Digitalisation of the economy in Germany

Digitalisation Index 2022

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

In 2022, the German economy becomes only slightly more digital than in 2021. The index score for Germany as a whole is 108.9 points in 2022, up from 107.9 points in 2021 and the base level of 100.0 points in 2020 (Figure 1).[1] After the sharp rise in 2021, the development in 2022 suggests a stagnation of digitalisation.

Figure 1: Results of the Digitalisation Index for Germany

*In index points, survey years 2020, 2021 and 2022*
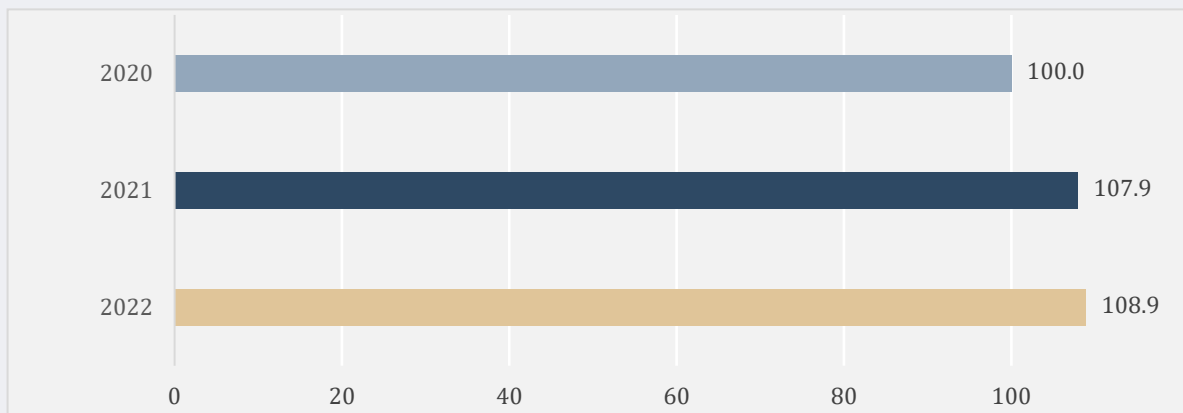
Source: German Economic Institute

The analysis of the change in the individual index categories provides information on the drivers of this development (Figure 2).

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[1] Information on the methodology can be found on the last page of this report. The 2021 index score was adjusted *ex post* from 108.0 to 107.9 points due to updated data for individual indicators. This is discussed in the long report on the 2022 Digitalisation Index.

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

In index points, survey years 2020, 2021 and 2022
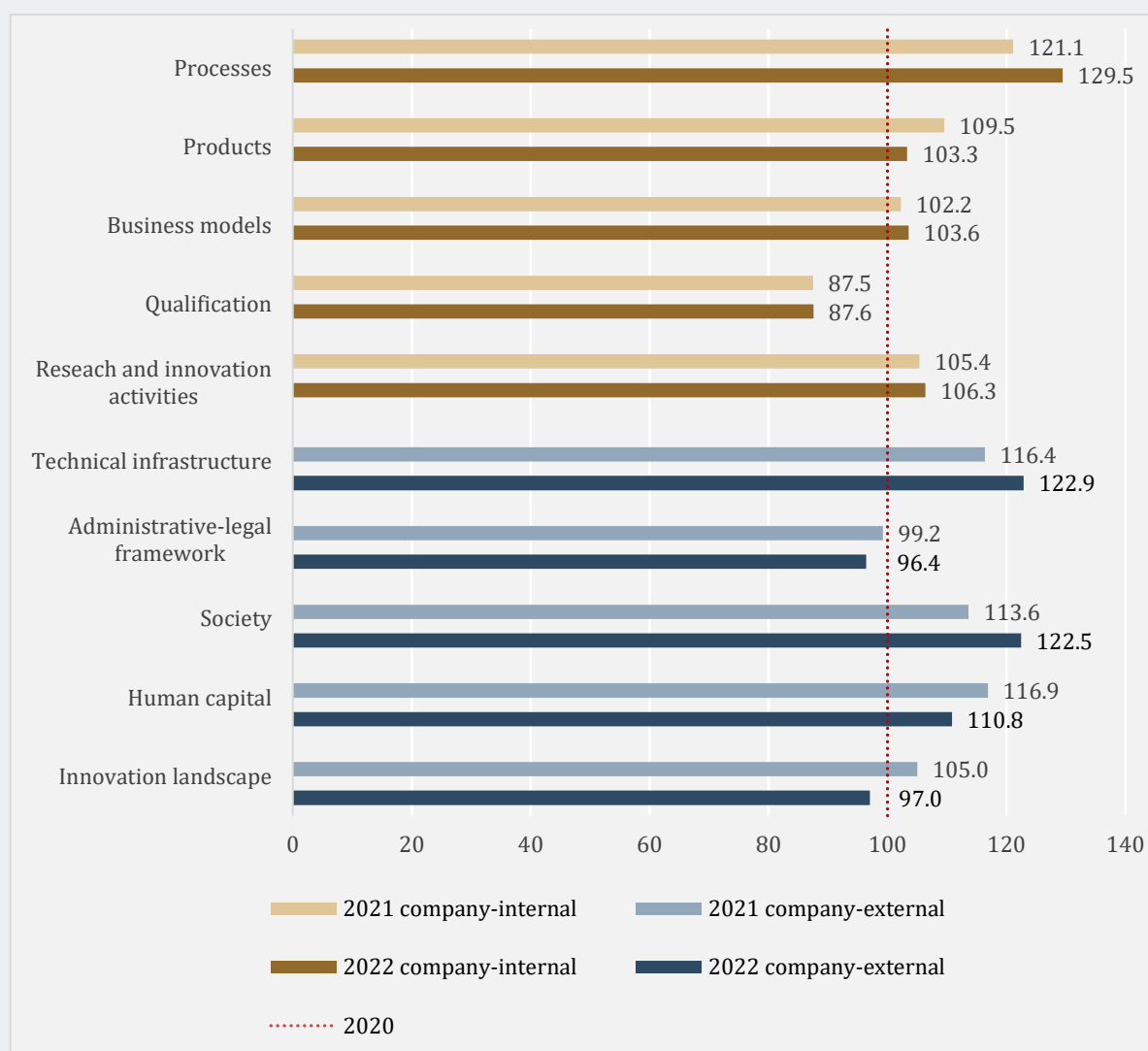
Source: German Economic Institute

- 2021 saw an increase in the framework conditions, that is, the indicators of company-external categories in particular. On average, they rose substantially more than the company-internal categories, driving digitalisation ahead as a result. In 2022, this is not the case: There is no clear driver for what has transpired. Company-internal categories increase by just 0.9 points on average. Company-external categories actually decline by 0.3 points on average.
- The company-external category of society shows the most absolute growth in comparison to 2021. It implies how digitally sophisticated the population is and how much it uses digital products and services. The category score increases by 8.8 points to 122.5 points. However, the company-external category with the highest score is technical infrastructure. It increases by 6.5 points and reaches a total of 122.9 points. It is the company-external category that has increased the most since 2020.
- Another company-internal category that grows relatively strongly is that of processes, which increases by 8.3 points, reaching a score of 129.5 points. As in 2021, this category achieves the highest overall score among all categories and therefore has improved the most since 2020. This category includes the indicator on digital networking with other companies along with the digital maturity of company-internal processes.

- In terms of company-internal categories, the categories of business models and research and innovation activities increase slightly, each by around one point. The category of qualifications stagnates (plus 0.1 point). The category of products decreases by 6.2 points.
- The company-external category of human capital, which increased substantially in 2021, loses 6.0 points in 2022.
- The score of the category of innovation landscape (minus 7.9 points) decreases most. The category of administrative-legal framework conditions also sees a slight decline of 2.8 points.
- While among the company-internal categories only the category of products sheds points, three of five company-external categories decline.

The increase in the category of society is primarily due to strong growth in the data volumes used. The category of technical infrastructure increases for the most part due to the significant gains in broadband availability for businesses. Differently to 2021, broadband availability for households does not increase substantially in 2022.

The decline in the category of human capital is primarily due to the widening skills gap in digitalisation jobs. In the period examined for the 2021 index, this gap shrunk due to Covid-19, which resulted in an increase in points. Now the gap is again slowly returning to the pre-crisis level. The skills gap – open positions minus suitably qualified unemployed job seekers – generally responds very strongly to economic crises when the unemployment rate rises and fewer jobs are posted at the same time.

The decline in the category of innovation landscape primarily correlates with the falling number of digital start-ups. However, there is also a drop in digitalisation patents by natural persons.

The development of the company-internal categories shows that businesses in Germany also digitalise their processes in 2022, but do not continue to digitalise their products or business models. The category of products sees a decline in both the indicator purely digital products as well as the indicator products with digital components. Business models are only slightly more digital in 2022 than they were in 2021. The superficial digitalisation boost due to the Covid-19 pandemic as shown by the Digitalisation Index 2021 does not appear to have extended to products and business models of companies over the course of the pandemic. Due to the confluence of various crises, including the consequences of the Ukraine war, supply chain difficulties, inflation and the energy crisis, many companies do not seem to be taking any major steps towards digitalisation or are (temporarily) putting such projects on hold. The long report on the 2022 Digitalisation Index will provide an in-depth analysis of this subject based on the development of the individual indicators.
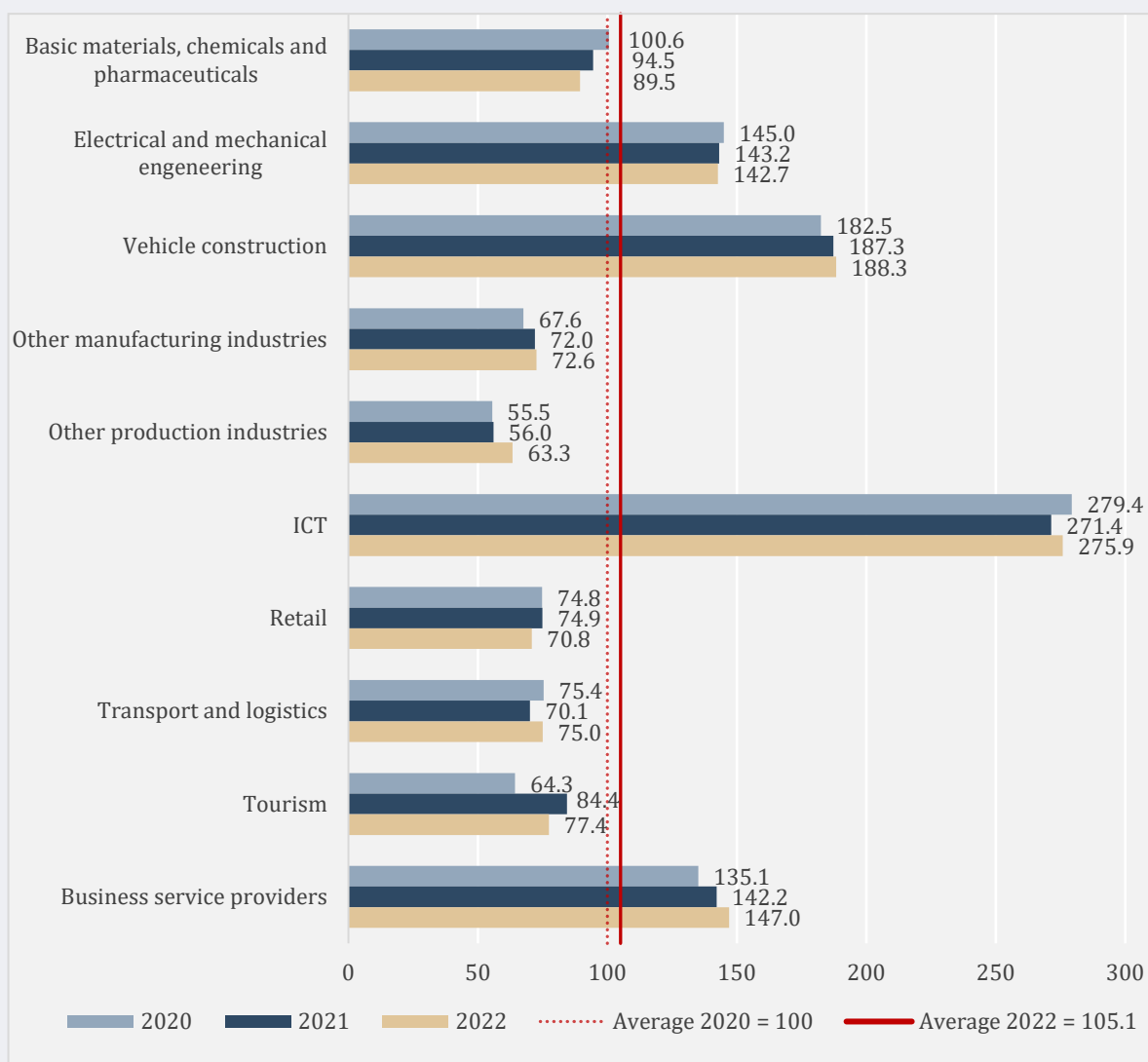
Digitalisation by industry group

There is almost no digitalisation progress at the level of the ten industry groups (Figure 3). The industry group average increases only slightly from 104.8 index points in 2021 to 105.1 points in 2022.[2] Some industry groups see slight gains in index points; others lose index points. There are no major shifts in the digitalisation structure of the industries in 2022 either. As in 2021, a total of four industry groups report declines, while six see gains. However, two industry groups gain just 1.1 points or less.

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[2] The averages of the individual differentiation levels may deviate slightly from the Germany index, since not all indicators and categories are available or relevant on all differentiation levels of the index.

- The 2022 leader in digitalisation continues to be the ICT sector. In 2021, its score declined slightly, but it increases again in 2022 by 4.5 points, reaching an index score of 275.9 points. Vehicle construction comes in second place, with a minimal gain of 1.1 points and a total score of 188.3 points. The third place in 2022 is occupied by business service providers (147.0 points) in 2022, slightly ahead of electrical and mechanical engineering (142.7 points). Business service providers include, for example, firms in architecture and engineering, auditing and consulting.
- The industry group of other production industries, which includes energy and water supply, sewage and waste disposal and construction, exhibits the most substantial gains in 2022. Its score increases by 7.4 points, but the industry group continues to bring up the rear among the industry groups with a total of 63.3 points.
- While tourism reported the strongest gains in 2021, it declines sharpest in 2022, shedding 7.0 points (2022 index score: 77.4 points).
- In addition to tourism and other production industries, there are also below-average performances in retail, other manufacturing industries, as well as transport and logistics, similar to 2021. The industry group of basic materials, chemicals and pharmaceuticals had an average performance in 2020, but loses points for the second year in a row and reaches a below-average score in digitalisation at 89.5 points.

Figure 3: Results of the Digitalisation Index by industry group

In index points, survey years 2020, 2021 and 2022

Source: German Economic Institute

The best and worst industry groups in terms of digitalisation have hardly changed with respect to the individual categories of the index over the three survey years. As in 2020 and 2021, the ICT sector remains the leader in all categories, with the exception of research and innovation activities, where vehicle production remains on top by a wide margin. Tourism continues to bring up the rear in 2022, as in 2020 and 2021, for qualifications and research and innovation activities. As in previous years, transport and logistics lag in the category of innovation landscape. Basic materials, chemicals and pharmaceuticals are once again the worst performers in business models. The industry group other production industries still has the lowest score in the category of processes. This industry group also lagged in the category of products in previous years. In 2022, however, retail sees the lowest score here.

The ICT sector score increases primarily in the category of products (plus 43 points), but also loses 46 points in the category of innovation landscape. Electrical and mechanical engineering as well as vehicle construction see clear gains in products (plus 24 points), but also shed 10 points in the category of processes. Business service providers, by contrast, primarily enjoy gains in the category of processes (plus 37 points). The industry group of other production industries has a substantial increase in processes (23 points). Although tourism gains in business models (plus 14 points), it sees substantial losses in processes (minus 25 points) and products (minus 26 points). The industry group of basic materials, chemicals and pharmaceuticals primarily loses in the categories of business models (minus 15 points) and processes (minus 13 points).

Compared to 2021 and to the other categories, there are few changes in the categories of qualifications and research and innovation activities.

To summarise, the industry groups once again exhibit major differences in digitalisation in 2022. In a few categories, some industry groups see declines. It is likely that the ongoing crisis plays a crucial role in this. The cost pressure and uncertainties that companies in Germany are currently facing are high. Unusual political and economic developments are leading to unusual conduct by companies – for example in digitalisation investments. It is possible that digital progress pursued during the Covid-19 pandemic – like developing digital products – has been stopped on account of the ongoing exceptional situation. This would explain the development of digitalisation in the tourism sector. The analysis of the individual indicators in the long report on the 2022 Digitalisation Index will give further details.

## Digitalisation by company size class

At the level of the three company size classes, the digitalisation results are mixed in 2022 once again (Figure 4). Two company size classes see increases in the index; one decreases. Overall, the levels of digitalisation continue to vary greatly by company size class. The average for company size classes increases slightly from 104.6 index points in 2021 to 105.7 points in 2022.

- Medium-sized companies with 50 to 249 employees see gains in digitalisation in 2022. Their index score rises from 119.4 index points in 2021 to 124.0 points in 2022. However, their score is still below the starting value of 125.9 in 2020.
- Large companies with 250 or more employees experience a decline in index points for the first time since 2020. Their index score slips from 205.2 index points in 2021 to 201.8 points in 2022. However, 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.

- The index score for small companies with 1 to 49 employees continues to rise moderately from 93.9 points in 2021 to 94.8 points in 2022. Despite the rise, the index score continues to be substantially below the average for company size classes in 2022. Small companies remain the least digitalised company size class.

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

In index points, survey years 2020, 2021 and 2022
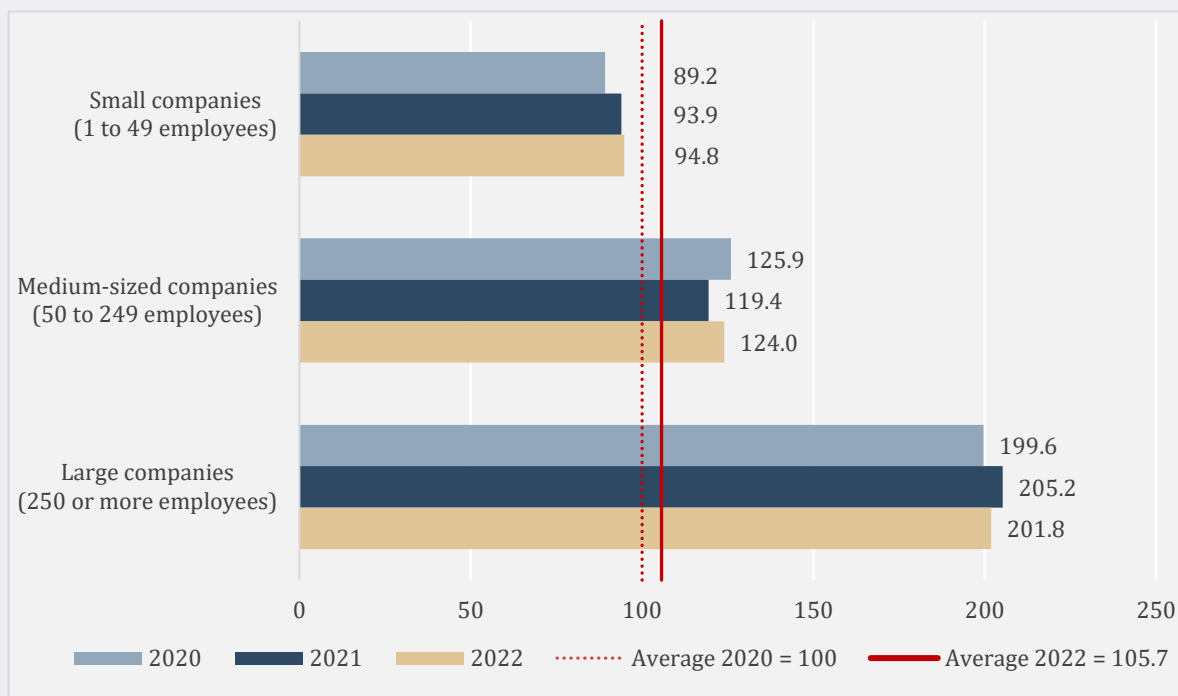
Source: German Economic Institute

Similar to previous years, large companies outperform the average in the categories of processes, qualifications, research and innovation activities as well as innovation landscape. They are also ahead of both smaller company size classes in the category of business models. As in 2020 and 2021, small companies achieve the best score in the category of products, followed by medium-sized and large companies. The reason for this may be the ICT-heavy sector structure in small companies that are particularly prone to digital products. Medium-sized companies continue to perform between small and large companies in almost all categories. An exception here is the category of research and innovation activities where medium-sized companies lagged behind both other company size classes in previous years.

The overall digitalisation increase for medium-sized companies is mainly due to their very good performance in the category of processes, which increases in 2022 by 17 points compared to 2021. Small companies are also able to make gains, especially in the category of processes (plus 8 points). By contrast, large companies primarily see declines in both of these categories (minus 15 points in processes and minus 13 points in products). The decline of their performance in 2022 would be greater overall if it were not for the improvement in the categories of business models (plus 16 points) and innovation landscape (plus 6 points).

Digitalisation by federal state group

On the level of the four federal state groups, the strong digitalisation gains in 2021 have given way to stagnation in digitalisation in 2022 (Figure 5). Two federal state groups gain index points in

2022, while two others lose points. In 2021, all federal state groups scored higher in comparison to the previous year. Overall, the absolute gap between the most and the least digitalised federal state group decreases once again. In 2022, the average for federal state groups increases by one point to 113.7 points.

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

In index points, survey years 2020, 2021 and 2022
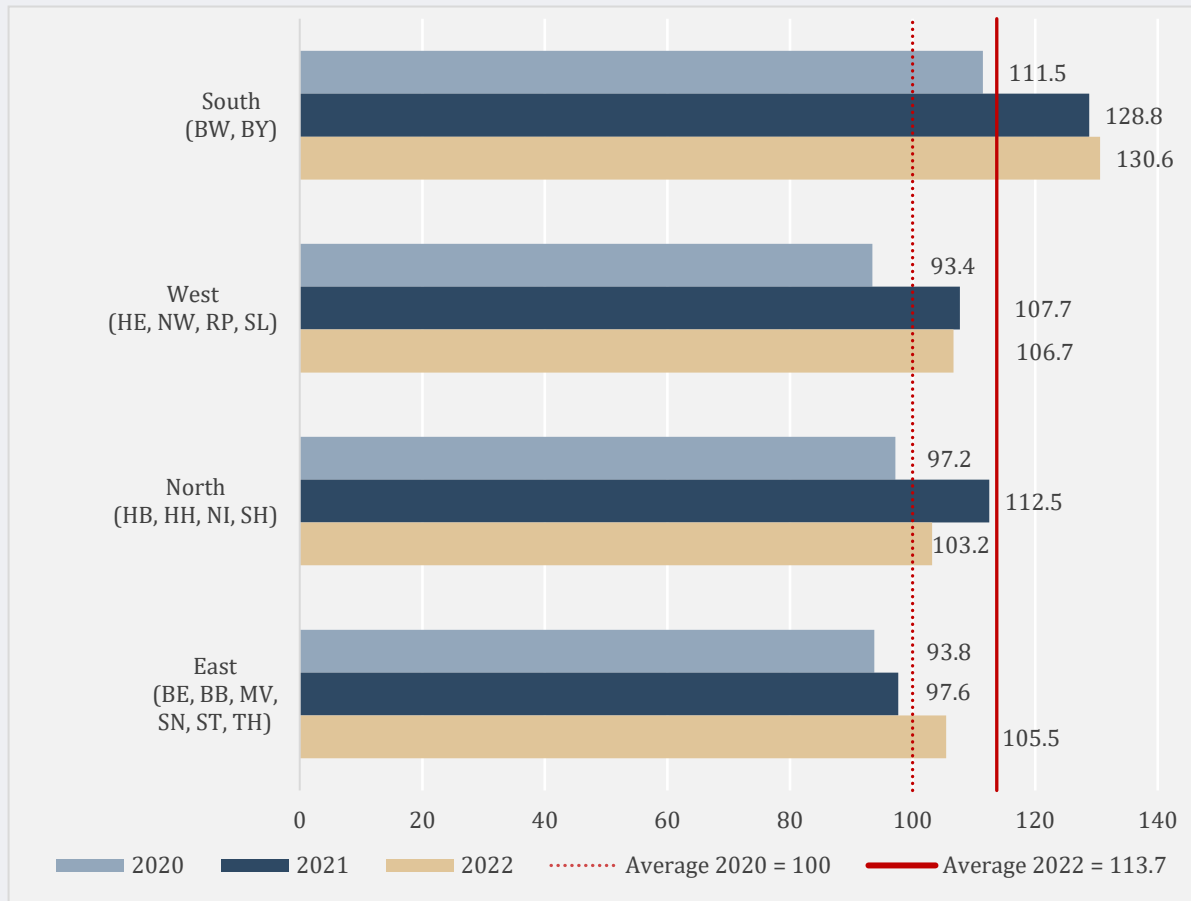
Source: German Economic Institute

- The greatest gains are exhibited by the federal state group East (Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia). Its index score rises from 97.6 index points in 2021 to 105.5 points in 2022. The federal state group East is still below the federal state group average of 113.7 but is no longer the weakest digitalised federal state group.
- In 2022, the weakest digitalised federal state group is the federal state group North (Lower Saxony, Schleswig-Holstein, Bremen and Hamburg). It sees a substantial decrease in index points and lags behind all federal state groups at 103.2 points.
- The federal state group South (Bavaria and Baden-Württemberg) scores well above average with 130.6 index points in 2022. It achieves a slight increase of 1.8 points in comparison to 2021 and remains at the top.
- The federal state group West (Hesse, North Rhine-Westphalia, Rhineland-Palatinate and Saarland) suffers slight losses in index points. 107.7 index points in 2021 become 106.7 in 2022. The federal state group West continues to produce below-average scores.

As in 2020 and 2021, the federal state group South outperforms the average, especially in the category of research and innovation activities. In addition, it continues to be a pioneer in the categories of innovation landscape, human capital, products and qualifications in 2022. The federal state

group North performs by far the best in technical infrastructure, as in the previous two years. It also scores highest in the category of business models. In 2021, the federal state group South was the leader of this category. In the category processes, the federal state group East is slightly ahead. As in 2021 and 2020, the federal state group West is number one in the category society. The federal state group East continues to bring up the rear in the categories research and innovation activities, qualifications, technical infrastructure, society and human capital. As in 2021, the federal state group West scores lowest in the categories business models and innovation landscape. The federal state group North continues to be last in products as well as in processes. In 2021, it still led in the latter category.

The increase in the digitalisation score of the federal state group East is mainly due to its substantial gains in the categories of processes (plus 69 points) and technical infrastructure (plus 19 points). The decline of the federal state group North results mainly from the decreasing scores of the categories of processes (minus 49 points) and innovation landscape (minus 18 points). As in the previous year, the federal state group North achieves a significant increase in technical infrastructure (plus 24 points), which, however, can only slightly compensate for the declines in other areas.

Digitalisation by type of region

At the level of the five types of regions[3], there are both increases and decreases in the digitalisation index in 2022, which vary in magnitude (Figure 6). Overall, the absolute gap between the type of region with the highest and the lowest level of digitalisation increases. In 2021, it fell slightly in comparison to 2020. The average for region types increases slightly from 113.8 index points in 2021 to 116.5 points in 2022.

- Core cities exhibit the greatest gains in digitalisation. Their index score rises from 112.2 index points in 2021 to 149.6 points in 2022. This puts them far above the average of the region types (116.5) and thus in first place among the region types. In 2021, the agglomerations scored highest.
- However in 2022, the agglomerations' digitalisation score stagnates. They lose around one index point and finish in second place. However, their 134.7 index points continue to put them at a more digital level than the three region types for rural areas.
- The high-density rural areas see the greatest increase in digitalisation, as in the previous year. Their score rises from 113.8 index points in 2021 to 122.9 points in 2022. This type of region finishes above the average for the types of regions in 2022 and is increasingly catching up with agglomerations.
- The most substantial decline in digitalisation occurs in medium-density rural areas. Their index score falls from 103.8 index points in 2021 to 94.4 points in 2022. Medium-density rural areas continue to occupy the fourth place in digitalisation among the types of region.
- The index score for low-density rural areas stagnates. It falls slightly from 89.3 points in 2021 to 88.2 points in 2022. Low-density rural areas continue to have a below-average score in comparison to the average in 2020 and score lowest in digitalisation.

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[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, 2021 and 2022
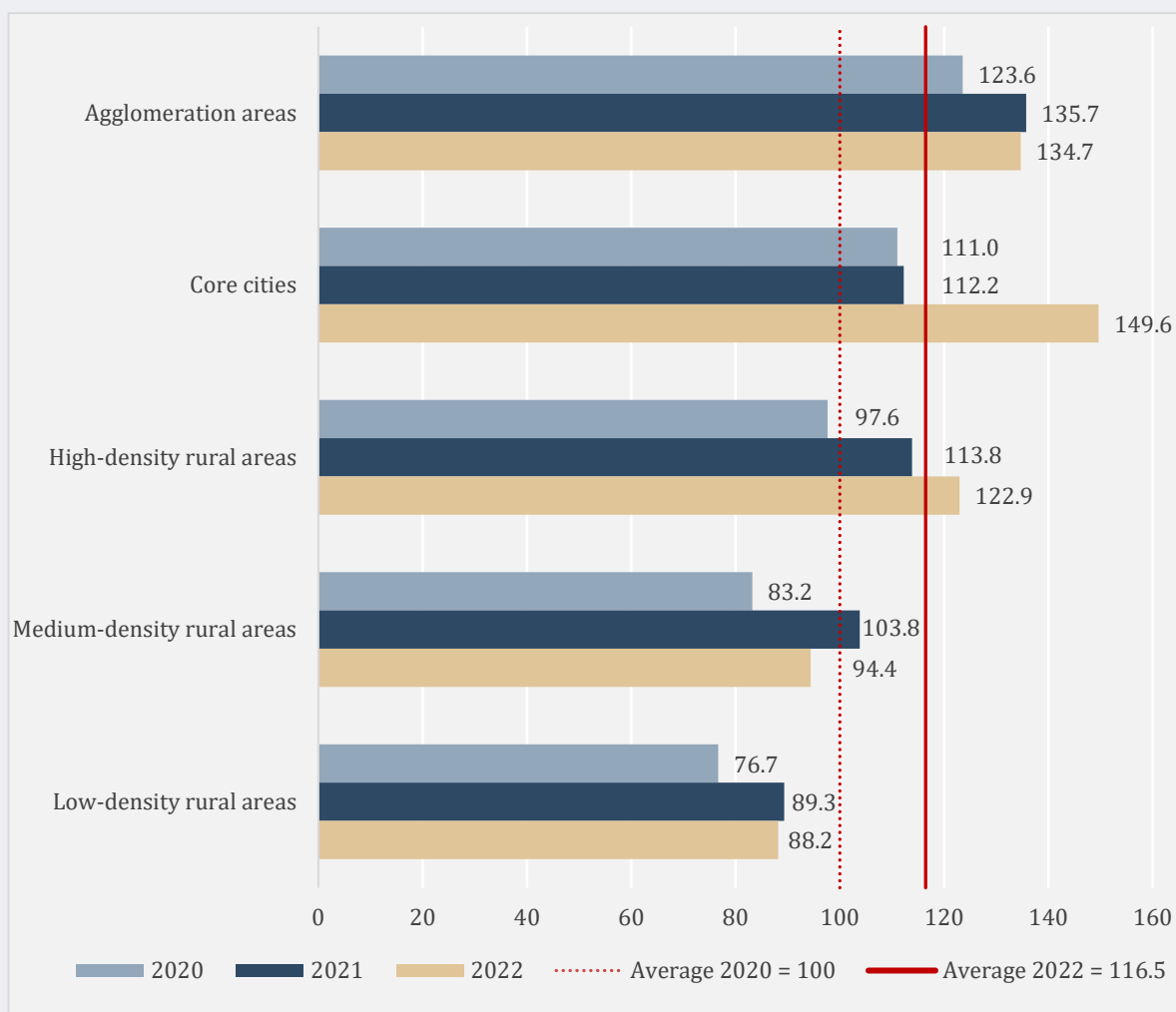
Source: German Economic Institute

As in 2020 and 2021, agglomerations lead the two company-external categories available at this index level, technical infrastructure and innovation landscape. This region type also continues to lead in research and innovation activities. In 2022, core cities are slightly ahead in business models, as in 2020. In 2021, agglomerations were ahead in this category. Core cities are also the leader in products, as in the previous year. High-density rural areas now achieve the best results in processes, while medium-density rural areas were at the top of this category in 2021. The low-density rural areas continue to lag in the company-external categories of technical infrastructure and innovation landscape, but also in research and innovation activities and products. Medium-density rural areas are in last place for processes and business models. In 2021, core cities were last in processes, while high-density rural areas brought up the rear in business models.

The significant rise of the digitalisation score of core cities can be attributed primarily to increases in the categories of products (plus 66 points), processes (plus 61 points) and business models (plus 17 points).[4] Core cities are also winning in the categories of technical infrastructure (plus 39

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[4] 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 group in a given type of region. This is most likely to affect core cities because the total number of companies surveyed is the lowest in 2020, 2021 and 2022 in this type of region.

points) and research and innovation activities (plus 12 points). As in the previous year, high-density rural areas have mainly seen gains in technical infrastructure (plus 26 points), processes (plus 20 points) and business models (plus 12 points). Improvements in the company-external categories seem to go hand in hand with company-internal progress in digitalisation. Medium-density rural areas slipped especially in the categories of processes (minus 20 points), innovation landscape (minus 18 points), products (minus 13 points) and business models (minus 12 points). Compared to them, other types of regions have been better able to compensate for the general decrease in the innovation landscape by improving company-internal digitalisation and technical infrastructure.

Conclusion and outlook

After the German economy substantially increased its digitalisation between 2020 and 2021, the gains are only marginal in 2022. There is a stagnation in the digitalisation of the German economy. Company-internal categories improve only slightly on average. The framework conditions that include the company-external categories even worsen slightly.

In 2021, the framework conditions show substantially stronger gains than the company-internal categories. In the summary version of last year's report, the greater gains in the framework conditions in 2021 were explained by the fact that they are a prerequisite for making companies more digital internally. The framework conditions would have to improve before more gains could be expected in the internal categories. Greater increases in internal categories were forecast for the near future as a result. And, indeed, the circumstances change in 2022, and the internal categories see greater gains than the external ones. However, they do this to such a small degree that the forecast cannot be confirmed. It cannot be assumed that the framework conditions have achieved an interim peak and now offer the perfect fertile ground for company digitalisation. On the contrary, there is still clear potential for improvement in the framework conditions as well as in the company-internal categories.

The digitalisation of the economy in Germany makes minimal progress in part due to the ongoing crisis. In 2021, it was explained here that the pandemic had primarily impacted internal categories by slowing digitalisation because companies often pursued savings measures and cut back on or postponed investments – including those for digitalisation – in the pandemic due to uncertainties and cost pressure. In the meantime, the framework conditions also seem to be suffering from the political and economic crises that have been added to the pandemic, namely the consequences of the Ukraine war, supply chain difficulties, price developments and the energy crisis. The index indicators show, for example, fewer digital start-ups, less R&D and a drop in innovation collaborations and increasing landline and internet prices. These times are an exceptional situation for society. Therefore, it is good news that the economy is still becoming more digital and its processes continue to be digitalised. Another good development is that society is increasingly making use of digitalisation. It is a critical driver of digital progress.

The various index levels show no great shifts over the course of time. It is not surprising that major companies and the ICT sector remain digitalisation pioneers. The federal state group East is able to catch up and relegates the federal state group North to last place. Overall, the federal state groups are moving closer together as digitalisation differences diminish. By contrast, the differences between the types of regions are expanding. Especially low-density rural areas are falling further behind.

Overall, the digitalisation momentum from the Covid-19 pandemic has not yet led to a comprehensive and sustainable digitalisation boost for the German economy. Due to the confluence of different crises and the continuation of the extraordinary situation, it cannot be ruled out that such a boost

will fail to materialise. Nonetheless, it is still impressive that the economy has not taken steps back in digitalisation due to this situation. It remains important that the framework conditions for digitalisation in Germany improve. The 2023 Digitalisation Index will show whether this will transpire in the near term.

On the methodology

The Digitalisation Index 2022 shows how the digitalisation of the economy in Germany has developed under the impact of the Corona pandemic and the Ukraine war. In particular, it verifies whether the often-claimed digitalisation boost resulting from the pandemic actually led to a more digital economy overall in Germany and what direct and indirect consequences the crisis situation is having on the digitalisation of companies in Germany. The comparison with the results from the initial publication of the Index 2020 and Index 2021[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, qualifications 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 2022. An extensive results report with detailed analyses will be published in early 2023. The IndicatorTool on de.digital illustrates the results.[8]

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[5] The 2020 and 2021 abridged version (in German and English) as well as the 2020 and 2021 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 and 2021 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 or 2021 long version at the link provided in the footnote above.

[7] A detailed explanation of the methodology is provided in the paper "Methodology of the Digitalisation Index" 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/indikatoren-tool.html.