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Preface

Digitalisation already has a significant impact on our way of life, our methods of communicating, working and doing business and our consumer habits – and this influence is set to increase further over time. If companies are to achieve success in the future, they must face the challenges of digitalisation and seize the opportunities offered by digital technologies and business models. The Monitoring Report measures developments in the digital transformation of the German economy and is an important indicator in this regard. It provides a sound information base for identifying areas of action for the economy and policymakers alike.

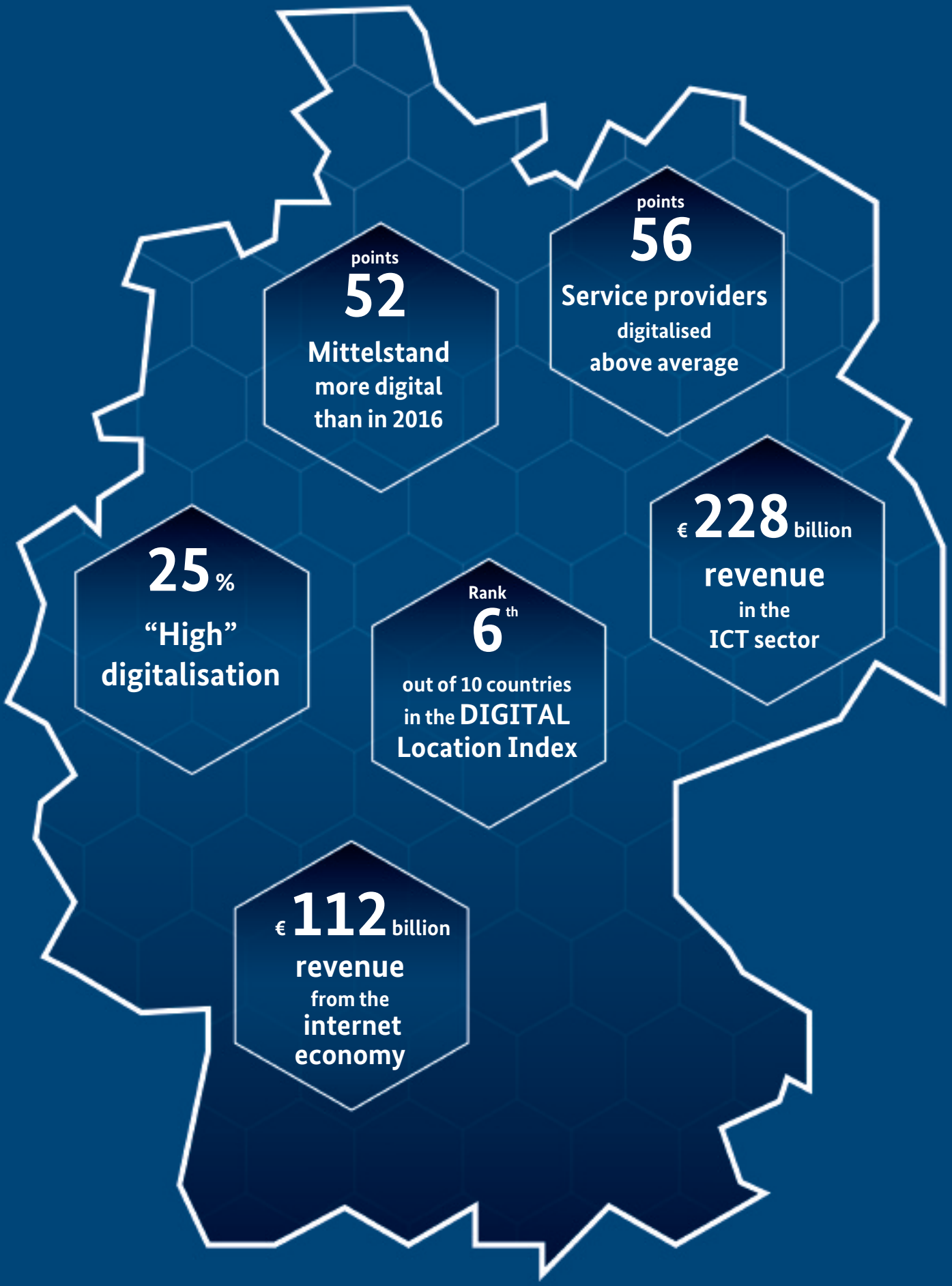
The 2017 DIGITAL Economy Index (see Chapter II below) shows the current and future level of digitalisation of the German commercial economy, broken down by 11 sectors and sizes of company. This year's analysis demonstrates that the Mittelstand is making progress in this field: the digitalisation of mid-sized companies was up two points on the previous year with 54 of a possible 100 index points. It is also encouraging to note that the German economy is increasingly investing in Industry 4.0. However, only one in three companies currently uses smart services and just one in five big data. Artificial intelligence is still in its infancy. These figures make it clear that there is still room for improvement in Germany's bid to become a fully digital economy.

This year, the Monitoring Report's main focus was on the topic of digital integration and cooperation. The findings showed that around 60 percent of companies were digitally connected with their business customers. However, just four percent of companies were cooperating with start-ups – demonstrating that existing innovation potential is not being sufficiently exploited. The strength of the German digital economy (the ICT sector and the internet economy) is of vital importance to the digitalisation process in the country and continued to drive the digital transformation in 2017 (see Chapter III below). Gross value added in the ICT sector rose by 3.8 percent in 2016 to € 105 billion. The innovation budgets of the ICT sector also grew to € 17.2 billion, corresponding to growth of almost 18 percent compared with the previous year. The ICT sector employed over 1.1 million workers, slightly more than the automotive and mechanical engineering industries.

The international DIGITAL Location Index, which compares the strength of the digital economy, ranked Germany sixth as in the previous year, with 57 points. The USA was again the clear leader with 81 index points, ahead of South Korea and the United Kingdom. Germany's biggest advance was made in the availability of venture capital, where it moved up four places to third in the 10-country comparison. Germany led the field as regards general innovation, but retained its below-average ranking of eighth for e-government offerings, pointing to urgent need for action in this field.

The Federal Ministry for Economic Affairs and Energy would like to thank all the experts and companies involved in compiling this year's DIGITAL Economy Monitoring Report. We would be delighted if you would also participate in next year's survey, bringing your experience and knowledge to bear in support of Germany's development as a digitalisation location.

Overview of Overall Findings



1. Management Summary

Digitalisation of the commercial economy has progressed in economically relevant sub-sectors.

The digitalisation of mid-sized companies (10 - 249 employees) rose by two points to 52 of a possible 100 index points and will increase to 54 points by 2022. The figure for large companies (250 employees and over) improved by one point to 54 index points and is set to reach 56 index points in 2022. Large and mid-sized companies accounted for 88 percent of the revenue generated by the commercial economy. By comparison, the slight decline in the digitalisation of small business (0 - 9 employees) does not seem especially significant. However, this has resulted in the 2017 DIGITAL Economy Index falling by one index point to 54 points, because the weighted index takes into account the fact that 89 percent of all commercial companies are small businesses, even though they accounted for just 12 percent of the revenue generated by the commercial economy.

The digital transformation continued to be driven by the highly digital ICT sector in 2017. Knowledge-based service providers and finance and insurance providers had an above-average level of digitalisation, as did retailers for the first time in 2017. Average digitalisation was achieved by energy and water supply, mechanical engineering, the chemical and pharmaceutical industry, automotive, and transport and logistics. Digitalisation in healthcare was classed as low, while the level of digitalisation in other manufacturing improved to average in 2017.

Existing strengths were developed by focusing on innovation applications. Almost every second commercial company used Internet of Things applications, while every third company benefited from smart services and every fifth from big data. One in seven manufacturers used Industry 4.0. The use of artificial intelligence was still in its infancy, with a take-up rate of just two percent. The opportunities presented by digital integration and cooperation could also be better exploited. Just one fifth of companies were already cooperating with partners from their own sector and 15 percent across sectors to drive forward digitalisation, while only four percent were cooperating with start-ups.

Germany's **digital economy** – the information and communications technology (ICT) sector including the internet economy – was ranked sixth out of 10 countries with 57 of a possible 100 points by the international 2017 DIGITAL Location Index, as in the previous year. The ranking of all the countries was unchanged from 2016.

This average performance can be attributed to the below-average market strength (41 index points) of Germany's digital economy: exports were weak in the ICT sector, and revenue and spending declined in the field of telecommunications (due among other things to the abolition of EU roaming charges), while performance on global ICT markets was average. Germany performed much better in respect of its technical infrastructure and economic and other environment, and led the field as regards general innovation. It jumped four places to third position in respect of the availability of venture capital, marking the greatest improvement of any of the monitored factors. Germany's weakest performance came in the field of R&D tax incentives. The intensity of use of new digital technologies and services was up on the previous year, while the quality of e-government offerings remained a major weakness.

The German ICT sector, which generated revenue of € 228 billion in 2016, was the sixth biggest market alongside the UK in terms of production value, behind South Korea, China, Finland, Japan and the USA. Its gross value added of € 105 billion and 4.8-percent share of the commercial economy as a whole placed it ahead of mechanical engineering and on a par with transport and logistics. Revenue generated by the German internet economy grew slightly to € 112 billion. In 2016, the number of employed and self-employed persons liable for social security contributions in the ICT sector rose once again to 1,119,787, and a total of 41,000 new jobs were created.

Key policy demands

The commercial economy considered the main duties of policymakers to lie in the expansion of broadband coverage, the creation of a pro-digital legal framework and access to publicly available knowledge as a basis for innovation.

2. Overview of Overall Findings

The Digital Transformation of the Economy

The digital transformation will be a key driver of sustainable growth and prosperity in the medium and long term. However, translating the theory and practice of digital transformation into individual steps from a conceptual, strategic and political point of view has proved difficult. The 2017 DIGITAL Economy Monitoring Report produced by Kantar TNS in cooperation with ZEW Mannheim aimed to address this.

In the first part of the report (cf. Chapter II: The Digitalisation of the German Economy), we measured the digital penetration of the commercial economy as a whole and its individual sectors, and how this is expected to develop between now and 2022, based on a representative survey of German companies. In addition, we analysed the positive effects of digitalisation on companies as well as obstacles to digitalisation. The monitoring report also looked at digital cooperation both within and across companies and sector boundaries. We defined the most important opportunities for and challenges of advancements in digitalisation based on the findings.

In the second part of the report (cf. Chapter III: Digital Economy: Key Figures and International Comparison), we analysed the digital economy, which is a significant economic factor. A secondary analysis and survey of international experts were conducted to compare the performance of this sector in Germany with other countries and to identify the unique strengths and weaknesses of the German digital economy. We also calculated the value added generated by the digital economy – the ICT sector and the internet economy – for the German economy.Wirtschaft generieren.

DIGITAL Economy Index: Definition

In this study, "digitalisation" means the transformation of business models and core internal processes through the use of information and communications technologies (ICT). The survey findings pertaining to digital business activity, the digitalisation of internal processes, and the intensity of use of digital technologies and services are summarised in the DIGITAL Economy Index.

I DIGITAL Economy Index: The Digitalisation of the Commercial Economy in 2017 and 2022

In the 2017 DIGITAL Economy Index – which measures digital penetration in the commercial economy – Germany achieved 54 of a possible 100 index points.

Based on the outlook of the companies surveyed, Germany is expected to reach 58 points in the 2022 DIGITAL Economy Index in five years' time, with large companies scoring 56, the Mittelstand 54 and small businesses 58 points.

Digitalisation of the commercial economy progressing quickly in large companies and the Mittelstand

The digitalisation of mid-sized companies (10 - 249 employees) was two points up on the previous year at 52 index points. It is expected to reach 54 points in 2022. The digitalisation of large companies reached 54 index points (up one point) and is expected to rise to 56 points in 2022. It is encouraging that digitalisation is increasing in these two sizes of company, which together accounted for 88 percent of revenue generated by the commercial economy as a whole.

Slight decline in digitalisation of small businesses

The slight decline of one index point to 54 points in the digitalisation of small businesses (0 - 9 employees) is less significant, since businesses of this size only accounted for 12 percent of total revenue in the commercial economy.

While the use of new technologies and services in small businesses continued to rise, the reorganisation of internal processes and workflows and the share of total revenue generated online were rated more cautiously by survey respondents in 2017. However, this decline in the small business index resulted in the 2017 DIGITAL Economy Index for the commercial economy as a whole also falling by one point to 54 points compared with the previous year. In order to provide an accurate representative depiction of companies in the commercial economy, the weighted index takes into account the fact that 88.9 percent of commercial companies are small businesses.

Over one quarter of commercial companies "highly" digital

Twenty-five percent of commercial companies had a "high" level of digitalisation (70 index points and over). Digitalisation was rated as "average" (between 40 and 69 index points) for 49 percent and as "low" (39 index points and under) for 27 percent of these companies. However, 29 percent of companies in the commercial economy still did not believe that digitalisation was necessary.

Service providers with "above-average" level of digitalisation

The level of digitalisation in the services sector reached 56 points. The DIGITAL Economy Index will rise to 60 points by 2022. The manufacturing sector achieved 42 index points, 3 points higher than in 2016. This is expected to increase to 44 index points by 2022. Fourteen percent of the manufacturing sector were already using Industry 4.0 applications, while seven percent planned to become involved in this field soon, which will have a positive impact on digitalisation in this sector.

Great discrepancies in digitalisation according to sector: digital pioneers making fast progress – late adopters stagnating

The level and speed of digitalisation varied significantly in the sectors observed:

- **"High" level of digitalisation** (70 index points and over): the ICT (information and communications technology) sector is a digital pioneer and at 78 points, scored well above the 2017 DIGITAL Economy Index as a whole (54 points).

- **"Above-average" digitalisation** (54-69 index points) was achieved by knowledge-based service providers (65 points), who are set to attain 68 index points in 2022. Finance and insurance providers will improve their level of digitalisation from 59 index points to 63 points by 2022, retaining third place in the industry rankings. The digitalisation of retail is progressing particularly quickly, with an improvement of eight points to 62 index points expected by 2022. This is the fastest rate across all sectors.

- **"Average" digitalisation** (40-53 index points) was the category into which six of the 11 core sectors analysed fell. Energy and water supply (2022: 49 points), mechanical engineering (2022: 47 points) and the chemical and pharmaceutical industry (2022: 49 points) all occupied fifth place with 45 points apiece. They were followed by automotive with 44 points (2022: 50 points), and transport and logistics (2022: 42 points) and other manufacturing (2022: stagnation at 40 points) with 40 points each.

- **"Low" digitalisation** (under 40 points) was again seen in just one sector: healthcare will remain in last place despite improving from 37 index points in 2017 to 39 points in 2022.

Digitalisation of business activities increasing in large and mid-sized companies – macro economically insignificant decline among small businesses

Seventy-five percent of companies in the commercial economy considered digitalisation important overall, a belief shared by 86 percent of the Mittelstand and 89 percent of large companies, which accounted for 88 percent of revenue generated by the commercial economy as a whole. However, just 74 percent of small businesses (compared with 84 in the previous year) agreed with this view. Thus, fewer companies overall believed in the importance of digitalisation compared with the previous year (2016: 85 percent). Small business accounted for only 12 percent of total revenue generated by the commercial economy, however. Its macroeconomic significance is therefore limited and the drop in this indicator is not particularly serious.

Ninety-three percent of companies (2016: 90 percent) were satisfied with the level of digitalisation achieved. Knowledge-based service providers were the most satisfied on this score (55 percent). Thirty-six percent of commercial companies were already generating 60 percent and more of their revenue digitally. The share of total revenue generated online was rated much more cautiously by the small businesses in this top revenue category than in the previous year (2017: 38 percent, 2016: 44 percent). This resulted in a decline in the company figures in this category, although the limited macroeconomic significance of small business renders this less serious. Seventeen percent of all commercial companies were still not generating any revenue digitally.

The offering of commercial companies was already highly digital overall at 61 percent (2016: 60 percent). While 64 percent of service providers rated the level of digitalisation of their products and services as high overall, this only applied to 48 percent of manufacturers. For the first time, more mid-sized companies (62 percent) than small businesses (61 percent) had highly digital offerings.

Fifty-eight percent of respondents said that digitalisation had a strong effect on business success. Sixty-two percent of service providers, but just 39 percent of manufacturing companies concurred with this statement, as did 69 percent of large and 65 percent of mid-sized companies.

Overall, digital activity weakened slightly; this can be attributed to the restraint shown by small businesses compared with the previous year.

Internal focus on digitalisation must be expanded – in respect of processes, investments in digitalisation and its integration into the corporate strategy.

Forty-seven percent (2016: 46 percent) of commercial companies had highly digital internal processes and workflows in 2017. Sixty-seven percent (2016: 70 percent) of companies had integrated digitalisation into their corporate strategy, and this figure will rise to 77 percent by 2022. In 2017, 28 percent (2016: 30 percent) of commercial companies invested more than 10 percent of total revenue in digitalisation, while there were still 15 percent of companies that did not invest in digitalisation at all. This figure will fall to seven percent by 2022.

The responses to these questions show that companies have to make much faster progress in reorganising their processes and workflows, especially when it comes to the share of digitally generated revenue.

Intensity of use of digital devices, technologies and infrastructure approaching saturation level, but still room for improvement in the use of digital services

Saturation levels have already been reached in the use of stationary digital devices such as computers and desktop PCs. All employees already used a stationary digital device in 73 percent of commercial companies. Use was much more prevalent in the services sector (77 percent) than in manufacturing (46 percent).

Employees used mobile digital devices in almost all large companies (over 250 employees), while such devices were not used at all in one quarter of small businesses. Forty-two percent of commercial companies provided all their employees with notebooks, tablets or smartphones for business purposes.

All employees had access to digital infrastructure such as the internet or intranet at 65 percent of commercial companies. The entire workforce had access to this infrastructure at 69 percent of service providers, but at just 38 percent of manufacturers.

Digital services were still used by comparatively few companies, with employees only able to access them in every second company. Their use was more prevalent in the services sector than in manufacturing.

II Success Factors

How do companies benefit from digitalisation? We asked commercial enterprises what effect digitalisation has had on them. Respondents were given the opportunity to rate seven different advantages in each case, with multiple responses permitted. They were also asked to identify the three most important internal obstacles to the rapid implementation of digitalisation projects.

Advantages

Sixty-eight percent of commercial companies regarded the generation of new knowledge as a particular benefit of digitalisation. Almost every second company (47 percent) confirmed that digitalisation had helped to cut costs. Thirty-eight percent stated that they had been able to access new markets and customer groups. The companies confirmed that innovation had increased as a result of digitalisation: 37 percent had been able to develop new digital services to supplement their range of products and services. Twenty-eight percent had launched completely new products and services, although 19 percent stated that entirely new offerings had only been able to be developed thanks to an equal partnership with other companies.

Obstacles to the implementation of digitalisation projects

Almost every second company (46 percent) expressed the view that the time or organisational effort required for digitalisation in their company was excessive. Thirty-seven percent stated that their company's digitalisation efforts were being hampered by excessively high costs. Thirty-two percent regarded legal uncertainties as the biggest stumbling block to ongoing digitalisation.

III Potential of Innovative Applications

What are the key challenges for companies?

Despite small advances, there is room for improvement in the digitalisation of business activities and the creation of a pro-digital corporate culture with a view to boosting companies' prospects of success on digital markets. Saturation levels are already being reached in the use of stationary digital devices. There is significant ground to be made up in the use of digital services. In particular, higher levels and a faster pace of digitalisation can be achieved by the use of innovative applications.

Six innovative applications and their growth

We asked commercial companies to what extent they were already involved in innovative application areas and what involvement was being planned in the near future.

- **Industry 4.0.** Fourteen percent of manufacturers were already using Industry 4.0 applications, with mechanical engineering (19 percent) the main user sector. Use is expected to increase by seven percentage points in the near future. Sixty-two percent of manufacturers believed that these applications were irrelevant.Anwendungen für irrelevant.

- **Internet of Things.** The Internet of Things (IoT) was used by almost every second commercial company (46 percent). Seven percent of companies intended to start using it shortly, while 33 percent still regarded the IoT as irrelevant. Use of these applications was most prevalent in service-oriented sectors, such as that of knowledge-based services (60 percent).

- **Smart services.** Thirty-three percent of commercial companies offered smart services. Customer-centric sectors were well represented, with 54 percent for the ICT economy and 47 percent for finance and insurance providers. Fourteen percent of commercial companies planned to introduce smart services in the near future, while 33 percent considered them irrelevant.

- **Big data.** Sixty-two percent of commercial enterprises did not consider big data applications to be relevant, while 19 percent used big data and six percent intended to start systematically analysing large data sets in the near future. Big data applications were used in 42 percent of large companies. Retail was the leading sector with a user rate of 23 percent.

- **Robotics and sensor technology.** Eleven percent of commercial enterprises were using robotics technology; two percent of companies were planning to do so in the near future and six percent had not yet looked into this application area, which 80 percent of the companies surveyed considered irrelevant.

- **Artificial intelligence.** AI applications are still in their infancy. Two percent of commercial companies reported that they were already benefiting from artificial intelligence, while three percent were planning to introduce AI applications. ICT was the leading sector, with 15 percent of companies already using AI applications. Seventy-nine percent of all companies said that these applications were not relevant to them.

ICT experts from Germany and the other nine countries included in the international DIGITAL Location Index were asked to forecast the opportunities for growth as part of an **international survey.** All countries can expect to see high growth in big data applications. German ICT experts expect smart services (52 percent) and Industry 4.0 applications (46 percent) to grow significantly.

IV Macroeconomic Significance of the German Digital Economy

The German digital economy is the main driver of digital transformation. The analysis conducted by ZEW demonstrates its great importance for the German economy and digital transformation.

In 2016, the ICT sector in Germany generated revenue of around € 228 billion. Gross value added in the ICT sector stood at € 105 billion, exceeding the € 100-billion mark for the second year in succession, and leaving traditional industries such as mechanical engineering and the chemical and pharmaceutical industry trailing far behind. The ICT sector proved a real job engine, employing over 1.1 million people, while 41,000 new jobs were created in 2016, making over 192,000 in total since 2010.

The internet economy also grew, if only slightly, with revenue of almost € 112 billion in 2016. Germany spent € 1,365 per capita on internet-based goods and services. In a comparison of the per-capita revenue generated by the internet economy in 10 countries, Germany occupied sixth place behind the UK, USA, South Korea, Finland and Japan. The innovation budgets of the ICT sector reached a new record level of € 17.2 billion, corresponding to growth of almost 18 percent compared with the previous year (€ 14.6 billion). ICT companies' spending on R&D and software development came to € 8.6 billion in total, corresponding to growth of almost € 0.9 billion in the course of a single year.

The ICT sector in Germany recorded 6,500 newly formed companies in 2016, just 89 percent of the figure achieved in the pre-crisis year of 2008. This is nevertheless a much better result than that of the economy as a whole, which only achieved 78 percent of the 2008 level.

V Strength of the German Digital Economy Compared with Other Countries

German digital economy ranked sixth out of 10 countries

The international 2017 DIGITAL Location Index ranked Germany's digital economy – the information and communications technology (ICT) sector plus the internet economy – sixth out of 10 countries with 57 of a possible 100 points. The German digital economy improved by one index point and maintained its mid-field placing. All the other countries also retained their previous year's rankings.

- **USA, South Korea and the UK again in the lead.** The USA was again the clear leader with 81 index points, ahead of South Korea with 74 points and the UK with 70 points. The German digital economy ranked among the top three in seven of the 48 criteria analysed. The USA did so 24 times, South Korea 27 times and the UK 26 times.

- **Finland and Japan ahead of Germany in fourth and fifth place.** Finland improved slightly by one index point and remained in fifth place. Japan scored one more index point too and maintained its fourth-place ranking. Finland did well in the Use category (fourth place) as well as in individual economic indicators such as gross value added and employees in the ICT sector (second place in both cases).

- **France, China, Spain and India behind Germany.** France was just one index point behind Germany. China gained most ground compared with the previous year, improving by five index points. This was not enough to move up from last year's eighth position, however. It was followed by Spain with 48 points and India in last place with 35 points.

The strengths and weaknesses and improvements and declines in the German digital economy were measured in three core areas: the position of the digital economy on the global markets, infrastructure, and the intensity of use of digital technologies and services.

Location Index – Market: Position of the German digital economy on the global markets

When the results of all 17 criteria used to analyse market strength and significance in the DIGITAL Location Index – Market were aggregated, Germany was ranked one place lower than last year in seventh with 41 index points, well behind the USA (77 points) and South Korea (66 points), and was overtaken by China, which recorded a clear improvement of seven points.

Germany accounted for the fifth-largest share of global ICT revenue. However, since Germany's digital economy did not export as much as the German economy as a whole, and telecommunications revenue fell due to the abolition of roaming charges and declining revenues for mobile termination charges, its score was below average. This also had an adverse effect on telecommunications revenue growth and per-capita spending on telecommunications (both eighth place). Germany was only ranked ninth for ICT goods and services as a percentage of total exports.

Location Index - Infrastructure: Infrastructure and economic environment

When the results of all 17 criteria used to analyse infrastructure and technical conditions in the DIGITAL Location Index – Infrastructure were aggregated, Germany tied with the USA for **fourth place** on 83 points. This was only four index points behind the leading country, the UK.

As in recent years, Germany once again led the field in terms of the penetration of desktop computers in households. For the first time, it was also able to achieve top place out of 10, up one position from last year, in the innovation rankings. It also scored well in the categories of internet access and the quality of education in STEM subjects, achieving third place in each. Germany was even able to jump four places to third position as regards the availability of venture capital, marking the greatest improvement of any of the monitored factors in all sub-sectors.

The clearest weakness was the lack of R&D tax incentives (ninth place). This was the only monitored factor for which Germany received zero index points. The country also revealed significant weaknesses in the availability of digital and technological skills (ninth place). Germany was also only ranked ninth for ICT patents as a percentage of all patents.

Location Index – Use of digital technologies by the general population, public and private sectors

Germany achieved its highest position as regards use of digital technologies for the adaptation of new technologies in companies and the number of music downloads per internet user, in both of which it ranked third.

Notable improvements were made in the use of new technologies and services by the **private sector**, such as in use of the internet as a distribution channel and the extent to which companies use ICT to sell products and services to other companies (both fourth place).

In terms of the **use of applications by the general population**, Germany managed to retain fourth place for internet access and e-commerce alike. As regards the prevalence of other new technologies and services among the population, Germany's performance was average for mobile internet use, the use of social networks and the use of online videos, in all of which it ranked seventh.

Germany placed eighth for the quality of **e-government offerings**. This remained its lowest ranking, despite an impressive increase of 17 index points in this category. In terms of use of ICT by the public sector, Germany climbed one place to fourth.

VI Advancements in Digitalisation through Organisational Integration and Cooperation

Both technological and organisational integration can help to drive the digital transformation forward. The latter case involves companies cooperating with one another both within and across sectors to transfer expertise and leverage synergies. ZEW analysed these topics separately as part of a case study.

Sixty-one percent of commercial companies, in particular mid-sized enterprises, were primarily digitally connected with their business customers. Fifty-one percent were digitally connected with suppliers, while 46 percent were integrated within production and service delivery.

Despite great potential, there is room for improvement as regards integration with private customers, which remained weak at 34 percent.

One fifth of commercial companies cooperated with companies from the same sector to drive forward digitalisation. By contrast, only 15 percent of companies cooperated across sectors. Cross-sector cooperation was more common than cooperation within sectors in mechanical engineering and automotive (two core sectors of Industry 4.0), as well as in healthcare (a sector with plenty of ground to make up in digitalisation) in particular.

Cooperating companies were more successful in achieving goals through digitalisation than their non-cooperating counterparts: 84 percent of companies currently cooperating were able to acquire new knowledge.

This figure is over 20 percentage points higher than that for non-cooperating companies. Overall, 63 percent of cooperating companies were able to develop new digital services to supplement their existing service offering, compared with 29 percent of non-cooperating companies.

VII What are the Key Challenges for Digital Policy?

Commercial companies regarded the main challenges for policy as being

1. the expansion of broadband (86 percent),
2. the creation of a pro-digital and, in particular, legal environment in respect of data protection and data security (81 percent), and
3. free access to new information about innovations acquired using public funds (79 percent).

In addition, 69 percent of companies expected policymakers to expand professional training and educational programmes with a focus on digitalisation. Sixty-five percent of respondents wanted the government to promote cooperation between established companies and start-ups. Sixty-three percent stated that the government must take steps to resolve the labour shortage. Sixty-two percent of commercial companies called on policymakers to make more funds available for research and development for digitalisation projects. Only just over half the companies (54 percent) believed that internal digitalisation projects should receive government funding.

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The Digitalisation of the German Economy

II. The Digitalisation of the German Economy

1. Overview of Findings

The findings of the representative company survey are presented in detail in this section of the report. We address both the 2017 DIGITAL Economy Index and all other issues regarding the potential of innovative applications, the potential of integration, advantages and obstacles and the demands made of the government by commercial companies.

German economy becoming increasingly digital. In 2017, the level of digitalisation of the German economy stood at 54 of a possible 100 index points (DIGITAL Economy Index 2017). One quarter of commercial companies were "highly" digital (70 index points and over). The manufacturing sector achieved 42 index points, three index points higher than in 2016, as a direct result of industrial companies' commitment to Industry 4.0 projects.

Take-up of digitalisation growing among large and mid-sized companies. The digitalisation of mid-sized companies (10 - 249 employees) was two points up on the previous year at 52 index points. It is expected to reach 54 points in 2022. Nineteen percent of mid-sized companies had a "high" level of digitalisation. The figure for large companies (over 250 employees) improved by one point to 54 index points in 2017 and will reach 56 index points in 2022. Seventeen percent of large companies were "highly" digital. Together, large and mid-sized companies accounted for 88 percent of the revenue generated by the commercial economy. By comparison, the slight decline in the digitalisation of small business (0 - 9 employees) by one index point to 54 index points does not seem especially significant.

However, this has resulted in the 2017 DIGITAL Economy Index score falling from 55 to 54 index points because the weighted index takes into account the fact that 89 percent of commercial companies are small businesses. That said, the DIGITAL Economy Index will again increase significantly to 58 points in 2022.

Significant variation from sector to sector. The "highly" digital ICT sector continued to lead the field with 78 index points. Knowledge-based service providers, finance and insurance providers and retailers had an "above average" level of digitalisation. Energy and water supply, mechanical engineering and the chemical and pharmaceutical industry were classed as "average". They were followed by automotive, which will move up from eighth to fifth place with an expected 50 index points in 2022. Other manufacturing climbed five index points from tenth to ninth place. This sector had an "average" level of digitalisation for the first time in 2017. Transport and logistics will improve to ninth place with 42 points by 2022. Healthcare once again had a "low" level of digitalisation.

The **potential of innovative applications** was still largely untapped. Every third company used smart services, every fifth big data, and every seventh manufacturer Industry 4.0. Artificial intelligence is still in its infancy.

Around 60 percent of commercial companies were digitally connected with their business customers. This was followed by integration with suppliers and within production and service delivery. One fifth of companies cooperated with partners from their own sector and 15 percent across sectors to drive forward digitalisation. Around four percent of companies were working with start-ups to promote digitalisation internally. The dominant cooperation strategy was the sharing of information and experience. The main reason for companies not cooperating on digitalisation issues was that they saw no need for cooperation.

Success factors in and obstacles to digitalisation. Particular advantages to be gained by companies as a result of digitalisation were the generation of new knowledge (68 percent), cost cutting (47 percent), access to new markets and customers (38 percent) and the development of new products and services (37 percent). Digitalisation also promoted innovation, according to 26 percent of respondents.

The main obstacles faced by companies in the implementation of digitalisation projects were the excessive time or organisational effort required (46 percent), excessively high costs (37 percent) and legal uncertainties (32 percent).

Policy demands. Eighty-six percent of companies wanted the government to promote the expansion of broadband. Other demands included the creation of a pro-digital legal environment (81 percent) and free access to new information about innovations acquired using public funds (79 percent).

DIGITAL Economy Index

2. DIGITAL Economy Index

2.1. Methods

Company survey

Between March and May 2017, Kantar TNS conducted a representative survey of German companies on the current status and future prospects of the digitalisation of the German economy and its core sectors. The survey was developed in close cooperation with ZEW Mannheim.

It is representative of the commercial economy, i. e. of the following 11 sectors: mechanical engineering, automotive, the chemical and pharmaceutical industry, other manufacturing, information and communications technology, energy and water supply, retail, transport and logistics, finance and insurance as well as knowledge-based services (such as management consulting, market research and media) and healthcare.

A total of 1,021 companies were surveyed for these studies. The quantitative, computer-based and standardised telephone interviews with open and closed questions were conducted by Kantar TNS. The disproportionate stratification of random sampling ensured that an adequate number of companies from different sectors and size categories were represented.

In this study, "digitalisation" means the transformation of business models as a result of fundamental changes to core internal processes, customer interfaces, products and services, as well as the use of information and communications technologies (ICT).

Based on the responses to this survey, we were able to answer the following core questions which were also used to calculate the DIGITAL Economy Index:

- What effect does digitalisation have on business success?
- To what extent are internal processes and workflows geared to digitalisation?
- How high is the intensity of use of digital devices, services and technologies?

The DIGITAL Economy Index summarises the results of the survey on these core questions. It shows – in a single number – the progress of digitalisation and how this is expected to change between now and 2022. The DIGITAL Economy Index measures the level of digitalisation of the German commercial economy and its sectors as a figure between 0 and 100 points for the years 2017 and 2022. Comparisons with the results from 2015 and 2016 show how digitalisation has developed. A score of zero means that no operational workflows or internal processes have been digitalised and that no digital technology is used. The highest possible rating of 100 points indicates that the economy or the company is completely digital.

The DIGITAL Economy Index enables us to compare the 11 core sectors of the commercial economy directly and to classify them based on the level and scope of digitalisation.

DIGITAL Economy Index
Overview of aspects taken into account in the calculation

Business success on digital markets	Company restructuring and digitalisation	Intensity of use of digital technologies and services
° Share of total revenue generated via digital channels	° Integration of digitalisation into the corporate strategy	° Use of stationary / mobile digital devices
° Range of digital products and services	° Digitalisation of internal processes	° Use of digital services (e. g. cloud computing, big data)
° Effect of digitalisation on business success	° Higher investment in digitalisation projects	° Use of digital infrastructure (e. g. mobile / stationary internet)
° Significance of digitalisation		
° Satisfaction with the level of digitalisation achieved		

2.2. Key Findings by Size Category, Sub-sector and Sector

DIGITAL Economy Index: Digitalisation of Large Companies and the Mittelstand

Digitalisation of large companies to rise to 56 index points by 2022

The level of digitalisation among large companies with 250 employees and over increased by one index point year on year to 54 index points in 2017. On average, the digitalisation process at larger companies was slower than in the Mittelstand. The result for large companies was exactly the same as that for the overall 2017 DIGITAL Economy Index.

By 2022, digitalisation at large companies will rise by two points to 56 index points. In other words, the rate of digitalisation at large companies will gain momentum over the coming years and will match take-up at mid-sized companies.

Twenty-two percent of large German companies still had a "low" level of digitalisation in 2017. Sixty-two percent of large companies were classed as "average" and 17 percent as "high". By 2022, more than every fifth large German company will be "highly" digital.

Large companies account for 55 percent of revenue generated by the commercial economy as a whole; thus, although only 0.51 percent of commercial enterprises are large companies, progress in companies of this size has a particularly pronounced macroeconomic effect.

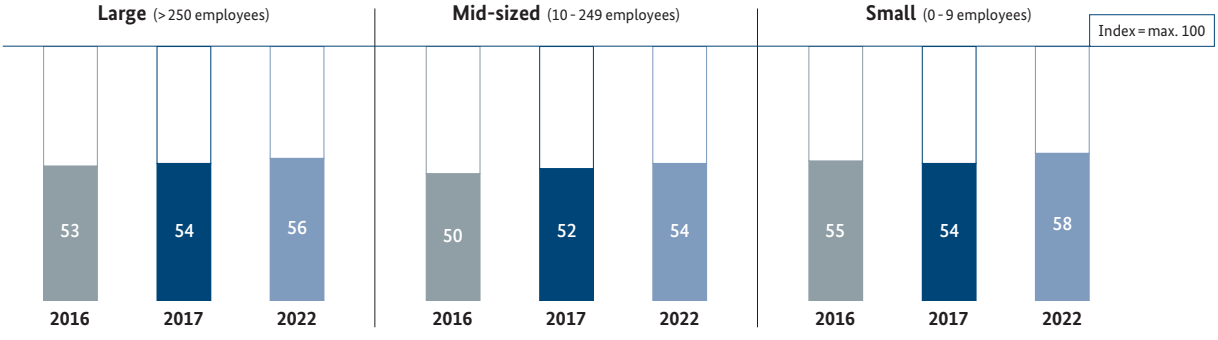
Faster take-up of digitalisation among the Mittelstand than at companies in other size categories

The level of digitalisation among mid-sized companies with between 10 and 249 employees rose by two index points to 52 points in 2017. This means that the Mittelstand is going digital at a faster rate than companies in other size categories. However, the Mittelstand was still less digital than the commercial economy as a whole, at two index points behind the 2017 DIGITAL Economy Index 2017 (54 points).

Fifty-two percent of mid-sized companies had an "average" level of digitalisation, 29 percent were classed as "low" and 19 percent as "high". In 2016, survey respondents predicted that the digital transformation of the Mittelstand would stagnate over the next five years. In 2017, however, they expected the Mittelstand's level of digitalisation to rise by two index points to 54 by 2022. If this prediction holds true, 28 percent of mid-sized companies will be "highly" digital in 2022.

Mid-sized companies account for 33 percent of revenue generated by the commercial economy. The macroeconomic effect of advances made in digitalisation in the commercial economy is therefore considerable.

DIGITAL Economy Index: Size categories 2016 / 2017 vs. 2022



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", own calculations, n=1,021

DIGITAL Economy Index: Digitalisation of Small Business

Macroeconomically insignificant decline in take-up of digitalisation among small businesses

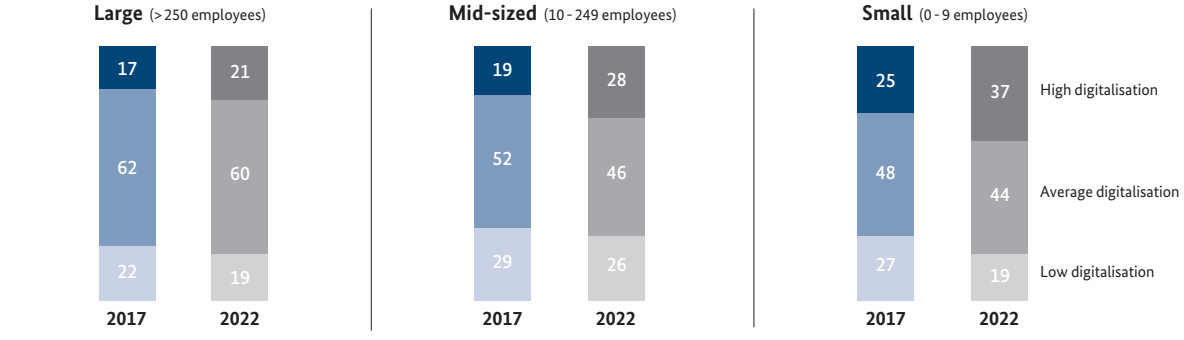
Small businesses with between zero and nine employees achieved 54 index points in 2017. This means that on average, large and small companies were equally digital in 2017. The DIGITAL Economy Index for small business declined by one index point year on year.

This is primarily attributable to the significant decrease in the level of digitalisation among small knowledge-based service providers, energy and water suppliers, finance and insurance providers, as well as small transport and logistics companies. The use of digital technologies and services remained high in all of these sectors. However, according to survey respondents, the reorganisation of internal processes and workflows as well as the share of total revenue generated online was lower in 2017 than in 2016.

The DIGITAL Economy Index for small business should rise by 4 points to 58 index points by 2022. This means that small businesses are going digital at a faster rate than companies in other size categories. Twenty-five percent of small companies had a "high" level of digitalisation in 2017. This figure is expected to rise to 37 percent in 2022, by which time fewer than one in five small businesses will have a "low" level of digitalisation.

Small business accounts for 12 percent of total revenue generated by the commercial economy. Its macroeconomic significance is therefore limited.

Analysis of level of digitalisation by company size 2017 vs. 2022



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", own calculations, n=1,021; rounding differences may occur

DIGITAL Economy Index: Commercial Economy as a Whole

Digitalisation of the commercial economy set to rise by four points to 58 index points by 2022

The DIGITAL Economy Index is representative of the commercial economy, i. e. of the following 11 sectors: mechanical engineering, automotive, the chemical and pharmaceutical industry, other manufacturing, information and communications technology, energy and water supply, retail, transport and logistics, finance and insurance as well as knowledge-based services (such as management consulting, market research and media) and healthcare.

The DIGITAL Economy Index – which measures the level of digitalisation achieved – stood at 54 out of 100 possible points in 2017, down one index point on the previous year. This is due to the decline in the figure for small business because the weighted index takes into account the fact that 89.1 percent of companies are small businesses. The decrease is insignificant at macroeconomic level compared with the progress achieved by large and mid-sized companies.

The level of digitalisation of the commercial economy is expected to rise to 58 points by 2022.

DIGITAL Economy Index: Commercial Economy by Level of Digitalisation

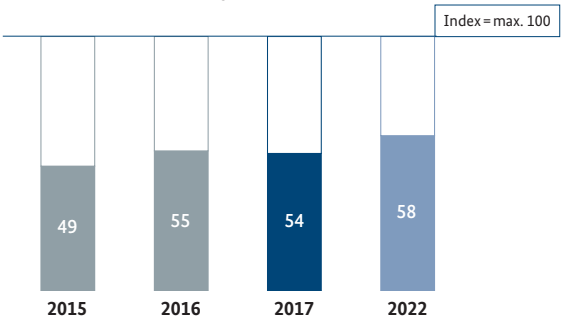
Only a handful of large and mid-sized companies "highly" digital

Twenty-five percent of commercial companies had a "high" level of digitalisation in 2017 (70 index points and over). This was the case in 17 percent of large companies, 19 percent of mid-sized enterprises and 25 percent of small businesses. Almost every second company had an "average" level of digitalisation (40 - 69 points), while 27 percent were classed as "low" (under 40 index points). In 2022, 36 percent of the commercial economy will be "highly" digital and 20 percent will have a "low" level of digitalisation.

Almost twice as many service providers (26 percent) as manufacturers (14 percent) were "highly" digital. Every second service provider was classed as "average", while 53 percent of manufacturers had a "low" level of digitalisation. By 2022, 38 percent of service providers and every fifth manufacturer will be "highly" digital.

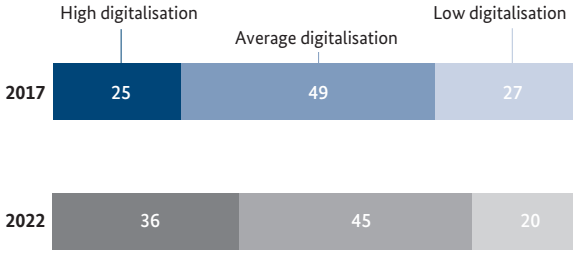
Unlike companies in other size categories, small businesses (0 - 9 employees) have a very high digital take-up rate because they can easily increase the use of digital devices or the share of digital revenue, which pushes up the level of digitalisation.

DIGITAL Economy Index 2015 / 2016 / 2017 vs. 2022 Commercial economy



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", own calculations, n=1,021, n = 770 / 924 / 1.021

Analysis of the Commercial Economy by Level of Digitalisation in 2017 vs. 2022



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", n=1,021; rounding differences may occur

DIGITAL Economy Index: Commercial Economy by Sub-sector

Service providers with above-average level of digitalisation despite slight decline

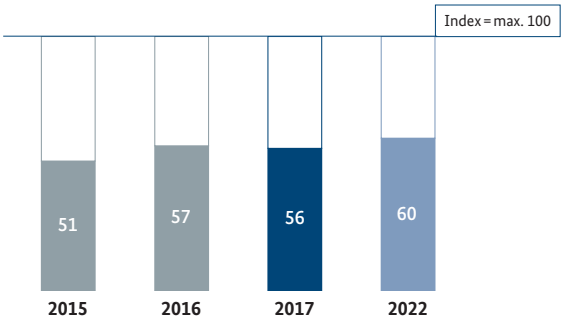
In the services sector, the level of digitalisation declined by one point year on year to 56 index points in 2017. Here, too, the decrease is primarily attributable to the lower take-up of digitalisation among small businesses across four sectors: energy and water supply (down three index points), transport and logistics (down three index points), finance and insurance providers (down two index points), and knowledge-based service providers (down five index points). The level of digitalisation is expected to grow by four points to 60 index points by 2022.

Higher digitalisation directly reflects take-up of Industry 4.0 technologies

The manufacturing sector achieved 42 index points for digitalisation in 2017, three points higher than in 2016. This figure is expected to climb to 44 index points by 2022, mainly as a result of the particularly high rate of digitalisation among other manufacturing companies. By global standards, Germany is one of the leading Industry 4.0 countries. Progress in this area directly translates to a higher level of digitalisation.

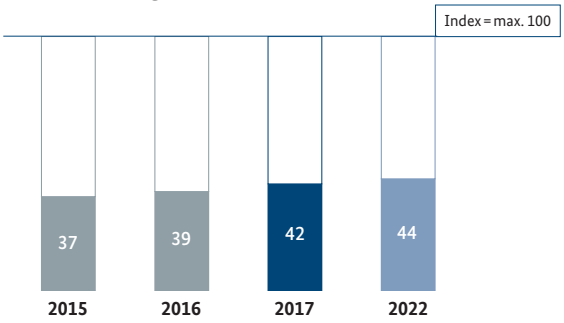
The forecasts also reflect the significant progress in the digital transformation of the manufacturing sector. Although only 14 percent of manufacturers were "highly" digital in 2017, this figure will increase to 20 percent in 2022.

DIGITAL Economy Index 2015 / 2016 / 2017 vs. 2022 Services Sector



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", own calculations, n=1,021, n = 770 / 924 / 1.021

DIGITAL Economy Index 2015 / 2016 / 2017 vs. 2022 Manufacturing sector



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", own calculations, n=1,021, n = 770 / 924 / 1.021

DIGITAL Economy Index: Commercial Economy by Sector

The level and speed of digitalisation varied significantly by sector.

"High" digitalisation (70 index points and over):

At 78 index points, the ICT sector led the digital transformation in 2017 and will continue to do so between now and 2022. The level of digitalisation rose by three index points year on year.

"Above average" digitalisation (54 - 69 index points):

Three sectors matched or exceeded the average figure for the commercial economy (54 index points). Knowledge-based service providers achieved 65 index points and maintained their second placing in the sector-by-sector ranking. However, this sector is no longer "highly" digital following a decrease in the level of digitalisation of small business. Finance and insurance providers followed in third place with 59 points and are expected to maintain this placing in 2022 with growth of four index points. Retail maintained its fourth placing with 54 index points. The digitalisation of retail is progressing particularly quickly, with an improvement of eight points to 62 index points. This is the fastest rate across all sectors.

"Average" digitalisation (40 - 53 index points):

Energy and water supply (45.2 points), mechanical engineering (44.7 points) and the chemical and pharmaceutical industry (44.2 points) scored below the average for the commercial economy (54 index points). This corresponds to fifth, sixth and seventh place in the sector-by-sector ranking. Automotive has made fast progress in digitalisation, with the index ranking improving by four points year on year as Industry 4.0 takes root. This sector is set to improve from eighth to fifth place with an expected 50 index points in 2022. The level of digitalisation in the mechanical engineering sector will also increase by two index points by 2022.

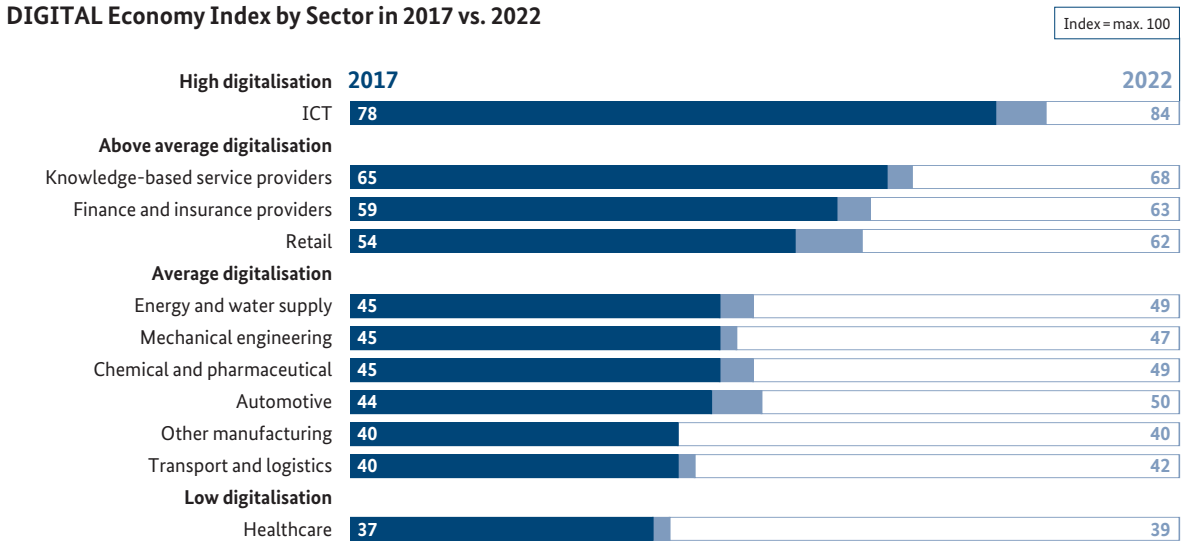
Biggest climber: Other manufacturing

The growing use of Industry 4.0 applications led to a year-on-year improvement of five points to 40 index points in other manufacturing. As a result, the sector has moved up from a "low" to an "average" level of digitalisation for the first time. Transport and logistics will improve to 42 index points by 2022, pushing ahead of the stagnating other manufacturing sector to ninth place in 2022.

"Low" digitalisation (under 40 index points):

Healthcare improved from 36 to 37 index points in 2017, but still came last out of all of the sectors observed. This is not expected to change between now and 2022.

DIGITAL Economy Index by Sector in 2017 vs. 2022



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", own calculations, n=1,021

DIGITAL Economy Index: Need for Digitalisation

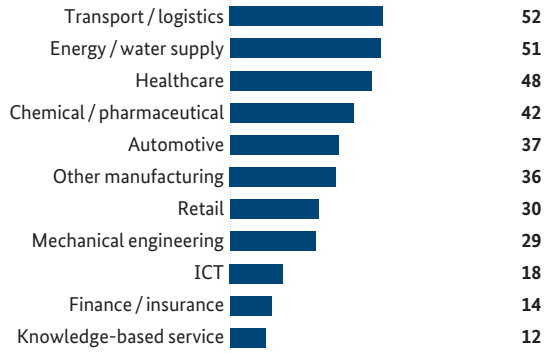
Still large share of digital sceptics across all sectors

Twenty-nine percent of commercial enterprises believed that their company had no need for digitalisation. Thirty percent of small businesses, 21 percent of mid-sized enterprises and 11 percent of large companies shared this view. More manufacturers (34 percent) than service providers (28 percent) agreed with this statement. Four percent of "highly" digital companies still believed that digitalisation was not necessary at their company. The figure was 21 percent among companies with "average" digitalisation and 66 percent among companies with "low" digitalisation.

Fifty-two percent of transport and logistics companies and 51 percent of energy and water providers agreed that digitalisation was not necessary in their own business, as did 48 percent of respondents in the healthcare segment, which has a "low" level of digitalisation, and 42 percent of companies in the chemical and pharmaceutical industry, which has an "average" level of digitalisation. Thirty-seven percent of automotive companies and 36 percent of other manufacturers took the same view.

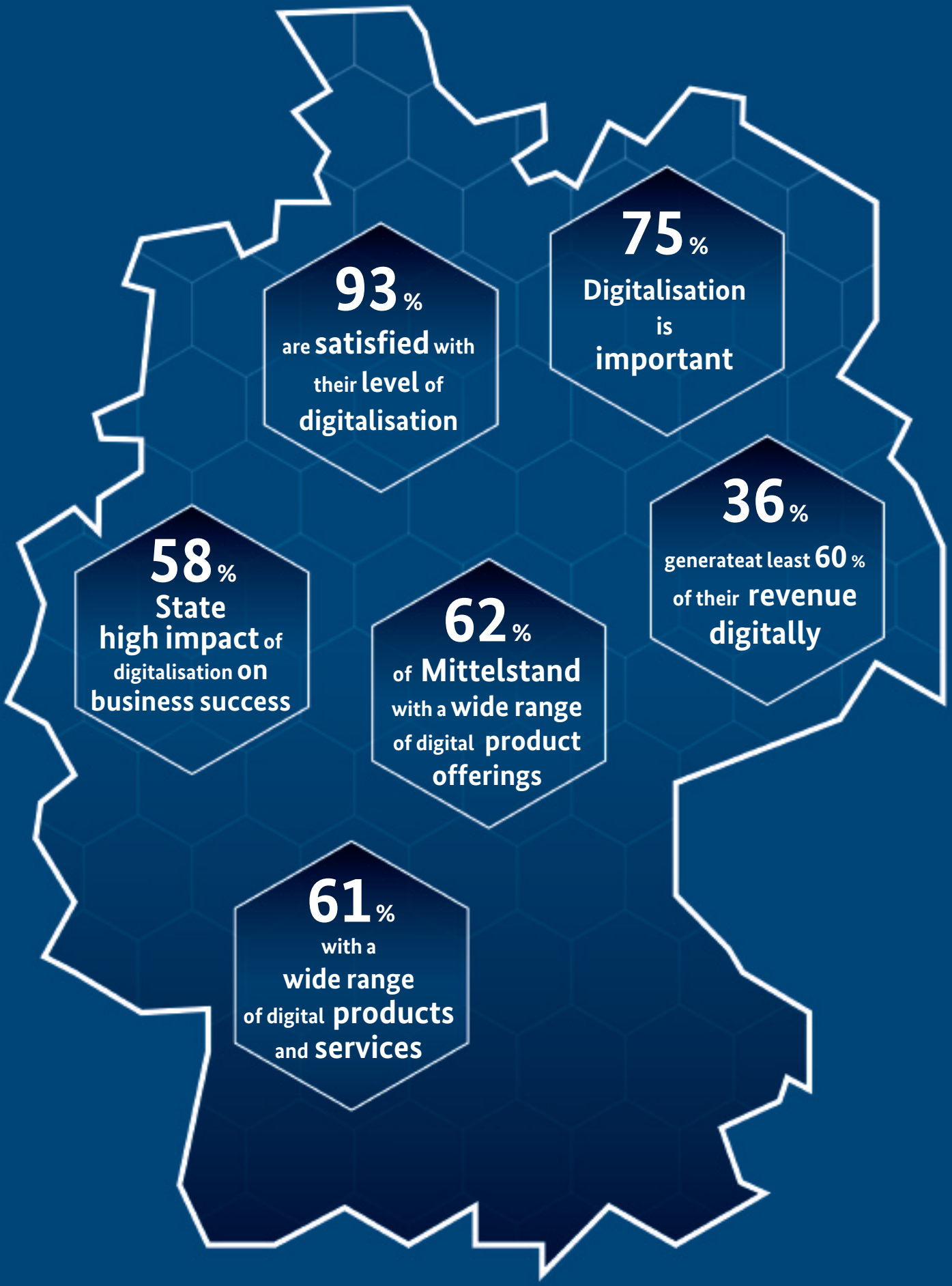
Even the digital pioneers had their share of digital sceptics: 18 percent of ICT companies, 14 percent of finance and insurance providers and 12 percent of knowledge-based service providers believed that their company did not need digitalisation.

Digitalisation not necessary



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", n=1,021; agreement in percent

Business Success on Digital Markets



2.3. Business Success on Digital Markets

Key Findings

In this chapter, we analyse the extent to which digitalisation influences business success on the basis of different questions. All the questions were used to calculate the DIGITAL Economy Index.

Three quarters of all companies in the commercial economy said that digitalisation was important. Seventy-five percent of respondents from the commercial economy believed that digitalisation was important overall. This applied to 77 percent of companies in the services sector, but to just 65 percent of manufacturing companies. Seventy-two percent of ICT companies and 51 percent of finance and insurance providers regarded digitalisation as extremely important. In 2017, one quarter of companies considered digitalisation to be of little significance, up from just 16 percent in 2016. This view was shared by 36 percent of small businesses.

Almost all commercial companies satisfied with the level of digitalisation achieved. Ninety-three percent of all respondents from the commercial economy expressed overall satisfaction with the level of digitalisation. Satisfaction was higher in the services sector (94 percent) than among manufacturers (90 percent). Small businesses were the most satisfied on this score (93 percent), followed by the Mittelstand (88 percent). Large companies (16 percent) and mechanical engineering companies (18 percent) were most dissatisfied with achievements in this field, as were 15 percent of retailers, 14 percent of healthcare companies and 10 percent of automotive companies.

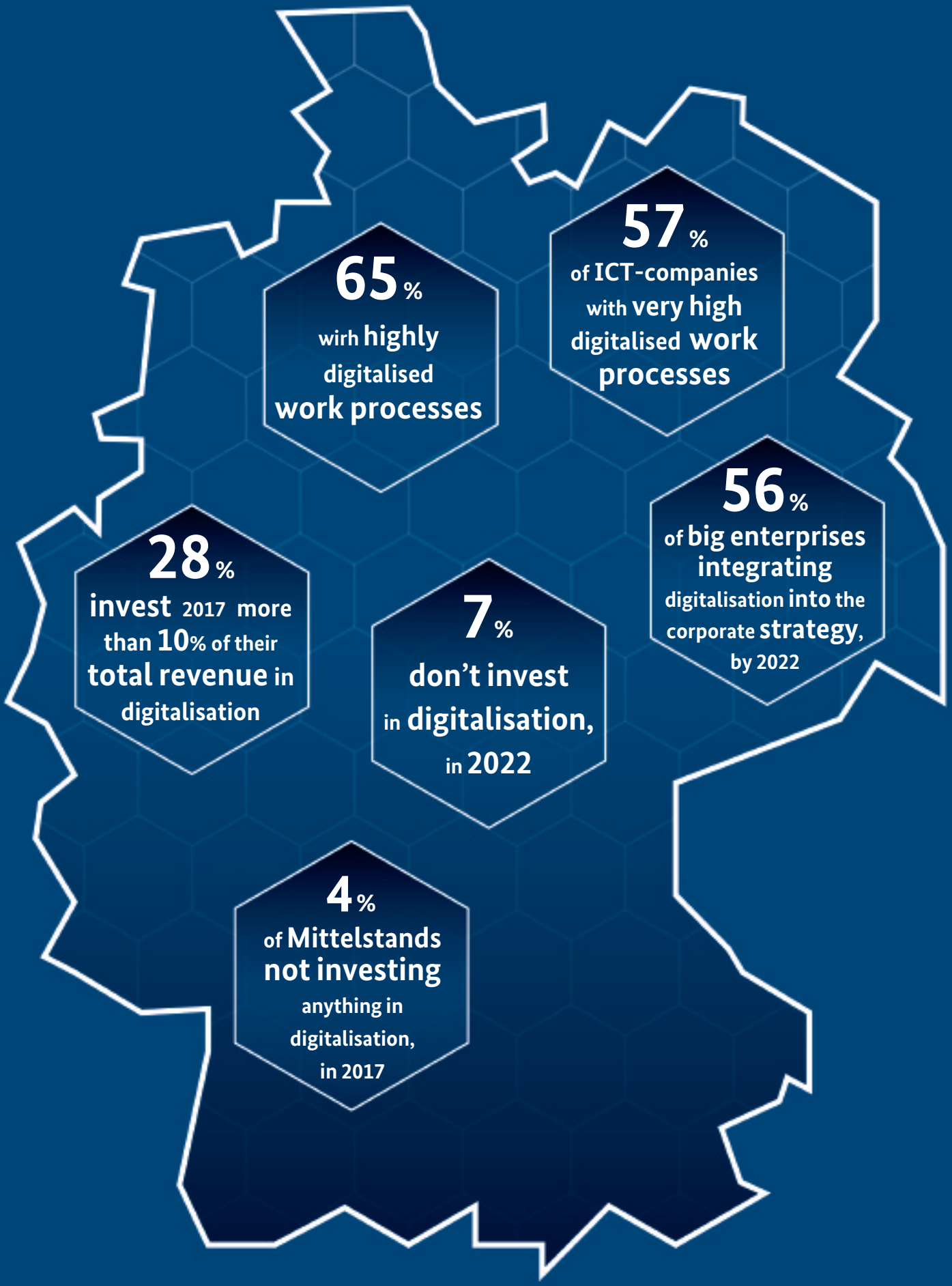
Seventeen percent of all companies still generated none of their revenue digitally. Small and mid-sized companies and large companies still have ground to make up as regards the generation of digital revenue. Thirty-six percent of commercial companies generated 60 percent and more of their revenue digitally. Thirty-nine percent of service providers did so, as well as 16 percent of manufacturers. Most of the small and mid-sized companies generated up to 30 percent of their revenue digitally. Twenty-five percent of macro economically significant large companies had not yet generated any digital revenue.

ICT companies (81 percent) and knowledge-based service providers (69 percent) remained digital pioneers, generating 60 percent and more of their revenue digitally. Seventeen percent of all commercial companies generated none of their revenue digitally, and there is room for improvement here.

Share of digital products and services high, but potential to expand. Sixty-one percent of commercial companies said that they had an “extremely wide”, “very wide” or “wide” range of digital products and services. This was stated by 64 percent of service providers, but by less than every second manufacturing company. For the first time, more mid-sized companies (62 percent) than small businesses (61 percent) had a wide range of digital product offerings. Eighty-five percent of ICT companies offered a very wide range of digital products and services, a higher percentage than in any other sector. By contrast, one in every seven companies from the chemical and pharmaceutical industry and energy and water supply sector had no digital offerings at all. The two leading sectors – the ICT economy (70 percent) and knowledge-based service providers (52 percent) – already had a very wide range of digital offerings.

Effect of digitalisation on business success still greatest in the ICT sector. Fifty-eight percent of commercial companies stated that digitalisation had a strong effect on business success. This was true of 62 percent of service providers, but of just 39 percent of manufacturing companies. Sixty-nine percent of large companies used the potential of digitalisation. The take-up was not quite as high among the Mittelstand (65 percent) and small businesses (57 percent). Digitalisation is driving business success in the ICT sector, with 72 percent believing that it had a very strong effect. Sixty-nine percent of finance and insurance providers also stated that digitalisation was a decisive factor in business success. By contrast, more than every second healthcare establishment (55 percent) and company in the other manufacturing sector (60 percent) believed that the effect of digitalisation of business success was “fairly low” or “very low”.

Restructuring and Digitalisation



2.4. Restructuring and Digitalisation

Key Findings

In this chapter, we examine the extent of current and future company reorganisation as a result of digitalisation. All the questions were used to calculate the DIGITAL Economy Index.

Digitalisation of internal processes in the services sector much more advanced than in manufacturing

Sixty-five percent of all commercial companies had "highly" digital internal processes. While almost every second service provider (49 percent) was already "highly" digital, digitalisation in every second manufacturing business (51 percent) was only "low" overall. Most processes and workflows were already "highly" digital in large companies, all of which had already digitalised at least some of their processes. The Mittelstand (46 percent) and small businesses (47 percent) had a similar level of digitalisation of processes and workflows. The digitalisation of internal processes had progressed furthest in the ICT sector. Healthcare establishments, one in every five of which had not yet digitalised any processes, have most ground to make up.

Digitalisation integrated in the strategy of 67 percent of all companies

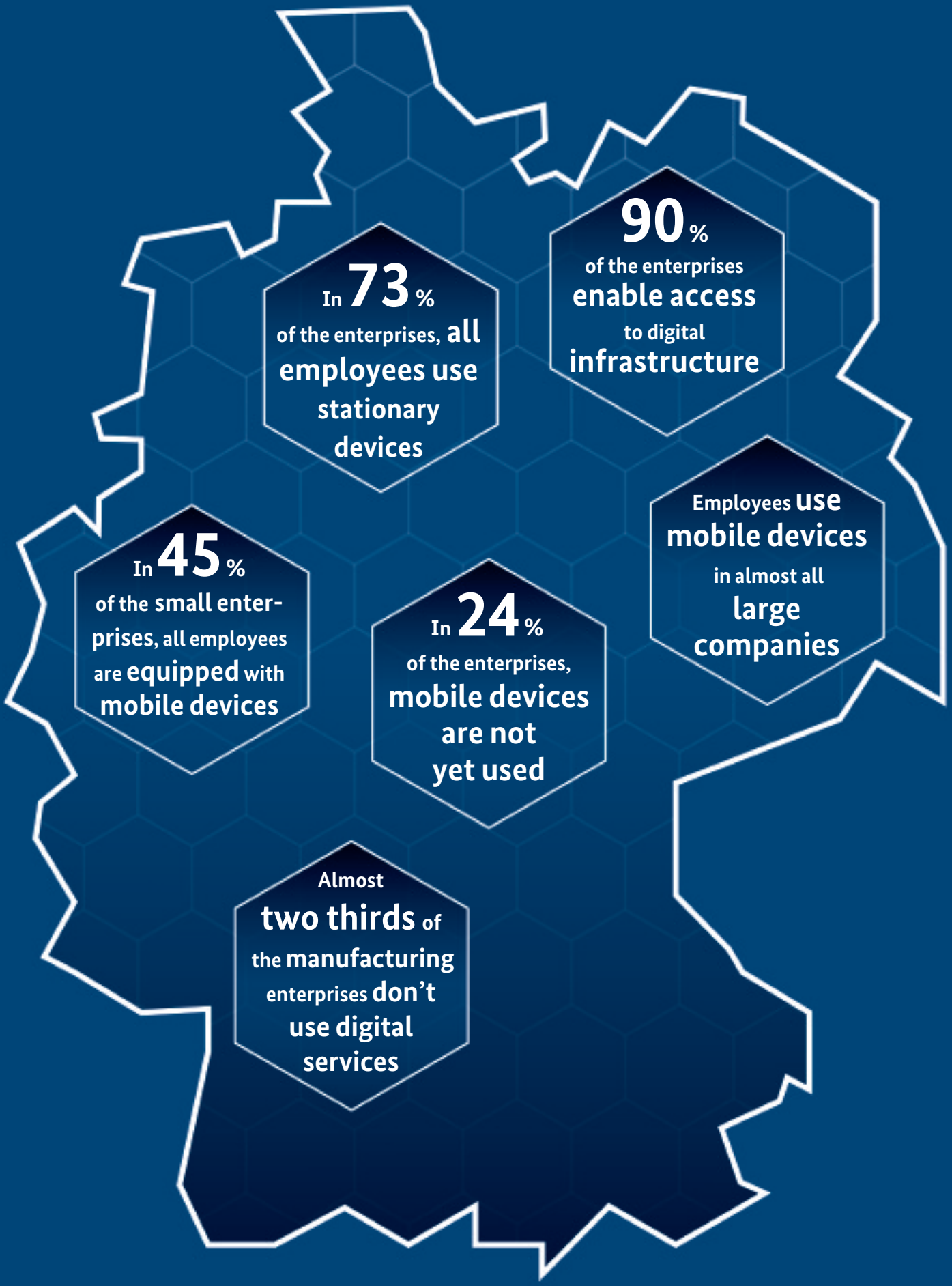
The strategic integration of digitalisation was "high" overall at 67 percent of commercial companies. This figure will increase by 10 percentage points between now and 2022. While the strategic integration of digitalisation was extensive at 71 percent of service providers, the same could only be said of 47 percent of manufacturers. The services sector will increase its score by 10 points over the next five years, while manufacturing is expecting a rise of 13 percentage points. Although progress was made in the strategic integration of digitalisation at all sizes of company, large companies still performed best here. By contrast, the percentage of companies that had integrated digitalisation in their strategy varied by sector. Only the ICT sector can already point to strong integration over both periods.

Marked increase in investment confidence – 39 percent of all commercial companies to invest over 10 percent of revenue in digitalisation in 2022

In 2017, 28 percent of commercial enterprises invested more than 10 percent of total revenue in digitalisation. This percentage will increase significantly to 39 percent by 2022. Forty-five percent of ICT companies (2022: 72 percent) invested at least 10 percent, as did 37 percent of knowledge-based service providers (2022: 41 percent).

It is particularly encouraging to note that the Mittelstand's investment confidence will increase by 13 percentage points to 36 percent in the highest investment category (> 10 percent of revenue) between now and 2022. Almost as many manufacturers (2022: 38 percent) as service providers (2022: 39 percent) will invest in digitalisation projects in 2022. Fifteen percent of all commercial companies had not yet invested in digitalisation in 2017. This figure will fall to just seven percent in 2022.

Use of Digital Devices, Infrastructure and Services



2.5. Use of Digital Devices, Infrastructure and Services

Key Findings

In this chapter, we show how well digital technologies have taken root in commercial companies. All the questions were used to calculate the DIGITAL Economy Index.

Use of stationary digital devices

All employees already used a stationary digital device such as a computer in 77 percent of the services sector. By contrast, the rate of use was significantly lower in manufacturing, where all employees had access to stationary digital devices at just 46 percent of companies. The entire workforce used stationary digital devices in over three quarters of small businesses (0 - 9 employees). As expected, this figure was much lower in large companies (21 percent). Almost all employees in the ICT sector used stationary digital devices for their work.

Use of mobile digital devices

Employees used mobile digital devices in almost all large companies (over 250 employees). By contrast, such devices were not used at all in one quarter of small businesses. However, the intensity of use, i. e. the percentage of employees using mobile devices in the different sizes of company, varied significantly. All employees used mobile devices in 45 percent of small businesses, while this was only the case in three percent of large companies. The breakdown by sub-sector shows a similar pattern: mobile devices were used by the entire workforce at significantly fewer manufacturing companies (21 percent) than service providers (45 percent).

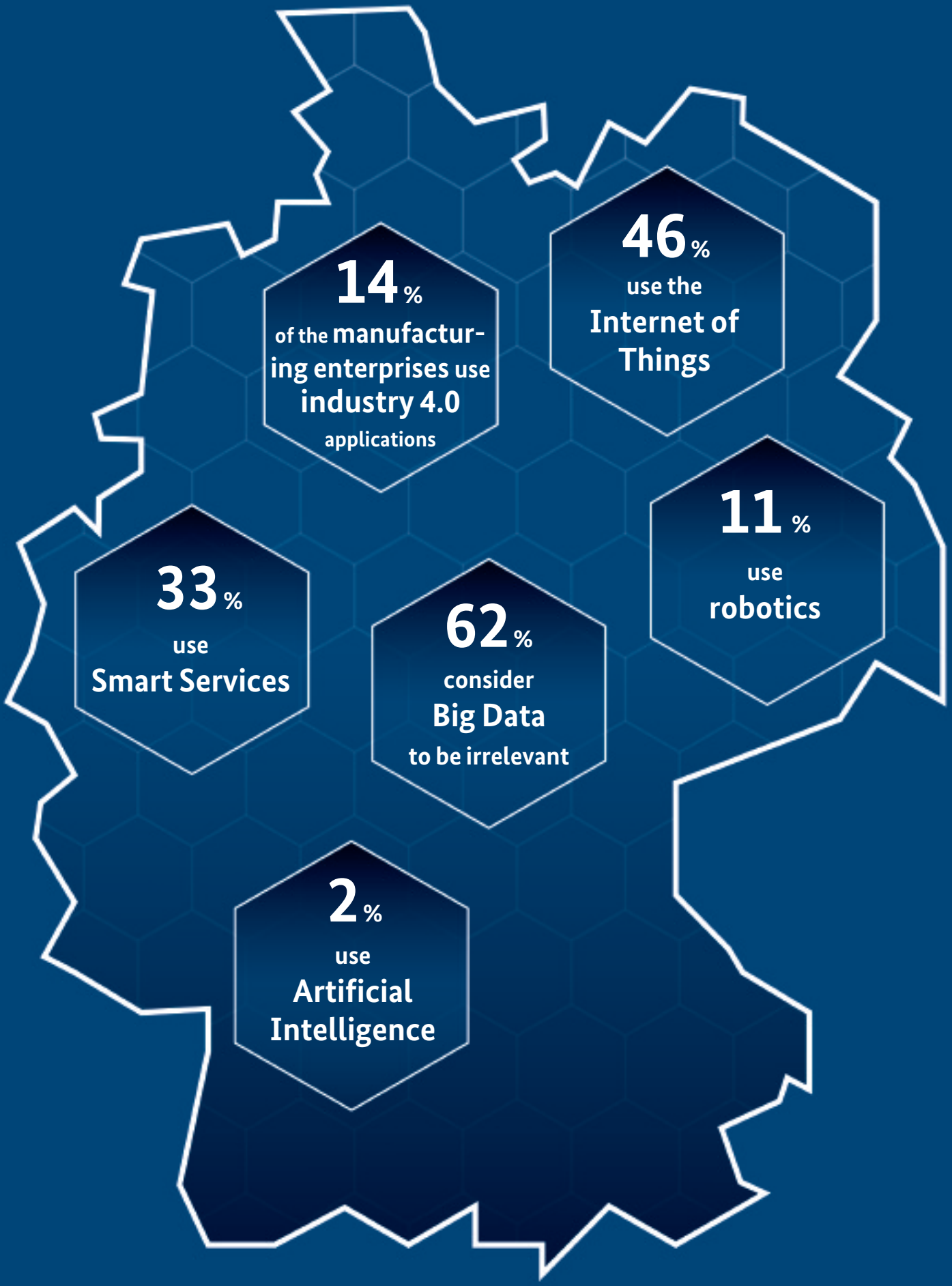
Use of digital infrastructure

Employees of service providers had particularly good access to digital infrastructure. All employees had access to digital infrastructure at almost 70 percent of companies in this sector, while this was the case at just 38 percent of manufacturers. In terms of the commercial economy as a whole, only very few companies (10 percent) had no access whatsoever to digital infrastructure; here, healthcare and transport and logistics led the field with figures of 30 percent and 32 percent respectively.

Use of digital services

Digital services were still used by comparatively few commercial companies, only half of which stated that employees were granted access to them. All employees had access to digital services at around one quarter of companies. As in the case of other technologies and applications, however, most of these companies were small businesses, so the total number of employees with access was not particularly high. As expected, digital services were more likely to be used by service providers than by manufacturers.

Innovative Applications



3. Innovative Applications

Key Findings

Few manufacturers were taking advantage of the potential of **Industry 4.0 a**pplications – cross-company and location-independent integration of production systems and processes previously operated on a standalone basis. Fourteen percent of manufacturers were using Industry 4.0 applications and another seven percent were planning to do so in the future.

The **Internet of Things (IoT)** is the digital integration of not just industry (this is essentially the concept behind Industry 4.0), but also other sectors such as transport, logistics and energy. IoT was used by just under half of commercial companies, with another seven percent planning to use it in the near future. Thirty-three percent of commercial companies considered that the Internet of Things was not relevant to their business, while another 11 percent had not yet looked into the issue.

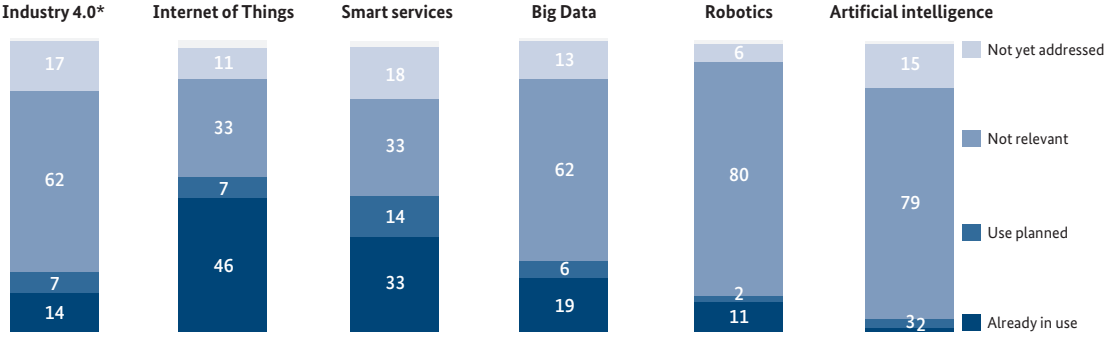
Smart services are packages of products and services for private and commercial users that are individually configured over the internet. These are personalised "as a service" based on customers' preferences and demands using digital data from different sources. Thirty-three percent of companies in the commercial economy used web-based services, and 14 percent of commercial enterprises were planning to use smart services in the near future. Another 18 percent had not yet looked into the issue. Thirty-three percent believed that smart services were not relevant to their business.

Big data is the systematic analysis of large data sets from a wide range of sources to strategically support business strategy and operational processes. Sixty-two percent of commercial enterprises stated that big data applications were not relevant to their business. Nineteen percent of companies already used big data and six percent wanted to start systematically analysing large data sets in the near future. Thirteen percent of companies admitted that they had not yet addressed the issue.

Only 11 percent of commercial enterprises used **robotics technology**, which was most prevalent in the manufacturing sector. Sixteen percent of manufacturers were already benefiting from this technology, while the same could be said of just 10 percent of service providers. Eighty percent of all companies stated that this technology was not relevant to them. Two percent were planning to introduce it, while six percent had not yet looked into the issue.

Artificial intelligence (AI) stands for the simulation of human intelligence and behaviours by self-learning computer systems, such as automated diagnosis and optimisation processes. AI applications are still in their infancy. Two percent of commercial companies reported that they used artificial intelligence and three percent were planning to introduce such applications. Seventy-nine percent of companies believed that this technology was currently not relevant to them and 25 percent had not yet looked into the issue.

Use of innovative applications in the commercial economy



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", n=1,021,* basis: Manufacturing sector n=392; figures in percent in response to the question: "Is your company active in the following areas of digitalisation?"; no answer (don't know/no answer) shown as difference to 100%; rounding differences may occur

Digitalisation: Success Factors and Obstacles

4. Digitalisation: Success Factors and Obstacles

Key Findings

Advantages

We asked commercial companies which goals they have achieved through digitalisation. Respondents were asked to assess whether seven different objectives applied to their company or not.

Generation of new knowledge and cost cutting seen as particular advantages of digitalisation.

Sixty-eight percent of commercial companies regarded the generation of new knowledge as a particular benefit of digitalisation. The figure was 86 percent for large companies and 76 percent for the Mittelstand. No other advantage of digitalisation came close to achieving these percentages. Forty-seven percent were able to cut costs as a result of digitalisation, including an impressive 71 percent of finance and insurance providers.

Access to new markets and customers and expansion of existing offerings with digital services cited as significant advantages by around one third of respondents.

Thirty-eight percent of commercial companies stated that digitalisation had enabled them to access new markets and customer groups. This advantage was appreciated by the Mittelstand (48 percent) in particular. Digitalisation had helped 37 percent of commercial companies to develop new digital services to supplement their range of products and services. This figure was three times higher among highly digital companies (57 percent) than among companies with low digitalisation (17 percent).

Digitalisation promoting innovation.

Twenty-eight percent of companies were able to launch completely new products or services as a result of digitalisation. This was stated by 58 percent of ICT companies and 48 percent of retailers. Twenty-one percent of commercial companies said that digitalisation had promoted the development of new business models, a view with which 48 percent of ICT companies agreed. Nineteen percent of commercial companies had only been able to develop new digital offerings with a view to exploiting new market access opportunities thanks to an equal partnership with other companies. Twenty-seven percent of large companies concurred with this statement.

Obstacles

We asked commercial companies to identify the three most important obstacles to digitalisation in their companies. Additional obstacles to digitalisation in the form of infrastructure and the economic environment are set out in detail in the "Policy Demands" chapter.

“Excessive time or organisational effort” seen as the biggest obstacle by almost every second company.

Forty-six percent of commercial companies regarded the “excessive time or organisational effort” required as the biggest barrier to digitalisation. Fully 70 percent of mechanical engineering companies shared this view.

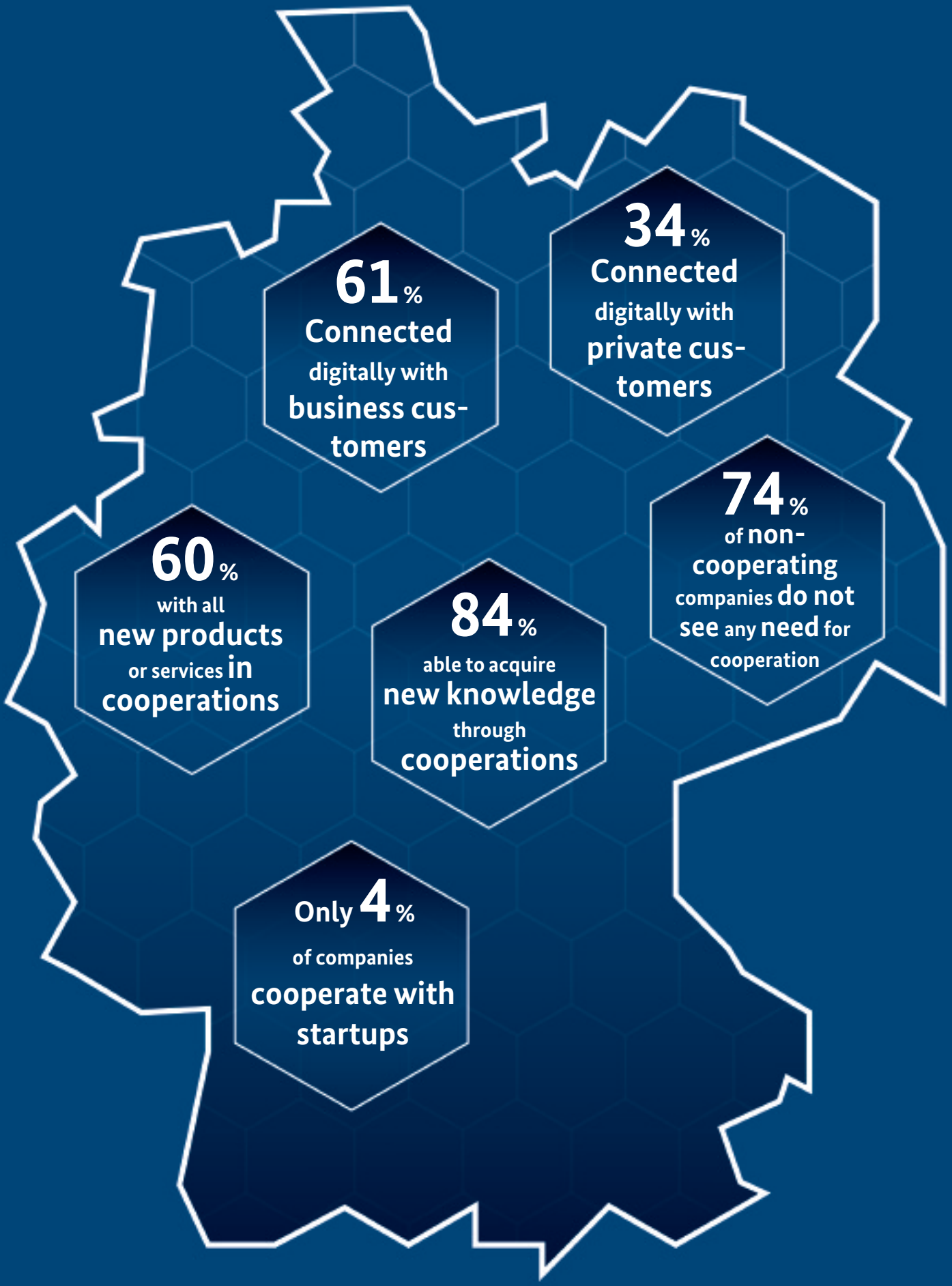
“Excessively high costs” regarded as a significant barrier.

“Excessively high costs” hampered 37 percent of commercial companies in the implementation of digitalisation projects. The figure was as high as 48 percent for large companies and 45 percent for mid-sized companies.

Legal uncertainties considered a major stumbling block by one third of companies.

Thirty-two percent of commercial companies regarded legal uncertainties as the biggest stumbling block to ongoing digitalisation. The only exceptions were the healthcare (16 percent) and energy and water supply (11 percent) sectors, where well under one third of companies considered legal uncertainties an obstacle.

Main Focus: Digital Integration and Cooperation



5. Main Focus: Digital Integration and Cooperation

Key Findings

Earlier stages of digitalisation primarily focused on individual workflows or production processes, or on individual steps of the value chain. New technological developments in the network infrastructure, high data traffic and innovative digital applications have now enabled these individual digital steps to be connected to drive forward the digital transformation of the economy. Technological integration should be accompanied by organisational integration to this end. The latter involves companies cooperating with one another both within and across sectors to transfer expertise and leverage synergies.

Sixty-one percent of companies connected with business customers, but only 34 percent with private customers

Sixty-one percent of commercial companies, in particular mid-sized enterprises, were primarily digitally connected with their business customers. Fifty-one percent were digitally connected with suppliers, while 46 percent were integrated within production and service delivery. Despite numerous opportunities and great potential, there is room for improvement as regards integration with private customers, which was still weak at just 34 percent.

Fifteen percent of companies cooperating across sectors

One fifth of commercial companies cooperated with companies from the same sector to drive forward digitalisation. Finance and insurance providers and retailers led the field here. The ICT sector was in the middle of the pack. Last place was occupied by healthcare, which has a very low level of digitalisation anyway. Only 15 percent of companies cooperated across sectors. However, the figures for mechanical engineering and automotive were significantly above this average at 21 and 28 percent respectively. In healthcare, too, cross-sector cooperation (10 percent of companies) was significantly higher than cooperation within the same sector. However, healthcare was still ranked second last.

Cooperating companies were primarily interested in sharing information and experience. This was true of both manufacturers and service providers. Three quarters of the companies that did not cooperate to drive forward digitalisation did not see any need for such cooperation.

Cooperating companies more successful in achieving goals through digitalisation than their non-cooperating counterparts

A comparison between companies that were currently cooperating and those that were not shows that the former were more successful in achieving goals through digitalisation. Eighty-four percent of companies that were currently cooperating were able to acquire new knowledge. This figure is over 20 percentage points higher than that for non-cooperating companies. Sixty-three percent of cooperating commercial companies were able to develop new digital services to supplement their existing service offering, compared with just 29 percent of non-cooperating companies. The difference was less pronounced when it came to cost cutting. Here, 51 percent of companies that were currently cooperating and 46 of those that were not achieved success through digitalisation.

Policy Demands

6. Policy Demands

Major Demands

High demand for expanding broadband, pro-digital environment and availability of information about innovations

According to 86 percent of survey respondents, the government's most important task was to promote the expansion of broadband. This was demanded by 87 percent of small businesses, 83 percent of mid-sized companies and 85 percent of large companies, particularly in sectors with a strong customer focus: knowledge-based service providers (91 percent), retailers, the ICT economy, and energy and water supply companies (all 90 percent), as well as financial and insurance providers (89 percent) felt that this should be a key political priority.

Next came the creation of a pro-digital legal environment, particularly in respect of data protection and data security (81 percent). Eighty-seven percent of companies from the chemical and pharmaceutical industry and 85 percent of retailers were in favour of this measure.

Seventy-nine percent of companies believed that the government had an obligation to ensure free access to new information about innovations acquired using public funds. This view was shared by 91 percent of knowledge-based service providers and 85 percent of healthcare companies.

Training in digital skills and start-ups demanded by over two thirds of survey respondents with a view to driving digital progress

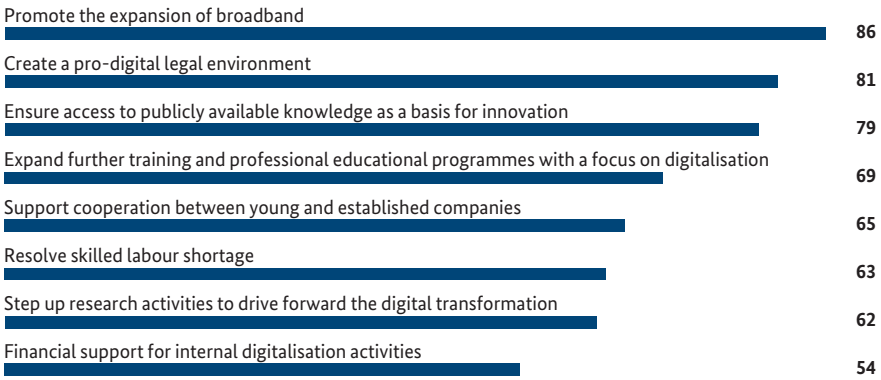
Sixty-nine percent of companies would like to see professional training and educational programmes expanded with a focus on digitalisation. This was particularly important to companies in the mechanical engineering (78 percent) and chemical and pharmaceutical (77 percent) sectors. Sixty-five percent of the companies surveyed wanted the government to promote cooperation between established companies and start-ups.

Reducing the skilled labour shortage a high priority, especially in mechanical engineering; government funding for internal digitalisation projects

Sixty-three percent of companies said that the government must take steps to resolve the labour shortage. The figure for the mechanical engineering sector was even higher, at 75 percent.

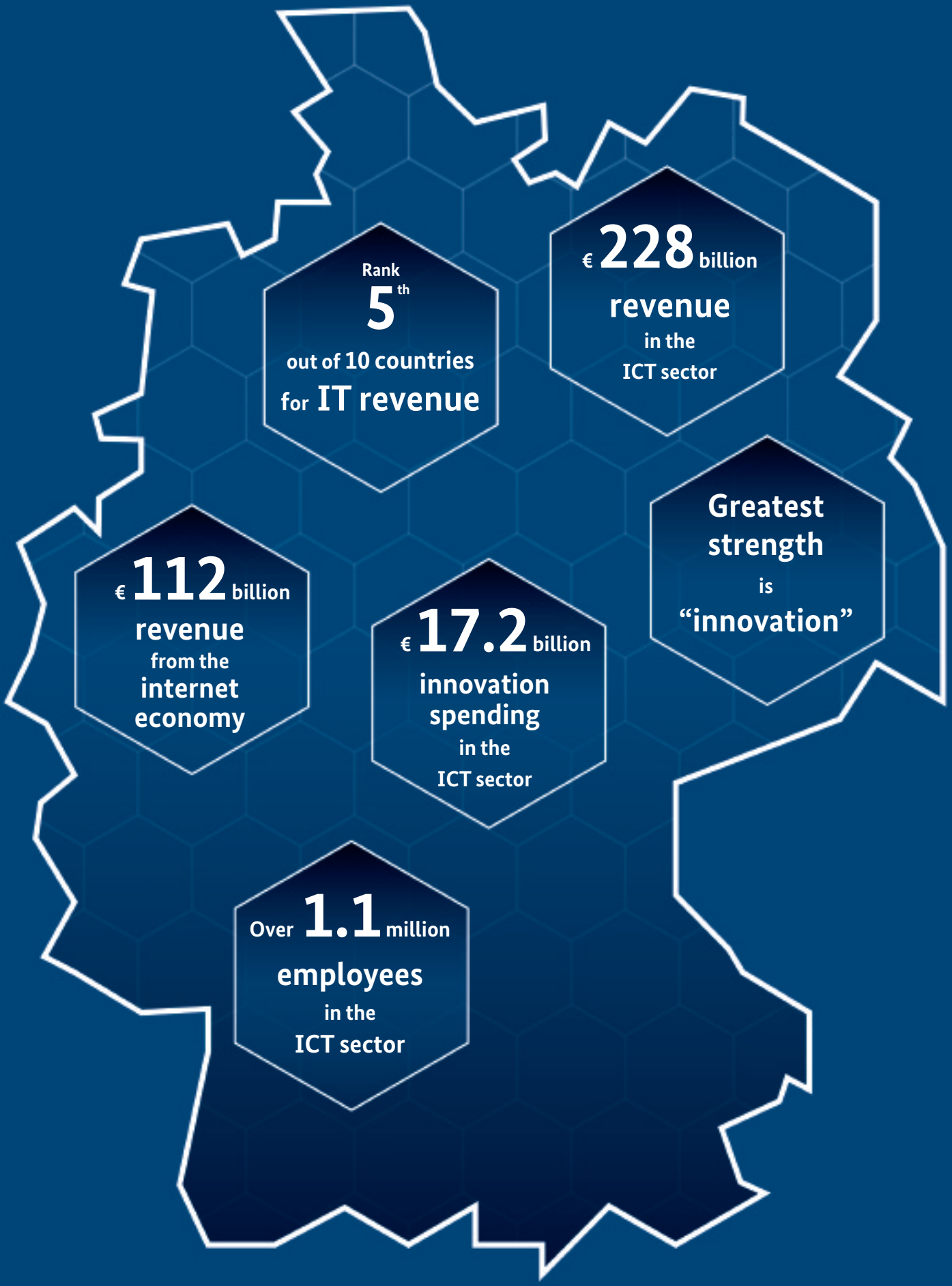
Sixty-two percent of companies called on policymakers to make more funds available for research and development for digitalisation projects, especially with a view to turning new ideas into market-ready solutions and products. Fifty-four percent believed that internal digitalisation projects should receive government funding. The figure for mechanical engineering was 65 percent, for healthcare 60 percent and for energy and water supply 58 percent.

Policy Demands



Source: Kantar TNS, representative company survey: "Digitalisation of the German economy 2017", n = 1,021;
agreement in percent in response to the question: "What are your demands on the government with respect to digitalisation?"

Digital Economy: Key Figures and International Comparison



III. Digital Economy

1. Overview of Findings

Economic significance of the digital economy – key figures and international comparison

The digital economy – the ICT sector and the internet economy – paves the way for digitalisation and is driving forward the digital transformation. In the first part of the study, we analysed the share of the commercial economy as a whole attributable to the digital economy and its significance to Germany. In particular, we focused on innovation and start-ups, which were primarily driven by the ICT sector.

In 2016, the ICT sector in Germany generated revenue of around € 228 billion, employing over 1.1 million people. Gross value added in the ICT sector stood at € 105 billion, exceeding the € 100-billion mark for the second year in succession, and leaving traditional industries such as mechanical engineering and the chemical and pharmaceutical industry trailing far behind. The internet economy also grew, if only slightly, with revenue of almost € 112 billion in 2016. In the 10-country comparison, Germany recorded the sixth highest revenue per capita from the internet economy. It spent € 1,365 per capita on internet-based goods and services in 2016.

The ICT sector continued to invest in innovations. Innovation budgets reached a new record of € 17.2 billion, up almost 18 percent on the year before (€ 14.6 billion). ICT companies' spending on R&D and software development came to € 8.6 billion in total, corresponding to growth of almost € 0.9 billion in the course of a single year.

In 2016, almost 6,500 companies were founded in Germany's ICT sector, just 89 percent of the figure achieved in the pre-crisis year of 2008. The result for the economy as a whole was only 78 percent.

DIGITAL Location Index: Strength of the digital economy compared with other countries

In the second part of the study, we analysed the significance of the German digital economy compared with nine other countries.

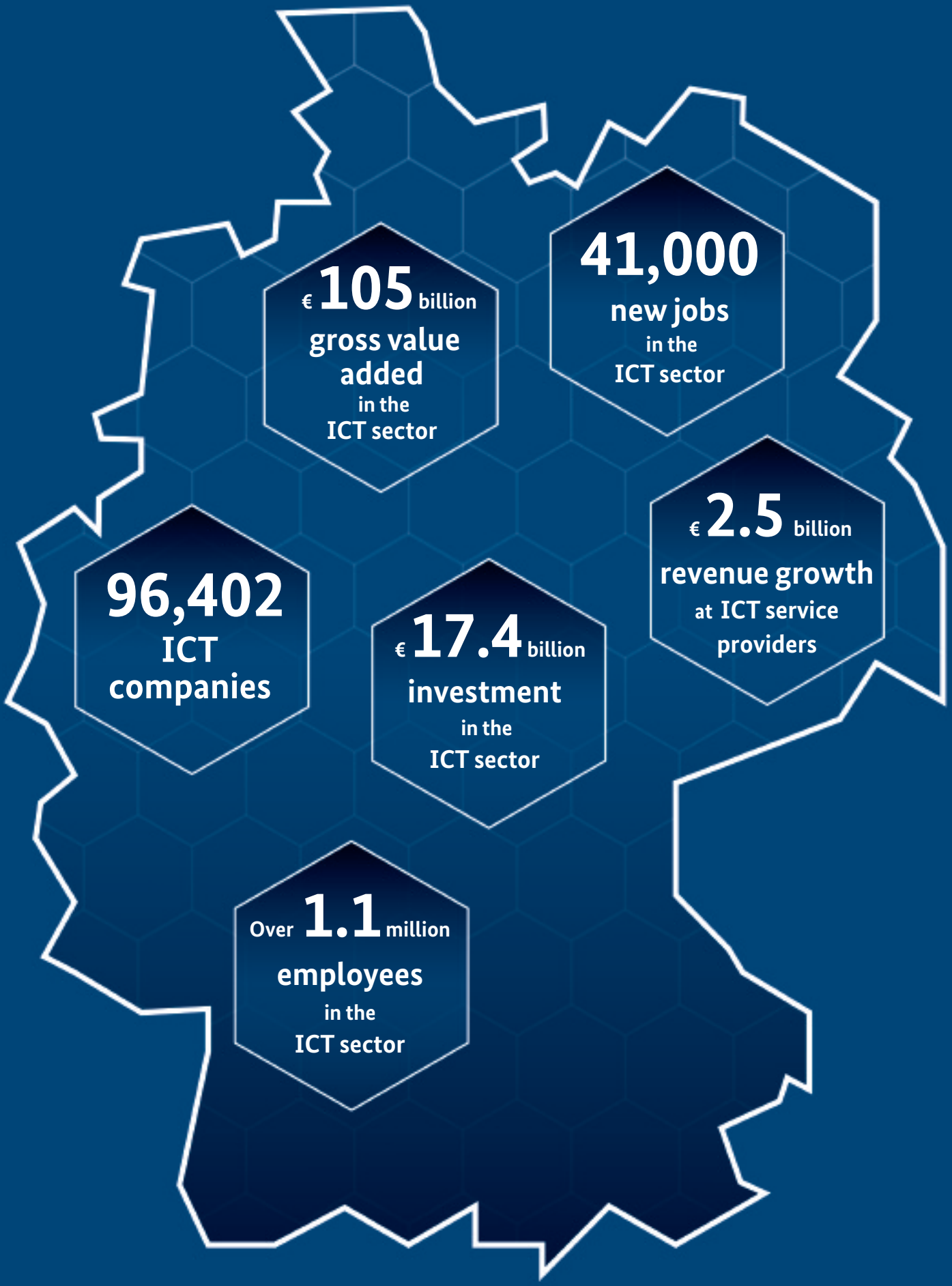
The international DIGITAL Location Index, which compares the strength of the digital economy, ranked Germany **sixth** as in the previous year, with 57 points. The USA was again the clear leader with 81 index points, ahead of South Korea and the United Kingdom.

The success of the digital economy is based on three pillars: position on the markets, infrastructure and intensity of use of digital technologies and services.

In the **Market category**, Germany achieved a below-average ranking of **seventh** with 41 of a possible 100 points, well behind the leaders USA (77 points). Germany managed a much more respectable **fourth** place in the **Infrastructure category**, sharing its ranking with the USA. It was also able to move up one place to **fifth** in the **Use category** with 80 points.

Germany's main strengths lie in innovation and computer use, and it led the field on both counts. Its main weaknesses were in e-government, its relatively weak ICT exports and its lack of R&D tax incentives.

Economic Significance of the German Digital Economy



2. Economic Significance of the German Digital Economy

Key Findings

The digital economy comprises the ICT sector and the internet economy and is the main driver of the digital transformation. As such, it is the focus of the value added analysis in this DIGITAL Economy Monitoring Report.

ICT sector records gross value added of € 105 billion

Gross value added in the ICT sector stood at € 105 billion, exceeding the € 100-billion mark for the second year in succession, and leaving traditional industries such as mechanical engineering and the chemical and pharmaceutical industry trailing far behind. The renewed rise in gross value added in the ICT sector can be attributed entirely to increasing value creation among ICT service providers.

Marked decline in gross capital expenditure in the ICT sector

Following unexpectedly high investment in purchased or internally developed production resources in the ICT sector in 2015, investment declined once again, reaching around € 17.4 billion in 2016. This figure is still well above the long-term average for this sector, however. Both ICT service providers and hardware manufacturers saw investments fall. Overall, however, investment in the ICT sector was still higher than that in the chemical and pharmaceutical industry and in mechanical engineering combined. These two traditional industries collectively invested € 2.5 billion less than the ICT sector.

ICT service providers with positive revenue growth

In 2016, the ICT sector in Germany generated revenue of around € 228 billion, some € 6 billion less than the previous year. ICT service providers continued their positive long-term performance with revenue growth of almost € 2.5 billion. However, hardware manufacturers saw their revenue decline by almost € 8.5 billion over the same period to the lowest level in the monitoring period 2009 - 2016.

ICT sector as job engine

In 2016, the number of employed and self-employed persons liable for social security contributions in the ICT sector rose once again to 1,119,787. A long-term comparison shows the ICT sector to be a job engine. A positive picture is painted not only by the 41,000 new jobs created in 2016, but also by the over 192,000 new jobs generated in total since 2010, giving the ICT sector the highest growth rate of all the sectors.

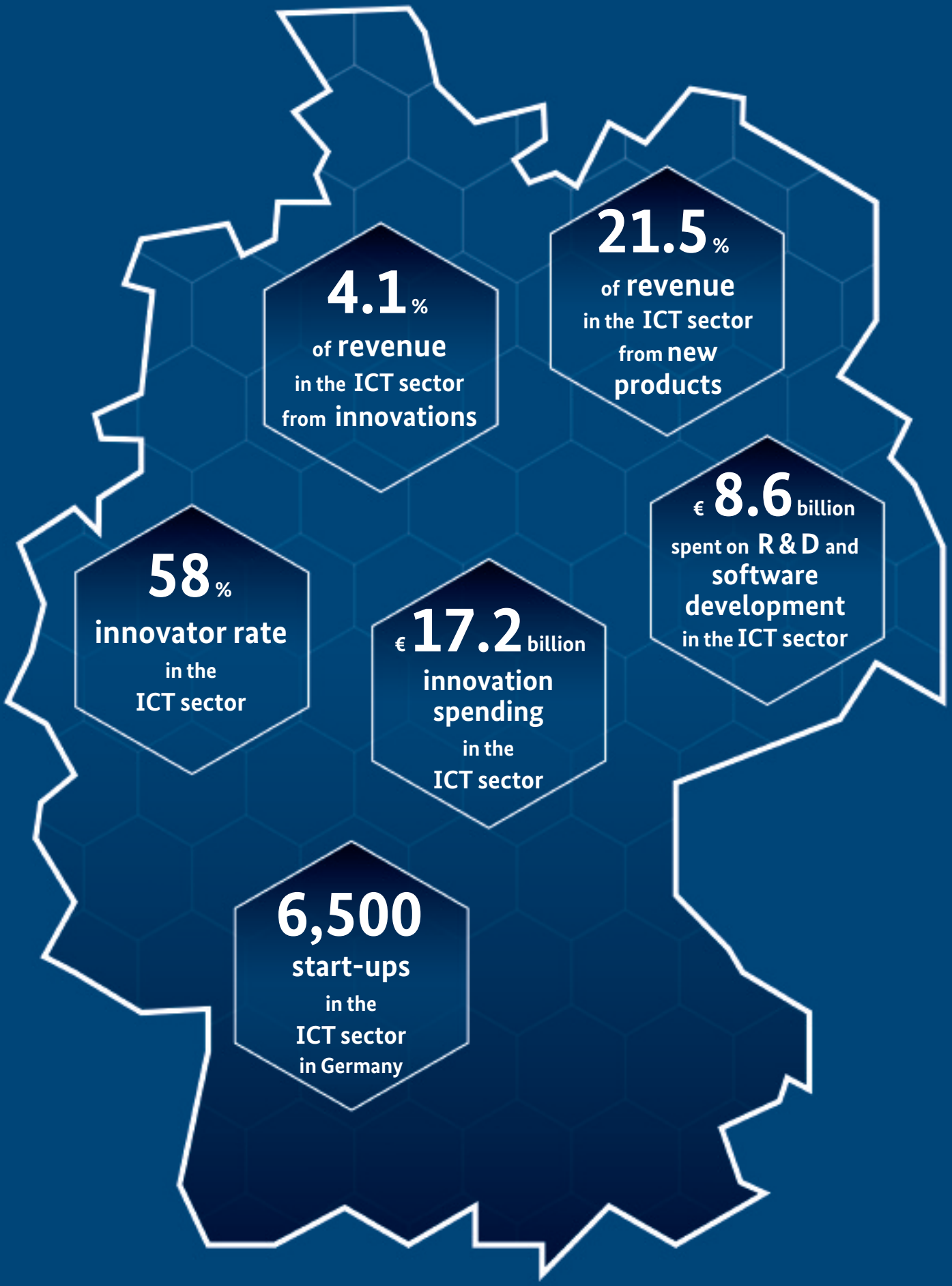
Low average company size in the ICT sector

A total of 96,402 companies were operating in the ICT sector in 2016. The mean company size of 11.6 employees was above the average for the commercial economy, but a considerable way behind the sectors dominated by large companies, such as the automotive (205.8), chemical and pharmaceutical (96.7) and mechanical engineering (52.0) industries.

Only slight growth in revenue from the internet economy to almost € 112 billion

In 2016, the German internet economy only grew slightly overall with revenue of almost € 112 billion. This was attributable in the main to the decline in B2B e-commerce following an exceptionally successful year in 2015. In the 10-country comparison, Germany recorded the sixth highest revenue per capita from the internet economy. It spent € 1,365 per capita on internet-based goods and services in 2016. The highest per-capita revenue was recorded in the UK (€ 2,503), the USA (€ 2,502) and South Korea (€ 2,439).

Innovation and Start-Ups in the ICT Sector



3. Innovation and Start-Ups in the ICT Sector

Key Findings

Ever fewer companies implementing innovations

The innovator rate, i.e. the percentage of companies that have introduced at least one new product or process within the past three years, once again declined considerably over the course of 2015 to just 58 percent (down seven percentage points) in the ICT sector. Although innovation in ICT companies was still high compared with other sectors, ICT came third behind the chemical and pharmaceutical (67 percent) and automotive (64 percent) industries in 2015. Only the even more severe decline of 13 percentage points in the mechanical engineering sector prevented ICT from dropping down to fourth place. The main reason for the fall in the innovator rate across the ICT sector as a whole was the slowdown among ICT service providers.

Innovation spending at record level

ICT companies stepped up their innovation efforts considerably in 2015. Innovation budgets reached a new record of € 17.2 billion, up almost 18 percent on the year before (€ 14.6 billion); the latter had, however, been relatively low compared with previous years. The four-year trend shows average growth per annum of just 3.2 percent since 2011. In mid-2016, ICT companies were planning to increase their innovation budgets significantly by a further eight percent, resulting in budgets for 2016 and 2017 of € 18.5 billion and € 20.0 billion respectively.

Innovation intensity particularly high for ICT hardware

The percentage of revenue spent on product and process innovation in a sector determines its innovation intensity. As with innovation spending, the ICT sector saw a higher than average increase in this figure. While all the other sectors apart from knowledge-based services recorded growth of no more than 0.4 percentage points compared with the previous year, innovation intensity in the ICT sector grew by almost twice this figure to 8.3 percent. This growth was driven in the main by ICT hardware, where innovation intensity rose from 12.0 to 14.2 percent. ICT hardware was thus the most innovation-intensive sub-sector, while the ICT sector as a whole came second only to automotive (9.9 percent) in this respect.

€ 8.6 billion invested in R&D and software development

In 2015, ICT companies' spending on R & D and software development came to € 8.6 billion in total, corresponding to growth of almost € 0.9 billion in the course of a single year. ICT hardware spent a particularly high percentage of its total innovation spending on R & D. At 70 percent, this percentage was only second to that of the chemical and pharmaceutical industry (72 percent). Measured against R & D intensity, i. e. the percentage of revenue invested in R & D, ICT hardware's spending on R & D in 2015 was highest by some margin at 10.0 percent, another considerable rise on 2014 (8.8 percent). However, since the R & D intensity of ICT service providers declined slightly over the same period, the figure for the sector as a whole remained almost unchanged at 4.1 percent.

Almost 6,500 start-ups in the ICT sector

In 2016, almost 6,500 companies were founded in the ICT sector, accounting for around four percent of all start-ups in Germany. This indicates that the dynamism in the start-up sector is currently less favourable in the ICT industry than in the commercial economy as a whole. The number of start-ups in Germany across all sectors remained virtually unchanged for the third year in succession, although a longer-term comparison shows that start-up figures in the ICT sector have developed more positively than elsewhere. The start-up figure for 2016 in the ICT sector was just 89 percent of that achieved in the pre-crisis year of 2008. However, the result for the economy as a whole was only 78 percent.

DIGITAL Location Index

4. DIGITAL Location Index: Global Performance

Key Findings

The success of the digital economy – the ICT sector and the internet economy – is based on three pillars: market strength, infrastructure and the use of technologies and applications.

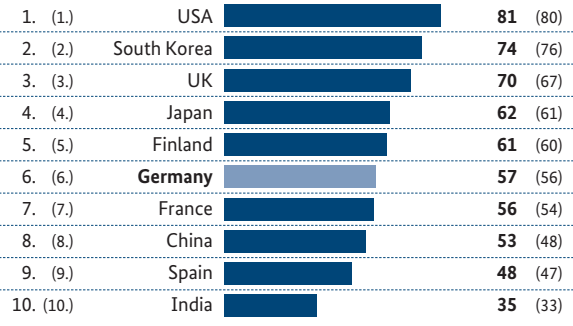
In order to compare the performance of different countries, this study first looked at the global markets. Market strength, i. e. supply and demand, revenue and exports in the digital economy, was analysed to this end.

Infrastructure was also taken into account for a comprehensive assessment of each country. Technical infrastructure and the economic environment is essential to a functioning market, innovation and growth, especially in the digital economy.

The intensity of use of digital technologies, products and services is also key to assessing the digital economy of a country. The market can only grow if it has informed, tech-savvy users, and investments are only profitable if there are enough users open to new technology.

This report analysed the strength of the 10 most important digital economies on the basis of 48 core indicators. Kantar TNS conducted a secondary analysis and a separate international survey of ICT experts in 10 countries and used proprietary survey data from both ZEW and Kantar TNS. In order to be able to compare the findings in the different countries, the best country out of 10 in each category was awarded 100 index points. The other countries were positioned relative to the category leader. Based on these indicators, the countries analysed could then be ranked and compared.

DIGITAL Location Index: Global Performance



Source: Kantar TNS, 2017; as of 2016, prior-year figures in brackets

Germany holding steady in sixth place

The international DIGITAL Location Index, which compares the strength of the digital economy, once again ranked Germany sixth with 57 of a possible 100 index points, a slight improvement of one index point.

The USA remained top of the 10 countries with 81 points. South Korea fell by two index points to 74 points, but maintained its second-place ranking ahead of the UK, up three points in third place.

Although China gained most ground compared with the previous year, its total of 53 points was not enough to move up from last year's eighth position. India brought up the rear with just 35 points.

Germany's strengths

Germany's main strengths were in general innovation, computer use, the better availability of venture capital, internet access, the quality of education in mathematics and natural sciences and the adaptation of new technologies in companies.

Germany's weaknesses

Germany's performance was below average as regards spending on telecommunications, growth in telecommunications revenue, ICT exports, R & D tax incentives, ICT patents, the availability of digital and technological skills and the quality of e-government offerings.

Location Index – Market

4.1. Location Index – Market: Position of the German Digital Economy on the Global Markets

Key Findings

The DIGITAL Location Index – Market assesses the position of the digital economy on the global markets. This study looked at supply and demand, revenue and exports in the digital economy with a view to determining market strength. The results for the 17 monitored factors were as follows:

Germany down one place from sixth to seventh

The DIGITAL Location Index – Market was once again headed by the USA, which achieved 77 of a possible 100 points, well ahead of second-placed South Korea (66 points).

The UK occupied third place on 56 points. Although Germany improved its index score from 40 to 41 points, this was not enough to prevent it dropping down one place from sixth to seventh because the other countries are developing at a faster pace. Germany was thus overtaken by China, which moved up to sixth with a considerable improvement of seven points. Spain (30 points) and India (28 points) once again brought up the rear.

Improvements: Germany's most significant increase in IT revenue growth

Germany's most significant improvement of 19 points was achieved in IT revenue growth, where it rose one place to fourth. Improvements were also made as regards IT spending and spending on online content, with rises of nine and six index points respectively. Revenue from internet connectivity also improved by five points.

DIGITAL Location Index – Market

1.	(1.)	USA	**77**	(77)
2.	(2.)	South Korea	**66**	(68)
3.	(3.)	UK	**56**	(52)
4.	(4.)	Japan	**49**	(47)
5.	(5.)	Finland	**47**	(46)
6.	(7.)	China	**45**	(38)
7.	(6.)	**Germany**	**41**	(40)
8.	(7.)	France	**39**	(38)
9.	(9.)	Spain	**30**	(29)
10.	(10.)	India	**28**	(27)

Source: Kantar TNS, 2017; as of 2016, prior-year figures in brackets

Declines: Fall in Germany's telecommunications revenue

The biggest decline was in Germany's telecommunications revenue growth, which dropped by 21 points to just three index points, causing the country to fall from fourth to eighth place. In addition to this significant decline, the market category also saw falls in gross capital expenditure (down five points) and in revenue from the internet economy, i.e. internet-based economic activity (down two points).

Strengths: Germany's performance average at best

Germany was unable to achieve a top three ranking in any of the important indicators in the Market category. It was only ranked in the upper mid-field for IT revenue growth and the percentage of online advertising (coming fourth in both), and performed worse than that in respect of all the other analysed indicators. Germany came fifth in both IT and telecommunications revenue, but with a very low tally of 12 and 15 index points respectively, far behind the leaders USA. Nor did the country rank higher then seventh in terms of gross value added, gross capital expenditure and the number of employees.

Weaknesses: ICT exports still weak

Germany's below-average performance was particularly poor in respect of two telecommunications indicators: it only achieved eighth place for both telecommunications revenue growth and spending on telecommunications. Germany's weakest performance has traditionally been in the field of ICT exports as a percentage of all German exports. Since ICT exports failed to keep pace with the export strength of the economy as a whole, Germany was unable to place better than ninth.

Location Index – Infrastructure and Economic Environment

4.2. Location Index – Infrastructure and Economic Environment

Key Findings

The DIGITAL Location Index – Infrastructure assesses technical infrastructure and the economic environment in the digital economy. The results for the 17 monitored factors were as follows:

Germany still in fourth place

The UK once again led the rankings for infrastructure and the economic environment with 87 of a possible 100 index points. It was followed closely by South Korea (86 points), with France (84 points) in third place. Germany's total of 83 index points, one more than last year, enabled it to retain fourth place.

As expected, China was ranked ninth of the 10 countries with a nevertheless respectable tally of 67 points, with India bringing up the rear far behind on 37 points.

Improvements: Significant rise in the availability of venture capital in Germany

The biggest improvement made by Germany in the Infrastructure category was in the availability of venture capital, with a rise of 10 index points compared with the previous year. This enabled Germany to move up four places to third in the 10-country comparison. The country also achieved a seven-point improvement in smartphone use, moving up three places to sixth. Other relevant improvements were made in the quality of education and the effect of ICT on business processes, both of which saw a four-point rise.

Declines: Number of ICT start-ups down

Germany saw a significant decline of 15 points in ICT start-ups as a percentage of all start-ups. It was nevertheless able to move up from fifth place to fourth, as the start-up rates in other countries declined even more steeply. Mobile phone use was also down very slightly by one point at 85 points, although it remained at a high level.

Strengths: Germany leads the way as regards innovation and computer use

As in recent years, Germany once again led the field in terms of the penetration of computers in households. For the first time, it was also able to achieve top place out of 10, up one position from last year, in the innovation rankings.

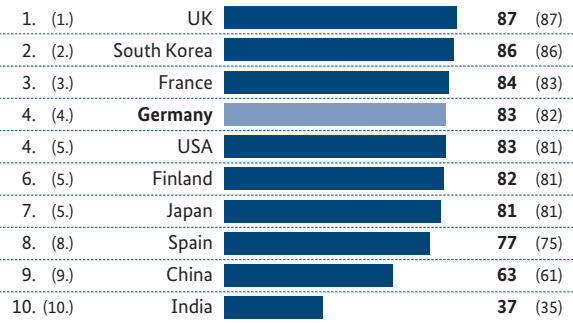
Strengths: Good positions for internet access, education and venture capital

Germany also achieved excellent rankings for internet access and the quality of education in STEM subjects, as well as for venture capital availability, occupying third position in all of these categories.

Weaknesses: Room for improvement in digital skills and R & D tax incentives

Germany showed significant weaknesses as regards the availability of digital and technological skills, where it came ninth. The lack of R & D tax incentives compared with the other countries must also be regarded as a notable weakness.

DIGITAL Location Index – Infrastructure



Source: Kantar TNS, 2017; as of 2016, prior-year figures in brackets

Location Index – Use of Digital Technologies

4.3. Location Index – Use of Digital Technologies by the General Population, Public and Private Sectors

Key Findings

The take-up of new technologies and services by the general population as well as the public and private sectors is assessed in the DIGITAL Location Index – Use. The results for the 14 monitored factors were as follows:

Germany up from sixth to fifth

The UK remained top of the 10 countries with 93 points, followed in second place by the USA, which improved by one index point to 91 points. South Korea (88 points) came third, followed by Finland, which managed a three-point rise on the previous year.

Germany's tally of 80 was four points up on the year before and enough to share fifth place with Japan, whose score dropped slightly from 81 to 80 points. China (68 points) and India (54 points) also brought up the rear in this category in ninth and tenth place respectively.

Improvements: Low-level progress made in e-government in Germany

Germany's biggest improvement in the Use category was achieved in e-government with growth of 17 points, although the country retained its below-average ranking of eighth. Significant ongoing improvements were also made as regards the use of online videos (up 11 points) and the number of music downloads (up eight index points).

Declines: Less success in promoting the use of ICT

Only one factor in the use of digital technologies saw a slight downturn: the public sector was slightly less successful in promoting the use of ICT than it had been in the previous year. Germany still ranked fourth out of 10, however.

Strengths: Germany ranked highest for use of new technologies in companies and music downloads

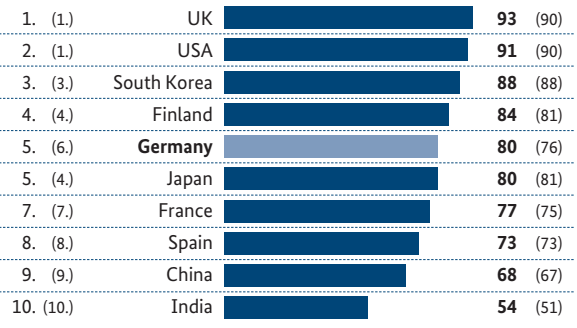
Germany achieved its highest position in the Use category for the adaptation of new technologies in companies and the number of music downloads per internet user, in both of which it ranked third.

In particular, Germany achieved upper mid-field placings for the use of the internet and e-commerce by private individuals, use of the internet as a distribution channel, use of ICT for B2B transactions, and use of ICT by the public sector. It ranked fourth for all of these factors and fifth for the download of apps.

Weaknesses: Mobile internet use and e-government

Germany performed relatively weakly as regards the use of mobile internet, social networks and online videos, where it ranked seventh. However, as in recent years, its worst ranking of eighth was for the quality of e-government, due in part to the federal structure of the country.

DIGITAL Location Index – Use of Digital Technologies



Source: Kantar TNS, 2017; as of 2016, prior-year figures in brackets

Appendix

About this Study

2017 DIGITAL Economy Monitoring Report

The 2017 DIGITAL Economy Monitoring Report used the 2017 DIGITAL Economy Index to analyse the current and future level of digitalisation of the German commercial economy, broken down by 11 sectors (part 1). The 2017 DIGITAL Economy Monitoring Report used the 2017 DIGITAL Location Index (part 2) to measure the competitiveness of the German digital economy as a sector.

Part 1: Digitalisation in 11 core sectors of the German commercial economy

The aim was to measure the level of digitalisation of companies in the commercial economy in 2017 and 2022 on a representative basis, as well as to identify the advantages of and obstacles to digitalisation.

Method: Between March and May 2017, Kantar TNS conducted a representative survey of German companies on the current status and future prospects of digitalisation in Germany. It is representative of the commercial economy as a whole, i.e. of the following 11 sectors: mechanical engineering, automotive, the chemical and pharmaceutical industry, other manufacturing, information and communications technology, energy and water supply, retail, transport and logistics, finance and insurance as well as knowledge-based services and healthcare.

A total of 1,021 companies from 11 sectors were surveyed for this study. The quantitative, computer-based and standardised telephone interviews with open and closed questions were conducted by Kantar TNS. The disproportionate stratification of random sampling ensured that an adequate number of companies from different sectors and size categories were represented.

Presentation of results in the DIGITAL Economy Index: The DIGITAL Economy Index measured the effect of digitalisation on business success, on the digital penetration of internal processes and workflows, as well as on the intensity of use of digital technologies and services. It presented the level of digitalisation of the German commercial economy and its sub-sectors in 2017 and 2022 as a figure between 0 and 100 points.

Digitalisation profile: Digitalisation by sector has been analysed in depth in separate reports in formats suitable for presentation. An additional separate analysis on digitalisation by company size was once again conducted in 2017.

Part 2: The German digital economy compared with other countries

The aim was to measure the strength of the German digital economy (the ICT sector and the internet economy) as a sector compared with nine other countries.

Method: Kantar TNS conducted an international secondary analysis in Germany and nine other countries of significant economic relevance to Germany: the USA and South Korea, the UK and Finland, France and Spain, as well as China, India and Japan.

In addition, 100 ICT experts were surveyed by Kantar TNS in each of these countries. ZEW also prepared exclusive supplementary analyses from proprietary studies. A unique feature of the DIGITAL Location Index is the calculation of the revenue generated by the internet economy in 10 countries.

Presentation of results in the DIGITAL Location Index: The results from both parts of the study were summarised in the 2017 DIGITAL Location Index. The DIGITAL Location Index shows – in a single number – the strength and economic significance of the digital economy in each country. In each category, the best country functioned as the benchmark and received the maximum of 100 points. The other countries were ranked between 0 and 100 points based on how far behind the leading country they were.

Value added: Special analyses by ZEW on gross value added, innovation, investment or start-ups illustrate the value added generated by the digital economy for Germany as a business location.

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