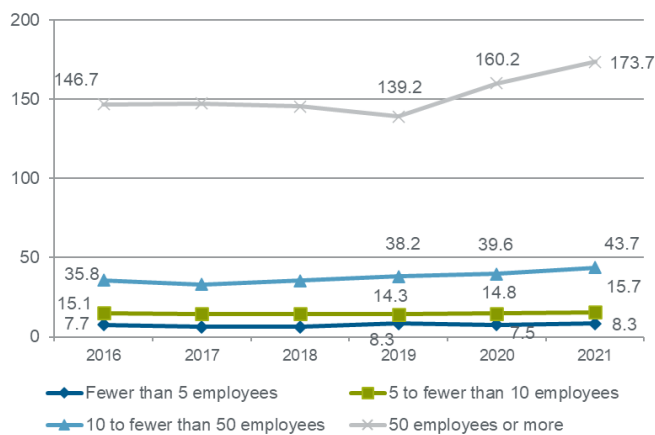
In purely arithmetic terms, the rise in average digitalisation expenditure resulted from the lower share of businesses with digitalisation projects and the simultaneous rise in aggregate digitalisation expenditure among SMEs. A recently published study revealed that the amounts spent by SMEs on digitalisation in response to the impact of the coronavirus pandemic were significantly lower in the first pandemic year than the amounts invested by businesses with strategically aligned and typically more ambitious digitalisation projects. On average, businesses whose digitalisation activities have a strategic focus spent up to 61% more on digitalisation than businesses that carried out digitalisation projects for crisis management purposes.<sup>42</sup>

Thus, the transition from carrying out acute crisis management projects to more long-term and, in part, strategically focused digitalisation projects also means that businesses with low digitalisation expenditure in particular scaled back or completely suspended their digitalisation activities while those with relatively high expenditures maintained and even intensified them.

The level of expenditure depends heavily on enterprise size. Businesses with fewer than five employees spent only a good EUR 8,000 on digitalisation on average in 2021. This proportion rose almost exponentially to nearly EUR 174,000 in enterprises with 50 and more employees (Figure 17). What is noteworthy is that since the outbreak of the coronavirus pandemic, average digitalisation expenditure rose much more strongly with increasing company size. That means large SMEs spent on average around 21 times more on digitalisation than small businesses in 2021. That gap was 'only' 17-fold in pre-pandemic 2019.

**Figure 17: Average expenditure on digitalisation by SME size**

EUR in thousand



Note: not counting enterprises of the remaining sectors, values extrapolated from the number of employees, only businesses with digitalisation expenditure.

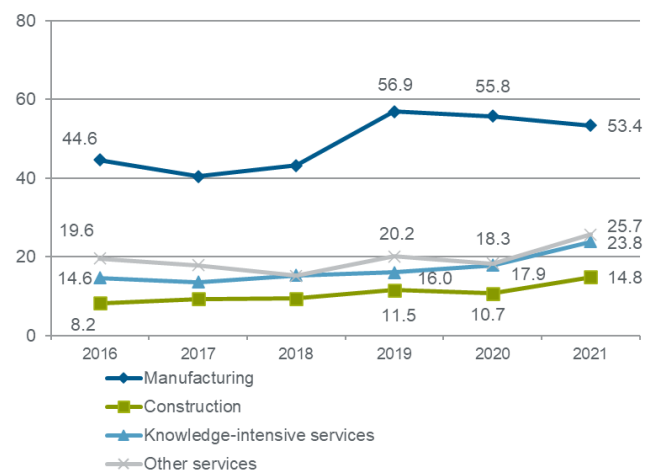
Sources: KfW SME Panel, own calculations

When we compare expenditure by enterprise size, we must always take into account that because of their size, small businesses also need to invest only smaller amounts in absolute terms in their digital transformation. Among other reasons, this is because they have less hardware and software and more work processes in which automation does not pay off. However, in relation to annual turnover, small businesses in particular invest above-average amounts in digitalisation relative to their size, which means that digitalisation places a heavier cost burden on them than on large enterprises.<sup>43</sup>

In a sector comparison, manufacturing enterprises spent the most – approx. EUR 53,000 (Figure 18). They were followed at a significant distance by companies providing other services and knowledge-based services, which were virtually on a par at almost EUR 26,000 and EUR 24,000, respectively. The construction sector was in fourth position with just under EUR 15,000. Compared with the previous year, average expenditure on digitalisation grew in all sectors but manufacturing. Average digitalisation expenditure in the manufacturing sector was significantly higher than in all other sectors across the entire period under review. It also rose sharply from 2018 to 2019 and has since hovered around that higher level nearly unchanged.

**Figure 18: SMEs' average expenditure on digitalisation by economic sector**

EUR in thousand



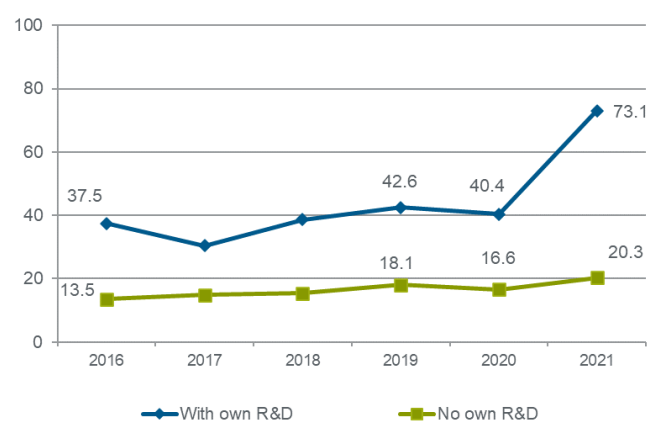
Note: Values extrapolated from the number of employees, only enterprises with digitalisation expenditure.

Sources: KfW SME Panel, own calculations

The likely main reason manufacturers spend so much on digitalisation is that digitalising production processes is very costly as 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. Changes are easier to make here. In the construction sector, too, digitalisation activities often focus on administrative processes and less on the direct provision of services. For this reason they are also likely to be less capital-intensive.

**Figure 19: Average digitalisation expenditure of SMEs with and without R&D activity**

EUR in thousand



Note: Values extrapolated from the number of employees, only enterprises with digitalisation expenditure.

Sources: KfW SME Panel, own calculations

Finally, not only are R&D-conducting SMEs more likely to carry out more digitalisation projects, and more ambitious ones; they also spend more on digitalisation on average (Figure 19). In the year 2021 average digitalisation expenditure in this small group of businesses rose considerably to EUR 73,000. It is thus 3.6 times higher than among businesses without R&D. This also confirms the results of recent studies according to which innovative enterprises in particular spend high

amounts on their digitalisation and carry out diverse and ambitious digitalisation projects.<sup>44</sup> This divide has recently widened sharply, giving rise to concerns that a gap will open up in the medium term between heavily digitalised, usually large R&D-conducting enterprises and typically small businesses without own R&D which will fall behind in digitalisation as well.

## 5. Conclusion

### Key findings on the development of digitalisation activities in the SME sector

In the second year of the coronavirus pandemic, the share of SMEs with completed digitalisation projects fell slightly on the previous year to 31%. But that share is still higher than before the outbreak of the pandemic. The recent decline is attributable to the trend among small businesses, where the share fell to 27%, which is lower than before the pandemic. The share of medium businesses that had digitalisation projects, on the other hand, also grew considerably in the second year. The high share of large enterprises actively engaged in digitalisation remained nearly constant. Other groups of typical pioneering companies, too, continue to exhibit significantly higher shares of firms with digitalisation projects than other businesses.

Digitalisation expenditure has recently also risen significantly in the SME sector. Increases in average digitalisation expenditure have occurred in every business size class, although they increase with the size of the enterprise. In particular, large SMEs and those that are engaged in R&D spent much more on digitalisation than in previous years.

Thus, especially in its second year, the coronavirus pandemic led to a noticeable surge in digitalisation, most of which took place in larger SMEs and pioneering companies.

A look at the completed projects shows that digitalisation activities undertaken for the purpose of acute crisis management had greater priority in the first year of the pandemic. Projects aimed at digitalising interactions with customers and suppliers as well as sales channels and introducing digital marketing strategies increased significantly. Rapid implementability and effectiveness of measures was important in order to continue operating and generating turnover even under pandemic conditions. Typical latecomers, in particular, carried out such projects as well. They were largely completed in the second year of the pandemic. The shares of such

projects are again returning to pre-crisis levels or below. Small businesses and latecomers, in particular, are likely to have again scaled back their digitalisation efforts after making adjustments to pandemic conditions.

Instead, digitalisation activities in the second pandemic year were more strongly focused on internal business processes. In particular, digitalisation measures aimed at the reorganisation of workflows as well as the integration of functional areas increased significantly or at least moderately against the general trend. Most of them were ambitious, in-depth projects that had longer timelines and were often also of strategic importance for the business. Such measures often enable untapped efficiency potentials to be leveraged for the long term, or fundamental changes to be made to work organisation. Past studies have shown that particularly businesses with strategically focused projects spend higher amounts on digitalisation than those whose focus is on crisis management.

Thus, the coronavirus pandemic has had an ambivalent impact on digitalisation. On the one hand, it is clear that it has been a major catalyst for digitalisation. Beyond this, current developments give hope that in future, it will be pursued from a more long-term perspective as well as with a more strategic focus. The coronavirus pandemic might therefore even provide a lasting boost for digitalisation overall. A considerable portion of SMEs expect lasting changes in their market that call for a response. Besides, the share of enterprises with a company-wide digitalisation strategy is also increasing – if only relatively slowly and starting from a low level.

On the other hand, the SME sector is threatening more than ever to split into highly digitalised businesses and those that end up being left behind. The divide between large and small SMEs as well as pioneers and latecomers widened during the pandemic. Thus, the share of companies with digitalisation projects is 2.4 times higher among large SMEs than among small

businesses. On average, they spend around 21 times more on digitalisation than small businesses.

### **Possible starting points for economic policy measures**

Germany has an elaborate system of measures to promote digitalisation that addresses all phases and actors of digitalisation. It is important that promotional measures address the digitalisation activities of both pioneers and digital latecomers. Only in this way will it be possible to tap into growth areas of the future, achieve economically measurable results<sup>45</sup> and prevent a split into digital and non-digital SMEs.

Genuine gaps in the promotional landscape are hardly discernible, although the scope of promotion in individual segments varies, so that different potentials for further developing promotional schemes can be identified. Promotion currently focuses mainly on support for top performers. Activities aimed at supporting the transfer of innovative digital solutions to broad areas of application and supporting the application of digital technologies, on the other hand, exist to a limited extent only.<sup>46</sup>

In order to incentivise SMEs to implement digitalisation projects it would make sense for economic policy to intensify promotional activities in segments that have thus far received less attention and tackle the key obstacles to digitalisation.

The previous KfW SME Digitalisation Report 2021 already set out in detail that digitalisation activities in the SME sector face a range of obstacles.<sup>47</sup> Key areas that need attention are human capital and skills, digital infrastructure and finance.

Barriers to digitalisation can often be traced to businesses' lack of in-house expertise. A shortage of IT skills and IT experts is an immediate factor. Other barriers to digitalisation often mentioned also have to do at least partly with the digitalisation skills that exist within businesses.

Deficits in digital infrastructure also constitute a major bottleneck for SMEs. Although the past years have seen major development, it is mentioned as a barrier not just by businesses in rural regions. Financing digitalisation projects also constitutes a formidable challenge for many businesses.

In addition, various studies have found that many businesses have not yet recognised the strategic importance of digitalisation. As recently as in early 2021, only one fifth of SMEs had a digitalisation

strategy.<sup>48</sup> Besides, only a small proportion of SMEs explicitly conduct digitalisation measures in pursuit of strategic objectives.<sup>49</sup> In general terms, a company's strategic focus has relatively little influence on the type of digitalisation project it carries out.<sup>50</sup> Even if the coronavirus pandemic has led to a rethink among some businesses and the share of companies that have a digitalisation strategy is rising, they continue to be outnumbered by the bulk of SMEs that approach digitalisation less from a systematic perspective than on an ad hoc basis – if at all.

The following options can be derived from these considerations as possible starting points for economic policy:

### **Enabling conditions**

In the area of supporting top performers, a possible approach to supporting digitalisation efforts could be to expand support for basic research at universities and non-university research facilities. Expanding R&D capacities in the area of digitalisation in research provides businesses with a basis from which to step up their own digitalisation efforts, for example because a larger number of qualified tertiary graduates and partners are available for joint research activities. The example of how R&D activities have developed in Germany generally illustrates the mutually beneficial interactions between academia and research work undertaken by businesses.<sup>51</sup>

The development of digital standards, as is being undertaken by the federal and state governments and the EU (e.g. GAIA-X) is a helpful measure being implemented outside the business sector. The problem of data protection, for example, which is mentioned by many SMEs as a barrier to digitalisation, is not least also an expression of the legal fragmentation of digital markets which makes it difficult for them to operate Europe-wide and thereby reach a critical size. Realising a single internal market in this respect as well would support the further development and marketing of digital technologies.

### **Capacity development**

A key barrier to digitalisation in the SME sector is the shortage of necessary skills. In order to build the skills it will be necessary in the medium term to mainstream digital learning in early stages of life<sup>52</sup> and integrate IT skills more closely into school, vocational training and tertiary education curricula. In the short term it will be necessary to undertake greater efforts in basic and advanced training to improve IT skills across the general workforce as well as improve the supply of IT specialists.



Businesses' training efforts can be supported by a range of economic policy measures. With respect to continuing education and training, it is important to realise the guiding principle of 'lifelong learning'. For one thing, this will require effective training incentives in the form of financial support such as promotional loans, direct cost reimbursement or the granting of tax benefits for continuing education expenditure. The certification of qualifications along with navigation and quality assurance in the confusing market for continuing education are also important starting points.<sup>53</sup> For another, broader provision of digital services by public agencies also acts as an incentive to acquire skills in the use of digital technologies.

Advisory offers also play an important role in building skills. The existing advisory services such as Digital Jetzt, go-digital and the Mittelstand-Digital centres are experiencing high demand but they still reach only a few thousand small and medium-sized enterprises. It can be assumed that demand is outstripping supply, so that expanding such services would reach further businesses.<sup>54</sup>

### **Recognition of strategic importance**

In order to more effectively develop the potentials of digitalisation, it also appears to be useful to more strongly illustrate the benefits of digitalisation for businesses, especially from a strategic perspective. Greater efforts must be undertaken to raise awareness of the strategic importance of digitalisation among businesses, for instance with regard to their positioning in markets, tapping into new customer groups and the further development of existing business models. Those who approach digitalisation from a strategic perspective invest more and take a broader approach to digitalisation. They also implement more ambitious projects.

Many small businesses with well-established but not very innovative business models generally do not devote enough attention to the aspect of strategic business development because their day-to-day business is the main priority.<sup>55</sup> Strengthening their general strategic capacity can be a lever particularly for these businesses to take greater account of strategic aspects in digitalisation.

### **Knowledge transfer**

A possible approach to improving the transfer of knowledge about digital technologies could be to provide research facilities with more help in putting their research findings into practice. It could be helpful to give research facilities wider scope for exploring the potential for practical application of research findings

on digital technologies. One possibility could be to conduct ideas competitions in combination with subsequent promotion of implementation or to set up funds to promote ideas at research-intensive academic institutions. Not least, application grants could create incentives for participating researchers to explore options for practical applications, technical feasibility, areas of application and market opportunities and to transfer promising innovations more quickly to the business sector.<sup>56</sup>

Another way of helping to bring new research findings faster to market is by improving transparency. A possible approach could be to raise awareness of new research findings that have market potential by providing publications in language that is understandable for businesses, for example through chambers of commerce and industry, business associations or other multipliers. A further approach for increasing transparency could be to establish a central platform that provides easily accessible information about promotional, advisory and support services.<sup>57</sup>

### **Digital infrastructure**

Even enterprises in conurbations often deplore inadequate Internet connectivity as a barrier to digitalisation. This demonstrates that, even in spaces that are currently better connected, there is a need to continuously verify whether the services provided still meet the requirements. While Internet expansion usually pays for itself in more densely populated areas, rural regions require additional economic policy measures.

Simplifying promotional terms would help small providers to make use of the programmes more often and, in this way, offer more broadband networks also in areas that are less profitable from a market perspective. As network development involves significant initial investment and high uncertainty about future returns, additional financial support for local network owners in the construction and maintenance of new networks could generate further impetus for expansion. The limited willingness of private users to pay for high bandwidths could be addressed with subsidy programmes for fibreglass connections. This would enable the regional usage rates required for expansion to be reached more often.<sup>58</sup>

### **Financing**

In order to mitigate financing problems it is important to set additional targeted financial incentives for the implementation of digitalisation projects. There is a wide range of starting points that must be based on the maturity level of the digital technologies.

In early phases, that means expanding the commitment of the public sector in the form of subsidies and tax benefits for R&D. Germany's support for corporate R&D is relatively moderate in an international comparison.<sup>59</sup> An additional approach to supporting top performers would be to more closely interconnect promotion of R&D and digitalisation. To this end, investment in digitalisation, for example in software and databases, should also be classified as activities eligible for support by making corresponding adjustments to the funding guidelines. A separation between R&D projects and digitalisation projects is particularly difficult in the services sector, because the introduction of new and the further development of existing service offerings and processes almost always require new digitalisation approaches and digital solutions.

Improving the offer of equity finance and quasi-equity financing instruments for start-ups would help new digital technologies and business models come to market quickly. The Future Fund launched in 2021, which includes the 'Deep Tech & Climate Fonds' building block, can be expected to provide positive impetus to VC offerings for German start-ups.

Low-interest loans would support the implementation of digitalisation measures across the business community as a whole and, thus, the diffusion of digital technologies. One option would be a combination of loans and grants, which could generate additional leverage effects. Grants widen the financial scope for businesses and help reduce the financial risks of such projects. The credit component helps businesses manage large project volumes, particularly in the adoption of new technologies. Existing promotional instruments can also be interconnected more closely or combined to achieve this. Further options could include combining such financing solutions with an advisory offer or strengthening transfer support by enabling research facilities to benefit from the grant component in their cooperation projects and the participating businesses to use the loan funds for putting into practice the research findings.<sup>60</sup> It should also be examined to what extent the use of financing instruments that preserve equity such as leasing or mezzanine capital can also be developed further to finance digitalisation projects.

### Structure of SMEs with completed digitalisation projects in 2019–2021

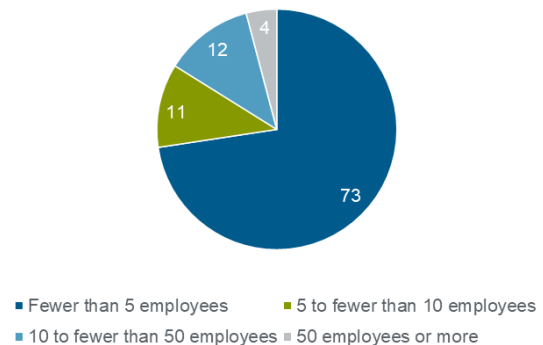
The SME sector, according to KfW's definition, covers all enterprises in Germany whose annual turnover does not exceed EUR 500 million. By this definition, around 3.79 million SMEs exist in Germany. The SME sector thus accounts for 99.95% of all enterprises. Of these enterprises, 1.2 million have successfully completed digitalisation projects.

Most SMEs with completed digitalisation projects are small businesses. The majority of SMEs with digitalisation projects – almost 900,000 enterprises, or 73% – have fewer than five employees. This high percentage is due to the overall structure of the small and medium-sized enterprise sector. Eighty-two per cent of SMEs have fewer than five employees. Around 7% of enterprises with digitalisation projects are manufacturers and 85% are service providers.

Eighty-five per cent of SMEs with completed digitalisation projects do not conduct any R&D of their own. A mere 7 and 8%, respectively, have conducted own R&D activities continuously or occasionally in the past three years.

### Figure 20: SMEs with completed digitalisation projects by enterprise size

In per cent

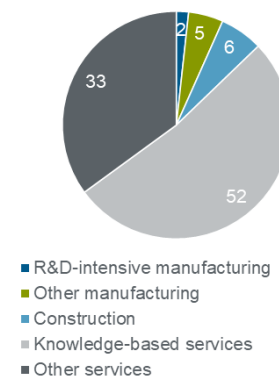


Note: Figures extrapolated to the number of enterprises.

Source: KfW SME Panel, own calculations

### Figure 21: SMEs with completed digitalisation projects by sector

In per cent

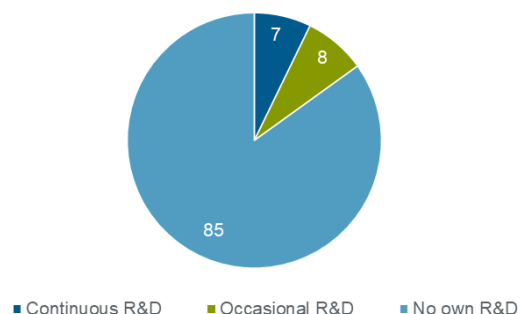


Note: Figures extrapolated to the number of enterprises.

Sources: KfW SME Panel, own calculations

### Figure 22: SMEs with completed digitalisation projects with and without own R&D activities

In per cent



Note: Figures extrapolated to the number of enterprises.

Sources: 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. As 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 10,796 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, innovation and digitalisation activities and financing structure. This tool is the only way to determine 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 20th wave was conducted in the period from 10 February 2022 to 17 June 2022.

<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. OECD (2020), *The Digitalisation of Science, Technology and Innovation: Key Developments and Policies*, Paris: OECD Publishing, OECD (2019), *Digital Innovation. Seizing Policy Opportunities*, Paris: OECD Publishing or Keuper, F. et al. (2013), *Digitalisierung und Innovation. Planung – Entstehung – Entwicklungsperspektiven (Digitalisation and innovation. Planning – Formation – Development Perspectives – our title translation, in German)*. Springer, Gabler Verlag.

<sup>3</sup> Cf. Zimmermann, V. (2022): *KfW SME Digitalisation report 2021 Corona pandemic triggers digitalisation push but digitalisation is still not a matter of course*, KfW Research, Rammer, C.; Fernández, G. and Czarnitzki, D. (2021): Artificial intelligence and industrial innovation: Evidence from firm-level data, ZEW Discussion Papers 21-036, Zimmermann, V. (2021): *Innovation and digitalisation in enterprises mutually reinforce each other*, Focus on Economics No. 338, KfW Research, and Rammer, C. et al. (2021): Zusammenhang zwischen der Durchführung von Digitalisierungs- und Innovationsvorhaben im Mittelstand (*Correlation between digitalisation and innovation projects in the SME sector – our title translation, in German*), Leibniz Centre for European Economic Research and technopolis; Zimmermann, V. (2021): *Coronavirus crisis is hampering innovation, digitalisation sees a mixed trend*, Focus on Economics No. 312, KfW Research.

<sup>4</sup> Cf. Czarnitzki, D. Fernández, G. and Rammer, C. (2022): Artificial intelligence and firm-level productivity, ZEW Discussion Papers 22-005, ZEW; Truant, E., Broccardo, L. and Dana, L. (2021): Digitalisation boosts company performance: an overview of Italian listed companies, *Technological Forecasting and Social Change* 173, issue C; Behrens, V. and Trunschke, M. (2020), *Industry 4.0 Related Innovation and Firm Growth*, ZEW Discussion Paper No. 20 – 070; Niebel, T. et al. (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; Gal, P., et al. (2019): Digitalisation and productivity: In search of the holy grail – Firm-level empirical evidence from EU countries; OECD Economics Department Working Papers Nr. 1533; Bertschek, I. et al. (2013), *More Bits – More Bucks? Measuring the Impact of Broadband Internet on Firm Performance*, *Information Economics and Policy* 25(3), p. 190–203; Cardona, M.; et al. (2013), *ICT and productivity: conclusions from the empirical literature*, *Information Economics and Policy* 25, p. 109–125 or Kretschmer, T. (2012), *Information and Communication Technologies and Productivity Growth: A Survey of the Literature*; OECD Digital Economy Papers, No.195, OECD Publishing.

- <sup>5</sup> Cf. Zimmermann, V. (2021): Information technologies are not one of Germany's strengths but of vital importance as technologies of the future, Focus on Economics No. 322, KfW Research, and Schmoch, U. et. al (2021): Identifizierung und Bewertung von Zukunftstechnologien für Deutschland (*Identifying and assessing future technologies for Germany – our title translation, in German*).
- <sup>6</sup> Cf. DESI (2022); DESI | Shaping Europe's digital future (europa.eu); last retrieved on 12 January 2023.
- <sup>7</sup> Cf. Zimmermann, V. (2021): Digitalisation in international comparison: Germany lags far behind in IT investment, Focus on Economics No. 352, KfW Research.
- <sup>8</sup> Cf. Abel-Koch, J. (2020): Coronavirus crisis drives shift to flexible and digital working in SMEs, Economics in Brief No. 197, KfW Research and Demmelhuber, K., et al. (2020): Homeoffice vor und nach Corona: Auswirkungen und Geschlechterbetroffenheit, (*Home working before and after the coronavirus: consequences and gender impact – our title translation, in German*), ifo Schnelldienst digital 14/2020.
- <sup>9</sup> Cf. Federal Statistical Office, press release No. 161 dated 8 May 2020.
- <sup>10</sup> Cf. Köhler-Geib, F. and Zimmermann, V. (2022): Die Auswirkungen der Coronapandemie auf die finanzielle Lage unterschiedlicher Gruppen von mittelständischen Unternehmen und deren Folgen für den Kreditzugang (*The impact of the coronavirus pandemic on the financial situation of different groups of small and medium-sized enterprises and its consequences for credit access – our title translation, in German*), Vierteljahreshefte zur Wirtschaftsforschung 2 / 2021, p. 31–48.
- <sup>11</sup> Cf. Bertschek, I. (2020): Digitalisierung – der Corona-Impfstoff für die Wirtschaft (*Digitalisation as a corona vaccine for the German economy – in German*), Wirtschaftsdienst 2020/9, p. 653–656.
- <sup>12</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>13</sup> Cf. Dasgupta, S., et al. (1999): Determinants of information technology adoption: an extension of existing models to firms in a developing country. *Journal of Global Information Management* 7 (3), p. 30–40.
- <sup>14</sup> Cf. Baptista, R. (2000): Do innovations diffuse faster within Geographical Clusters? *International Journal of Industrial Organisation* 18: 515–535 or Crepon, B.E. et al. (1998): Research, Innovation and Productivity: An Econometric Analysis at the firm level, *Economics of Innovation and New Technology* 21(3): 223–245.
- <sup>15</sup> Cf. Hwang, H.S., et al. (2004): Critical factors influencing the adoption of data warehouse technology: a study of the banking industry in Taiwan. *Decision Support Systems* 37 (1), p. 1–21; Premkumar, G. and Roberts, M. (1999): Adoption of new information technologies in rural small business, *OMEGA, International Journal of Management Science* 27 (4), p. 467–484 and Cohen, W. and Levin, R. (1989): Empirical studies of innovation and market structure. In: Schmalensee, R. and Willing, R. (Hrsg.), *Handbook of Industrial Organization*, Vol. II., p. 1059–1107.
- <sup>16</sup> Cf. Zimmermann, V. (2020), KfW SME Digitalisation Report 2019. Digitalisation projects are gaining traction in the SME sector but digitalisation expenditure has remained low for years, KfW Research.
- <sup>17</sup> Cf. Zimmermann, V. (2020), How SMEs fund their innovation and investment expenditure – a comparison, Focus on Economics No. 280, KfW Research or Zimmermann, V. (2018): Business Survey 2018. Digitalisation is gaining momentum, KfW Research.
- <sup>18</sup> This sector includes mechanical engineering, electrical and chemical engineering, for example.
- <sup>19</sup> Cf. Köhler-Geib, F. and Zimmermann, V. (2022), Die Auswirkungen der Coronapandemie auf die finanzielle Lage unterschiedlicher Gruppen von mittelständischen Unternehmen und deren Folgen für den Kreditzugang (*The impact of the coronavirus pandemic on the financial situation of different groups of small and medium-sized enterprises and its consequences for credit access – our title translation, in German*), Vierteljahreshefte zur Wirtschaftsforschung 2021(2), p. 31–48 and Zimmermann, V. (2021): Which enterprises have been hit hardest by the coronavirus crisis and what lessons can we learn from it?, Focus on Economics No. 343, KfW Research.
- <sup>20</sup> These include media, IT and information services providers, law firms, tax consultancies and management consulting firms, for example.
- <sup>21</sup> Cf. Zimmermann, V. (2018): Determinants of digitalisation and innovation behaviour in the SME sector. Focus on Economics No. 236, KfW Research.
- <sup>22</sup> Cf. Gattignon, H. and Robertson, T.S. (1989): Technology diffusion: an empirical test of competitive effects. *Journal of Marketing* 53 (1), p. 35–49.
- <sup>23</sup> Cf. Premkumar, G. and Roberts, M. (1999): Adoption of new information technologies in rural small business, *OMEGA, International Journal of Management Science* 27 (4), p. 467–484.
- <sup>24</sup> Cf. Schlegelmilch, B. (1988): Der Zusammenhang zwischen Innovationsneigung und Exportleistung (*The correlation between innovation propensity and export performance – our title translation, in German*). Ergebnisse einer empirischen Untersuchung in der deutschen Maschinenbauindustrie (*Results of an empiric survey of the German engineering industry – our title translation, in German*), in: *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 Löf, H. (2009), Learning by Exporting Revisited – the role of intensity and persistence, *Scandinavian Journal of Economics* 111(4), p. 893–913.
- <sup>25</sup> Cf. Zimmermann, V. (2021): Which enterprises have been hit hardest by the coronavirus crisis and what lessons can we learn from it?, Focus on Economics No. 343, KfW Research.
- <sup>26</sup> Cf. Hottenrott, H and Peters, B. (2012): Innovative capability and financing constraints for innovation – more money, more innovation? *Review of Economics and Statistics* 94(4), p. 1126–1142 and Zimmermann, V. (2018): Determinants of digitalisation and innovation behaviour in the SME sector, Focus on Economics No. 236, KfW Research.
- <sup>27</sup> Cf. Nelson, R.R. and Phelps, E.S. (1966): Investment in Humans, Technological Diffusion and Economic Growth. *American Economic Review* 56, p. 69–75; Griliches, Z. (1969): Capital Skill Complementarity. *Review of Economics and Statistics* 5, p. 465–468; Welch, F. (1970): Education in Production. *Journal of Political Economy* 78(1):35–59; Schultz, T. W. (1975): The Value of the Ability to Deal with Disequilibria. *Journal of Economic Literature* 13(3), p. 827–846 or Tinbergen, J. (1975): Income Differences: Recent Research, Amsterdam: North Holland; Wozniak, G.D. (1987): Human Capital, Information, and the early Adoption of new Technology, *The Journal of Human Resources* 22(1): 101–112; Blechinger, D. and Pfeiffer, F. (1999): Qualifikation, Beschäftigung und technischer Fortschritt (*Qualifications, employment and technological progress – our title translation, in German*), *Jahrbücher für Nationalökonomie und Statistik* 218 (1+2), p. 128–146; Rubart, J. (2007): The employment effects of technological change: heterogeneous labor, wage inequality and unemployment, Publications of Darmstadt Technical University, Institute for Business Studies (BWL), Darmstadt Technical University, Department of Business Administration, Economics and Law, Institute for Business Studies (BWL), Gebhardt, J. et al. (2015): Developments 4.0 Prospects on future requirements and impacts on work



and vocational education, *Journal of Technical Education* 3(2): 45–61 or Biagi, F. and Falk, M. (2017): The Impact of ICT and E-Commerce on Employment in Europe, *Journal of Policy Modeling*, 39(1), p. 1–18.

<sup>28</sup> Cf. Doms, M., et al. (1997): Workers, wages and technology. *The Quarterly Journal of Economics* 112 (1), p. 253–290; Arvanitis, S. (2005): Computerization, workplace organization, skilled labour and firm productivity: evidence for the Swiss business sector; *Economic of Innovation and New Technology* 14 (4), p. 225–249 or Falk, M. (2005): ICT-linked firm reorganisation and productivity gains. *Technovation* 25 (11), p. 1229–1250.

<sup>29</sup> Cf. OECD (2015) (publisher), *Frascati Manual 2015. Guidelines for collecting and reporting data on research and experimental development*.

<sup>30</sup> Cf. Zimmermann, V. (2021), Innovation and digitalisation in enterprises mutually reinforce each other, Focus on Economics No. 338.

<sup>31</sup> Cf. Zimmermann, V. (2022), Die Entwicklung der FuE-Ausgaben in Deutschland im internationalen Vergleich (The development of R&D expenditure in Germany in international comparison – in German), Focus on Economics No. 404, KfW Research, and Rammer, C. (2022): Studie zur Entwicklung der Forschungs- und Entwicklungsausgaben in Deutschland im internationalen Vergleich (*Study on the development of research and development expenditure in Germany in an international comparison* – our title translation, in German), ZEW – Leibniz Centre for European Economic Research

<sup>32</sup> Cf. Zimmermann, V. (2021): Coronavirus crisis is hampering innovation, digitalisation sees a mixed trend, Focus on Economics No. 312, and Zimmermann, V. (2020): SMEs are responding creatively to the coronavirus crisis, Focus on Economics No. 291.

<sup>33</sup> Cf. Zimmermann, V. (2022): Digitalisierungsaktivitäten im Mittelstand zielen nur selten auf die Verfolgung von Wettbewerbsstrategien (Digitalisation activities in the SME sector only rarely pursue competitive strategies – in German only), Focus on Economics No. 407, KfW Research.

<sup>34</sup> Cf. Zimmermann, V. (2022): Digitalisierungsaktivitäten im Mittelstand zielen nur selten auf die Verfolgung von Wettbewerbsstrategien (Digitalisation activities in the SME sector only rarely pursue competitive strategies – in German only), Focus on Economics No. 407, KfW Research.

<sup>35</sup> Cf. Zimmermann, V. (2022): Erwartete Verschiebung der Nachfrage hin zu digitalen Angeboten beschleunigt Digitalisierung im Mittelstand (Expected demand shift to digital offerings accelerates digitalisation in SMEs – in German only), Focus on Economics No. 372, KfW Research.

<sup>36</sup> Cf. Zimmermann, V. (2022): Vielfältige Hemmnisse bremsen die Digitalisierung im Mittelstand (Various obstacles hamper digitalisation in SMEs – in German), Focus on Economics No. 380, KfW Research and Zimmermann, V. (2019), Business Survey 2019. More and more businesses have firm plans for digitalisation, hurdles also more widely acknowledged, KfW Research and Zimmermann, V. (2017): Business Survey 2017. Digital transformation of industries: broad basis, multiple barriers, KfW Research.

<sup>37</sup> Cf. Leifels, A. (2021): German SMEs lack digital skills, need more training, Focus on Economics No. 346, KfW Research.

<sup>38</sup> Cf. Poschen, K. and Zimmermann, V. (2014): Falling sales expectations curb SME innovation activity in Germany, Economics in Brief No. 58, KfW Economic Research, and Zimmermann, V. (2000): Innovation und Konjunktur (Innovation and economic activity), KfW Economic Research. Points of View No. 4, Frankfurt am Main.

<sup>39</sup> Cf. Zimmermann, V. (2018): Business Survey 2018. Digitalisation is gaining momentum, KfW Research.

<sup>40</sup> Cf. Zimmermann, V. (2022): Vielfältige Hemmnisse bremsen die Digitalisierung im Mittelstand (Various obstacles hamper digitalisation in SMEs – in German), Focus on Economics No. 380, KfW Research.

<sup>41</sup> Cf. Schwartz, M. (2022), KfW SME Panel 2022: SMEs have largely digested the pandemic, but the war in Ukraine and the energy crisis are clouding the business outlook, KfW Research.

<sup>42</sup> Cf. Zimmermann, V. (2022): Digitalisierungsaktivitäten im Mittelstand zielen nur selten auf die Verfolgung von Wettbewerbsstrategien (Digitalisation activities in the SME sector only rarely pursue competitive strategies – in German only), Focus on Economics No. 407, KfW Research.

<sup>43</sup> Cf. Zimmermann, V. (2020): KfW SME Digitalisation Report 2019. Digitalisation projects are gaining traction in the SME sector but digitalisation expenditure has remained low for years, KfW Research.

<sup>44</sup> Cf. Zimmermann, V. (2021): Innovation and digitalisation in enterprises mutually reinforce each other, Focus on Economics No. 338, KfW Research and Zimmermann, V. (2022): Digitalisierungsaktivitäten im Mittelstand zielen nur selten auf die Verfolgung von Wettbewerbsstrategien (Digitalisation activities in the SME sector only rarely pursue competitive strategies – in German only), Focus on Economics No. 407, KfW Research.

<sup>45</sup> Cf. Andrews, D. et al. (2015), *Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries*, OECD Productivity Working Paper no. 2, Andrews, D. et al. (2016) *The best versus the rest: The global productivity slowdown, divergence across firms and the role of public policy*, OECD Productivity Working Paper No.5 or Gal. P. et al. (2019), *Digitalisation and productivity: In search of the holy grail - Firm-level empirical evidence from EU countries*, OECD Economics Department Working Papers No. 1533.

<sup>46</sup> Cf. Kulicke, M.; Beckert, B. and Stolz, C. (2023): Studie zum Förderfeld „Digitalisierung und Innovation“ im Auftrag der Kreditanstalt für Wiederaufbau (KfW) (*Study on the promotional area of 'Digitalisation and innovation' on behalf of KfW* – our title translation, in German), Fraunhofer-Institut für System- und Innovationsforschung ISI.

<sup>47</sup> Cf. Zimmermann, V. (2022): Vielfältige Hemmnisse bremsen die Digitalisierung im Mittelstand (Various obstacles hamper digitalisation in SMEs – in German), Focus on Economics No. 380, KfW Research and Zimmermann, V. (2022): KfW SME Digitalisation report 2021 Corona pandemic triggers digitalisation push but digitalisation is still not a matter of course, KfW Research.

<sup>48</sup> Cf. Zimmermann, V. (2022): Digitalisierungsstrategien in kleinen, regional agierenden und nicht-innovativen Unternehmen selten (Digitalisation strategies are uncommon in small, regionally operating and non-innovative businesses – in German only) Focus on Economics No. 382, KfW Research.

<sup>49</sup> Cf. Zimmermann, V. (2022): Digitalisierungsaktivitäten im Mittelstand zielen nur selten auf die Verfolgung von Wettbewerbsstrategien (Digitalisation activities in the SME sector only rarely pursue competitive strategies – in German only), Focus on Economics No. 407, KfW Research.

<sup>50</sup> Cf. Zimmermann, V. (2021): Innovation and digitalisation in enterprises mutually reinforce each other, Focus on Economics No. 338, KfW Research, and Rammer, C. et al. (2021): Zusammenhang zwischen der Durchführung von Digitalisierungs- und Innovationsvorhaben im Mittelstand (*Correlation between digitalisation and innovation projects in the SME sector* – our title translation, in German), Leibniz Centre for European Economic Research and technopolis.

<sup>51</sup> Cf. Zimmermann, V. (2022): Vielfältige Hemmnisse bremsen die Digitalisierung im Mittelstand (Various obstacles hamper digitalisation in SMEs – in German), Focus on Economics No. 380, KfW Research.

<sup>52</sup> Cf. Leifels, A. (2021): German SMEs lack digital skills, need more training, Focus on Economics No. 346, KfW Research.

<sup>53</sup> Cf. Leifels, A. (2021): German SMEs lack digital skills, need more training, Focus on Economics No. 346, KfW Research.

<sup>54</sup> Cf. Kulicke, M.; Beckert, B. and Stolz, C. (2023): Studie zum Förderfeld „Digitalisierung und Innovation“ im Auftrag der Kreditanstalt für Wiederaufbau (KfW) (*Study on the promotional area of 'Digitalisation and innovation' on behalf of KfW – our title translation, in German*), Fraunhofer-Institut für System- und Innovationsforschung ISI.

<sup>55</sup> Cf. Zimmermann, V. (2022): Types of SMEs in the innovation system: activities, constraints and successes, Focus on Economics No. 394, KfW Research and Rammer, C.; Krieger, B. and Peters, B. (2022): Drivers and Barriers for Innovation in the German SME sector, ZEW – Leibniz Centre for European Economic Research.

<sup>56</sup> Cf. Zimmermann, V. (2023): Wo steht Deutschland bei Innovation und Digitalisierung im internationalen Vergleich? (Where does Germany stand in innovation and digitalisation in an international comparison? – in German only), Focus on Economics No. 412, KfW Research and Kulicke, M.; Beckert, B. and Stolz, C. (2023): Studie zum Förderfeld „Digitalisierung und Innovation“ im Auftrag der Kreditanstalt für Wiederaufbau (KfW) (*Study on the promotional area of 'Digitalisation and innovation' on behalf of KfW – our title translation, in German*), Fraunhofer-Institut für System- und Innovationsforschung ISI.

<sup>57</sup> Cf. Zimmermann, V. (2023): Wo steht Deutschland bei Innovation und Digitalisierung im internationalen Vergleich? (Where does Germany stand in innovation and digitalisation in an international comparison? – in German only), Focus on Economics No. 412, KfW Research, and Kulicke, M.; Beckert, B. and Stolz, C. (2023): Studie zum Förderfeld „Digitalisierung und Innovation“ im Auftrag der Kreditanstalt für Wiederaufbau (KfW) (*Study on the promotional area of 'Digitalisation and innovation' on behalf of KfW – our title translation, in German*), Fraunhofer-Institut für System- und Innovationsforschung ISI.

<sup>58</sup> Cf. Zimmermann, V. (2022): Vielfältige Hemmnisse bremsen die Digitalisierungsaktivitäten deutscher Unternehmen (*Various obstacles hamper digitalisation activities of German companies – our title translation, in German only*), heading: for discussion; ifo-Schnelldienst 2022(2), p. 8–11.

<sup>59</sup> Cf. Zimmermann, V. (2022): Zimmermann, V. (2022), Die Entwicklung der FuE-Ausgaben in Deutschland im internationalen Vergleich (The development of R&D expenditure in Germany in international comparison – in German), Focus on Economics No. 404, KfW Research, and Rammer, C. (2022): Studie zur Entwicklung der Forschungs- und Entwicklungsausgaben in Deutschland im internationalen Vergleich (*Study on the development of research and development expenditure in Germany in an international comparison – our title translation, in German*), ZEW – Leibniz Centre for European Economic Research

<sup>60</sup> Cf. Zimmermann, V. (2023): Wo steht Deutschland bei Innovation und Digitalisierung im internationalen Vergleich? (Where does Germany stand in innovation and digitalisation in an international comparison? – in German only), Focus on Economics No. 412, KfW Research, and Kulicke, M.; Beckert, B. and Stolz, C. (2023): Studie zum Förderfeld „Digitalisierung und Innovation“ im Auftrag der Kreditanstalt für Wiederaufbau (KfW) (*Study on the promotional area of 'Digitalisation and innovation' on behalf of KfW – our title translation, in German*), Fraunhofer-Institut für System- und Innovationsforschung ISI.