Bundesministerium
für Wirtschaft
und Energie

Digitalisation of the Economy in Germany

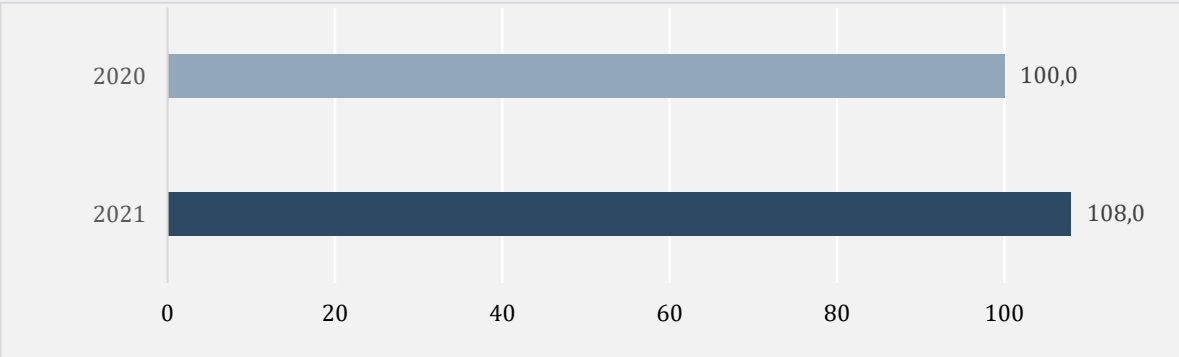
Digitalisation Index 2021

Summary of the Digitalisation Index results in the project "Development and Measurement of the Digitalisation of the Economy in Germany"

The German economy in 2021 has become more digital than in 2020. The Germany-wide index score in 2021 has reached 108.0 points in comparison to a standardised 100.0 points in the previous year (Figure 1).[1]

Figure 1: Results of the Digitalisation Index for Germany

In index points, survey years 2020 and 2021



Source: German Economic Institute, IW Consult

The analysis of the change in the individual index categories provides information on the drivers of this development (Figure 2). This is especially clear because the indicator scores and thus also the category scores summarised from them have both been standardised to 100 in 2020.

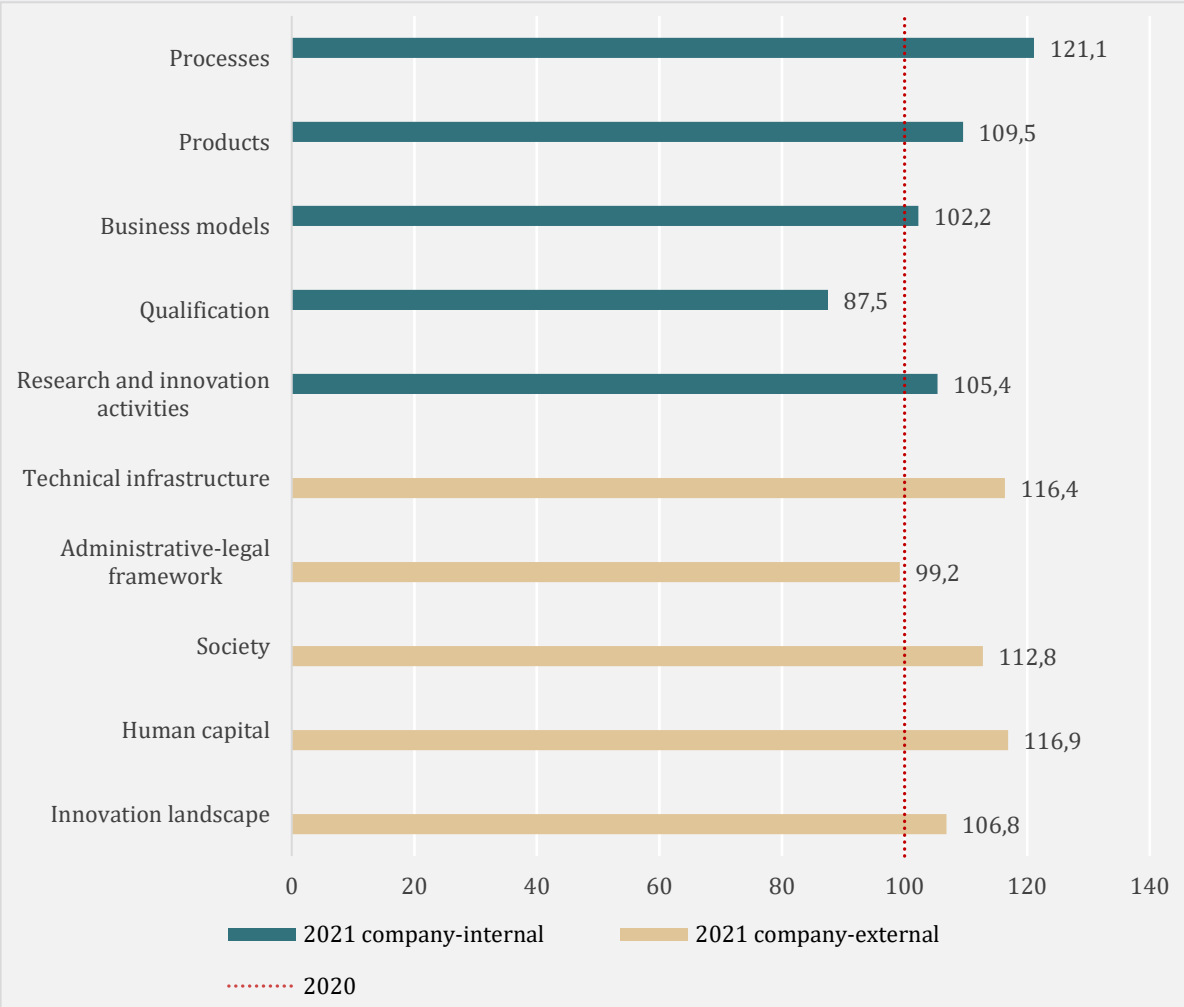
- Improvement in the general conditions is the main driver of the increasing digitalisation of the economy in Germany. The company-external categories have increased by an average of 10 index points. The company-internal categories have increased by 5 index points on average.
- The strongest growth, however, has been seen in one company-internal category, namely processes. This category also describes the digital networking with other companies along with the digital maturity of a company's internal processes. The category score rises to 121.1 points.

[1] Information on the methodology can be found on the last page of this report.

- The company-external categories of human capital (116.9 points) and technical infrastructure (116.4 points) have also increased considerably.
- The category of administrative-legal framework conditions has seen a slight decline to 99.2 points.
- There have also been significant declines in the category of qualifications. Its score in 2021 is 87.5 points.

Figure 2: Results of the Digitalisation Index for Germany by category

In index points, survey years 2020 and 2021



Source: German Economic Institute, IW Consult

The substantial rise seen in the category of processes is mainly due to the increasing digital networking of companies. The category of human capital has been able to increase in particular, because the skilled labour gap in digitalisation occupations has shrunk in the period under consideration. The score for the technical infrastructure has increased for the most part due to the significant gains in broadband availability for businesses and households. The decline in the category of qualifications is mainly due to poorer scores in the share of companies that offer continuing education courses for company-internal IT users and IT specialists.

The increases in the categories of processes, products and business models, which consist of indicators based on a company survey, reveal the concrete direction of digitalisation. Firstly, processes in

particular are being digitalised (plus 21 points), followed by the emergence of digital products (plus 10 points) and finally business models (plus 2 points). These developments also indicate that the so-called digitalisation boost as a result of Corona has mainly taken place at the process level and is not comprehensive. At the same time, it is unclear what exact influence the Corona pandemic has had on the individual category scores. Initial assumptions are made in the following sections and will be examined in greater depth in the long version of the Digitalisation Index when the change in the individual indicators is discussed.[2]

Digitalisation by industry group

The picture is mixed at the level of the ten industry groups (Figure 3). Some sectors have seen slight gains in index points; others have lost index points. There are no major shifts in the digitalisation structure of the industries. Overall, the sectors have only become slightly more digital year-on-year.

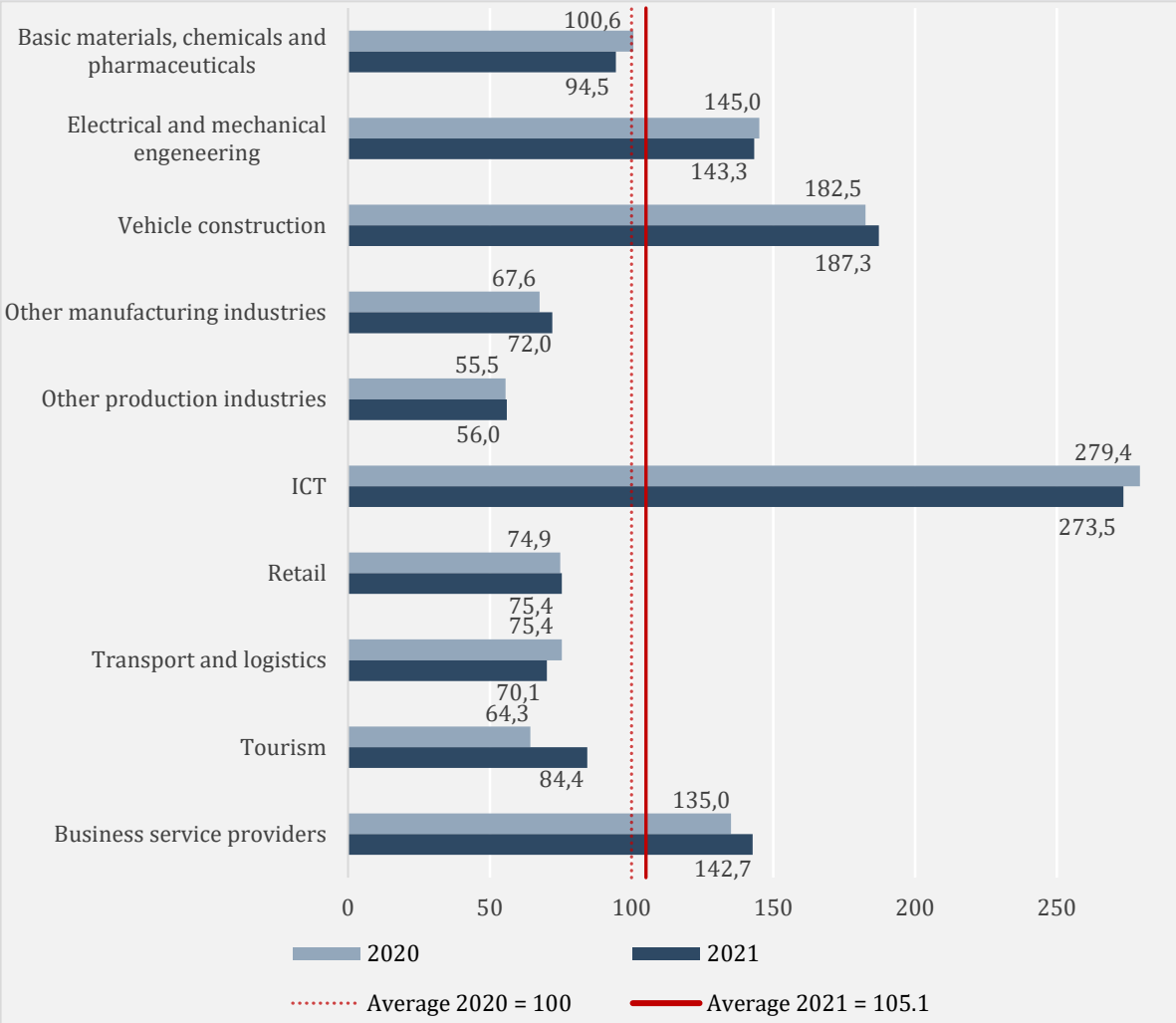
- The strongest growth has been seen in tourism. The tourism industry's index score has risen from 64.3 to 84.4, but is still well below the average of 100 in 2020 and 105.1 in 2021 for all industries.
- Despite a decline of about 6 points, the ICT sector remains the clear leader with 273.5 index points. Its index score is about 86 points ahead of the second-place industry of vehicle construction. Vehicle construction has been able to catch up somewhat to the ICT sector, rising by around 11 points year-on-year.
- In third place, as in 2020, is the industry of electrical and mechanical engineering, which reported a slight decline to 143.3 index points.
- With 142.7 index points, the business service providers follow right behind, clearly closing the gap by rising around 8 points. Business service providers include, for example, architecture and engineering firms, auditing firms or company consulting firms.
- The index score for the industry group of basic materials, chemicals and pharmaceuticals has fallen from 100.6 to 94.5 points.
- Significantly below average are retail, other manufacturing industries, transport and logistics, as well as other production industries. These sectors are seeing some rise in their scores, with the exception of transport and logistics. Transport and logistics has declined by 5 index points.

As in 2020, the ICT sector remains the leader in all categories, with the exception of research and innovation activities, where vehicle construction remains on top by a wide margin. Tourism continues to be the straggler in terms of qualifications and research and innovation activities. As in 2020, transport and logistics have lagged in the category of innovation landscape. Basic materials, chemicals and pharmaceuticals are again the worst performers in terms of products and business models. Other production industries, which includes energy and water supply, sewage and waste disposal, and construction, continues to report the worst score in the category of processes.

[2] It is important to remember that not all indicators allow conclusions to be drawn about the effect of the Corona pandemic, because few indicators were collected before the pandemic. This is discussed at length in the long version.

Figure 3: Results of the Digitalisation Index by sector

In index points, survey years 2020 and 2021



Source: German Economic Institute, IW Consult

The rise in the tourism industry is mainly driven by the significant increases in the category of processes (plus 84 points). The sector has also seen increases for both products and business models. The ICT sector is particularly affected by the decline in the category of qualifications (minus 22 points), but it has also lost points in processes (minus 13 points) and business models (minus 11 points). The sector's products, by contrast, are significantly more digital than in the previous year (plus 18 points). The increases in vehicle construction are mainly due to the rise in research and innovation activities (plus 53 points).

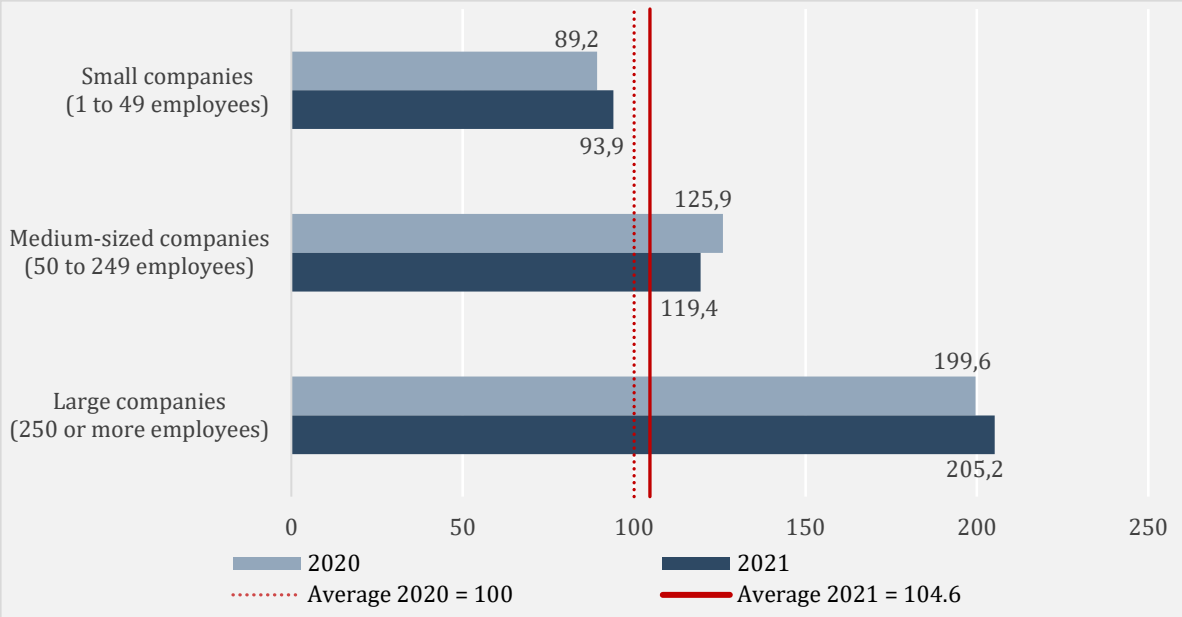
The equivocal changes in digitalisation that become apparent when looking at the sectors reflect the divergent effects of the Corona pandemic, a long-lasting exceptional situation that affects the sectors in different ways and for which the sectors have found different solutions. In part, the solutions lie in digitalisation – for example, in the increasing digital networking of companies with other companies – as the change in tourism shows. At the same time, however, cross-sectoral cost pressure, uncertainties and declines in demand also come into play. These can shift companies' focus to concerns that are unrelated to digitalisation.

Digitalisation by company size class

The picture is also mixed at the level of the three company size classes (Figure 4). Two company size classes have seen increases in the index, one decreases. Overall, the levels of digitalisation continue to vary greatly by company size class.

Figure 4: Results of the Digitalisation Index by company size class

In index points, survey years 2020 and 2021



Source: German Economic Institute, IW Consult

- Large companies with 250 or more employees are seeing increases in particular. Their index score has risen from 199.6 to 205.2. They remain the most digitalised company size class and continue to achieve an index score more than twice as high as that of small companies.
- Small companies with 1 to 49 employees are also more digital in 2021 than they were in 2020. Their index score has risen from 89.2 to 93.9 points, but remains well below the average of 104.6 for the company size classes in 2021. They remain the least digitalised company size class.
- Medium-sized companies with 50 to 249 employees have suffered declines in index points. Their index score has dropped from 125.9 to 119.4.

Similar to 2020, large companies have outperformed the average especially in the categories of qualifications, processes, research and innovation activities as well as innovation landscape. As in 2020, small companies are only outstripping large ones in the category of products, which is also due to the ICT-heavy industry structure of small companies. Medium-sized companies lie between small and large companies in almost all categories. The exceptions are the categories of products and research and innovation activities, where medium-sized companies perform the worst.

The increase for large companies is mainly due to the very good performance in the category of processes, which has increased by 39 points compared to 2020. Small companies have also been able to make gains, especially in the category of processes (plus 22 points). Medium-sized companies are particularly affected by the decline in the category of qualifications (minus 21 points). The small and large companies have also performed worse in the category of qualifications than in the

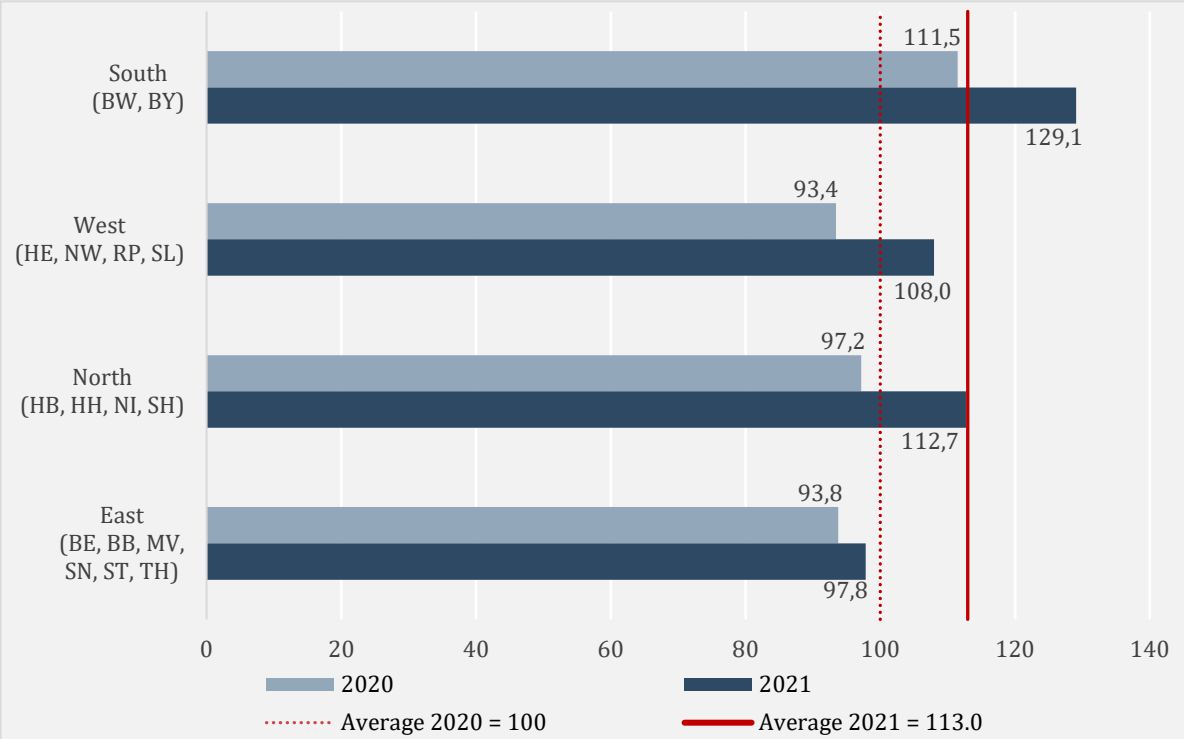
previous year, but the decline in these companies is smaller and is compensated for by the gains in processes and products.

Digitalisation by federal state group

The four federal state groups have observed clear increases in the level of digitalisation (Figure 5). All federal state groups have gained index points in 2021 relative to 2020, albeit to varying degrees. Overall, the absolute gap between the most and least digitalised federal state group is increasing.

Figure 5: Results of the Digitalisation Index by federal state group

In index points, survey years 2020 and 2021



Source: German Economic Institute, IW Consult

- The biggest gains have been seen in the federal state group referred to as South (Bavaria and Baden-Württemberg). The index score has risen from 111.5 to 129.1 points. The federal state group South remains the most digitalised federal state group.
- The federal state group North (Lower Saxony, Schleswig-Holstein, Bremen and Hamburg) has also gained a substantial number of points. With 112.7 index points, the federal state group is in second place, as it was in 2020.
- The third-largest absolute increase was observed in the federal state group West (Hesse, North Rhine-Westphalia, Rhineland-Palatinate and Saarland). 93.4 index points in 2020 have become 108.0 in the survey year 2021. However, this still means that the federal state group West continues to underperform the federal state group average in 2021 (113.0).
- The federal state group East (Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia) remains substantially below average with 97.8 index points in 2021. It has seen an increase of only 4.1 index points compared to 2020 and thus remains below the average for all federal state groups in 2020.

As in 2020, the federal state group South has outperformed the average especially in the category of research and innovation activities. But also in the categories of innovation landscape, human capital, products, business models and qualifications, the federal state group South has been a pioneer in 2021. In the categories of processes and technical infrastructure, the federal state group North has performed best. In the category of society, the federal state group West is slightly ahead. The federal state group East brings up the rear in the categories of research and innovation activities, processes, qualifications, technical infrastructure, human capital and society. The federal state group West performs worst in the categories of business models and innovation landscape. The federal state group North is last in products.

The increase in the federal state group South is mainly due to the significant gains in the categories of processes (plus 22 points), technical infrastructure (plus 21 points), products (plus 20 points), human capital (plus 19 points) and business models (plus 15 points). Company-internal categories have thus improved in particular. With technical infrastructure and human capital, however, key company-external categories have also risen. The minor increase in the federal state group East is mainly due to the declines in the categories of processes (minus 14 points) and innovation landscape (minus 5 points). The other categories of the federal state group East are increasing, but often more weakly than in the other federal state groups. The most significant increase, 14 points, has been in technical infrastructure. The federal state group East is also becoming more digital overall, but much more slowly than the other federal state groups.

Digitalisation by type of region

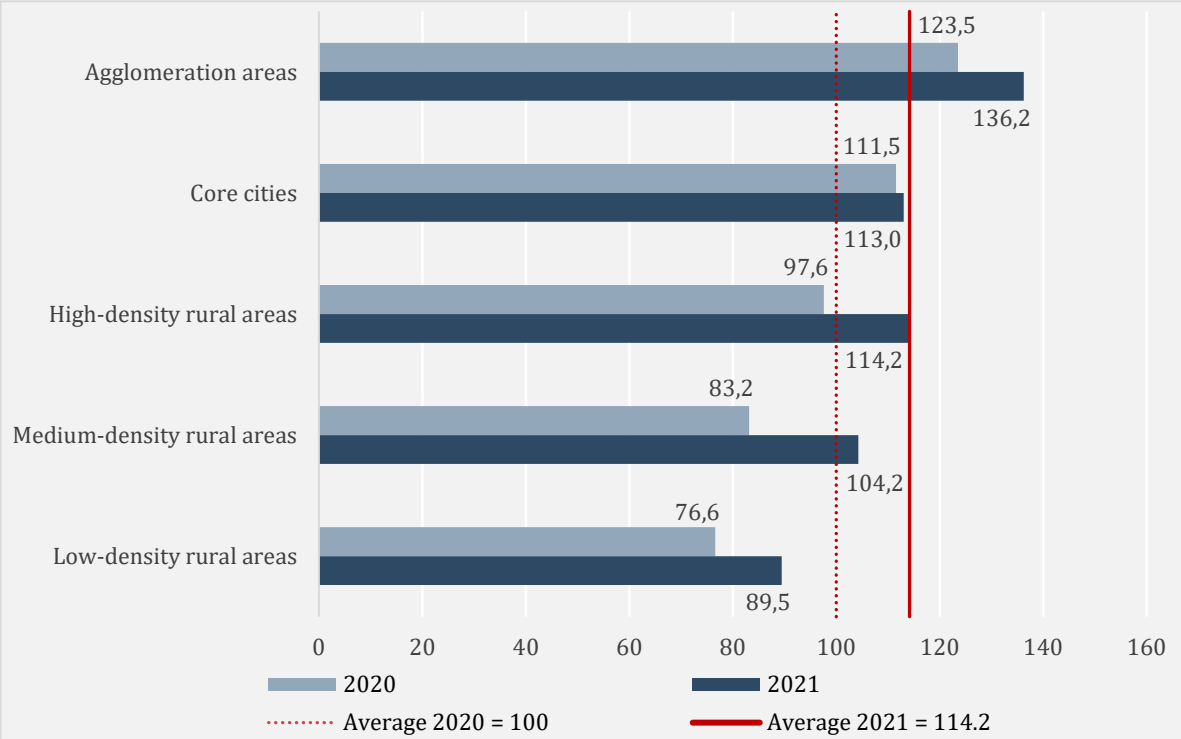
At the level of the five types of regions[3], increases in the digitalisation index can be seen across the board, albeit to different degrees (Figure 6). Overall, the absolute gap between the types of regions with the most and least digitalisation remains almost the same.

- The strongest gains have been seen in medium-density rural areas. Their index score has risen from 83.2 to 104.2. However, this is still below the average for the types of regions in the survey year 2021 (114.2).
- High-density rural areas are also making significant gains. Their score has risen from 97.6 to 114.2. They are thus exactly in line with the average for the types of regions in 2021.
- As in 2020, the agglomeration areas are the leaders. With 136.2 index points, they are clearly more digital than the other types of regions. The increase is around 13 points.
- The core cities have only seen a slight increase, from 111.5 to 113.0 index points, and have ceded second place to the high-density rural areas.
- Despite enjoying a similarly high increase as agglomeration areas (plus 13 index points), the low-density rural areas continue to pull up the rear. They have reached only 89.5 index points and thus remain below the average value of all types of regions in 2020.

[3] An agglomeration is understood to be a district-free city that either has more than 500,000 inhabitants or at least 100,000 inhabitants and a population density of at least 775 inhabitants per km². Core cities include those independent cities that do not meet the criteria of an agglomeration. High-density rural areas are districts with a population density of more than 223 inhabitants per km²; medium-density rural areas have between 139 and 223 inhabitants per km² and low-density rural areas have less than 139 inhabitants per km².

Figure 6: Results of the Digitalisation Index by type of region

In index points, survey years 2020 and 2021



Source: German Economic Institute, IW Consult

As in 2020, the agglomeration areas are the bellwethers in the two company-external categories available at this index level, technical infrastructure and innovation landscape. They also have the upper hand in research and innovation activities as well as in business models. In 2020, the core cities were still slightly ahead in terms of business models. And now the core cities are ahead in the category of products in 2021, which was still led by agglomeration areas in 2020. In 2021, the dense rural areas have been ahead in the category of processes, which was still led by the core cities in 2020.[4] The low-density rural areas are lagging in the company-external categories of technical infrastructure and innovation landscape, but also in research and innovation activities and products.

The significant rise in medium-density rural areas can be attributed primarily to increases in the categories of processes (plus 28 points), technical infrastructure (plus 21 points) and products (plus 18 points). The high-density rural areas have mainly seen gains in technical infrastructure (plus 22 points), processes (plus 18 points) and products (plus 17 points). Improvements in the technical framework conditions seem to go hand in hand with company-internal progress in digitalisation. This may also be a lever for low-density rural areas to catch up to other types of regions in terms of digitalisation.

[4] These slight shifts in company-internal, survey-based indicators may also be explained by the modified survey sample composition, which has led to a change in the number of companies in a more or less digital industry in a given type of region. This is most likely to affect the core cities because the total number of companies surveyed is the lowest in the core cities in 2020 and 2021.

Conclusion and outlook

The German economy in 2021 has become almost universally more digital than in 2020. In particular, the framework conditions for the digitalisation of the economy, the company-external categories, have improved. But company-internal categories have also increased on average. There are no fundamental shifts at the different index levels: Large companies and the ICT sector continue to be clear digitalisation pioneers. The federal state group East and the low-density rural areas have the greatest need to catch up.

There are several possible explanations for why the average increases in internal and external digitalisation aspects differ. One explanation is that the external framework conditions surrounding companies determine the possibilities for digitalisation in the companies. A developed technical infrastructure, suitable administrative-legal framework conditions, a digitally-oriented society, available human capital and a flourishing innovation landscape are prerequisites and drivers for the economy to become more digital internally: both in processes, products and business models, as well as in the qualification of a company's own workforce and in its own research and innovation activities. In order for companies to become more digital internally, the external framework conditions must first be improved. Accordingly, the framework conditions, the external categories, are currently showing even greater rises. Higher increases in internal categories are expected in the future.

Another explanation is that the Corona pandemic has impacted the internal and external categories to different degrees. It is possible that the pandemic has had more of a braking effect on digitalisation in the internal categories than in the external categories. This can be explained by the fact that the internal categories reflect the immediate situation of the companies, many of which had to introduce cost-cutting measures and reduce or postpone investments during the pandemic due to uncertainties. Many companies may have put major digitalisation projects on hold. This assumption is supported by the index result that it is mainly the companies' processes that are becoming more digital, but their products and especially their business models to a lesser extent.

Accordingly, the so-called Corona digitalisation boost can by no means be described as all-encompassing, but primarily concerns processes such as networked working. The index results suggest that the direct effect, at least in the short term, is more of a home office boost than a digitalisation boost. Nevertheless, the positive development of the external categories in particular suggests that the economy in Germany will also achieve significantly higher values in the internal categories in the future, when the exceptional situation caused by the pandemic has less of a negative effect on the budget and sales. It is therefore all the more important to continue to improve the external conditions quickly.

The Digitalisation Index 2022 will show which trends are continuing. In particular, the figures will indicate whether the economy in Germany can harness the momentum of the home office boost from the Corona pandemic and turn it into a sustainable digitalisation boost.

On the methodology

The Digitalisation Index 2021 shows how the digitalisation of the economy in Germany has developed under the impact of the Corona pandemic. In particular, it verifies whether the frequently stated pandemic-induced digitalisation boost has actually led to a universally more digital economy in Germany. The comparison with the results from the initial publication of the Digitalisation Index 2020[5] demonstrates the development of the digitalisation of the economy throughout Germany as well as at the levels of sectors, company size classes, federal state groups and types of regions.

The index measures company-internal and company-external indicators of digitalisation. The internal indicators are divided into five categories: processes, products, business models, qualification and research and innovation activities. The external indicators are divided into the following categories: technical infrastructure, administrative-legal framework conditions, society, human capital and innovation landscape. Each category contains several meaningful indicators.[6] Due to different data availability and differentiability, not all indicators and categories are applicable at all differentiation levels of the index.[7]

This report presents the core results of the Digitalisation Index for the survey year 2021. An extensive results report with detailed analyses will be published in early 2022. The interactive indicator tool (IndikatorenTool) at de.digital illustrates the results.[8]

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[5] The 2020 abridged version (in German and English) as well as the 2020 long version can be found at https://www.de.digital/DIGITAL/Navigation/DE/Lagebild/Digitalisierungsindex/digitalisierungsindex.html. At the different levels of differentiation, the 2020 index values have changed slightly in some cases due to indicator updates. This is discussed at length in the long version.
[6] For a complete listing of all indicators and their availability at each level of differentiation, see the 2020 long version at the link provided in the footnote above.
[7] A detailed explanation of the methodology is provided in the paper "Methodik des Digitalisierungsindex" at https://www.de.digital/DIGITAL/Redaktion/DE/Digitalisierungsindex/Publikationen/publikation-download-methodik-des-digitalisierungsindex.pdf.
[8] It can be retrieved at https://www.de.digital/DIGITAL/Navigation/DE/Lagebild/Indikatorentool/indikatorentool.html.