Digitalisation of the economy in Germany

Digitalisation Index 2023

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

The digitalisation of the economy in Germany continues to stagnate in 2023. The index score for Germany as a whole is 108.6 points in 2023 compared to 110.5 points in 2022, 108.1 points in 2021 and the base level of 100.0 points in 2020 (Figure 1).[1] After the sharp rise in 2021, the development of digitalisation since then can be described as more of a lateral or sideways movement.

Figure 1: Results of the Digitalisation Index for Germany

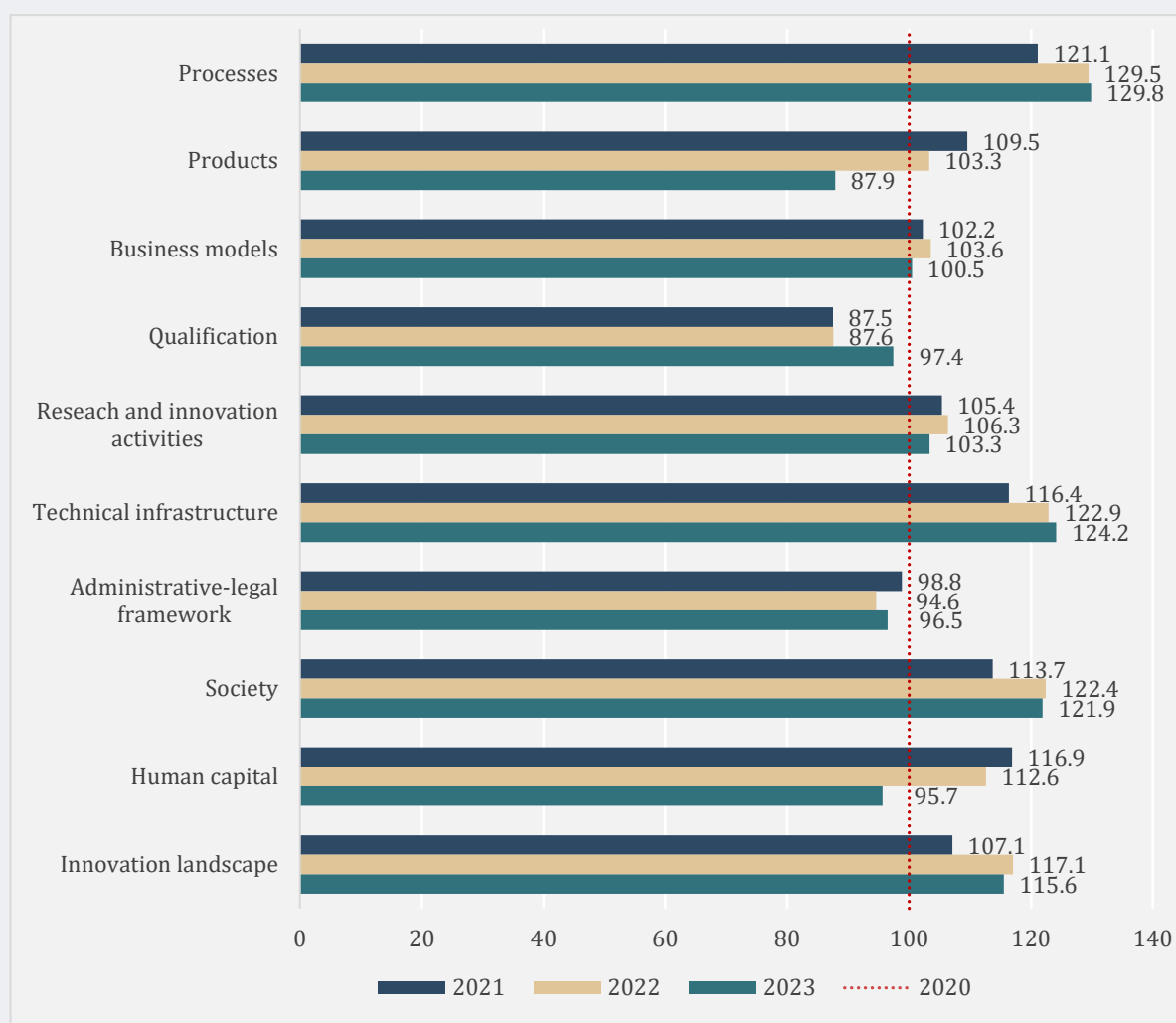*In index points, survey years 2020, 2021, 2022 and 2023*
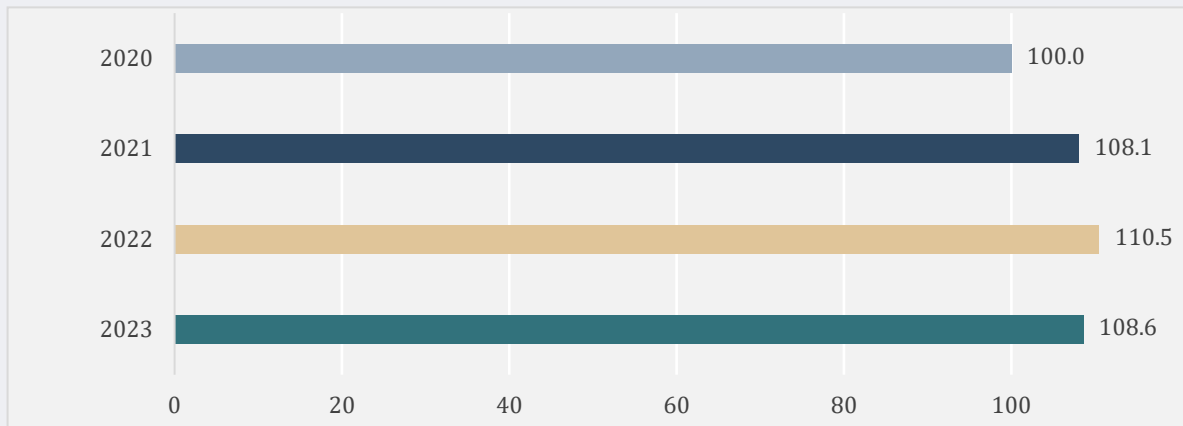
Source: German Economic Institute

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 index values for 2021 and 2022 have been adjusted subsequently from 107.9 to 108.1 points (2021) and from 108.9 to 110.5 points (2022) due to data updates for individual indicators. This is discussed in the long report on the 2023 Digitalisation Index.

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

In index points, survey years 2020, 2021, 2022 and 2023

Category	2021	2022	2023
Processes	121.1	129.5	129.8
Products	109.5	103.3	87.9
Business models	102.2	103.6	100.5
Qualification	87.5	87.6	97.4
Reseach and innovation activities	105.4	106.3	103.3
Technical infrastructure	116.4	122.9	124.2
Administrative-legal framework	98.8	94.6	96.5
Society	113.7	122.4	121.9
Human capital	116.9	112.6	95.7
Innovation landscape	107.1	117.1	115.6

Source: German Economic Institute

The framework conditions particularly improved in 2021 and 2022, i.e., the indicators of company-external categories. On average, they rose substantially more than the company-internal categories, driving digitalisation ahead as a result. In 2023, this is not the case: Digitalisation does not increase in neither the company-internal categories nor the framework conditions. Company-internal categories lose 1.0 points on average, while company-external categories decline by 2.6 points on average.

The company-internal category of qualification grows the most in absolute terms relative to 2022. It reflects the extent to which necessary digitalisation skills are available or being developed within companies. The category score rises by 9.9 points to 97.4 points. This is mainly due to companies providing more training for their IT specialists and IT users. However, the category score is still below the initial score of 100.0 points in 2020. This rise makes up for some of the significant drop in this category in 2021.

As in previous years, the category with the highest score is that of processes. It also includes the digital networking with other companies along with the digital maturity of company-internal processes. In 2023, this category increases only slightly, by 0.4 points. It achieves, with 129.8 points, the highest overall score among all categories and therefore has improved the most since 2020. This suggests that the processes of many companies have become significantly more digital.

Company-external categories increase only slightly from 2022 to 2023. The administrative-legal framework conditions grow by 1.9 points to a total of 96.5 points, mainly due to the provision of more public online forms. Technical infrastructure increases by 1.3 points to reach 124.2 points, which is the highest category score among the external conditions, similarly to 2022. In particular, improvements in broadband availability in households are the main driver.

Among the company-internal categories, the categories of business models as well as research and innovation activities decrease by 3.1 and 3.0 points respectively. The category of products continues its negative trend from 2022, losing 15.4 points in 2023. This is mainly due to a significant drop in the share of revenues from products with digital components. By contrast, the share of revenues that companies generate with purely digital products declines only slightly.

In the company-external category of human capital, the negative trend that started in 2022 continues. In 2023, the category of human capital loses 16.9 points, the largest decrease among all categories. Similar to 2022, the decline is primarily due to the extending skills gap in digitalisation jobs. In the survey year of 2021, this gap shrunk due to Covid-19, which resulted in an increase in index points. 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. Since 2022, the number of open positions in digitalisation occupations has increased significantly and the number of unemployed persons has decreased, leading to an extension of the skills gap approaching pre-crisis level.

The company-external categories of innovation landscape (minus 1.5 points) and society (minus 0.5 points) also decline slightly. This is due to a falling number of digital start-ups and, in general, digitalisation is receiving less public attention, for example in newspaper articles. In both the company-internal categories and the framework conditions, three of five categories decrease respectively.

Developments in the company-internal categories may suggest that the German economy has reached a point where further improvements in the digitalisation of processes or business models may require considerable effort for companies. Conversely, the digitalisation of products is declining. The ongoing crises, characterised by rising energy prices in Germany, disrupted supply chains, inflation and general uncertainty, pose significant challenges for companies in Germany. As a direct result, many companies may reduce the priority given to investments in digitalisation or (temporarily) postpone related projects due to increasing cost pressures, for example.

Company-external framework conditions also improve only slightly. In particular, the framework conditions could either facilitate faster progress in digitalisation for companies or help overcome obstacles. A growing shortage of skilled workers, a lack of external impetus for innovation or a slower pace of expansion of the technical infrastructure are currently having a slowing rather than accelerating effect to digitalisation. The long report on the 2023 Digitalisation Index will provide an in-depth analysis of this subject based on the development of the individual indicators.

Digitalisation by industry group

Digitalisation is also moving sideways at the level of the seven industry groups[2] (Figure 3). The industry group average decreases from 107.6 index points in 2022 to 105.1 points in 2023.[3] Overall, digitalisation increases in only two of the seven industry groups (construction, utilities and waste management, as well as other manufacturing industries), but both are still well below the industry group average in 2020. In 2023, as in previous years, there are no significant shifts between the industry groups. They are becoming increasingly similar.

Figure 3: Results of the Digitalisation Index by industry group

In index points, survey years 2020, 2021, 2022 and 2023
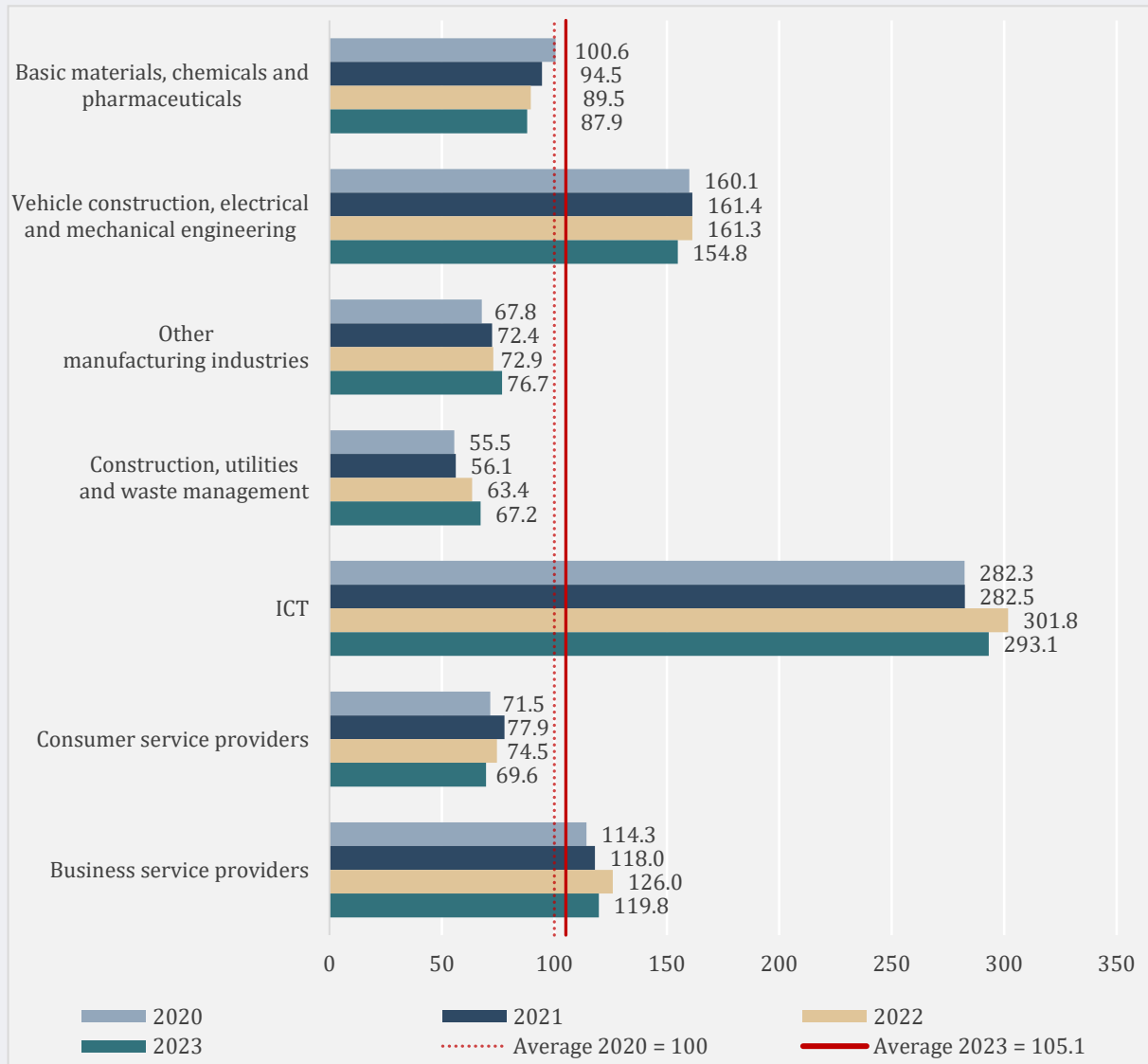
Source: German Economic Institute

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[2] The ten industry groups used in previous index surveys have now been reduced to seven. This ensures stable data quality and reduces complexity. The industry groups of electrical and mechanical engineering as well as vehicle production, originally recorded separately, have now been merged; retail and tourism have been combined into consumer service providers, while transport and logistics are categorised as business service providers. Index results for the survey years 2020 to 2022 have been recalculated retrospectively. The transition is discussed in the long report on the 2023 Digitalisation Index.

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

- The 2023 leader in digitalisation continues to be the ICT sector. After stagnating in 2021 and experiencing the strongest growth of all industry groups in 2022, its index value falls by 8.7 points to 293.1 points in 2023. Vehicle construction, electrical and mechanical engineering remains in second place with 154.8 points in 2023 (minus 6.5 points). Business service providers[4] remain in third place with 119.8 points in 2023 (minus 6.2 points). As a result, the index values for the top three industry groups decrease the most.
- The only growth in digitalisation is in other manufacturing industries (plus 3.9 points) and the industry group construction, utilities and waste management (plus 3.8 points). This puts other manufacturing industries in fifth place in 2023, with 76.7 points, up from sixth place in the previous year. Construction, utilities and waste management still draws up the last place of the seven industry groups, with 67.2 points in 2023.
- Similar to previous years, consumer service providers also score well below average in 2023, with 69.6 points. This industry group loses 4.8 points compared to 2022, placing it sixth among the industry groups. While the industry group of basic materials, chemicals and pharmaceuticals had an average performance in 2020, it loses points for the third year in a row in 2023 and reaches a below-average score of 87.9 points.

The best and worst industry groups in terms of digitalisation have hardly changed with respect to the individual categories of the index over the four survey years. As in 2020, 2021 and 2022, the ICT sector remains the leader in all categories, with the exception of the category of research and innovation activities, where the industry group of vehicle construction, electrical and mechanical engineering remains on top by a wide margin. In 2023, consumer service providers still lag in the categories of qualification as well as research and innovation activities. In the category of innovation landscape, the industry group of construction, utilities and waste management still ranks the lowest. As in previous years, basic materials, chemicals and pharmaceuticals are the worst performers in terms of products and business models. While the industry group of construction, utilities and waste management was the worst performer in the category of processes from 2020 to 2022, it makes significant progress in 2023, pushing the industry group of basic materials, chemicals and pharmaceuticals to the bottom.

The ICT sector score increases primarily in the category of qualification (plus 29 points), but also loses 300 points in the category of innovation landscape. Although its performance remains well above average, the ICT sector loses around a third of its points. This is solely due to the lower number of newly founded digital start-ups in the ICT sector compared to 2022. The industry group of vehicle construction, electrical and mechanical engineering loses points in almost all categories, with the largest losses in products (minus 15 points) as well as research and innovation activities (minus 13 points). Other manufacturing industries makes the largest gain in the category of processes (plus 16 points) but loses points in research and innovation activities (minus 9 points). The industry group of construction, utilities and waste management significantly gains in the category of processes (plus 23 points), while losing points in the category of products (minus 21 points). Consumer service providers lose points in the categories of innovation landscape (minus 21 points) and business models (minus 11 points). Business service providers lose 27 points each in the categories of products and innovation landscape but gain 18 points in the category of qualification. Basic materials, chemicals and pharmaceuticals gain the most in the category of business models (plus 10 points), while losing points in the category of products (minus 21 points).

To summarise, the industry groups once again exhibit major differences in 2023. A total of five out of seven industry groups, especially the leaders, experience slight declines in digitalisation, while

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[4] Business service providers include, for example, firms in architecture and engineering, auditing and consulting.
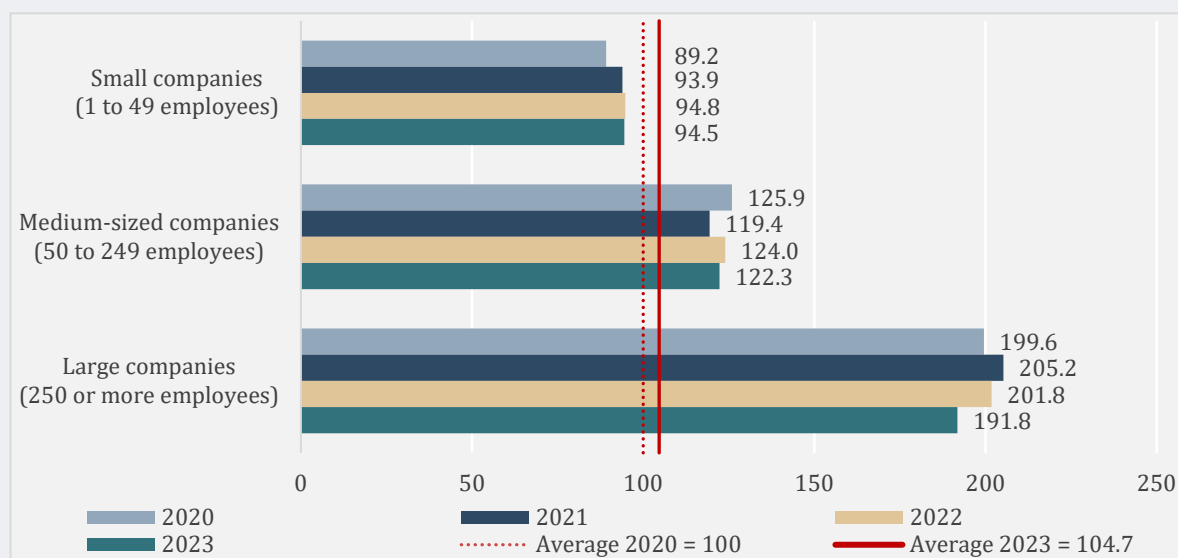
only the taillights show growth. On a positive note, the industry taillights (other manufacturing industries and construction, utilities and waste management) can catch up and particularly digitalise their processes more. As a result, business models and products could also become more digital in the future. However, all industry groups show a significant decline in the digitalisation of their products. The upside is that there is growth in the category of qualification, largely due to an increase in IT training offers, especially in the ICT sector, and business service providers. It is likely that the decline in digitalisation in the leading industry groups is due to the ongoing number of crises. Cost pressures, primarily due to persistent inflation, remain especially high for companies. It is possible that digital progress pursued during the Covid-19 pandemic – like developing a digital product – has stopped on account of the ongoing exceptional situation. In addition, the start-up of new businesses is often delayed in times of great uncertainty, which has a negative impact on the innovation landscape. The analysis of the individual indicators in the long report on the 2023 Digitalisation Index will go into more detail on this.

Digitalisation by company size class

Digitalisation is also stagnating at the level of the three company size classes (Figure 4). Overall, the levels of digitalisation continue to vary greatly by company size class. In 2023, the average for the company size classes decreases by one point to 104.7 points.

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

In index points, survey years 2020, 2021, 2022 and 2023

	Small companies (1 to 49 employees)	Medium-sized companies (50 to 249 employees)	Large companies (250 or more employees)
2020	89.2	125.9	199.6
2021	93.9	119.4	205.2
2022	94.8	124.0	201.8
2023	94.5	122.3	191.8

Average 2020 = 100 Average 2023 = 104.7

Source: German Economic Institute

- The index score for small companies with 1 to 49 employees remains almost constant at 94.5 points in 2023 compared to 94.8 points in 2022. The index score is still substantially below the average for company size classes. Small companies remain the least digitally advanced company size class.
- Medium-sized companies with 50 to 249 employees decline slightly in digitalisation after exhibiting gains in 2022. Their index score falls from 124.0 index points in 2022 to 122.3 points in 2023. However, their index score is still below the starting level of 125.9 in 2020.
- Large companies with 250 or more employees shed index points for the second year in a row. Their index score decreases from 201.8 index points in 2022 to 191.8 points in 2023. However, they remain by far the most digitally advanced company size class. Their index score is still more than double that of small companies.

As in previous years, large companies are also digitalisation leaders in the categories of processes, business models, qualification, research and innovation activities as well as innovation landscape. Analogous to the previous years, 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. Moreover, except for research and innovation activities, medium-sized companies fall between large and small companies. As in previous years, medium-sized companies are at the bottom of this category.

The decline in digitalisation among large companies is mainly due to losses in the category of processes (minus 23 points), especially in the digitalisation of internal processes. With the exception of the innovation landscape, large companies are also worse in all other categories in comparison to 2022. The sideways movement of small and medium-sized companies is mainly due to the fact that they also make gains in some categories. For example, while medium-sized companies lose points in processes (minus 15 points), they gain points in qualification (plus 12 points). Small companies also make gains in qualification (plus 10 points) but shed points in products (minus 16 points).

Digitalisation by federal state group

Digitalisation is also stagnating at the level of the federal state groups (Figure 5). Only in the federal state group North the index score rises slightly in 2023. Overall, the absolute gap between the most and least digitally advanced federal state group continues to extend, whereas it narrowed in 2022. The federal state group average falls from 116.3 index points in 2022 to 111.9 points in 2023.

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

In index points, survey years 2020, 2021, 2022 and 2023
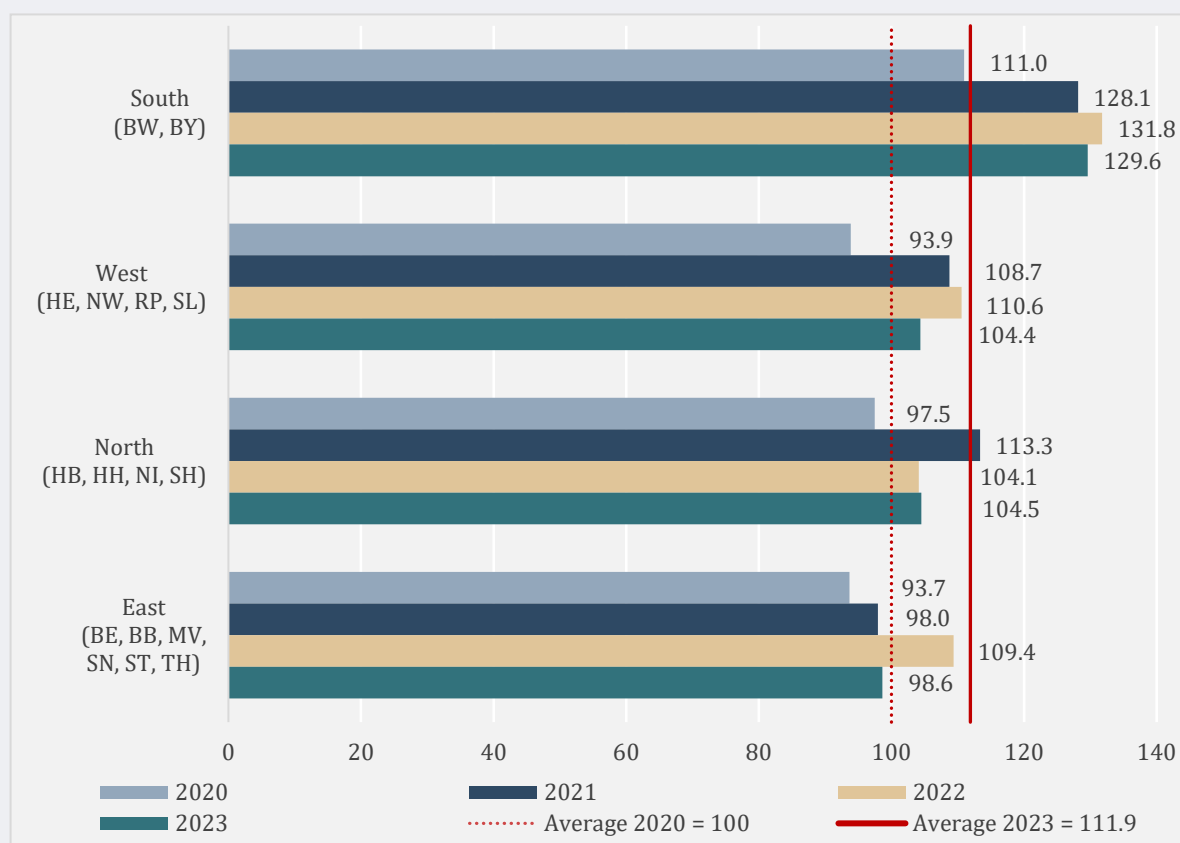
Source: German Economic Institute

- The federal state group North (Bremen, Hamburg, Lower Saxony and Schleswig-Holstein) is the only federal state group that improves in 2023. The index score rises slightly by 0.4 points to 104.5 points. This puts it in second place among the federal state groups, whereas it was at the bottom in 2022.
- The index value of the federal state group South (Baden-Württemberg and Bavaria) also changes only slightly in 2023 (minus 2.2 points). However, at 129.6 points, it is still far ahead of the other federal state groups and remains well above the national average.
- The federal state group West (Hesse, North Rhine-Westphalia, Rhineland-Palatinate and Saarland) is worse in 2023 by 6.2 points, falling to a total of 104.4 index points. As a result, it finishes below average in the current year and now ranks third among the federal state groups, down from second place in the previous year.
- The federal state group East (Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia) is the least digitally advanced federal state group in 2023. With an index value of 98.6 points, it is below average in 2023 and loses 10.7 points since 2022, when it was in third place among the four federal state groups.

As in the years 2020 to 2022, the federal state group South remains the best performer in the category of research and innovation activities. It retains its top position in the categories of innovation landscape, human capital and products over the last few years and is also well ahead in the category of qualification. For the first time, it also achieves the best result in processes. As in the previous year, the federal state group North scores best in the category of business models. It also maintains a clear lead in the category of technical infrastructure, similar to 2022. In contrast to previous years, the federal state group West loses its leading position in the category of society to the federal state group North in 2023. The federal state group East continues to be last in the categories of qualification, research and innovation activities, technical infrastructure, society and human capital. As in the previous year, the federal state group North scores worst in the categories of processes and innovation landscape. The federal state group West ranks last in the categories of products and business models.

The decline in the federal state group East is mainly due to a decline in the categories of processes (minus 49 points) and human capital (minus 14 points). The slight improvement in the federal state group North is mainly due to a better performance in the categories of processes (plus 12 points) and products (plus 8 points) compared to the previous year. This compensates for the decline in the category of human capital (minus 11 points). In 2023, the federal states group South improves mainly in the category of processes (plus 26 points). However, this is not enough to compensate for the overall decline in human capital (minus 20 points) and products (minus 14 points). The federal state group West drops the most in the categories of products (minus 30 points), human capital (minus 13 points) and processes (minus 12 points). These declines could not be offset by an improvement in technical infrastructure (plus 15 points).

Digitalisation by type of region

At the level of the two types of regions,[5] the digitalisation index is moving sideways in 2023 (Figure 6). Urban areas continue to be more digitally advanced than rural areas. The absolute gap between the two index scores has reached its lowest level since 2020. In total, the average for region types has decreases from 118.7 index points in 2022 to 112.4 points in 2023.

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

In index points, survey years 2020, 2021, 2022 and 2023
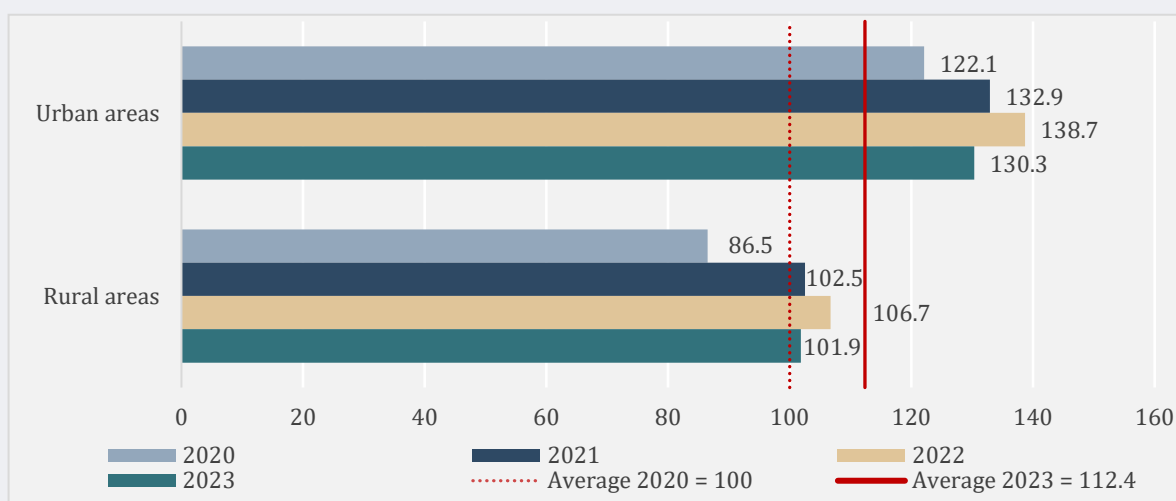
Source: German Economic Institute

- The index value for urban areas falls for the first time by 8.3 points to 130.3 points in 2023. Nevertheless, urban areas still perform above average, with an index value 28.5 points higher than that of rural areas.
- In 2023, rural areas return to their 2021 level of digitalisation, with their index score falling from 106.7 index points in 2022 to 101.9 points in 2023. The decline in points, at minus 4.8 points, is less overall than in urban areas.

As in previous years, urban areas continue to outperform rural areas in all categories in 2023, with the exception of the category of processes, where rural areas lead since 2021. They retain this lead in 2023. In the categories of technical infrastructure and innovation landscape, urban areas continue to significantly outperform rural areas. However, rural areas are slowly catching up in these categories: Compared to the previous year, rural areas lose fewer points than urban areas in the innovation landscape and even gain points in technical infrastructure, while urban areas lose index points. By contrast, for products and business models, urban areas are outpacing rural areas.

In urban areas, only business models become slightly more digital in 2023 (plus 4 points). However, this is not able to compensate for the widespread decline in digitalisation in other categories, especially in the categories of innovation landscape (minus 35 points), technical infrastructure (minus 16 points) and processes (minus 11 points). In rural areas, the technical infrastructure improves significantly in 2023 (plus 21 points). However, other categories also decline significantly, such as the innovation landscape (minus 19 points) and products (minus 12 points).

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[5] In previous index surveys, five types of regions were considered, which are now combined in the groups urban areas and rural areas. This ensures stable data quality and reduces complexity. The urban areas include all district-free cities in Germany, formerly agglomeration areas and core cities, while rural areas include all districts, formerly high-density, medium-density and low-density rural areas. Index results for the survey years 2020 to 2022 have been recalculated retrospectively. The transition is discussed in the long report on the 2023 Digitalisation Index.

Conclusion and outlook

After the German economy substantially increased its digitalisation between 2020 and 2021, digitalisation has stagnated in 2022 and 2023. There seems to be a sideways movement both in company-internal categories and in the framework conditions that encompass company-external categories.

The index levels show no great shifts over time. As in previous years, large companies, the ICT sector, the federal state group South and urban areas are by far the pioneers of digitalisation. However, the industry groups, company size classes and region types are converging as a whole and the differences in digitalisation are narrowing. The digitalisation of the economy has therefore become more homogeneous.

However, the digitalisation of the economy in Germany continues to stagnate in 2023. This may be due to the ongoing crises. The economy, like society, continues to be affected by inflation, supply chain difficulties, the energy crisis and ongoing uncertainties. In last year's report, it was noted that it is remarkable that digitalisation did not actually regress in 2022 due to the impact of the exceptional economic situation. In 2023, there is again no significant increase in digitalisation. For example, the revenues of companies with partially digitalised products decreases between 2022 and 2023. It is possible that companies in recent years, maybe fuelled by the digitalisation momentum of the Covid-19 pandemic, tested the extent to which their products can be complemented with digital components. With increased cost pressure, such digitalisation projects may now be taking on a subordinate role and companies may be focusing more on their core products. Another reason for the declining share of revenues from partially digitalised products may be more cautious consumer behaviour in society due to rising inflation. Not only within companies, but also in society as a whole, the focus on digitalisation may be decreasing due to crises, with other issues taking precedence, some of which may be existential. This is reflected in the significant decline in newspaper articles on digitalisation in this current survey year: Digitalisation is no longer a central issue in the public eye.

On the positive side, companies are not reducing the digitalisation of their processes and business models, in contrast to products. However, there is no growth in these categories either. The lack of growth may be due to the fact that increased digitalisation is not an immediate tool for many companies to cope with the current crises or to mitigate their negative effects in the short term, as was the case during the Covid-19 pandemic. In the medium to long term, however, companies in Germany can benefit from more digitalised processes, business models and products if they lead to efficiency gains, drive innovation and open up new markets. If this leads to competitive advantages, increasing digitalisation can also strengthen the competitiveness of the German economy.

In addition to digitalisation, companies in Germany are currently undergoing several transformation processes, some of which overlap. This is particularly evident in the growing skills gap in digitalisation jobs. Demographic change and the associated tight skilled labour market are making it difficult for companies to find suitable skilled staff to drive their digitalisation efforts. The skills gap, which tends to be highly sensitive to economic fluctuations, has returned to pre-crisis level now that the Covid-19 pandemic has subsided. However, the latest data edge suggests that the current crises resulting from the war in Ukraine and the associated economic downturn will also have an impact on the skills gap, albeit with a time lag: Companies are posting fewer vacancies due to high inflation, disrupted supply chains and significantly higher energy costs, which is expected to lead to a gradual narrowing of the skills gap. However, this is not necessarily a positive sign. It suggests that companies are indeed postponing or suspending digitalisation projects, or at least that

they do not currently need relevant skills. Given the overall tight skilled labour market, it is important that more companies start to meet their need for digitalisation skills with company-internal resources by increasing IT training and upskilling their existing personnel for IT-related positions.

Only through a combination of digitalisation efforts within companies and external framework conditions the digitalisation of the economy can progress more rapidly. Therefore, it remains crucial to improve the framework conditions in Germany such that they do not become a bottleneck but rather facilitate digitalisation. Examples include technical infrastructure, the administrative-legal framework and the innovation landscape, which recently improve only marginally or, in some cases, deteriorate slightly. The 2024 Digitalisation Index will show how they can be improved in the short term.

On the methodology

The 2023 Digitalisation Index shows how the digitalisation of the economy in Germany has developed under the impact of the ongoing crises, namely the Covid-19 pandemic, the Ukraine war, supply chain difficulties, price developments and the energy crisis. In particular, it verifies whether the often-claimed digitalisation boost resulting from the Covid-19 pandemic actually led to a more digital economy overall in Germany and what the direct and indirect consequences of the current crises due to the Ukraine war are on the digitalisation of the economy in Germany. The comparison with the results from the initial publication of the Index 2020 and Indices 2021 and 2022[6] demonstrates the development of digitalisation throughout Germany as well as at the levels of industry groups, company size classes, federal state groups and region types.

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, society, human capital and innovation landscape. Each category contains several meaningful indicators.[7] Due to different data availability and differentiability, not all indicators and categories are applicable at all differentiation levels of the index.[8]

This report presents the core results of the Digitalisation Index for the survey year 2023. An extensive results report with detailed analyses will be published in early 2024. The IndicatorTool on de.digital illustrates the results.[9]

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[6] The 2020, 2021 and 2022 summary versions (in German and English) as well as the 2020, 2021 and 2022 long versions can be found at https://www.de.digital/DIGITAL/Navigation/DE/Lagebild/Digitalisierungsindex/digitalisierungsindex.html. At the various levels of differentiation, the 2020, 2021 and 2022 index values have changed slightly in some cases due to indicator updates. This is discussed at length in the long version.

[7] A complete list of all indicators and their availability at the different levels of differentiation can be found in the "Glossary of indicators" at https://www.de.digital/DIGITAL/Redaktion/DE/Digitalisierungsindex/Publikationen/publikation-download-glossar-indikatoren.pdf?__blob=publicationFile&v=1.

[8] 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.

[9] It can be retrieved at https://www.de.digital/DIGITAL/Navigation/DE/Lagebild/Indikatorentool/indikatorentool.html.